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A CASE STUDY OF CONSECUTIVE REORGANIZATIONS
OF THE SCIENCE LABORATORIES AT THE
NASA-GODDARD SPACE FLIGHT CENTER

by

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ABSTRACT OF THE THESIS

A Case Study of Consecutive Reorganizations

Of the Science Laboratories at the

NASA-Goddard Space Flight Center

By Emily M. Michaud

Thesis director: Professor Marc Holzer

The research reported here seeks to explore cyclical reorganizations of government-owned and -operated scientific laboratories at the NASA Goddard Space Flight Center (GSFC) and determine the effects on civil service bench scientists.

The work takes the form of a case study following the guidelines imposed by Yin. It first delineates the relationship of science and power; it then proceeds to identify the process and context of the specific circumstances. The process is identified as organizational change and the context as the GSFC seen variously as one or many laboratories. The objective is to determine how a series of reorganizations affect the research objectives of bench scientists that exist at the lowest line-level of the organizational hierarchy. Following a model described by Stake the research questions are bifurcated into those dealing with organizations grounded in the field of Public Administration and those relating to GSFC itself. The hypotheses are similarly bifurcated.

Three lenses are utilized in assessing the reorganizations of GSFC, attempting to emulate the model brought to prominence by Allison and Zelikow. The three organizational changes occurred consecutively in 1984, 1990 and 2005. They are examined through the triangulation of a functional/structural lens, a theoretical lens and

finally and most substantively a human agency lens. The most recent organizational change occurring in 2005 and called a Transformation, as defined by French *et al.*, is at the core of the study. It employs in-depth interviews that are analyzed through a methodology developed by Kvale. The reason for employing interviews to study the 2005 Transformation is compelling since it follows a business model in which internal and individual introspection adjust to outside conditions.

A series of 35 interviews were conducted borrowing freely from the instrument and protocol utilized by earlier studies of Bozeman and Rainey in their examination of laboratories of the Department of Energy (DOE). The issue here is whether government reorganizations can be viewed as instruments of control and whether independent research by government scientists is most profitably conducted in a loosely coupled and complex organization as described by Perrow. In this context, Price's curriculum model and his hierarchical/bureaucratic model were examined. The interview responses lead to the general conclusion that Goddard laboratories are embedded in a hybrid organization and might exist most comfortably within a combination of both the bureaucratic and curriculum paradigms.

Implications for further study include how organizational changes of research laboratories might be more carefully executed in the future and whether or not it is necessary for Field Center laboratories to completely align with NASA Headquarters for funding purposes. Also touched on in this section is the role of the public administrator as a conduit for the needs of both the bureaucracy and the bench scientist.

Preface

This study would have been impossible without the generosity of the bench scientists of the Goddard Space Flight Center and Institute for Space Studies. I am deeply grateful for their valuable time and expertise.

I also want to thank my husband and family and acknowledge the invaluable assistance of Maggie Betancourt of Columbia University.

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I. Introduction

This investigation examines an intersection – between the scientific research of the bench scientist within the laboratories of the NASA-Goddard Space Flight Center and the process of hierarchical reorganizations. The viewpoint is that of a generalist in public administration occupying the interstice or niche between the paradigms of hierarchical organization charts and the curriculum model of university research (Price, 1962).

Since the author is positioned within the organization, the study relies upon the tradition of insider research as described by Brannick and Coghlan (2007). It also draws upon the scholarship of Price, (1962) who has highlighted the importance of and need for an “... intervening layer of administration between science and politics, to protect

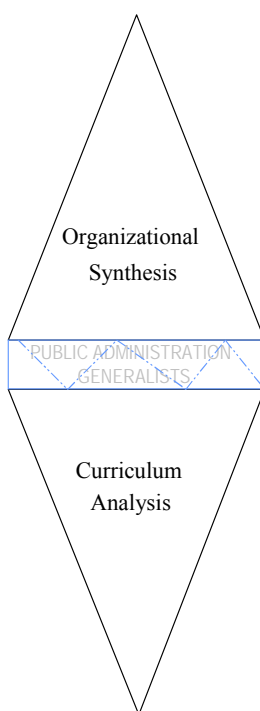


Figure 1

science and make their relationship more smooth” (Price, p. 109). The person occupying this interstice should possess his or her own unique expertise in ‘listening’ and, above all,

possess dispassionate empathy. It is very much in this spirit that I began the present inquiry.

The methodology combines materials of historical analysis and data obtained in the field through the systematic interviewing of professional elite bench scientists (Hertz and Imber, 1995). The interview analysis and methodology attempt to follow the general guidelines and examples of Kvale (1996) and Miles and Huberman (1994).

Trying to partially emulate Allison and Zelikow (1999), I utilized three viewpoints to triangulate reorganization attempts of the science laboratories of the Goddard Space Flight Center. I first examined the GSFC laboratories structurally, concentrating on how they adjusted to structural government reorganizations within the government hierarchy. I then assessed the theoretical implications, utilizing the specific work of various scholars in the field. Finally, the study evolved to human agency aspects and attempts to explicate these aspects as they impacted the bench researchers – this being the actual focus of the study. It is at this level where the business of research is actually done and this devolved as the core of my investigation. It is the bench scientists who are in the direct line positions of scientific laboratories. This Human Agency section suggests conclusions concerning both context and process. It also leads to potential implications for the future.

A critical aspect of the investigation was inspired by the research design suggested in a Symposium in Public Performance & Management Review edited by Rainey, Bozeman and Kingsley (2004). The original study (Bozeman *et al.*, 2001) supplied the core concept found in the Human Agency paradigm and an invaluable model for my in-depth interviews. The Rainey/Bozeman study examined the effects of

contractor change on research scientists in three government owned- contractor-operated (GOCOs) laboratories. It was suggested that certain changes in contractors led to the control and direction of the research of scientists (Bozeman *et al* (2001). I felt that this work could be adapted to a case-study inquiry of the effects on a government-owned government-operated laboratory not, in this case, by contractor change, but by means of the equally controlling process of reorganization.

The inquiry also touches on the tradition of Action Research (Herr & Anderson, 2005; Coghlan, & Brannick, 2006), in its attempts to manipulate rich data in order to develop a theoretical understanding of the state of scientific research within an organization during a climate of change. It is hoped that any insights resulting from this investigation might, if judiciously interpreted, prove a valuable guide to similar reorganizations undertaken in somewhat similar circumstances in the future.

The study clearly falls within the category of a case study because it is heavily grounded in context. In this area I am much indebted to the invaluable parameters set forth by Yin (1989, 2003, 2004), and Stake (1995). The work of these scholars assisted in revealing the necessary focus on phenomena and context resulting in research questions appropriate and valuable to the project.

Frank Fischer, discusses a post-positivist paradigm that seeks to “capture and incorporate the multiplicity of theoretical perspectives and explanations that bear on a particular event or phenomenon” (Fischer, 2000, p. 76). As one admittedly mired in the cul-de-sac of postmodernism, I am grateful to Dr. Fisher for signposts indicating a way out and forward.

A. Science/Power/NASA

Shapin stresses that the sociological aspects of science are ultimately incorporated into its core disciplines. “I *take for granted* that science is a historically situated and social activity and that it is to be understood in relation to the *contexts* in which it occurs” (Shapin, 1996, p. 9).

My own point of view had been shaped by familiar and external situations being that while the scientific method is eminently useful and utilized in many disciplines, the applications and results of scientific inquiry itself are never completely neutral but rather at the service of dominant political, moral and social purposes. This applies to the laboratories examined in this study. Furthermore, not only have science and technology been situated solidly within the political and social ideologies of their day, since the Renaissance, scientific applications have periodically coalesced and fed actual revolutions wherein new centers of power gained societal control. It is therefore possible to trace the ascendancy of merchant princes, national sovereignty, and finally the oligarchy of the industrial bourgeois oligarchy through science (Dickson, 1984). During the Renaissance scientific researchers, (then called humanist philosophers) worked under powerful clans such as the Medicis, and furthered the development of a body of work in both management and the natural sciences (The Medici and Science, Institute & Museum of the History of Science). These scientific functionaries of their day were firmly shackled to centers of power.

The rise of the nation states and ensuing nationalistic competitions firmly soldered scientific research to military tactics and industrial might. Scientific activity assisted in establishing the great western hegemony. The ascendancy of Western

civilization culminated in two great superpowers, one of these, the United States of America, was firmly rooted in its western European origins. In technological aspects, the growth of American power resembled the expansive and religious growth of the now vilified Crusades (Quigley, 1961; Noble, 1999). The American paradigm was therefore expansive, optimistic and fueled by the self-delusion of religious fervor and entitlement. The other colossus, The Union of Soviet Socialist Republics (USSR), followed traditional Russian schizophrenia and straddled both West and East. It also armed itself with a single-minded, overreaching and powerful ideology – able to confront the liberalism of the West. Both of these powers were anxious to demonstrate the superiority of their respective world-views through exemplars of scientific superiority, especially in the arena beyond the atmosphere – space.

B. The Context – The NASA/Goddard Space Flight Center Science Laboratories

The National Aeronautics and Space Administration (NASA) had its birth as part of a massive and ultimately overblown geopolitical struggle. The launch of the sputniks by the USSR in the late 50's was a crisis in which one colossus, the US, was clearly perceived as being technologically inferior (McDougall, 1985; Etzioni, 1964) to its rival. A large part of the effort to correct this perception was the formation in the US of a new civilian government agency, The National Aeronautics and Space Agency (NASA) accompanied with appropriate and lofty national goals.

The Cold War, along with its appendage of space domination, is today a thing of the past. Contrary to some ideological beliefs, it was neither won nor lost. It has also come to light that the space race was largely a fictitious contest, since there was no missile gap, and the Soviets were not really outpacing the United States in reaching the

Moon (Launius & McCurdy, 1997). Despite that fact, there yet remains a strong nationalistic Cold War aftertaste and mentality in much of what NASA does.

It has also become obvious to space cognoscenti that extensive exploration of the solar system with human passengers will only be remotely feasible as a result of international cooperative globalization (Levine, 1975). Space exploration is too dangerous, far-reaching and, above all, expensive for any one nation to accomplish. If there is to be a metaphorical final frontier in space, international organizational cooperation is the only mantra under which it can reasonably be expected to succeed, not strong nationalistic sentiment and executive control.

Price (1962) explained that loosely constructed governing boards could provide insulation from executive control. This loosely administered amalgam closely resembles that of the National Advisory Committee for Aeronautics (NACA), NASA's precursor. Indeed, the entire scientific research community was quite flexible and diverse prior to World War II (Mark & Levine, 1984). And yet, "It would be dangerous to propose an action that might seem to a Congress or a congressional staff investigator to indicate an undesirable degree of sympathy with foreign nations or a willingness to part with our precious secrets" (Price, 1962, p. 113).

Despite the end of the Cold War, accompanied by the supposed collapse of Communism as a failed system and the subsequent US/Russian cooperation in space, the vestiges of a shadow competition with someone or something still remains. This, despite the fact that C.P. Snow asserts that all political entities making concerted efforts in selected scientific programs are likely to be not that far apart (Snow, 1961). It is in the nature of scientific progress that it tends to coalesce oblivious to political frontiers.

Within the geopolitical aspects outlined above, NASA was established in 1958 as a civilian government agency (Rosholt, 1966). This national effort could have been attempted under the aegis of the military but such restrictions would have greatly diminished the propaganda value of US space achievements (McDougall, 1985). NASA was also established under the umbrella of the federal civil service although granted many exceptions from its operations (Rosholt, 1966). The status of an independent federal agency tended to give NASA a certain insulation and immunity from political and ideological struggles. The Agency was able to incrementally shed the mindset of the Cold War and embrace international cooperation in many of its ongoing activities. For their part, research scientists (as they usually do) exhibited the traits of "... rational men with purposes and wills of their own" (Price, p. 98).

The Agency's external environment shifted from ideological competition to political and ideological polarization within its own national boundaries. In this arena a government scientific agency is likely to find itself caught in the crossfire between warring internal political paradigms. Because of past controversies concerning enormous initiatives such as the Manhattan Project, it had been determined by organizations such as the National Science Foundation that future science would depend, in large part, on the federal government for support. This patronage placed scientific research squarely at the center of increasingly divisive internal politics.

NASA, a construct of the Cold War, contained within its early exponential growth, much that emulated the larger model of science including its attachment to power. Furthermore, the growth of technology and the physical sciences in the US bore a direct link to the growth of American power and expansion. US ideology has always

displayed an affinity for and identification to medieval crusades in many ways, including an abundance of expansive optimism fueled by the self-delusion of religious fervor (Quigley, 1961). Metaphors such as frontiers including the final frontier are appealing and eradicate past national guilt.

During the what is called the 2005 transformation of science laboratories at the Goddard Space Flight Center, scientists accepted what Fischer might have termed a ‘contextual discourse’ (Fischer, 1995). They attempted to validate their research specialties to the promise of manned exploration of the solar system rather than the more balanced paradigm that included the study of Earth and its systems as an integral part of further exploration (Interview GSFC-16). Ultimately, this would lead many both inside and outside the Agency to an ideological discourse in which research in the fundamental ecological balance of the Earth conflicted with maintaining the business of the geopolitics of the nation-state including its stake in the military industrial complex.

At present NASA’s organizational structure is sprawling. It consists of geographically separate and semi-specialized entities known as Field Centers (originally and sometimes still thought of as separate laboratories) with a bureaucratic core in Washington, D.C., known as NASA Headquarters. The scattered ‘campuses’ in large part, evolved historically, often gathered in from the footprints left by NASA’s precursor, NACA, military components, such as Werner von Braun’s Redstone project, and parts of facilities descended from the prestigious Naval Research Laboratory. Centers such as the astronauts’ base camp in Houston were created, almost whole cloth because of powerful political interests. The idea was to situate facilities in various geographical parts of the United States, thus giving these areas potential jobs and a regional share in the ideology

and promise of space exploration (Rosholt, 1966; Rosenthal, 1968; McDougall, 1985; Levine, 1982; Lambright, 1995). It is therefore not too cynical a view to state that the space program was launched by means of and greatly strengthened by the time-honored concept of ‘pork’ or earmarks (Etzioni, A. 1964; Launius & McCurdy, 1997).

Political interests in Texas and Maryland reached hotly contested bargains for the creation of facilities in both states. In the case of Maryland, the proximity of the capitol and a gifted pool of talent inherited from the Naval Research Laboratory suggested the creation of a premiere research facility. In Texas, the strong advocacy of Lyndon Johnson plus agreements with Rice University resulted in the glamorous manned space flight center, complete with astronauts (Rosholt, 1966).

Because of its roots in the Naval Research Laboratory, Goddard was from its inception dedicated to research – extending from a broad-based continuum of theoretical work to applied technology and engineering. Following the first Apollo Moon landings, a logical niche for space science of the type conducted at Goddard had been established. NASA’s Earth science, on the other hand, evolved out of applications from satellite data. With the aid of satellite instruments, a capacity was developed to not only look outward to the Solar System, galaxy and universe, but also inward – seeing the Earth in an entirely new ‘systems’ perspective – as a truly unique and exceptional planet.

At present, the Goddard Space Flight Center is one of approximately 11 major NASA Field Centers. It comprises a staff somewhere near 11,800, including civil servants, contractors, university affiliates and other ancillary staff members. It also occupies a sprawling campus with more than 30 buildings (Wallace, 1999). GSFC oversees component installations at Wallops, Virginia (formerly a testing facility of

NACA), and what was formerly a theoretical Institute in New York City, the Goddard Institute for Space Studies (GISS), now devoted to work in the atmospheric physics of global warming with a close affiliation to Columbia University.

GSFC has since its inception in 1959, played its allotted part in space exploration, including the scientific research attendant upon such activity (Wallace, 1999). This has involved a not always smooth juxtaposition between the paradigm of the engineer with its rules and regulations and the free-wheeling independent attitude of the research scientist (Wallace, 1999).

It is within the context of Goddard scientists and their research that I will examine three separate attempts at reorganization of the space and Earth science components of GSFC, within the timeframe from 1984 to 2005. The first two reorganizations occurred in 1984 and 1990. The most recent process, in 2005, called a 'Transformation' rather than a mere reorganization, forms the core of the study and as such is given closer scrutiny. The word transformation is linked to trends copied from constantly evolving, business models. It stands in contrast to the more scientifically and collegial university models of the past. In the business literature the term 'transformation' suggests a change from within in response to external circumstances (French, *et al.* 2005). An organizational transformation is a fairly recent concept grounded in the literature of organizational development. It suggests planned change that is experimental and conceptually in a state of flux (French, *et al.* 2005). Having explored and read about Transformational Change it remains unclear whether those operating within a government bureaucracy are equipped to truly understand this concept, let alone put it in place as a process.

The research laboratories I examined reside within the somewhat artificially bifurcated disciplines of space and Earth sciences. They are restricted to the Goddard Space Flight Center (GSFC), and one remotely situated component installation. Goddard is considered the premier scientific laboratory or series of laboratories participating in the US space program.

The scientific disciplines at GSFC (as is the case with all research) form a natural continuum, in this case somewhat arbitrarily dedicated to either Space or the more recently evolved Earth sciences. Needless to say, there are many subsets of these two major disciplines.

These scientific endeavors exist and operate within the milieu of national and international power politics. The proximity of the major portion of GSFC to the nation's capital and NASA's historical ties to geopolitics inevitably forges this inexorable bond. Turf imbroglios are not a new topic. As previously stated science and power (at least in western culture), have been intertwined since the 1700's (Fischer, 1990; Fischer, 2000; Noble, 1997; Shapin, 1996).

C. The Process – Government Reorganization

Shapin takes it for granted that “science is historically situated within social activity and that it is to be understood in relation to the contexts in which it occurs” (Shapin, 1996, p. 9). From this may be concluded that many historical interpretations of science have tended to consider what is actually external to science proper. It might also be logically assumed that bureaucratic reorganizations and other changes imposed on government organizations are always preceded as well as caused by outside forces (Pfeffer and Salancik, 2003). In this matter government-owned and -operated

laboratories would be no exception. Of course, all organizations are subject to the pathology (often benign) of reorganization. It has been described by one of the people I interviewed (GSFC-8), as something managers (old or new) feel compelled to do.

There is much in organizational theory that can be applied to the cyclical changes in NASA and the Goddard Space Flight Center. Emmerich (1971) has provided valuable organizational perspective of NASA since its inception. Light (1997) provides four paradigms for reorganization. They are Scientific Management, War on Waste, Watchful Eye and Liberation Management. To some degree each of these can be made to partly fit the three reorganizations covered in this investigation.

Rosembloom (2000) stresses the ever-increasing role of Congress in the control of government agencies. This is particularly relevant given the four powerful budgetary bodies concerned with NASA in both the House and Senate.

Siedman (1998) dissects the lack of planning in most reorganizations.

Szanton (1981) gives six main reasons usually assumed as causes for reorganizations. The first three, being: to shake things up, simplify operations or reduce expenses. He judges these to be a waste of time. The remaining three are to symbolize priorities, to improve program effectiveness and accomplish policy integration. These last three may be applied to some change processes in GSFC laboratories. All help in applying a theoretical lens to the processes of change at Goddard.

Aldrich (1979) addresses the self-existence and independence of organizations as they attempt to hold together and confront the principle of power. He also suggests that it is unrealistic to examine organizational properties in a one-dimensional light – hence

hopefully adding some justification to my attempts to isolate structural, theoretical and quality of life aspects in Goddard laboratories.

March & Olson (1983) suggest that reorganizations simply happen and neither follow the orthodox and political goals for economy and control nor the administrative rhetoric of effectiveness and efficiency. This calls to mind the quote from interviewee (GSFC-8) "... it's just something that managers do" or "...This is more or less a management type thing and they entertain themselves with it" (GSFC-27).

Finally, going as far back as Gulick (1937), reorganization was viewed as a political struggle striving to achieve balance within the bureaucracy in the face of outside influences. These influences can be either supportive or antagonistic. The narrative of 'realpolitik' as opposed to traditional hierarchical and managerial control is not incompatible with theories of Pfeffer and Salancik (2003) or even March and Olson (1983). Gulick puts what he calls the rhetoric of orthodoxy and rhetoric of realpolitik in juxtaposition stating: "A compelling feature of the history of administrative reorganization is the way in which these two rhetorics have persisted throughout the twentieth century" (Gulick, 1937, p. 285). The Gulick and Urwick papers on organizational structure are still timely in the 21st century. Following that source, much of what happened during NASA reorganizations can be seen as attempts at scientific management, in vogue at the time of FDR.

The work of the above scholars all apply to various aspects of the process of reorganization. In a theoretical sense process and context intersect and interact.

II. Three Reorganizations of the Goddard Science Laboratories

This study draws on two early reorganizations, in 1985 and 1990, of Goddard's science laboratories as background for a third and hopefully more penetrating treatment occurring in 2005 and baring the label of Transformation.

Although reorganizations often become unintentional blunt instruments, the reorganizations of 1985 and 1990 were easily attributable to and induced by the external policy climates of their day. Such processes represented what NASA managers and administrators considered the 'best fit' to the overall political flavor at the time (Rosholt, 1966; Rosenthal, 1968; Webb, 1969; A.L. Levine, 1975; Mark & Levine, 1984; McDougall, 1985; Ragsdale, 1997).

A. The Constraints of Near- Earth Orbit – Earth Science Emerges from

Applications -- The Reorganization of 1984.

In 1984, save for the rhetoric, plans for further space exploration had been deemed impractical in the foreseeable future. Pursuit of science had the advantage of supplying a placeholder, concentrating on data and achievements of the past while keeping the NASA bureaucracy intact. Furthermore, looking at Earth from near orbit could be assisted by the manned space flight hardware of the Space Shuttle. This gave impetus to a paradigm shift that reconciled the Space Agency to its more earthbound companion independent agencies, such as Health Education and Welfare. Rather than competing with the latter for funds contributing to domestic welfare, NASA could actually for the first time be seen to be supplementing the goal for improved living conditions on Earth. Earth science was removed from satellite applications and assumed the loftier designation of science. Earth sciences, retaining their geographical sphere,

were joined to space sciences including disciplines focused on studying the solar system, galaxy or cosmos. Earth sciences and space sciences were placed in one directorate of sciences; the cosmologist shared the same organization with the atmospheric physicist.

Turning the eyes of space exploration back towards Earth also seemed to justify a trendy systems-thinking concept engulfing Earth itself, as well as its inhabitants and even its institutions. So following the ever-constant evolution of disciplines, Earth Science morphed and attached itself to Space science that was providing valuable data in astrophysics, astronomy and planetary studies. Researchers in Earth sciences were elevated to the status of their colleagues studying the cosmos. This was a logical development for the Agency and its premier Field Center laboratory, since near-Earth orbit efforts such as Skylab, the Space Shuttle and the Space Station tended to be more closely tethered to the home planet. The icon of space travel could be relegated to fiction a little while longer. A reorganization was effected in 1984 joining Space and Earth Sciences into a major Science Directorate with the code number designation of 600. Within the government bureaucracy of Goddard, three-digit numbers are utilized to designate areas of functionality. Thus, Code 100 was assigned to the highest level, that of the Center Director, including all subsequently attached offices devolving from it. In its wake followed Code 200, designated as business and financial functions, 600 reserved for science, and 700 for engineering, etc... (Goddard Space Flight Center Telephone Directory, July 1987).

Earth sciences was given appropriate facilities and an administrative home in the most luxurious building on the Goddard campus, Building 26, affectionately or ironically known as 'Peiper's Palace' (complete with pastoral views of an urban forest and pond),

named after the eminent space scientist, George Peiper. It was an elite and collegial space, clearly modeled after a university department. This move went a long way toward establishing Space science as an elite discipline at Goddard (Goddard News, August, 1986).

B. Ecology and the Environment – the Reorganization of 1990

By 1990 the age of ecology and concern for global warming had arrived. It was decided that there should be two science directorates, one designated to space and one to planet Earth. While humanity looked outward to the cosmos it could also turn inward from a new and compelling vantage point.

In 1990, Earth sciences was becoming an articulation of the increasingly popular environmental movement. GSFC Center Director, Dr. John W. Townsend, was interviewed for the in-house publication “Goddard News” in December of 1989 and in an expansive style explained that Goddard would assume a major role in both space and earth exploration (Goddard News, 1989). The final frontier was shifting to include Earth, now seen as a planet in its own right, including a series of systems, some occurring naturally, others, anthropogenically.

The major objectives of the Center as stated by Dr. Townsend all related to science. Earth sciences was particularly singled out and an important part of GSFC’s role was to “start up a major Earth Science initiative, namely the Earth Observing System, popularly referred to as EOS (Goddard News, 1989). To that end, a new directorate was established for Earth Sciences and facilities were erected to house this new initiative and the mammoth amounts of data that it would generate. Hires in Earth science (both civil service and contractor) personnel were set at new and generous levels. There were now

two equally prestigious science directorates: Space Sciences (Code 600) and Earth Sciences (Code 900). It should also be noted that maintaining what Dr. Townsend called “Goddard’s world class research in space science” remained a principal goal of this new era (Goddard News, 1989).

If the reorganization of 1985 had accepted a new and highly enhanced role for scientific data and hence the science of interpreting or analyzing it, the reorganization of 1990 embraced government scientific research and particularly Earth science research as a worthy end-result for NASA. The rhetoric of exploration was now most often applied to a strategy embedded in science rather than referring to people in space. Astronauts on the Space Shuttle were expected to have at least one PhD in order to perform and monitor scientific experiments.

EOS was as audacious as it was ambitious. Huge platforms were to fly in space containing instruments to measure “global change as a product of the changing interrelationships among Earth’s systems: atmospheres, oceans, land, and polar regions” (White, 1990). ‘Systems thinking’ being a popular concept of the time, NASA was embarking on a serious mission to the most immediate and important of all planets, Earth. NASA satellites were positioned to reveal much that had previously been hidden on the planet. Also, interactions between space and Earth science as equal disciplines were viewed as beneficial to both since these disciplines had much to learn from one another. In an Earth science laboratory, the experiences of atmospheres of planets such as Venus might provide a blueprint for what could possibly threaten Earth. In terms of instrumentation and calibration, NASA space scientists and engineers already had a wealth of experience.

Two separate and equal science Directorates at Goddard, encouraging free interaction between and across disciplines and even nations, was the paradigm of the future. The Cold War was over and no new threats on the horizon need impede free and open collaboration among nation-states.

C. The Transformation of 2005 – Nostalgia for Exploration and the Rhetoric of Frontier America

In 2005, a long-lasting right-wing ascendancy in the US led to a diminishing of science resulting in all scientific disciplines at Goddard being lumped into one directorate. The importance of climate and potential climate impacts was trivialized and greatly diminished. Once again the banner of physical exploration encompassing the Moon and near Solar System bodies was unfurled. The nationalistic and manifest destiny of a permanent base on the Moon and the goal of reaching even reaching Mars was something NASA did not ignore since it formed an integral part of all Mission Statements and Strategic Plans.

In 2005, however, there was no Cold War or Missile Gap, perceived or real. What was emerging was a faceless and shapeless enemy called global terrorism and hence the strange phraseology of ‘protecting the home planet’. This was the impetus to once again adjust NASA’s and GSFC’s goals, shaping a new paradigm and necessitating a more profound organizational change, now to be called a Transformation. The goal was to recapture the spirit and remembered ebullience of Apollo, wrapped in patriotism. NASA was said to have lost its way, meandering in Earth studies while the empty and lonely heavens still beckoned and indeed demanded exploration. NASA was not only to return to the Moon, but push ahead to Mars and then beyond.

Of course, in a very real sense NASA had already left the solar system through unmanned space probes such as Galileo and Cassini. Nevertheless, since these did not include the visible and tangible presence of humanity on board and returned nothing but scientific data. Unmanned spacecrafts lacked the ability to inspire rhetoric in a postmodern world.

The concept of the Final Frontier is compelling and seductive and teleological. The universe is defined as well as explained through its final destiny, to be controlled and demystified by humankind. The Manifest Destiny of a continent is transposed to the Solar System and the expanding Universe.

Therefore, Goddard sciences were now subsumed under the standard of exploration. Once again a bold new initiative was born out of a climate of fear and uncertainty. The major difference being that although this initiative required the marshalling of massive resources, none seemed immediately forthcoming. The attempt was to capture the imagination and pride of a nation as had President Kennedy's famous speech in 1969 had done, however, this time the symbolism was hollow and entirely postmodern and in fact only captured the imagination of the few space buffs already converted.

This word 'transformation' will be further examined in comparison with the more familiar 'reorganization'. The effects seemed basically the same although the latter term suggested a more profound and perhaps even spontaneous process.

III. General Research Questions and Hypotheses

A. Iota Questions and Hypotheses Relating to General Research Field

Following the how/why nature of case study research questions as closely as possible Yin (1989), I also bifurcated the questions and hypotheses, as suggested by Stake (1995). The symbol iota (ι) indicate issues that are intricately bound to theoretical, political, and historical aspects of the field of public administration.

- ι1** How does the 2005 Transformation of scientific laboratories at GSFC agree with some classic concepts of government reorganization?
- ι2** How does reorganization of a government-owned and -operated laboratory enhance or hamper opportunity to do research?
- ι3.** What are the differences in how applied and theoretical research may be affected in the 2005 Transformation?
- ι4.** What is the model for the concept of a transformation and how does it affect research at the bench scientist level?

ι. Hypotheses

► A government-owned and -operated lab would be less susceptible to doctrinaire organization changes since vested civil servants reside within a buffered and protected environment.

While government operated laboratories might be more susceptible to doctrinaire organizational rule and thereby easy to channel and control it is also true that vested civil servants presents a null hypothesis permitting more indifference to hierarchical constraints. This then becomes a question of balance and the proportion to which a

historically exempted government agency adjusts and or successfully resists organizational change when viewed in a structural and theoretical light.

► A government-owned and –operated may be more susceptible to government bureaucratic organizational change.

► Organizational change is a reaction to external circumstances of the day – political or otherwise.

► A ‘transformation’ attempts to be a more penetrating change from within to external forces. It aspires to be more than reshuffling boxes

► Full Cost Accounting is a major organ for control that confronts the built in resiliency of diverse research.

► There is built-in resilience in scientific laboratories because of the nature of research

► Reorganizations in themselves do not affect researchers’ morale and the satisfaction attached to quality of life in the workplace.

► Theoretical research is easier to penetrate and therefore more difficult to fund than applied/project research.

► The business model does not lend itself to scientific creativity.

B. Theta Questions and Hypotheses Relating to GSFC as Context

Stake differentiates major research questions intrinsic to and embedded in this specific case to be the designated symbol Θ (theta), as in:

$\Theta 1$. Why have GSFC science laboratories undergone cyclical reorganizations in 1984, 1990 and 2005?

Θ2. Why and how does the recent 2005 ‘transformation’ of GSFC laboratories differ from the previous combinations/separations of science laboratories in the past, specifically in 1984 and 1990?

Θ3. How did a cyclical succession of reorganizations affect the quality of research at GSFC?

Θ4. What is the impact of Full Cost Accounting when factored into the latest organizational change process at GSFC?

Θ5. In a government-owned and -operated laboratory such as GSFC, how are scientists and their respective research affected by reorganization?

Hypotheses Relating to the Case of GSFC

► The 2005 Transformation did not enhance the spirit of inquiry, morale or well-being of the researchers interviewed.

► Full Cost Accounting was generally not thought of as a positive influence on morale and research by the scientists at GSFC.

► One NASA was viewed similarly negatively as intrusive and detrimental to the research process by GSFC bench-scientists.

► Applied research relying on projects is easier to mainstream and thus direct than lone theoretical work.

► There is a built in resiliency and imperviousness science scientists in the face of bureaucratic penetration, because of diversity and the nature of expertise.

► In a positive sense, varying and fragmented disciplines are difficult to manipulate and control.

V. Research Design and Methods – Multiple Paradigms/Methodological

Inventiveness

Following the example of Allison and Zelikow (1999), I approached my examination utilizing three different paradigms or models that were triangulated to observe a process within a particular context. The structural view mainly draws from formal and official sources displayed and publicized both within and without the organization. These sources are extracted from organizational charts, strategic plans, press releases, internal reports and even such mundane sources as old phone books. They can be found on official web-sites, archives, and jetsam found in file cabinets and supply closets. They represent the organizational self-image and include historical and political reasons for adjustments over time. The three periods of organizational change and the organization itself were examined through this functional or structural lens.

The theoretical model depends on the research findings of scholars in the field of organizational theory and public administration that I found particularly relevant to the case. I examined five schema relating to processes of organizational content and change. The principal sources in this paradigm are Price (1962), Szanton (1981), Mark and Levine (1984), Perrow (1986), Light (1997), and Pfeffer and Salancik (2003).

The final reorganization deals with the most recent realignment is called a Transformation. It was necessary to go to the business model for its roots, found in Transformation Development (French *et al*, (2005). This change represents an internal adjustment on the part of members of an organization to external forces. I chose to utilize open-ended interviews in an attempt to extricate data found at the point of intersection between organizational change and a certain class of individuals found

within this organization. These were the people I was really interested in. For the interview portion of the study I followed the interview protocols of Kvale (1996) and the research question/hypotheses formula of Stake (1995).

Metrics were difficult to find and apply in this specific case, especially in a time-series sense. The conventional metrics such as publications and citations have now, because of Full Cost Accounting, become quite ancillary to the metrics of funded proposals. This fact was clearly revealed in the course of conducting my interviews which mainly had to do with the 2005 Transformation. It was also pointed out to me that publications often react to catalysts that are completely independent from any organizational change, such as mission launches and data telemetry. Citations, on the other hand, while documented are generally considered undependable by most working researchers, except when being considered for promotion.

Figure 2, seen below and adapted from organizational properties depicted by Buchanan and Bryman (2007) is a diagram of the entire methodological concept of this study.

System of Influences on Methodology of Reorganization/Transformation of GSFC Science Laboratories

Currents of organizational research

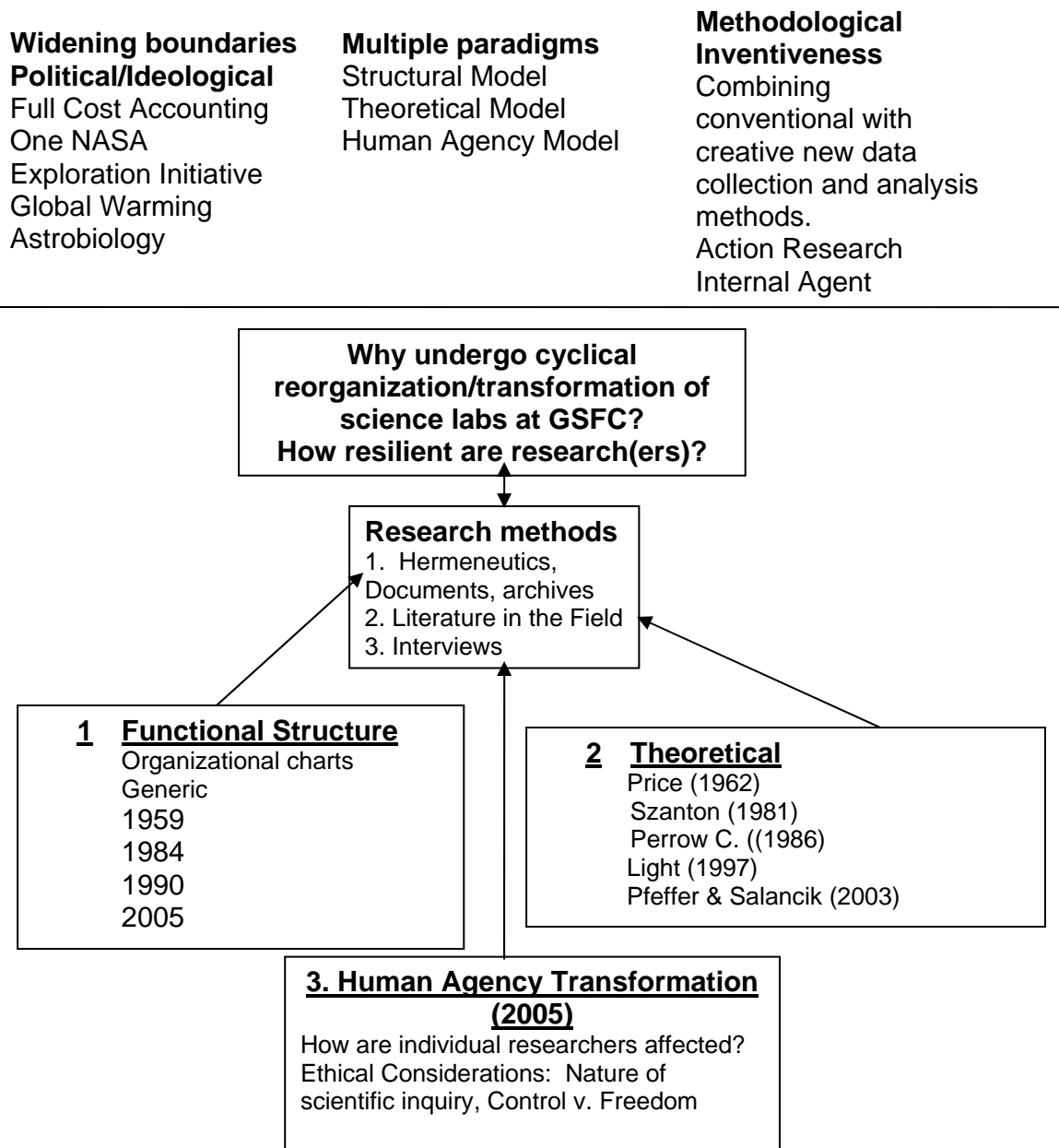


Figure 2

VI. The Lens of Structural/Organizational Functions

Organizational configuration is the subject of a major portion of managerial presentations and agency literature. Strategic plans and mission-statements utilizing concepts of structured-planning, delineate the tactics, strategy, overall structure and goals that organizations present to their members and to outsiders. Internally, organizations consistently revert back to the canons of scientific management depicting their configurations through organizational charts (Gulick, 1937). These structural depictions present a snapshot of the makeup of a construct, explaining it to itself as well as to forces on which it depends or who in turn depend upon it. Organizational charts are often ridiculed as meaningless and they certainly fail to demonstrate the nuances of the true internal workings of an organization. Nevertheless, such charts along with mission statements, strategic plans and internal newsletters provide useful data for a structural analysis of organizational evolution.

Mark and Levine (1984) give a generic example of the formal organization of a research institution. This meta-organizational chart follows the bureaucratic model. It depicts the actual work being done at the branch or workgroup level. While this might suggest that there is a certain similarity within the workgroups at this lowest level since they are supposedly all working on directed tasks, in research terms these units are often made up of highly diverse teams with different areas of expertise. As such they can be subdivided into even smaller units called sections and even at that level the investigations as well as the people remain highly specialized.

The levels above the branch or laboratory groupings consist of divisions. They are managerially important since they provide linkages to resources and also function as

organizational entities linking the line-working people at the lower level (people who perform the organizations core processes) with upper management. The division level tends to have support offices and staff. The implication is that they *should* be utilizing such resources to facilitate the tasks of the laboratories. Advancing higher up the pyramid, in large organizations you usually find directorates. They can be arranged according to either discipline or function. Finally, at the very top sits the director

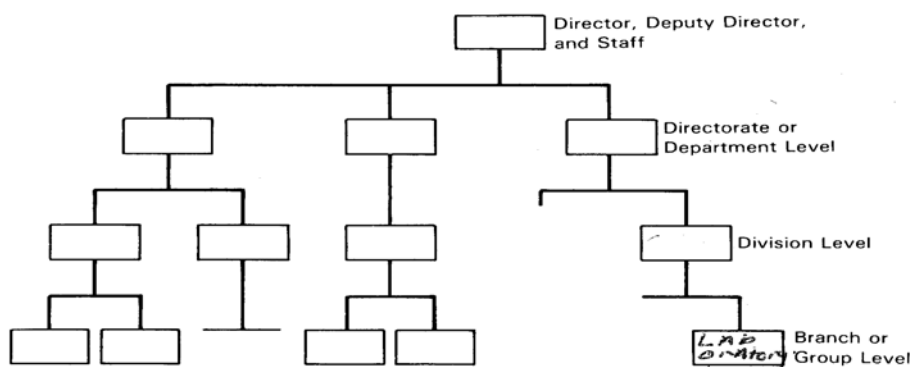


Figure 3

and his apparatus of management such as Legal, public affairs, etc...

The purity of this delineation can quickly become complicated. For example, at a field center such as Goddard, the word laboratory is ubiquitous. It can often refer to the entire center as well as the lowest work group. Another problem is support. While there is what often seems to be an army of staff at the Directorate and even Division levels this assistance does not necessarily filter down to the lowest laboratories. These can be often left with an abundance of administrative tasks and a paucity of help.

Mark and Levine (1984) give valuable organizational and structural insights that are still relevant in determining what government-owned and -operated laboratories

actually do and how well they do it. They also postulate on the uniqueness of research organizations and their relation to management.

When NASA came into existence, President Eisenhower explicitly wanted it to be a civilian space agency – perhaps because military forces had already laid claim to the darker aspects of space exploration (McDougall, 1985). The idea of a civilian space agency led to a debate as to whether NASA employees were to be included as part of the civil service or not. In the end a series of compromises were arrived at leading to a sort of dual track arrangement. A great many exceptions were guaranteed to the Agency's elite cadres of research scientists and engineers. To simplify their categorization NASA devised the term 'Aero-Space Technologist'. This could be applied to many areas of academic training as well as fields of advanced research (Rosenthal, 1968). In other agencies, the position as well as number of people supervised tended to determine the pay-grades. At NASA, however, grades were modified to fit the expertise, education and overall stature of the occupant. The 'man-in-grade' concept gave NASA management wide discretionary powers to devise 'exceptions' to both the General Schedule (GS) and the Classification Act of 1940 (Rosholt, 1966). This created the problem of integrating scientific/technical elites within a bureaucratic structure – a problem that was not rendered transparent through organizational charts and mission-statements.

The first organizational chart outlining NASA structure was released in 1959 with the help of McKinsey and Co. Incidentally, the firm of McKinsey evolved as did NASA, 'transforming' itself into the McKinsey Global Institute with timely interests in global warming and various offshore strategies.

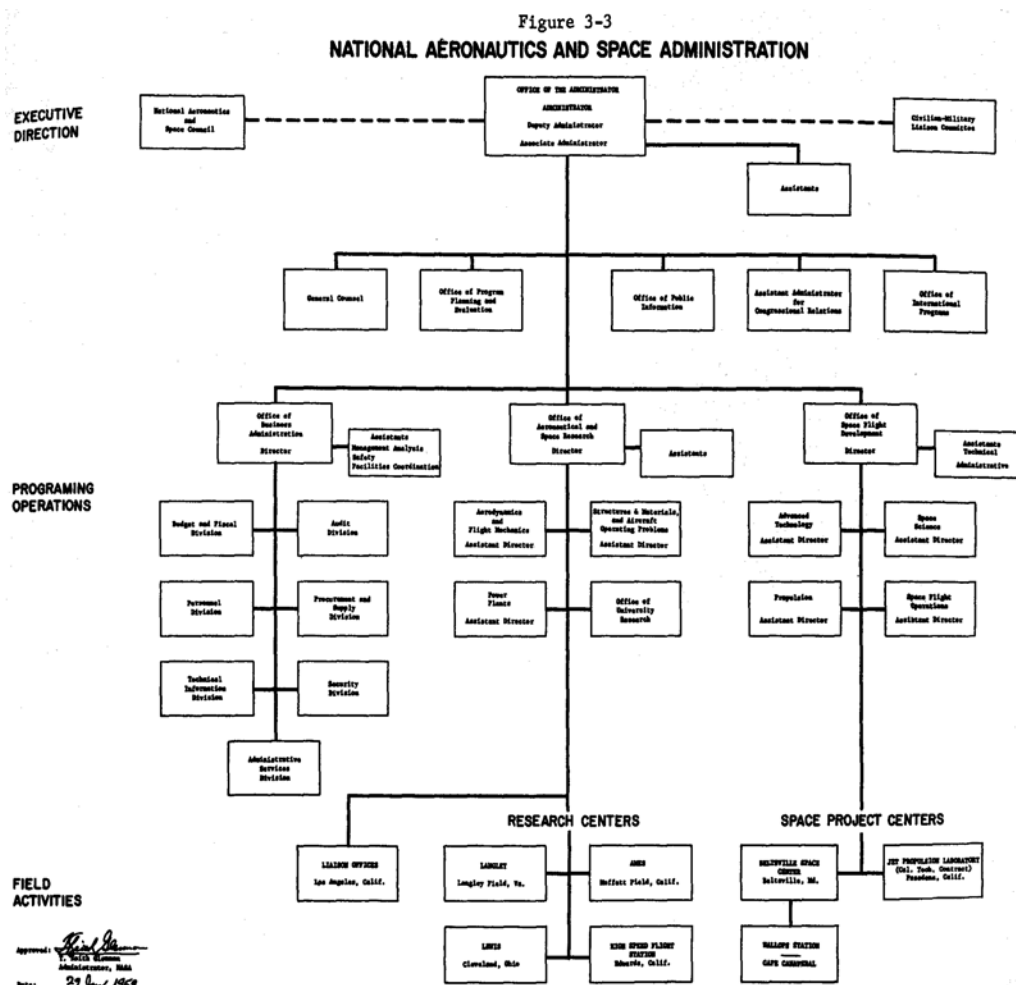


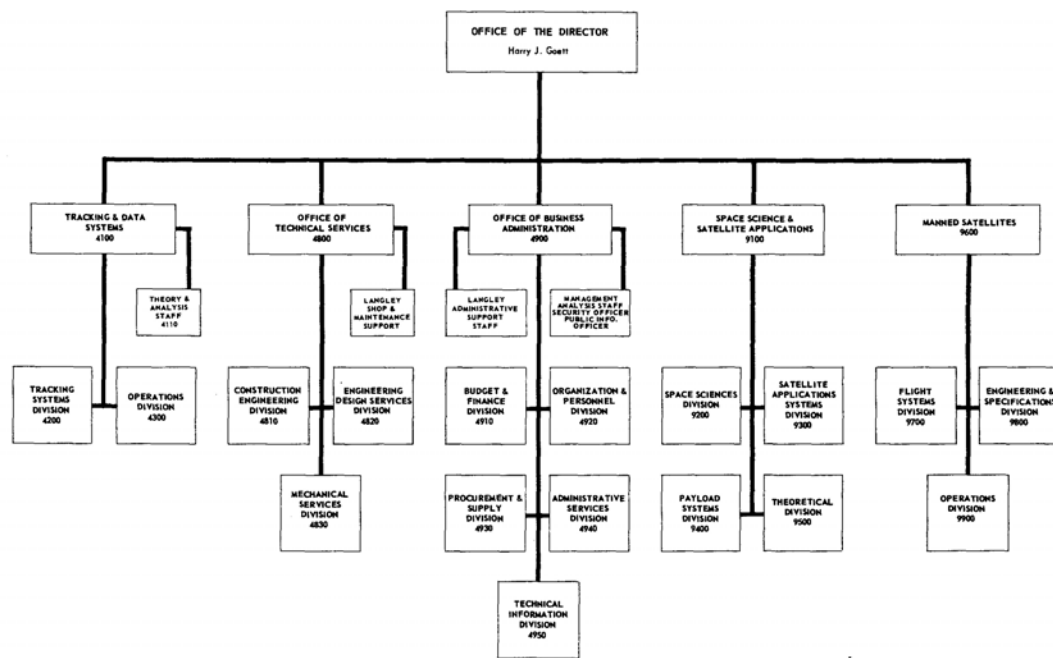
Figure 4

(Initial NASA organizational chart from Mc Kinsey and Co. (Rosholt, Fig. 3-3))

The 1959 organizational chart was to last for approximately a year and demonstrated the complexities of integrating NACA core facilities with the exigencies of space travel. It followed a hierarchical organizational structure, arranging itself vertically. Higher line organizations were designated the Office of Business Administration, the Office of Aeronautical and Space Research and the Office of Space Flight Developments. The Headquarters configuration conferred an equal status on the newly created space

flight aspects and the already existing NACA research centers such as Langley and Ames. These NACA entities existed in direct line contact within the Office of Aeronautical and Space Research. The Office of Space Flight encompassed not only technology, propulsion and space flight operations but also an entity called space science. Three Project Centers were designated under the Space Flight Development: Wallops/Cape Canaveral, the Jet Propulsion Laboratory at Cal Tech and the newly formed Beltsville Space Center, soon to be renamed the Goddard Space Flight Center. It accreted many of the research facilities and people from the Naval Research Laboratory. This made it difficult to designate it solely a space flight project entity although the words 'Space Flight' in GSFC originated from the fact that it was originally rooted as a line-center stemming from the Headquarters Office of Space Flight Developments. HQ positions identified as Associate Administrators would continue to retain the power of general managers of designated Field Centers and then later of scientific disciplines. This 'line' power function would flow from them to the various 'Field Activities'. Disciplines evolved primarily at the Directorate level but occasionally filtered down to individual researchers in various sub-disciplines.

In 1959, what was to become the Goddard Space Flight Center, set up its own organizational chart. They set up five major organizational directorates, one of which (9100) was designated to Space Science and Satellite Applications. Two of its divisions were dedicated to Space Sciences and Theoretical Studies (Rosenthal, 1968).



Organization chart, July 1959.

Figure 5

(Organization chart, July 1959, Appendix F, p.262).

At NASA HQ according to Homer Newall (1960), there was some discomfort among the scientific community concerning the status of space science as a subsidiary of spaceflight development. It was strongly believed that science should be the driver and not a mere appendage or afterthought of spacecraft wanderings. There was difficulty in the ordering and integration of NACA that had strong research components embedded as direct line functions headed by a loose steering committee.

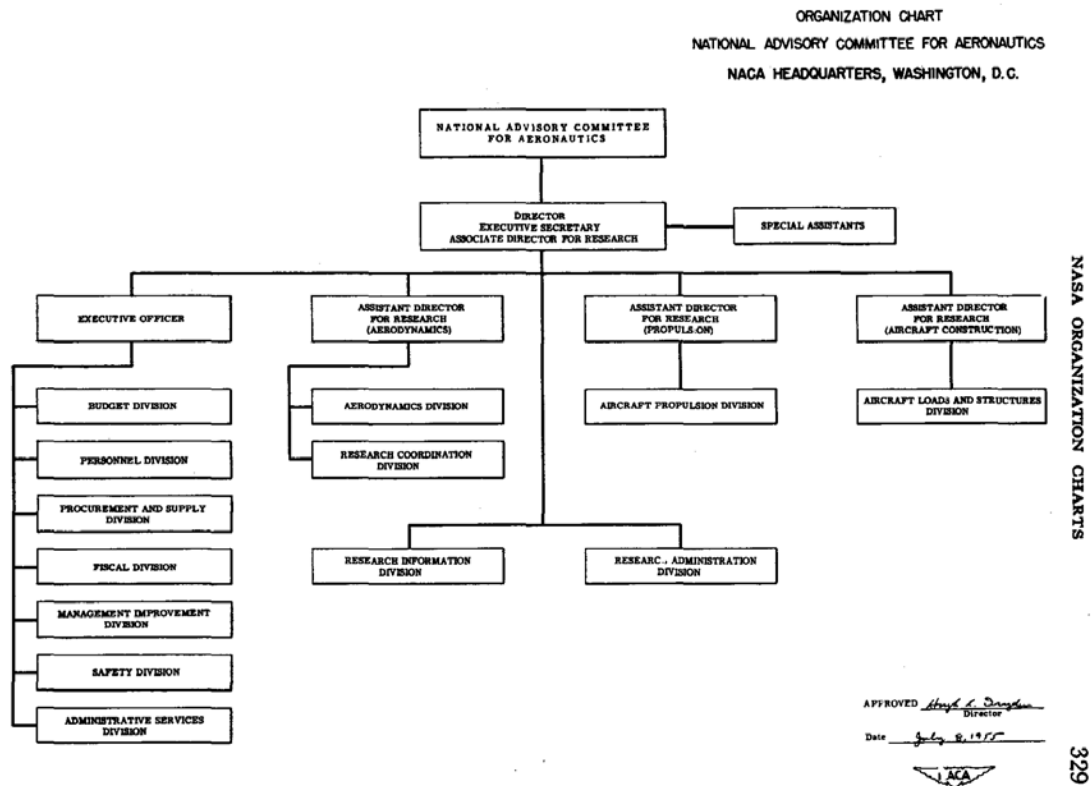


Figure 6

(NACA organizational chart, 1955).

The NACA structure (above) retained advocates – both within and outside the new NASA organization.

It probably came as a relief to many when the first major reorganization of NASA by its second Administrator James E. Webb, elevated science through the newly created Office of Space Science (Newall, 1960).



(Organizational Chart, November 1961 – 215-892 0-66 (Face p. 244) No. 1).

In this snapshot, all of the Field Centers are equally lined up under the Administrator, his Deputy (Mr.Outside) and the Associate Administrator (Mr. Inside). The Office of Space Science is not directly connected to any Center and gone are the Research/Space Project Center distinctions. This results is a more complex yet less rigid structure with space science and something called

‘applications’ elevated to same level as Manned Space Flight. Webb, a ‘broad-gauged man’ had prophetically determined that the future of the space agency must extend beyond the space race as engendered by the Cold War (Webb, 1969; Lambright, 1995).

Because of its connections with the Navel Research Laboratory, Goddard already had a clearly established scientific base in 1961. It quickly developed the ability to develop and produce world class, in-house research programs utilizing the enormous amount of data being retrieved from the increasing proliferation of Earth orbiting satellites.

The abbreviated, over-simplified and stenciled information found in organizational charts, make it possible to anchor and trace the development of Headquarters and Goddard, observing how their functional and structural workings developed and aligned.

In 1984 a major reorganization of science laboratories occurred when what had evolved from satellite applications became the Earth Science disciplines and were placed within the Space Science Directorate (Goddard News – July, 1984). The Goddard Director stated that this would allow more efficient interaction with NASA Headquarters since it had also reorganized by 1983 but not quite to the point of dropping the word ‘applications’ .

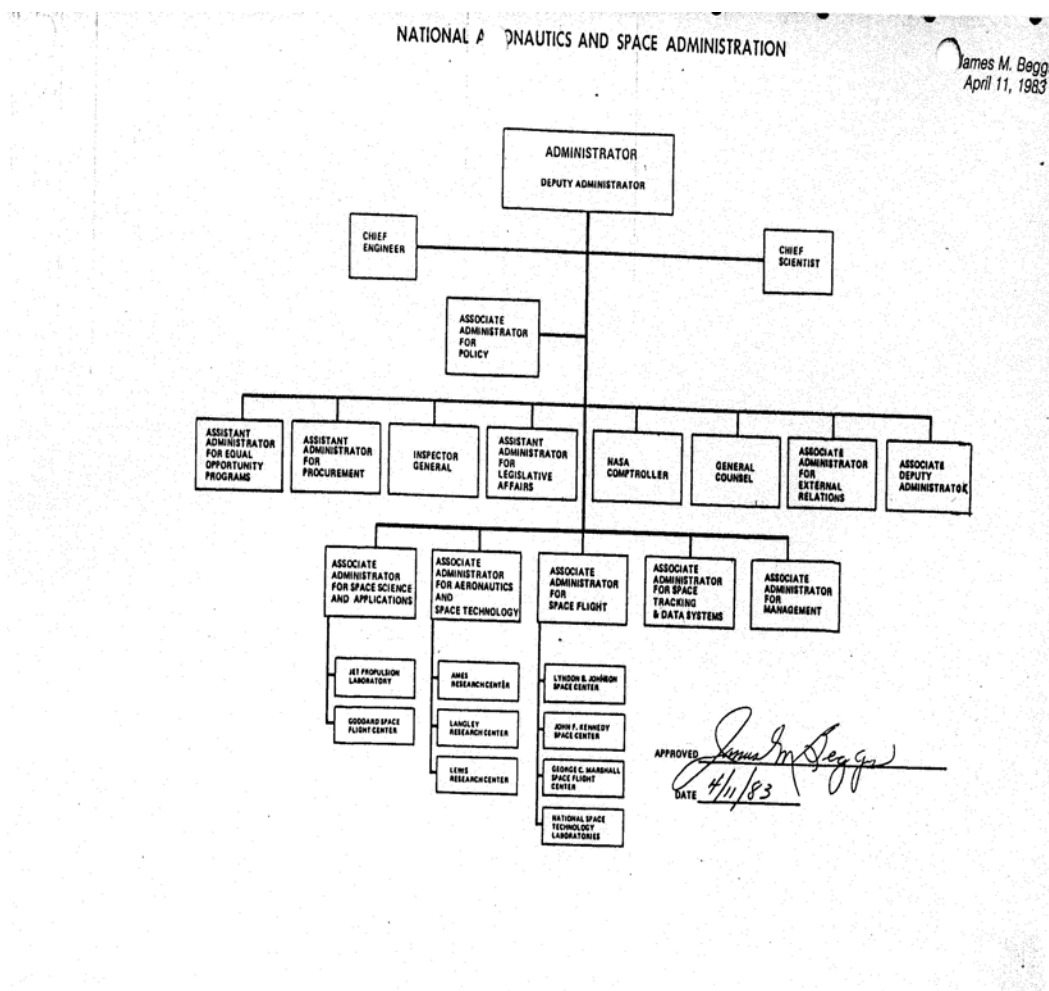
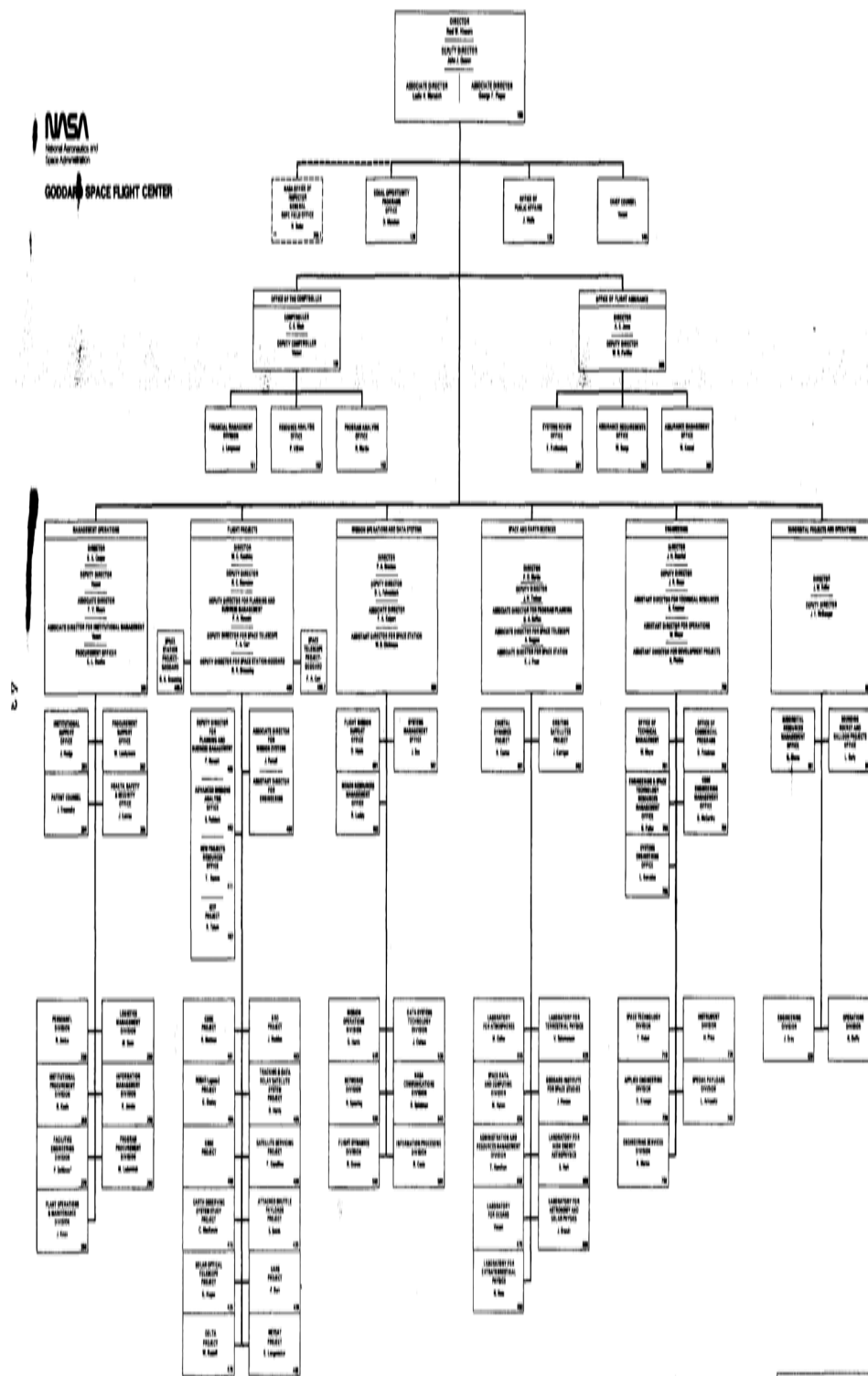


Figure 8

(HQ organization chart 4/11/83).

HQ had designated five associate administrators, one of which being the Associate Administrator for Space Science and Applications and the two Field Centers in this line were Goddard and the Jet Propulsion Laboratory. Goddard was no longer clustered within a group of Space Project Centers but now placed in the line organization as a Research Center. At Goddard, the term ‘applications’ was quickly renamed Earth science and along with space science was consolidated into one directorate with divisions reflecting specific disciplines.



REPORTS DIRECTLY TO THE CHIEF OF POLICE

APPROVED: Karl M. Harnisch
 Karl M. Harnisch, Director, BPP

Figure 9 (Goddard organizational chart, 1986 from Goddard phone book).

As always in such arrangements, there remained a great deal of discipline and workgroup overlapping but redundancy at NASA was not necessarily considered inefficient.

Stated goals were to encourage a wide breadth of research with a minimum of regulating behavior, rules and regulations. There was also an attempt to encourage communications, allow for personal growth and above all entrust authority and responsibility to the lowest possible level (Goddard News – December 1984).

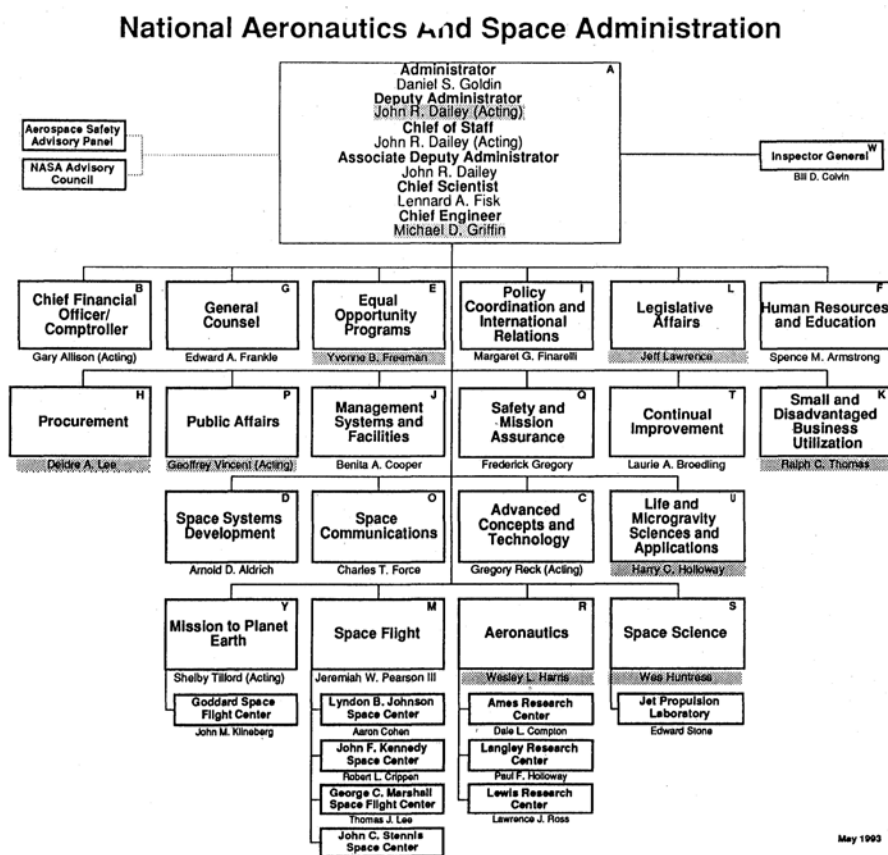
Despite the supposed elevation and broader definition of science, Noel Hinners, Director of Goddard stated in a New Year's Message that: "The year was not without its share of pain, frustration and sadness. I regret that reorganizations did cause individual hurt and that I could not get you all the resources you need. We lost valued colleagues and friends by retirement, resignation or death but have wonderful memories" (Goddard News- January 1985).

Actually NASA Field Centers were growing and becoming more defined by incrementally assimilating former NACA organizations, military components and research laboratories such as the Naval Research Laboratory.

In 1990 another organizational accommodation occurred, with Earth sciences assuming a dominant and highly visible role at NASA. There was talk of a symmetry made up of Mission from Planet Earth and Mission to Planet Earth. Earth observing satellites had identified data that seemed crucial to understanding the planet as a series of systems. Although Earth science was considered less elegant – more messy – by many

scientists, it suddenly could be seen to possess what space exploration had constantly been striving for since the end of the Cold War, relevance. Once again Headquarters and Goddard reorganized. This time it was decided that there should be two equal but separate directorates at Goddard one dedicated to Earth science disciplines and one to space.

At Headquarters there were eight technical line organizations: Space Systems Development, Space Communications, Advanced Concepts and Technology, Life and Microgravity Sciences and Applications, Mission to Planet Earth, Space Flight, Aeronautics and Space Science. Mission to Planet Earth was assigned to Goddard and space Science to JPL.



(Figure 10 from Annual Report). HQ organizational chart May 1993

In actuality both space and Earth disciplines continued to exist at Goddard. This fact was explained away by the invention and designation of 'Lead Centers'. Similarly, Earth continued to exist in other installations as long as it was understood that Goddard had the lead responsibility for this area of scientific research. This reflected an attempt to streamline a somewhat sprawling structure without changing the inner workings of individual workgroups. Space scientists at Goddard did not relocate to JPL nor was there any attempt to make them do so. In 1989, the Goddard Director had iterated three key objectives for their future. They were "1) to maintain Goddard's world class research in space science; 2) to start up a major Earth science initiative, the Earth Observing System; 3) and continue to provide quality technical and support functions for these programs" (Goddard News – December, 1989, p. 6).

As Goddard was about to turn 30, it seemed established as a leader in both space and Earth sciences – a premier government-owned and -operated laboratory. Goddard had established and maintained its leadership role in Earth science and space science. Truly to separate these two would have proven to be impossible since many of their methodologies and objectives remained similar if not identical.

Earth sciences was experiencing significant advances. Early satellite images had provided observations of worldwide land surveys. Increasingly sophisticated instruments stood poised to venture into a more refined examination of the upper atmosphere enabling serious studies of atmospheric changes affecting weather and above all climate. Plans were underway for a multi-faceted project with the umbrella name of the Earth Observing System (EOS). Furthermore, despite the designation of JPL as lead center, Goddard had maintained a significant role in space science, studying space from space.

Finally, in 2005 Goddard laboratories underwent another reorganization and this one proved to be distinctly different from the others. For one thing it borrowed a term from a business model, calling itself a Transformation. Based on the assumption that language matters, it may not be tangential to this inquiry to ask why?

I found that the term ‘transformation’ as applied to organizational change, was grounded in the literature of business organizational development. It is a somewhat recent model of the planned change process that is described as ill-defined, experimental and in flux (French, *et al.* 2005). It can be traced to the 1987 work of Jerry L. Porras’ ‘stream analysis’. Porras’ model utilizes four organizational components: Organizing Arrangements (OA), Social Factors (SF) Technology (T) and Physical Setting (PS) (Porras, 2005).

A 6th edition of French’s textbook defines organizational transformation (OT) as “... a recent extension of organizational development that seeks to create far-reaching changes in an organization’s structures, processes, culture, and orientation to its environment” (French *et.al.*, p. viii).

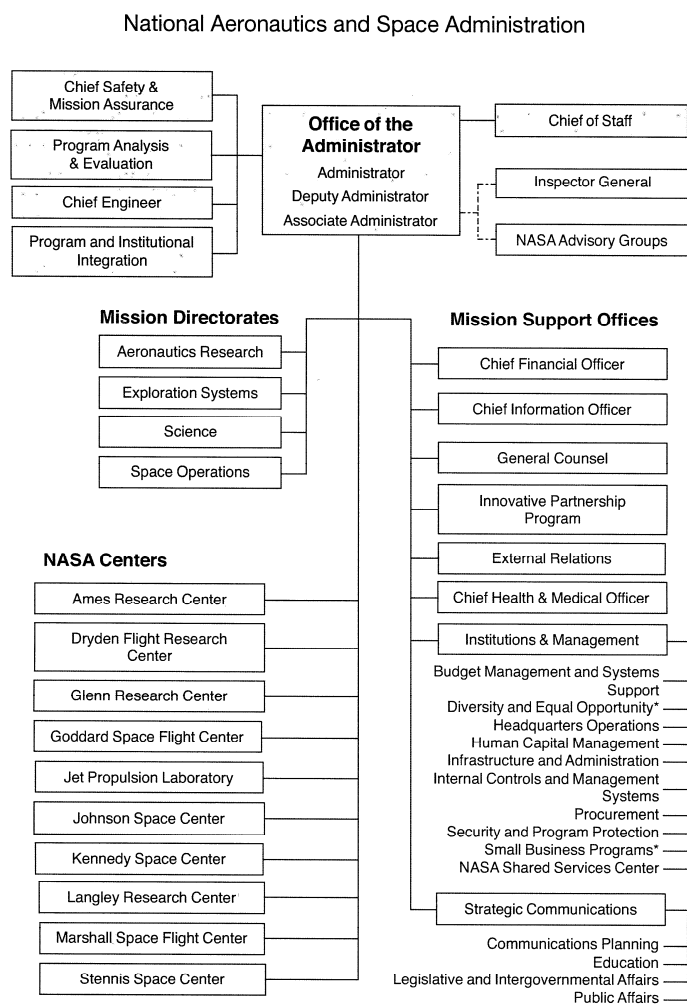
Along with the familiar facets of planned change in a reorganization, such as realignment of goals, job skills, social factors, technology and physical settings; a transformation adds a change in vision, beliefs, principles and mission. Also, among its core assumptions is the belief that “... individual behavior is central to producing organizational outcomes ...” (Porras & Silvers, 2005). What is sought and expected in such a change is a complete paradigm shift in which the organization, though individual members, is made over to better confront and align with present and future conditions and environments. The organizational boxes are not merely shifted or rearranged, they

are often shattered or subsumed by other boxes. The change is intended to be cultural and profound.

Applying the above concept to a research laboratory culture that is at once both bureaucratic and highly diverse presents no small feat. In order to analyze and explicate such a process, I felt that organization charts would prove less helpful than an examination of the precise intersection between the process and the individual – as the model itself suggests.

After the 2005 Transformation, the Headquarters organization chart no longer reflected the organizational bifurcation of scientific research into disciplines of Earth and space. Under a series of what were called Mission Directorates, Science was given its own ‘box’, others being Aeronautics Research, Exploration Systems and Space Operations. None of these ‘missions’ connected directly with any field centers but rather stemmed directly from the Office of the Administrator. Similarly all of the NASA Centers were alphabetically arranged in direct line with the Office of the Administrator. This design would make it difficult for researchers to communicate with their program or project equivalents at the directorate level at NASA Headquarters except in an informal way

Headquarters Organization Chart

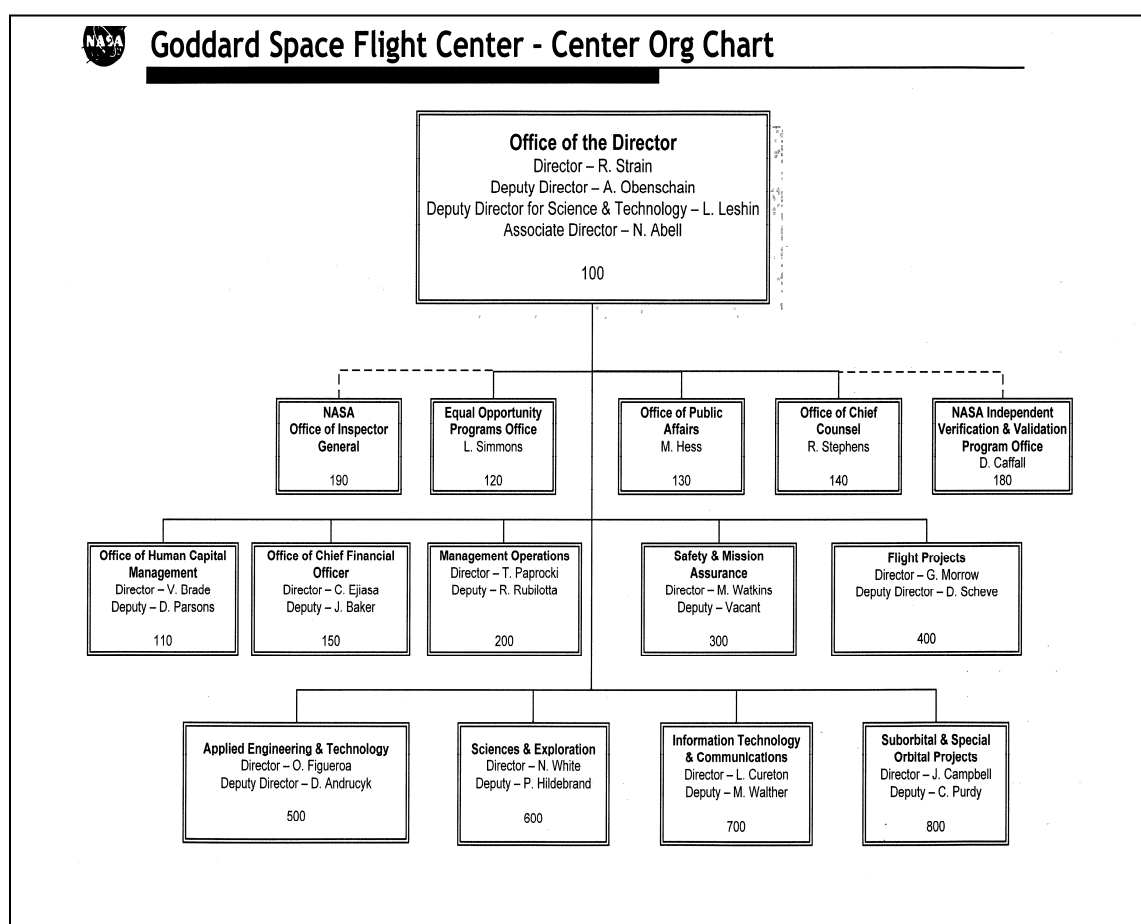


(Figure 11- Headquarters Directory, Spring 2008).

If the organizational chart from Headquarters left a lot of unanswered questions, the adaptation at GSFC was somewhat startling. Seizing upon the internal change paradigm of a transformation, science was seemingly camouflaged under what was called

the Sciences and Exploration Directorate. Formerly, Earth and space sciences had both operated at the directorate level with a clear organizational connection to Headquarters. Now they were both joined under the same directorate and fractured into four divisions. The sciences (both Earth and space) ‘demoted’ to division status with sub-disciplines assuming (for the most part) the role of laboratories rather than branches. An interesting side effect was that since divisions had now become laboratories, those scientists who been granted Senior Executive Series status by virtue of being Division Chiefs were able to retain their standing. This would have not been easy had they been acknowledged to be mere Branch Heads.

Figure 12



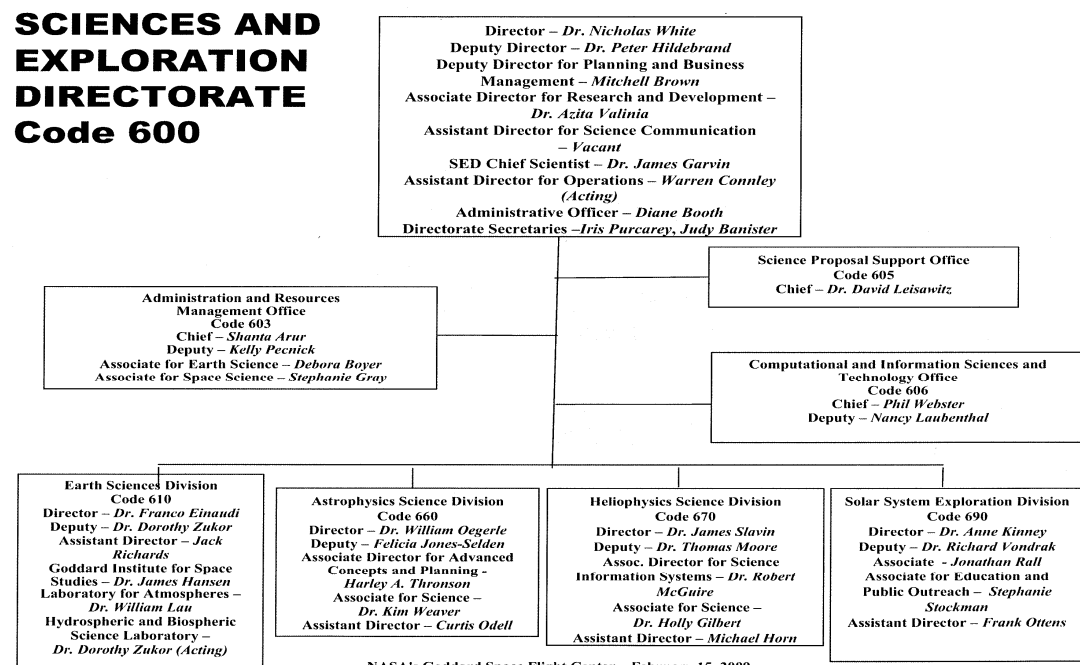


Figure 13

A. Public Administration research questions

11 Utilizing the information from a structural lens, it would seem that in a hybrid organization such as NASA, it is not easy to follow the purely classic concepts of functional organizational charts since the organization tends to be constantly in a state of flux. Goddard was constantly forced to realign itself because of research changes and developments as much as conforming to the directions of Headquarters.

12. Although the 1984 reorganization at Goddard seemed to cause some discomfort and even loss of staff as evidenced by the Director's New Year's address, for the most part workgroups were not sundered. The expressed goal was to elevate and increase the science component by adding Earth disciplines to the mix. It might be said to have enhanced Earth science without diminishing space science. At Headquarters,

Goddard as a Field Center was moved from Space Flight to Space Science. This could only have pleased the cadre of scientists and researchers in residence.

13. It is not clear whether applied or theoretical research fared better at Goddard in 1984 from a purely structural or functional approach.

B. GSFC Research Questions

1. GSFC underwent cyclical reorganizations in 1984, 1990 and 2005 partly to remain aligned with Headquarters and its funding sources. Headquarters, on the other hand was struggling with incorporating diverse organizations to a single and meaningful mission.

2. Organizationally, the business grounded Transformation differs from previous reorganizations because it attempts to readjust the inner workings of consolidated workgroups accustomed to diverse processes and free-flowing communications into a different culture. It also attempts to go from a loosely coupled organization to something much more mission oriented and disciplined.

3. It is not clear from looking at the structural and functional components how the quality of research at GSFC would be affected.

4. Full Cost Accounting does not appear in any organizational depiction except for the implications drawn from the newly founded 'Proposal Office' after 2005.

5. Solely from the functional-structural lens it is not clear how controlling reorganizations would be to research in a government-owned and –operated laboratory. Certainly they represent an intention to streamline and direct research but an organization chart does not readily reveal how this may or may not succeed.

VI. Theoretical Lens

Looking through an alternate lens and utilizing the theories of scholars who have dealt with the subject of reorganizations, I attempted to gather evidential properties and apply these to the processes occurring at Goddard Space Flight Center's laboratories.

A. The View from Szanton

Szanton's (1981) reasons for reorganizations as already noted are: to shake things up, to simplify operations, to reduce costs, to symbolize priorities, to improve program effectiveness and to improve policy integration.

Certainly shaking things up was a view held by some of the people interviewed who stated that all organizational changes were simply something that managers did. In 1984 the missions and strategies of most Field Centers and laboratories had evolved rather freely and Headquarters had as a top priority to set directed goals at Goddard. Productivity was the order of the day and from the merger of space and Earth Sciences, it was hoped would also come a better 'product' (Goddard News, July, 1984). Szanton would have probably called this reorganization, one of structure rather than one of resources or processes. For the science laboratories and scientists it was seen as a consolidation. Space and Earth research emerged as a continuum and were placed in the same box.

In 1990, Earth Sciences at NASA assumed a global perspective since NASA was no longer linked to the Cold War. The Goddard director had a strong background in engineering. He saw applications as leading science and not the other way around (Exler, R., 1990). Having one science directorate was viewed as unwieldy and it may have been

felt that the up and coming Earth sciences, ready to launch its most ambitious program, the Earth Observing System (EOS), had to be isolated in order to control its science.

Finally in 2005, shaking things up was accomplished by a strong penetration into the work force, down to the smallest work unit and individual.

Another given reason for reorganization by Szanton is to streamline operations. In 1984 it may have been thought that consolidating all of the researchers into one Directorate would accomplish that goal. Certainly some staff functions such as business matters were consolidated in only to be split apart again in 1990. After the Ride Report (1987) strategic plans and mission statements spoke of a balanced program for NASA. There was exploration and there was science. Within the science component were included applications and engineering and program science – some of which became quite independent. For the most part changes however did not occur within line functions and research disciplines remained grouped as they had always been albeit within a much more specialized directorate.

2005 and the Transformation were also intended to streamline operations. This meant realigning disciplines and elevating Space Exploration especially manned exploration to the position it had once occupied, during the Cold War.

As far as reducing costs were concerned, there seems to have been little mention of this made in both 1984 and 1990. Certainly this was the era of privatization but NASA Field Centers had always depended on a strategic in-house contractor staff (Seidman, 1998). There was also a growing impetus to link NASA and Goddard activities with the military, calling for long-range national space goals (Covault, 1984).

In 2005 it was a stated goal to revive the manned space flight component of NASA without an increase in funding. In attempting to implement Full Cost Accounting funds were taken from researchers by forcing them to bring their own salaries. There were suspicions; expressed by Goddard scientists that such funding cuts did not seem to have profited the realm of space exploration. Many viewed space exploration as only being feasible as an international effort since it required too many resources to be accomplished as an appendage to nationalism (Levine, 1975).

Around 1984 symbolizing priorities would lead to publicizing scientific gains in near orbit as well as the possibility of the transference of the dividends of Goddard research to the private sector. In 1990, viewing Earth as an aspect of systems science furthered atmospheric modeling as the Earth sciences assumed their own directorate. Finally, after the 2005 Transformation, symbols and priorities returned to manned space flight, expressing the lure and prophesy of humanity ultimately reaching Mars.

Improving program effectiveness probably always influenced Goddard reorganizations in 1984, 1990 and 2005. By aligning itself with Headquarters Goddard hoped to improve planning and above all funding. By 1985, a Strategic Plan stressed structured planning processes to develop plans and assess strengths and weaknesses of Goddard. Critical Success Factors were introduced with stated goals of maintaining national and world-class science relating to space and the Earth and its environment. Scientific research was seen as a driving force rather than an appendage to satellite data (Goddard's Strategic Planning 1986).

In 1990 the two science directorates at Goddard stressed three specific areas of responsibility: Earth Science, Space Science and Technology. There were other program

and institutional goals and strategies but they paled beside the number one program goal, of serving as a national resource for discovery in Earth and space science and technology development (Goddard Space Flight Center Implementing NASA's Strategies for the 21st Century, 1990).

As far as improving policy integration, Goddard progressed from an emphasis on science in general in 1984, to an independent emphasis on Earth and space science in 1990 and finally an emphasis on manned Exploration leading to, what many called, the demotion of science. Szanton's reasons for reorganization represent attempts to integrate policy with various administrations, legislators or outside and popular sentiment. With the possible exception of 2005, these changes were more nuanced than substantive. Individual laboratories, made up of even smaller work disciplines were very diffuse and diffuse programs are difficult to fund (Szanton, 1981) or not fund. They are also difficult to keep track of and tend to follow their own leads.

B. The View from Light

Paul C. Light (1997) examines organizational change under the headings of scientific management, war on waste, watchful eye and liberation management.

From the beginning Goddard and NASA Headquarters were set up according to the scientific organizational principles set forth in the Gulick papers (1937) as applied to a research organization described in Mark and Levine (1984). Although Goddard was a hierarchical organization with clear chains of command, the specialization of rapidly changing disciplines gave this traditionally mechanistic organization a decidedly organismic make-up with knowledge being scattered throughout the entire Center.

The reorganization of 1984 was an attempt to follow where scientific research was leading. The clear-cut mechanistic organizational chart was in flux and scientific research was evolving more quickly than manned space hardware. It was cheaper and tended to provide more results for the money. The establishment of two science directorates in 1990 furthered this evolution although it was clearly halted in 2005 when the organization chart was skewed toward an older and more mechanistic and traditional path – at least in rhetoric.

War on waste achieved prominence as the frenzy for privatization. It gained ascendancy around 1981. NASA had always been comfortable in a contractor environment. Its second administrator, James Webb, used to boast that the NASA budget gave a great deal back to the private sector through government contracts. War on Waste might be said to be a major element in 2005 if not in 1984 and 1990, however, since a mentality of rigid fiscal responsibility generated a growing number of audits and reviews. Strategic management became the order of the day.

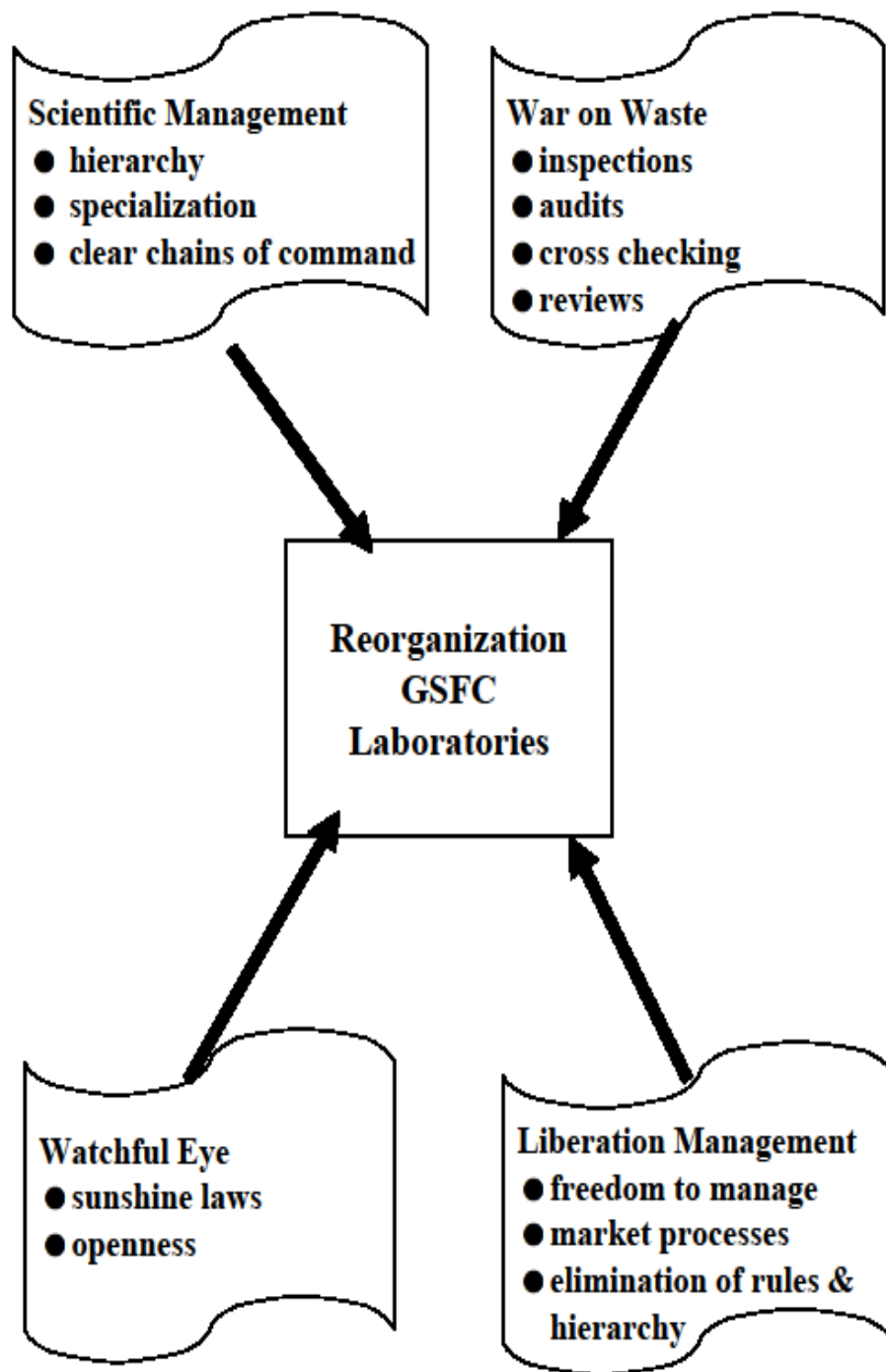
Watchful Eye had been in effect since the late 70's with sunshine laws and Freedom of Information mandates but this did not greatly affect Goddard or NASA unless something along the line of the Challenger and Columbia tragedies occurred. One interviewee identified the Columbia Accident Investigation Report (Gehman, *et al.* 2003), as one of the prime causes of the 2005 Transformation.

Liberation management was highly touted during the Government and Performance Act of 1993 (Osborne & Gaebler (1993), but it had little impact at Goddard where scientists usually ran scientific research and considered the bureaucracy no more than an annoyance – minor or in some cases major. The Strategic Plan of 1996 stressed a

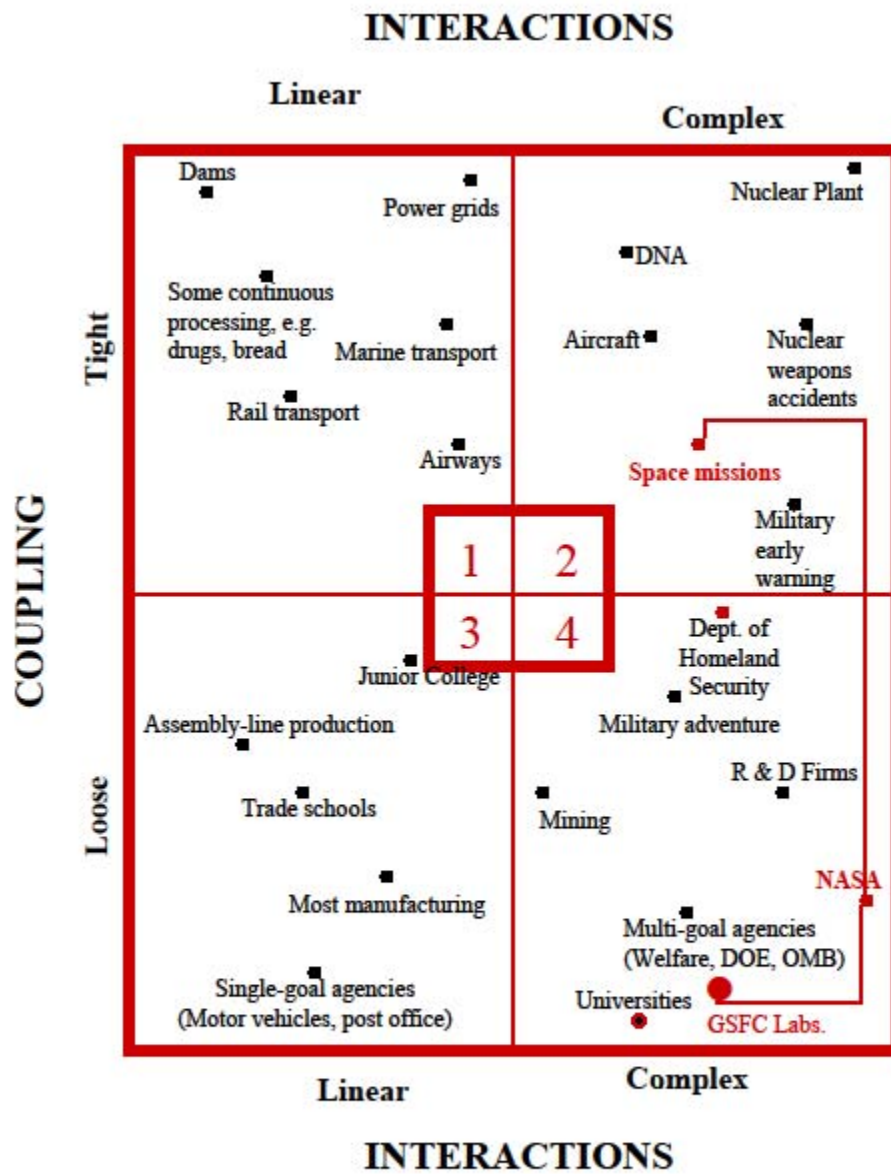
framework for a single NASA that dealt directly with customers. It also addressed constricted budgets, eliminating duplication, and assigning a higher level of integration and accountability to contractors (NASA Strategic Plan, 1996). One can also find traces of 'Liberation Management' in attempts at merit pay reform and the Faster, Better, Cheaper mentality of the late 90's.

Finally, the Strategic Plan of 2005 speaks of integrated financial management. It also states that priorities will be set by the vision established by the President. The 2005 document reads like an accounting manual accompanied with glossy pictures of space explorers. There is no watchful eye or liberation management. The war on waste is handled through accounting systems and the hierarchical rule comes straight from the top. The Transformation of 2005 sets a vision for the path of the United States to the Moon and Mars. Only in passing, are other minor objectives mentioned.

In actuality, any aspect of Light's typology fits comfortably within the three reorganizations examined although in fairness to Light they were never intended to. Aspects of all four can be discerned in all the inner-workings of change at GSFC.



Light, P.C. (1997)



Perrow, C., (1986)

Figure 15

The View from Perrow

Perrow (1986) addresses organizations as having either complex or linear interactions and as being coupled in either a loose or tight configuration. He also addresses the subject of change in an existing power structure as a state of flux.

The question of scientific research as a emerging component in a federal research center such as Goddard – one embracing strong cosmologically and theoretical components – would have caused the Field Center to develop as a hybrid organization, no longer squarely grounded in the ‘tight and complex quadrant’. Space missions would certainly apply to Goddard in the early stages of its existence, undoubtedly contributing to its being named the Goddard Space Flight Center.

By 1984, however, Goddard had evolved into a diverse organization, having much in common with loosely coupled organizations such as R & D Firms and the complexity resembling universities and multi-goal agencies – all depicted in Perrow’s complex and loosely structured quadrant.

The reorganization of 1990 further underlines these changes when space missions themselves vie away from the manned program, turning satellite observations toward Earth, developing further complexities demanded by systems thinking.

Seen in the light of Perrow’s diagram (shown above) the 2005 transformation seeks to ground the Goddard Space Flight Center once again within a much ‘tighter’ coupling. This explains the transformative change from within necessary to return to a more military paradigm. Looking at Perrow’s diagram rather than an organization chart clarifies the move necessary to accomplish this change. One must move from a loose organization to a tightly coupled one, meaning that directives will penetrate more in the

manner of bureaucratic uniformity. Interactions will not be possible without permission from above and the concept of collegiality will be at odds with the organizational structure. While not dealing with government reorganizations per se, Perrow nevertheless shines an unexpected and revealing light on them.

The View from Mark and Levine

Mark and Levine (1984) provide an invaluable combination with expertise in both the physical sciences and public administration. For them research in the federal government includes the need for long-term commitments, flexibility of goals, freedom to publish, free and open access to the international community and a secure status as elites for the professional researcher. They also state the fact that basic and applied research might have difficulty existing within the same organization as well as the fact that it is almost impossible for myriads of research tasks to be monitored by a single administrative head while providing the freedom to explore new areas.

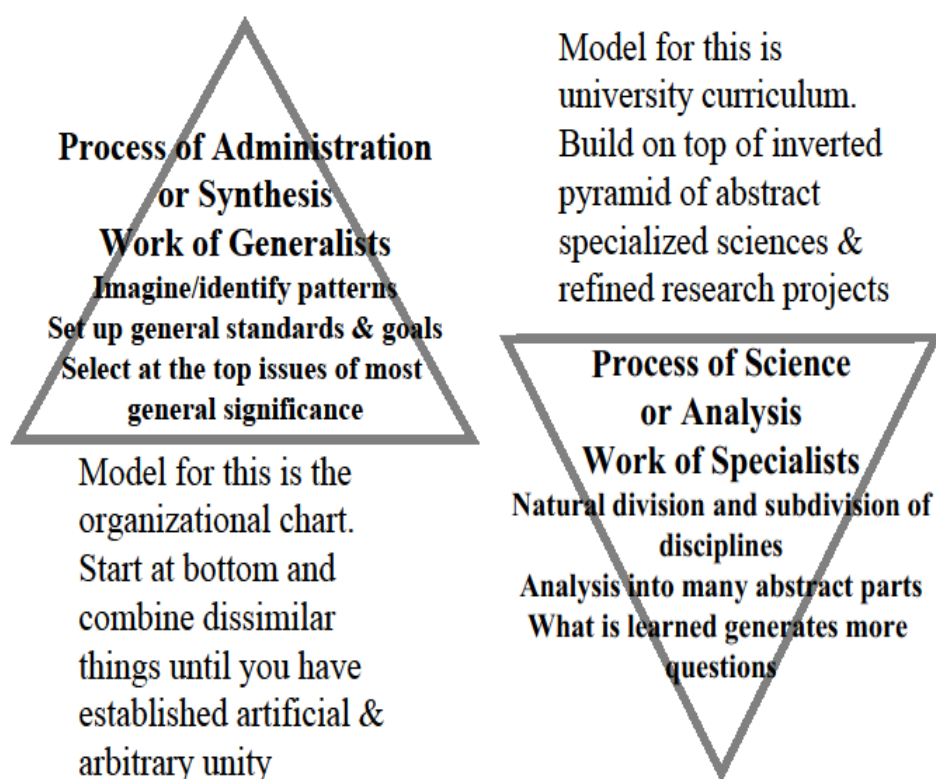
Autonomy and accountability have always been a difficult balance for Goddard with many espousing the existence of small scale research tasks for their own sake and not as ancillary to large space projects.

In the end the authors settle on British sociologists Burns and Stalker (1971) who in their study of organizational classifications coined the words mechanistic and organismic. The mechanistic is the classical organization as described by Weber and Gulick. It can be easily broken down into functional tasks. These are also seen as more appropriate in stable conditions. In a laboratory such as the Goddard Space Flight Center, however, where disciplines are evolving there is need for a more growing, living – even vine-like organization that is appropriately called organismic. Boundaries are

never certain and in such a milieu the individual must be willing to adjust to wherever his expertise leads and not necessarily to needs as defined by the bureaucracy.

This sort of imagery is very helpful in analyzing the government-operated laboratory such as Goddard in that it often seems like an organismic organization attempting to reconcile itself to mechanistic bonds. The reorganizations in 1984 and 1990 suggest this idea. Science comes to the fore in 1984, adapts to new icons of environmental and ecological contributions in 1990 and finally in 2005 finds itself confronted with the rhetoric of the Cold War and a paradigm from its now distant past.

E. The View from Price



Price, D.K. (1962). Government And Science. New York: Oxford University Press..

Figure 16

Price perhaps conceptualizes more than anyone else the basic difference between the hierarchical/bureaucratic makeup of the scientific organizational chart and the curriculum model in which the research scientist tends to feel more comfortable. Seen in this perspective the reorganizations of 1984 and 1990 mattered very little since they took place almost totally within the realm of the bureaucratic pyramid.

Most of the bench-scientists interviewed expressed the opinion that the early reorganizations were transparent and that at their level they were hardly aware that they were going on. The actions of joining or separating large research laboratories were occurring on the level of the organizational hierarchy. In a hierarchical model the dominant process is one of synthesis, attempting to achieve cohesion or uniform patterns to be transferred from the higher to the lower levels. Presumably uniform direction can create organizational unity, standards and goals. It is easy to postulate that this unity and general direction is largely artificial for the bottom layers tend to pay very attention to this direction when informed of it through mission statements and strategic plans.

In the 2005 Transformation, however, the confluence of Full Cost Accounting and other administrative systems succeeded in penetrating the natural divisions and subdivisions by occupying the top of the curriculum model – the inverted pyramid. The abstract concepts descending on bench scientists from the bureaucracy were reinforced by weapons of funding and dictated uniformity.

Since analysis is the working methodology for researchers, many felt constraints on abstract specializations leading to constantly refined disciplines.

As Price warns: “When you try to match up the pyramid of the government organization with the inverted pyramid of science, are bound to run into trouble” (Price,

1962, p. 163). In 2005, the two models bumped into each other rather than intersected. This resulted in some damage done to researchers and their work which will be investigated through interviews.

F. The View from Pfeffer and Salancik

Pfeffer and Salancik (2003) stress the internal interdependence of organizations balanced with external forces. In 1984 and 1990 the Goddard Space Flight Center laboratories were responding to changes being made at NASA Headquarters. In turn, NASA as an agency was responding to external forces of decreased interest in space exploration, shrinking resources and the growing prominence of and compulsion toward ecological concerns.

In 1984, managers at NASA were perhaps not willingly turning away from the Apollo paradigm but utilizing scientific data as one of the prime reasons to continue it. The adventurer in space was becoming the scientist in space and in the world of geopolitics, science breeds cooperation rather than national competition. Since loosely coupled systems tend to persevere it was easy to pay lip service to commitments of the past glories while developing highly diverse internal disciplines. There was little interest in huge expenditures for manned-space travel despite the rhetoric of space stations but as Pfeffer and Salancik put it "...beliefs and successes of the past become entrenched in physical and managerial structure (p. 8).

In 1984 and again in 1990, NASA was no longer simply in the business of space missions on Perrow's coupling/interactions grid but had moved down ward toward loosely coupled organizations and to the right indicating a much more complex series of interactions. Reorganizations at Goddard might ignore the implications of this shift on

its science laboratories but in so doing neglected to see independent autonomy, discretion and other social contexts that defied the very order they were attempting to implement.

The social context of the bench scientist was as connected to the National Science Foundation – where grants could be freely obtained as with NASA Headquarters.

University colleagues had arguably more influence through peer review than did supervisors. What were referred to as interlocked activities outside of the command structure dominated external relations.

It is because of this inclusion in different social structures on the part of bench scientists that reorganizations driven by privatization, managing for results, freedom of information and other government flavors of the day, remained largely transparent. Furthermore, the scientific expertise that managers were trying to direct and control was not easily understood by those desiring this control. Goddard space and Earth scientific research operated in a large variety of contexts and was often linked to researchers outside the organization. Thus the ‘enabling’ function of these government laboratories was real and had developed constituencies with academia and even foreign laboratories. This decentralization of information lent itself to a decentralization of authority which sacrificed a certain amount of managerial efficiency to adaptability. As Pfeffer and Salancik explain it: “... organizational responsiveness will increase when power and control are not institutionalized and new skills, competencies and interests can emerge with changing environmental contingencies” (p. 277).

This adaptability and insulation from bureaucratic control underwent an extreme assault through the transformation of 2005. The transformation was a stated attempt to

change from within and yet the goal of adapting to outside influences bore little resemblance to the social contexts of researchers..

Appointed leaders at the top of the hierarchy were attempting to further the intentions of a rhetoric that many researchers considered outmoded. The usual attempts at camouflage were difficult because of financial tools such as Full Cost Accounting and managerial concepts such as One NASA. The Transformation armed with Full Cost Accounting represented an attempt to control or institutionalize what operated best in a milieu of freedom. A direct controlling and rationing of resources from those who require them represented real control – even control of research agendas.

It is these social controls by means of funding that makes 2005 a different process than earlier change attempts. In the Goddard laboratories there had existed those who had independent funding and others who were content to exist ‘in the noise’ having little need for support. Many of these at the bench-science level were nonetheless affected by a Transformation calling for change from within to external forces they neither understood nor recognized.

G. Relevance to Iota Research Questions

The theoretical lens is by definition relevant to questions having to do with Public Administration and only addresses Goddard Space Flight Center specifically in a peripheral manner through my interpretation. For that reason only the iota questions are addressed below.

11. How do reorganizations of scientific laboratories at GSFC agree with classic concepts of government reorganizations?

Szanton gives rational reasons for why government organizations undergo planned change and three he singled out as efficacious. They are: symbolizing priorities, improving program effectiveness and improving policy integration – all stated goals during the Goddard 1984 and 1990 reorganizations.

The ascendance of sciences in general, specifically the Earth sciences in 1990 represented specific and newly stated priorities. Improving program effectiveness was evidenced by the fact that Goddard laboratories were usually aligning with previous changes in Headquarters. It is less clear how Goddard organizational changes improved policy integration, especially in 2005. Certainly merging the Earth and space sciences could be interpreted as an effort to increase cross-fertilization and collaboration. It is also true that the stated national goals of returning to a manned space program spurred the Science and Exploration Directorate. However, it could be reasonably argued that the Agency's goals and mission in space had never been forgotten – either at Headquarters or the other Field Centers, including Goddard.

The three reasons that Szanton says never works are: shaking things up, reducing costs and streamlining operations. Shaking things up was never perceived as a good thing. Center Directors usually ended up apologizing for such disruptions. Furthermore, no one I have spoken to argued that costs were reduced or that operations were streamlined. In fact, everyone I spoke to thought had paperwork increased following each reorganization.

Light's reasons followed the fashion of the times. Managers always depended on scientific management and the organization chart to explain efficiency and clarify chains of command. Although 1984 was a time of shrinking government bureaucracy, there was

little structural simplification or increased contracting out of essential services and support. In 1990, War On Waste was implemented under the mantra of Faster, Cheaper, Better. This proved to be somewhat semi-successful but came with a new recognition of the enormous potential of observing Earth from space since much of this activity could in fact be done at a greatly reduced cost compared to the old-style Buck Rogers mentality. There was, however, never an elimination of rules and hierarchy. The openness of Watchful Eye more or less vacillated according to whether projects were successful or not and liberation management was more spoken of than observed.

The reason that both Szanton's and Light's typologies do not entirely fit Goddard reorganizations is that as observed using the Perrow model the organizations in question were exceedingly difficult to understand and thus control and they were also loosely coupled. Workgroup members had a great deal more in common with researchers in other field centers, organizations or even international colleagues than with their own power structure.

Goddard laboratories followed the organismic model mentioned in Mark and Levine and this defied bureaucratic control. Also, the culture of analysis described by Price contributed to an insularity and autonomy of those bench-scientists working at the lowest level of the bureaucratic pyramid.

Pfeffer and Salancik best describe the 2005 Transformation and why it was so soundly resisted and decried. When bureaucratic will combined with the power of the purse attempted to penetrate the adaptability and insulation of scientific research what resulted was what Szanton might describe as 'shaking things up'.

12. How does reorganization of a government-owned & operated laboratory facilitate or diminish the opportunity to do research?

To return to Perrow and Price, it is not conducive nor helpful to the practice of research to frequently reorganize since the development of new ideas progress independently from independent contingencies rather than organizational typologies. This is also suggested stated by Pfeffer and Salancik.

13. What are the differences in how applied and theoretical research may be affected in a reorganization?

There are two ways to look at this question. One is that applied research is more visible and therefore more malleable while theoretical studies are more vulnerable. The other is that theoretical research can hide beneath the radar, latch on to the coattails of larger applied projects or prominent protectors.

14. What is the model for the concept of a transformation and how would it affect research at the bench scientist level?

The concept of a transformation comes from the business model and implies a change from within in response to external circumstances. The problem here is that the external circumstances are easier to react to if they are real rather than the result of rhetoric.

VIII. Human Agency Lens –

Transformation – In-Depth, Semi-Structured Interviews with Bench Scientists

The interview questions revealed that for those researchers who had experienced the reorganizations in 1984 and 1990 the process or processes were fairly transparent. This was not the case with the Transformation of 2005.

For the most recent Transformation, in order to take an in-depth look at and analyze GSFC laboratories, I determined that it was critical to understand the roles of bench scientists as they saw themselves. Furthermore, since a transformation is defined in the organizational literature as a change from ‘within’ to outside circumstances, it seemed to suggest that the process should be examined from within with as little managerial filtering as possible.

In 2005, the entire Agency including all of its Field Centers were expected to reaffirm the original ‘Buck Rogers’ goal of a permanent base on the Moon and the colonization of Mars. That was determined to be the real frontier and final frontier rather than scientific knowledge or the notion of looking back on the home planet.

A small digression on the word ‘home’ might perhaps be here permitted. It is a symbolic word representing the concept of comfort and safety to be protected from outside threats, natural or otherwise. A man’s home is his castle (moat included). There’s no place like home. The homeland must be secured against the dangers of external threats. Finally, the home world must also be protected – but here the manner is left purposefully vague. It may be significant that the phrase ‘home world’ was introduced after 9/11.

While the 1985 and 1990 reorganizations may have seemed quite seamless and transparent to the research scientists embroiled within their vortices, the 2005 Transformation attempted a completely different and much more profound cycle of change. The relevant term here is Organizational Transformation or (OT) as opposed to Organizational Development or planned change (French *et al.*, 2005).

A. Selection Methodology

In 2005 the NASA-Goddard Space Flight Center (GSFC) science directorates underwent a reorganization (formally referred to as a transformation). The Science Directorates, previously separated in 1990 into the Space Sciences Directorate (Code 600) and the Earth Sciences Directorate (Code 900), were now recombined into the Sciences and Exploration Directorate in 2005. This transformation was largely in line with and based on an executive order by the White House, in turn based on a policy statement entitled “A Renewed Spirit of Discovery”. The result of this proposed policy was a report issued by the Aldridge Commission (Aldridge *et al.* 2004). The Aldridge report, in turn, led to a restructuring at NASA Headquarters and the consequent realignment of science laboratories at GSFC.

The Bozeman *et al.* study (on which my interview instrument is largely based) selected participants from categories of contractors, managers and researchers (Bozeman, *et al.* 2001). My study attempted to pick potential participations guided by segments of change. I wanted to identify the most promising individuals to approach when requesting participants for in-depth interviews. This also allowed me to hone and focus my questionnaire.

In deconstructing the process and its effects I wanted to analyze the human element. By segmenting individuals I let the process itself guide me in selecting those interviewees most able to reveal phenomena at the core of the change.

I anticipated that the space scientists because of the thrust of the Aldridge Report and the President's announced vision of space exploration (Aldridge *et al.* 2004) would follow an easier path than that of Earth scientists. There are ten tables included in Appendix II, each one building on the last.

I had originally planned 67 interviews, placed in segments and selected according to the level of disruption experienced by bench scientists in both the Earth and space science disciplines. Due to the length of the interviews and the richness of data provided, this number proved unrealistic. In addition, whether or not interviewees had experienced extreme disruption or remained logistically relatively unscathed did not seem to influence their opinions relative to the 2005 Transformation. I therefore decide on 35 interviews.

Largely following the guidelines set out by Kvale (1996), I interviewed 35 bench research scientists at the Goddard Space Flight Center and the Goddard Institute for Space Studies. I judged this top level of the academic model or bottom layer of the bureaucratic model to be critical to the success or failure of any attempted organizational change.

I devised a questionnaire for in-depth interviews questions that was open-ended in nature. This was largely based on the instrument used by Rainey and Bozeman (2001). My own selection methodology served as a guide, not always rigidly adhered to, that enabled me to select a cross-section of participants based on how much the transformation had disturbed their working conditions and affected their morale. I chose

participants in both the Earth and space sciences and ended up with a nice balance of ‘greybeards’, mid-career researchers and junior staff scientists.

My initial contact was by phone, where I explained the purpose of my study, assured confidentiality and specified the estimated amount of time the interview would take. I also assured potential participants that I had the approval of the then Division Chief and all other relevant managers. No one seemed to care about anonymity or confidentiality.

My interviews necessitated travelling via AMTRAK on designated days, days in which I could justify my trip by attending other meetings. All in all people were available and seemed eager to participate. I also received permission to record my interviews with a small cd diskette recorder.

There were 34 major categories in my questionnaire each having, for the most part, succeeding prompts and follow-ups. In some occasions, if the interviewee directed it, some of these were truncated.

I followed Kvale’s methodology of transcription, categorization, condensation and lastly analysis. The interviews were transcribed and subsequently categorized according to 27 factors and the categories condensed as they aligned with the research questions.

B. Meaning Categorization

I first established a meaning categorization for each transcribed interview. To do this I isolated the 27 factors which comprised the major subject matter of the questionnaire. Each would then be touched on and ascribed varying orders of importance by the interviewees. Some were deemed to be of little or no importance by researchers

but overall all the factors were worthy of elaboration by some. I called these factors my ‘free list’. The interview process and resulting taxonomy made it possible to empirically test the following themes or issues.

Transformation (general). The transformation in general was the subject matter of my first factor. This was an all-encompassing category that often proved valuable when subjects expressed meta-values or sociological/philosophical musings on matters such as reorganizations or in rare cases, transformations.

Role/Participation. I asked each subject the extent to which they had been invited to participate or had indeed taken part in organizational change. Since I had limited my inquiry to research scientists, very few expressed any interest or participation in the 2005 Transformation, or any organizational change.

Previous Reorganizations. I asked my subjects if any had been aware of the previous reorganizations in 1984 and 1990. Those who has been around at the time stated that these were mostly transparent and on paper only.

Reason for Current Reorganization. This question elicited a variety of answers, many of a political and external nature.

Resources Involved. Responses for this category depended on both the isolation or autonomy of the various scientists. Those who were insulated by ‘projects’ tended to be somewhat cavalier. Many, however, decried the time, and other resources consumed by bureaucratic change.

Full Cost Accounting. Within the concept of widening boundaries, this procedure proved to be the single most important subject in terms of impact and elicited the most passionate responses. Few were in favor of the implementation and results.

Funding. Diminishing resources and increased competition led not to ferocity but a demoralized acceptance. Funding was hand-in-glove with Full Cost Accounting.

Proposals. These proved to be the metric de jour because of Full Cost Accounting. They are the designated method for bringing in a researcher's salary and have spawned a minor bureaucracy of their own.

Alignment with Headquarters. This is often given as the primary reason for any reorganization at the Field Center level.

Formal Structure. This addressed the structure and hierarchical differences both before and after reorganizations, especially the Transformation in 2005.

Research Agenda/Control. This factor attempted to narrow in on the hidden purposes or agenda of reorganizations – not simply moving boxes around but attempting to exact a profound and lasting change and control over research.

Science. The degree and nature of impact on scientific research is central to the study. Its condition determines the mental well-being of the bench scientist, working in isolation. Whether or not this activity should be conducted by the federal government or through federal grants to academic or private institutions is not germane to the work. It is assumed, that federally funded and operated laboratories at NASA are desirable and even necessary.

Applied Technology. This question addressed the project versus program dichotomy. Project funded research fits more easily into the 'exploration' paradigm.

Such large entities are more easily funded, since a few large proposals are more easily managed than small and highly diverse efforts.

Service/Outreach. This is a flawed factor since, in reality, it deals with two discrete concepts and should thus be broken into two separate topics. Service is defined as the enabling power and expertise Goddard scientists provide to the overall scientific community – an important example relates to the archiving and distribution of satellite data. Outreach, on the other hand, is the serious duty of passing on scientific results to the national and international community, be they legislative, or academic. It would also include outreach at the college, junior college, secondary and grade school levels as well as teacher development and education for the public at large.

Power. In any change there are presumably winners and losers. Questions surrounding this factor were intended to tease out perceptions relating to organizational power struggles.

Work Effectiveness. Since the impact of organizational change on bench scientists is of primary importance to this inquiry, opinions regarding this factor were relevant.

Job Satisfaction. In many cases, the job of a research scientist contains its own reward. However, how a bench scientist feels about her or his work and the gratification derived was seen as important.

Performance Assessment/Plan. This depicts how Goddard employees, including researchers perceive the importance or lack of importance as how they are judged or assessed.

Morale. The matter of morale is something that can best be discerned by directly asking the question. The answers were in large part already determined by previous questions and in the best cases elicited further elaborations.

Collaboration/Competition. This was a revealing yin/yang topic since a Transformation would hopefully encourage collaboration and dampen competition. Surprisingly this was not always the case.

Human Capital. Following the business organizational model, the office of personnel has now taken on the name Human Capital Management. The author admits to an aversion to this term and may have conveyed this to respondents. Most, however, seemed to find the term ‘human capital’ offensive without prompting.

Strategy. It seemed relevant to explore the impact of NASA and Goddard strategy on current research situations and possible future expectations.

Metrics. How work is measured and assessed was considered important and pointed to the emergence of proposal writing as the overriding metric because of Full Cost Accounting.

Contractors. NASA and Goddard has always depended on and worked in close partnership with a contractor force. It seemed important to examine this relationship.

University Partners. Similar to the above category, cooperative agreements with universities or university consortia have always provided government scientists with valuable collaborative expertise. This relationship, since the early days of the Agency,

has proven to be critical to scientific research. Its status and well-being therefore seemed important to explore.

Directorate Support. Any aide that upper management proffered to scientific research, laboratories and scientists would indicate the extent to which adverse effects might be mitigated.

Heliophysics. This was a further and final adjustment of the 2005 Transformation. Studies of the Earth had originally been lumped in to include the Sun. Many researchers felt this an uncomfortable union and heliophysics was subsequently established as its own division. Whether or not scientists judged this to be of any importance depended on how closely their disciplines were situated to the fields in question.

The above interpreted themes were then put in juxtaposed with the transcribed interview text. This comprised the process of Categorization. Interviews averaged from approximately 1 hour to forty-five minutes – although some lasted considerably longer. As I gained facility with the format and process I was able to exercise more influence on duration. Nevertheless, it was often rewarding to let subjects ‘ramble’ and ‘nuggets’ often fitted nicely as other factors emerged. The raw data in each transcript averaged approximately 15 pages.

The resulting categories were matched to appropriate responses from each interviewee. An example of the beginning of one categorization process is provided in the table below. The formal structure follows that of Kvale.

Table 1

1. Transformation (in general)	→	People higher up the ladder point to achievements, cost savings but doesn't know. Used to <i>sell</i> things .like Exploration, Origins, Frontiers for America Because of FCA, cannot do imaginative things. Require startup monies. Not clear if it's a zero sum gain or not
2. Role Participation	→	Not involved in planning & reorganization did not have any direct effect on me. Transparent. Doesn't sit in organizational meetings

All of the transcriptions were examined and responses were related to the 27 factors. Relevant statements were extricated and listed to the right of the arrows. Each interview was also categorized according to my selection methodology as related to: A = Supervisor change, B = Office closer to supervisor, C = Office moved, D = Old Office Closer to Supervisor and E = Member of old 900 Directorate.

The assumption was that those researchers who had experienced more 'displacement' in terms of five categories would exhibit the most discomfort and hence less efficiency in work results. The five binary possibilities covered: supervisor change, office change, proximity or lack of proximity to supervisor, and lastly whether or not the researcher had previously been part of the old Earth Science Directorate. It had been my assumption that the joining of space and Earth sciences was more to the detriment of the latter since the word 'exploration' could be more closely associated to space disciplines than those relating to Earth. No further budget allocations seemed forthcoming in relations to a grand-tour of the solar system and it was suspected that funds for such

preliminary studies would come from Earth related disciplines. That and the fact that the Administration took a dim view of Earth-atmospheric studies since they related directly to climate change and global warming, indicated that former members of the Earth Sciences directorate would fare far less well than those previously associated with space science. It was science as a whole, however, whether Earth or space that seemed ripe for pruning and it turned out to make little difference whether the opinions any given researcher was more grounded in space or Earth studies.

The binary answers of groups in my selection methodology proved not to have much significance on researchers' opinions. Matters such as Full Cost Accounting had a great deal more impact than mere logistical matters. The selection process was a useful guide in assuring a diverse selection and in determining which scientists to request interviews from but was of little consequence in ascertaining the quality of the workplace on interviewees.

C. Condensation

Again, following the Kvale process, I devised a table of "Meaning Condensation" which incorporated the research questions with the three lenses and the factors derived from the interview questions. Here, all aspects of methodology, and research data coalesced and related to one another. The paradigms of structural, theoretical and human agency formed a framework in which to examine and empirically evaluate answers to the research questions arranged through assigned factors and the reactions they evoked during the interview process.

The Meaning Condensation Table including the questions originating in the Human Agency interview material is on the following page.

Table 2

Meaning Condensation combined with 1 Research Questions

<i>1 Natural Unit/Research Questions involved with political, social, historical, and personal contexts</i>	<i>Central theme</i>
<p>11 How does the latest Transformation of scientific laboratories at GSFC agree with classic concepts of government reorganization? Interview Categories: 3. Previous reorgs.; 5. Resources involved; 9. Alignment with HQ; 22. Strategy</p>	<p align="center"><u>THEORETICAL</u></p> <p><u>History:</u> McDougall, Launius, Price <u>Light:</u> Scientific management, War on waste, Watchful eye, Liberation management <u>Szanton:</u> structure, resources, processes <u>March & Olson:</u> Garbage Can Model</p>
<p>12. Does reorganization at of a government owned and operated laboratory facilitate or diminish the opportunity of scientists to conduct research? Interview Categories: 6. Full Cost Accounting; 8. Proposals; 10. Formal Structure; 11. Research Agenda/Control; 12. Science; 15. Power; 16. Work Effectiveness; 17. Job Satisfaction; 19. Moral; 23. Metrics; 25. University Partners; 26. Directorate Support;</p>	<p align="center"><u>STRUCTURAL</u></p> <p>Perrow: Loosely coupled organization Hans Mark & Arnold Levine Alfred Rosenthal Organization Charts</p>
<p>13. How do a succession of reorganizations affect the quality of research at GSFC? Interview Categories 3. Previous Reorganizations; 9. Alignment with HQ; 11. Research Agenda/Control; 12. Science; 16. Work Effectiveness; 17. Job Satisfaction; 19. Morale; 20. Collaboration/Competition; 21. Human Capital; 24. Contractors; 25. University Partners;</p>	<p align="center"><u>Human Agency</u></p> <p>According to interviews 1984 and 1990 were transparent.</p>
<p>14. In a Transformation, are applied research and theoretical research affected in different proportions? Interview Categories 11. Research Agenda/Control; 12. Science; 13. Applied Technology; 18. Performance Assessment/Plan; 20. Collaboration/Competition; 21. Human Capital; 27. Heliophysics;</p>	<p align="center"><u>Human Agency</u></p> <p>Projects (missions) v. Programs Discussion with Dr. Larry Travis: Research & Analysis (Programs) – research that can be done anywhere also now called SR&T (Scientific Research & Technology)</p>
<p>15. What is the Model for the word Transformation?</p>	<p align="center"><u>Theoretical</u></p> <p>Business Model (citation): Change from within to cope with external situations. How does this change link up to Full Cost Accounting and One NASA? Could this metamorphosis threaten what was unique about the loosely-coupled, diverse original?</p>

Meaning Condensation combined with Θ Research Questions

<i>Θ Natural Unit/Research Question in Context of Case</i>	<i>Central Themes</i>
Θ 1. Why has Goddard Space Flight Center (GSFC) science laboratories undergone reorganizations in 1984, 1990 and 2005? Interview categories: 3. Previous reorgs. 4. Reason for current reorg. 10. Formal structure 22. Strategy 27. Heliophysics	<p style="text-align: center;"><u>THEORETICAL</u></p> <ol style="list-style-type: none"> 1. Political – external conditions 2. Agenda of Exploration – geopolitical <p style="text-align: center;"><u>STRUCTURAL</u></p> <ol style="list-style-type: none"> 3. Earth Science Diminished <p style="text-align: center;"><u>HUMAN AGENCY</u></p> <ol style="list-style-type: none"> 4. Anxiety & apprehension 5. Set in motion by CAIB Report
Θ 2. Why and how does the recent 2005 ‘Transformation differ from the previous combinations/separations of the past, specifically those in 1984 & 1990? Interview categories: 1. Transformation 3. Previous reorgs. 8. Proposals 9. Alignment with HQ 10. Formal Structure 15. Power 17. Job satisfaction 18. Performance assessment/plan 19. Morale 22. Strategy 23. Metrics 25. University partners 26. Directorate support	<p style="text-align: center;"><u>THEORETICAL</u></p> <p>Business concept of Transformation</p> <p style="text-align: center;"><u>STRUCTURAL</u></p> <p style="text-align: center;"><u>HUMAN AGENCY</u></p> <ol style="list-style-type: none"> 1. Perfect Storm: FCA Transformation, Exploration, New Accounting System 2. One NASA
Θ 3. What is the impact of Full Cost Accounting when factored into the latest change? Interview categories: 6. Full cost accounting 8. Proposals 15. Power 16. Work effectiveness 17. Job satisfaction 17. Performance Assessment/Plan 19. Morale 20. Collaboration/competition 21. Human capital 23. Metrics 24. Contractors 25. University Partners 26. Directorate support	<p style="text-align: center;"><u>THEORETICAL</u></p> <p>War on waste</p> <p style="text-align: center;"><u>STRUCTURAL</u></p> <p style="text-align: center;"><u>HUMAN AGENCY</u></p>

Out of data categorization, condensation and manipulation I then proceeded to evolve a general narrative and interpretation to discern the intended and expressed meaning to be found in the answers derived by my interview instrument. A useful tool is the hermeneutic circle. “The closer determination of the meaning of the separate parts may eventually change the originally anticipated meaning of the totality, which again

influences the meaning of the separate parts, (Kvale. p. 47..., 1996)” This could be an endlessly refining process but the time to end it is when you decide you have reached a sensible meaning without ‘internal contradictions’. The significance of dealing with interview texts, is that the author is both creator and responsible for negotiation and interpretation.

Kvale cites seven regulating conditions of interpretation:

- 1) A continuous back and forth process between segments and the whole
- 2) Ending when you have achieved a good gestalt of the whole affair, an inner unity as free of contradictions as possible. For example the problem of dealing with the question of service/outreach, which should really be two questions
- 3) Testing the parts against the whole – such as the situation of the interviewee in an attempted binomial selection process
- 4) The autonomy of the text by understanding what it says about the Transformation
- 5) Knowing the theme or milieu which the investigator has chosen to explore
- 6) Laying out presuppositions that influence the text.
- 7) Understanding that you have to be willing to risk being creative in order to arrive at a better understanding perhaps even a new dimension of the topic.

During an interview you are in a situation which can be only partially described. For example, one subject may have felt neglected making him anxious to talk, another might be politically alienated, etc... What resulted from the interviews was an incomplete account with a wealth of information left out.

Also, there was a lot of ‘noise’ in many of these interviews such one lengthy lecture on parallel processing that occurred in an early encounter and which I was unable

to politely cut off. After condensing the categories it was then time to attempt to map and analyze the data.

IX. Meaning Analysis and Mapping

What follows is an-depth narrative resulting in what Kvale calls “Meaning Interpretations”. An attempt was made to ‘map’, through color coding, the original, research questions to answers elicited by questions found in the interview instrument, allowing for the richness of the data. As with the original transcriptions, the mapping documentation is not included in the general study but results are incorporated in the analysis narrative. This is solely an organizational tool for the narrative.

In the Human Agency lens both general matters of the field of public administration (ι) and specific questions relating to the Goddard Space Flight Center (Θ) were addressed. The connection between interviews and the original hypotheses is discussed in the research conclusions.

Interviews are identified through the locality in which they were conducted as in GSFC for Goddard Space Flight Center and GISS for Goddard Institute for Space Studies. The locality is followed by the number of the interview (not necessarily in the order taken) but rather in the order transcribed and categorized as in GSFC 1, 2, 3, etc... This assures the confidentiality of respondents while keeping the integral conditions of the interview intact. The following data reflects the opinions of the researchers being interviewed.

In terms of the 2005 Transformation, many of the general comments were that it made little or no difference from previous reorganizations. For example, when asked about the Transformation, GSFC-1 stated that reorganizations had very little impact and

were generally undertaken for political reasons, in this case the rubric of ‘exploration’. Alignment with Headquarters was not done according to discipline or to enhance collaboration but entirely because of what was deemed important by higher ups. Things were destroyed or created according to the whims of funding accessibility. This seemed to imply an almost Olympian like fatalism. This subject also eschewed and disapproved of a vertically ‘narrowing’ bureaucratic structure.

This subject saw the Earth sciences as a ‘cash-cow’ sacrificed to the rhetoric of space exploration. Science was a “financial reservoir” where money was stored or ‘stashed’ away from Congress. There was currently much more emphasis on project-oriented work usually supplied by off-the-shelf equipment. This subject was a ‘graybeard’ who delighted in designing and maintaining advanced equipment through research ingenuity. Lack of funding was drying up his resources but he was still operating – after a fashion.

He stated that the 90’s had placed a large emphasis on studying the Earth from space. Earth was seen as a network of interrelating systems and studied from a global aspect.

Leadership in the Agency was negligible or non-existent. During the tenure of Sean O’Keefe there was little information flow and all aspects of the Agency developed a siege mentality. The most important resource sacrificed to reorganizations was time because of an increase in paperwork.

The scientific staff had either adapted or left and there was a decrease in collaboration as well as little inspiration relating to work. Headquarters’ agenda was predominantly based on control.

Full Cost Accounting had not been taken seriously at first and compared to the likes of Total Quality Management or ISO, but was now being used in a creative way to sculpt projects by forcing people to bring in their own salaries through funding. It became clear that since proposals solicited from outside NASA were precluded from being applied to the salaries of NASA researchers, this constituted an iron vise of control.

This subject had undergone: supervisor change, had his office moved, wasn't really sure of the proximity of his office to his new supervisor as opposed to his former office and was a member of the old Earth Sciences Directorate. While he had probably suffered maximum disruption, he seemed experienced enough to 'roll with the punches'.

GSFC-1's response to question i1 that asked how the 2005 Transformation agrees with classic concepts of government reorganization, indicated that there was no improvement in either effectiveness or efficiency since such processes are driven more by politics than research agendas. This also concurred with question i1 as to why this particular Field Center had chosen to merge and separate its scientific disciplines from 1984 to 2005. Question i2 inquired into how the research in a government owned and operated laboratory could be affected by reorganization. The answer was through Full Cost Accounting. Question i2 attempted to pinpoint how the 2005 Transformation differed from other organizational changes. This also evoked the response that Full Cost Accounting could be utilized in a creative way to direct people into research directions where they were likely to bring in their own funding. Question i5 as to how scientists and their respective research were generally affected by the Transformation elicited the opinion that GSFC was no longer an "inspiring place in which to work".

Early in the interview, GSFC-2 stated “I can feel the President’s breath on my neck”. In terms of the overall Transformation, this interviewee agreed with GSFC-1 that the resulting structure was more hierarchical. In addition, control was largely relegated to the top. The concept of One NASA was put forth as a means of control as opposed to getting things done.

Full Cost Accounting necessitated a great deal more proposal writing and in combination with the Transformation had resulted in a straight-jacket like effect in that researchers were not allowed to seek outside funding for their salaries. There were also not allowed to be university professors because universities tended to put sizable overhead on their salaries. This interviewee also mentioned a new financial package, Systems Application Products (SAP) that compounded problems with Full Cost Accounting resulting in scientific research being dictated by arbitrary software purchases (<http://www.sap.com/about/company>).

While funds for science seemed to be drying up, accelerated proposal writing spurred competition rather than cooperation. Morale was worse than it had ever been and work conditions were chaotic with little empowerment. He ended this train of thought by saying that those who could were eyeing retirement.

The subject stated that research agendas should be determined in a disciplinary fashion rather than dictated by organization charts. On the other hand he noted that merging at the macro level could, to a certain extent, leave the micro matters untouched. In such a manner, the ‘conservers’ in Downs’ model (1994), often survived as so much flotsam and jetsam. This was doubly possible when, despite fiats from above, leadership seemed reluctant to exercise its prerogatives.

Alignment with Headquarters structure was top-down, hierarchical and more bureaucratic. All-in-all the dichotomy of space and Earth sciences into separate directorates had seemed desirable since a much larger organization tended to result in information being ‘stove piped’ from above and not as accessible or informal to the bottom of the line.

New ideas tended to be less encouraged, as was seen in the abolition of the Director’s Discretionary Fund which had previously supplied seed money for new and innovative projects and programs.

Processes governing ‘human capital’ were more complicated and Performance Plans often presented supervisors with rigid factors to be evaluated sans nuance. Previously productive educational programs were undermined because of lack of funds. All of these factors had a detrimental effect on overall morale.

Work effectiveness continued to be gauged in papers and talks and “getting out what you have done”, but scientists felt not really wanted and operated in a survival mode. He ascribed this to a general climate of anti-intellectualism outside the Agency.

The mantra of ‘One NASA’ while touted as a banner for Agency unity was, in reality, constricting and striving for ossified conformity. A good example of this was an on-line proposal submissions mechanism called NSIRES (1994).

This subject had undergone supervisor change and his office had been moved. He remained in roughly the same physical proximity as his new supervisor. He was not a member of the old Earth sciences directorate.

Question i4. relates to organizational change in public administration, specifically how the business model of transformation affects the bench scientist. It evoked an

extremely negative response in this respondent. He indicated that if a project called 'LISA Pathfinder' (mentioned in a recent op-ed piece in the New York Times by former Associate Administrator at NASA as being an example of out of control overruns), were cancelled he would resign. His interview indicated that concepts such as One NASA stifled inquiry.

The theta research questions relating to the change process at GSFC also indicated that scientists were adversely affected by the concept of a Transformation and that there was difficulty in buffering the work of bench researchers.

Interview GSFC-3 constantly highlighted the critical importance of the concept of free inquiry. Diametrically opposed to this, he felt the Transformation represented strict control since what tended to be funded through proposal writing was what the current Administration wanted. No research was actually encouraged since space exploration demanded most of the resources and attention. In that sense, question í1 as to how the latest 2005 Transformation differed from previous models of change was answered by statements indicating great differences as to the penetration into the world of the bench scientist not previously experienced. Full Cost Accounting became the gatekeeper of research and excellent proposals not in line with current ideology could go unfunded. Being forced to do directed-research resulted in "low job satisfaction". Question í2 whether research opportunities were diminished or facilitated and this subject answered definitely that research was affected in a negative way. He added that he felt less empowered and thinking of retiring. As to research question Ø3 relating to how a series of reorganizations might specifically affect the quality of Goddard research, the subject indicated that he had not come to GSFC to be a manager and had therefore not been

involved in any aspect of any change, adding that previous reorganizations had been largely transparent. Presently, he rejected having to have goals and values dictated from on high. There was decidedly less emphasis on science and more emphasis on applied technology as well as on service and outreach. Structurally, he felt there was little consequence in re-arranging boxes in an organizational chart – such “names and numbers had little effect”. Conducting effective research that he felt excited about was the only important work incentive however the necessity of producing funded proposals impacted the freedom to write quality papers. This respondent also indicated that university partners could now be seen as potential rivals because of Full Cost Accounting.

This subject had experienced supervisor change and had less proximity to his current supervisor. He had not been forced to change offices and was not a member of the old Earth Science Directorate.

He felt that applied research seemed to benefit over theoretical research. Question 1 attempted to determine whether applied and theoretical research were differently impacted in a transformation and the interviewee stressed that the situation of the bench scientist was much less conducive to free inquiry than previously. This also answered question Q2, in that the 2005 Transformation had significantly differed from previous changes in its impact on research. Question Q4 dealing with penetration of Full Cost Accounting elicited extremely negative responses, extending to question Q5 concerning government-owned and -operated laboratories and the direct corollary of their research and the status of funding.

Interview GSFC-4, along with interview along with GSFC-5, exhibited much less criticism of the 2005 Transformation than previous subjects, seeming to be comfortable

with the new emphasis on exploration. He also expressed the opinion that a further organizational adjustment that had removed Sun research from Earth sciences and established a new heliophysics division, was a logical development. This interviewee had experienced very little in the way of displacement – no supervisor change or office change. He was not a part of the old Earth sciences directorate. He was also much more aware of and comfortable with the structure of the organizational hierarchy. The main problem with Full Cost Accounting was that it had not been “implemented in a neutral way”. He saw the entire transformation (like earlier reorganizations) as a “minor perturbation” compared with Full cost Accounting. Mapping to question Θ1, as to why GSFC had undergone cyclical reorganizations, the interviewee expressed the opinion that new managers simply felt “obligated to change things”.

When I came to question Θ4 concerning the impact of Full Cost Accounting when factored into the latest transformation, he said that Full Cost Accounting clearly had the greater impact since it changed what had been salaries into grants. This juxtaposition could have been an accident but the implementation was not beneficial nor was it implemented in a neutral way. FCA was seen as a mechanism of research control and had instigated a push toward proposal writing. Seen in this light, the answer to question Θ4 as to the impact of FCA would have been that researchers in a government-owned and -operated laboratory could be deeply affected – including their research. FCA would also be extremely effective in aligning laboratories according to directives from on high. In this there was agreement with GSFC-1 (although this subject was more positive concerning the results) that the vertical penetration was more apparent than in previous reorgs.

Interview GSFC-5 differed from many of the others in that the 2005

Transformation was actually viewed in a positive light. The subject had suffered no displacement, remaining a space science and project-oriented researcher. He did, however, hold negative views regarding Full Cost Accounting.

His responses indicated that his opinion regarding question Q2 regarding the singularity of the Transformation was that it evoked apprehension and fear of unknown circumstances among scientists. That had not been the case in reorganizations occurring in 1984 and 1990. The subject had been present for them but indicated that he had been barely aware of them. Even in the case of the 2005 Transformation the subject, as almost all of the other researchers interviewed, had experienced no active participation.

Although he did not think there was a link between the Transformation and Full Cost Accounting, it remained a salient point that they happened at the same time and that if monies were going to pay for the salaries of civil servants there were less funds available for actual research.

The 2005 Transformation, along with all other reorganizations, mirrored what happened at NASA Headquarters. They had decided to consolidate the sciences and Goddard had simply followed suit. Although there was clearly some organizational and political demotion in the fact that Earth and space sciences went from directorate to division status, the subject reflected simply for the most part this only indicated “name changes”.

Mapping to research question Q1 as to why cyclical reorganizations occur, this subject clearly indicated that alignment with NASA Headquarters was a major reason for cyclical organizations at GSFC. The recent Transformation had been atypical in that it

brought Full Cost Accounting to bear on research. This addressed questions Θ2 as to how 2005 differed from other reorganizations and question Θ4, factoring in of Full Cost Accounting into the change process itself. By implication, the answers to questions Θ3 and Θ5 were that research was made more difficult through successive reorganizations and scientists experienced lower morale adversely affecting their research. Some people had elected to leave the laboratory.

In interview GSFC-6, the subject was insular and ignored, as best he could, all that did not directly concern his work group. He was also aware of competition evolving because of funding between the newly combined Earth and space sciences. Once again Full Cost Accounting was seen to be a major intrusion on research while the Transformation was viewed as a minor perturbation.

Earth sciences was no longer a distinct entity and therefore not as prestigious as in the past – especially at the top level. This interview would place the transformation within the realm of external politics (Pfeffer & Salancik 2003). Research question Θ2, concerning how the current transformation differed from previous organizational changes, was in the subject's opinion that the politically and ideologically the Earth sciences had been diminished as a result of the enhancement of manned space exploration.

A perhaps not unintentional side effect was a substantial increase in processes and procedures needing internal approval. This state of affairs totally contradicts the peer/professional approval roots of NASA as explained in Romzek and Dubnick (1990).

As usual, this subject had not participated in any part of the reorganizational process and seemed unaware what resources may have been involved or drawn upon.

Once again question Θ4 factoring in Full Cost Accounting, elicited a heated response. The subject opined that it totally dwarfed anything coming out of a typical reorganization. It had resulted in “huge problems in hiring people on the outside”. Furthermore it prompted many researchers to retire early. There appeared little linkage with the Transformation, however – rather it had “simply happened in the same timeframe”. The interviewee did not actually think his research group’s funding had been affected. GSFC underwent cyclical reorganizations simply to align with NASA Headquarters simply to better match their internal organizations – supplying a response to question Θ1.

He had noticed little structural change – “same people sitting in the same offices, doing the same work but code numbers (organizational designations) had changed”. He noted that some major organizational upheavals had occurred when work groups were merged with others and people were even assigned supervisors in different locations, i.e. Wallops, Virginia. This subject clearly saw things in disciplinary terms and felt that any organizational structure failing to align with disciplines could be easily bypassed. He personally would, for example, bypass a supervisor to consult directly with a laboratory chief if the research demanded it. The largest impact in 2005 had been to science managers at the top. He also inferred that in this merger of Earth and space, there were winners and losers. Earth scientists were more adversely affected by virtue of the fact that their areas were no longer as important as those researchers able to participate in space exploration. This shift of emphasis partly explained the exponential increase of internal approvals and audits.

The subject stated that he had tried to avail himself of discretionary funds to apply Earth sciences techniques to remote sensing on the Moon or Mars and had actually been awarded funds. It was not, however, an amount sufficient to complete the experiment.

Question i3 asks about the differences in how theoretical and applied research is affected in the Transformation. On this matter, the subject voiced the opinion that there seemed to be more interest in NASA's research being of general use to society tipping the scales in the favor of applied research. This, however, has always been a public relations gambit indulged in by the Space Agency. While, this opinion was not shared by many, including the then Administrator, he also felt there was more of an emphasis in NASA participation in education.

At to general work effectiveness, this was not impacted by organizational change as much as by Full Cost Accounting. As a bench scientist the subject felt there was no empowerment – one was simply a “victim of circumstances”. Performance plans were totally ignored and meant very little to supervisors or those they supervised. There were real attempts at control here on the part of the hierarchy but they were usually futile and this had to be known by upper management, hence a charade. Despite this, the real metric remained how many papers were published.

A newly established Proposal Support Office was mentioned as having provided help for the increased efforts demanded in writing proposals. This subject was insular and ignored, as best he could, all that did not directly concern his work group.

This interviewee had had his supervisor change but had experienced limited disruption in that his office had not moved and he seemed little connected to the official

hierarchy. He clearly demonstrated inclinations of an Earth scientist and had been a member of that directorate.

The subject of GSFC-7 mentioned the Columbia Accident Investigation Board report (CAIB) as a major impetus for the 2005 Transformation. There had been a great push by then Administrator Sean O’Keefe for everyone in the Agency (no matter the job classification) to read this report and presumably learn from it. My question regarding the new organizational subdivision of Heliophysics was especially relevant since the subject was in this Division. He was not enthusiastic since it had cut short any attempts to form a synergy with Earth sciences, where it had previously been ensconced. This scientist exhibited a certain fatalism about life in a government agency. “... the executive branch determines policy, we carry it out. Exploration is akin to the dissolutions of goals at Bell Labs or IBM”.

Full Cost Accounting meant living on soft money for many and this resulted in an identity crisis, of sorts. For the most part however, people remained in the same office and did the same work – which indicated organizational indifference in that any new research potential was minimized.

As with so many others, this researcher had not actively participated in either the transformation process or experienced any significant change from any previous reorganization. He felt, however that there was a clear agenda to participate in and help the US industrial base and participate in national competitiveness. Following the President’s policy agenda took precedence over doing what you wanted to accomplish in research.

Many resources had been involved in this change. Researchers in Field Centers such as Goddard now thought of themselves as soft money scientists and because of competition for funds this led to less free collaboration with university researchers. Compounding this situation, Full Cost Accounting had gone into effect at the same time as a cumbersome new accounting system. The latter was not conducive to many and varied small projects. FCA and Full Cost Recovery of government science had impacted research infinitely more than any Transformation could possibly do. This subject felt that it would not have been necessary to bring in funding reform as a bludgeon to effect cultural change. Researchers suddenly found themselves devoting more time to writing competitive proposals than doing research. Many researchers were bewildered by the change. While a closer alignment with Headquarters had been intended, what had resulted was perhaps an unintended consequence of a competition for HQ funds with outside researchers perceiving Goddard people being too close to the funding source.

Question 05 as to the extent to which government owned and operated laboratories were affected by reorganizations was directly addressed by this subject since he stated that it couldn't be assumed that a researcher would be "working on what you were doing if it's decided you're to focus on going to Mars". Nevertheless, for the most part the laboratories were still expected to service and enable GSFC and the outside population with NASA scientific data archives. Enabling collaborative discoveries continued to formerly define GSFC laboratories as service organizations which had historically been their role.

The subject suggested that I could probably dispense with all of my questions and simply ask about morale. This touched on nearly all of the research questions relating

specifically to Goddard laboratories: the uniqueness of the Transformation, the impact of a succession of organizational change, the impact of Full Cost Accounting and how researchers and their work was affected. The situation was that there seemed to be a lack of enthusiasm for attempted culture change and a great “undercurrent of uneasiness”. Scientists and their respective research seemed adversely affected and the metrics stressed were a major emphasis on proposal writing.

The subject felt that new partnerships would likely develop but that there was likely to be less collaboration and more competition with university partners because of Full Cost Accounting. Other interviewees were subsequently to make this point. Civil service researchers were viewed as more expensive when factored into a proposal because of Full Cost Accounting. On the other hand contractor-partners felt apprehensive since civil servants still had a modicum of job protection, while they could be fired. He had not, however, noticed any problems in hiring or attracting new hires nor any dramatic increase in employee turnover.

Since the subject was located in the new Heliophysics Division he felt this to be a positive aspect of the Transformation. Being previously part of the Earth Sciences disciplines had seemed to have some justification, but the separation of Earth and Sun had ultimately resulted in a more logical organizational structure. Nevertheless, he remained, however, unsure of any effect on productivity or job satisfaction.

This scientist had undergone supervisor change and had had his office move. He was an old member of Earth Sciences. He had, therefore, been subject to substantial displacement.

Interview GSFC-8 used the phrase “...a perfect storm” to describe the 2005 process. The elements for this included: Full Cost Accounting, the new SAP accounting system, the Transformation, the ‘return to the Moon’ rhetoric. The term “uncovered civil servant” was used. A sort of organic confluence of change described here is best expressed in the Venn diagram seen below.

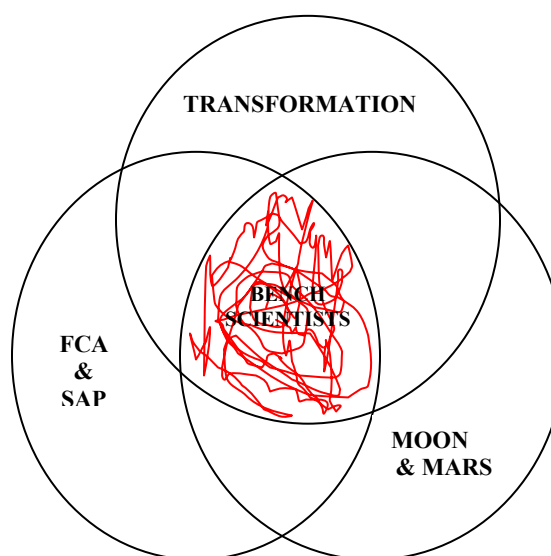


Figure 17

The subject also felt that normal and self-defining boundaries between Earth and space sciences might be a good thing depending on which side you were on, and depending on the politics of the time. He also felt the rather illusive term of ‘Astrobiology’ was an effective vehicle for interdisciplinary collaboration.

In this researcher’s opinion Full Cost Accounting *was* linked to the Transformation and this link was critical. The normal disciplinary boundaries were being eroded as they were revealed and this resulted in a scurrying for cover. One area of protective cover seemed to be the collaborative nature of astrobiology. Thus question Θ2

concerning the difference between the transformation and prior reorganizations (1984, 1990) was addressed by the fact that 2005 was indeed unique in its penetration of the actual workings of laboratories. This organizational change also resulted in a schizophrenic rearrangement of research disciplines that was in many ways viewed as illogical. Space exploration was largely undefined even as it seemed to be expanding. Research question Θ5 as to the state of research was answered by the fact that in this process science itself was either caught in a vortex (as depicted in the above figure) or simply left out in the cold. Likewise addressed was question Θ4 as to the impact of Full Cost Accounting and the answer was that the result was definitely negative.

The interviewee was consistent with others in the fact that he seemed quite unaware of the Transformation as a standalone event. He complained that previously in 1990 when the disciplines of Earth and space were split you might have found yourself on one side of the fence with the wrong degree. Such organizational distinctions, however, even with Full Cost Accounting, often didn't stop people from pursuing ingenious ways of finding money. The familiar fatalism was addressed to question Θ1 as to the reason GSFC underwent cyclical reorganizations and explained away with: "things change because that's what managers do. "Someone looks at the boxes – puts them together – splits them apart and puts them together again".

How researchers and their research are affected in Question Θ5 was also addressed in that scientists and their research were judged to be drained of their resources by the process. It's not a simple 'from this organization /to that organization' action as expressed in organizational literature, because a worker's space is always a contentious topic. Furthermore, the whole thing involves a significant effort.

Full Cost Accounting implied that NASA Headquarters dictated control over areas of research. Research opportunities might flourish or totally vanish. This made bench-level scientists much more dependant on Headquarters. In some way all of this might be linked to the Transformation, but not clearly. Full Cost Accounting, coupled with the new accounting system was described as a real “whammy”. The bottom line was that in a government-owned and -operated laboratory, Full Cost Accounting rendered everyone vulnerable and dependant on writing proposals.

While NASA operates on a flat budget, certain research groups can be targeted for more or less funding. This is demonstrated by boilerplate performance plans and the fact that only NASA proposal awards can be applied to NASA salaries. It was also made clear to assembled and previously enthusiastic space scientists that in the new Lunar exploration initiative there was no room for science. To make matters worse, proposals are not handled in a timely fashion. As much as half a year can go by before a proposal is reviewed. Yet, this subject felt that it was important to align with Headquarters but that had usually always happened at the top. What had made this 2005 process unique was funding control in the guise of Full Cost Accounting.

On paper, a combination of Earth and space seems to relieve boundaries and eliminate misplacements, supporting the hypothesis that fragmented disciplines are difficult to control since there is a built in resilience by nature of their complexity and diversity. Researchers more or less continued to work with people with whom they had previously worked. Collaboration is, of course, always stressed as witnessed by the ebb and flow of astrobiology. But when funding is controlled by non-scientific objectives all areas of research are in the last analysis driven by upper management.

This respondent felt that science was not viewed as important in this organizational change and much of the budget seemed to preclude it. People who had spent a great deal of time preparing to participate in a Lunar exploration missions were basically told to forget it. There was no money in that paradigm for a science program.

In this subject's opinion an organizational emphasis was placed on service functions, at least on paper and this seemed to imply that applied research would receive more support and attention than theoretical work. This is because enabling research is directed to a particular task, a task not necessarily determined by the researcher participating in the enabling. Question i3 attempts to navigate this balance between applied and theoretical research.

By virtue of Full Cost Accounting, all GSFC scientists were relegated to soft-money status as opposed to being vested civil servants. On the other hand, since it had been stated contractors, unlike civil servants, could be terminated there was a great push to assign tasks to civil servants who were not otherwise able to cover their salaries rather than contractors – even though the latter might be better qualified for these tasks. It is easy to see that this how this presented a clear and ongoing dilemma.

Questions i2 and Q3 both address the impact of changes on research activity and in this respect the subject stated quite categorically that the Transformation was a distraction and that it adversely affected scientific efficiency and productivity. The results included more paperwork as evidenced by the unofficial acronym 'continually recurring asinine processes' (CRAP).

Full Cost Accounting permeated all performance evaluations and plans since formulas were devised to measure proposal attempts and successes. Morale was seriously affected.

There were positive aspects seen in the combination of space and Earth, in that efforts toward interdisciplinary or collaborative work had greatly increased. Goddard researchers were constantly trying to get involved with NASA's Astrobiology Institute¹. Being in the same directorate gave scientists the ability to see and perhaps get involved in previously unseen research efforts through joint proposals. Connections between Earth and space missions led to personal connections and nescient collaborative efforts. Merging space and Earth disciplines had, at least according to this subject, increased the potential for collaborative work.

The insertion of Full Cost Accounting into the Transformation mélange remained the stumbling block to a smooth and effective working environment. It made it more difficult to attract gifted researchers to NASA and in a counter-intuitive way more difficult to deal with less productive civil servants in lieu of gifted contractors. An example of this is that it might be more difficult to hire a gifted contractor if an unoccupied civil servant was available for the same job – in this situation skill might not trump tenure.

The word was that there were “lots of résumés out on the street, especially younger people, who were not as invested”. Proposals were dutifully counted (attempts and successes) and became the most important metric of success, although publications were still given lip-service.

¹ The NASA Astrobiology Institute (NAI) was established by NASA in 1998 to study life in the universe.

Connections with universities remained important. In fact, it was felt by many senior staffers that if a scientist couldn't directly contribute to a space mission he or she *should* be working in a university, the logic being that such expertise could more properly be supplied through university collaboration.

This denigrating of in-house scientific expertise had its downside as well as its undeniable logic. University researchers became increasingly reluctant to partner with civil servants in light of having to add civil service salaries to proposals. James Webb had discovered to his chagrin that some universities were much more eager to accept funds than fulfill research obligations (Lambright, 1969; 1995).

Lastly, along with almost every other respondent, this person attested to the fact that the organizational structure, in this case the directorate, had supplied substantial support for the writing and submission of proposals.

As a former member of the Earth sciences directorate this subject had experienced considerable displacement during the Transformation. His supervisor had changed and his office had been relocated. He was presently located more closely to his current supervisor but this did not seem to be a significant matter.

GSFC-9 was the original representative of my designation of 'Lone Wolf' taken from my selection methodology. The reason for this is that he had been literally plucked out of his original organizational work group and put in another group – none of his colleagues had followed. He was now in the newly created Heliophysics Division. In my initial phone call to him to set up the interview he described himself as "pretty much alone". He said his job satisfaction was outside of the bureaucracy so he fulfilled my characterization of someone who was possibly buffered from organizational change.

As was the case with all interviewees, this respondent declared himself to have no role whatsoever in organizational change. His original group had been disbanded and he had been told that he was going to be joining a solar physics groups. It made sense to him so he accepted it – insouciance carried to the 9th power. He had experienced previous reorganizations and seemed little impressed with those as well.

When presented with the question dealing with the impact of Full Cost Accounting he gave the now familiar response that it was a waste of time and was starting to actually hurt – even an insular person such as himself. This touched on funding and the fact of “people spending half their time on proposals”. Proposals had become the most important metric in GSFC laboratories. It was an overwhelming detriment to actual research work.

The current 2005 change had been all about the politics and external forces including a bias against research to please HQ upper management (Pfeffer & Salancik, 2003). Laboratories had to stay in step with HQ and how *it* was divided and HQ was reeling under the Administration’s exploration rhetoric. Strangely enough seeking closer alignment with HQ had not facilitated funding. The subject stated that he personally had no relationship with NASA Headquarters whatsoever. The 2005 Transformation might find its roots in the business model or public administration theories but this interviewee spent very little time thinking about it unless provoked. He was a research scientist, engaged in “self-directed research”. It annoyed him that there had emerged a new group of managers to whom he had to prove his relevance.

In response to question Q5 as to how the transformation affected his individual work he replied that all he really needed was a desktop computer. His research agenda

had remained the same however he felt less empowered since he had been plucked up and set down where others decided his research actually belonged. He had had no say in this decision. He was simply a lone bench scientist. The only resource he depended on was the Goddard Library. It did impact him that, for whatever reason, this GSFC facility was being decimated. The concept of a library meant a great deal to this scientist (as well as to many others) – a loss of the heart of the place. The downscaling of the library coincided with a major change in organizational values that meant less concern about “publications with good results” and less personal contact with other scientists. He added that the readjustment in values was reflected in the fact that researchers now grasped for money in lieu of anything else. Another result of the times, he felt, was a reduction in status in comparison with researchers outside of NASA. This reflected the ‘just another contractor’ concept expressed by Bozeman, B. *et al.*, (2001), in their studies on Government-Owned and Contractor-Operated Laboratories such as Oak Ridge. In that case, the result had led to substituting ‘lowest bidder’ organization rather than one of academia or laboratory excellence. The interviewee expanded on the fact that in the eyes of the Goddard Center Director the efficient running of Project COBE by Dr. John Mather had been more important than the Nobel Prize resulting from the science. He considered the Lunar initiative as ‘applied’ work and, as far as question 13 was concerned, there was a greater thrust in this direction to the detriment of theoretical work.

Touching on research question Q5 as to how scientists and their work were generally affected by reorganization, the respondent seemed to suggest that older researchers had seen this all before and were therefore less afraid although far less empowered. Examples of the angst resulting from the pawn-like status of bench

scientists were many, including disruptive e-mails and an increase in hallway gossip all of which resulted in less time available for significant work. Job satisfaction was not a concern of the bureaucracy – indeed it was suggested that it may never have been. He mentioned that a precise formula had been worked out based on a historical proposal approval rate which stated how many proposals would have to be submitted to cover any given salary. This had become a major contributing factor in the evaluation of performances.

This subject felt that scientific collaborations remained basically unaffected and that although people grumbled very few had actually taken steps to leave. The imperviousness and entrenchment of research seemed to directly relate to the above opinions. Things more or less remained the same if a person had almost everything they wanted and didn't need a great deal of funding. The major change was that proposal writing had increased. Again the directorate was said to supply excellent assistance with this through the Proposal Office and the Heliophysics Division (which the interviewee was now in) seemed a more logical arrangement than what had previously existed when solar matters had been stirred into Earth sciences. This subject belonged to a category that had experienced extreme disruption although he had had enough power to decline office relocation indicating some sense of safety and self-confidence.

I elected to include 5 interviews from my own laboratory. Two of the interviewees were women. There were not many female scientists among my list of subjects, mainly for the reason that there are not a majority of women in research positions at GSFC. Although a The Goddard Institute is a much smaller entity (~20 civil servant research scientists), seven of them are women and two researchers on-deck for

new hires are also women. Should that come to pass, it would mean that 9 out of twenty two scientists at GISS would be females. Secondly, as a sort of ‘skunk-works’² operation GISS researchers operate from a unique and semi-autonomous perspective. The laboratory had actually undergone an organizational demotion, from Division to Laboratory status but the Laboratory Chief being a renowned and internationally famous ‘celebrity’ whose expertise is recognized in far wider circles than NASA served as an effective protector for the entire staff.

I have justified my use of internal research through (Coghlan & Brannick 2006 and Brannick & Coghlan 2007). The five interviews (out of a total of ten), were chosen because of the value of the data they presented.

A certain amount of internal reflexivity was needed to order to clearly sort my motives and any existing pre-dispositions and biases (Dexter, 1970). I meticulously tried to accomplish this.

Interview GISS-2 was a specialist in radiation who had started as a planetary researcher. As such, she had clearly favored a more cohesive and less artificial barrier between space and Earth sciences since she naturally straddled the two. She saw the transformation, in general, as an opportunity to exercise flexibility in going “after planetary money”. Along with many others she decried the loss of control in the proposal process and the increase in what she called “bean counting”. She felt that her laboratory was fortuitously isolated and could benefit from goals that were somewhat more streamlined. However, she was repelled by what had been forced upon researchers at GSFC proper – “people shuffled around and forced to work with new people”. Also the

² A group within an organization enjoying autonomy & unhampered by bureaucracy. Originated at Lockheed.

insecurity and implied humiliation of being considered ‘available for work’ altered how people felt about their day-to-day existence. This seemed to be the fate of those who were unable to bring in funding to cover their own salaries and who did not possess the protection of a project umbrella or powerful protector. She herself felt little discomfort and some enhancement in her research opportunities, yet she looked with sympathy at colleagues not similarly protected.

This subject had come on board as a planetary scientist when Earth and space sciences had been joined in one directorate. Following the discipline split in 1990 she was one of those who found herself on the Earth sciences side of the fence with little access to planetary proposals and collaborations. Presently, she was hoping to return to her original interests in planetary atmospheric radiation.

Like all the others interviewed she had had no participative role in this latest or any reorganization. For her, how reorganizations of government-owned and –operated laboratories affected research, especially at GSFC (questions Q2 or Q3) was an increase or decrease of breadth. Her expertise in radiation could and did encompass both space and Earth science disciplines and she welcomed the opportunity to do both. It seemed more realistic for her when the disciplines were joined were joined in one directorate.

Addressing question Q4, as to the impact of Full Cost Accounting on the 2005 process, she judged it to be Headquarters driven and said it had a huge effect on manpower as well as general morale. There was enormous uncertainty concerning all budgetary and funding matters. Proposals could no longer be sent directly to Headquarters but had to be filtered through an additional level of bureaucracy. This also adversely affected the funding timeline since everything had to be commenced earlier and

yet final funding decisions seemed much slower in coming. Proposals that had been written two years ago still hadn't been decided on.

This researcher supposed that all tools such as Full Cost Accounting came directly from Headquarters. She found it interesting that Full Cost Accounting had been thoroughly and quickly institutionalized within the entire bureaucracy. Funding channels appeared to be more compartmentalized and in many cases researchers were forced to depend on sole support.

Organizational code changes meant little to this interviewee, however incorporating Full Cost Accounting had greatly increased bureaucratic functions and she felt that information flowed less freely. Many people were engaged in justifying their existence yet there seemed to be less ability on the part of managers for budget and proposal approval

Pertaining to research question Q5, as to how scientist and their research were affected by reorganizations, she elaborated on as to whether the function of a Goddard scientist was to support missions or whether the science should, in fact, determine the missions. This is a critically important question that can be defended in either direction. What was clear was that everything, including research was driven by funding. Added to this was the matter that free and open research often did not coincide with political agendas.

The interviewee seemed to waver between indifference to change – “day to day work not affected except with Full Cost Accounting” – and demonstrating deep grievances. She felt that in many ways the joining of disciplines resulted in a better situation, however, Full Cost Accounting had resulted in great discontinuities between

former funding agents and “tremendous job dissatisfaction”. Newly instituted on-line procedures meant a plethora of training requirements and committee work. The performance metrics had little relation with what was actually done. Bringing in money had been inserted as a major research goal, placed alongside refereed research publications. Her most pressing and only problem was with funding in the presence of Full Cost Accounting. Collaboration opportunities seemed to be better as did attracting and attaining new hires. In fact, some people had been permitted to transfer from Ames Research Center to the Institute.

It was clear that after this reorganization one either wrote proposals or endured lack of favor. This changed all aspects of research including publication page charges. Contractors found themselves at a disadvantage to University personnel because of head taxes on the former.

The componential status of this particular laboratory showed this researcher to have been little affected by actual organizational change, transformation or otherwise. The only substantial impact remained the implementation of Full Cost Accounting and its imposition of it on research activities.

GISS-4 is considered by many to be one of the most productive and gifted researchers in NASA, in both project and theoretical areas. Although not a manager per se, he possesses executive ability and confidence allowing him to direct the science of one of the largest missions in Earth sciences.

The subject’s opinions of the 2005 changes were basically negative. For this he gave two reasons. The first was that civil servants had been divested of their permanent staff positions and were thus at a disadvantage with tenured collaborating university

faculty members. Grant monies obtained from outside of NASA could be used for travel but could not be applied to civil service salaries. Funds to cover civil service salaries had to be allocated solely through proposals to NASA Headquarters. Although he tended to shrug this off as “change for the sake of change”, it nevertheless added a deep sense of anxiety, to the extent that many researchers were actively looking for other jobs. Secondly, there was “no reasonable balance between research and funding”. In an attempt to keep up or adjust, the bureaucracy kept changing forms and multiplying paperwork.

In reference to question í1, as to how this Transformation agreed with the classic concepts of government reorganization, his answers implied that 2005 changes extended the usual effects of ordinary reorganizations, although the interviewee had admittedly not been around for changes in 1984 and 1990.

He had not directly participated in the current process but had had to cope with submitting many proposals to insure needed funds. This activity had definitely diminished his actual research which answered question í2 concerning how reorganization affected the research in a government laboratory.

He personally had had less trouble adjusting to the actual mechanics of Full Cost Accounting than most bench scientists. He felt that the electronic submission procedure allowed you to “do it yourself” and saw that as a liberating thing. He did express the opinion of other interviewees that combining Full Cost Accounting with a new financial system had made matters much more difficult.

For whatever reason, there had been a significant reduction of funds and it was much more difficult to bring in funding; this at the same time that bringing in money

was being assessed with greater importance. Adding to this difficulty was the fact that proposals (perhaps because of the increased volume) were not being reviewed in a timely manner, elevating a sense of uncertainty. The interviewee felt that Headquarters endeavored to save money by this funding delay. Furthermore, while it undeniably helped to submit proposals electronically, scientists of this interviewee's stature and experience were also called upon to review many proposals. He mentioned that there was a 100-page instruction book on how to submit proposals and that unless one conformed *exactly* with these instructions the proposals could be rejected out of hand. Templates were devised as aides but this largely had the effect of generating hundreds of proposals in hopes that some might be accepted. The entire system lacked balance and was not reasonable. His comments succinctly addressed question Q4, factoring in of Full Cost Accounting into the Transformation. It was also salient that he stated that while the Directorate supplied support for proposal writing, the staff for this was paid out of the very research they were trying to facilitate.

As a Project Scientist this subject enjoyed a close and ongoing working relationship with colleagues at Headquarters and had experienced no change due to the Transformation although it did somewhat expedite matters to be more closely and organizationally aligned.

Organization charts were simply not important to this scientist and in this he largely agreed with other respondents. Structure was of minimal consequence compared to funding. This was to be an ongoing and familiar refrain. What is termed 'the org. chart' is negligible to researchers – just “numbers of the codes”.

Question i3 distinguishing between the effect upon applied and theoretical research was addressed in a seemingly logical and generic fashion. He felt that applied research was easier to direct than theoretic research and therefore easier to fund or not to fund. He added that in some cases theoretical work might be easier to camouflage under different entities, even projects.

He summed up by stating that there was “more emphasis placed on space missions because that brings in more money”. Both questions i2 and i3 as to the effect of reorganizations on research were answered by the general effects on this scientist. While, he still expounded the value of research as the most important aspect of his work he was forced to admit that bringing in funds to assure existence was a close second. He attested to the fact that science funds had been drastically reduced in his area, “from 10 million to three and a half million”. Also, to be a Goddard scientist was “not perceived as an elite science job anymore”. There was “less emphasis on science and more on legalistic issues and instructions”. Furthermore, government researchers were more vulnerable to the political atmosphere, unlike those who worked in universities. In reference to research question i5, this interview would indicate that Goddard scientists and their research could be intensely affected by external events and politics, especially through such tools as Full Cost Accounting when folded into organizational change.

According to this subject, presenting results at conferences (this researcher in fact organizes and runs international conferences), publications and citations are still the grist of gratification for a researcher. He also felt compelled to say that he was tremendously concerned with his budget overruns and aware of the fact that if you brought in money you were assessed more favorably.

The subject stated, “I haven’t seen a happy person”. The current “atmosphere is geared to pushing people out if they can’t support themselves”. That illusive yet all-important feeling of how government scientists are viewed in the outside world had resulted in a sense of inferiority for civil service researchers, making it that much more difficult to attract people to their ranks.

Previously, university researchers had complained about civil servants spending 100% of their time on research and not having to bring in any funds for their salaries but as a result of 2005, this had changed dramatically. Now government scientists were no longer insulated from politics while university researchers seemed to be somewhat less tainted.

This interviewee was not as isolated as other researchers in a component installation that is physically removed from Goddard itself. He is, in fact, directly responsible for one of the most important missions in his discipline at NASA. Little had changed for him, at least in a logistical sense.

Interview GISS-5 was a senior scientist, on the verge of retirement. He was extremely candid and not afraid to take his statements to what could be termed the 2nd level of systems discourse – at the very least (Fischer (1995)). As a scientist he felt that any “reorganization could be blind”. He did not specify whether this blindness resulted from a directed objective of bureaucratic change or if it might couch hidden agendas rather than stated objectives.

Referring to research question Q2 as to how and why the 2005 Transformation was different from the two previous organizational changes, this subject allowed himself a strong personal perspective. Consistent with past (and future) interviews, funding was

determined to be the most conspicuous distinction. The interviewee voiced some tough statements, some seemingly contradictory, such as saying that the reorganization was indiscriminately blind yet at the same time ideologically opposed to Earth sciences. The distinct thrust of the 2005 Transformation was its stated primary focus on the manned exploration of the Moon and Mars. The subject felt that this had rendered NASA “more politicized” as an organization. In other words, there were “systematic and political reasons for this reorganization”. In his view, the former organizational dichotomy of Earth and space research had been more desirable. While there were admittedly disciplinary overlaps between the two initiatives, there were also “great differences in techniques, approaches and aims”. He stated that if NASA abandoned Earth science there was no one in the academic or private world to pick up the slack. In that case, NASA would be “just another government bureaucracy, wasting time”. The interviewee felt very strongly that NASA should be the “home of elite Earth science research”. Presently, and in the recent past NASA provided a real possibility “to improve the quality of life on Earth”. Full Cost Accounting combined with a “lack of specificity in getting funds to researchers” presented a major problem to science at Goddard.

As usual, the subject claimed he had not been actively involved in planning for the reorganization but he did contrast it from 1984, 1990 changes in line with research questions Θ1 and Θ3 as to a succession of reorganizations and their effect on research. In the earlier processes, reorganizations had to do with code or organizational numbers and very little else had changed. The interviewee surmised “that previous reorganizations were not so politically motivated” that addressed question Θ2 as to the distinction between this change and others.

Question Θ4 attempted to examine Full Cost Accounting, the blunt instrument of funding, as an agent of control. This research scientist presented views that this was a matter driven by political influence. Scientists were affected if they happened to be on the wrong side of the ideological divide and so research question Θ5 as to how scientists and their research were affected, was totally wound up in ideology, funding and rhetoric. Other than this, the usual changes of phone books and names on doors were of little importance. The interviewee stated that “20% of the Earth sciences budget had been cut”, with more cuts on the way. Proposals had become more expensive to submit and, in general, were wrecking havoc on daily work routines. He compared the Transformation to the war in Iraq, in the sense that both were out of control. He further stated that Full Cost Accounting came out of the university community and had been coupled to the Transformation as a political agent.

The researcher stated that the Agency didn’t “come forth on funded proposals” and that monies could be summarily taken away. Funding was obviously “pulling away from science” if one could not submit a proposal without a reliable expectation of funding.

This subject thought that all of the above matters would have had a bigger impact on research had it not been for the fact that NASA Headquarters was still primarily driven by personalities, many of whom were sympathetic to the research they were in charge of funding.

Questions ι2 and Θ5 were both aimed at examining if there might not exist a hidden insulation or buffering for research in a government-owned and -operated laboratory such as GSFC. In this scientist’s opinion at least, this seems to be supported.

Career science managers at Headquarters tended to think of themselves as team members with Field Center scientists. They were often motivated to assist researchers despite the fact that reorganizations often blindly put non-scientific people in charge. This teamwork concept with Headquarters often ameliorated organizational change. The protection afforded to ‘out of favor scientific disciplines’ was partly due to the fact that program managers at Headquarters tended to acquire on-the-job expertise in the disciplines over which they were put in charge and this led to a certain sympathy.

Structurally this scientist saw a total “disconnect between form and substance”. NASA Headquarters had been forced into this change in 2005 and the rest of NASA had had to follow suit. He stressed that “research is done on the scientific level not according to the structure of the organization” and that “collaboration is person-based, not based on structure”. He also directly belittled organizational charts by declaring that “proximity is more important than any organizational structure in working with people”. This, to my mind reinforces the ‘garbage can model’ of March and Olson (1983).

He stated that researchers whose research was ‘out of favor’ continued “doing what we think is important but not very visibly”. For example, he was personally not convinced that Earth sciences was still actually a part of NASA but it seemed to go on anyhow. He also expressed the opinion that while it was true that researchers tended to focus on things that had more monetary payoffs, research tended to go where it led scientists and not the other way around. A research field was amorphous and although there was a reluctance to work on global warming, because all the news tended to be bad, there was a “profound need for Earth science” and that was quite simply the very existence of “life on Earth”.

In general, he felt that conditions had deteriorated since 2005. Space hardware directed more attention toward applied technology rather than on theoretical research. Service to the outside scientific community was increasingly difficult to accomplish and maintain in the face of shrinking budgets. In addition, speaking to the press tended to be ideologically controlled. Appointees were convenient scapegoats but the problem went much more deeply than political lackeys.

The interviewee judged his work solely through research results but added that performances ratings were now being assessed by the ability to procure funding rather than “how much one has contributed to the field”. In this world it was becoming increasing difficult to “stay the course”.

One of the factors on the interviewee’s mind was the potential difficulty in hiring civil servants – especially in the Earth sciences. In-house contractors, not the big external aerospace contractors, faced a dubious future since the metric du jour had become how many proposals could be funded to cover civil service salaries, ignoring the head tax on contractors. He also felt that university researchers were greatly assisted and were “probably responsible” for Full Cost Accounting, since it made them much more competitive when civil servants had to bring in their own salaries. He also agreed that GSFC had attempted to help researchers cope with the current situation by setting up a service entity to help with proposal submissions.

Finally, as to the mini-adjustment of joining Solar research to that of the Earth, the subject was rather lukewarm as to the wisdom of this joining since he was of the opinion that it neither helped nor hindered scientific collaboration.

One of the interesting ‘sidebars’ of this interview was a comment on the interdisciplinary and collaborative effort known as ‘astrobiology’. Astrobiology is an initiative that, while seeming to have an ebb and flow, represents a hopeful area for the future of NASA science. Proposals have been submitted in this area and some have even been successfully chosen, however, because of the lengthy process of the funding process nothing substantive has yet been produced. Still, there are ongoing attempts at resurrecting astrobiology and people have been encouraged to ‘vary’ their accepted proposals. He added that these responders were understandably a little wary.

This respondent also addressed the ‘infamous’ (for NASA Earth scientists) possibility that the National Oceanic and Atmospheric Administration (NOAA) should be given the ‘lead’ for Earth science. He pointed out that this was not practicable for real progress in the field since NOAA has day-to-day responsibilities dealing with weather and transportation. It is by nature not inclined to commit to theoretical or decadal climate research. On the other hand, the National Science Foundation (NSF) is dedicated to funding universities where teaching is, understandably as important as research. He therefore made a strong case for NASA funding and for NASA being the home of an elite cadre of Earth scientists having the potential to assist in the understanding of our planet and its future problems.

This subject had experienced no extraordinary physical or logistic displacement as defined in my selection methodology. However, he was a member of the 900 Earth sciences directorate and believed very strongly in its ecological implications. His interest in and support of space sciences was represented by his hope for a strong collaborative effort in the emergence of astrobiology.

Interview GISS-6 highlighted research opportunities that she had taken advantage of through the Applications Initiatives for Climate Impacts at Headquarters. She was by profession a research agronomist brought into the NASA fold at the time when systems thinking in reference to Earth as a planet was emerging. Understandably, her interests in climate impacts on Mars or the Moon were minor. Because of this, she had single handedly formed an alliance with a climate applications group at NASA Headquarters. Through her initiative the importance of and dependence on Applications (from which Earth science had originally emerged as a result of satellite missions) she seemed to have come full-circle. Concerning question Q5, as to how scientists and their research are affected by reorganizations in government laboratories, the subject seemed to possess a built-in ability to adjust to changing internal and external circumstances.

The interviewee strongly believed that the past organizational dichotomy between Earth and space science was a better arrangement than the current merger of these two. She also marveled at the apparent (at least to her) speed with which this change had taken place – particularly “absurd” in light of the fact that obtaining funding had been unexpectedly added as part of researchers’ duties. She described meetings in which researchers were advised as to how they could torque their research to coincide with manned exploration.

Not only had this researcher not participated in the change process, she felt that there had been no real discussion of its implications and of this new organizational structure. She had had little or no experience with previous reorganizations, having come on board in 1994 after Earth and space disciplines had been established in separate directorates.

The subject emphasized the fact that the 2005 Transformation seemed to be totally politically motivated by the Administration due to the fact that Earth science research done at Goddard had become critically important and successful and therefore needed to be de-emphasized since it bore directly on the question of global warming. In this matter the Administration's view was in direct opposition to the majority of scientific findings. This directly addressed Question Θ2 as to whether the 2005 reorganization represented a singularity which to this researcher seemed to be the case

Of course, as usual, question Θ4 concerning the instigation of Full Cost Accounting played an important part in this employee's world and she found it difficult to separate it from everything else. It seemed to generate more paperwork and greater oversight by the public relations people as to what statements researchers were allowed to voice in public. For this reason, the scientist felt generally less empowered. She explained how she was forced to report any contacts outside of NASA including participating in interviews, weeks ahead of time. She described proposals as "very difficult and enormous jobs" compared to publications which were professionally fulfilling. Full Cost Accounting evoked the same response from her as that of Interview GISS- 2 in that it was described as generating unfavorable impacts that were "huge". The same word 'huge' was used to describe the effect of Full Cost Accounting. Furthermore, making tenure conditional on funding raised real questions as to whether or not NASA really wanted to support science. The matter of it being incumbent upon NASA, as a government agency, to fund university research was mentioned. Also mentioned was the fact that even with funded proposals it took an unusual amount of time before one ever saw the money.

While the Field Centers had picked up the ‘exploration torch’ from Headquarters with as much alacrity as they could, her own particular laboratory was heavily insulated from this rhetoric because of its Chief who was a world-renowned research scientist and the definitive authority in his field.

Also a protection was being ‘below the radar’. This lack of organizational focus resulted in less attention being paid to something that was “unpopular with the Administration” anyway. She described herself as “blissfully insulated” and this isolation had made the migration of her programs to Applications at NASA HQ possible. Since her area of research, climate impacts, had lost a great deal of what had been to begin with a smallish amount of funding, the necessity of proposal writing aimed directly at the Headquarters Applications program had become crucial. In addition, she had garnered research funds from “every major federal agency that works in climate change as well as state, city and international agencies. While these monies could not be applied to her salary, it kept her research group alive and viable. It was in this manner that she provided an answer to question Q5, how scientists and their research were affected by reorganizations. Her interaction with the Applications group at Headquarters had mitigated the effects of the 2005 reorganization on her work group.

While it was difficult for this researcher to follow the organizational path of her Field Center (GSFC), in her quest for research dollars, her newly forged links with Headquarters had proven fruitful and promised to remain so. It had supplied a “good home for research” and she spoke of “re-finding the paths to stronger ties with some parts of NASA Headquarters”. In this manner the researcher had successfully bypassed formal

organizational paths resulting from the “recent misguided fusion” – of Earth and space sciences.

Because of a systematic re-focusing of funding away from disciplines studying global change there was, in effect, no actual institutional support for the interviewee’s research and the whole responsibility for its funding was on her shoulders. The interviewee felt it possible that researchers in planetary studies might develop closer ties with Earth systems, however, she added that in the final analysis, groups at Goddard did not seem to be interested in cross-cutting disciplines. It was obvious that she did not anticipate that collaborative work would increase with the joining of disciplines.

She rather lamented lost progress in having to create and re-create research programs and the overall diminishing of research opportunities in general. She feared that changes around the “edges” of scientific progress could “marginalize” disciplines, such as hers. The circumstances she described above made it that much harder to disregard distractions and concentrate on the work at hand. The interviewee finished up by describing a “siege mentality with people demoralized and work devalued.” In dire need of extra staff, she stressed the importance of bringing in new people into the NASA scientific disciplines. She also regarded staff retention as an anticipated problem.

I chose to include Interview GISS-9 despite basic incongruities. He has considerable managerial duties which he efficiently performs. While still an active researcher it may be debatable how much research he actually performs. He does, however, identify completely with the ideology of the bench scientist and shields them, if humanly possible. As deputy to the laboratory chief, this is part of his major duties as understood by his immediate superior. He also has a great deal of autonomy.

The interviewee asserted that the 2005 Transformation had not been discussed with employees and had clearly been effected to mirror what had been done at HQ – divisions organized by general categories and within those divisions, laboratories that greatly resembled the previous organizational structure. No other possible paradigm was conceivable. While Headquarters might not have insisted on parallel realignment on the part of the Field Centers the science component at GSFC felt it wise to comply. The interviewee stated that such an alignment probably improved communication with Headquarters at a higher level, in that there were now fewer people on top. Actually, not many of the other scientists interviewed held to this view. The subject himself went on to admit that there it could difficult figuring out who the Headquarters managers that researchers should communicate with actually were. He also stated that people at HQ kept doing pretty much the same thing they had always been doing under the old structure.

The overall results of the Transformation process had been modest and seen in a certain light had some positive aspects because of the fact that that there was more freedom to reconsider certain matters.

He naturally felt that there had been little effect on his laboratory since it was physically apart from Greenbelt, Maryland. He mentioned that during this time a HQ program chief had been made the Goddard Center Director and surmised that this fact may have facilitated communication with HQ (this individual has since gone back to Headquarters, at least temporarily).

In his opinion, reorganizations, the 2005 Transformation included, did not significantly alter past or present structures. They seemed to be inevitable and they

imposed a modest tax on general resources such as personnel time, routing lists, etc.... In his opinion, it would be best if such processes were held to a minimum. In this way, negative impacts were also minimized. In his opinion, reorganizing in two-year intervals would be much too frequent. It was simply an exercise in change and resulted in the people who were not in power, being made to feel even less empowered. He mentioned “an attempt to feign employee participation” when decisions had already been determined. In response to matters bearing on research questions 12 & 11 as to the difference between the Transformation and other reorganizations whether in the classic organizational sense or specifically at Goddard, this interviewee indicated that all these changes this could be described by NASA HQ’s ongoing efforts to position itself within whatever power structure happened to be ascendance at the time.

He rather dismissed any substantial impact because of organizational change since in his opinion nothing had really happened “except code designation”, at least for his laboratory. “Two directorates had combined into three and then four (Heliophysics) divisions”. He pointed out that organizations under a Division used to be called Branches and they had kept that structure for some larger Divisions that had logical subdivisions – for the others the all-encompassing and ubiquitous term of Laboratory was now being conveniently utilized. The bottom line was that there was now one science directorate where there had previously been two.

The interviewee admitted that structure did assume importance by virtue of the fact that having large organizations at the directorate level, such as the Sciences and Exploration Directorate, meant more reviews, prior to reaching the Center Director. He

also added that in the opposite half of the information loop, more was coming directly down the chain from the NASA Administrator.

The structural merging of Earth and space disciplines also made a difference for general business matters. He was reluctant but unable to deny that the quality of work life had not improved because of “foul-ups or “waste of time”.

This scientist had experienced the science reorganizations of 1984 and 1990 and did not feel that they were appreciably different from 2005, despite a progressively more detailed pattern in the general chain of command – as already mentioned. He also agreed with GISS-6, that in 1990, the creation of the Earth Observing System and the placing of Earth Sciences into a separate and distinct directorate had represented a large increase in their importance, visibility and funding. The earlier changes in 1984 had also represented an upgrade in Earth sciences’ prestige since they had had been raised to the level of and incorporated with space sciences.

Factoring in the impact of Full Cost Accounting (question Q4) on the current research culture did evoke a significant response from the respondent. It maintained that it had had a detrimental effect on the retention and hiring of new people. He was very conscious of the importance of teamwork between civil service researchers and in-house contractors and stated that Full Cost Accounting had resulted in a detrimental effect on the latter. It prompted management to take care of civil servants first and also favored university personnel who had less of a ‘head-tax’ imposed on them.

Although having originally attested to progressively more detailed structure in the general chain of command he stated that he could still routinely talk to HQ program

mangers, in relation to specific scientific disciplines. He would not acknowledge much of a connection or link between Full Cost Accounting and the Transformation itself.

This interviewee felt that proposal writing had undergone a much more significant change because of the new on-line processes than due to any Full Cost constraints.

In a total contradiction to data obtained from other interviews relating to research question asking about the different effects on applied and theoretical research as a result of the Transformation (i3), he felt that such basic research such as global climate modeling might receive more emphasis due to Full Cost Accounting. Also unlike many others, this subject felt that researchers and their work were largely unaffected by organizational change in a government operated laboratory (question Q5). While an individual might have gone from a Director to a Division Chief – which was admittedly further down on the organizational chart, he or she basically managed the same number of people. Research question i2 had asked how reorganization in a government-owned and –operated laboratory might affect the ability to conduct research. This subject stated that it was impossible to consider possibilities if in the end they would not be considered. To explain this he stated that the viability of the traditional and protected civil service staff had not been tested, despite the new idea of term hires (civil servants who could be hired for a certain period and needed subsequent renewal). Term hires might represent the wave of the future, but did not facilitate or diminish the opportunity to do research. He stated that there currently might be more of an emphasis on communicating with the public as a metric, through popular science articles. On the whole, this subject tended to “look at the laboratory as a whole and quality publications per unit of time remained the most important output”.

Performance evaluations were forever constant in their continuous changes, perhaps not because of reorganizations but “because of mandated changes stemming from above”.

In the end, the interviewee did not feel the combining space and Earth sciences had resulted in better communication and more collaboration. He speculated that the fusion might result in a larger support staff and that this could be a good thing. On the other hand, he added that being in a bigger ‘pool’ could result in hiring quotas or ‘freezes’. He reiterated that the wrong people, i.e. on-site contractors and university personnel were being threatened. Civil servants were clearly seen to have higher priority and in the face of Full Cost Accounting there were official attempts to take work from contractors and move it to over to civil servants who had been unable to raise adequate funding. This, in the interviewee’s opinion, hurt teamwork because contractors were made to feel like second class citizens.

In summary, this scientist had been minimally impacted by the 2005 Transformation. Certainly his organization had, in a sense, been demoted from a Division to a Laboratory but that meant very little except for the fact that there were more people bunched above him and the rest of his work group.

Interview GSFC-10 stated at the beginning of our encounter “I’m one of those people who clings to the bottom layer”. He was what is affectionately known as a “graybeard” (in his youth, he had worked for Edward Teller). A planetary scientist and member of space sciences, he optimistically felt that the Transformation might make it easier to work with Earth scientists and develop multi-disciplinary proposals. In addition, he put great stress in the creativity of science.

He believed that having Earth and space groups work together could enhance the knowledge of both. He pointed out that even though funding for Earth science was down, Earth was a planet too and thus as a planetary researcher, it was important to work with Earth scientists.

On the downside he felt that the Transformation process had greatly increased the number of managers and, of course, every researcher got taxed for managers. Also, paperwork had almost become an end in itself and that NASA was currently struggling to survive attempts at politicization that went hand in glove with attempts to squelch Earth sciences. In what could be termed a direct response to question Q1 as to the Transformation seen in the light of classic concepts of reorganizations he stated that taken at face value, the latest Transformation at GSFC did not follow any stated or classic reason for government reorganization other than an aim to diminish the Agency while at the same time pushing it in the direction of a certain ideological direction. In his opinion, this differed from reorganizations in 1984 and 1990 (both of which he had experienced). In those earlier cases there had been no noticeable difference before or after the reorganizations. The current Transformation, however, seemed to him to be the result of a desire for top-down control. This also supplied an answer to question Q2 which basically asked how the 2005 Transformation differs from previous Goddard reorganizations. It isolated the element of control. If one accepted this scientist's belief in the creativity of science, it seemed that the 2005 process could not avoid being detrimental to research activity.

The interviewee felt that the 'budgetary' component of public administration, as interpreted by Sean O'Keefe (a previous NASA Administrator with roots in the Office of

Management and Budget) had ruined the Agency. The whole thing had been poorly administered and there was great confusion as to where people were to charge their work time (the old Full Time Equivalent or FTE numbers were now closely associated and interlinked with something called Work Breakdown Structures or WBS numbers). Furthermore, the paperwork demands had exploded and were “eating up creativity, productivity and time – with proposal writing”. These “fiscal hoops” he laid at the feet of Sean O’Keefe and not the Transformation. He explained that it took close to 200K to cover most salaries and that proposals were most frequently funded to the tune of 150K. Everyone was expected to write five proposals but would be extremely lucky if even one of those five got funded. It was easy to see that this was a rather hopeless and losing proposition. He added that there was “no rationality in passing down funding crap to the working level”, in this case the bench scientist. He added that writing proposals was akin to a “black art”. Furthermore, he added that aligning with NASA Headquarters was like “aligning with the Mad Hatter”. There was no evidence such an attempted alignment had produced anything beneficial. In his opinion the reorganization or transformation had accomplished little except for the fact that budgetary matters were now being actually manipulated to direct and control research. He felt that scientists and their research were variously affected but applying this to question Q5 as to whether these effects could be ascribed to the Transformation proved to be troublesome, at least when following this scientist’s reasoning. He did indicate that whatever formal structure existed did so to serve management rather than science and although NASA Headquarters might choose to compartmentalize itself, should not apply to Goddard laboratories. How certain research disciplines might fit together was an arbitrary thing and because of that fact they should

not be “determined by bureaucratic organization charts”. This interviewee’s opinion regarding research was that “by definition, creativity cannot be managed”. This led to the conclusion that managing scientific research successfully required a light rather than heavy hand – even perhaps in some cases a certain ‘sleight of hand’. He said it was a mistake for top GSFC management to try to mimic the compartmentalization of Headquarters.

Specifically, he approved the increasing importance of Earth sciences but felt that the serious issue of global warming could benefit by the cross-breeding of terrestrial and planetary science – in other words, “a lot of people interacting”. It was because of this that scientific laboratories did not comfortably fit into the classic concepts of organizational change. In response to such changes branch heads and other supervisors would in the normal course of events try to shield scientists from it. Indeed, he stated that the “best managers encouraged researchers to do their own thing”. He mentioned the late Dr. Edward Teller³, whom he had worked under, as having employed the exact opposite approach.

Unlike other researchers interviewed, this veteran believed that despite difficulties, there was currently more emphasis on science. He also seemed generally optimistic concerning future research opportunities within Goddard. He believed there was a growing emphasis in NASA’s investment in improving basic science-teaching in schools and, all in all, he remained remote from and far above the stress, pressure and competition that so many others complained of. Science, he declared, “was an art”. There might be more emphasis on applied technology because of financial reasons but he

³ Generally thought to be the ‘Father of the H Bomb and ascribing to a super-nationalistic and doctrinaire management style.

happily clung to “the bottom layer” of the bureaucratic pyramid and resolutely resisted the attempt at organizational uniformity being impressed on his work.

To this scientist, at least, reorganization in a government-owned and –operated laboratory did little to diminish the work of the bench scientist. It could be surmised that such a veteran had developed his own insulation to paperwork and what he called “negative stuff”. Indeed, he said that all such ‘distractions’ further compelled him to do stuff he was interested in”.

He still felt personally empowered despite being hampered by paperwork, made more arduous since the “bean-counters had discovered the computer”. Everything had become more complicated including how performances were assessed. All of this, however, he declared to be largely irrelevant since peers continued to basically determine performance assessments, thus maintaining a model put forth by Romzek & Dubnick (1990). Attempts at a town hall-type community culture driven by management were inevitably trumped by naturally occurring and unforced collaborations -- this, despite the fact that “multi-disciplinary funding is a problem” and “often disappears”. NASA’s idea of thinking of Earth as a planet with interrelated internal and external systems naturally spurred collaboration among all disciplines. It yet remained to be seen if this interdisciplinary and collaborative opportunity was going to work because individual scientists were generally unmotivated when it was delivered by means of the rhetoric of the Transformation.

As a government laboratory, Goddard tended to leave scientists free to pursue what they wanted to, more than was the case with engineers, because the historical

impetus of science favored such freedom. He also added that a directorate support office giving help with proposals was a good idea, and often necessitated by funding shortfalls.

Interview GSFC – 11 followed an entirely different tack. The interviewee was optimistic and positive about NASA, GSFC, the Transformation and even Full Cost Accounting. He also embraced the business model and thought of his laboratories supplying ‘customers’ within and (possibly) outside of NASA. On the matter of Full Cost Accounting, he thought it revealing how much things really cost but didn’t really feel as if this impacted him. His was a nuts and bolts world – the world of the project scientist who develops instruments and keeps them flying, not the world of the theoretician. The 2005 Transformation brought more business to his labs and there were no other changes, the whole affair was seamless.

During the organizational changes he had actually been asked what Branch he wanted to go into, but he regarded this as only peripheral involvement. Referring to questions i2 and Θ3, as to how reorganization or a succession of organizations affected the quality of research or opportunities offered to researchers, he stated that 2005 had made little or no impact and neither had any previous case of organizational change.

In the matter of question i3 addressing the effect on theoretical versus applied research, the interviewee admitted to no stress because of proposal writing since his existence depended on funding coming from projects. It was applied research. His relationship with Headquarters hadn’t changed and as a calibration scientist he maintained a close contact with HQ. He felt encouraged as well as gratified in examining “space & Earth applications vis à vis each other. For his brand of science which was rooted in applications and embedded in projects there was virtually no change. His laboratories

were always encouraged to apply for what needed to be put in orbit. This interviewee also felt that the 2005 Transformation had elevated the importance of Earth sciences relative to space science since it had given the former a broader base.

This researcher did admit that his involvement in flight programs had put a crimp in his publication record but on the other hand his morale and job satisfaction were high. He felt collaborations to be flourishing on both the space and Earth side of the fence. The hiring process for his kind of work remained slow but this was because there were few ‘nuts and bolts’ people being turned out by graduate schools and the greybeards were retiring. He did not feel this, however, to be part of a general reorganization turnover. This subject appreciated directorate support, particularly in financial matters and was encouraged by the splitting of the Sun and Earth Division into Heliophysics and Earth Sciences since this gave his laboratory more ‘business’.

Interview GSFC-12 was a former researcher in the Earth sciences directorate, and also took a somewhat optimistic view of the joining of Earth and space disciplines, although not to the extent of GSFC-11. He described himself as being on the “periphery of space and Earth sciences”, as such he felt quite at home within a combination of the two.

He reiterated the creed of GSFC-10; that science was creative and he was also critical of Full Cost Accounting which resulted in less emphasis on science and more on bringing in money. He expressed the provocative statement that the 2005 Transformation may have been necessary “to make it work” – it, being Full Cost Accounting. This was intriguing and directly addressed research questions 11 and 12 as to how the Transformation differed from other attempts at reorganization, both in the classic sense

and at Goddard. In this subject's view before the Transformation, Full Cost Accounting had been discussed but always in the planning stages since no one really knew how to implement it.

The interviewee also explained that the Head of the Directorate Proposal Office had indicated to him that there was, in effect, a pecking order for assistance given to internal proposal attempts and reviews.

He stated that one way Goddard seemed to be dealing with FCA and its effect on salaries was putting more people in management categories since those salaries could be partially covered by administrative costs. Everyone seemed to tacitly accept and support this. It relates to research question Θ5 about how researchers at Goddard are affected by reorganizations since it indicates that a government-owned and -operated laboratory is able to finesse certain dictated organizational changes mandated from above or outside. Such increases in management, however, could easily lead to promotions that might otherwise not have occurred and explained the preponderance of associates, assistants and deputies. The money for these salaries could only be raised by taxing scientific programs, since there was no independent funding source emanating from Headquarters.

During the course of the interview this researcher appeared to do a 180° flip, indicating that having all science under one roof, in the last analysis, did not work since it lead to more competition for diminishing funds. In his particular case, there might be possibilities for more interaction but it depended, in large amount "on who you know".

As respect to research question Θ2 concerning how the Transformation differed from previous reorganizations, this interviewee admitted to hardly having been cognizant

of what happened in 1984 and 1990. What was of greater importance to him was the fact that he had made a conscious decision in 1973 to migrate to Earth sciences.

Full Cost Accounting represented the most significant change impressed upon GSFC and he felt its implications were quite serious. It represented a system that was supposedly meant to establish the fact that the taxpayer's money was well spent (Light, 1997), but it had been seemingly initiated without logic. In his opinion government laboratories were not meant to generate money. Full Cost Accounting basically relegates everything to the private sector while the government is supposed to manage or 'steer' (Osborne and Gaebler, 1993). Old timers, he said, knew better. They knew that government is subject to politics and what resulted from Full Cost Accounting was a "very negative thing". People now have to concentrate on raising money and not doing science.

So far this researcher said he had managed to survive. Certain buzz words like 'space weather' helped and Earth science managers attempted to run their programs so everyone would get funded although continuity was a problem since there was very limited amounts set aside for future satellites.

There was simply not enough funding for everyone to bring in 100% of their salary. Even excellent proposals often did not get funded and this he termed "heartbreaking". The proposal process itself, now done on-line, had become intensely more complicated and more competitive with management weighing in to a significant degree. The only fairly consistent source of income came from project science since for the most part a flying satellite had to be maintained.

As with all such organizational changes the name Transformation was just that – a name change. It had resulted in a new level of administration being imposed, names were changed and people moved around. Most of these changes had not exactly been issued through actual directives, but it made sense to try and meet funding requirements.

He mentioned One NASA which is a concept I had stumbled upon as the boundaries of this study had expanded. This represented an ongoing attempt to relegate much in the Agency to a ‘one size fits all’ policy. It rather obliquely attacked the diversity of NASA scientific laboratories by demanding uniformity in such matters as e-mail, computers, etc... It also introduced, the interviewee stated, the probability of single point failure. The Field Centers he felt had been set up as specialized laboratories with core units of science. It seemed they should be allowed some redundancy and that there should be respect for idiosyncratic tendencies. Many of the funds came from the outside but there had to be a delicate balance maintained between internal and external science and this was the balance that “made everything work”.

This scientist had elected to place his fortunes in Earth science and felt comfortable existing on the fringes, developing his own programs under cover of such things as ‘space weather’. He said that people still wrote papers and did not necessarily have to get them approved. Reorganization had not effected a change of methodologies because, as he had previously stated, science and research were creative processes. He had no management ambitions but could not help noting that many scientists were no longer left free to do science. He did not believe that writing proposals because of Full Cost Accounting was good for the country. Money was now the driver at NASA and he stated that he would retire if ever forced to give up science.

He seemed to indicate that there was some possible wiggle room in the face of Full Cost Accounting but that this Transformation had affected the scientific process to a much greater and more penetrating degree than previous organizational changes. These sentiments referred to research question Θ2 & Θ5 which asked respectively how the transformation differed from previous attempts at organizational change and how the 2005 process had affected scientists and their research.

For the NASA Field Centers, autonomy and diversity have been under continuous assault for many years – most recently under the banner of One NASA (One NASA 2003 Annual Report). This initiative is seen by some as a favorable one as far as focus and strategy are concerned. On the other hand, many at the bench level see Center independence preserving the pluralism and independence of scientific research. All power being bestowed upon a strong Headquarters renders the Agency's diverse science programs more vulnerable to political and ideological divisiveness.

Addressing the spectrum of organizational research questions, both in a general (i) and specific (Θ) context, this researcher seemed to indicate that reorganizations of government-owned and -operated laboratories rendered the operations of these laboratories most vulnerable during times of organizational change.

Publishing papers, giving invited talks, attending conferences and international meetings remained the indicators of success and work effectiveness. They could all be encompassed under the umbrella of doing science. Any other performance indicators, such as uniformity of computers and safety measure that did not apply to researchers, were irrelevant at the bench scientist level. On the plus side, organizational change had resulted in no internal changes regarding scientists and their work and there had been

increased collaboration. At Goddard, after the 2005 Transformation, research question Q5 which asked how researchers and their work had been affected, he answered by saying that for whatever reason “long-time civil servants might suddenly find themselves without a job”. While such civil servants couldn’t actually be fired they could be denied the money necessary to do their work – in such circumstances most would be expected to opt for retirement.

This interviewee went on to predict that eventually support for university partners would also dry up – at least those coming from inside the government because there would be no internal driver coming from internal civil servants.

This researcher had experienced a change in supervisor but otherwise no significant disruptions. He digressed while describing the Transformation, going on to provide a useful definition of the term ‘laboratory’. He defined this as a free-wheeling term occasionally describing an entire Field Center as well as a small individual work unit.

Interview GSFC-13 proved an interesting departure from most interviews with some similarity to GSFC – 11 in displaying a close affinity to and identity with NASA Headquarters. He dismissed many managers at GSFC as “would be academics” and resented being taxed for managers’ salary. He saw no connection between this complaint and the Transformation.

The interviewee did not feel that reorganizations of any sort did much to change any aspects of his job. Without actually stating the fact, he insinuated a lack of interest in how administrators attempted to manipulate organizational units. There’s “always a logic behind it but one logic is as good as another”. Fragmentation at the lower levels “where

all the work is done” did not seem to expedite communications nor add to synergistic possibilities.

He could see no connection between Full Cost Accounting and the Transformation and blamed all work disruptions on local Center management. Escalating layers of local bureaucracy resulted in additional taxes being imposed on his work. It was not only necessary to cover 100% of one’s salary but also to cover organizational taxes. At the same time, he seemed to have nothing but praise for NASA Headquarters.

This scientist’s opinion was that a succession of reorganizations had siphoned a tremendous amount of money from the working levels in order to pay taxes to the Center (research question Θ3). He criticized Goddard’s financial procedures in general, stating that the financial software utilized (SAP) was terrible. This, coupled with the pressure to bring in funds for salaries resulted in a tremendous amount of proposal writing. At the same time, the timeline for getting these proposals written, accepted and funded had shrunk. In effect, he saw himself working solely for NASA Headquarters doing calibration work for ocean-biology and biogeochemistry and having as little to do as possible with “GSFC’s silly management structure”. He claimed that what had happened in 2005 had little to do with organizational structure but was simply a matter of affixing different mail codes. This had been totally orchestrated by GSFC with the result that “more time was spent on unscientific decisions”. Headquarters was mission oriented while Goddard liked to envision itself as a university. He claimed that science itself as an entity still resisted being subsumed by management but that those who produced it had to spend a great deal of time going around bureaucracies. In his opinion, this resulted in “significantly less emphasis on science”.

He stated that “reorganizations try to reach down as far as possible and remove discretion”. Discretionary powers were moving farther away and his partial solution to this state of affairs was to bypass Goddard management entirely and deal with Headquarters.

In his view his discipline of oceanography was very much in the applied science category and this was being negatively impacted by GSFC management. He also felt that service and/or outreach should be done at the voluntary and personal rather than programmatic level since it could also prove to be a distraction from research. Paperwork was always increasing, more signatures were required and more assistants needed placating. Along with this went the fact that there was little or no support and scientists were forced to acquire expertise in non-scientific matters such as shipping. It had become policy to segregate managers by lumping them physically together – quite removed from people who actually did the work. In some cases supervisors were located in a different state (Wallops, Virginia). It was always difficult to discern the end result of any process. Performance plans meant little other than an attempt to hold everyone to an academic standard. He felt that the only assessments that truly mattered were found not in the organizational and bureaucratic structure but rather at Headquarters and in the national and international scientific communities. Professionalism and peer review remained the only true metrics (Romzek and Dubnick 1990).

While the 2005 Transformation did not seem to bear the brunt of this scientist’s wrath, he was adamant in his statements that morale was significantly worse and that collaboration had decreased. His was a siege mentality and he used the metaphor of a ‘foxhole’ to describe the workplace. “Don’t know what’s going on in the next

foxhole”— defend small part of fund and not invited to participate in the whole”.

Managers at the Center were remote and had, in fact, never visited the building he was in. What currently existed was a state of intense competition for funds rather than one of collaboration and this state of affairs could be laid solely at the feet of Goddard managers. Even the creation of the new division of Heliophysics had resulted in increased internal competition because of the amount of money ‘dumped’ into it. This government agency’s special mission had taken a back seat to the search for funds – on an individual basis and it was every ‘foxhole’ for itself, although the interviewee did admit to some value in obtaining university partners with strong academic backgrounds since they could, in some cases, provide a refuge from the incessant search for funds.

Although he said that his own particular work unit had experienced little turnover, he bemoaned the plight of contractors who tended to be treated much worse than civil servants – even to the extent of being forced to submit to onerous background checks which did little to enhance security.

Interview GSFC-14 was undergoing a transition to ‘team leader’ a seemingly euphemistic non-title that he described as conferring responsibility with a minimum of authority. Team leaders, he explained, might be demoted ‘section heads’ whose sections had ceased to exist or researchers who suddenly found themselves in charge of people engaged in unrelated work activities and lumped into artificial organizational groupings. The interviewee pointed out that the real point of stress in a tortured organizational change appeared when individuals were forced to reside in arbitrary organizational groupings.

He also added that newly purchased ‘off the shelf’ financial business software, SAP Americas, was totally unsuited to Goddard’s many and diverse activities. SAP might be better suited to more monolithic Field Centers but that at GSFC, along with Full Cost Accounting, it contributed to what interviewee GSFC-8 had called “a perfect storm”.

In a complete contradiction from GSFC-13 this researcher claimed that the 2005 Transformation was a reaction and adjustment to changes of direction at NASA Headquarters. He was a member of a group that switched *in toto* from one organization to another. The real problems had come about because of a combination of Full Cost Accounting and the new accounting system.

Basically he felt that the entire 2005 Transformation process reflected the President’s view of how science should be organized. It was not entirely obvious who would in time be termed winners or losers. He felt that Goddard had attempted to make this transition as transparent and easy as it could. Again this was a complete contradiction of Interview GSFC-13, who saw Goddard managers at the root of the problem while putting NASA HQ in the role of the bench level’s protector. Although a designated team leader, he was not involved in planning for any organizational changes but did think that some branches might have been involved in discussions as to where they might eventually end up. He observed that in 1990 when Earth and space science had been established in different directorates he had scarcely noticed the change. In the current situation, all decisions had been effected at a much higher level than where he resided and the results were noticeable. This answered the research question Q2 as to how the Transformation had differed from previous reorganizations. He mentioned that

his laboratory chief now appeared to be more active, although this was probably due to nothing more than his personality

Again, he felt that the main difference between 2005 and reorganizations of the past seemed to reside in the financial mélange that was Full Cost Accounting in tandem with the new accounting software purchases off-the-shelf from Systems Applications Products.

While it was true that monies coming directly from Headquarters might not be drastically affected, the tools in place to keep track of them simply did not work. Luckily for him, as part of a large and permanent group he was not as yet expected to write proposals to justify his existence. One HQ program manager handled virtually all of his funding and the interviewee seemed to have no trouble seeing him.

The interviewee stated that the current Transformation was entirely an attempt to respond to Headquarters. The major adjustments had been made at higher levels and much of the change had been ‘personality-driven’ – mostly from the top down. In attempting to adjust to a new and more intrusive organizational structure, former definitions had tended to slip. For example, divisions and particularly laboratories were distinct levels of a hierarchical structure and yet the terms were often used synonymously to indicate work groups. The whole process seemed to this researcher to be personality driven although he did feel the people in power to be generally sympathetic.

He personally admitted to feeling much less empowered. In the end, it all depended on whether or not one’s individual manager was more or less proactive – especially in resource management. Generally, however, a research oriented individual tended to let his people direct themselves.

As to the effect the 2005 Transformation had had on research in general (questions Q3 and Q5), he noted that many civil servants had inherited administrative duties resulting in less time for research. He emphasized this by the statement “more decisions – less time”. Although his original laboratory had been disestablished, his immediate workgroup had managed to stay together and focused through a series of self- and group-directed efforts. He held out the hope that ultimately the joining of Earth and space sciences might yet enable more research opportunities.

Addressing question Q3 as to the different impact on applied versus theoretical science, he said he felt no obvious bias in favor of applied science over any other kind of work although there was might be a stronger impetus to provide data to the scientific community at large. This ‘service’ component had always been seen as of great importance to the Agency since it contributed to a justification of its existence.

In his area most of the work was done by contractors and he did not feel as if they had been affected by the reorganization. This was in direct contrast to previous interviewees such as GSFC-13 who saw contractors as extremely vulnerable, particularly in the face of Full Cost Accounting. This researcher felt that Full Cost Accounting was basically at the root of all current problems. Civil service scientists now needed to find funding yet lacked adequate support and resources with which to accomplish this. Proposals might fail because of a lack of such support. He included in this support the area of Human Capital whose critical metrics now largely centered on procuring funding for salaries. This and the obligation of having to account for every hour of one’s time proved very discouraging to any collaborative effort.

While this scientist had been a member of the old Earth Sciences directorate, physically he had suffered very little displacement. Neither his office nor his immediate supervisor had changed. Like others he tended to use the word ‘laboratory’ in different organizational contexts and reiterated that in a certain sense all of Goddard Space Flight Center could be considered a single laboratory. He also seemed somewhat insulated from upper management and the bureaucracy.

Interview GSFC-15 seemed somewhat perplexed as to the thrust of the information I was seeking and also expressed some interest in how he had been selected. After a brief explanation of the selection methodology, he readily responded to questions. He stressed the fact that he was totally unconcerned with anything administrative or bureaucratic. For him, organizational change had resulted in an increasing number of inefficient processes exemplified by too many passwords. He stated that the increased need for proposals might be bearable were it not for the fact that researchers were weighed down with administrative duties. Peer reviewed publications, previously viewed as the true determinant of performance value, suffered because of administrative processes. He emphasized that the publication process should be accomplished with a minimum of red tape other than peer review. “When you mess about with how people choose to express their ideas, it’s not good”. Thus, in a general sense, the opportunity to do research had suffered from adverse effects as had the general morale of bench scientists, referring directly to question Q5 as to how Goddard scientists and their research were affected by reorganization. The current atmosphere contained less collaboration than might have been anticipated by a merging of disciplines. In addition, there was also a greater difficulty in attracting promising young people to Goddard.

The 2005 Transformation itself he dismissed as trivial. Full Cost Accounting was at the core of what was currently the problem with NASA – that and the attempt to implement an ossifying uniformity through the rhetoric of One NASA. He felt that the manned spaceflight or the exploration initiative might continue to “live off the drops from competition with the Chinese”. Other than that there was nothing positive resulting from any current endeavor. He complained that “they wanted to eliminate the civil service and have everything done by contractors”. This resulted in nothing being more efficient and everything taking longer to do.

Also mentioned was ‘the fat lady’, referring to Senator Barbara Mikulski of Maryland. Touted as a great defender of Goddard, he claimed that she was oblivious to any effect on scientific research as long as jobs stayed in Maryland. As far as applied work was concerned, not much was being built within the fence at Goddard itself but as long as things were contracted to and around Johns Hopkins that was perfectly okay with Senator Mikulski.

The interviewee suggested that a better model for doing what NASA used to do was the National Institute of Standards & Technology under the Department of Commerce. He judged NASA to be hopeless and perhaps not worthy of survival – an Agency that had aged and outlived its time.

The only role he would accept was in research; to everything else he adopted a totally passive posture. Changes occurred because Headquarters was given ‘marching orders’ from external forces and the results were a “great waste of time” that gobbled up resources (Pfeffer and Salancik, 2003). He also complained against stringent security

measures accompanied with a runaway escalation of passwords, but added that it looked like this was here to stay.

He actually did not deem Full Cost Accounting to be a bad idea on paper and added that in the best of all possible worlds it might even work as a measure of the efficiency of an operation. It had, however, been atrociously implemented resulting in total confusion – a train wreck. Coupled with Full Cost Accounting, ‘off the shelf’ accounting software had never worked. He cynically added that at least it “gave programmers something to do”. The previous interviewee (GSFC-14), originally from the old Earth science directorate, had voiced the same opinion as this interviewee, previously from space sciences. Also, he said the ever-growing flood of proposals flowing from Full Cost Accounting were a “huge waste of effort”.

Unlike GSFC-13, this researcher did not consider a closer alignment with NASA Headquarters a good thing. This sort of attempted rapprochement did not facilitate contact with funding sources but rather resulted in more pressure from above. He added that in the past, ideas had come from the working level and flowed upwards and that “now orders came from somewhere else and flowed downward”. It seemed that after this transformation, for whatever combination of reasons, a rigid hierarchical structure had been imposed on scientists and their research. Following the business model they were no longer looked upon as experts in the field. Rather than information flowing upward, “marching orders now came from above”. Researchers were moved around, less empowered in their research and merely doing what they were told. As an example of this ‘motion for motion’s sake’ he cited his own presence in the Heliophysics Division. He claimed to be “in it by mistake”. The name of the new entity (heliophysics) had been

picked because it was purposely vague. It was neither a logical work group nor a refinement of previous organizational changes.

The rhetoric of the day proclaimed that the ultimate goal was to travel to Mars but he asserted that there was simply not enough money to do that unilaterally – an opinion shared by Levine, (1975), among others. The interviewee also added that planned payloads for the Moon did not include science and that if the expression of ideas was repressed, researchers and research itself might prove less dependable. It “makes it difficult to find errors in research”.

Interview GSFC-16 disagreed with GSFC-13’s allegiance to Headquarters displaying a distinctly anti-headquarters bias. He also felt that relations with it had changed for the worse. His general sentiments about the 2005 Transformation were those of dislike and cynicism. He also felt that there might be some connection between Full Cost Accounting and the Transformation since it made it easier to enforce the Headquarters agenda. He also added the most or many scientists saw the 2005 organizational change and Full Cost Accounting as “parallel yet separate negative nuisances”.

He described himself as a planetary scientist/instrumentalist that “got kicked out of the Universe into the Solar System”. All in all, he felt research had escaped relatively unaffected but infrastructure and support services for sciences had become much weaker. He added that since Earth science had become politically unacceptable this had also constituted a major change.

Previous reorganizations in 1984 and 1990 had been seamless with little effect on day to day research and as far as the current organizational changes were concerned, he

viewed these as an attempt to fix a broken system without really knowing how to do it. In or around 2005, research had been impaired by inefficiency and the onerous necessity of having to account for 100% of work time as demanded by Full Cost Accounting.

The interviewee claimed that rather than an atmosphere that promoted freedom of inquiry, Goddard now had tiers of managers holding numerous meetings moving individuals around to “find out where they fit in the organization”. Since scientific laboratories at Goddard seemed to follow the model Perrow (1986), described as a loosely coupled organization, such attempts at bureaucratic control resulted in a great deal of time spent to little effect.

This researcher also said that he believed Full Cost Accounting made it easier for the architects of the Transformation to keep count of things, in a ‘bean counter’ sense. It facilitated the gathering of information without asking by people at Headquarters. In terms of actually keeping track of funds, however, everything was more obtuse. Researchers were on their own trying to find funding that was neither likely to be “consistent nor long lasting”. Aligning with Headquarters funding organs might help in this matter but did not lead to better or more creative ideas. Also, universities researchers were now reluctant to include civil servants on proposals because of funding uncertainties.

The resulting influx of proposals spawned an increase in tracking requirements and laborious on-line processes made such processes needlessly cumbersome. He summarized by saying that the most recent Transformation at GSFC was an attempt to follow Headquarters’ agenda or – “an attempt to follow the money”.

He answered question Q5 as to whether researchers and their work were affected in a definitive manner saying that currently both were adversely affected. Management did not seem to know what it was doing and scientists found themselves shunted from branches to laboratories and often traded to different divisions. Attempts at communications simply resulted in more e-mails and more committees where generally opinions from those who were affected were not sought. What was evolving was an organizational structure that was taller and narrower with flow directed arbitrarily from the top.

In an attempt to implement e-government, computers were being used by people who understood neither computers nor software. An example of this was a new e-mail system that sought to impose uniformly upon the entire agency. Among other problems it had a limited amount of memory and the possibility of a single point failure. Productivity, he felt, was down and decisions that formerly could be expedited now took a great deal of time.

The interviewee felt that it was not feasible for researchers to move in and out of disciplines. This demonstrated that individual research was generally not actively supported since scientists were cavalierly told to simply “find a project to work on” rather than concentrating on what needed to be done. Expressing similar sentiments as GSFC-13, he stated that upper management was physically distant from bench-level work groups. Researchers were, therefore, much less likely to get responses from line supervisors.

There was an ongoing attempt to pay lip service to proposed Lunar research but it was difficult to get support even for this. Meanwhile theoreticians were suffering from

a lack of interest because of such attempts. He stated that it demonstrated less respect for and emphasis on science when researchers were moved in and out of disciplines in search of a ‘good fit’. People were told to “find a “project to work on” as opposed to determining what *needed* to be done.

He explained that both enabling service for the general scientific community and outreach to nonscientists had experienced a decrease in support and funding. Science enabling or service generally consisted in the reduction and analysis of data available to the general scientific community. The influence of GSFC as a laboratory or collection of laboratories had been weakened with regards to Headquarters and he regarded Headquarters as generally “technically incompetent”, adding that they should stick to policy decisions.

He explained that there was an ongoing attempt to assess researchers’ performance generically, as a unit which the interviewee felt was simply not suited to diverse disciplines. For example, he stressed that it was useless to think that organizational structure could determine how and which scientists would work together – this he termed a clear waste of time. Scientists collaborated together because of their needs – and for no other reason. An influx of infrastructure people led to inflexibility and a general decrease in morale making Goddard generally less desirable to younger researchers.

This researcher described what had come out of the 2005 Transformation as a confused paradigm – one that had previously never been described on paper. There was still an interest in publications and scientific proposals and hopefully an amalgam of these might come to reflect some strategy. However, the metric of producing proposals

to pay for salaries resulted in the fact that those who were proposing were very uptight and operating in a very “unforgiving process”. Since promotions were also affected by funding (the bigger your salary, the more you had to bring in) the process could become highly skewed and unfair. Funding inconsistencies also put contractor partners at a distinct disadvantage. University researchers, on the other hand might tend to consider civil servants more expensive partners with which to submit proposals. Government scientists were seen as not only more expensive but less reliable partners. In answer to question Q5, both Goddard scientists and their research had not prospered since 2005. That said, he lauded the efforts of the Goddard’s proposal office in trying to assist researchers with the heavy demands of proposal writing.

This subject was a space scientist who had suffered relatively little displacement, his supervisor had changed but he claimed his new one to be more proactive and supportive of his research. He felt initiatives such as Full Cost Accounting, One NASA and NOMAD (the uniform e-mail system) simply made it easier for the hierarchy to get information and track and control things without involving the rank and file. These were devices of restraint and not conducive to a climate of free inquiry.

Interview GSFC-17 was not reluctant to state her political opinions both in internal and external matters. She claimed to have many avenues of funding available. Because of this she felt somewhat sheltered from the politics of reorganization.

According to her: “... a lot of what scientists do is think – staring off into space.” Although this might look like not doing anything, she claimed it was a vital part of their work. It was also something that was difficult to give a ‘charge number’ to or quantify in any sense.

A relatively new employee in space sciences, she had not been affected much by any logistical changes. She referred to the Transformation as “rotating org charts” and joined others in decrying the current lack of funding. She felt that it was impossible to separate the 2005 science transformation from other initiatives such as One NASA adding that such things were generally bad for Goddard. She also cautioned me to beware of many coincident happenings that might or might not be connected on various levels.

As a bench scientist, she voiced definite criticisms against Full Cost Accounting stating that it had been badly implemented in no small measure because of the generally vilified new accounting system. This organizational upset had in effect rendered the merging of Earth and space disciplines immaterial. As for the reasons for this merger, she felt that those were not clear and probably inconsequential although she felt that bringing scientific disciplines together might possibly be a good thing and possibly result in stronger and more unified groupings. Common seminars, for example, led to more integration and collaboration. However, because of the unfortunate manner in which Full Cost Accounting had been implemented people were attached to projects for survival and this often left theorists and generalists out in the cold. The transformation was definitely biased in favor of applied rather than theoretical research.

The rhetoric of exploration she called ‘junk’ since it was initially sucking science money in a very top down manner. She added that this was all happening in a time when everything seemed to be in a state of flux. Many changes she did not see as stemming from one separate cause but rather the result of many different connections at

all levels. She admitted to having simply observed all of this happen, not being directly involved.

She added that NASA Headquarters was seemingly in chaos and Goddard was only attempting to stay in step. The true reasons for many wasted resources were Full Cost Accounting, the SAP accounting system and the mantra of exploration. The new accounting system she judged was not worth learning. It was doubly frustrating because one could track where the money was going but couldn't stop anyone in the chain of command from taking it. Whether the sciences themselves were combined or separated really did not matter because research efforts were ultimately hindered in a frenzy of bookkeeping which hampered getting things off the ground and made the process of going from idea to instrument much longer and more difficult. Much of this state of affairs, she felt, may have been an attempt to redress what had been a perceived advantage to government scientists. It had had been imposed on NASA by the then current NASA Administrator and the Office of Management and Budget (OMB). She insisted that none of this had in the final result saved any money (Seidman, 1998). In fact, the proposal process was so complicated that it had necessitated a dedicated proposal office.

This researcher claimed to be somewhat sheltered because of her work on ongoing missions and projects but added that doing science while trying to seemingly acquiesce to the "exploration thing" was very difficult.

She described herself to be on the cusp of interfacing between engineering and science, although admitted to thinking more like a scientist meaning that she needed time to just think. As had been iterated in other interviews she agreed that it was laughable

trying to remember if one belonged to a laboratory, a directorate or a division. In the last analysis what really mattered was the personality and stature of who was running the entity.

She continued to stress the fact that an off-the-shelf – one-size-fits-all accounting system was not appropriate for the diversity of Goddard's grants. This homogeneous concept – also present – in computer purchases was detrimental to the freedom dictated by scientific research since scientists tended to create their own platforms. They could best determine what was needed to accomplish their tasks.

In a rather isolated moment she noted that politically scientists tended to be democrats and the Administration's touting of space exploration sans funds was not appreciated. This was also sucking money out of science despite the attempt of scientists to participate in the rhetoric. She indicated that Headquarters staff had improved although science was simply not seen as critical let alone important. Her opinion was that this was largely because of the Administration including the NASA Administrator. There were fewer dollars for both applied and theoretical science. Also, since NASA's enabling activities were not officially linked to missions they were similarly deprived of funding. This was disappointing since one of the major reasons for the existence of civil service scientists was to render this important service to the scientific community at large. Furthermore, information now tended to flow from the top down with occasional 'logjams' particularly in the space sciences.

The lack of funding was accompanied by a huge increase in paperwork and diminished administrative support dictating that researchers spend more time on non-scientific activities. She added that it was still possible for a researcher to plot her own

course and that she had personally made desirable changes by localizing her own experiences and seeking out opportunities and new ideas through mission assignments despite arbitrary performance plans and having to cover her salary. The interviewee indicated that after 2005, the undermining of science accompanied with an obvious waste of resources had been demoralizing. Plenty of people left and she missed “valuable colleagues who used to be nearby”. The most critical metric, for her, were still publications but that process was currently much more complicated than in the past.

Interview GSFC-18 judged the 2005 Transformation to be totally unimportant as far as any significant changes occurring at the Goddard Space Flight Center were concerned. He was totally grounded in the Agency categories of Programs and Projects as organizational concepts and seemed satisfied in doing “a little bit of service and a little bit of science”. He existed at the boundary of what had previously been considered informal grassroots, cross-disciplinary studies. Perhaps because of this, he viewed the new merging of scientific disciplines as promising. His insularity was demonstrated by the fact that he was not entirely sure if his supervisor had changed or not in 2005. Despite the fact that he dismissed the 2005 Transformation he thought that it had resulted in some positive effects. His lack of concern for planned organizational change might well have stemmed from the fact that he seemed to have been well-buffered from management logistics being largely imbedded in and occupied with project work. He had seen little change in values or goals since most programs and projects were stove-piped and resisted any move between divisions. The interviewee had begun his career at GSFC as a contractor and had always done the same research – everything surrounding him seemed completely transparent.

He judged that reorganizations “chewed a lot of managers’ time” but added that the resulting changes primarily had to do with such mundane matters as property and organizational code designations. He was also the first and only interviewee who eschewed civil service tenure, judging Full Cost Accounting as a positive thing despite the fact that everyone was now subservient to the process of writing proposals. Displaying a certain insouciance, he added that there would always be winners and losers in a time of constrained resources such as that during the Transformation. The 2005 change, he felt, had simply been put in motion to mirror what occurred at Headquarters. What had resulted was a strengthening of research linkages that had already existed informally. The only things that had really changed were names – no levels of bureaucracy or paperwork had been added. Information flows were the same. This was in contradiction of every other interview but need not have been an outlier of anything but my particular pool.

He admitted that organizational change and attempted innovations had stirred up turbulence that had been followed by rumors. While this might prove distracting he felt that Goddard was now entering a “steady-state” situation that would ultimately result in more collaboration.

The interviewee admitted that those researchers forced to bring in their own salaries might have opted for retirement and that this culture might also affect hires. He added that the current trend of offering emeritus status to retirement eligible researchers might help to facilitate new hires.

In terms of the new Heliophysics division, he stated that studying the Sun-Earth connection as a system was positive step in formalizing the important interdisciplinary work of how the Sun affected planets.

Interview GSFC-19's prestigious reputation preceded him. It had been suggested by at least one previous interviewee that he would supply valuable and candid information given that his stature was known and respected by both the national and international scientific community. He fit one of the categories I was looking for and I was pleasantly surprised when he immediately agreed to an interview.

This interviewee displayed a patent scorn for NASA's pandering to 'the Hill'. He gave as an example of this what scientists call the 'dog and pony shows' that are periodically given to certain members of Congress and staffers.

He said that he had removed himself from most of the recent organizational changes by having taken a detail with a Headquarters funded program called the Climate Change Science Program. He explained that he had done this to mitigate what would have been the burden of his salary being costed to the science programs he was leading adding that Full Cost Accounting was neither 'full-cost' nor 'accounting' but rather a sort of wrong-headed socialism for the poor and capitalism for the rich

He personally did not see much impact or use in moving people from one organizational hierarchy into another and in that sense the 2005 Transformation itself had not seemed to him a seminal event. Calling it a transformation rather than a reorganization to succumb to the rhetoric of a business model had made little difference in anything save rhetoric. He did allude to a hidden agenda in the fact that the Bush Administration clearly wanted Earth Science to go away because of the potential that

scientific findings would lead to government regulation, adding that there had been a concentrated effort to keep NASA scientists from speaking out about Earth science activities in Greenland and intense pressure to keep NASA scientists from talking to the Speaker of the House. Such ideological restrictions had not existed in earlier reorganizations. Reorganizations occurring in 1984 and 1990 had made very little difference at the bench scientist level. His opinions went directly to question Q2 as to how the 2005 Transformation differed from previous reorganizations.

As previously explained, he stressed that the reason he had taken a detail away from his research group, going to the Climate Change Science Program had been because he did not want his projects raided for his salary in the name of Full Cost Accounting. By making members of his team Principal Investigators on their own traditionally funded proposals, they could not be touched. He added that Full Cost Accounting was “a fraud and that the people responsible should be fired” – quite the opposite view from GSFC-18. Apart from civil service salary requirements two-thirds of his funding came from non-NASA sources.

The fact that proposal submissions were now done on-line did not actually hamper the process and directorate support was helpful and valuable. Also, according to the interviewee, the relationship with Headquarters remained relatively unchanged. Collaborations that had existed prior to the Transformation were still in place. He seemed cavalier of formal structural matters, clearly working directly with colleagues and peers (Romzek and Dubnick 1990).

He shared the common perception that there had been a substantial reduction in Earth science efforts because of the diversion of money to exploration. However, he

personally had never changed his immediate research agenda and if ordered to do it, he would refuse.

He stated that in addition to being less empowered, scientists had less time to commit to service to the community or outreach to the public. Whether or not these stumbling blocks could be casually connected to the Transformation or not, productivity had clearly been negatively affected. There was a decrease in the general ability to work on interesting climate questions, to reach conclusions and to publish, although he added that he tended to ignore onerous rules for publishing. The current restrictions had also negatively affected the general ability to work unfettered in groups, a condition that nourished the ‘leapfrogging’ capability of younger colleagues.

He summed up his negative assessment by saying that he hoped favorable times might bounce back along with an increase in publications, presentations, seminars and science citations. Presently the metric of how much money one could raise loomed over all others. As a result morale was persistently worse than before the organizational changes. There had been no extensive changes in scientific efforts, including those having to do with collaboration but there were problems hiring people at a time when the workforce was growing older. He however imagined (without elaboration) that in some cases retirements actually might improve productivity.

The scientist stressed the need to protect in-house contractor partners which he had done by making them principal investigators on their own proposals, applying the same strategy to university partners.

Interview-20 shared the by now almost customary complaints concerning hierarchy and bureaucracy but also added that he felt that these had little to do with

laboratory restructuring. In his opinion, things were "... going in a certain direction because that is the direction that is funded". He also added that because of the joining of space and Earth disciplines certain resources could now be tapped into that had been previously unavailable – so that seemed to be a good thing.

On the minus side, Full Cost Accounting precluded imaginative startups and he deemed this not to be good. He specified that all of the increased paperwork and bureaucracy could be interpreted as having utilized this transformation as an instrument of control. "It's done to put everything under some big umbrella contract so that it will be easier to follow the money and follow things". He added that this did not make it easier for the individual investigator.

To him there was a clear indication that the 2005 Transformation was an instrument designed for the control of research and researchers. The reason for this control was to prevent dissemination of information that was judged to be politically and ideologically sensitive.

He stated that the rhetoric of 'exploration, origins, and frontiers for America' were used as talking points to sell a state of mind – one perhaps actually done more effectively by various forms of science fiction.

As was the case with many other bench scientists, this subject had not been directly involved with actually planning for any changes in 2005. He surmised that it had been part of an attempt by NASA to partially sell itself to the public and possibly justify expenditures of space exploration.

He stated that since the Administration felt discomfort because of the increasingly irrefutable facts coming out of Earth sciences, NASA might find it profitable

to seemingly reduce its importance and visibility by putting it organizationally under a general exploration and sciences directorate. In the last analysis the Transformation had not resulted in an elimination of duplication of resources but rather a waste of time.

Full Cost Accounting, as the interviewee pointed out, had been discussed for years even though in an organization such as Goddard it was fiendishly difficult, perhaps impossible to implement because the Center was made up of many diverse and varying research laboratories. He added that in such a climate, redundancies in the form of duplications are not always necessarily bad.

In response to Θ2 addressing the singularity of the transformation as opposed to previous reorganizations, this scientist said that it had resulted in proposal writing becoming the major undertaking and that this undermined the actual time spent on science. “Everything is cost driven”. Since this researcher claimed he spent little time interacting with Headquarters personnel, he did not see how attempting to mirror its structure facilitated dialogue and added that actual funding was now much slower in coming.

One structural complaint about the 2005 process that this and other researchers decried was the removal of engineers from laboratories for the purpose of being put into a single organizational unit. This scientist emphatically believed that scientific interaction could not be directed by organizational machinations. What had been created under the rubric of slogans such as One NASA was a controlling top-down structure that sought to spread its tentacles into everything – even to the use individual computers.

When colleagues formerly within a common organizational branch were summarily separated, it was difficult to see how this facilitated collaboration.

Referring to my selection methodology, this scientist had not been a member of the Earth sciences branch, had experienced a supervisor change and had been moved from his original office.

He described himself as a theoretician in support of missions and as far as his work was concerned, he felt that the imposition of bureaucratic rules had little to do with actual restructuring and nothing to do with science. He reiterated that one was forced to go in the direction of funding while the truly essential goal and meaningful work remained peer recognition. In his opinion, freedom of inquiry was now determined by one's ability to fall between the cracks and the best research was not always determined or demonstrated by deadlines and official reports.

Question Q5 as to how research and researchers were affected by this reorganization was definitely answered in a negative vein. The process was simply making it harder to do science mainly because of the need for incessant proposal writing. Presenting an accurate representation of Price's bureaucratic pyramid, the interviewee stated that science was treated in a top-down pattern that attempted to render uniformity at the bottom layer. To his mind, this was simply not compatible with scientific research.

The interviewee stated that generally people engrossed in organizational structure did not care about science. At Goddard everything now came down to Projects and their support. This translated into work feeding into applied technology where, in the most extreme cases, the hardware could come to dominate what research is performed. Theoretical or what he would call 'pure' science was now generally frowned upon and recognition by the scientific community not stressed as it should be. He gave as evidence the fact that many impediments were placed in the research process such as those

regulating scientific presentations. With wry humor he described struggles for lab space, buildings, and offices in a rather detached manner. He also stressed a previously heard motif that individual personality determined power, including how one was perceived and treated. Nevertheless, he added that generally he “still does what he wants to do”.

Undeniably, Full Cost Accounting forced a certain amount of obligated work and this was generally a bother. It was accompanied with a proliferation of e-mails, publication constraints, required training and computer centralization. There was also an increased difficulty in dealing with and hiring foreign nationals. The sum of it was that scientists were now treated by and like bureaucrats and there existed a looming problem of privacy concerns because of increased security demands. Performance plans were generally subject to rating quotas as well as the usual publications, lectures, and invited talks. He considered it ironic since there was less and less time to meet desired metrics because of the overarching metric of written and/or funded proposals.

In general, all of the above situations resulted in low morale. He gave as an example that economy goals often filtered down to such bothersome trivialities as less trash pickup and needlessly complicated procurement regulations.

Full Cost Accounting had also negatively impacted collaboration with outside scientists since the GSFC civil servant now had to cost a large part of his or her salary on any collaborative proposal and because of this information was no longer as easily shared. The situation had resulted in increased retirements and turnover of support staff. Although this might be looked on as efficiency gains by some it resulted in loss of organizational memory that in turn translated into wasted effort. The researcher stressed that true change could only come directly from the scientists and their work – the rest was

simply salesmanship. There was now much less to sell, hence the need for more intense rhetoric.

He pointed out as others had done that the Directorate made sincere attempts to support researchers in their proposal writing, alerting them to deadlines and even providing them with financial help but basically compared the state of the bench scientist to that of the once prominent Goddard Library.

Interview GSFC-21 reiterated a theme found in the previous interview (GSFC-20) in pointing out that the power of the individual outweighed organizational machinations. He also introduced the concept of ‘work breakdown structures’ (WBS), including the idea that managers controlling these have become the real source of power because of funding and Full Cost Accounting. He implied that this setup, instead of being regarded as mere bookkeeping, had actually replaced the old hierarchical structure of UPN job order numbers for general costing.

This researcher stated that while functionality had previously resided at the laboratory level, it had now been pushed up the Directorate level. This again coincided with the Price models of hierarchical versus curriculum models. In a classical organizational sense such a shift of functionality to a higher level could mean a more efficient method of organizational direction and control. In a laboratory, it might rather translate into a rather meaningless activity if applied to science in a funded program or project. For others, not possessing nor protected by blanket funding, it translated into a heavy increase in and dependence on proposal writing. Furthermore, he felt that the electronic submission of proposals resulted in even more complicated processes and procedures, including a further increase in what he termed the incessant demands of

bureaucracy. It generated more reviews and he felt that it also discouraged alterations and spontaneity. He summed this up by pointing out that with more eyes watching it was doubtful if the success rate of proposals had increased. I pointed out that there were methodologies to assist in measuring such things as papers, funded proposals and citations Geisler (2000). If upper management attempted such studies or contracted them out, they were not widely disseminated.

As with most of the other scientists I interviewed, he had not directly participated in the 2005 change other than attending the occasional 'all-hands' meeting. Although present for the 1990 separation of Earth and space disciplines, he had been completely unaware of any repercussions.

We discussed the matters in research question in Q4 pertaining to the impact of Full Cost Accounting and he judged that the reasons for the Transformation could have been connected to Full Cost Accounting. He added that the end results were a more cumbersome way of doing business. He also expressed the hope that some sort of 'block grant' mechanism might provide relief from Full Cost Accounting and its demands to bring in money to cover salaries. Otherwise, he predicted a downsizing of civil service and contractor personnel. Empowerment went to anyone with connection to money and this was where the WBS managers might represent a real shift in power as opposed to the traditional line/staff hierarchy.

The interviewee pointed out that since people were not integrated at the lowest levels, proposals could not be written to cover everything and everyone. This explained why he felt that block grants were so desirable. He did not consider it a good thing that one could only study things if they brought in money. This provided a clear answer to

Θ2 as to how and why the 2005 transformation differed from previous reorganizations.

The transformation attempted a built in control, by means of funding, to what researchers could and could not investigate.

In terms of Headquarters control, this subject assumed there had been little in the way of actual alignment except for along purely structural lines. This transformation had been a zero sum change at the grassroots level. He added that it was an entirely different matter higher up the chain of command. Offices had been created and staff had been pushed up and increased at the Directorate level. There were claims of injected transparency in the new management structure but it had actually resulted in more managers and more overhead. If a scientist was unable to raise his or her salary they might, for example, be kicked upstairs into an office or staff position and forced to perform administrative tasks – and for this they would be supported. In addition, the subsequent extraction of engineers from research teams had made both research and its applications more difficult.

This scientist's informal work-unit had mainly survived despite a split in his former laboratory. On the other hand, as previously stated, Full Cost Accounting and its work breakdown structures had rendered in-line management almost irrelevant. The functional infrastructure was kept in place at a high cost of moving people into management and hiding the overhead.

The aspect of control could be seen in the attempt to categorize all work. This researcher referred to it as cubby holing. It resulted in a loss of flexibility as well as a lack of spontaneity. He claimed that research areas seemed to be devoid of special distinctiveness to Headquarters. Disciplines might be treated very loosely and rearranged

and traded almost at will. He pointed out that that this defied the fact that “research boundaries are and should be coarse”.

The time allotted for core science had been greatly reduced and people worked very hard simply reacting to orders. He emphasized the need for basic research and actually compared the new space exploration rhetoric as the new Nixon – “back and tan and ready to go”.

As far as general management was concerned, while local bosses were receptive and listened, power strongly depended on personality and the control of funds – even to the point of determining new hires. He referred to the often-repeated lament of the “management theory of the month”, adding that the constant search for justification and funding resulted in pressure to get ever more proposals out in attempts to cover costs, including salaries. As might be expected, such a flurry of proposal writing enhanced competition and lessened collaboration. It might even result in idea paranoia and infighting while there was simply less time to actually write papers. He said that in science, duplication is not necessarily a bad thing, however in the culture such as the one just described, duplication could easily lead to stress. Contractors understood that except in special cases, they were expendable.

Full Cost Accounting had hampered hiring young scientists since their salaries had to be covered and also made it extremely difficult for “incubating projects”.

The concepts described by the words disgruntled and downsizing and retirement were linked to a workforce now referred to as ‘human capital’. He, on the other hand, preferred to think of workgroups as ‘platoons’ to whom mission statements mattered very

little. Increasingly, all were beginning to realize that unless “it brings in dollars such posturing is useless”.

Finally he dismissed the refinement of the creation of a new division called Heliophysics. He joked about the notion of ‘space weather’ as an invention for many to feed off of, expressing the view that any effect of space weather on Earth was truly minimal. This scientist was a space scientist yet he clearly felt that Earth science should be funded more than space science. An example of this was space weather. He finished off by saying that “Katrina is more important than space weather”.

Interview GSFC-22 had been involved in the initial planning stages of the 2005 Transformation but had “walked away disillusioned because of isolation of management from staff.”

He had been present during both the 1984 and 1990 reorganizations and spoke fondly of 1984, when opportunities for exchanges between technology and science had opened up exhilarating possibilities. He was less favorably inclined toward the 1990 split between Earth and space science since it had decreased collaborative options.

As to question Q4 concerning Full Cost Accounting, he said that it had the aspects of a shell game directed by NASA Headquarters. Full Cost Accounting had resulted in taxes that swallowed up research resources, causing nothing but confusion. This particular researcher had previously headed initiatives to assist U.S. tribal colleges and such initiatives had been ruined by lack of funding. He stated that Full Cost Accounting had forced and driven the Transformation in order to re-align with Headquarters.

The first people to be hurt had been what are commonly called ‘soft money’ researchers such as postdoctoral researchers and contractors. Later repercussions had

spread to civil servants as funds for research became less important than scrambling in order to bring in enough for salaries. Working on proposals had become the overriding and incessant task. Naturally there were more proposals than money available and multistage electronic submissions made the process extremely complicated. He also felt that access to science managers at Headquarters had become more difficult. Contact with funding sources was almost non-existent. Here, I want to point out that this researcher's opinion was not shared by all interviewees, many of them felt that contact with Headquarters funding sources had remained virtually unchanged or in some cases, improved.

Whatever management structure existed was neither visible nor available to workers. As stated in other interviews, there was little if any communication up the chain of command. Attempting to mirror Headquarters resulted in shattering research components into many different and artificial parts for the purpose of supplying manpower to various projects. That being said, there was no interface between project and science teams. The subservience of science to projects often led to the selection of university personnel over civil servants. Scientists who had previously operated as providers or enablers in the NASA research process were now less empowered in every way. It was also increasingly difficult to have free and open exchanges with international colleagues. The organization as such, he judged to be falling apart. "Research [was] either atomized or project oriented". He also decried the de-emphasis of astrophysics in favor of such 'hot topics' as planet detection or manned-Mars exploration. The Mars initiative he judged to be impossible since the resources were simply not in place. Any

management originating through line channels was negligible and the better option was to simply concentrate on protecting people.

The true indicators of work-effectiveness, in his opinion, continued to be relevant papers and other research-related activities such as mentoring younger colleagues and supervising Ph.D. candidates. More and more this was now being done at universities and it was also the case that university/civil service partnerships were less tenable since the latter were judged in a competitive rather than supportive manner. Attempts at collaborative efforts experienced a greater degree of difficulty since researchers felt compelled to compete both internally and with the outside community in what was almost an atmosphere of panic. Morale was understandably low and people tended to disappear through retirement. Often they were not replaced. Increasingly managers or leaders were hired from the outside and the interviewee suggested that not knowing the culture made it that more difficult to adapt to changes. Under the radar, collaboration at the peer level continued and he expressed the hope that civil servants could afford to bide their time.

Relating to the research question Q5 as to how GSFC researchers and their research were affected by reorganizations, it seemed to this bench scientist that in the case of the 2005 Transformation, researchers were now spinning their wheels, spending most of their time writing proposals for decreasing and even disappearing resources. In addition, the scientist population was undeniably aging and although many still acted as if research was and should be at the basis of space exploration, funding losses resulted in a loss of continuity rather than continuous progress. As with next generation technology, much will have to be relearned.

Interview GSFC-23 reiterated the theme that in 2005, Goddard managers knee-jerked when dictated by NASA Headquarters. As a laboratory or compilation of laboratories, there was little independence. Labs separated or combined in search of a congruent fit with HQ. He felt that with stronger local management as well as a more directed sense of mission, this did not have to happen. The reason Goddard science laboratories had undergone cyclical reorganizations was because of Headquarters, (research question Θ1). The scientist added that such organizational changes cost a lot of money to very little effect since work units tended to be buffered and not interact with each other. Even in a state of transition they tended to remain discrete. Reorganizations could thus have minimal substantive effects, at least at Goddard. As an Earth scientist he firmly believed that the Transformation represented an attempt to de-emphasize Earth science disciplines. The effect of transformation itself, however, was negligible compared to that of Full Cost Accounting.

The interviewee had been involved in the 1984 change but not the one in 1990. I inquired about research question Θ2 contrasting the Transformation with previous reorganizations and he replied that the earlier ones had merely involved name changes and most people had not been rendered too unhappy except for the fact that they regarded the exercises as a waste of time resulting in both conversation and a sense of uncertainty. Whatever reasons given for them, reorganizations, he felt were basically disruptive. The 2005 Transformation supposedly harkening back to the exploration of the Moon and Mars, he ascribed to political mandates. What was particularly exasperating was that this was supposed to come out of existing funds. Not to mention the fact that constantly joining and separating laboratories cost a great deal of money. The 2005 Transformation

both added and subtracted the number of management units and manpower. The fact that it also encompassed structural changes made it cost a great deal more.

The impact of Full Cost Accounting caused more stress than any administrative change. It had resulted in many researchers having to bring in their own salaries during a paucity of missions and funding shortfalls. Since NASA had never been known to present Congress with realistic budgets the dire consequences of FCA revealed and exasperated long standing vulnerabilities.

As far as proposal writing was concerned, this scientist claimed that it was not exactly a level playing field but rather comprised a kind of club made up of people with proposal experience. Many had little or no experience in the process and to make matters worse these newcomers were often seen as a threat. A new office had been established to assist with proposal writing. He added that it was a tough game for those not used to the process since review panels could appear rather callow to the uninitiated.

Scientists and their respective research he saw as having been severely affected because of organizational flux. Hierarchical levels had become hopelessly compromised and confused. In a collegial attempt to mask the fact that Earth sciences had been effectively demoted from a directorate to a division, former divisions now became conveniently known as ‘laboratories’ rather than the more pedestrian branches or sections. There were now more layers at the top of the pyramid – all busily ‘interfacing’.

Despite this confusion many work units remained ‘sealed’ and survived. On the other hand, many individual researchers were set adrift “supposed to reinvent ... own careers by writing proposals in new areas”. This especially impacted those not working in the center of a particular research mass. While it was quite possible that new

boundaries reveal opportunities on the edge of a discipline, it was also true that when researchers were thrown into groups they were not used to working with, a certain amount of inefficiency was bound to occur. He added that in the case of previous reorganizations at least, there had been some gains as well as losses. Accompanying this Transformation was a sort of ‘one size fits all’ mentality, born out of the concept of One NASA. This was an attempt at uniformity that didn’t, or at least shouldn’t apply to working scientists.

He sensed that putting all of the sciences into one organization had probably decreased funding. He also pointed out that since NASA science had originally developed because of data from Lunar missions, it had remained rather financially isolated until the advent of Full Cost Accounting.

Work Breakdown Structure numbers, implying extra duties (first introduced by GSFC-21), could be found for people who could not otherwise acquire funding. If they were lucky they could perform these duties and still continue working on what interested them. This view suggested that it was still possible to achieve a certain amount of insulated and independent research despite Full Cost Accounting and WBS numbers.

The interviewee pointed out that the current hierarchical structure fostered competition rather than collaboration and this was reinforced by the fact that “branches, divisions, directorates hardly ever interacted with one another”. However, he saw as an ongoing situation that had predated the Transformation.

One incongruity resulting from transformational changes was that many established members of the Senior Executive Service (SES) no longer possessed the

hierarchical status that warranted the rank and yet remained within SES classification despite demoted positions.

As a former member of the Code 900 Earth Sciences Directorate, this researcher summed up the series of reorganizations by saying that in 1984 and 1990 Earth Sciences had been elevated and in 2005 they had been downgraded.

Interview GSFC-24 reiterated the opinion that the Goddard organization is more influenced by personalities than managerial structure.

Full Cost Accounting, he described as a “horrible idea”, adding that it pushed budgetary/management functions down to the lowest local level – that of the bench scientist.

Addressing questions Q1 and Q2, as the effects of a ‘transformation’ as opposed to regular reorganizations, he did not judge it to be more profound or intrusive than any other process. He had not been involved in any planning aspect in 2005 nor had he had any experience with previous reorganizations.

Touching on part of question Q1 concerning the reasons for cyclical reorganizations, he surmised that the 2005 Transformation had been an attempt to combine and consolidate within the Goddard science community. As an Earth scientist he admitted his former cadre had much to learn from the space people concerning getting proposals funded.

Regarding the impact of Full Cost Accounting, he saw this as an entirely separate construct that coincidentally overlapped with the 2005 transformation. Full Cost Accounting had been a horrible idea since it forced budgetary management to the level of the bench scientist, having no connection or coordination with what was happening at the

top of the management chain – it was not unusual for funding cycles to be six months out of sync. This made it difficult to support orderly increments of work and people. Added to this sporadic funding, the Center had committed to a ‘one size fits all’ One NASA paradigm which might work well with more static functions but was ill suited for the flux of research programs. This lack of alignment of funding with funding needs was often driven by what this subject called the ‘big pot’. There was no certainty that the funding would be there when it was needed. He explained this by stating “there was no feedback loop”. Previously peer-driven proposals had given way to a generic and electronic process. He went on to state that the manner of doing business with top-level Headquarters management had not really changed. Upper and middle management still existed within a well-predicted structure but life for the bench scientist was much harder and funding was extremely difficult to plan for or predict.

He distinguished between presidential directives that at the time were pushing the exploration idea and Agency habits that tended to present a united front by broadening the exploration concept to include ‘exploring our natural environment’.

Agreeing with previous interviewees, this scientist stressed that much at Goddard was driven by personality rather than managerial structure – the power of a program or project scientist was more important than formal titles.

Unfortunately, scientists and their research were now secondary to bringing in work and funding rather than satisfying peer review. Job satisfaction had previously thrived in the diversity of Perrow’s loosely coupled organization but funding and computing resources were now artificially distributed and managed without compensating for differing needs at the bench scientist level.

While performance metrics had not changed in name they were no longer assessed at the grass root level, he added, perhaps rather significantly, that lines of communication and collaboration were never truly driven by organizational change or Full Cost Accounting but rather as they has always been, through person to person contact: “all research is local and not through the chain of command”. Nevertheless, Full Cost Accounting did directly affect staffing since the new concept of term-contracts rather than permanent civil service hires tended to be largely resource-driven. Despite all real or attempted organizational changes, he stressed that climate change research remained the most important goal. That was a constant, even with contractors and the now more prominently placed university personnel. This interviewee was singular in expressing hope for future Earth/space collaboration after and perhaps because of the 2005 Transformation.

Interview GSFC-25 gave a good overview and succinct description of the workings within a scientific discipline when workers are beset with organizational logic. She was also part of the new Heliophysics Division that had been created when the original Sun-Earth Division had proven unwieldy and/or unstable. She said she found the term ‘transformation’ to be pretentious compared to the more familiar reorganization, As far as the supposed transformative process itself she confessed that it was hard to differentiate between conditions before and after the event, except that paperwork increased due to Full Cost Accounting.

She termed it “maddening” that they were trying to tailor research to organizational fiats. She went on to declare that while reorganizations were simply a waste of time, the transformation was even more annoying because of its supposed high

seriousness. The very word 'transformation' seemed to suggest a great and higher purpose.

However, she doggedly continued to do the science she had always done. Although she had been at Goddard for fifteen years she had little or no recollection of previous organizational changes. She assumed that all of them came out of some attempted synergy with NASA Headquarters.

She had had no role whatsoever in the process itself with the exception of going to an all-hands meeting during which her work group had made what she felt had been a modest request that had been summarily turned down with no explanation. There seemed to be a push to recruit researchers for committees only to have all of their suggestions rejected.

She stated that Full Cost Accounting was attempting to eliminate theoretical work unless it could be justified by being attached to a specifically directed project. The response connected to and addressed the fact that theoretical research was negatively affected while applied research was somewhat protected if it happened to be related to a project.

The powers that be had decided early on that civil servants would not be fired, but rather forced to do a lot more proposing. This produced a stressful environment in which scientists were assessed by means of attempted and/or funded proposals. It still remained unclear if this activity was bringing in more resources from Headquarters. Program scientists at HQ remained well known to bench-scientists at Goddard and although the latter were relatively low on the hierarchy they remained familiar and not unsympathetic to them.

As a solar physicist she hadn't wanted to be attached to Earth sciences and was grateful for a new division dedicated to heliophysics. She felt Earth sciences to be closely if not entirely related to modeling programs. She was therefore a great deal more comfortable not being part of a 'Sun-Earth' connection. She worked with projects because as a theoretician, this justified her existence. Research in the Sun in and of itself, should have been sufficient, but that was not the case after the Transformation. Interest in the Sun was rather prompted by the supposed intention of going to Mars. She also admitted to participating in outreach and service to the outside community but added that there was currently very little interest in education.

She was trying to stay away from organizational politics since it was clear to her that in that arena her research would be unimportant. It was difficult to decipher power relationships and she preferred to not become embroiled in the Earth science struggle. She kept her science career going by publishing papers and contributing to overall discussions in her field.

International Traffic in Arms (ITAR) regulations intruded in scientific speaking and writing, because of the supposed danger of exposing classified secrets. As far as facilitating or diminishing the opportunity for scientific research, current conditions leaned toward the latter. More people had to sign off on everything, including publishing papers. Since 2005 every second of one's time had to be accounted for and costed.

Since her original work group or laboratory didn't exist anymore she displayed fatalism about old and new colleagues. People tended to drift apart and proximity tended to be an important factor in collaboration.

As with almost every other interview she blamed Full Cost Accounting and not the Transformation for declining morale. Her immediate research, however, seemed to be thriving in that heliophysics had actually managed to hire a couple of people. She admitted to some confusion as to where the money for their salaries was coming from. Also, scientists don't turn over quickly and so far she seemed hopeful that they hadn't lost anyone. Her laboratory paid "lip service to Mars and sneaked in some straight science" never forgetting that the most important things were funded proposals. Certain offices established at the Directorate level, such as the proposal office, tried to be helpful but as far as information technology was concerned, there was a distinct lack of expertise.

Structurally the Sciences and Exploration Directorate was now divided into four divisions: Astrophysics and Solar System Exploration (both devoted to space science), Earth science, and the newest, Heliophysics which had a foot in both Earth and space. The phrase 'Living With A Star' was a big selling point. This was her division but she was more or less doing the same science she had always done.

GSFC-26 agreed to emphasize his role as a researcher but he was also the Head of the Proposal Office. In addition, he was known to me socially from his graduate school days. These facts alerted my skepticism and also (hopefully) a degree of critical thinking and self-analysis in dealing with preconceptions. Interestingly, he spoke of 'critical-mass' in respect to work-groups or laboratories. He also viewed the Transformation as a sort of lubricant that made other changes more facile – another intriguing metaphor.

The subject agreed with previous interviews that Full Cost Accounting translated into attempting to account for every bit of one's time, to be either charged to a project or

other form of approved research. This had gone a long way toward eliminating all *ad hoc* efforts and research innovations. Full Cost Accounting had strongly impacted not only the ability to do work in science but technology investments as well. He gave as an example of the latter, the disappearance of the Office of Aeronautics and Space Technology (Code R) from Headquarters. Full Cost Accounting, he felt, had a much greater impact on laboratory structure than the Transformation although the transformation itself may have assisted and fostered new hybrid fields such as astrobiology. In his opinion astrobiology was driven by the search to find life elsewhere in the universe other than Earth. This was also of great interest to both the internal and external scientific community – the general feeling being that it could result in great funding increases. All priorities seemed related to funding. While no one attempted to put a price tag on the changes occurring in and around 2005, he had heard talk of ‘long-run’ savings. He suspected they would never materialize. He also suspected that this was how organizational change was routinely justified.

As with so many others he had no active role in the 2005 changes except for a ‘here we go again’ feeling. He just went with the flow and his research remained relatively unaffected. He had not been a civil servant during the previous organizational changes and possessed little knowledge about what had happened in 1998 or 1990.

Asked about why Goddard science laboratories reorganized in a cyclical fashion, his opinion was that in 2005, at least, GSFC had desired to remain aligned with Headquarters and so had elected to integrate the Earth and space sciences. The greatest effect on organizational structure had been fairly far up the command line – things like Branch Heads becoming Laboratory Chiefs. On the other hand, entire branches were

dissolved if they were judged not to have ‘critical mass’. Such changes demanded open communication (that may or may not have been forthcoming) since they caused changes throughout the entire workforce.

When discussing Full Cost Accounting he stressed that it had imposed real pressure on hiring and attracting people. It had also induced personnel turnover. The rigidity introduced meant less time for outreach or science enabling since it tended to put people in direct competition with the very researchers they should be enabling. If there was a link between Full Cost Accounting and the Transformation, he judged it to be subtle. The Transformation had not really been necessary to implement Full Cost Accounting but its role as ‘lubricant’ had facilitated the process. The effect of Full Cost Accounting would have been just as severe under the old organizational structure.

The interviewee reasoned that in the world of Full Cost Accounting it probably facilitated funding for GSFC to have aligned as closely as possible with Headquarters. Such closeness, he felt, was facilitated through personal rather than structural reasons. There existed close cross-fertilization among Goddard and HQ personnel.

This was at least the third time that a scientist had tended to stress personal factors over structural arrangements. In this matter the Transformation had had little noticeable effect. Mature working-relationships developed and would always prove a greater influence than any organizational change, even a Transformation. The subject felt strongly that cultural changes at NASA had to do with leadership not structure. He argued that structurally the new arrangements after 2005 made sense but not more sense than the previous organizational charts.

Question about how different the transformation was from previous changes, he replied that the disabling of entire workgroups had resounded at the grassroots level. But again, he felt it was driven more by personalities than structure. Survival in the full cost world had more to do with the support or lack of support of different people in different positions as well as on external recognition factors.

The interviewee pointed out that Goddard was too highly diverse – containing many small research efforts – for a generic installment of Full Cost Accounting. This meant that there were simply not enough digits for Work Breakdown Structure numbers. In larger Centers that were less ‘loosely coupled’ possessing fewer projects, stringent accounting procedures might be easier to integrate. At Goddard, it had impacted the way science was conducted – perhaps even permanently. Paperwork was forever increasing and this included an increase in bureaucratic exigencies that in turn resulted in less time for scientific research. He referred to ‘administrivia’ and indicated that it served best when kept to a minimum.

This subject still considered himself a research scientist despite his managerial-duties. He judged science to be currently driven by Full Cost Accounting with a heavy emphasis on the goal of detecting and characterizing exo-planets. He also felt that devoting one third of NASA’s budget to science was both reasonable and respectable and that funding for scientific inquiry could not be expected to exponentially rise forever.

As a space scientist he felt that Earth science tended not to further new instrumentation, depending on less innovative technology, stating that space technology was more easily applied to specific missions and possessed clearer goals and funding was more easily derived from such specific goals.

The subject stated that NASA scientists and their research tended to be motivated by a desire to collaborate with and enable the overall scientific community and that rewards were mainly realized through peer-recognition in this same community rather than by means of monetary or formal awards (Romzek and Dubnick 1990). In such an environment, performance assessments matter little. The measurements are always changing and currently work-units are being assessed by the number of proposals put forth and funded. This has had a diminishing effect on job satisfaction and a proliferation of cynical 'hallway conversations'.

There tended to be fewer connections between researchers and their work. Old connections had been lost as ties were severed and while some new collaborations may have come into existence, older ones had been harder to maintain. All in all, the subject felt that the situation was probably a wash. While civil servants might still want to enable research for the outside community, they were often writing proposals to compete with those who in earlier times they would have been assisting. And while civil servants were not leaving in droves it was difficult to attract new people. The demographics in the science community at GSFC was skewed to people close to retirement. There was a critical gap in the ranks of researchers in their 'middle years'.

In the last analysis, this interviewee felt somewhat optimistic about the future of Goddard since he thought there were efforts being made to evolve a better handle on performance data such as the number of proposals and publications. Full Cost Accounting, however, had not been a positive element for many reasons, one being that it tended to squeeze out contractor-partners as civil servants scrambled to bring in their own

salaries. Nevertheless, NASA seemed to keep on advancing despite not because of organizational management.

Interview GSFC-27 was someone who had just converted to *emeritus* status. A highly regarded and celebrated senior scientist, he had always eschewed all things managerial and bureaucratic: “these reorganizations, at the working level have not much impact. Hopefully it stays like that. This is more or less a management-type thing and they entertain themselves with it.”

I felt this subject’s distinction between ‘working-level’ and ‘management type’ to be an important one. He was also the first person to refer directly to a sort of internecine rivalry within and among disciplines. Clearly he was not in any sense of the word a ‘nationalist’ and decried the difficulty in hiring foreign scientists for the civil service. He strongly felt that talent should not be limited to researchers from the United States since often the right person had to be sought internationally.

He stated that all reorganizations, including the 2005 Transformation were counterproductive by nature of the fact that they occurred. At the ‘working level’, they had little impact. He also added that if one stayed around long enough situations started to repeat themselves. He had experienced previous reorganizations and there was little difference among them – all they produced were “meetings and anxiety”.

He identified himself as a researcher doing basic work in atmospheric science including some experimental work. He had remained totally passive during the Transformation, noting that all those boxes looked good on paper but that this sort of thing “doesn’t work”.

As to the reasons GSFC labs underwent cyclical reorganizations, he assumed that new managers felt they had to change things and that the whole thing had little practical value. As with so many others, he was quite vehemently displeased over all of the engineers being summarily moved into out of workgroups and into one vast organizational unit.

When asked about Full Cost Accounting, the subject observed that it appeared to have come in gradually and had little to do with the Transformation. He assumed it to have been mandated by Congress. Because of One NASA, managers were inclined to think in terms of large inflexible aggregates (accounting, computers, etc.). All of that resulted in more overhead and research funding had not been affected

The increase in proposal writing was triggered by the outside world (Pfeffer & Salancik). He added that in fact many researchers were now doing nothing but writing proposals.

Reflecting on reorganizations in general (since the interviewee did not seem to discriminate between the Transformation and previous processes), he rather shattered the concept of any formal organizational structure. He said organizational affiliations existed in name only. He added that teams should not be periodically assigned and re-assigned as was now the case since expert teams were mostly small, with small projects on small budgets and above all established at the grassroots level. Having too much management in charge of large lugubrious and homogenized units meant that the research disciplines were by necessity heavily taxed to maintain them. At this point he reiterated the familiar sentiment that the identity of managers mattered a great deal more than the organizational structure in which they were embedded.

This scientist was a strong advocate for a diverse and open workplace stating that “segregation of disciplines stifles communications”. Of significance to the impact on applied versus theoretical researchers (question 13), he observed that experimental scientists and theoreticians were being filtered out of the Goddard system. He said he felt sorry for support scientists and theoreticians having to write so many proposals adding that theoreticians could not live without experiments. Earth science was particularly affected since it remained relatively poor in science experimentation.

He believed that although outreach and enabling the outside community had remained healthy it was not because of imperial management. He did use the word ‘control’, stating that in some cases talking to advocates and supporters at Headquarters was discouraged.

After having stated that the Transformation was not essentially different from other processes of organizational change, the interviewee somewhat contradicted himself stating that it was causing the disappearance of the ‘skunk works’ order of things⁴. To him ideal conditions meant seeing as few managers as possible and an open atmosphere that included unfettered collaboration with foreign talent. Good work tended to be done efficiently by means of effective relationships. Again, this led to the basic NASA concept of peer review. The subject had worked in both academia and the private sector and claimed that unlike these two Goddard (a government-owned and -operated operation) had a freer exchange of information at the working level.

Since the subject claimed never to have lost a proposal, processes such as performance plans meant little to him, although he supposed that for some falling into the

⁴ Skunk Works refers to a small, highly diverse and modestly funded work unit modeled after a Lockheed lab.

unfortunate category of ‘deadwood’ these could be quite intensive. At one point he suggested that publishing papers might have become easier but did not elaborate.

He said the quality of research at Goddard suffered because cross-correlation between Earth and space disciplines was not really encouraged. He determined that this was because such collaborations flew in the face of managerial control. He indicated that this was competition for the sake of empire building and had little to do with science.

Interview GSFC-28 was a dedicated and highly focused scientist who described herself as someone attempting to “navigate the shoals of needless bureaucratic change”. She also viewed relationships with NASA Headquarters as one of ongoing antagonism.

As a researcher, she indicated that all organizational changes seemed trivial when juxtaposed with Full Cost Accounting and related problems deriving from new accounting software procured from Systems Applications and Products (SAP). As far as she was concerned, research was segregated and most organizational changes were barely noticed. She marveled that “people feel the need to do these things”. Obviously, she had had no direct role in the 2005 Transformation and it was the only organizational change she had experienced at GSFC. She gave no thought whatsoever to what had caused the process.

She didn’t know whether there was any link between Full Cost Accounting and the Transformation but stated that it had caused some researcher attrition. As to the situation of increased proposal writing, she admitted that some, mainly space scientists, possessed a facility and confidence in the process and often helped those who were more intimidated. Therefore, for the purposes of expediting proposals, this Earth scientist felt it

a good thing for Earth and space disciplines to be joined, adding that the Proposal Office was very helpful. Also, she felt more at ease proposing electronically.

While other subjects (GSFC 6 and 8, among others) felt that GSFC science laboratories often reorganized to align more closely with HQ, she had no idea whether such exercises brought about the desired closeness. She was assigned to the same HQ Program Manager as before Transformation and, in any case, had always felt a more or less adversarial relationship with NASA Headquarters. The structure of her laboratory had remained constant. They had simply added another layer of management above it – Earth sciences had in the past been a directorate and now it was demoted to a division.

Regardless of formal structure she felt strongly that most decisions should be made locally and for this reason didn't like the concept of One NASA. As Perrow observed, a loosely coupled organization is not a good fit with bureaucratic control. A series of diverse laboratories comprised of even more diverse disciplines did not strictly agree with the classic concepts of government reorganization.

The subject stated that she continued to do research in atmospheric aerosols and was a Principal Investigator on several proposals. She had absolutely no connection to management although admitted to a certain alarm when a recent NASA Strategic Plan made no mention of Planet Earth. Also the NASA Administrator at the time had made what many considered patently anti-science statements. Nevertheless, she was still funded and her research had not been affected by any reorganization. She added that paperwork had gotten heavier and performance plans were constantly changing but not because of the Transformation. It had always been critical to write and publish papers and have successful proposals. It was now just more administratively difficult.

When the question was put to her about overall morale, she admitted to feeling less empowered in her research, but again not because of the Transformation. She mused that one would think that collaborations would have increased but they hadn't. It was things such as Full Cost Accounting and SAP that, in her opinion, occurring in tandem with the Transformation, had made a difference, rather than the Transformation itself.

Interview GSFC-29 had not experienced many physical disruptions, as designated in my selection methodology, however, he was perhaps the most negative and dissatisfied person in the entire series. He viewed the combination of Earth and space as a subjugation of Earth sciences by space sciences and addressing the status of research, he stated that the Transformation had effectively destroyed organizational order. He gave as an example of this view the fact that heliospheric sciences had originally been placed under Earth sciences and since it soon became obvious that this made little sense, the situation had then been changed by creating a heliophysics division. He went on to say that it was really just a matter of balancing bodies. Managers tended to judge size as the important determinant in organizational structure rather than type or compatibility of research areas. Some work groups had simply been deemed too big and were thus broken up.

As to how the 2005 Transformation differed from other change processes, the interviewee claimed that combined with budget cuts and other perturbations it had really hurt research unlike the previous changes. By making Earth science invisible it had also made it possible to remove from 30 to 40 percent of its funding. The fact that Earth sciences had been moved under space science had seemed at first to be a minor

organizational change, happening rather mysteriously. There had been no visible changes in either goals or values, perhaps due to the fact that such changes required real leaders.

The depletion of funds, he ascribed to those he called the ‘Mars guys’, the Bush Administration and the bean counters. The manned space program had never entirely ceased to exist, even after the end of the Cold War, and indeed this interviewee felt it would be impossible to cut. He was, however of the opinion that the space station should have been minimized.

This subject was not a theoretician and as a bench scientist he had not participated in any process of change nor could he remember any previous reorganization. To his mind they were all tended to be very much the same. He thought the exception with 2005 lay in the fact “Bush got word from space flight wonks about Mars”. Added to this, because of big budget cuts brought about by converting to Full Cost Accounting, funds for Earth science salaries had been transferred to the Mars program, the contractor research staff had been decimated and the results had been a morale buster for senior scientists. He added that budget cuts always led to uncertainty. A great many scientists with university grants felt the pinch as well and were forced to pay attention to the metrics that were utilized to justify their salaries. Such precarious conditions had led to a plethora of proposals as witnessed by the number of submissions to the Agency’s Research Opportunities in Space and Earth Sciences (ROSES). There were actually more proposals than money to fund them. In this matter, the interviewee was of a mind that Full Cost Accounting was not actually linked to the Transformation but had accidentally occurred at the same time.

As with other subjects interviewed, this researcher believed that NASA Centers changed their structure to match what was going on at Headquarters. Presumably that is why Goddard tended to cyclically reorganize. This merely resulted in name changes. His present Branch had been renamed ‘Mesoscale Atmospheric Processes’ and nobody really knew what that meant. Hierarchical changes, unlike budget uncertainties, were hardly worth noticing.

The recent 2005 transformation had resulted in disorganization at the local level without improving central management. Prior to the 2005, when the engineers had been moved into a separate organization, there had existed a valuable versatility to do small stuff. Now this was no longer the case. This tended to directly impact what Price would call the diversity at the top of the inverted pyramid idea as well as the ability to manage at the local level. It was accompanied by a decrease in general service to the scientific community as well as less non-technical outreach.

His overall complaints were mainly leveled at Earth sciences managers who, he claimed, demonstrated an inability to project budgets or control laboratory space. There was little ability to plan since fiscal year budgets remained unknown until the end of the fiscal year. He explained that space science management was more “instrument and project savvy” while Earth scientists were mostly made up of modelers. Poor management had led to a lack of fiscal discipline along with a decrease in morale and work effectiveness. While the Administration had attempted to draw monies away from the Earth sciences, the managers had assisted it by a lack of budget knowledge and an inability to manage programs. Research teams made up of diverse elements hardly existed anymore while no one was really paying attention to performance metrics.

Indeed most laboratory chiefs did not possess the competence to do so. He added that Earth scientists remained somewhat easier to retain because there were fewer places for them to go, unlike young engineers who tended to be able to find employment elsewhere.

He believed that it was as difficult to do applied work as theoretical work since the appropriate program managers at Headquarters tended to conceal themselves behind Announcements of Opportunity for proposals and since program managers did not seem to be running their programs, it had become difficult to figure out who actually had authority.

Since Full Cost Accounting demanded justification for salaries the cadre of contractors had been drastically cut. This had resulted in giving work to even more expensive contractors because of a lack of in-house support.

Finally, he stated that the new blanket university agreements such as those involving the Gamma-ray Large Area Space Telescope (GLAST) meant putting a lot more funds in academia while rendering the civil service increasingly hampered by security measures because of 9/11 and homeland security.

Interview GSFC-30 was given by a researcher who had succumbed to the forces of Full Cost Accounting and admitted to having ‘been kicked upstairs’ into a management position. He has since retired. He saw the present situation as one in which “people are fishing for something to do” amidst a great deal of meaningless activity including changes in the budget that he judged to be nonsense.

Along with many others, he viewed the major changes coming not from any organizational transformation but rather from Full Cost Accounting. This, he admitted, had terminated his research and put him in a management position. His inputs mostly

related to Full Cost Accounting and as a result of it the state of researchers and their research (question Q4).

He stated that he simply could not understand how anyone could consider the present conditions an improvement over anything. The line chain of command did not work very well because different managers seemed to indiscriminately pass things down; things such as needless security issues. The desire for rigid consolidation seen in One NASA had proven not to be more efficient and he added that it most probably cost more money. An example was having a lumbering one agency-wide e-mail system. While these things might appear to be cost effective economies of scale, in actuality they were impediments because of loss of diversity.

As with all previous interviewees, he had not directly participated in any of the change processes. He believed that the Transformation and all previous reorganizations consisted in merely putting different numbers on organizations while doing the same research.

The cause underlying the current situation was the external impetus put forth by the Administration pushing to highlight space exploration (Pfeffer and Salancik). As far as most working-scientists were concerned, it was a zero-sum gain and many had been pushed into the ranks of management. It was a fact that managers did not have to cover their salaries and relied on the taxes placed on scientific research. For them, organizational changes did matter and they were rather embroiled in a struggle that contained both winners and losers. He referred to one former NASA Administrator in passing as 'the accountant' and noted that he had pushed for both the Transformation and Full Cost Accounting.

Although he agreed with GSFC29 that the Earth sciences had come under siege, he noted that the money did keep coming. In this sense the Transformation may have caused closer alignment with Headquarters and this may have helped. Funding, he observed tended to have cycles of its own despite the desperation in obtaining general overhead funds because of Full Cost Accounting.

Of course, bench scientists now spent the majority of their time writing proposals in order to be allowed to conduct their science. He added: “I didn’t study physics for ten or more years to become an English major”. Apart from the basic tedium of proposal construction he observed that it was not easy to break into the ‘proposal network’. Others had commented that successful proposal writers seemed to belong to a club. It usually required several proposals to take care of full time salary equivalence. Initially, this had caused publications to decrease until people had found a way around required proposals. The implication was that there were possibilities for survival through adjustment. Templates had been devised but he warned that they could be tricky and one push of the wrong button could make the whole thing disappear.

All in all, he deemed structural changes to be of little consequence. What had happened in 2005 was the imposition of an additional layer of management. However he felt that information flowed vertically or horizontally depending on individuals.

Management at GSFC was ineffective, reduced to accounting and attempting to effect undefined changes – hence reorganizations. The major resource affected by this process was time. As someone investigating uncertainties in the modeling process, he had not needed much in the way of resources but managerial duties had been added until his research was effectively terminated. He added that he had at first enjoyed the

managerial vantage of seeing new and different research but that the duties had quickly gotten 'old'. He firmly believed that the only answer to the funding problem lay in institutional funding. Otherwise money for instruments and contractor salaries could soon become cut off and this would, of course, continue to impact science in a negative way.

Work effectiveness had formerly been judged through research and quality publications while at present there was an enormous amount of energy consumed in putting reports together. Monies were still found to reward valuable research but overall performance metrics were irrelevant since they tended to attempt to judge individuals rather than teams or laboratories.

Morale tended to suffer because civil servants, like himself, could be given uncomfortable jobs. The Transformation of 2005 was considered by many to have been distressing and there was an overall feeling that research was being shortchanged although he felt that competition for funding had not negatively impacted general collaborative efforts.

Training courses (in non-scientific matters) had mushroomed with little positive effect and in the face of such intrusions many were thinking of retirement.

The refocusing of NASA toward 'exploration' was something desired by the hierarchy and so scientific metrics adjusted accordingly. There was an endless go around on budget issues and how they should be operated. People were taken off research contracts and installed into university centers. This helped overhead in the short run but did little to stabilize or contribute to research efforts.

X. Widening Boundaries

Habermas suggests that there are action research elements in research interviews in which possibilities of change are generated (Habermas, 1971).

Boundaries were widened by nature of the ability to ‘sound off’ afforded and invited by the interview process. Throughout the interviews the subjects in this study opined on the desirability of different and less intrusive processes of change. It became apparent that there existed for many researchers an optimum paradigm in which change could be effected by being less intrusively managed. Few were prepared to lobby for a better situation yet the possibility for a more desirable world, once suggested, could be hoped for and elaborated on, especially because of the emergence of a new political climate. Below I list and briefly explain ideas that evolved out of the interviews, both about my subjects and me. Some of them may perhaps suggest ideas for further study.

A. Full Cost Accounting

Certain unexpected constructs and ideas presented themselves throughout the interviews. One of these was Full Cost Accounting that is reported as having been initiated by NASA in 1995 under the administration of Daniel Golden although no one seems really sure when and at what level this was finally implemented.. Certainly it seemed to come on the heels of the 2005 Transformation.

In 1997 at GSFC, the “Full Cost Management Plan”⁵ was intended to describe implementation “in the very near future” and to dispel misconceptions (apprehensions?) of the coming Full Cost Accounting. That was approximately some eight years before the transformation. Furthermore, it had been expected that a full transition to the plan would occur in 2000.

In 1997/1998 it was foreseen that there would be one single appropriation with a two-year funding availability. Four budget line items would be composed of:

- 1) Space Science Enterprise
- 2) Mission to Planet Earth Enterprise (Earth Science)
- 3) Aeronautics and Space Transportation Technology Enterprise and,
- 4) Human Exploration and Development of Space Enterprise.

During the 2005 Transformation these line items were struck although it was decided to put them in later. Many believe that the Mission to Planet Earth Enterprise was demoted from a prominent and highly touted endeavor to a greatly reduced status. In fact, with the resurgence of Exploration, all science was reduced. For whatever reason the Transformation, armed with Full Cost Account does not seem to have ever been intended to be neutral. The preponderance of bench scientists interviewed felt that in 2005, at the point of intersection between themselves and organizational change, they were not better off.

B. One NASA

One NASA was another concept that assumed unexpected prominence through the interview process. I had heard of One NASA for quite some time and remained uncertain as to what it implied so I was rather surprised that it was mentioned so often. I had not included it in my questionnaire but it generated a great deal of *ad hoc* contributions and so I realized that it was considered of great importance to most researchers. It is most easily noticed by the rigid standardization it has introduced: one computing system, one e-mail system and most of all, endless training sessions on just about every possible subject.

⁵ <http://cfo.gsfc.nasa.gov/cfo/fullcost/Fcmanage1.html> 9/21/98

C. Doing Research In Your Own Organization

Developments in organizational research methods have recently shed favorable light on doing research in one's own organization (Coghlan & Brannick, 2006; Brannick & Coghlan, 2007).

Following this encouragement I was encouraged in examining a process from within my own organization in order to learn from it and possibly establish signposts toward make the change process more amenable to bench scientists in the study. My position in the organization is that of an administration/professional, holding what is commonly known as a staff position. Particularly in dealing with bench scientists I accepted data that was broad and comprehensive. I hope that it can also be termed diagnostic in nature. Because I was wary of familiarity I followed a strictly defined Apollonian plan in order to enjoy the fruits of a Dionysian analysis. These strictures, I believe, assisted me as I sought to achieve the role of a temporary and objective researcher within my own organization.

D. Self-examination

Coghlan and Brannick (2006) describe and encourage a rigorous system of self examination for those attempting to conduct analysis within their own organization. A noticeable result of analyzing interview content from my own laboratory at the Goddard Institute for Space Studies (GISS) was contextual. My analyses at first seemed deeper, more insightful and intuitive. Halfway through examining the first GISS interview I realized that this aspect of familiarity had to be factored in since the end result was a double-edged sword. On the one hand, knowing the researchers and their particular predicaments gave me useful insight into those researchers at GSFC that I did not know

at all. On the other hand, I had to constantly guard against coming to conclusions that were not truly realistic or valid. My familiarity with my subjects had to be kept in mind in order to keep bias to a minimum.

I was not directly concerned with the reorganizations in question nor was I in anyway responsible for tracking their outcomes. My preconceived opinions and sympathies, such as they existed, I chose to strictly bind by means of a rigorous synthesis of methodologies. In the end, I hope that any biases were eradicated or at least held at bay.

E. Interviewing Elites

Because of their advanced degrees (all interviewees were PhD researchers), and excepted civil service status my subjects had to be approached as professional elites (Hertz, & Imber, 1995). I consequently approached them with deference and respect, being conscious of their time constraints.

The question of whether my views were compatible with the self-definition of the physical scientists almost never came up. Although Hertz and Imber state that it can be difficult to gain access to elites, in my case the difficulty was negligible. As I gained a certain proficiency in the interview process, I learned to nuance my posture with minute shifts from subordination to super-ordination. For many of my subjects it was the first time they were faced with the fact that public administration itself was a recognized field. (Even though so lofty a personage as James Webb practiced it). There always remained the fact that in a broad sense I work for these professional researchers and support them. However, they seemed to recognize the fact that I was conducting my own research in a parallel universe. It is interesting to note that all but three researchers approached

acceded to my interview requests, even when being informed that this would take close to one hour and would be recorded. Of the two refusals, two were for logistic reasons and only one remained unexplained.

Since the interviews were open ended many of my subjects became expansive, even those who had at first seemed reticent. The encounters began formally, even haltingly, moved on to a period of ease and in almost every case ended in a lively dialogue – what Kvale would have termed, I sincerely hope, an Interview (Kvale, 1996).

XI. Conclusions and Relevance

The overriding research questions asked were: why do the science laboratories at Goddard Space Flight Center undergo cyclical reorganizations at Goddard Space Flight Center and how resilient to these reorganizations are the researchers affected?

The general answers to those two questions can be answered simply by stating that Goddard Space Flight Center laboratories undergo cyclical reorganizations in an attempt to continuously consolidate the disparate components it inherited from its beginnings. This can be seen by through the developing organizational charts seen through the Functional/Structural lens. Laboratories in a Field Center such as Goddard also strive for alignment with NASA Headquarters as it adjusts to outside circumstances.

Researchers and their work, on the whole, can be disrupted by such processes depending to the extent to which they are dependent on upper management for resources – funding, manpower and overall support. If sheltered within the folds of an important program or project or protected as part of a workgroup headed by a prominent researcher they can remain secure – even faced with as frightening and misunderstood instrument as Full Cost Accounting.

Iota questions relating to the general research field were variously answered by all three lenses.

11. How does the 2005 Transformation agree with some classic concepts of reorganization?

Szanton judges the following three objectives for reorganizations to have some chance of success: to symbolize priorities, to improve program effectiveness and accomplish policy integration. In 2005, I would conclude that only the first, of symbolizing priorities, name a new impetus for manned space exploration was even attempted and that probably not successfully. Judged by the interviews, the last two were probably not achieved. Of the objectives he judged a waste of time, it could be argued that the Transformation did succeed in shaking things up – not necessarily resulting in better conditions. Operations seem to have become more complicated rather than simplified and expenses were most probably not reduced, although nobody really knows.

Light's reasons for reorganization do function when attempting to explain the science laboratory reorganizations at Goddard, but in a slightly unorthodox and unanticipated manner.

The goals of scientific management were clearly in evidence in all three reorganizations as can be seen by the evolving organizational charts. There were clearly attempts to delineate hierarchy, specialization and clear chains of command.

War on Waste may have been in vogue during the Reagan, Bush and Carter administrations but NASA hardware and overall missions always drew the greatest fire. Mr. Goldin's initiative of Faster Better Cheaper (McCurdy, 2001), was a valiant attempt that received mixed reviews and applied to exploration missions. The science laboratories

had never assumed the greatest share of NASA's budget. GSFC-26 stated that he felt that one-third of the Agency's funding was a fair allotment for the sciences and that their costs should not be expected to rise exponentially. All but one of the people I interviewed believed that Full Cost Accounting had not made things cheaper.

Since Goddard laboratories have always striven for openness to foreign colleagues, the general public and the university population, Light's Watchful Eye was always embraced by scientists, if not by management.

Finally, Light's liberation management, probably little understood by Headquarters, continues to exist fairly low down the chain of command but not officially. It exists only because of the built in diversity and complexity of scientific research, it exists even in the face of Full Cost Accounting.

i2. How does reorganization of a government-owned and –operated laboratory enhance or hamper the ability to do research?

The effects of most reorganizations are negligible because of the diversity and expertise of those at the lowest work level. Only when accompanied with funding constructs such as Full Cost Accounting, can organizational change cause an impact. Most of the interviewees felt that it was negative.

i3. What are the differences in how applied and theoretical research may have been affected by the 2005 Transformation?

A preponderance of interviews indicated that bench-researchers were most vulnerable if they were theoretical scientists and not protected by either a funded project or powerful scientist. Applied researchers tended to be much less at risk.

í4. What is the model for the concept of a transformation and how does it affect research at the bench scientist level?

The term Transformation is adapted from a business model. It is ideally a process of planned change stressing behavioral sciences theories. It, particularly focuses on individuals within the organization, particularly their existential state (Porras and Silvers, 2005). It includes a change in culture – hopefully effected from the bottom up, in order to react and adapt to external forces. A Transformation is usually introduced via a consulting firms such as ROBBINS GIOIA and it is the subject of their case studies dealing with such organizations as Verizon, GM, AT&T, General Motors, Merrill Lynch and the Defense Department (www.Robbinsgioai.com) .

At Goddard, according to many interviews the attempt to implement a Transformation seems to have been imposed top-down rather than bottom-out and without the accompaniment of Full Cost Accounting, could hardly have imposed a culture change or any other substantive change.

Theta questions relating specifically to Goddard laboratories are iterated below.

Θ1. Why have GSFC science laboratories undergone cyclical reorganizations in 1984, 1990 and 2005?

The answer to this is given in the overall research questions, namely that Goddard reorganized its science laboratories to align itself with NASA Headquarters following their reorganizations. It was expected that this would facilitate and hopefully expedite connections to funding. According to interviews, in 1984 Earth sciences was elevated out of satellite applications and joined to space sciences. In 1990, Earth sciences assumed even greater prominence as ecological concerns mounted. At NASA, studying

Earth and its systems from space became a prime enterprise. In 2005, both space and Earth sciences were somewhat obscured in the face of the new manned space exploration initiative.

Θ2. Why and how does the 2005 transformation differ from the previous changes in 1984 and 1990?

For all the rhetoric of Transformation, in 2005 there were concentrated assaults on research as it had been conducted in the past at Goddard. Full Cost Accounting and to a lesser extent, One NASA proved effective tools of the bureaucracy on the ways of bench scientists. For the most part, they all claimed the effects to be detrimental.

Θ3. How do a succession of reorganizations affect the quality of research of Goddard researchers?

If not done too often and kept to a minimum, negative effects could be minimized (GISS-9). Researchers questioned tended to refer to the 1984 and 1990 reorganizations as transparent, although there were some minor perturbations and some anxiety.

Θ4. What is the impact of Full Cost Accounting when factored into the 2005 Transformation?

Full Cost Accounting was referred to as a parallel process with little relation to the Transformation. It was also suspected to be the engine driving the Transformation. Some said that the Transformation was necessary in order to effectively implement Full Cost Accounting. GSFC-26 stated that if there were a link between Full Cost Accounting and the Transformation it was subtle. Whatever its connection to organizational change in 2005, Full Cost Accounting had proven to be an assault on theoretical work and a blow to the morale of many if not most bench-scientists.

Θ5. In a government-owned and –operated laboratory such as Goddard, how are scientists and their research affected by reorganization?

Reorganizations, however well intentioned, cause anxiety and also cause negative impacts on time as well as other resources. However, as GISS-5 had said “they could be blind”, which I interpreted to mean indiscriminate, rather like a blunt instrument. The Transformation of 2005, on the other hand, had been perceived by many as an attack on researchers and their science.

Iota Hypotheses

► Whether or not a government –owned and –operated laboratory might be more susceptible to bureaucratic organizational rule when researchers were vested by civil service protection could be more easily determined during earlier and more orthodox reorganizations. In those cases, the changes seem to have been transparent and fairly minimal.

It is difficult to penetrate workgroups dealing with problematical and miscellaneous matters that operate within a sphere of expertise, often confounding the understanding of those not similarly educated. In other words, it is daunting to try to control that which you do not understand. This in and of itself make variegated research work difficult to control.

► Organizational change is a reaction to external circumstances of the day – political or other wise.

This can be partly determined by looking at a series of organizational charts and in order to determine how they possibly reacted to external situations, politics and ideology of the day. James Webb, had two key associates, one he called Mr. Inside and

the other Mr. Outside. Both were critical to his immense success in shaping NASA (Lambright, 1995; Webb, 1969). Certainly, Launius and McCurdy (1997) have suggested that various Administrations had limited influence on overall NASA policies.

Funding is always of paramount importance since appropriations, depending on how enacted by upper management, can filter down pretty quickly through all levels of the Agency, including the smallest research workgroup.

To government scientists, the strongest external influence remains that of peer review and the accolades or dismissal of colleagues both within and without the organization. As Pfeffer & Salancik (2003) pointed out the social context within members of an organization, in this case the bench-scientist, is more likely to encompass that of colleagues, whether from their own laboratory or other scientific organizations. Because of this the external circumstances that the individuals in the laboratory are sensitive to might not be the same as those of the bureaucratic organization.

► A Transformation is more penetrating than a mere shuffling of organizational boxes.

From the definition of the term Transformation, it would seem that it might constitute a serious attempt to penetrate all facets of an organization, including individual paradigm adjustments. As suggested from the basic nature of the process, such an attempt would not be successful unless the majority of workers signed on and unless the change were driven from the bottom up (Porras & Silvers 2005). Should those conditions not be met any attempt to penetrate the core processes and effect a real transformation within an organization would be likely to fail.

In the last analysis a Transformation might try to retain some semblance to former organizational charts, however, it basically seeks to undergo radical changes that result in such charts making little sense. At Goddard, supervisors found themselves located in different locations from supervisees, adding to the needless disruptions of work, in turn leading to less productivity and a great deal more anxiety.

► The effect of Full Cost Accounting, whether intended or not, has served as a major tool of control by the bureaucracy on the work of bench-scientists. It has forced theoreticians as well as others to labor to bring in their own salaries by writing proposals – often directing their efforts away from what they were previously working on and often serving little benefit to either scientist or the laboratory.

If it were not for Full Cost Accounting, the entire attempt at Transformation might have been rendered laughable to those who were forced to endure it – largely because of its inflated rhetoric. However the Transformation may have been the means by which to enact Full Cost Accounting. The opinions of interviewees were divided about a connection between the two.

► There is built-in resilience in scientific laboratories because of the nature of research. Disciplines tend to split of into smaller and smaller units of study (Price, 1962) and if resource demands are modest or if protected by a project or celebrated scientific patron, such workgroups can easily slip through under the radar of organizational change.

Also, as pointed out by Pfeffer & Salancik, (2003) and Mark and Levine 1984), it is difficult to control what you don't understand. Depending on the need for organizational resources and their availability there is a built in insulation and therefore independence in a free-wheeling, loosely couple research climate.

► Reorganizations do not affect the morale, work-satisfaction or quality of work life.

From the words of the Center Director in 1985, it seems clear that even in the case of even more modest reorganizations (in this case when Earth sciences left application and joined with space sciences in 1984), did cause anxiety and that people were often not given needed resources to effect the change (Hinnens, 1985). This 'New Year's' message could also imply that the morale, and satisfaction attached to researchers' work as well as their quality of life were negatively affected, at least in the case of some people.

Reorganizations do affect the ability, morale or job satisfaction of bench-scientists to the extent that these changes are able to penetrate the analytical model of research diversity.

► Theoretical research is more difficult to fund than applied or project research.

This was confirmed by several interviewees who said that if a theoretician had neither project nor prestigious scientist protection, he or she could either bring in successful proposals or be declared 'available for work'.

► A business model does not lend itself to scientific creativity.

This fact was upheld by several interview subjects who emphatically stated that research was more akin to art than bean-counting. In the sense that the business model emphasizes efficiency over creativity and freedom it is probably somewhat incompatible with scientific research.

⊖ Hypotheses

► The Transformation did not basically enhance the spirit of inquiry, morale or well-being of the researchers interviewed at Greenbelt and GISS.

It could be said with some certainty that varying and fragmented disciplines are quite difficult to control and sweep into uniform organizational charts. Despite the most serious attempts at uniformity, little crops of ‘science’ keep popping up all over organizational charts at Goddard and other Field Centers. Scientific research is more easily seen as a continuum rather than discrete and separate entities.

Because of the vested circumstances of civil servants, and the elite status of research scientists and especially because of the diverse nature of scientific disciplines, it would not be more susceptible to organizational rule unless individual funding could be affected.

► Full Cost Accounting was not a positive influence at Goddard in 2005.

Only one researcher declared that it was useful to know what things cost and he was a highly involved project scientist who appeared to deal directly with Headquarters and seemed totally immune to what was happening at Goddard. Almost everyone else indicted Full Cost Accounting as a harmful idea that was badly implemented.

► One NASA is negatively intrusive and detrimental to research because a loosely-coupled organization does not lend itself to ‘one-size-fits-all’ be it computers, e-mail, badging, training needs, or travel regulations. Often these functions are contracted out to entities who have little feeling for the diversity of the culture they are dealing with. Applied or Project Research is easier to mainstream and thus direct than theoretical research.

This hypothesis was definitely acquiesced to by all interviewees. People involved in large funded projects seemed, for the most part, much less concerned with Full Cost Accounting.

► Research scientists can exhibit imperviousness and entrenchment in the face of bureaucratic penetration.

They can, as indicated by various statements iterated above. This has always been the case. Full Cost Accounting has, however, made this imperviousness and entrenchment much less secure.

► Varying and fragmented disciplines are difficult to control.

Again, this is the case since such disciplines can easily exist ‘below the radar’.

Human Agency Model and Interviews

While the 1984 and 1990 reorganizations for the most part can easily be viewed with either a structural or theoretical paradigm. The 2005 Transformation sought to effect a profound change from within. It was not exactly clear which external causes the Agency was adjusting to in this case but some of the people interviewed were of the opinion that the principle external agent was a resurgence of the rhetoric of humans traveling to the Moon or Mars. Many were not quite sure whether Headquarters itself induced these changes or whether they were more reflecting of the ideology of those in political power.

Whatever the causes, this organizational change was not transparent as previous processes had been. It sought to deeply penetrate what was viewed as normal research inquiry. In some cases basic work groups and even individual research programs had been either broken up or morphed into other organizations. In such situations the classic concepts of organizational consistency and civil service protection were largely undermined.

Whether or not the interviewees could identify a direct and focal cause, they mostly agreed that there had been a profound change within the organization. They all tended to want to dismiss the Transformation since they were somewhat conditioned to dismiss all organizational changes but found that this time it was not so easily done. Most agreed that the overall timbre of the times surrounding the Transformation was not positive. What had happened in and around 2005 could not easily be ignored

Again, the external circumstances remained rather vague but it was felt by some that the Center was attempting to maximize gains and minimize losses for whatever was going on. At least one researcher, however, disdained the fact that such a bureaucratic process could truly affect morale or creativity since such a process was itself a triviality.

Perhaps because of the use of the word 'Transformation' there was a wide consensus among interviewees that what happened in 2005 differed from other attempts at organizational adjustment. The reason this was not considered a regular attempt at cyclical reorganizational alignment was most probably because it happened in tandem with Full Cost Accounting. I had a question relating to Full Cost Accounting in my interview instrument. I had anticipated that the reactions to it would be largely negative however what I really wanted to know was whether or not interview subjects perceived a connection between it and the Transformation. With few exceptions most researchers did see such a connection however an overwhelming majority had already mentioned Full Cost Accounting early in the interview process before the question came up. All but one person regarded it as a detriment to research in general. On the other hand, those who had experienced the cyclical alignment with Headquarters in 1984 and 1990 felt that

those changes had been at most minor perturbations. The word ‘transparent’ was utilized by at least two scientists.

The elevation and prominence of Earth science was not viewed in a competitive sense by space scientists and the organizational combining of these disciplines was viewed by many as a positive and collaborative move. Similarly, most researchers had at first not objected to being organizationally included within a Directorate that included the word exploration. Space scientists in particular believed that new missions to the Moon and Mars would exponentially expand their research horizons and began to conceptualize daring new experiments. This made their disappointment that much more severe when they were informed by the then Administrator that exploration projects would have no room for science payloads.

Organizational rule during the 2005 period was imposed strictly in a top-down manner and accompanied with increased bureaucratic control. A departure point for my study had been the Rainey/Bozeman studies dealing with the government-owned, contractor-operated laboratories of the Department of Energy (DOE). In those cases it seemed that contractor change could be said to be an engine of control – significantly affecting and directing both scientists and their research. I had surmised that perhaps in government-owned and –operated laboratories, reorganizations might serve the same function. I decided that in the end there were many ways to insulate research in government laboratories and that reorganizations could only affect research in an insignificant manner since laboratories such as those at Goddard periodically aligned themselves with changes at Headquarters to facilitate funding. For the most part these operations were to be of negligible interest to bench scientists.

The real agent of change proved to be Full Cost Accounting and, here, the effect on scientists was deeply penetrating. This was more than a reshuffling of boxes and offices. It penetrated the diversity of scientific disciplines – reorganizing them in a seemingly random fashion. One singular result of the new state of affairs was that civil service scientists were now required to write proposals in order to ‘cover’ their own salaries in addition to bringing in funds for other necessities of research. As already mentioned, this was particularly arduous for theoreticians who happened not to be attached to specific projects.

It should perhaps be explained that at NASA, projects usually indicate work attached to particular missions. Programs indicate general areas of study, such as numerical modeling. Provided that a project or program has overall funding, researchers even theoreticians working under that specific umbrella can be more or less insulated. Other researchers, not so lucky, can be quickly transformed into soft money scientists – forced to write proposals to justify their existence. The protection and excepted privileges granted by early aero-space technology (AST) classification are effectively swept away. Of course the position of ‘being a civil servant still precludes termination. It was stated early on during the Transformation that Full Costs Accounting would result in no civil service ‘reductions in force’ (RIFS). The threat that remained was that if it weres not possible for a researcher to bring in enough money to pay for his or her keep they would be termed ‘available for work’ and possibly saddled with administrative duties. There is a stigma attached to this status that is certainly at odds with the earlier concept of researchers being in an elite situation. It also brought out a ‘divide and conquer mentality’ since some scientists found themselves with little to worry about and

others felt extremely vulnerable. At least one researcher already mentioned who was heavily involved in projects stated that it was good to know what things really cost. Others saw the merging of the sciences into one directorate as very negative since it was accompanied with severe funding cuts and this resulted in the fact of more disciplines with fewer resources.

In the theory chapter I pointed out that both Szanton and Light had given fiscal economies as reasons for government reorganizations. Szanton had gone on to state that such goals were never realized. At the end of my study it remained unclear to me what Full Cost Accounting really was, especially as exercised by a government agency. But the term itself was certainly used to attempt to shake things up in Goddard laboratories. Incidentally this is another goal of reorganization that Szanton claims will not work.

What did result after 2005 in Goddard laboratories was a feverish activity of proposal writing. A special office was established to assist those who were inexperienced with this process and many new announcements were introduced. Older researchers may have been put at more of disadvantage by the fact that while templates were devised for this activity the system utilized was under development and, as was pointed out to me by one interviewee, the entire proposal could be irrevocably lost by merely punching in the wrong set of keystrokes. Writing proposals can be seen as an integral part of the scientific process since the activity is part of a general accountability and may even focus the resulting research. However it soon became apparent, according to many interviewed, that there was not nearly enough funding available to accommodate all individual needs. Furthermore, even when funds were allocated they were extremely slow in coming. What seemed to be evolving was a system of protection whereby

prestigious researchers, who were traditionally and easily funded, were able to protect subordinates by ‘covering’ their salaries and other research needs. One such world-class scientist expressed the view that being asked to produce a percentage of funded proposals for his laboratory seemed to suggest that the more proposals that were attempted the lower would be the acceptance percentage and this confronted the fact that every researcher should be encouraged to write proposals. In communicating with his superiors he pointed out “I attach a draft of my SES paperwork. However, there is one data point that has to be checked. Last year we had to make a statement that our percentage win rate on proposals was less than 25%. It is a strange criterion, because if one insists on a high percentage it means that we should discourage proposals from those very people who have trouble getting funding including those who submit proposals for new ideas rather than tried-and-true-old-stuff” (anonymous e-mail dated 09-05-07).

Of course, researchers can also be protected through their work on funded projects and if their work is considered to be valuable it often happens that no one looks too closely at how the research is integral to the project in question.

Previously many Goddard researchers had bonded with Headquarters program managers. In some cases these researchers, who might possess the expertise that Headquarters managers did not – especially if such managers had just been assigned to a new discipline – took the opportunity to assist in proposal evaluations. Now because Program Managers were more organizationally removed from what went on in laboratories, such organizational synergy was not easy to accomplish.

Like Full Cost Accounting many interviewees mentioned the subject of One NASA. One NASA had been around since before the turn of the century. There were

ubiquitous One NASA teams that were attempting to standardize all support services and computing resources. Standardization can probably translate into some sort of efficiency in some organizations, but in a loosely coupled and diverse organization such as that comprising the Goddard laboratories it cannot be constantly adjusting to varying conditions. Similarly, off-the-shelf software is difficult to reconcile with researchers who build their own computer platforms. E-mail systems require more memory than provided in order to accommodate huge data sets, often for considerable amounts of time. One such off-the-shelf-product was the familiar SAP accounting package. At Goddard it had to be continuously ‘tweaked’ in order to adapt to Goddard programs and projects. Their number and variety simply required more digits than the system could supply. All the researchers I spoke to were not fond of the One NASA implementation. It wasn’t that they rejected the idea of unified goals; they simply thought it a waste of time for non-research oriented managers to attempt to introduce concepts better suited to industry than research.

Science and its practice can be easily seen as a basically creative process and as such it doesn’t respond comfortably to fiats. Researchers have always had a tendency to merely tolerate and even occasionally overlook the bureaucracy that manages them. This is not to imply that science cannot be managed but that like art it requires an understanding and a soft touch. Such terms as ‘feet on the desk’ or ‘blue sky’ have real meaning for researchers. Furthermore many supervisors, having scientific backgrounds respect these concepts. This insulation or buffering formula was well understood by James Webb (1969) and continues to exist today. Price’s inverted pyramid of the curriculum model is difficult to control even with Full Cost Accounting. One researcher

expressed his safety from the current state of affairs by referring to himself as a ‘bottom feeder’. At least two others stated that they were able to hide ‘below the radar’.

I gave mention in my introduction to the historical union of science and power and certainly during the Cold War NASA had its link with the geopolitics of national prestige and power. The stated goal was to reach the Moon and return. However, a large organization was amassed and this organization then assumed a life of its own. It is to the credit of NASA’s James Webb, that he saw the organization as one of the future as well as the present. Although Webb never lived to see it, NASA’s increasingly diverse science and the links of its scientific staff with colleagues outside the Agency reached several inflection points (Grove, 1999) that may have provided immunity from the normal aging of bureaucracies (Downs, 1994).

I reached the conclusion that because of the nature of research, it was extremely difficult to control in a government operated laboratory – even with funding tools such as Full Cost Accounting. There is a facility for people conducting advanced work that is, in some cases, little understood by others to disguise and camouflage where the research is leading them. In the same way satellite applications easily developed into scientific research that is now difficult to pin down.

There is no doubt that the Transformation, armed with Full Cost Accounting was able to penetrate Goddard laboratories as never before. It would also be erroneous to describe the process as a change from within. Certainly there were some winners and some losers but most researchers seem to have survived to be challenged another day. There may have been a positive culling of those unwilling or unable to adapt but on whole the government system remained sound and research was not truncated to an

irrevocable extent. Goddard managers, being scientists themselves for the most part, may have handled the process as they had to but with room for generosity.

One interviewee stated that science itself had come under attack through the ideological and political climate of the day and at Goddard, it seems to have survived although some research suffered a severe set back. Researchers were and are still distracted by the fact that a dominant percentage of funded proposals must be set aside to cover their salaries and in many cases the salaries of subordinates. In this scenario there remains less time and money for scientific inquiry, especially those relating to new and innovative work. It is difficult to maintain a feeling of belong to a camaraderie of elites if one can be branded as 'available for work'. This bears a similarity of researchers in the Rainey/Bozeman study (Bozeman, *et al.*, 2001) bemoaning the fact that they were now 'just another contractor'.

I reached the conclusion that the Transformation business model did not lend itself to the spirit of inquiry. It also seemed apparent to me that its influence might have been as negligible as past reorganizations had it not been for Full Cost Accounting. The Transformation might in some sense be regarded as a Trojan horse that caused enough activity to both carry in and set in place a controlling version of Full Cost Accounting, that was extremely deleterious to scientific research, although most scientists I spoke to did not connect the two and suggested that they were merely parallel occurrences.

It is well to remember the 'points of inflection' discussed by Grove (1999). NASA and its research continue to have relevance by launching off of such new points of departure. An excellent example is global climate studies. It was pointed out to me by one interviewee that Goddard research produces research results that are for several

reasons not possible anywhere else. That being the case, normal organizational changes should be accepted but handled carefully and in accordance with scientific disciplines. Scientific research is both the driver and result of space exploration. There is no war between the two. We should approach administrative and organizational change as carefully and precisely as we do physics and engineering.

APPENDIX I

INTERVIEW PROTOCOL FOR 2005 TRANSFORMATION Human Agency Model

As earth sciences and space sciences were merged into the Sciences and Exploration Directorate through the 2005 transformation, what were the perceptions of the researchers involved?

Question	Prompts or Follow-ups
1. Please describe your role in your present laboratory?	1a. How long have you worked in your particular organizational unit? 1b. Has your organizational affiliation changed?
2. Can you describe your role & experiences during the most recent 2005 reorganization/ transformation?	2a. Were you involved in planning for the change? 2b. How closely were you involved in the change? 2c. To what extent are your perceptions based on your own direct experience? 2d. On what you have heard from others? 2e. To the extent that you participated in the current 'transformation', how was your work affected?
3. Had you experienced previous reorgs? In 1990? 1984?	3a In the previous reorganizations that you experienced, what were the most important differences before and after each process?
4. What conditions do you think prompted this most recent reorganization/ transformation?	4a. Any other reorganization you may be familiar with?
5. To your best knowledge, what resources were involved in implementing this reorganization?	5a. Were any of <i>your</i> resources involved?
6. What was the formal and/or informal organizational arrangement before and after the reorganization?	6a. Were the formal organizational differences (if any) initiated by Headquarters? 6b. The Field Center? 6c. The Laboratory?

<p>7. How has the structure of your lab and/or GSFC changed?</p>	<p>7a. What has been the impact and/or nature of these changes? Possibilities: 7b. Specific changes in responsibility? 7c. Changes in hierarchical structure/level? 7d. Changes in information flows? 7e. Power relationships?</p>
<p>8. Did structural changes that did occur reflect closer alignment with NASA Headquarters?</p>	<p>8a. If there was closer alignment with Headquarters, did this facilitate contact with funding organizations? 8b. Did it hinder this? 8c. Is there an organization at NASA Headquarters directly related to your work? (a good example would be for gravitational physics).</p>
<p>9. How did the most recent reorganization affect your own work and activities, and those of people you know well or work with? Please reflect on the entire process -- the situation before the reorganization and leading up to it, as well as during and after the change.</p>	<p>9a. Were there positive effects? Good things? 9b. Were there negative effects? Bad things? 9c. Can you describe specific examples and events with which you were familiar and about which you are very sure? 9d. Changes in productivity such as in paperwork processes (e.g. approval signatures, requirements, etc...)? 9.e.1. Performance Plans? 9.e.2. Proposal Writing and Approval? 9.e.3. Time necessary to carry out decisions?</p>
<p>10. Has the 2005 Transformation introduced new areas of research, methodologies or methodologies? Have they eliminated any areas of research?</p>	<p>10a. Please elaborate on any research areas that may have been added or deleted.</p>
<p>11. Has the 2005 Transformation resulted in more collaboration among laboratories? Less?</p>	<p>11a. Please elaborate on increased or decreased collaboration among laboratories.</p>
<p>12. Were there benefits or problems in the area of personnel or human resources?</p>	<p>12a. Do you know of problems in hiring or attracting people? 12b. Could you please describe problems in hiring or attracting? 12c. Have any positive changes resulted? 12d. Can you describe any other positive changes?</p>

	<p>12e. Has personnel turnover (change induced) affected your ability to fulfill your job responsibilities?</p> <p>12f. In general, do you feel reorganization has affected personnel retention or recruitment either positively or negatively?</p>
13. During and after the present ‘transformation’, were there benefits or problems in general strategy, priorities, and programs for your laboratory?	13a. To what extent do you perceive any changes in the goals or values of your organization?
14. Have there been any changes in your laboratory’s research agenda that resulted from the latest reorganization?	<p>14a. Has reorganization affected the funding for your research group?</p> <p>14b. Has it affected the importance of your group’s work compared to other groups in the lab?</p>
15. Does it seem to you that relations with NASA Headquarters have changed because of reorganizations?	15a. Can you give one or two examples?
16. Does it seem to you that relations with contractors have changed because of reorganizations?	16a. Can you give one or two examples?
17. Does it seem to you that relations with University partners have changed because of reorganizations?	17a. Can you give one or two examples?
18. Since the most recent reorganization does it seem to you that there has been more or less emphasis on science?	18a. Have your own relations with the scientific community changed as a result of the most recent reorganization?
19. On applied technology?	
20. Service/outreach functions?	20a. Has your laboratory become more or less service oriented?
21. What are the most important indicators of work effectiveness for you?	<p>21a. Have your research incentives changed as a result of reorganization?</p> <p>21b. If your research incentives have changed, please describe how.</p> <p>21c. What changes have occurred in your/your research group’s performance as assessed since reorganization?</p> <p>21d. What changes have been implemented after the reorganization?</p>
22. How is your/your unit’s performance assessed?	

Question	Prompts or Follow-ups
23. What lab outcome metrics are available and how have these data changed since the reorganization?	23a. Have processes and procedures concerning research proposals changed? 23b. Have processes and procedures changed as to publications? 23c. Have processes and procedures changed as to citations?
24. Have changes at the directorate level offices, as a result of the transformation, provided different support to your laboratory?	24a. Specifically, has the Science Proposal Support Office and the Computational & Information Sciences and Technology Office provided effecting support?
25. Do you feel your job satisfaction or morale is better or worse now than before the most recent transformation?	25a. Do you feel more or less empowered in your research?
26. Have you heard any ‘horror stories,’ or any ‘success stories’ you feel are attributable to the transformation?	26a. Would you care to relate and such ‘success’ or ‘horror’ stories?
27. As a result of the Transformation, did you immediate supervisor change?	27a. Would you like to elaborate on the change of lack of it?
28. As a result of the Transformation is your present office closer to that of your supervisor’s?	28a. If your present office is closer to your supervisor what influence (if any) does this have on your effectiveness and productivity? 29b. Is it an asset or a liability or neither?
29. As a result of the Transformation has your office moved?	29a. If your office has changed do you consider this a positive or negative factor?
30. Was your old office closer to your supervisor than it was after the Transformation?	30a. If your old office was closer to your supervisor than it is at present, did you view this as a more desirable situation than the present?
31. Were you a member of the old Earth Sciences (900) Directorate?	31a. If you were, do you consider the past dichotomy a better arrangement than the current transformation?
32. Have you been affected by the launching of Code 670 – the Heliophysics Division?	32a. Do you consider this change reflective of a refinement of the original transformation or a return to a more logical organizational structure?
33. What is the impact on the transformation of the concept of Full Cost Accounting?	33a. Is there any connection or link between the two?
34. Are there any other issues, pertaining to reorganizations, that you might like to discuss?	34. What are the most important aspects that I have missed?

CRITERIA FOR RESEARCHER GROUPINGS

Criteria Index	CATEGORY	T	F
1	Branch Head Changed	yes	no
2	New Office Close to New Branch Head	yes	no
3	Office Changed	yes	no
4	Old Office Close to Old Branch Head	yes	no
5	Old Earth Sciences Laboratory (900)	yes	no

1. Researcher's Branch Head was changed because of transformation.
2. Researcher's new office is close to new Branch Head
3. Researcher's office changed location.
4. Researcher's old office was close to old Branch Head.
5. Researcher was in old Earth Sciences (900) laboratory.

APPENDIX II

Preliminary Selection Methodology

Table 1 lists laboratories of both space and Earth sciences before the 2005 transformation. The space laboratories are identified with three-digit codes beginning with 6 while the Earth laboratories have similar numerical codes beginning with the number 9.

Table 2 lists the laboratories after the transformation. All codes are now designated by the initial digit 6, formerly associated with the space science directorate. In addition, many of the former Earth sciences laboratories have been organizationally divided so that an additional digit is now required (GSFC Phone Directories, 2002-2005; Sciences and Exploration Directory; GSFC Earth-Sun Exploration Division Strategic Plan).

Table 3 lists the composition of the 2005 laboratories as composed of researchers from the previous 1990 laboratories. In some cases entire laboratories were moved en-mass and in others there were personnel dispersed from several laboratories into the new 2005 laboratories.

Tables 4 and 5 serve as background material for Table 6.

Table 4 sets up my criteria groupings. I have determined, through yes or no criteria, the most important physical and logistic components that could affected researchers within a process of change. The resulting 'yes or no' groupings enabled me to select potential interviewees. I then revised my original instrument/questionnaire to reflect these new considerations.

Because there are five binary (yes/no) criteria for selection, there are $(2)^5 = 32$ possible “segments”. That is, all possible outcomes are given by the 32 segments (rows) listed in Table 5. It will be noted that the 32 segments are grouped according to the binomial theorem. The binomial coefficients are given by Pascal's triangle. This tool indicates how many segments there are in each grouping. For five independent binary criteria, these binomial coefficients are: 1 (for 5 yes), 5 (for 4 yes, 1 no), 10 (for 3 yes, 2 no), 10 (for 2 yes, 3 no), 5 (for 1 yes, 4 no), and finally 1 (for 5 no). Respectively these are segments 1, 2 through 6, 7 through 16, 17 through 26, 27 through 31, and finally 32 (Lial, Greenwell, & Ritchey, 2005; Gellert, Kustner, Hellwich & Kastner, eds. 1977).

Table 6 presents a list of researchers who have been dispersed from their original laboratories. I have temporarily indulged myself with the rather colorful and non-scientific designations of: ‘lone wolves’ in the case of researchers who found themselves singly detached, ‘duets’ for two researchers in a similar situation and ‘splits’ in cases where laboratories were bifurcated and assigned to two new organizations. The last columns identify the *criteria values* based on Table 4 and the *segments* identified in Table 5.

Table 7 identifies the population of researchers found within the various segments as displayed in the final column of Table 6. I at first settled on a sample size of 32 out of a population of possible 56. This population had experienced a considerable amount of movement or disruption, if you will, and for this reason I have chosen more than half their number to be included in my sample.

Table 8 is analogous to Table 7. In this case I examined groups of researchers who had both largely survived the Transformation, intact and others who had been largely disrupted. I chose a sample of 35 out of 323 possibilities.

APPENDIX II - TABLE 1

LABORATORY DESIGNATIONS BEFORE 2005 TRANSFORMATION

'Old' Code	LABORATORY NAME
600	Space Sciences Directorate
630	Space Science & Data Operations
631	Astrophysics Data Facility
632	Space Physics Data Facility
633	National Space Science Data Center & World Center A
661	Gamma Ray, Cosmic Ray and Gravitational Wave Astrophysics Branch
662	X-Ray Astrophysics Branch
680	Laboratory for Astronomy and Solar Physics
681	UV/Optical Astronomy Branch
682	Solar Physics Branch
685	Infrared Astrophysics Branch
686	Instrument and Computer Systems Branch
690	Laboratory for Extraterrestrial Physics
691	Astrochemistry Branch
692	Interplanetary Physics Branch
693	Planetary Systems Branch
695	Planetary Magnetospheres Branch
696	Electrodynamics Branch
900	Earth Sciences Directorate
910	Laboratory for Atmospheres
912	Mesoscale Atmospheric Processes Branch
913	Climate and Radiation Branch
915	Atmospheric Experiment Branch
916	Atmospheric Chemistry and Dynamics Branch
920	Laboratory for Terrestrial Physics
921	Geodynamics Branch
922	Terrestrial Information Systems Branch
923	Biospheric Sciences Branch
924	Laser Remote Sensing Branch
926	Space Geodesy Branch

APPENDIX II - TABLE 1 (continued)

LABORATORY DESIGNATIONS BEFORE 2005 TRANSFORMATION

'Old' Code	LABORATORY NAME
930	Earth and Space Data Computing Division
931	Science Computing Branch
933	Science Communications and Technology Branch
935	Applied Information Sciences Branch
940	Goddard Institute for Space Studies
970	Laboratory for Hydrospheric Processes
971	Oceans and Ice Branch
972	Observational Science Branch
974	Hydrological Sciences Branch
975	Microwave Sensors Branch

APPENDIX II - TABLE 2

LABORATORY DESIGNATIONS AFTER 2005 TRANSFORMATION

'New' Code	LABORATORY NAME
600	Sciences and Exploration Directorate
610	Earth-Sun Exploration Division
611	Goddard Institute for Space Studies
612	Laboratory for Solar and Space Physics
612.1	Solar Physics Branch
612.2	Heliospheric Physics Branch
612.3	Geospace Physics Branch
612.4	Space Physics Data Facility
613	Laboratory for Atmospheres
613.1	Mesoscale Atmospheric Processes Branch
613.2	Climate and Radiation Branch
613.3	Atmospheric Chemistry and Dynamics Branch
614	Hydrospheric and Biospheric Sciences Laboratory
614.1	Cryospheric Sciences Branch
614.2	Ocean Sciences Branch
614.3	Hydrological Sciences Branch
614.4	Biospheric Sciences Branch
614.5	Biospheric Information Systems Branch
614.6	Instrumentation Sciences Branch
660	Exploration of the Universe Division
661	Astroparticle Physics Laboratory
662	X-Ray Astrophysics Branch
663	Gravitational Astrophysics Laboratory
665	Observational Cosmology Laboratory
667	Exoplanets and Stellar Astrophysics Laboratory

APPENDIX II -TABLE 2 (continued)

LABORATORY DESIGNATIONS AFTER 2005 TRANSFORMATION

'New' Code	LABORATORY NAME
690	Solar System Exploration Division
691	Astrochemistry Laboratory
693	Planetary Systems Laboratory
694	Laser Remote Sensing Laboratory
695	Planetary Magnetospheres Branch
697	Space Geodesy Laboratory
698	Planetary Geodynamics Laboratory
699	Atmospheric Experiments Laboratory

APPENDIX II - TABLE 3

Re-distribution of Personnel

New Laboratory	# of Personnel	Old Laboratory	# of Personnel
611	23	940	23
612.1	21	682	19
		930	1
		915	1
612.2	15	692	13
		690	2
612.3	12	696	10
		695	1
		690	1
612.4	9	632	6
		630	2
		933	1
613.1	21	912	21
613.2	12	913	12
613.3	18	916	18
614.1	10	972	2
		971	8
614.2	14	972	5
		971	8
		970	1
614.3	10	974	10
614.4	23	924	2
		923	20
		922	1
614.5	9	922	9
614.6	16	975	8
		972	8
661	15	661	15

APPENDIX II - TABLE 3 (continued)**Re-distribution of Personnel**

New Laboratory	# of Personnel	Old Laboratory	# of Personnel
662	24	633	1
		660.1	1
		662	20
		681	1
		685	1
663	11	661	1
		663	8
		681	1
		(new hire)	1
665	20	681	3
		685	17
667	14	681	12
		685	2
691	15	691	15
693	21	693	20
		923	1
694	9	924	9
695	15	681	1
		695	13
		935	1
697	9	926	8
		920	1
698	11	921	11
699	6	915	6

APPENDIX II - TABLE 4

CRITERIA FOR RESEARCHER GROUPINGS

Criteria Index	CATEGORY	T	F
1	Branch Head Changed	yes	no
2	New Office Close to New Branch Head	yes	no
3	Office Changed	yes	no
4	Old Office Close to Old Branch Head	yes	no
5	Old Earth Sciences Laboratory (900)	yes	no

6. Researcher's Branch Head was changed because of transformation.
7. Researcher's new office is close to new Branch Head
8. Researcher's office changed location.
9. Researcher's old office was close to old Branch Head.
10. Researcher was in old Earth Sciences (900) laboratory.

APPENDIX II - TABLE 5
DEFINITION OF SEGMENTS

Segment	CRITERIA INDEX				
	1	2	3	4	5
1	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	N
3	Y	Y	Y	N	Y
4	Y	Y	N	Y	Y
5	Y	N	Y	Y	Y
6	N	Y	Y	Y	Y
7	Y	Y	Y	N	N
8	Y	Y	N	Y	N
9	Y	N	Y	Y	N
10	N	Y	Y	Y	N
11	Y	Y	N	N	Y
12	Y	N	Y	N	Y
13	N	Y	Y	N	Y
14	Y	N	N	Y	Y
15	N	Y	N	Y	Y
16	N	N	Y	Y	Y
17	Y	Y	N	N	N
18	Y	N	Y	N	N
19	Y	N	N	Y	N
20	Y	N	N	N	Y
21	N	Y	Y	N	N
22	N	Y	N	Y	N
23	N	Y	N	N	Y
24	N	N	Y	Y	N
25	N	N	Y	N	Y
26	N	N	N	Y	Y
27	Y	N	N	N	N
28	N	Y	N	N	N
29	N	N	Y	N	N
30	N	N	N	Y	N
31	N	N	N	N	Y
32	N	N	N	N	N

APPENDIX II - TABLE 6

Researchers Dispersed From Original Research Groups

New Code	New Branch Head	Off.	Lone Wolf	Old Off.	New Off.	Old Code	III. Old Branch Head	Off.	CRITERIA INDEX					Seg. #
									1	2	3	4	5	
693	Name withheld	Bldg. 2-R163	Name withheld	33-G325	2-154	923	Name withheld	32-S036J	Y	Y	Y	N	Y	3
697	Name withheld	33-G219	Name withheld	33-G207	33-G209	926 (MIT)	Name withheld	33-G219	N	Y	Y	Y	Y	6
612.1	Name withheld	21-134	Name withheld	22- C157	22- C157	915	Name withheld	33-C211 A	Y	N	N	N	Y	20
“	Name withheld	“	Name withheld	28-W230G	28- W230G	930	Name withheld	28-W230 H	Y	N	N	Y	Y	14
612.3	Name withheld	21- 222	Name withheld	2- 225	21- 212	690	Name withheld	2- 115	Y	Y	Y	Y	N	2
“	Name withheld	“	Name withheld	21- 268	21- 268	695	Name withheld	2-136	Y	Y	N	N	N	17
695	Name withheld	21- 257B	Name withheld	21- 036	21- 036	681	Name withheld	21- 012A	Y	N	Y	Y	N	9
“	Name withheld	“	Name withheld	28- S206	28- S206	955	Name withheld	28-W186 B	Y	Y	N	N	Y	11
663	Name withheld	“	Name withheld	2- S004	2-201	661	Name withheld	2- 250B	Y	Y	Y	Y	N	2
“	“ Name withheld	“	Name withheld	21- 014	2S012	681	Name withheld	21- 012A	Y	Y	Y	Y	N	2
“	Name withheld “	“	(new hire)				Name withheld							

TABLE 6 (continued b)

CRITERIA INDEX

New Code	New Branch Head	Off.	Lone Wolf	Old Off.	New Off.	Old Code	IV. Old Branch Head	Off.	1	2	3	4	5	Seg. #
614.4	Name withheld	33-G425	Name withheld	?	33- G325	922	Name withheld	32-S036J	Y	N	?	?	Y	12
612.4	Name withheld	26-143A	Name withheld	28-W239	26- 112	933	Name withheld	28-W135 A	Y	Y	Y	Y	Y	1
662	Name withheld	2- 250	Name withheld	26- 126	2-227	633	Name withheld	26-162A	Y	Y	Y	Y	N	2
“	Name withheld	“	Name withheld	2- T06	2- 223	660.1	Name withheld	2- 011	Y	Y	Y	Y	N	2
“	Name withheld	“	Name withheld	21- 024	2- 047	681	Name withheld	21-021A	Y	Y	Y	Y	N	2
“	Name withheld	“	Name withheld	2-S203	2-S203	?685	Name withheld	21-216	Y	Y	N	N	N	17
614.2	Vacant			??	??	970	Name withheld	33-A120 C	Y	?	?	?	Y	12
“	“		Duos											
612.2	Name withheld	21-257A	Name withheld	2-111	21-257	690	Name withheld	2-115	Y	Y	Y	Y	N	2
“	Name withheld	“	Name withheld	2-137	21-231	690	Name withheld	“	Y	Y	Y	Y	N	2
614.1	Name withheld	33-A205	Name withheld	N159-E218	N159-E201	972	Name withheld	N159 - E220	Y	N	Y	Y	Y	5
“	Name withheld		Name withheld	N159-E201	N159-E201	972	Name withheld	“	Y	N	N	Y	Y	14
667	Vacant		Name withheld	21- 216	21- 066	685		21-216	Y	?	Y	Y	N	9
“	Name withheld		Name withheld	21-123	21-070	685	“	“	Y	?	Y	Y	N	9

APPENDIX II - TABLE 6 (continued c)

CRITERIA INDEX

New Code	New Branch Head	Off.	Duos	Old Off.	New Off.	Old Code	V. Old Branch Head	Off.	1	2	3	4	5	Seg. #
614.4	Name withheld	33-G425	Name withheld	33- 326	---	924	Name withheld	33-F406	Y	?	?	Y	Y	5
"	Name withheld	"	Name withheld	33-D324	33-D324	924	"	"	Y	Y	N	Y	Y	4
612.4	Name withheld	26-143A	Name withheld	26- 143	26-143	630	Name withheld	26-143B	Y	Y	N	Y	N	8
"		"		28-N110	28- N118	630.1	"	"	Y	N	Y	N	N	18
"		"	Splits											
614.6	Name withheld	N159-E220	Name withheld	N159-W132	N159-W132	972	Name withheld	N159-E220	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E205	N159-E205	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E220	N159-E220	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E202	N159-E202	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E105	N159-E105	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E121	N159-E121	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E222	N159-E222	972	"	"	N	Y	N	Y	Y	15
"	"	"	Name withheld	N159-E117	N159-E117	972	"	"	N	Y	Y	Y	Y	6

APPENDIX II - TABLE 6 (continued d)

CRITERIA INDEX

New Code	New Branch Head	Off.	Splits	Old Off.	New Off.	Old Code	VI.	Old Branch Head	Off.	1	2	3	4	5	Seg. #
614.6	Name withheld	N159-E220	Name withheld	33-A428	33-A428	975 (UM BC)		vacant		Y	N	N	N	Y	20
“	“	“	Name withheld	33-A426	33-A428	975		“		Y	N	Y	N	Y	12
“	“	“	Name withheld	33-A418	33-A418	975		“		Y	N	N	N	Y	20
“	“	“	Name withheld	33-A420	33-A420	975		“		Y	N	N	N	Y	20
“	“	“	Name withheld	33-A412	33-A412	975		“		Y	N	N	N	Y	20
“	“	“	Name withheld	33-B404	33-B404	975		“		Y	N	N	N	Y	20
“	“	“	Name withheld	33-A414	(AERO) 16-137	975		“		Y	N	Y	N	Y	12
“	“	“	Name withheld	33-A416	33-A416	975		“		Y	N	N	N	Y	20
614.2	Name withheld	33-A215	Name withheld	33-A212	33-A215	971		Name withheld	33-A208	Y	Y	Y	N	Y	3
“	“	“	Name withheld	33-A219	33-A212	971		“	“	Y	Y	Y	Y	Y	1
“	“	“	Name withheld	33-A221	33-A221	971		“	“	Y	Y	N	Y	Y	4
“	“	“	Name withheld	28-W126	28-W126	971		“	“	Y	N	N	N	Y	20
“	“	“	Name withheld	33-A211	33-A228	971		“	“	Y	Y	Y	Y	Y	1
“	“	“	Name withheld	33-A222	33-A222	971		“	“	Y	Y	N	Y	Y	4
“	“	“	Name withheld	22-250	22-250	971		“	“	Y	N	N	N	Y	20
“	“	“	Name withheld	28-107	28-107	971		“	“	Y	N	N	N	Y	20

APPENDIX II - TABLE 6 (continued e)

CRITERIA INDEX

New Code	New Branch Head	Off.	Splits	Old Off.	New Off.	Old Code	VII. Old Branch Head	Off.	1	2	3	4	5	Seg. #
614.2	Name withheld	33-A215	Name withheld	N159-E217	Retired to Oregon State U	972	Name withheld	N159-E220	Y	N	Y	Y	Y	5
“	“	“	Name withheld	N159-E220	N159-E220	972	“	“	Y	N	Y	N	Y	12
“	“	“	Name withheld	N159-W134	N159-W134	972	“	“	Y	N	N	N	Y	20
“	“		Name withheld	N159-E217	N159-E217	972	“	“	Y	N	N	N	Y	20
“	“	“	Name withheld	N159-E213	N159-E222	972	“	“	Y	N	Y	N	Y	12

APPENDIX II - TABLE 7

Population and Proposed Sample Size by Segment

SEGMENT #	POPULATION	SAMPLE
1	3	2
2	8	4
3	2	1
4	3	2
5	3	2
6	2	1
7	0	
8	1	1
9	3	2
10	0	
11	1	1
12	6	3
13	0	
14	2	1
15	7	4
16	0	
17	2	1
18	1	1
19	0	
20	12	6
21	0	
22	0	
23	0	
24	0	
25	0	
26	0	
27	0	
28	0	
29	0	
30	0	
31	0	
32	0	
TOTAL	56	32

APPENDIX II - TABLE 8

Population and Proposed Sample Size for Non-segment Researchers

VIII. LABORATORY #	IX. POPULATION	SAMPLE
611	23	2
612.1	19	2
612.2	13	2
612.3	10	1
612.4	6	1
613.1	21	2
613.2	12	1
616.3	18	2
614.1	8	1
614.3	10	1
614.4	20	2
614.5	9	1
661	15	2
662	20	2
663	8	1
665	17	2
667	12	1
691	15	2
693	20	2
694	9	1
695	13	1
697	8	1
698	11	1
699	6	1

TOTAL**323****35**

APPENDIX II - TABLE 9
Population and Proposed Sample Size by Segment

SEG. #	POP.	SAMPLE	INTERVIEWEE
1	3	2	Name withheld
2	8	4	Names withheld
3	2	1	Name withheld
4	3	2	Name withheld
5	3	2	
6	2	1	
7	0		
8	1	1	
9	3	2	Name withheld
10	0		
11	1	1	Name withheld
12	6	3	Name withheld
13	0		
14	2	1	
15	7	4	
16	0		
17	2	1	Names withheld
18	1	1	
19	0		
20	12	6	Names withheld

APPENDIX II - TABLE 10

Population and Proposed Sample Size for Non-segment Researchers

LABORATORY #	POPULATION	SAMPLE	INTERVIEWEE
611	23	2	GISS
612.1	19	2	Name withheld
612.2	13	2	
612.3	10	1	
612.4	6	1	
613.1	21	2	Name withheld
613.2	12	1	
616.3	18	2	
614.1	8	1	Name withheld Bldg. 33 A-205
614.3	10	1	
614.4	20	2	Name withheld
614.5	9	1	
661	15	2	Name withheld Bldg. 2 243
662	20	2	
663	8	1	
665	17	2	
667	12	1	
691	15	2	
693	20	2	Name withheld Bldg. 2 Room 132 – 158
694	9	1	
695	13	1	
697	8	1	Name withheld
698	11	1	
699	6	1	

Bibliography

Aldrich, H.E. (1979). Organizations And Environments. Englewood Cliffs, NJ: Prentice-Hall Inc.

Aldridge, E.C. *et al* (2004). Report Of The President's Commission On Implementation Of United States Space Exploration Policy. http://www.nasa.gov/pdf/60736main_M2M_report.

Allison, G & Zelikow, P. (1999). Essence of Decision – Explaining the Cuban Missile Crisis (2nd ed.). New York: Longman.

Bozeman, B., Kingsley, G., Youtie, J., Rainey, H., Wilson, L., Dietz, J., & Lane, E., (2001). Contractor Change at the Department of Energy's Multi-program Laboratories: Three Case Studies. (Contract no. DE-FG02096ER45562). Barry.bozeman@pubpolicy.gatech.edu.

Brannick, T. & Coghlan D. (2007). In Defense of Being “Native” The Case for Insider Academic Research. Organizational Research Methods. 10, (1) 59-74.

Buchanan, D.A. & Bryman, A. (2007). Contextualizing Methods Choice in Organizational Research. Organizational Research Methods. 10, (3) 483-501.

Burns, T, (1971). Mechanistic and Organismic Structures (as cited in Mark & Levine, 1984)

Coghlan, D. & Brannick, T. (2006). Doing Action Research In Your Own Organization. (2nd ed.). Thousand Oaks: SAGE Publications.

Covault, C. (1984, August). U.S. Adopts New Space Strategy. Aviation Week & Space Technology, 14-16.

Dexter, L.A. (1970). Elite and Specialized Interviewing. Evanston: Northwestern University Press.

Dickson, D. (1984). The New Politics of Science. New York: Pantheon. ¿?

Downs, A. (1994). Inside Bureaucracy. Prospect Heights, IL: Waveland Press, Inc. (Original work published 1966).

Emmerich, H.C. (1971). Federal Organizations and Administrative Management. University of Alabama: University of Alabama Press

Etzioni, A. (1964). The Moon-Doggle – Domestic And International Implications of the Space Race. Garden City: Doubleday & Company, Inc.

Exler, R. (1990, August). John M. Klineberg Joins Goddard as Center Director. Goddard News, 6.

Fischer, F. (1990). Technocracy and the Politics of Expertise. Newbury Park, CA: Sage Publications.

Fischer, F. (1995). Evaluating Public Policy. Chicago: Nelson-Hall inc.

Fischer, F. (2000). Citizens, Experts, and the Environment. Durham: Duke University Press.

French, W.L., Bell, C.H. Jr., & Zawacki, R.A. (Eds.) (6th ed). (2005). Organization Development and Transformation – Managing Effective Change. Boston: McGraw-Hill Irwin.

Gehman, Jr., H.W. *et al.*, (2003) Columbia Accident Investigation Board (Rep. Vol.1). Washington, D.C.: Government Printing Office.

Geisler, E. (2000). The Metrics of Science and Technology. Westport, CT: Quorum Books.

Gelbert, W, Hustner, H., Hellwich, M. & Hastner, H. (Eds.). (1977). The VNR Concise Encyclopedia of Mathematics. New York: Van Nostrand Reinhold Company.

Goddard News – July, 1984.

Goddard News – December 1984

Goddard News- January 1985

Goddard News, August, 1986

Goddard News, Center Director Speaks On Future of Goddard, December, 1989 (p. 6)

Goddard Space Flight Center Implementing NASA's Strategies for the 21st Century, 1990).Goddard Space Flight Center: NASA

Goddard Space Flight Center Telephone Directory – July 1987. Washington, DC: NASA

Goddard Space Flight Center Telephone Directory (2002). Goddard Space Flight Center: Greenbelt, Maryland.

Goddard Space Flight Center Telephone Directory (2005). Goddard Space Flight Center: Greenbelt, Maryland.

Goddard's Strategic Planning – a Progress Report: Fall 1986, Goddard Space Flight Center).

Grove, A.S. (1999). Only the Paranoid Survive: How to Exploit the Crisis Points That Challenge Every Company. New York: Broadway Business.

GSFC Earth-Sun Exploration Division Strategic Plan – Our Vision “To Improve Life on Earth through the Use of Space Observations”. (2005) National Aeronautics and Space Administration: Greenbelt. Maryland.

Gulick, L., Urwick, L., Mooney, J.D., Fayol, H., Dennison, H.S., Henderson, L.J., Whitehead, T.N., Mayo, E., Follett, M.P., Lee, J., and Graicunas, V.A. (1937). In Papers on the Science of Administration. L. Gulick & L. Urwick (Eds). New York: Institute of Public Administration.

Habermas, J. (1971). Knowledge And Human Interests. (Jeremy J. Shapiro, Trans.). Boston: Beacon Press.

Headquarters Directory, Spring 2008

Hertz, R. & Imber, J.B. (Eds.) (1995). Introduction. Studying Elites Using Qualitative Methods. Thousand Oaks: SAGE Publications

Herr, K. & Anderson, G.L. (2005). The Action Research Dissertation – A Guide for Students and Faculty. Thousand Oaks: SAGE Publications.

Hinners, N.W. (1985). A New Year's Message From the Center Director. Goddard News, January, 1985, 2.

(<http://www.sap.com/about/company>).

Institute and Museum of the History of Science. The Medici and Science, <http://brunelleschi.imss.fi.it/mediciscienze/emed.asp?c=70001>

Kvale, S. (1996). InterViews, An Introduction to Qualitative Research Interviewing. Thousand Oaks: SAGE Publications.

Lambright, W.H. (1969). Launching NASA's Sustaining University Program. Syracuse, NY: The Inter-University Case Program, Inc.

Lambright, W. H. (1995). Powering Apollo – James Webb of NASA. Baltimore: The Johns Hopkins University Press.

Launius, R.D. & McCurdy, H.W. (1997). Introduction: The Imperial Presidency in the History of Space Exploration. In R.D. Launius & H.E. McCurdy (Eds.) Spaceflight and the Myth of Presidential Leadership. Urbana and Chicago: University of Illinois Press.

Launius, R.D. & McCurdy, H.W. (1997). Epilogue: Beyond NASA Exceptionalism. In R.D. Launius & H.E. McCurdy (Eds.) Spaceflight and the Myth of Presidential Leadership. Urbana and Chicago: University of Illinois Press.

Levine, A.L. (1975). The Future of the U.S. Space Program. New York: Praeger Publishers.

Lial, M.L., Greenwell, R.N., & Ritchey, N.P. (2005). (8th ed.). Finite Mathematics. Boston: Pearson Addison Wesley.

Light, P.C. (1997). The Tides of Reform – Making Government Work, 1945-1995. New Haven: Yale University Press.

March, J.G & Olson, J.P. (1983). Organizing Political Life: What Administrative Reorganization Tells Us About Government. The American Political Science Review, 77 (2), 281-296.

Mark, H. & Levine A. (1984). The Management of Research Institutions – a look at government laboratories. Washington, D.C.: NASA SP—481.

McCurdy, H.E. (2001). Faster Better Cheaper – Low-Cost Innovation in the U.S. Space Program. Baltimore: The Johns Hopkins University Press.

McDougall, W.A. (1985). ... the Heavens and the Earth – A Political History of the Space Age. New York: Basic Books, Inc.

Miles, M.B. & Huberman, A.M. (1994). Qualitative Data Analysis – An Expanded Sourcebook. 2nd

NASA Strategic Plan, February 1996, NASA: Washington, D.C.

Newell, H. (1960). The Beginnings of Space Science Policy- Reading No. 7. In. Roger D. Launius (Ed.), NASA A History of the U.S. Civil Space Program (pp.) 160-166. Malabar, FL: Krieger Publishing Company.

Noble, D.F. (1999). The Religion of Technology – The Divinity Of Man And The Spirit of Invention. New York: Penguin Books.

NPIRES (1994).

Office of Management, Management Processes Branch. (1985). The Evolution of the NASA Organization. Washington, D.C.:NASA.

One NASA 2003 Annual Report. <http://www.onenasa.nasa.gov>.

Osborne, D. & Gaebler T., (1993). Reinventing Government – How the Entrepreneurial Spirit Is Transforming The Public Center. New York: Penguin Books.

Perrow, C., (1986). Complex Organizations – A Critical Essay. (3rd Ed.). New York: Random House.

Pfeffer, J. & Salancik G.R. (2003). The External Control of Organizations – A Resource Dependence Perspective. Stanford, CA: Stanford Business Classics.

Pierce, J.L. (1995). Reflections on Fieldwork in a Complex Organization: Lawyers, Ethnographic Authority, and Lethal Weapons. in Hertz, R & Imber, J.B. (Eds.) Studying Elites Using Qualitative Methods. Thousand Oaks: SAGE Publications

Porras, J.I. & Silvers, R.C. (2005). Organizational development and Transformation. In French, W.L., Bell, C.H. Jr., & Zawacki, R.A. (Eds.) 6th ed). (2005). Organization Development and Transformation – Managing Effective Change. Boston: McGraw-Hill Irwin.

Price, D.K. (1962). Government And Science – Their Dynamic Relation In American Democracy. New York: Oxford University Press.

Quigley, C. (1961). The Evolution Of Civilizations – An Introduction to Historical Analysis. New York: The Macmillan Company.

Ragsdale, L. (1997). Politics Not Science: The U.S. Space Program in the Reagan and Bush Years. In R.D. Launius & H.E. McCurdy (Eds.) Spaceflight and the Myth of Presidential Leadership. Urbana and Chicago: University of Illinois Press.

Rainey, H.G., Bozeman B. & Kingsley, G. (Eds.) (2004). Symposium. Privatized Administration of the National Laboratories: Developments in the Government-Owned, Contractor-Operated Approach. Public Performance & Management Review, 28, (2) 157-235.

Ride, S.K., (1987). Leadership and America's Future in Space. (Rep. to the Administrator). Washington, D.C.: NASA.

Romzek, B.S. & Dubnick, M.J. (1990). Accountability in the Public Sector: Lessons from the Challenger Tragedy. In F. Lane (Ed.) Current Issues in Public Administration. (pp. 234-253). New York: St. Martin's Press.

Rosenbloom, D.H. (2000). Building a legislative-centered public administration: Congress and the administrative state, 1946-1999. Tuscaloosa: University of Alabama Press.

Rosenthal, A. (1968). Venture Into Space – Early Years of Goddard Space Flight Center. Washington, D.C. NASA SP-4301.

Rosholt, R.L. An Administrative History of NASA, 1958-1963. Washington, D.C.: National Aeronautics And Space Administration.

Sciences and Exploration Directory – General Information, Directories and Mail. NASA Goddard Sciences Transformation – General Information [Http://sciences.gsfc.nasa.gov/general_info_012805](http://sciences.gsfc.nasa.gov/general_info_012805)

Seidman, H. (1998). Politics, Position and Power – The Dynamics of Federal Organization (5th ed.). New York: Oxford University Press.

Shapin, S. (1996). The Scientific Revolution. Chicago: University of Chicago Press.

Snow, C.P. (1961). Science and Government. Cambridge: Harvard University Press.

Stake, R.E. (1995). The Art of Case Study Research. Thousand Oaks: SAGE.

Szanton, P. (Ed.) (1981). Federal Reorganization – What have We Learned? Chatham, NJ: Chatham House Publishers, Inc.

Waldo, D. (1948). The Administrative State – A Study of the Political Theory of American Public Administration. New York: The Ronald Press Company.
The study of US public administration has historically been grounded in business.

Wallace, L.E. (1999). Dreams, Hopes, Realities – NASA's Goddard Space flight Center – The First Forty Years. Washington, D.C.: The NASA History Series (NASA SP-4312).

Webb, J.E. (1969). Space Age Management. New York: McGraw-Hill.

White, C. Dr. Gerald Soffen: A Renaissance Man With a Global Perspective. Goddard News, April 1990 (p. 6)

www.robbsingioai.com

Yin, R.K., (Rev. Ed.), (1989). Case Study Research – Design and Methods. Newbury Park: SAGE Publications.

Yin, R.K. (2nd Ed.) (2003) Applications of Case Study Research. Thousand Oaks: SAGE Publications.

Yin, R.K. (Ed.). (2004.) Introduction. The Case Study Anthology. (pp. xi-xx). Thousand Oaks: SAGE Publications.

Curriculum vitae

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Education

Sacred Heart Academy	Graduated 1959
Georgetown University School of Foreign Service Bachelor of Science in Foreign Service Major: International Affairs	1959-1963
Catholic University of America School of Speech & Drama 20 semester hours toward an M.A. in Speech and Drama. Foreign language requirement satisfied	1964-1966
Baruch College, City University of New York Masters of Public Administration	1992-1994
School of Public Service and Administration, Rutgers University-Newark Ph.D. in Public Administration	2000-2009

Work Experience

National Players, Olney Theatre, Winooski Playhouse Actress	1964-1970
Lincoln Center for the Performing Arts Assistant Manager, Visitors' Services	1970-1979
NASA-Goddard Institute for Space Studies Programs Analyst & Executive Officer	1980-present

Honor Societies: Pi Alpha Alpha, Beta Gamma Epsilon

Awards

Maine Statewide 'Spears' Award for Drama	1959
Regent's Award, Georgetown University	1963
Gilbert (Best Actress Award), Catholic University	1966
NASA Outstanding Performance Award	1983
New York City Board of Education, 'Partner in Education Award'	1990
NASA/GSFC Equal Opportunity Honor Award	1993
NASA Special Act Award	1996