**Space Policy: A Comparative Study of the**
**George W. Bush and Barack Obama Administrations**

**by**

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**Abstract**

This dissertation is a comparative study between the George W. Bush and Barack Obama administrations' space policies. The work employs qualitative techniques, such as interviews and archival analysis, to elucidate and explicate the factors behind the policy decisions that these administrations considered in their policy formulations for the medium of space. A special focus is placed on the Commercial Orbital Transportation Services (COTS) policy of the Bush administration, and the Commercial Crew Development (CCDev) policy of the Obama administration. Both policies expand and enlarge American industry's role in the national space effort by relying on commercial space operators to transport astronauts and cargo to the International Space Station in low Earth orbit (LEO). However, with the CCDev program the Obama administration cancelled Constellation, a spacecraft that was to be government developed and operated by NASA, in favor of an industry-government partnership with Space X and Boeing for space transportation services to LEO. This represented a radical policy departure from the Bush administration which initiated the development of Constellation. The work also touches on the Obama administration's policy decision to shift NASA's focus away from human missions returning to the Moon in favor of new missions involving asteroids. In addition to the commercial and civil aspects of the national space effort the dissertation also places a special emphasis on national security issues in space that the Bush and Obama administrations were faced with. In particular the work analyzes the growing role of the private sector in military space operations with such things as the collection of imagery and bandwidth for communications and data. The work also explores other security issues in space such as future

satellite architectures, space situational awareness, space debris removal, transparency and

confidence building measures, arms control measures, and a code of conduct in space.

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**Space Policy**

When the Obama administration came into office in 2009, it made the decision to sustain

the national space effort at a level commensurate with the past, and to do so by partially

privatizing NASA's activities and to rely increasingly on commercial providers of satellite data

for national security needs (Digital Globe 2014). This was a meaningful adjustment to the

policies of the previous administration. This dissertation will explain the reasons for this

decision. Accordingly the research question is: What are the political, economic, and security

factors accounting for the Obama administration's policy to partially privatize the national space

effort?

With the privatization policy the US government agreed to provide a measure of

financing to private companies to undertake to develop spacecraft to ferry NASA's astronauts to

space, known as the Commercial Crew Development program, rather than committing NASA to

the development of its own spacecraft, known as Constellation, which would have been a far

more expensive proposition. Once the private spacecraft were ready NASA would purchase

space on them for its missions. By infusing these companies with funds the government sought

to energize them, thereby multiplying the effects of dwindling resources and the overall power of

the national space effort. Indeed, the ongoing effects of these arrangements may be the key to

maintaining the vibrancy of the American national space effort. In addition, a central feature of

the Bush administration's space policy was utilizing a derivative of Constellation for a human

return to the Moon. However, the Obama administration cancelled the Moon mission and

instead directed NASA to conduct a mission to an asteroid, and then later to redirect an asteroid

to cislunar space.

The first hypothesized reason for the policy decision to partially privatize the national space effort is that the recession of 2008 served to place extraordinary pressure on the federal budget of the United States. This made it very difficult to fund NASA's and the Pentagon's budgets for space at the optimum levels. However, the data reveals that the financial crisis of 2008 had little to no effect on the Obama administration's decision to cancel Constellation and proceed with Commercial Crew. What is more, according to the data the 2008 financial crisis appears to have had little effect on policy for the civil and military space programs more broadly. It appears that the Obama administration believed that NASA was funded adequately but doing the wrong mission.

The second hypothesized reason for the policy decision to cancel Constellation and proceed with Commercial Crew was the existence of a private sector effort in space that was growing in competence which enabled the Obama administration to increasingly rely on them in the development of policy. The data confirms this hypothesis. According to the data, if Space X had never launched a rocket there would be no Commercial Crew Development program.

The third reason was that the Obama administration perceived that there would be greater efficiencies in the procurement processes for space assets by partially privatizing the national space effort. The fourth reason was that the Obama administration perceived that there would be greater efficiencies in space operations by partially privatizing the national space effort. The data confirm these hypotheses. According to the data, the Obama administration hoped that the private sector could bring greater efficiencies to space procurement processes and space operations.

The primary reason why the Obama administration's policy differed from the Bush administration's policy—why the Obama administration cancelled the Constellation program and shifted NASA's direction away from a return to the Moon in favor of a mission to an asteroid—is because the Obama administration loathed the Bush administration so much that they were intent on pursuing different space programs. They wanted to cancel the Bush administration's space program. They were intent on doing the opposite of what the Bush administration had undertaken. All of the policymakers in these administrations that were interviewed confirm this dynamic, which came as somewhat of a surprise to the research effort. Another factor that explains why the policy decisions of the Obama administration differed from those of the Bush administration was growing private sector competence. Peter Marquez, who was on the national security council in both administrations, explained that if Space X had never launched a rocket there would have been no Commercial Crew Development (CCDev) program. Accordingly, the Constellation program was initiated in 2005 before Space X launched its first rocket in 2006. Space X was increasingly demonstrating competence for space pursuits which signaled to the Obama administration that they could rely on companies such as Space X in the development of space policy. Another factor that explains why the policy decision to cancel Constellation and proceed with CCDev was made by the Obama administration was because the Bush and Obama administrations did not value space in the same way. According to the data from an interviewee at the time that the Obama administration canceled Constellation they appropriated money for a high speed rail initiative in Tampa, FL for the exact same amount of money that would have been required for Constellation. The Obama administration believed that

other policy areas, such as domestic economic initiatives for infrastructure, were more important than the space program.

## Background

At the outset of national forays into the medium of space at the beginning of the Cold War it was initially recognized that given the nature of space as a common zone it became exceedingly difficult to regulate sovereign areas of space as had been done with territorial waters and airspace (Johnson-Freese 2009). This is largely due to the astrophysical aspects of the orbits that are closest to the Earth (low Earth orbits (LEO)). Here satellites transit orbital altitudes across the whole of the Earth and do not rest over one territory. Hence no nation could claim an orbit transiting not only its aerospace but those across the rest of the Earth as well. Therefore space powers, particularly the United States and the Soviet Union, determined that sovereignty could not include any area in Earth orbit. In this regard, the superpowers strove to utilize the unique aspects of the medium of space to stabilize deterrence and created arms control regimes in the medium toward this end. This meant that each superpower had to accept the other's activities in space provided they were not overtly hostile (Johnson-Freese 2009). Eventually this principle was extended to other space powers in addition. The concert of space powers created an international regime in the medium that would effectively serve to block any of them from developing a surprise advantage over the rest. For if one nation was able to achieve an unanticipated advantage that would allow it to dominate the medium then international politics could be irrevocably changed (Dolman 2002).

The medium of space had tremendous ramifications for espionage. Before space had been successfully accessed the United States relied on aircraft to acquire information about the Soviet Union. But while it was reasonable to believe that all intelligence targets were linked by water ways, railroads, and highways to their supply depots, there remained considerable concerns that critical targets may have been missed because they were out of the range of spy aircraft or because they were not covered enough times. It was agreed by American policymakers and the intelligence community that moving intelligence collection activities to space would remedy these issues in the immediate future (Burrows 1986).

Initially this dynamic did not sit well with the Soviets as American reconnaissance satellites would offset the strategic advantages they possessed as a closed society. Before the Soviets would eventually accept the new security dynamics of the medium they protested that spying was illegal, and this included spying from space. Indeed, in bad faith the Soviets held fast to this position even after they started launching their own reconnaissance spacecraft (Schauer 1976).

Complicating security matters for the United States was the veil of secrecy that enshrouded the Soviet space program. By conducting their space program in such extreme secrecy the Soviets were able to cloak their military activities under non-military, or civilian, guises. They did this by claiming that their space program was directed only towards scientific pursuits (Schauer 1976). In contrast the American space effort was far more transparent. In fact, the Eisenhower administration deliberately separated the civilian space program from the military space program. Thus, whereas NASA launched its own rockets, all Soviet rockets were launched by the Strategic Rocket Forces, their military space service (Schauer 1976).

The Cold War space race was titanic.  At stake was considerable prestige burnished from their respective scientific exploits which they could translate into increased influence around the world in their fierce ideological competition.  In this regard there was a ferocious battle between the superpower blocs "for the hearts and minds of non-aligned" nations (Johnson-Freese 2009, 36).  Each superpower was striving to outdo the other in space to prove to the rest of the world which was the most technologically sophisticated and in turn the most attractive power to align with (Johnson-Freese 2009).

Concerning this competition the infamous, and inaccurately perceived, missile gap served to spur the United States to excel in space.  The missile gap arose largely in response to the launch of Sputnik.  Sputnik created a presumption in the United States' technically illiterate media and public that if the Soviets could orbit satellites then they could launch massive amounts of missiles against the United States.  "Specifically, the notion that the Soviets could orbit nuclear weapons to rain down on the United States at will was widely perpetuated" (Johnson-Freese 2009, 36).  However, around 1962 the Russians had to accept the unfortunate reality that their national space effort had masked a missile arsenal that had not materialized.  Furthermore, Kruschev had exacerbated the situation by increasingly engaging in futile stunts in space that had a negligible effect on the competency of the Soviet military space effort (McDougall 1985).  In addition, while John F. Kennedy used the infamous missile gap as a rallying cry for his 1960 presidential campaign, US military intelligence were aware that the Soviets did not possess as much atomic weaponry as was believed (Dolman 2002).

To stabilize the space environment away from military confrontation the United States took the position that space should only be used for peaceful purposes.  However, by this the

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United States meant nonaggressive. This was in contrast to the Soviet position by which they defined peaceful as nonmilitary (Schauer 1976). Of course the Soviet position was disingenuous in the extreme as they were conducting military activities in space under the cover of scientific pursuits.

And yet the medium of space is so critical because it is largely an extension of the battlespace on Earth. Assets in the medium serve to enable and enhance terrestrial operations significantly. "Basically what a particular service does on the ground, sea, or in the air either requires some space system to do well or can itself be better done in space. Such activities of the three services as mapping, meteorology, communications, surveillance and early warning are pertinent here. The navy and air force can use satellites for navigation and to do mapping operations to improve the targeting of Polaris and Minuteman missiles." (Schauer 1976, 47-48).

It is in view of this reality that the Reagan administration reopened the definition of nonaggressive concerning the uses of the medium of space. The Reagan administration redefined nonaggressive to mean defensive in nature (Johnson-Freese 2009). This was a particularly interesting policy shift as most, if not all, space systems that are deployed primarily for defensive purposes could be dually used for offensive purposes as well. This policy shift was largely determined by the idea that "if the U.S. did not have aerospace supremacy, including superior destructive capacity in space, its freedom to use the aerospace medium would be denied it by the U.S.S.R...Moreover, since the Soviet Union had developed satellite interceptors and (presumably earthbound) fractional orbital bombs while the U.S. had not" the US strategic position was becoming increasingly precarious (Schauer 1976, 48).

The United States attempted to surpass the Soviet Union's military space capabilities by adopting the building block theory. This theory held that the space program should attempt to develop foundational, all purpose capabilities even if the military could not identify how they planned to use them once they were obtained (Schauer 1976). The strategic logic for this theory was derived in large part because of the notion that in the future the Soviet Union could seek to deny American access to the medium. Therefore, in the technological competition between the two superpowers the United States needed to be ready to rapidly develop and deploy its space based assets on short notice (Schauer 1976). It was thought that the building block theory would allow them to achieve this. In this regard, some Americans took comfort in the idea that the Russian way of doing things was not more adept at creating technology, but rather specific capabilities, none of which held the possibility of drastically changing the strategic situation (McDougall 1985).

### Significance

The medium of space has huge strategic significance. In the 21$^{st}$ century the medium could develop into the most significant theater of military operations. John F. Kennedy recognized as much in 1960 when he stated: "Control of space will be decided in the next decade. If the Soviets control space they can control the Earth, as in the past centuries the nations that controlled the seas dominated the continents" (Johnson 1987, 27).

In this regard digital nations have centers of gravity that are critical to their functioning (Gray 1999). Space-based assets constitute the center of gravity of digital nations. Assets such as the Global Positioning System enable the digitization of national economies. One example is

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that the timing signal of the GPS has become ubiquitous for ATM time stamps across digital nations.  Not only does the GPS perform this critical function but it's positioning capacities have become vital for a vast array of other commercial activities as well "ranging from just-in-time logistics, international air and maritime traffic control, and the functioning of cellular telephone networks" (Sheldon 2007).   To state Carl von Clausewitz's (1976) famous dictum:  "one must keep the dominant characteristics of both belligerents in mind.  Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends.  That is the point against which all our energies should be directed" (720).

Hays (2009) has addressed the critical nature of space-based assets as global utilities. According to Hays (2009) the global information grid could not operate effectively without space-based assets.  As such, commercial space activities have come to be seen as global utilities.  The capabilities these assets provide include "communication, environmental, position, image, location, timing, or other vital technical service or data to global users" (Hays 2009, 184). Thus, space-based global utilities have become as important to modern society as water and electricity services (Hays 2009).

Indeed, space-based assets have become increasingly critical to a global economy seeking to perform a vast array of services enabled by satellites.  Perhaps the best example of how dependent the global economy has become on space based assets took place in the 1990s when a stray piece of space debris struck an American satellite causing it to lose control.  The satellite was lost and the major consequence was that ninety percent of the 45 million pagers in the United States failed to operate for over 24 hours (Davis 2006).  This event caused American strategists to realize just how critical space systems had become to their economy.

As such American strategists have sought to build significant redundancy into their satellite constellations at considerable cost. Yet the cost of maintaining this redundancy is well worth it as the vast majority of information that enables the recent revolution in military affairs (RMA) is obtained by and communicated with satellites. While there are other terrestrial means with which to collect intelligence, the nature of the space medium as overlooking the Earth allows for significantly increased, and even better, opportunities compared to other mediums for information gathering activities (Gray 1999). Therefore, Gray (1999) maintains that "if space control is lost, an information-oriented RMA will not work" (251). In this respect, space assets could constitute the critical element of the RMA. If the war goes bad in space then American forces could suffer devastating consequences in the air, at sea, and on the land (Gray 1999).

In order to achieve the greatest strategic effects in war the United States has gone to great lengths to "link its space, air, and ground" platforms into one fully compatible sensing organism (David 2003). This has served to significantly reduce "the friction and fog of war" for American forces (David 2003). With this intelligent, concerted sensing apparatus American forces are able to adjust between theater views and imagery of the local battlespace. This allows warriors to coordinate operations with precision (David 2003).

Yet all of these effects and services could be jeopardized if the United States government does not have the wherewithal to continue to support them at optimum levels. This is precisely why the Obama administration's privatization policy has become so critical. By infusing the private sector with critical resources for research and development (R&D), and then supporting their commercial activities in the medium, the United States government can energize and multiply the effects of finite resources on the national space effort. Already the United States

military purchases most of its communication and imagery needs from private enterprises. Perhaps it could transition more of its other capabilities to the private sector and thereby relieve the pressure on its space budget. This would continue the policy that the Obama administration has in place with NASA.

Scholars have noted a present lack of literature on the Obama administration's privatization policy, and indeed on all of its policy in space. The significance of this work is that it is one of the first to assess the Obama administration's space policy, particularly the privatization aspects. It is an important contribution to the scholarly understanding of how the Obama administration's space policy was made. In order to determine in a more precise fashion how the Obama administration developed its space policy the study used information from the Bush era in the context of a comparative case study between the two administrations. The work focuses mainly on the policy documents presented by the Bush and Obama administrations in 2006 and 2010, particularly the national security aspects of the national space effort and the privatization policies. Then data from interviews with a number of Bush and Obama administration officials were utilized to corroborate the findings. In addition, the work includes internal government releases, news coverage of the policy adjustments, and Congressional testimony from NASA veterans who are critics of the Obama policy.

## Chapter 2:  Literature Review

The mediums of space and the sea have many common characteristics. They are both common zones where forces cannot subsist. Due to their nature they cannot be rendered into national possession. Therefore, many space theorists have used theory from sea power to draw

an analogy between the sea and space to better explain the strategic dynamics of the medium of space. As such, this work draws on sea power theory as well to shed light on the dynamics of space. In addition, as the weaponization of space is probably the most important policy issue for space facing American administrations this work also explores the dynamics of the space weaponization political debate as well.

## Space and the Sea

Since the dawn of the space age the medium of space has become as strategically significant as the sea was during the colonial era. Once again, John F. Kennedy recognized as much in 1960 when he stated "control of space will be decided in the next decade. If the Soviets control space they can control the Earth, as in the past centuries the nations that controlled the seas dominated the continents" (Johnson 1987, 27). There are many similarities between space power and sea power in this regard. Mahan's conception of sea power at the opening of the 18th century during the War of the Spanish Succession is telling of these similarities. Mahan (1918) maintained that applied sea power was silent, resilient, and exhausting. Sea power acts to sever the enemy's lines of supply while defending its own. Sea power maintains war in theaters where it is itself absent, or in merely a supporting role. Then, at critical junctures, sea power delivers devastating blows that often prove decisive to the final outcome of war (Mahan 1918). During the colonial era England's sea power gave her the ability to conduct far flung operations at many points around the globe simultaneously, such as the Philippines, India, Portugal, and Cuba (Mahan 1918). Today, space power enables United States forces to operate on all continents of the globe without a fear of a "serious break in their communications" as well (Mahan 1918, 317).

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In fact, many of the drones that prowl the skies over the Middle East are operated from bases in the United States. During the first Gulf War in 1991 Patriot missile operations were coordinated by bases in the United States.

These conditions mean that a space power such as the United States is necessarily on the border of all countries. Just in the same way that ships of war were often found loitering off the coast of states during the colonial era, today a space power loiters above states. As an example from sea power Mahan noted the relationship between England and Portugal. As England had a powerful naval fleet it was always near to a maritime nation such as Portugal as England was always where her fleet was (Mahan 1918). For this very reason Portugal would not renounce her alliance with England during the 7 Years War after France and Spain had ordered her to. Portugal considered England to be closer and more powerful than Spain. For these reasons Portugal remained in alliance with England throughout the course of the war (Mahan 1918). Similar to the effect that naval fleets had during this prior history, a fleet of space weapons capable of targeting the Earth, such as kinetic-energy weapons, could thwart the ability of other nations to project power. These capabilities are not only within the reach of the United States but are also in reach of Asian nations like China and India (Preston 2002). These dynamics demonstrate the closeness of space powers to all other nations.

The medium of space and the oceans are also strategically similar because of other common characteristics. Like the sea, space is a common zone that can be accessed by any participant with the requisite means. Sir Julian S. Corbett (1972) maintained that sea cannot be conquered because its nature as a common zone does not make it conducive to ownership, with the exception of territorial waters. The sea cannot be reduced into possession because neutrals

can always enter it at any time. This is unlike what happens with conquered land where neutrals can be excluded. Another reason why the sea is not susceptible to ownership is because armed forces cannot subsist upon it (Corbett 1972). The dynamics of the medium of space are exactly the same as those Corbett attributed to the sea. Similar to the sea, command of space consists in the control of celestial lines of communication (CLOC) for both civil and military purposes. Thus, as in the sea, the object of the action in space is most importantly the control of communications, rather than the control of territory as in land warfare. It is true that land warfare is largely "a question of communications, but" these pertain to "the army alone, and not" the overall communications of the nation (Corbett 1972, 90). "Key to understanding Corbett's thinking is that command of the sea actually only exists in a state of war. For if one claims command of the sea during times of peace, it is done rhetorically and only means one state has adequate naval positions and a sizable fleet to secure command once hostilities are commenced" (Klein 2006, 24). It is precisely these dynamics that necessarily preclude any would be effort to attempt to bar participants from the medium of space during times of peace. In the past, certain strategic circles in the United States have actually considered the proposition of blocking other space participants' access to space and using this capability as leverage in broader geo-political negotiations. Corbett's logic concerning a similar consideration at sea is incisive in this regard. Corbett (1972) maintained that attempting to create such a preponderance of naval strength, and in turn a strategical situation that made trade on the sea invulnerable, would be economically ruinous. It would make it nearly impossible to provide adequate cover for all assets throughout the theater of operations. What is more, the act of seeking this position of despotism on the sea, even if it were possible, would lead every nation to rise up against it. All of these challenges would be facing such a

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power while its goal would still be distant (Corbett 1972). These dynamics are the same for the medium of space.

**Building Space Power**

While a tyrannical posture in space would be strategically ruinous, it nevertheless remains imperative that United States forces have the best training and morale possible when they engage in the medium. Indeed, when strategies for war go awry in battle, and everything collapses around the fighting force, the training that warfighters have is the best chance for overcoming the foe (Leonhard 1998). Sea power, again, provides a good example of this dynamic. Mahan's (1918) account of the contest in the Indian Ocean during the Seven Years War is a good illustration. In the running battles on the sea between a French squadron and an English squadron the training of the English under officers proved decisive. The French captain, Suffren, was the better captain. He was more sagacious, energetic, tenacious, and was clearly the better seaman. Hughes, the English captain, possessed all of the technical skills necessary to handle a ship, but did not possess any of the qualities necessary for a general officer (Mahan 1918). However, the seamanship of the English under officers was far superior than those of the French. The French ships were considerably worse handled. Suffren would claim that at least three times the English ships avoided catastrophe by the superior quality of the junior officers (Mahan 1918). Similarly, the quality of under officers of space forces will have as decisive of an impact in contests in space.

Further along these lines the quality of technology is incredibly important for space forces. The nature of the space medium as an expansive, inhospitable theater where most, if not

all, operations are conducted remotely with advanced technology necessarily means that space forces are totally dependent on this technology to execute their operations. Therefore, if something goes wrong with the technology then all could be lost. Gray (1999) maintains that "enthusiastic amateurs die in short order" (234) under these conditions.

However, there is some question as to how effective a centralized focus can be over the long term on improving the technological aptitude of a nation in space. Another example from sea power is telling in this regard. During Cardinal Richelieu's tenure in French leadership France pursued a centralized ship-building effort. This effort, however, did not take hold at the roots of French society (Mahan 1918). Consequently, when the favor of the central state was withdrawn, the French effort at sea also withered (Mahan 1918). All of the tremendous growth that the French shipping industry experienced due to the favor of the central government completely came apart when this favor was withdrawn. "Time was not allowed for its roots to strike down deep into the life of the nation" (Mahan 1918, 73). It seemed that for a time Richelieu's policies would lead to French greatness on the sea in complement to its superiority on the land.

Perhaps a good example of an overly centralized space program was that of the Soviet Union. The entire space effort in the Soviet Union was directed from a central planning body. In contrast, the United States space program emphasized the advances that private sector space actors could make in addition to the central efforts of NASA and the military. This necessarily meant that the foundations of the technological aptitude in the United States were stronger than those in the Soviet Union. This would have profound ramifications in the space competition between the two.

This dynamic was apparent at the beginning of the space age. Because of their overly centralized space planning body the Soviet effort was technologically stunted and they were not prepared to capitalize on their initial space technologies. Their investments in the early years yielded sparse and narrow technological returns. Sputnik was basically a tape-recorder in orbit. All it did was beep for 21 days (Johnson 1987). In contrast, an early American asset, Explorer I, discovered the Van Allen radiation belts. Another early American asset, Vanguard I, provided important data for the shape of our planet over the course of six years (Johnson 1987). And while these developments were proceeding apace, none of the missions that the Soviets launched between 1959-1961 consisted of any applications research. Instead, the Soviet leader Kruschev lambasted the United States while wasting Soviet resources on glorified publicity stunts in space (Johnson 1987).

As an overly centralized space program the Soviet space program was stunted because it did not allow information from scientific breakthroughs to develop adequately by allowing the seamless diffusion of knowledge throughout its aerospace effort. The overly centralized Soviet space program with its neurotic need for excessive secrecy necessarily curtailed effective communications between the broad array of scientists and technicians working on spacecraft. The research process can be characterized as an interaction between people and groups. Often people or teams build on the work previously done by others. By centralizing their space program excessively and placing too much emphasis on secrecy the Soviets stunted effective communication between the broad array of scientists and technicians in their society who could contribute to the national space effort.

The high technological aptitude of the American space effort which was solid at the roots

of American society would have profound ramifications for the military aspects of space as well.

One example of this is the electronic intelligence that American space assets are able to gather.

One of the most vital aspects of American capabilities "is the ability to detect" enemy activity

through the manipulation of the electromagnetic spectrum (Leonhard 1998, 17).  Johnson (1987)

illustrates how this has helps determine enemy orders of battle:

> "A kindred class of satellites monitor the Earth, not in the optical portion of the
> electromagnetic spectrum but through the radio and radar atmospheric windows.  These
> electronic intelligence (elint) gathering satellites listen patiently to the radio and radar
> emissions of ground, air and sea emitters.  For example, the detection and location of
> emissions of the search and tracking radars of mobile air defense units provide valuable
> assistance to the planning of tactical air strikes.  Likewise, the interception of
> communications may disclose not only the contents of the messages, but also the
> locations and identities of the communicators.  Together these types of information
> permit the construction of an electronic order of battle (EOB) which would influence the
> conduct of an engagement" (60).

 Furthermore:

> "Data received from elint satellites would add another dimension to the battlefield
> picture.  The movement of radio and radar sites would permit an electronic order of battle
> which could then be compared with photographic intelligence.  For example, the
> relocation of command posts and electronic jammers might foreshadow a weakness along
> the forward edge of battle or a redirection and new push elsewhere along the front.  The
> interception of enemy communications might yield valuable intelligence data" (Johnson
> 1987, 207).

Because of these capabilities United States forces are "able to develop high rates of

change in battle that cannot be outpaced, while sharply narrowing the strategic choices of the

enemy" (Cebrowski and Barnett).  Due to these capabilities, the US is now able to "emphasize

precision firepower, special forces, psychological operations, and jointness—as opposed to the

purported traditional dependence on overwhelming force, mass, and concentration—and the

resultant qualities of speed, maneuver, flexibility, and surprise"  (Echevarria 2004, 8).

## The Dynamics of Military Space

The first Persian Gulf War was a manifestation of the power of space-based assets. Space-based assets for command, control, communications, and intelligence (C3I) made possible tremendous "quality and quantity of information" which proved decisive to the successful operations of that war (Lambakis 2001, 116). The United States "structured its campaign around the free flow of information at the tactical, operational, and strategic levels" and obtained an invaluable advantage which led to the utter annihilation of Iraqi forces (Lambakis 2001, 116). The famous flanking maneuver of the United States through the desert was made possible by the GPS. This movement only strengthened the position of the United States that it must control space at all costs (Johnson-Freese 2009).

This makes the prospect of an attack on space-based assets all the more disconcerting for the United States. However, the scope of the attack is increasingly important as Lambakis (2001) points out:

> "Attacks on space systems are only meaningful to the defense planner if they undermine the satellite mission. Pinpricks by the enemy, the loss of a satellite here and there, may be inconsequential to the course of a military campaign if the overall function of the satellite system remains intact. These same attacks, however, despite being operationally negligible, could have a profound effect at the levels of policy and strategy by negatively impacting public perceptions in the United States or diverting the attention of commanders. The loss of a few satellites during hostilities will not mean that the war is lost, although history does show that little events have a way of producing big surprises. The loss of a single spacecraft providing timely photographs or positional data during a critical maneuver could profoundly affect operational and tactical developments on land" (116-117).

Thus, even a small attack on a US satellite constellation could be meaningful. At the very least it could provide a symbolic victory to an inferior foe or a terrorist who acquired the means to

access space.  Therefore, if it can be determined that an attack directed toward an American

satellite or command and control facility could give a foe a military or political victory, that the

technical capacity for such an attack exists, and that these means are within the financial reach of

foreign entities, then the United States should definitely study the problem and take the requisite

countermeasures necessary for fending off such an attack (Lambakis 2001).

But before countermeasures can be adequately deployed, it is necessary for policymakers

to properly define them.   And yet thus far administrations have had difficulty defining space

weapons.  Consequently, it has been difficult to proceed with a coherent strategy governing their

deployment.  This has added even more complexity to the process of defending space as the

argument that has been made by those who advocate for space weapons is that they cannot be

limited, prohibited, or regulated until they are defined (Johnson-Freese 2009).  But without a

definition it is difficult to produce doctrines to guide their use.  Many have given up trying to

define them because almost any asset in space could be employed as a weapon—satellites can

collide with each other, the shuttle or Soyuz can capture assets, and space powers can create

debris to foul orbits (Moltz 2008).  Nevertheless, there still have been some attempts to define

them.  Johnson-Freese (2009) has categorized them into three types:

> "The narrowest definitions hold that space weapons are those systems in which the
> destructive component resides in orbit.  A slightly broader category includes both
> terrestrial and space-based systems directed at space-based and terrestrial targets.  The
> broadest category includes fundamentally all space systems:  any dual-use capability,
> including sensors and propulsion contributing to space-weapons capabilities, systems
> contributing to force enhancement such as the GPS and communications satellites, and
> systems passing through space, such as ICBMs or even the Space Shuttle" (80).

Without a doubt the Soviet Union developed what was clearly a space weapon by the 1970s.

The Soviets had developed a co-orbiting ASAT that was designed to rendezvous with another

satellite in orbit and destroy it by shooting shrapnel at it as they approached. This was once considered the main threat to US satellites (Lambakis 2001). Such a threat necessitated that the United States develop doctrines to guide their efforts in space.

An early and all-encompassing doctrine of the United States was the building block theory. This theory maintained that basic capabilities for a range of uses should be created even if the military had no idea how they would be used once they were developed (Schauer 1976). This theory gained currency due to the belief that the Soviet Union would attempt to dominate space and stop the United States from utilizing it with antisatellite systems. This theory led the United States into a technological competition with the Soviets that necessitated that the United States quickly develop space capabilities as a hedge against what the Soviets might do (Schauer 1976).

After the Cold War was over the United States produced a new doctrine in 1996. The Air Force Space Operations Doctrine was a new approach. The main tenets of the doctrine were space support, force enhancement, space control, and force application. "Space support is carried out by terrestrial elements of military space forces to sustain, surge, and reconstitute elements of a military space system or capability. These activities deploy, sustain, or augment on-orbit spacecraft, direct missions, and support other government or civil organizations. Space support involves spacelift and satellite operations" (Johnson-Freese 2009, 51). "Force enhancement refers to operations conducted from space with the objective of enabling or supporting terrestrial forces such as navigation, communications, and reconnaissance" (Johnson-Freese 2009, 51). "Space control is stated as the means by which we gain and maintain space

superiority to assure friendly forces can use the space environment while denying its use to the enemy" (Johnson-Freese 2009, 52). "Force application consists of attacks against terrestrial targets carried out by military weapons systems in space…currently there are no force application assets operating in space, but technology and national policy could change so that force application missions can be performed from platforms operating in space" (Johnson-Freese 2009, 51). Collectively, these doctrines would guide the use of American space capabilities in the early 21$^{st}$ century.

**Weapons**

Perhaps the earliest American military space capabilities were acquired as part of the civilian space program run by NASA. The Gemini astronauts brought infrared equipment with them into space to gauge "the radiations given off by rockets" (Schauer 1976, 52). It is very likely that the Russians engaged in similar activities early on in their space program as well (Schauer 1976). As the years progressed there would continue to be overlap between the military and civilian American space programs. Many of the technologies were dual use, and many of the technical issues were similar. One example of this was that at one point 85 percent of NASA's work was with the military (Schauer 1976). The Skylab mission began as a concept for an orbital bomber before emerging as the Manned Orbiting Laboratory (MOL) and eventually developing into Skylab. This whole process was administered by NASA but included experiments of a military nature (Schauer 1976). In addition, the military has operated various enabling assets in the early stages of its space program such as "communication, command and

control, weather, navigation, geodesy, and ferret missions which probe the radar and communications systems of other countries" (Schauer 1976, 57).

Weapons, however, are an entirely different prospect than the capabilities emanating from the civilian space program. In this regard, the United States proliferated its first overtly ASAT weapon in 1985. It was launched from an F-15 and ascended directly to its target in space. Air or ground launched ASATS do not need to be overly sophisticated to hit enemy systems in low Earth orbit (LEO). These weapons, which use kinetic force to destroy space targets, can be very effective. Unlike beam weapons, they employ solid mass to hit targets. Explosives are unneeded (Lambakis 2001). "A rocket could be launched from anywhere on the globe off any platform, including the deck of a ship directly under the orbital path of the target, making these ASAT systems much more operationally flexible and potentially more survivable than co-orbital interceptors" (Lambakis 2001, 122)

Another type of kinetic kill space weapon is one that originates in space and targets the Earth. Also known as the "Rods from God" this weapon uses ultra-high velocities from its descent to the Earth to strike targets on the ground. There are questions about their financial viability as "scientists point out that it would cost fifty to one hundred times as much as a similar attack from the ground" (Johnson-Freese 2009, 89).

Perhaps the most devastating space weapon would be that of a nuclear warhead delivered on a ballistic missile to detonate in space. The blasts from such an attack could easily destroy space assets or degrade satellite operations (Lambakis 2001). Many military strategists currently believe the prospect of detonating a nuclear weapon in space is the most probable way a foe might carry out an asymmetric attack against American forces (Lambakis 2001). The only way

to defend against such a possibility is to harden the circuitry of satellites to protect them from the electromagnetic pulse and radiation. "Military and commercial architectures are likely robust enough to ensure survival of some satellites for intelligence, warning, communications, navigation, meteorological, Earth observation, and communications purposes following a high-altitude nuclear burst" (Lambakis 2001, 123).

The Soviets had developed a variety of means for targeting the United States with nuclear weapons that either transited or resided in space. The SS-9 booster was used by the Soviets to test their fractional orbital bombardment system (FOBS) (Schauer 1976). The Soviets had plans for orbital bombardment systems as well. Schauer (1976) describes the characteristics of FOBS:

> "It is worth noting some of the characteristics of orbital and fractional orbital weapons, since one of the superpowers has chosen to develop them and the other has not. First, compared to conventional ICBMs, FOBS cut radar warning time from about fifteen to five or six minutes, although the difference in warning time obtained from satellites like MIDAS would be less. FOBS may be fired in trajectories that do not pass through early warning radars, which both countries deploy extensively only on their northern frontiers. Because an FOBS might be indistinguishable from an ordinary satellite until it deorbited and because of its low trajectory and warning-time advantage, countermeasures such as dispersal, alert and interception would all be too late or more difficult" (61).

By creating FOBS the Soviets tried to get the United States to create a costly system to defend against them (Schauer 1976).

Lasers are a space weapon that have yet to be deployed, but could be decisive in a battle for space. "Lasers are coherent beams of electromagnetic radiation" Lambakis 2001, 124). A laser can render a satellite inoperable by overheating it, by dazzling critical sensors, or by slicing through the surface of the asset. Ground-based lasers are a dangerous threat to assets in LEO, but they are hampered by the effects of the atmosphere. Heavy cloud cover alone could compromise the effectiveness of ground-based lasers (Lambakis 2001).

Particle beam weapons are another form of directed energy that could have decisive military applications. "Particle beam weapons consist of large accelerators that propel charged or neutral particles at great speeds toward their target. Unlike a laser, a particle beam could immediately penetrate the surface of a satellite and disable its internal components through heat and radiation damage" (Lambakis 2001, 124).

One type of space weapon which has already been deployed is microsatellites. There is some confusion as to whether microsatellites could be construed as weapons, but they have the potential for offensive actions. The Air Force launched microsatellites in 2003 and 2005 known as XSS satellites. These satellites are between ten and five hundred kilograms in weight and were therefore easier to develop and orbit (Johnson-Freese 2009). They were tasked with carrying out proximity operations in LEO, which meant they were to encircle other satellites. "Ostensibly, the satellites are a step toward developing the capability to refuel, resupply, repair, and reposition satellites from space…But in addition, USAF budget documents show that the XSS program is related to P 0603605F Advanced Weapons Technology, which is dedicated to research on laser and microwave weapons. Thus, the XSS program could evolve into a space-based kinetic-energy and/or a directed-energy ASAT program" (Johnson-Freese 2009, 91).

Another class of satellite tasked with escorting US assets in space is the Automated Navigation and Guidance Experiment in Local Space, or ANGELS. The Air Force promulgated this program in 2005. These satellites were to weigh between one and ten kilograms, as such they were considered nanosatellites (Johnson-Freese 2009). Originally these nanosatellites were to accompany larger satellites and watch for nefarious activity that could arise from parasitic satellites of other space powers. However, in late 2007, the Air Force significantly altered the

program.  The Air Force opted for a new way forward for the ANGELS—no longer would they

escort other assets, instead they would be deployed to improve space situational awareness

(SSA) (Johnson-Freese 2009).

Perhaps the most conventional space weapon is that of the space bomber.  Concepts for

space bombers have been around since the dawn of the space age, but recently the United States

Air Force has pursued designs for a new platform.  Whereas the old concepts call for a manned

platform, the new concept pursued by the Air Force is unmanned.  This concept is known as the

Common Aero Vehicle (CAV).  It is considered for potential engagements in the medium and for

lightning missions to deliver munitions from space to the Earth (Moltz 2008).

But however successful or unsuccessful the operations of space weapons in orbit maybe,

the medium is also subject to attack by striking critical nodes in their command and control

systems on Earth.  Conventional weapons delivered from other mediums, such as the sea or air,

or Special Forces could be deployed to degrade space capabilities on the ground.  The locations

of space command, control, and launch facilities are easy to find.  If an attack can successfully

disrupt the operations of these facilities then the attacker could thwart enemy activity in space.

(Lambakis 2001).  While many of these space weapons systems would possess artificial

intelligence enabling autonomous command and control, if terrestrial forces are nevertheless able

to successfully knock offline the command and control sites on Earth that ultimately operate

these weapons systems, then the conflict in space will most likely come to a close sooner rather

than later.

The proliferation of space weapons is bound to have hugely significant geo-strategic

ramifications.  The leadership of many countries may deem that the destruction of the American

advantage in space is a necessity in the pursuit of their broader geo-strategic objectives. If this

rationale took hold in these countries then they may be beyond deterrence (Lambakis 2001). If

this is so, many countries may initially opt for soft-kill capabilities, even if they would ultimately

like to have hard-kill capabilities. The soft-kill alternative would consist largely of electronic

warfare (EW)—attacking the links between ground facilities and satellites (Lambakis 2001).

Unless satellites have the necessary countermeasures, EW could easily knock unprotected assets

offline. Furthermore, EW capabilities are more easily obtainable because they require more

simple technologies. "Indeed, one can counter U.S. GPS navigation satellites with a simple one-

watt jammer" (Lambakis 2001, 126).

Countries with the technical and financial means, however, may pursue the hard kill

alternative. China has done as much. China's test of a direct ascent ASAT in January 2007

altered the strategic dynamics of the Asia-Pacific region considerably. Going forward the United

States must consider the possibility of having its space assets knocked offline in the event of a

regional conflict. But China's test had other ramifications beyond the dynamics of a potential

conflict. "This test threatened a more crowded space environment by adding a significant

amount of new debris—almost 10% to the amount of trackable objects" (Moltz 2008, 261).

What is more, by violating an understood global norm of refraining from destructive testing in

space, the Chinese action may lead to a string of testing by other powers such as the United

States and India. Thus in 2007, "as space activity completed its first fifty years" it became

possible that the direction of "space security would eventually move" into "a new era of space

nationalism, replete with space-based offensive and defensive weapons" (Moltz 2008, 261).

**The Controversy of Space Weapons**

Space weapons offer many advantages to space powers who would possess them. One of which is the capability of striking fleeting targets on short notice. However, despite these advantages space weapons are incredibly controversial. Consider an excerpt from Johnson-Freese (2009):

> "At any given moment, does the Air Force dominate the airspace over Argentina? Or South Africa? Or most other countries? No. Could it attain dominance of the airspace in those locations? Yes, given the time to deploy. But it would only sustain that dominance for as long as needed to support an operation. So their dominance would have limited geographic scope and limited duration. Space dominance, on the other hand, if it is to be effective in the ways its proponents hope (for example, in the ways air dominance is effective in a theater of operations), must be unlimited in scope and duration. It must cover the entire globe, all the time. And hegemonists wonder why this makes foreigners nervous? It sounds like an orbital Iron Curtain" (68).

Although certain space weapons have already been developed, their effect on the level of space security is determined by both technical and political factors. In regard to the technical aspects, strategic considerations must account for the amount of space weapons, what actors possess them, their readiness, whether they are in space or on the ground, and if there are sufficient techniques for overcoming them in an attack. In regard to the political aspects, space security is determined by the effectiveness of treaties and international norms intended to ban or limit these weapons (Moltz 2008).

And yet many questions arise concerning the viability of space weapons and the constellations necessary to provide adequate coverage. Some of these questions are definitely pertinent for a weapons system deployed with the intention of striking targets on the Earth with kinetic force. To strike Earth with the requisite quickness, speed would be a necessity so it is likely that such an asset would be deployed in LEO. But in LEO a constellation would be

necessary due to the fact that the satellites would orbit at intervals around the Earth. And if the system was required to attack targets on short notice anywhere on Earth then as much as 100 satellites may be necessary (Johnson-Freese 2009). It would be incredibly difficult to test such a system. But then the system would remain in disuse until it was tasked with this incredibly quick mission. Given these circumstances, there is a chance it may not work properly due to kinks in the system. Missile defenses from space would also suffer from the same problems (Johnson-Freese 2009). These defenses ostensibly would be deployed to intercept intercontinental ballistic missiles (ICBM) in their boost phase. However, powers that can launch these missiles can also strike assets in LEO. This dynamic makes missile defenses in LEO extremely vulnerable. And if the opposing power can successfully knock offline one of the interceptors then this would create a gap in the system through which an ICBM could be launched (Johnson-Freese 2009).

Furthermore, many scientists have come out publicly doubting how efficacious boost phase missile defenses can be. In 2003 the American Physical Society produced a detailed technical report analyzing the capabilities that the United States already has in existence and what is needed to make the system effective. It determined that the defenses the United States intended to develop in conjunction with existing systems were unlikely to successfully intercept ICBMs. What is more the Airborne Laser was experiencing significant difficulties with its ability to gauge the range of ICBMs and reload the laser (Moltz 2008). In addition, the enormous cost of the space-based components was prohibitive of the whole enterprise. The authors concluded by maintaining that a comprehensive boost phase missile defense system could not be obtained in the next 10 years (Moltz 2008).

It was in this context that Krepon, of the Henry L. Stimson Center, denounced any would be effort by the United States to move toward the weaponization of space. According to Krepon "the repercussions will include new international competition to put weapons in space, further strains in alliance relations, closer strategic cooperation between Russia and China, deeper partisan division at home, weakened nonproliferation treaties, and ironically, greater difficulties in developing…missile defense. Because of the threat of asymmetrical warfare, space dominance would be very hard to achieve and would have many adverse effects" (Moltz 2008, 264).

These dynamics would be unfortunate for the United States strategically as the national security apparatus finds satellites to be a necessity in the many tasks they must undertake, both critical and mundane. As has been discussed, potential enemies of the United States would perceive these assets as instrumental to the functioning of the nation. It can therefore be surmised that they may attack them if they believe that by doing so they can win an important or even symbolic victory. This leaves the United States in a quandary due to the controversy of weapons to defend assets and the technical drawbacks to their establishment. In this regard many strategic thinkers have proposed keep out zones to influence the behavior of actors in space. Lambakis (2001) maintains that "policy and strategy must support a no-holds-barred deterrence posture, within which such things as keep-out zones around critical space assets may play a key role" (134). Lambakis (2001) goes further and suggests that the United States establish rules of the road in international negotiations to avert conflicts in space. According to Lambakis (2001) "one approach for providing a measure of protection for space assets might be to establish a rule and create, either by negotiation or unilaterally, exclusion, self-defense, or

keep out zones around designated must have satellites.  Such zones, which may involve

establishing a circumferential distance around all sides of a satellite, may be more easily

monitored in GEO, where the space around a satellite can be more readily defined in relation to

Earth" (134-135).

Krepon has also advocated for the United States to establish rules of the road in space to

prevent conflicts.  Krepon foresees this as a first step before more formal controls can be placed

on space weapons.  This approach has received significant attention at the Pentagon and more

broadly in Washington.  Krepon's proposal is modeled after the U.S.-Soviet Incidents at Sea

accord.  This proposal calls on states participating in space to "register their spacecraft promptly,

undertake actions to avoid dangerous maneuvers that might lead to collisions in space, and

refrain from close approaches or simulated attacks on satellites (including remotely with lasers)"

(Moltz 2008, 280).

One of the main reasons why the Pentagon has shifted closer to these approaches as

opposed to deploying weapons to defend space assets was the realization that if the Air Force

tests, deploys, and uses space weapons they will create massive amounts of space debris, which

could be more dangerous than confronting enemies in space by other means (Moltz 2008).  As

the United States has already achieved global supremacy in the air, at sea, and on the land, and as

this supremacy was due in large measure to the enabling effects that space systems have, the

United States has opted to continue utilizing space "in a support and force enhancement role"

(Moltz 2008, 316).  As the space systems that enable terrestrial weapons platforms have had a

revolutionary effect on warfare, the United States has chosen not to jeopardize these advantages

by pursuing weapons in space. Thus, the United States has determined that it could be better to address vulnerabilities in space through terrestrial means (Moltz 2008).

## Moving Forward

The dynamics of the medium of space are incredibly complex. Weaponizing space would have definite advantages and yet there are certain disadvantages inherent in this process. Dolman (2012) lays out the dilemma:

> "If space is a military domain, then it should follow the same logic. A state that relies on military support from space—the effects it achieves from having assets in space—must plan to gain at least limited or temporary control of space in times of conflict. And control is possible only from within the domain. If the state is unwilling to put weapons into space, then it cannot hope to ensure effects from space when another state attempts to contest its position. Its logical recourse is to wean itself quickly from space support, enhancement, and enablement, and move to a pre-space military force structure. It must then stop wasting procurement money, production, and personnel on military space. If the military might be forced to fight without assured space support, then it should train to do so. The most efficient military in a space-denied environment will be the one that does not require the use of space at all" (88).

And yet the thought of the United States weaning itself off of the capabilities that space-based assets afford is unthinkable. The United States would give up the decisive military advantages that it currently possesses. Gone would be the precision movement enabled by the GPS that led to the decisive flanking movement through the desert in the First Gulf War. Gone would be the precision strike capabilities that the United States uses to degrade enemy war infrastructures so thoroughly. Gone would be the all of the C3I capabilities that link the services so smoothly and effectively allow for seamless joint operations. However, if a space power such as China can contest the medium and jeopardize US assets then the United States must consider countermeasures as Dolman would assert. The question then becomes how to manage the

creation of countermeasures without incurring all of the political and military disadvantages that these could lead to.

Perhaps the United States would do well to study the influence of sea power in this regard. As has been discussed the sea is a domain that has similar attributes to space. Like the sea, space is a common zone. Like the sea, the inherent value of space is its nature as a medium by which economic information is communicated. Therefore, the United States would do well to observe the nature of the medium and understand why it is so important when crafting its strategies to safeguard its critical assets with countermeasures. Thus, the United States would be wise to first strike down space roots deep into the foundation of its society. By striking down roots the United States would necessarily improve the aptitude for space pursuits throughout the nation. By doing so, the United States can proceed in space with the most competent forces and the best equipment possible. This scenario would allow the United States to mitigate much of the problems that may arise by placing weapons into space.

Indeed, despite all the drawbacks to space weapons it is likely to be historically inevitable that they will eventually be proliferated. China worked on its direct ascent ASAT weapon for many years behind closed doors before they finally tested it. It is probable that the Chinese are secretly working on even more advanced space weaponry, such as that which would be based in the domain, that it will use to contest the medium and neutralize the advantages that the United States possesses. If the United States is to be ready for this rising challenge it too must pursue its own set of weapons while taking special note of the past.

**The Bush and Obama Policies**

On June 28, 2010 the Obama administration released a new policy to guide the national space efforts of the United States (Obama 2010). The policy is important for the "change in tone" from the one released by the Bush administration in 2006 (Smith 2011, 20). "The Bush space policy was criticized for its nationalistic attitude, some even called it belligerent" (Smith 2011, 20). The Bush policy sought to express the notion that the United States possessed significant strategic advantages in space that it did not plan to forego. What is more, while the Bush policy did not completely eschew international cooperation, it made it known that the United States did not need the assistance of any other states in the medium (Smith 2011).

However, while the tone of the two policies was quite different, which was reflected in the manner that each of the administrations were conducting their affairs, the core principles of each of the documents, although phrased differently, were largely similar (Keuter 2010). This was in keeping with the way the Bush administration's 2006 policy continued "the core principles of the 1996 Clinton policy" (Keuter 2010, 1). As such, there has largely been continuity in the main principles guiding the American national space effort over the various administrations.

Nevertheless, "the Obama policy appears to emphasize international cooperation and highlights the goal of US space leadership more than past policies" (Kueter 2010, 1). This was largely due to the economic conditions prevailing at the time, including the onset of a major recession. The financial crisis of 2008, of which many states have still not fully recovered, "brought the realization that, to achieve great things in space, the US government would need more partnerships, with other countries and with the private sector. Thus, the new Obama policy shifts its tone towards building a global sense of responsibility for sustaining the space

environment so all can use it, and for partnerships in using and exploring space" (Smith 2011, 20).

According to Smith (2011) the key to the Obama administration's policy, and all of the new things it emphasizes, is the way in which it was implemented. For this it was important that the Obama administration cultivate relationships with the major space faring states in order to emphasize activities that will lead to more sustainable conditions in the medium. To achieve this the Obama administration was more willing to talk with and listen to the international community than the Bush administration (Smith 2011). In this regard, the Obama administration knew full well that the implementation of its policy would take place on an international basis (Smith 2011). This was especially true of international activities such as the construction of the international space station (ISS) and efforts to mitigate space debris.

Yet still, "it is important to note, however, that the USA did not break with past policy that allows the country—in the words of the Obama policy—to 'deter, defend against, and if necessary, defeat' anyone who tries to interfere with US space systems. In fact, there is much in the Obama policy vis à vis national security space that is similar to what is found in past policies. It is really the tone that is different" (Smith 2011, 21). With excerpts from both policies Smith (2011) highlights the comparison.

> Consider an excerpt from the Bush policy document. The Bush policy said:
>
> "The United States considers space systems to have the right of passage through, and operations in space, without interference. Consistent with this principle, the United States will view purposeful interference with its space systems as an infringement on its rights" (Bush 2006).

As it happens the Obama policy basically states the same thing but only in a more inclusive fashion:

"The United States considers the space systems of all nations to have the right of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights" (Obama 2010).

Further along these lines, the Bush and Obama policies are quite similar when it comes to defending space assets. The Bush policy said:

"The United States considers space capabilities vital to its national interests. Consistent with this policy, the United States will: preserve its rights, capabilities, and freedom of action in space; dissuade or deter others from either impeding those rights or developing capabilities intended to do so; take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to US interests" (Bush 2006).

The Obama policy says:

"The United States will consistent with the inherent right of self defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them" (Obama 2010).

It states further that "the Secretary of Defense shall:

Develop capabilities, plans and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack US or allied space systems" (Obama 2010).

But while the security operations of the two policies were similar, the Obama administration showed a greater penchant for arms control. This was in stark contrast to what was perceived as a more hardline stance by the Bush administration, which thought that any notion of arms control would inhibit its freedom of action in the medium. In this regard the Obama policy says:

"The United States will pursue bilateral and multilateral transparency and confidence building measures to encourage responsible actions in, and the peaceful use of, space. The United States will consider proposals and concepts for arms control measures if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies" (Obama 2010).

As such, with the exception of arms control, there is largely continuity when it comes to

the national security policies of the Bush and Obama administrations in the medium.  This was

also the case when it came to the privatization of the civil space effort.  The Bush policy stated:

> "The United States is committed to encouraging and facilitating a growing and
> entrepreneurial US commercial space sector.  Toward that end, the United States
> Government will use US commercial space capabilities to the maximum practical extent,
> consistent with national security" (Bush 2006).

The Obama administration furthered this policy when on 1 February 2010 it announced "as part

of its 2011 budget request" that it would "rely on the private sector" to transport crew and cargo

to low Earth orbit (LEO) rather than undertaking to develop a NASA vehicle to perform these

transportation services (Smith 2011, 22).  The NASA vehicle was to be a variant of Constellation

for LEO travel.  Under this new policy the federal government would provide "$6 billion over 5

years" to private operators to develop spacecraft for LEO travel (Smith 2011, 22).  Once the

private sector spacecraft were ready the government would then purchase space on them for

astronauts and supplies.  It is important to note that the government funds were not intended to

pay for the full cost of the private spacecraft.  It was only meant to boost their R&D efforts.  The

private operators would then make profits by ferrying crew and cargo to the ISS as well as to

additional infrastructure in LEO that was being developed elsewhere by the private sector.  It

was thought that this arrangement would allow NASA to devote more resources to human

spaceflight and scientific efforts in deeper space, such as a mission to an asteroid by 2025 (Smith

2011).

In order to determine the future course of the national space program the Obama

administration turned to Norman Augustine, a former executive of Lockheed Martin and a

veteran of the aerospace industry.  Augustine formed a committee to assess the future of the

human spaceflight program that NASA had been planning since the second Bush administration. In an early report produced in September 2009 the committee found that NASA's plans for human spaceflight were unsustainable due to insufficient levels of funding (Logsdon 2010). Higher levels of funding would be required if the necessary technologies were to be developed in time to allow for the proposed human missions to be conducted according to the Bush administration's timelines. The final report, produced in October 2009, advised that NASA's levels of funding be significantly increased, that there should be additional budget allocations for human spaceflight capabilities, that the life of the International Space Station be increased until 2020, that it would be technically possible for industry to play an increased role in space transportation, and outlined a number of possibilities for NASA to conduct manned missions into deeper space (Logsdon 2010).

Specifically, the Augustine Commission maintained that a $3 billion increase to the budgeted funds for Constellation would be necessary to make a return trip to the moon possible (Washington Post Editorial 2010). Facing these difficult budget realities it would be necessary for the Obama administration to make a strategic change to NASA's plans. Augustine had found that with projected budgets NASA would be unlikely to mount a moon mission until 2028 and even then would still lack lunar landing equipment (Achenbach 2010).

Therefore, "working urgently and with a high level of secrecy because they realized that, if planning for a dramatic shift in strategy became known, there would be an immediate critical reaction, during January 2010 a small group of people from the Office of Management and Budget, Office of Science and Technology Policy, National Security Council, and some immediate presidential advisers, plus some of NASA's political leadership, crafted the basic

features of a new approach to human spaceflight…There was also agreement to jump start an

industry-government partnership in carrying crews to orbit with a multi-billion dollar investment

in fostering that partnership" (Logsdon 2010, 17).

However, these dealings did not sit well with NASA veterans, including Neil Armstrong.

"In a rare public appearance, Armstrong questioned Obama's motives by stating: 'A plan that

was invisible to so many was likely contrived by a very small group in secret who persuaded the

president that this was a unique opportunity to put his stamp on a new and innovative program.  I

believe the president was poorly advised'" (O'Keefe and Kaufman 2010, A02).

Nevertheless, in June 2010 the Obama administration moved forward with a new agenda

for space that included the cancellation of Constellation, a new international stance on arms

control favoring increased cooperation between nations, and a new role for the private sector in

human spaceflight.  The new role for the private sector was a logical step for the administration

as private contractors had been supplying capabilities for the national space effort since its

inception.  Having contractors then conduct the missions themselves with NASA serving in a

regulatory capacity was a natural evolution (Washington Post Editorial 2010).

Regardless, the new Obama policy was the object of a series of blistering attacks from

Congressmen and women whose constituencies would be adversely impacted by the policy

change.  Many of these districts had businesses that stood to suffer significant financial losses

when their contracts were canceled with the demise of Constellation (Logsdon 2010).  This

dynamic would result in considerable job losses.  Additionally, more and more spaceflight

veterans, including from the Apollo program, publicly voiced their objections to the policy.

"The criticisms focused on the viability of relying on the private sector for crew transport to the

ISS and the lack of specific goals and schedules for deep space exploration missions" (Logsdon 2010, 15).

The Gulf Coast was the region that stood to lose the most from the cancellation of Constellation, which is why representatives from this region were the most vocal in their criticism. Most of NASA's contractors are based in the South and thousands of jobs would be lost in this region as a result of the new policy. The development of Constellation was intended to replace many of the jobs that were to be lost as the shuttle was retired (Kaufman 2010). However, these representatives did not appreciate the tremendous economic benefits that the nation stood to reap with the encouragement of a thriving and entrepreneurial private space sector. Indeed, the vitality of the national space effort must be based on more than an agency, it must draw its strength from the character and pursuits of its population. This is precisely why the Obama administration's space policy was so significant. What is more, Obama administration officials may have perceived greater efficiencies in the private sector which encouraged the development of a policy meant to rely increasingly on the private sector in addition to all of the added benefits of promoting a spacefaring culture.

Regardless, in light of the economic dynamics—the effects on jobs in their constituencies—the Senate Committee on Commerce, Science and Transportation sought to strike a compromise between the economic needs of their districts and the Obama administration's new policy. They accepted the increased role of the private sector in space transportation, but in addition the bill they produced instructed NASA to initiate development of a massive new rocket called the Space Launch System (SLS). They also specified how the

vehicle was to be designed (Logsdon 2010).  Furthermore, the Senate instructed NASA to further

prepare man-rated vehicles for deep space exploration (Logsdon 2010).

Still, members of Congress from the other side of the aisle continued to assail the new

policy.  In Senate appropriations activities Richard Shelby, the Senator from Alabama, accused

Obama officials of neglecting the American space program, while George LeMieux, the Senator

from Florida, maintained that the Obama administration was allowing the space programs of

Russia, China, and India to "leap frog the United States" (Kaufman 2010, O'Keefe and Kaufman

2010, A02).  Shelby also stated that the Obama administration was setting up a "welfare program

for the commercial space industry" (Kaufman 2010, A04).

NASA administrator Charles Bolden refuted these accusations and tried to suggest that

the Obama administration was laying the groundwork that would allow the American

commercial space sector to thrive.  Bolden stated at the National Press Club:  "We have to get

out of the business of owning and operating low Earth orbit transportation systems and hand that

off to the private sector, with sufficient oversight to ensure the safety of our astronauts"

(Achenbach 2011, A11).  In congressional deliberations Bolden went further and detailed how

growing private sector competence was making the new policy a viable option.  Bolden also

detailed what NASA was doing to aid the competence of the private sector.  In this regard,

NASA put together "a manual to share with commercial companies about how to 'man-rate'

their vehicles.  Some companies have said they could have rockets and spacecraft ready to carry

astronauts within three years of getting a go-ahead" (Kaufman 2010, A04).  Bolden stated

further:  "I guarantee that before we put any vehicle into space, there will be one safety standard

for taking astronauts from this planet to anywhere else" (Kaufman 2010, A04).

The key challenge facing the Obama administration in this regard was "how to successfully transition from the shuttle to the Constellation program" when scarce resources were available (Sadeh 2009, 110). Ultimately the Obama administration dropped plans for Constellation and attempted to energize the private sector with an infusion of government funds. It was thought this would allow NASA to maintain "the current and planned programs and projects in space and Earth sciences and utilizing the ISS once it is fully assembled" (Sadeh 2009, 110).

Further along these policy lines the US military space effort is undergoing a budget squeeze as well that may worsen as the demographic shift takes place in the United States and the needs of entitlement programs explode. In this event, it may be prudent policy to support the defense industry in a similar fashion as happened for LEO travel. One member of the military, Colonel MV "Coyote" Smith has even suggested that a public-private partnership be created to manage the military's satellites on orbit. Such a proposal is highly critical for military operations from space and the effects they create.

## Chapter 3: Methods

The research problem for this study consisted of identifying the critical political, economic, and security factors that were involved in the policy formulation process for the George W. Bush and Barack Obama administrations' civil and national security space policies. To reiterate, the main policy decision that these administrations made for their respective national space efforts consisted of the partial privatization of their respective national space efforts. The Bush administration initiated the Commercial Orbital Transportation Services

(COTS) program which involves the transport of cargo to the International Space Station (ISS) by the commercial space sector rather than by NASA, and the Obama administration incrementally adjusted this policy by promulgating the Commercial Crew Development (CCDev) program which involves the transport of astronauts, or crew, to the ISS by the commercial space sector rather than with a government, or NASA, spacecraft. When the Obama administration initiated the policy for CCDev a critical feature of the policy was the cancellation of the Constellation program. Constellation was to be a government spacecraft whose development was initiated by the Bush administration. The cancellation of Constellation represented a radical policy departure from the Bush administration by the Obama administration even though the policy to utilize commercial services for the transport of astronauts to the ISS was still an incremental policy evolution. With respect to national security space both administrations steadily expanded the commercial space sector's role in operations by increasingly relying on the commercial space sector for routine imagery needs (Digital Globe 2014) and leasing bandwidth on commercial satellites for communications and data.

**Research Question**: What are the political, economic, and security factors accounting for the Obama administration's policy to partially privatize the national space effort?

## Hypotheses

H1: The 2008 recession placed extraordinary pressure on the federal budget of the United States government which necessitated that the Obama administration develop an industry-government partnership for LEO space travel to meet the nation's space transportation

needs.

H2: Growing private sector competence in the American space industry signaled to the Obama administration that the administration could rely on them in the development of space policy.

H3: The Obama administration perceived that there would be greater efficiencies in the procurement processes for space assets by creating an industry-government partnership for space travel.

H4: The Obama administration perceived that there would be greater efficiencies in space operations by creating an industry-government partnership for space travel.

The hypotheses were tested by collecting data from policymakers in the George W. Bush and Barack Obama administrations through a snowball interview process. The data were corroborated by analyzing primary source internal documents from these administrations.

## Research Design Overview

This study made use of qualitative methods, specifically case studies. "A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 2009, 18). According to Yin (2009) the case study makes use of multiple sources of evidence in a process known as triangulation to link the multitude of variables in the study when there are more of these variables than data points. The case study also utilizes theoretical propositions that were developed previously to guide the collection of data and the analysis of the data.

The Most Similar Systems design was utilized to select cases. Most Similar Systems designs involve the matching up and comparing of two systems with many similarities but with a critical difference that can explain a causal difference in the dependent variable (Lim 2006). According to Lim (2006) case studies in comparative politics need not only compare states, but can also compare institutions and regimes. This aspect of case studies is critical as the Bush and Obama administrations are the focus of the study. Indeed, in many case studies with a single unit, researchers seek to divide their studies into two distinct time periods in efforts to explicate an important change for the dependent variable representing the two periods (Lim 2006). Furthermore, the other variables in the study remain the same between the two periods except for the variable that created the difference in the dependent variable (Lim 2006). The case comparison study sought to ascertain how the Obama administration's space policy developed after entering office and how it marked an important change from the Bush administration.

The study triangulated by using multiple sources of evidence and data to corroborate the findings (Yin 2009). These sources included interviews and archival analysis. Interviews were undertaken to derive the most in depth expert knowledge from practitioners in the field and from noted scholars who have developed tremendous expertise during their years of study. These interviews were in part undertaken in Washington D.C. with selected Bush and Obama administration officials. In addition, interviews were also conducted by phone with important Bush and Obama officials who were not in Washington D.C. or whose schedules required other accommodations. Document analysis, consisting of original policy documents and official communications was another basis for the study. These two techniques were employed to discover and validate the findings of the research.

## Interviews

Interviews were appropriate because the best and most pertinent information is to be had from those who were actually involved in the policymaking processes of these administrations, or who were extremely close to the policymaking processes of these administrations. In addition, there is a present lack of literature on the Bush and Obama administrations' space policies, especially the aspect of partial privatization. In order to obtain the necessary information to conduct this study it was necessary to get firsthand accounts of the policymaking process from officials that were in these administrations. Furthermore, it was necessary to corroborate the information about these administrations' policymaking processes in what little literature was actually available in academic journals and documents released by think tanks.

The interviews were conducted using a semi-structured format, as it allowed opportunity for the interviewee to wander while holding to a prepared script as the basis for the interview (Leech 2002). It was thought that this arrangement would allow the interviewee to impart the greatest amount of his or her knowledge while at the same time confirming or disconfirming the independent variables of the study. The interviewer was loath to proceed with structured interviews because of the possibility that the most pertinent insights would not be obtained from too rigid of an interview protocol. There were opposite concerns for the unstructured interview. Therefore, the semi-structured interview was selected because it would give the interviewee opportunity to inform the interviewer what the most important topics and aspects of the Bush and Obama administrations' space policies were. Accordingly, the interviews followed a prepared script and the questions for each interviewee varied depending on if their expertise was on the civil or the security side of space policy. The questions were open ended and the interviewer

took care to follow up with additional questions to glean the most pertinent information from the interviewee.

The instrument was piloted with US Air Force Colonel Robert Smith. Based on the feedback from Colonel Smith three additional questions were added to the beginning of the instrument. These questions were broad, open-ended, and took a very careful tact with the interviewees. The questions shed light onto the space policy formulations for both the George W. Bush and Barack Obama administrations.

For this work a number of government officials from both the George W. Bush administration and Barack Obama administration were interviewed. These included directors for space on the National Security Council (NSC) for both administrations, officials at the Pentagon under the Obama administration, major generals who were in charge of the executive agent for space at the Pentagon under both administrations, a colonel who served at the executive agent for space at the Pentagon under the Bush administration, a lieutenant colonel who served at the executive agent for space at the Pentagon under the Bush administration, an official who served at space command during the Obama administration, a former high ranking official at NASA during the Bush administration, a former colonel who worked at the Pentagon under both administrations, and one of the foremost historians of space.

Peter Marquez was the director of space policy for the NSC under both the Bush and Obama administrations. Marquez was tasked with developing space policy for the Presidents he served. Shawn Steene is an official who has served at the Pentagon for many years. Steene was involved with the Pentagon's space policy under the Obama administration. Official 1, who shall remain nameless, was not very involved with the drafting of the Bush and Obama

administrations' space policies but, however, was closely involved in their implementation. This person served at the executive agent for space at the Department of Defense. This agency at the Pentagon during the Obama administration performed the same function as the National Security Space Office (NSSO) under the Bush administration but is known by a different name. This person was primarily advising on space policy and not developing it. John Logsdon is one of the foremost space historians in the world and is currently professor emeritus at George Washington University. Scott Pace has had a long career in the field of space in and out of government. In 1993 Pace was a career civil servant in the department of commerce. He worked with the national space council. Also in 1993 Pace began working for the Rand Corporation supporting the Office of Science and Technology Policy (OSTP) for the Clinton administration. In 2000 Pace worked on science and technology policy for the Bush campaign. He was part of the NASA transition team after Bush won the election. Pace was then assistant director for OSTP for aeronautics and space. In 2002 Pace became NASA deputy chief of staff for O'Keefe. After working for the 41st President Bush, supporting the Clinton administration at Rand, and as a political appointee in the 43rd President Bush's administration Pace became chair of the Space Policy institute at George Washington University where he presently works. Official 2 served in the George W. Bush administration on the NSC, and shall remain nameless, was responsible for helping to develop space policy for the President. Major general Armor is currently retired from the United States Air Force but presently works for Orbital ATK. While in uniform major general Armor led the National Security Space Office at the Pentagon during the George W. Bush administration. Robert Butterworth was working at space command at the time of the formulation of the Obama administration's space policy. Evidently he was invited by one of his

former students to participate in the drafting of the policy.  Peter Marquez was one of the former

students who invited Butterworth.  Butterworth was part of the team that was working on

execution questions.  Lieutenant colonel McGibney was involved with the Bush administration's

space policy.  He was at the Pentagon in the summer of 2005.  Evidently there were already

some working drafts of the policy when he arrived.  McGibney worked in the NSSO.  McGibney

was heavily involved in coordinating the development of the policy across the governmental

apparatus.  Major general Santee ran the executive agent for space at the Pentagon during the

Obama administration.  In this capacity Santee was heavily involved in the security aspects of

the Obama administration's space policy.  Colonel MV "Coyote" Smith led the Dreamworks

branch of the NSSO at the Pentagon during the Bush administration.  In this capacity Coyote

worked under major general Armor.  And finally, Audrey Schaeffer was a Pentagon official

during the Obama administration, and according to major general Santee, held the "pen" in the

drafting of the Pentagon's space policy under the Obama administration.  In all 12 people were

interviewed for this study.

Table 3.1

**Bush Officials**

| Official | Organization |
|---|---|
| Peter Marquez | National Security Council |
| Official 1 | Pentagon |
| John Logsdon | George Washington University |
| Scott Pace | NASA |
| Official 2 | National Security Council |
| Major General Armor | Pentagon |
| Lieutenant Colonel McGibney | Pentagon |
| Colonel MV "Coyote" Smith | Pentagon |

Table 3.2

**Obama Officials**

| Official | Organization |
| --- | --- |
| Peter Marquez | National Security Council |
| Shawn Steene | Pentagon |
| Official 1 | Pentagon |
| John Logsdon | George Washington University |
| Robert Butterworth | United States Space Command |
| Major General Santee | Pentagon |
| Audrey Schaeffer | Pentagon |

These officials were interviewed because they were the primary policymakers for the

Bush and Obama administrations' space policies or because they were extremely close to the

policymaking processes for these administrations.  In addition, there was somewhat of a

snowball process for obtaining these interviews beginning with Colonel MV "Coyote" Smith and

the rest of the interviews that resulted from this process occurred naturally in the progression of

data collection.

The data from the interviews were systematically analyzed using pattern matching.  For

pattern matching the study sought to identify emergent themes and trends in the data.  As such, a

connecting strategy was employed that attempted to look for patterns or narratives in the process.

This qualitative study tried to understand meaning or beliefs behind events and behaviors.  It

tried to understand the context that policymaking processes were formulated in.  It also tried to

understand unanticipated phenomena, such as the Obama administration's inclination to

distinguish themselves from the Bush administration, and then to build theories around it.  In

doing so the study attempted to better understand causality.

One potential limitation to this approach was researcher bias—the assumptions that the

researcher brought to the process—which became more evident after data collection.  In

addition, other limitations included "bias due to poorly articulated questions, response bias,

inaccuracies due to poor recall, and reflexivity—interviewee gives what interviewer wants to

hear" (Yin 2009, 102). In order to overcome these limitations the researcher interviewed the

largest amount of people possible in an attempt to corroborate or validate the data that each

individual interviewee imparted. In addition, the researcher used multiple sources of evidence

(literature, media reports, and archival documents) for convergence.


## Archival Analysis

Archival analysis was appropriate for this study because it was necessary to use multiple

sources of evidence to corroborate the data that the interview process yielded. It was also

necessary to do archival analysis to test hypothesis 2—growing private sector competence

signaled to the Obama administration that they could rely on the private sector in the formulation

of their respective space policy. Accordingly, the archival analysis revealed that NASA's

commercial partners were in fact achieving a number of technical milestones that allowed the

Obama administration to include the private sector in their policy and then to continue the policy.

Archival analysis was approached initially with the need to understand the Bush and

Obama administrations' space policies. To begin, the national space policies of both

administrations were reviewed at the outset of the research process. From there the archival

analysis proceeded with recommendations from the interviewees. In Washington, D.C. John

Logsdon, one of the foremost historians of space in the world, informed the researcher that

NASA headquarters was in possession of a trove of materials on the COTS and CCDev

programs. NASA has a history office located at NASA headquarters in Washington, D.C.

Archival research was then undertaken at NASA headquarters and a number of copies of internal

NASA documents about the COTS and CCDev programs were obtained.  For the national

security research effort major general Santee recommended that the researcher review the Obama

administration's National Security Space Strategy and 3100.10 documents.  The National

Security Space Strategy outlines the Obama administration's national security strategy in space

and the 3100.10 document discusses the implementation of the national security space strategy.

Both can be found at an official United States government website.  In addition, a congressional

hearing with testimony on the CCDev program from Neil Armstrong, Gene Cernan, and Mike

Griffin was obtained from electronic records made available from Auburn University's library.

The primary source documents in question (see table 3.3 and table 3.4) included the

national space policies of the United States from the Bush through the Obama administrations,

The Vision for Space Exploration, the Commercial Orbital Transportation Services program, the

Commercial Crew Development program, the Pentagon's National Security Space Strategy and

3100.10 document from the Obama administration, internal NASA releases from the COTS and

CCDev programs, and a Congressional hearing.  As the study is a case comparison of the Bush

and Obama administrations, documents from the Bush era were utilized as a starting point from

which to proceed with the Obama administration.  These documents discuss the priorities of the

American national space effort.  In the most recent national space document from the Obama

administration the priorities included stability, mission assurance, the acquisitions process, space

operations, and countering threats to space assets, in addition to that of privatization.

Table 3.3

**Bush Primary Source Documents**

| Document | Year |
|---|---|
| Vision for Space Exploration | 2004 |

| Commercial Orbital Transportation Services | 2005 |
|---|---|
| National Space Policy | 2006 |

Table 3.4

**Obama Primary Source Documents**

| Document | Year |
|---|---|
| National Space Policy | 2010 |
| Commercial Crew Development | 2010 |
| National Security Space Strategy | 2011 |
| 3100.10 | 2012 |
| House Committee on Science, Space, and Technology:  NASA Human Spaceflight Past, Present, and Future | 2011 |
| CCDev NASA Release:  12-147 | 2012 |
| CCDev NASA Release:  12-170 | 2012 |
| CCDev NASA Release:  12-150 | 2012 |
| COTS NASA Media Advisory:  M12-094 | 2012 |
| COTS NASA Release: 13-067 | 2013 |

As with the analysis from the data from the interviews, the data from the archival analysis were systematically analyzed using pattern matching.  For pattern matching with the data from the archival analysis the study sought to locate emergent themes and trends in the data within a context that would allow it corroborate the data from the interviews.  In addition, some primary source documents, most notably the 2006 Bush national space policy and the 2010 Obama national space policy, were used as a starting point from which to proceed with the study.  As such, a connecting strategy was employed with the archival data that attempted to link patterns or narratives in the data between the information from the interviews and the information from NASA's archives.  In any event this qualitative study tried to understand meaning or beliefs behind events and behaviors.  It tried to understand the context that policymaking processes were formulated in.  It also tried to understand unanticipated phenomena, such as the heated

opposition to the Obama administration's space policy from veteran NASA astronauts and a former NASA administrator under the Bush administration, and then to build theories around it. In doing so the study attempted to better understand causality.

**Variables**

*Dependent Variable*:  The Obama administration's policy decision to create an industry-government partnership for space travel.

Due to the 2008 financial crisis there was tremendous pressure placed on the federal budget of the United States.  This pressure led to significant program cuts at NASA (canceling of Constellation) and for the military's space effort.  As such, in order to sustain the national space effort at a level commensurate with the past, the Obama administration relied more heavily on the private sector to propel the national space effort.  This included providing funds to private operators to ferry crew and cargo to the international space station and relying more heavily on private operators for the collection of satellite data for national security needs.

As the Dependent Variable is the difference between the Bush and Obama space policies, as reflected in the Obama administration's policy decision to cancel Constellation and proceed with CCDev, the Dependent Variable reflects this policy shift.  Therefore, the policy was operationalized by analyzing its various facets, particularly studying the chronology of events and debates surrounding it.  This analysis served to inform the study about the characteristics of the dependent variable and how the dependent variable shifted with a corresponding shift in the independent variables.  This information was gathered from the present and the recent past, but additional information spanning the lifetime of the American space program was utilized as well.

*First Independent Variable*:  Financial pressure owing to the 2008 crisis.

The first independent variable is financial pressure owing to the 2008 crisis.  Due to the crisis there was a lack of resources for the national space effort.  Money is necessary to develop spacecraft and conduct operations in the medium.  Without it there can be no space program.  This is precisely why privatization was such an innovative policy because it enables the administration to multiply the effects of the space program with finite resources.

Financial pressure was measured by analyzing the data collected from the interviewees with special knowledge of the financial dynamics surrounding both the civil and security space programs of the United States.  The information that was gleaned from these activities was put to use to determine from experts if the privatization policy is indeed multiplying the effect of finite resources.  Once this issue was resolved conclusively and to the satisfaction of the study, financial pressure was measured in such a way as to determine if the privatization policy was allowing for adequate resources for the national space effort and thus contributing to a vibrant space program.

*The Second Independent Variable*:  Perceptions of efficiency.

The second independent variable is perceptions of efficiency.  Efficiency can be characterized by a process which expends the least amount of time and cost in order to achieve an objective.  In the case of the space program, the objective could be the development of new spacecraft, or operations in deep space to retrieve an asteroid.  A highly efficient space program will be one in which the most activities are taking place in the most sophisticated ways given a definite amount of resources.  It is surmised that the Obama administration perceived that the

private sector could carry on the national space effort more efficiently than was the case by the public sector which contributed to their policy decision to partially privatize the national space effort.

Perceptions of efficiency was measured through interviews with experts in the space industry and government, primarily from officials in Washington D.C.  Of acute interest was determining the effect that efficient development activities and operations have on the vibrancy of the American national space effort.  This process sought to tease out from experts precisely the ways in which the Bush administration perceived efficiencies in government as well as the space industry, and the ways in which the Obama administration perceived that the private sector could more efficiently improve the development of space systems and operations in the medium and thus contribute to a more vibrant space program.

*The Third Independent Variable*:  Growing private sector competence.

The third independent variable is growing private sector competence.  Competence for space pursuits is the aptitude for science, physics, engineering, math, and activities in the medium in general in a space faring nation.  It is surmised that at the time of the Obama administration's policy formulation the private sector was demonstrating a critical aptitude for space pursuits which signaled to the Obama administration that they could rely on the private sector to carry out significant elements of their policy.

This variable was measured from interviews with experts in the space industry and government and from data from NASA's archives.  This process sought to gather all pertinent information regarding the competence for space pursuits that the key players from industry

possess.  First it was determined if the Bush administration determined that the private sector's competence was growing, and then it was determined if, indeed, Obama administration officials concluded that this was a key factor in their policy deliberations.

The variety of ways that triangulation took place featured interviews and archival analysis.  The Bush and Obama administrations' space policies were not developed solely based on considerations for domestic politics, however.  Indeed, considerations for the international political environment were key factors in the policymaking processes for these administrations. Therefore, analysis about the international environment is warranted.


## Chapter 4:  The International Environment

The international environment for space is incredibly important.  First, since the beginning of the space age exploits in space have generated a significant amount of prestige that has historically translated into political influence around the globe for deft spacefaring nations. As has been discussed, the United States and the Soviet Union were dueling with each other in space throughout the Cold War because of the international political influence that exploits in space generate.  Indeed, for Kennedy and Johnson the whole purpose of the Apollo Moon program was the prestige that landing humans on the Moon would generate for the United States. There were ancillary scientific and technological benefits of the Apollo program, but for Kennedy and Johnson prestige was the main motivation.

Secondly, it is a scientific fact that there is a tremendous amount of natural resources in the cosmos.  Thus, the international environment becomes exceedingly consequential as

competition or cooperation with other space programs for the mineral resources in space could lead to dynamic economic conditions for nations who are able to harness these resources.

Another reason that the international environment for space is exceedingly consequential is because cooperation in space has a harmonizing effect on the international system. This dynamic is precisely why the United States and the Soviet Union cooperated in space with the Apollo-Soyuz program at the height of the Cold War. If the United States and other nations are able to effectively cooperate in space the effect will be to cause harmony in the international system. As such, a look at the space programs of other major spacefaring nations follows.

## Russia

The Russian space program is guided by the Russian Federal Space Agency, more commonly known as Roscosmos. However, much like the United States the Russians have taken steps to privatize their national space effort. But the Russians have gone even further than the United States in this regard. Whereas the United States has sought to privatize the LEO aspects of their space program and have maintained governmental responsibility through NASA for efforts into deeper space, it appears the Russians have attempted to privatize their national space effort almost completely in its entirety. The Russians have created what they call a Joint Stock Company which consists of privatized attributes from industry to be regulated by their federal space agency.

As such, in 2013 the Russian government appeared to attempt "to consolidate its space sector in an open joint stock company called the United Rocket and Space Corporation in a way that would preserve and enhance the Roscosmos space agency" according to Deputy Prime

Minister Dmitry Rogozin (Messier 2013). Evidently the policy met with approval from Russian

President Vladimir Putin after Prime Minister Dmitry Medvedev presented it in 2013. Russian

officials pursued this policy because they believed it would allow them to overcome the

problems that have plagued their space sector by enhancing government supervision. Such

arrangements are not new for the Russians. "Russia uses the open joint stock company structure

in a number of key sectors, including airlines (Aeroflot), railroads (Russian Railways), and

energy (Gazprom). These companies are somewhat similar to limited liability partnerships and

corporations in the United States" (Messier 2013).

Russian officials were keenly interested in having Roscosmos deeply involved in the

transition. Additionally, Russian officials arranged for the new enterprise to possess a

controlling stake in Energia, a rocket company that the Russian government also has a 38 percent

interest in. According to Russian officials "Russia employs about 250,000 people in its space

sector, while the United States has about 70,000 people working in the field. Russian

productivity is eight times lower than in America, with companies duplicating each others' work

and operating at about 40 percent efficiency" (Messier 2013).

But while the Russians have pursued these arrangements they have had no interest in

further consolidating the aerospace sector by combining space and aviation companies into one

organization. Nevertheless, it appears that the Russian government does in fact want these

sectors to collaborate more on various projects, including an "air-launched rocket project and

hypersonic missiles and aircraft as examples" (Messier 2013).

The new privatization arrangement of the Russian space program is interesting because

while it definitely seeks to privatize most aspects of the space program it also attempts to re-

nationalize them as well.  In this regard, the open Joint Stock Company is a state corporation.  It

functions as a corporation but comes under increased oversight from the Russian government.

"The plan involves re-nationalization of the industry under a unified command structure

and reducing redundant capabilities, acts that could lead to tens of thousands of layoffs.  The new

state corporation will be created to take over manufacturing facilities from the Federal Space

Agency, whose prestige has been severely dented in recent years by a string of failed rocket

launches.  The proposed United Rocket and Space Corporation will enable the trimming away of

redundant departments replicated elsewhere in the space industry.  A variety of manufacturing

facilities in the rocket and space industry are currently bundled in 10 integrated structures and

there are also a large number of independent organizations operating outside those structures that

operate to their own plans" (Messier 2013).  Russian officials believe this new public-private

arrangement will allow technical policies to be unified across their national space program and

enable cost savings by combining developers and manufacturers.  "The proposed corporation

will comprise all rocket and space-manufacturing facilities and design bureaus, except for a

number of defense-related firms.  Under the plan, the Federal Space Agency, or Roscosmos, will

act as a federal executive body and contracting authority for programs to be implemented by the

industry" (Messier 2013).

Developments with the Russian space program are critical for the United States in the

immediate future as the United States presently relies on Russian spacecraft to transport its

astronauts into space.  Indeed, the Obama administration's policy for LEO space travel has

resulted in this reality for NASA.  As it happens the American private sector would not have

their space transportation capabilities ready for NASA for many years after the shuttle was

terminated.  In the meantime, the American national space effort would have to rely on Russian spacecraft for transportation to orbit.  The Russian spacecraft is known as Soyuz.

"A Soyuz space capsule took the first crew to the International Space Station in November 2000.  Since that time, at least one Soyuz has always been at the station, generally to serve as a lifeboat should the crew have to return to Earth unexpectedly. After the retirement of the space shuttle in 2011, the Soyuz TMA became the sole means of transportation for crew members going to or returning from the orbiting laboratory" (NASA 2015).

The Russians launch their Soyuz capsules from the Baikonur Cosmodrome with rockets that are also termed Soyuz.  This launch facility is located in Kazakhstan.  "Once the Soyuz reaches orbit, the crew performs systems checks and keeps in touch with controllers at the Russian Mission Control Center.  At least one Russian Soyuz spacecraft is always docked to the space station.  In addition, there is usually one or more resupply spacecraft attached to the station.  The station is well supplied with docking and berthing ports for all these types of vehicles.  Up to three crew members can launch and return to Earth from the station aboard a Soyuz TMA spacecraft.  The vehicle lands on the flat steppe of Kazakhstan in central Asia" (NASA 2015).

Beyond Soyuz and activities at the ISS the Russians have a variety of other priorities for their space program.  The development of Angara rockets is a particularly critical priority for the Russians.  The Angaras are intended to advance the Russian space program in the international space race that is emerging in the 21st century.  The Russians are also keenly interested in creating more sophisticated communications satellites.  But perhaps the top priority of the Russian space program has been the development of the GLONASS constellation.  GLONASS

are navigations satellites that are being developed with the intention of relieving Russian

dependence, and that of other nations in the Russian sphere of influence, on the American GPS

constellation. As such, the Russians have committed substantial resources to the development of

these assets.


## China

The space race between the two superpowers during the Cold War was titanic. However,

as the Cold War came to a conclusion a new space player began to emerge. For most of the Cold

War China had little interest in space, but this began to change in 1985 when Deng Xiaoping

reassessed China's strategic environment. Deng concluded with the Central Military

Commission (CMC) that "future conflicts were likely to be localized yet intensive" (Cheng 2012,

57). "Rather than major global wars" the People's Liberation Army (PLA) should prepare for

localized wars on China's periphery without the use of nuclear weapons that would be limited in

scope (Cheng 2012, 57). To this end support for China's comprehensive space program began to

build in 1986 when Deng promulgated Plan 863. This project was undertaken at the behest of

top Chinese scientists and was formally recognized as the National High-Technology Research

and Development Plan (Cheng 2012). This project was created to establish the scientific

foundation necessary for a modernizing country. "Aerospace, along with automation, advanced

materials, and bio-engineering, were seen as key areas of high technology, justifying substantial,

sustained resource investment" (Cheng 2012, 57).

In order to develop their space program at the most rapid pace possible the Chinese

turned to the Russian Space Agency. By doing so the Chinese could build upon the previous

experience and hardware designs of the Russians.  Accordingly China and Russia agreed to cooperate formally in a 1994 agreement.  A year after this agreement was reached, a sizable Chinese delegation visited Russia.  The Chinese contingent acquired many key space technologies such as "a spacesuit, a complete Soyuz capsule, docking equipment, a life-support system, and a variety of other hardware and design information to guide their planned human spaceflight program" Moltz 2012, 88).  In the years that followed a number of Chinese delegations would go back to Russia to gather more details on how to train astronauts and utilize space medicine (Moltz 2012).

But China would look even further afield as the years went by and its space program progressed.  For instance, the Chinese pursued microsatellite technology that British interests had long been developing.  Tsinghua University engaged Surrey Satellite Technology, Ltd., a British company, in a joint venture to develop these spacecraft (Moltz 2012).  As a result of this effort China produced its first microsatellite by June 2000.  It was sent into orbit on a Russian rocket. Since this development the joint venture has produced many more satellites for Surrey and other Chinese interests (Moltz 2012).

While China was busy embarking on its endeavors in space, the PLA was keen to notice the use of space by the United States in the first Gulf War.  Operations Desert Shield and Desert Storm had a significant impact on the mentality of Chinese military thinking.  It brought home to the PLA that advanced technology was not just a subtle change but had fundamentally shifted the way militaries wage war.  "As the then–deputy director of the PLA's 'think-tank,' the Academy of Military Science (AMS), observed, 'The Gulf War marked a big step forward in both military theory and practice'" (Cheng 2012, 58).

In the 2003 Gulf War the point was brought home again to the PLA. The PLA watched the expert use of space by American forces. It witnessed the vital role space played "in large scale, modern military operations" (Moltz 2012, 92). As such, China was bound and determined not to let American forces have such an easy advantage in space in the event of conflict over Taiwan. China subsequently moved to even the imbalance. To these ends the Chinese sought to develop more sophisticated reconnaissance and communications assets, an operational ASAT, and a space tracking network with sites across the sea and the land. The tracking network necessitated that the Chinese reach special agreements with countries who would host the ground sites, many of whom are located in the South Pacific (Moltz 2012).

After observing how space allowed American forces to conduct joint operations seamlessly and how command, control, communications, and intelligence (C3I) were critically enabled by space assets the PLA resolved to exploit space in a similar fashion. The role of joint operations and C3I by the United States heavily influenced the PLA's concept of space-enabled operations (Cheng 2012). "PLA analyses concluded that the ability to coordinate the operations of different services would produce synergies that no single service could hope to match. Joint operations were seen as the 'fundamental expression' of 'local wars under modern, high-tech conditions'" (Cheng 2012, 59).

And yet while the PLA was developing doctrines for the use of space-based assets to link their forces in war, China was busy promoting space arms control in the international arena. In 2002 China and Russia brought forward an initiative at the United Nations that discussed a future treaty to prevent the deployment of space weapons and banning their use against space assets.

The proposal was modeled after a 1983 Soviet initiative aimed at stopping the Strategic Defense Initiative. It also included parts of a Chinese working paper (Moltz 2012).

Following his accession to power in 2002 Hu Jintao continued to promote China's space program. While Hu was in power, China established many types of satellites on orbit, "including new remote sensing satellites (the Yaogan series), microsatellites such as the Shijian series, and improved versions of the Fengyun and Ziyuan series" (Cheng 2012, 63). Indeed, the first decade of the 21$^{st}$ century consisted of many important events for the Chinese space program. More developed space nations, such as Britain and France, were so enthusiastic about working with China that they created spacecraft free of American components to avoid American restrictions on Chinese space activities. In this regard the Chinese had managed to outmaneuver American sanctions (Moltz 2012). Some of the achievements of the Chinese space program during this period included human spaceflight and improved satellites and launch vehicles.

China also was keen to demonstrate its prowess in the military aspects of space under Hu Jintao. The PLA conducted an ASAT test in January 2007. The test consisted of a direct ascent system that relied on kinetic force. The missile was launched from the Xichang Satellite Launch Center and destroyed an aging weather satellite that fell into disuse. The collision occurred in LEO. Unfortunately, a significant amount of space debris was created by the collision (Cheng 2012). A few years later in January 2010 the PLA conducted a test of its missile defenses. One missile intercepted another over Chinese territory. It was an exo-atmospheric intercept at the edge of space that was discovered by American sensors in orbit (Cheng 2012). While the test was ostensibly for missile defenses it was nevertheless believed to have helped Chinese scientists with their ASAT system. Following this in August 2010 the Chinese conducted proximity

operations with two microsatellites.  It was reported that they maneuvered close to each other and actually bumped together (Cheng 2012).

But however significant the strides that China has been making in space maybe, the Chinese have a long way to go before they achieve parity with the United States.  "Areas of continued Chinese military space weakness pointed to by foreign analysts include the absence of signals or electronic intelligence satellites; the lack of a space-based missile early-warning network; the lack of an integrated, tested, and secure military-use GPS system for precision missile guidance; a limited constellation of milsats (heightening vulnerability to attack); limited military experience in modern space operations; apparent possession of inadequate number of launchers for a large-scale ASAT attack; and the lack of a major military ally in case of extended space warfare" (Moltz 2012, 106).

## Europe

The space program of Europe is a collaborative effort on the part of many countries. Most of the space efforts on the part of European nations are combined and coordinated by an international space agency called the European Space Agency (ESA).  ESA's budget in 2015 was 4.433 billion Euros (ESA 2015).  The ESA is an intergovernmental organization that does not possess private elements similar to the Russian national space effort.

However, the Europeans have in fact established a public-private partnership called Paradigm to manage their secure satellite communications which are mostly military in nature. Paradigm is managed by EADS which is an aeronautical industry consortium consisting of elements from many European countries.

The European national space efforts does in fact possess human spaceflight activities, however they have not developed man-rated spacecraft to carry astronauts. ESA relies on other nations to transport their astronauts into space. Regarding human space flight activities, Europe is one of the biggest and most important participants in the ISS. The Europeans have made significant contributions both to the development of the station's structure as well as to the scientific pursuits that are carried out on the station in LEO.

Over the course of the decades since the beginning of European space activities the continent has conducted a variety of unmanned missions across the solar system for the purposes of scientific exploration. Additionally, the Europeans have also launched a number of lunar missions. The Europeans are also engaged in a variety of Earth observation activities including for climate science. Obviously the Europeans have also developed highly sophisticated communications satellites, one effort of which is the aforementioned Paradigm which provides very secure communications links for national security purposes.

To support their various space activities the Europeans have established a major spaceport. The space port is located in the northern part of South America in French Guiana at Kourou. The spaceport is referred to industry parlance as Kourou. This location was ideal for the Europeans because it is much closer to the equator than alternative locations in Europe. The most important rocket currently in use by the Europeans is the Ariane 5. It was primarily developed by EADS with support from ESA.

ESA is a major proponent of international cooperation in the medium of space and engages in a number of cooperative space pursuits with the space agencies of other nations. The most visible of which are their aforementioned activities with the ISS. In this respect, the

Russians are a major partner in space for the Europeans.  As the Europeans do not possess a man-rated space vehicle they rely primarily on Russian Soyuz spacecraft for the transportation of their astronauts into space, as will be the case with the American space program until the Obama administration's policy for commercial space operators comes to fruition.  As such, the Europeans are relying on Russia for space access on a long-term basis (Launchers, ESA 2015). "There is a framework agreement between ESA and the government of the Russian Federation on cooperation and partnership in the exploration and use of outer space for peaceful purposes, and cooperation is already underway in two different areas of launcher activity that will bring benefits to both partners" (Launchers, ESA 2015).

As part of this framework the Russians have access to Europe's spaceport at Kourou. This access was established through an agreement between the two sides officially signed on 19 January 2005 (Launchers, ESA 2015).  The agreement was also intended to promote the development of launchers between the partners.

With the agreement Soyuz spacecraft will be launched from Kourou.  "Soyuz, in its different versions, is renowned both for the number of successful launches made—more than 1700—and for its role in carrying men and women from many different nations into space.  The launch of Soyuz from the Spaceport in French Guiana consolidates Europe's access to space for medium-size missions. Russia benefits from the many advantages provided by the Spaceport and from improved access to the commercial market.  The building of the Soyuz launch site was completed in 2011.  Soyuz lifted off for the first time from Europe's Spaceport in French Guiana on 21 October 2011" (Launchers, ESA 2015).

This agreement is not only a remedy for Europe's questions about space access in the present but will also have significant implications for European space access in the future. In this regard, the Europeans and the Russians have every intention on cooperating to develop the next generation of launchers. It is thought that this arrangement will save time, reduce technical risks, and manage costs (Launchers, ESA 2015).

The Europeans have also recently made history with a first for a space program. For the first time ever a space program successfully "orbited a comet and landed on its surface" (Risen 2014). While the Americans were the first to land humans on the Moon and unmanned systems on Mars, ESA is the first to land on a comet. The European spacecraft is called Rosetta and "traveled 4 billion miles during a decade" to reach the comet which is named 67P/Churyumov (Risen 2014).

The value of the European mission is largely technical at this stage. Proximity operations for landing on objects traveling tens of thousands of miles an hour in space are somewhat complicated. But the European effort successfully demonstrated the capabilities necessary to do so which will be a tremendous boon for other actors, both national and private, who have major intentions to conduct missions to comets and asteroids in the coming years and decades. The mission has also yielded significant results of a scientific nature as well. The scientific data derived from the mission will "help humans learn more about planetoids, mine resources for space colonies and even save Earth from extinction" (Risen 2014). "The craft is beaming scientists in France information about soil samples and other data about the comet, which orbits the Sun at 85,000 mph. After more than 10 years traveling through space, the mission is making the best ever scientific analysis of one of the oldest remnants of the Solar System" (Risen 2014).

**Japan**

The Japanese space program is sophisticated, much like the Europeans, but much like the Europeans the Japanese national space effort does not possess man-rated spacecraft to carry its astronauts into orbit. Indeed, only the American, Russian, and Chinese space programs have obtained the feat. Japan's space agency is called JAXA. JAXA was created in 2003 when the Japanese merged a number of space organizations into a single organization. One of the main pursuits of JAXA is space research. They are also heavily involved in technology development. JAXA has launched a variety of sophisticated satellites and is currently developing the capabilities to explore the Moon as well as asteroids.

In addition to these civilian space activities Japanese politicians are also in the midst of a policy shift for the Japanese space program. Due to China's rise and the development of their military space activities, as well as the unsettling developments of the missile and nuclear programs of North Korea, Japan is beginning to shift it space program away from purely civilian pursuits to focus more on the military aspects of space. As such, in 2012 the Japanese government passed legislation that reorganizes political control of policy-making for space as well as control over the budget for space. This move was intended to allow for the development of space activities of a military nature with a special focus on early warning systems based in space (Kallender-Umezu 2012).

"The raft of legislation, based on the Bill to Amend the Law of Establishment of the Cabinet Office, enables the Prime Minister's Cabinet Office to take control of the planning and budgeting of Japan's government space program. It also removes an article in a prior law governing JAXA, the nation's equivalent to NASA, which had restricted JAXA's ability to

pursue military space programs" (Kallender-Umezu 2012). Before these political moves the

Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) was

responsible for the direction of JAXA. Such political arrangements necessarily meant that

JAXA's activities were restricted to purely peaceful, or non-military, pursuits which were

intended to prohibit the organization from pursuing systems in space that could be used for

warfare (Kallender-Umezu 2012).

However, with the ever increasing proliferation of military space systems by China,

combined with the missile and nuclear developments of an increasingly unstable North Korea,

the Japanese felt obliged to make political changes and to actively develop military space

capabilities to counter these threats. "As the Cabinet Office, the Ministry of Defense, and the

Ministry of Economy, Trade and Industry (METI) will all have a form of 'joint control' over

JAXA, the space agency will gradually move away from its purely scientific, non-military role.

Under the new arrangement, each ministry will be able to propose its own space programs.

METI, for example, is interested in promoting dual-use Earth observation and reconnaissance

satellites and an air-launch space access system. There also is strong bipartisan political support

for Japan to develop and launch its own missile early-warning system to support the nation's

small fleet of Aegis destroyers for upper-tier defense, and its PAC-3 systems for lower-tier

defense. The Cabinet Office also will take direct control of the budget and program development

of Japan's regional GPS system, called the Quasi-Zenith Satellite System" (Kallender-Umezu

2012).

The Japanese are also keenly interested in incorporating elements of their private sector into their national space effort.  In this regard, various consortia have been created in Japan to engage in space pursuits, some of which include the development of space solar power.

## India

The national space agency of India is called the Indian Space Research Organization (ISRO).  ISRO has pursued a variety of unmanned missions in space including to both the Moon and Mars.  However, as with the Europeans and the Japanese, the Indians do not as of yet have a man-rated launch vehicle.  Thus, their space activities have been restricted to unmanned pursuits.  But the Indians do have plans for human spaceflight, which are not limited to, but do include, developing a reusable launch vehicle.  The Indians are also planning to engage in deep space exploration with a variety of interplanetary probes.

The main objectives of the Indian space program are "operational flights of the Polar Satellite Launch Vehicle (PSLV), developmental flight of the Geo-synchronous Satellite Launch Vehicle (GSLV- Mk II), development of the heavy lift Geo-synchronous Satellite Launch Vehicle (GSLV-Mk III), and development of semi-cryogenic technology for future launch vehicles" (ISRO 2015).  Other important objectives of the Indian space program include "the design, development and realization of communication satellites; the design, development and realization of Earth observation satellites; the development of navigation satellite systems; the development of space science and planetary exploration satellite systems; and Earth observation applications" (ISRO 2015).  In addition, the Indians would like to develop "space-based systems for societal applications" as much as possible while "advancing technologies for newer initiatives" (ISRO 2015).  For this they intend to redouble their efforts to educate and train space

professionals in their population to build capacity. The Indians are also keenly interested in developing facilities and infrastructure for missions and operations support. International cooperation is a major goal for their program as well (ISRO 2015).

The international environment for space is critical indeed. Many nations, including the United States at present, rely on Russia to transport astronauts into space with their Soyuz spacecraft. Meanwhile, military competition in space is heating up in Asia, most notably between China and Japan. Any American administration in the process of formulating policy for space must take into account the international situation. Presidential decision making for the space program becomes very important in this regard.

## Chapter 5: Presidential Decision Making

Presidential decision making is very important for space policy. It appears that when the public is inattentive to the issues Presidents have a free hand to craft and implement space policy. However, it also appears that in the policy process for space the President's officials and the Congress are at least as important as the President. Indeed, the President often relies on his or her officials to sort out all of the details of the policy for the President. And then the Congress often has the final say and ultimately decides what policy will be implemented because the Congress controls the financing for the national space effort.

In any event, many have observed that Americans possess a very limited attention span when it comes to matters of state such as foreign affairs or the more mundane aspects of space. Indeed, with the exception of the Apollo program and the lunar landings most Americans have not been very concerned about the day to day activities of the national space effort. They are

totally unaware of how dependent is our digital society on space-based assets for communications, financial transactions, and the broader economy.

However, at the same time scholars have noted a highly attentive public when it comes to matters of war and peace, particularly when the United States government is intent on committing ground forces to battle (Knecht and Weatherford 2006). This dynamic is in stark contrast to the public's lack of interest in non-crisis matters such as international trade or aid. Furthermore, it seems as though most Americans are almost entirely dependent on the mainstream media for what little information they do receive about these issues. This makes the public highly susceptible to elite interpretation of events and in turn the ability of elites in the media to spin these issues for the broader public. This process necessarily means that influence in American society flows downward from the highest levels, from politicians and officials to the public (Knecht and Weatherford 2006). As such, presidents and the officials that surround them are rarely ever constrained in matters of state, such as for foreign policy or the space program, when the public is inattentive to the issues, which is the case most of the time. The importance of the space program, or matters of foreign policy, to the general populace in the United States are the centerpieces of this picture: political leaders that are held accountable to their populations through elections tend to be more concerned about the impact of their policy decisions on their election prospects if their populations are more attentive to the issues in question (Knecht and Weatherford 2006).

Regarding presidential decision making Knecht and Weatherford (2006) have conceptualized the process "as a sequence of five stages: (1) agenda setting/problem representation, (2) option generation, (3) policy selection, (4) implementation, (5) policy review"

(706).  This process of course is heavily influenced by crisis scenarios and their resulting impact on public opinion.  As such, scholars have discovered empirical evidence that political leaders opt for more aggressive actions in periods of economic difficulty or when they are close to elections (Meernik 2001).  Some scholars have even suggested that the leaders of foreign nations deliberately time crisis situations to occur when the economy of the United States is experiencing difficulties and also at other times when American Presidents have more incentives to get involved with foreign adventures (Meernik 2001).

Typically crisis scenarios increase the salience of the issue for the American public, especially if the issue is war.  Therefore, as issues become more salient, and the public increases its attention to the issues, this typically has a constraining effect on the president's decision making process (Knecht and Weatherford 2006).  In the case of space program, where the public has paid little attention since the Moon landings, presidents have typically had a free hand in formulating policy.  Indeed, public inattentiveness to the space program has been so great that Congress often prioritizes other political initiatives over the national space effort so much so that the president's space initiatives have gotten bogged down in the political process on Capitol Hill.

Scholars have also posited that crises tend to arise when the nation's leaders are performing poorly (Meernik 2001).  They maintain that presidents do not use force to divert issues for the public (Meernik 2001).  In contrast, the political atmosphere in Washington D.C. for noncrisis decision making usually entails political calculations based on a population that pays attention to the policy decision but then diverts its attention when the decision is being implemented.  Often Presidents find it necessary to make policy decisions that will be popular with an attentive population, however, as soon as the public's attention is diverted

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administrations find themselves with considerable latitude to implement the policy decisions in a manner that they think is consistent with what they consider to be the national interest (Knecht and Weatherford 2006).

Scholars maintain that if public opinion does in fact have an impact on presidential decision making, it is probable that this influence is determined by how severe the crisis is (Meernik 2001). If the crisis is extraordinarily critical for the country, presidents will typically have little room for political maneuver and will be compelled to act within the confines of how the public perceives the crisis. In extreme crisis scenarios it is often necessary for the president to use force, as is the case with the rise of terrorist groups and the threat they pose to American interests and allies. In these cases the international environment may necessitate a military response. However, when threats are not imminent and the public is inattentive to the issue the prevailing political conditions offer wide latitude for the president to decide from a wide range of policy alternatives, including inaction (Meernik 2001).

Regarding presidential decision making Ostrom and Job (1986) characterize the process in three different ways—"rational actor, cybernetic, and cognitive process" (543). But Ostrom and Job (1986) assume that presidents do not actually progress through the decision making process as a typical rational actor would, but rather in a manner consistent with the cybernetic approach. "Operating in a context that has been described as 'structural uncertainty,' the president is not able to determine the state of the environment, locate available alternatives, or assess the consequences of those alternatives—in short, the raw materials of rational choice are absent" (Ostrom and Job 1986, 543). Instead of the rational actor approach, it is much more likely that presidents adopt a cybernetic method whereby decision processes take place in

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extremely complicated and uncertain situations making use of simplified decision patterns. "The mechanics of choice are simple: the president monitors a limited set of essential or critical factors, and considers a restricted set of decision options. Choice is tied to the essential variables by a relatively simple decision rule. Underlying the cybernetic characterization of decision making is the following principle: 'A man, viewed as a behaving system, is quite simple. The apparent complexity of his behavior over time is largely a reflection of the complexity of the environment in which he finds himself'" (Ostrom and Job 1986, 543-544). In order to accurately link the environment with the decision process in a cybernetic way it is necessary "to take into account (a) the cognitive structure of the president-as-a- decision-maker, (b) the formulation and content of his decision premises, and (c) the logic of the inference process (or the decision rule) followed to reach a decision" (Ostrom and Job 1986, 544).

Public opinion is important in presidential decision making processes for many reasons. Probably the most obvious is also the most important—the election cycle. Eventually presidents will be held to account by the public at the polls, either directly when he or she is up for re-election or indirectly when the fortunes of his or her party is at stake if he or she is not running for re-election. In this regard, there is evidence that, in some cases, the president's foreign policy decisions are an important determinant when the public selects between candidates, a dynamic that in turn affects the president's foreign policy decisions (Knecht and Weatherford 2006). However, in regard to the space program, while there may be some key constituencies in states that have significant infrastructure for the national space effort, the public has largely been ambivalent about the space program after the end of Apollo. Therefore, it is unlikely that public opinion about space has had a significant impact on the electoral prospects of presidents.

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Regarding foreign policy, in those cases where the public appears attentive to the issues, Presidents of the United States often find it necessary to utilize foreign policy decisions to build, or shore up, their political capital. Often the most critical aspect of political capital is support for their administrations as reflected by approval ratings. High approval ratings necessarily give Presidents leverage in their dealings with the Congress (Knecht and Weatherford 2006). However, when the foreign policy decisions of Presidents turn out to be fiascos their approval ratings plummet and their political capital vanishes, which in turn compounds the problem even more as the lack of political capital tends to inhibit both their domestic and foreign policy agendas at the same time (Knecht and Weatherford 2006).

Some have surmised that presidents formulate their policies with a uniform process for decision making by organizing and assembling their information in a simplistic fashion. They base the political calculus with which they manage crisis scenarios on the various interconnected aspects of the domestic and international situations. In this regard, they focus on the linkages between the domestic and international situations (Ostrom and Job 1986).

But beyond the public's perception of events there are many other factors that affect the president's decision premises which may constrain the president's autonomy when making political decisions. These may include the disposition of the Congress and/or all of the activities of interests groups seeking to influence policy. These factors become even more prevalent when the public is largely ambivalent on the issues (Knecht and Weatherford 2006). Indeed, the Congress is especially influential in regard to such issues as international trade that do not entail crisis scenarios. This is so because the general population is largely ambivalent about the technicalities surrounding these issues, while at the same time there are important constituencies

in many congressional districts that will be directly impacted by political decisions on these issues. It is in this context that members of Congress attempt to utilize what influence they may have to secure rents for these constituencies (Knecht and Weatherford 2006). Such actions often serve to complicate the president's political calculus and in turn his or her decision premises. This was the case in regard to the effort to establish a Free Trade Area of the Americas (Knecht and Weatherford 2006). In this case US agricultural subsidies derailed the initiative (Knecht and Weatherford 2006). Therefore, while the president's decision premises are not solely conditioned by the public's attention span, it can nevertheless be surmised that public inattention usually gives the president more political room to maneuver in matters of foreign policy as well as the space program (Knecht and Weatherford 2006).

As the leader of the nation, the Commander in Chief is expected to address and manage the multitude of concerns the public has about issues of war and peace, the economy, and social harmony. In an effort to effectively do so, the president must amass a certain amount of political capital in the domestic political arena while effectively transferring the effects of such capital to the international political arena and then reversing the flow (Ostrom and Job 1986). In the process it will be necessary for the president to gauge, with some precision, the public's disposition to international events in combination with the public's disposition to the internal environment especially with respect to the management of the economy. Such political skills are necessary for any president if he or she is to cultivate a powerful resource base that can ensure his or her political survival, policy independence, and the future election prospects of his or her party (Ostrom and Job 1986). "Doing so naturally focuses his or her attention on factors such as his or her current and relative popularity and the US electoral calendar. Thus, the president will

be viewed as operating within a tripartite context. He or she will be seen to monitor salient dimensions in the domestic, international, and political arenas, and in his or her decision making will assess the relative importance of each of these dimensions before taking action " (Ostrom and Job 1986, 545).

Many proponents of the space program have supported strong presidents. They have believed that strong executive power would allow for long range programs, like Apollo, to take place (Launius and McCurdy 1997). Indeed, they have believed that strong executive power would necessarily create the political dynamic that would allow long range programs to be shepherded through the complicated political process and remain intact even in the face of diverse sets of vested interests that may have wanted to derail the programs. However, after Watergate presidential power may have been an illusion. This may have been so because the president was and is reliant on Congress to provide funds. Therefore, after Apollo, many space initiatives were delayed or obstructed by the varying political forces in the Congress and the influence they possessed over the budgeting process. In this regard, according too many, the real "powers of the presidency amounted to little more than the power to persuade" (Launius and McCurdy 1997, 3).

Nevertheless, the decision making processes for each president varied from administration to administration according to the structure of the political offices beneath them. This was most definitely the case in the distinctly different processes for Kennedy and Johnson in comparison to Nixon. "Taking an approach that differed in form rather than substance, Nixon relied upon his Office of Management and Budget to analyze space issues and resolve

interdepartmental disputes.  The president, of course, retained final control over space policy

decisions" (Launius and McCurdy 1997, 6).

In any event, the decision to conduct human missions to the Moon taken by Kennedy

may have been an anomaly in the course of the national space effort from its inception to the

present (Launius and McCurdy 1997).  Indeed, by the time that Reagan entered office the

political dynamic for the space program had changed markedly.  Shortly after entering office

Reagan announced a new space initiative that involved the development of a manned space

station.  NASA drew up a schedule for its development that would have led to its establishment

on orbit by 1994 (Launius and McCurdy 1997).  However, in contrast to the Apollo program that

was initiated by Kennedy where Americans set foot on the Moon eight years after Kennedy had

proposed the initiative, Reagan's space station initiative was still the subject of political

wrangling by the Congress ten years later and the initiative had not progressed (Launius and

McCurdy 1997).  Perhaps the shock of Sputnik would explain the urgency with which the

political system in the United States was able to come together and cooperate to undertake the

Apollo program.  Perhaps by the 1980s the fear of the Soviets in space was more controllable for

American politicians which might explain why, like many other political initiatives, space

initiatives were delayed and obstructed by manifold forces inherent in the American political

system.  Budgetary most prevalent among them—the case may have been that the Congress had

other priorities with the finite resources at their disposal.

There has been much speculation about how and why the Soviets were able to beat the

Americans into space with their Sputniks.  It is highly unlikely that any of these reasons could

have been technical or economic, but rather acutely attributed to the worldview of Eisenhower

and his decision making processes.  Eisenhower was the supreme commander of allied forces in the European theater during World War II and this experience had a significant impact on his approach to national security issues including developments in space.  According to Eisenhower "spiritual force, multiplied by economic force, is roughly equal to security.  If one of these factors falls to zero, or near zero, the resulting product does likewise" (Callahan and Greenstein 1997, 17).  Therefore, regarding national security, which would include space initiatives, Eisenhower believed the best way to enhance it for the United States was to foster the health of the domestic economy.  And as a republican, Eisenhower believed the best way to do this was to limit the size and scope of government, especially its spending.  Indeed, "on April 30, 1953, Eisenhower was told by the National Security Council (NSC) that the United States faced two fundamental threats:  the external Soviet menace and the internal danger that the costs of defending the free world 'may seriously weaken the economy of the United States and thus destroy the very freedom, values, and institutions which we are seeking to maintain'" (Callahan and Greenstein 1997, 18).  As such, the New Look placed a greater emphasis on nuclear weapons as opposed to conventional forces which was intended to "check the growth of the budget" (Callahan and Greenstein 1997, 20).  Further along these lines Eisenhower did not see the need to increase outlays for the space program in order to beat the Soviets in a race in space that would have only yielded propaganda results.  Indeed, "Eisenhower was ambivalent about the issue of prestige in the cold war" (Callahan and Greenstein 1997, 21).

But with the greater security emphasis placed on nuclear weapons Eisenhower also placed a significant emphasis on the mechanisms for their delivery.  That is, the Eisenhower administration actively sought to develop ICBMs with some urgency.  However, while this was

the case, the civilian satellite program may have delayed the development of ICBMs. Therefore, ICBMs were given greater priority, which may have ultimately delayed the civilian satellite program. In addition, spy satellites were given greater priority as well. It may have been possible to pursue all three equally but this would have required higher defense spending which Eisenhower was loath to do (Callahan and Greenstein 1997). As such, due to the national security priorities of Eisenhower, in addition to his economic philosophy, the Americans did not race the Soviets with enough urgency to orbit the first satellite for civilian purposes. Eisenhower wanted to avoid the notion of a race because it might have led to hysterical unrestrained spending (Callahan and Greenstein 1997).

The decision to create NASA was also undertaken by Eisenhower. It was very obviously incredibly momentous and portended significantly for the American national space effort. Concerning NASA, Eisenhower was initially reluctant to create the civilian space agency because he thought it would lead to duplication in the national space effort, it would create a new bureaucracy, and it would grow government. But then Eisenhower realized that scientific gains should be made available to the rest of the world, while at the same time the military aspects of space would require secrecy (Callahan and Greenstein 1997). Therefore, he believed it would be best to create the civilian space agency as a vehicle with which the national space effort could engage the world.

Following Eisenhower Kennedy emerged as the next President. "Kennedy framed his desire for American leadership in terms of military and economic strength as well as international prestige. American shortcomings in space gave him a powerful symbol in all three areas" (Beschloss 1997, 51).

Scholars have speculated about the motives behind the grandiose space initiatives that were a result of Kennedy's decision making processes. One has even suggested that Kennedy may have intended for space activity to attract public attention away from foreign policy fiascos like the Bay of Pigs (Beschloss 1997). At the time of the Kennedy administration the Soviets did not have a booster big enough to get to the Moon so the United States was not behind in the competition and could conceivably win that race (Beschloss 1997).

What is more, Kennedy's decision making processes were likely heavily influenced by his top officials. In this regard, in the early 1960s there were cuts to the military budget and McNamara thought the space program would be a way for contractors to maintain revenue (Beschloss 1997). "McNamara noted that without Apollo there would be a dangerous oversupply of manpower in the aerospace industry, 'this took away all argument against the space program'" (Beschloss 1997, 60).

Nevertheless, the decision to go to the Moon may have ultimately been the product of a difficult political situation that was prevailing for Kennedy at the time. "It is a measure of Kennedy's aversion to long-term planning and his tendency to be rattled by momentary crisis that one may conclude that in the absence of the Gagarin triumph and the Bay of Pigs fiasco in April 1961, he might never have gone to the length of asking Congress to spend $20 billion on a crash Moon program. Kennedy's desire for a quick, theatrical reversal of his new administration's flagging position, especially just before a summit with Kruschev, is a more potent explanation of his Apollo decision than any other. Johnson's desire for turf, McNamara's desire to use aerospace overcapacity, Kennedy's own conviction that a Moon program was

consistent with what Sorenson called 'the New Frontier spirit of discovery'—these things helped the decision along, but none was so important" (Beschloss 1997, 63).

Like Kennedy, Johnson also had a Congress that was largely compliant. This would necessarily ensure that there would be a measure of continuity for the national space effort for these successive administrations. Beyond continuing Kennedy's policy for the Moon there were "four considerations that determined Johnson's thinking about space policy in 1957-69: national security, personal political and party gain, domestic social advance, and budgetary constraints" (Dallek 1997, 68). Sputnik I and II moved Johnson to support "an aggressive American space program" (Dallek 1997, 69). Johnson's first goal was to close the missile gap. Second he thought that supporting a vibrant national space effort would benefit himself and his party politically. In any event, national security space was first on Johnson's agenda (Dallek 1997).

Long before Johnson was president, as a Senator he used Congressional activities, mainly hearings, on Soviet space activities to lambast the Republican administration and advance his political career. As vice president Johnson was very active in space matters even though the vice presidency is devoid of much responsibility (Dallek 1997).

After becoming president Johnson supported manned missions to the Moon for its propaganda value (Dallek 1997). In addition, Johnson's decision making processes concerning space were largely due to his propensity to advocate for liberal nationalism—"the ability of government to ensure economic and social progress through the use of its largesse" (Dallek 1997, 72). Johnson also thought the Moon program would contribute to economic growth by fostering research and engineering (Dallek 1997). Indeed, the Great society programs were also intended to improve the technological aptitude of the nation (Dallek 1997).

However, Johnson was reluctant to start ambitious new space projects during Apollo (Dallek 1997). In fact, NASA actually suffered cuts during the Johnson administration due to Vietnam spending (Dallek 1997).

Nixon marked a return to Eisenhower's philosophy. "Nixon was concerned about scientific-technological programs that might stress engineering over science, competition over cooperation, civilian over military, and adventure over applications, and this consideration prompted him to deal carefully with NASA's programs" (Hoff 1997, 93). Nixon wanted a frugal approach to government spending which necessitated caution for the space program (Hoff 1997). Evidently Nixon did not need the space effort as much as Kennedy and Johnson did to appear to the public that he was effective in dealing with the Soviets (Hoff 1997).

"The principle reasons for the deceleration of the space program under Nixon and for the rest of the 1970s arose from four rather broad issues that have been largely unexplored in the history of NASA: personnel, budgetary, foreign policy, and political factors" (Hoff 1997, 94). As far as personnel, there were little to no aids that were interested in promoting the space effort (Hoff 1997). Furthermore, NASA officials were dependent on relations with the Bureau of Budget and later OMB for their programs (Hoff 1997). Nixon's policy of détente meant that the United States would be less concerned about racing with the Soviets in space and more concerned with cooperation (Hoff 1997). Additionally, other domestic concerns—"environment, poverty, crime, urban renewal, and racism"—trumped concerns for the space program (Hoff 1997, 95). Nevertheless, Nixon approved the development of the space shuttle during his administration. Also, the 1970s marked a new spirit of international cooperation with Apollo-Soyuz and international communications consortiums such as Intelsat.

The Reagan and first Bush years were typified by incremental policy (Ragsdale 1997). In this regard, "a conglomerate of semifeudal, loosely allied offices with considerable independence from each other battled over incremental changes" (Ragsdale 1997, 140). With respect to this political dynamic "presidents rely on these numerous offices to make decisions for them. The chief executives become involved in the decision process at its end, if at all. Thus, although there is more hierarchy in the White House than on Capitol Hill, presidents do not have (nor do they often wish to have) full control over all decisions made on their behalf" (Ragsdale 1997, 143). This was most definitely the case for the Nixon administration when policy decisions involving the shuttle were the result of review process conducted by the OMB (Ragsdale 1997).

While the space shuttle was the product of a policy decision by Nixon, the policies of Reagan and Bush continued the initial policy in an incremental fashion. Beyond the space shuttle, Reagan proposed the aforementioned space station initiative. When the first Bush came to office after Reagan he proposed grandiose space initiatives in the manner of Kennedy that included a manned return to the Moon as well as an eventual manned mission to Mars. However, "NASA's three largest initiatives—the space shuttle, the space station, and the missions to the Moon and Mars—were all affected by the contradiction between big science and small policy at the heart of the national space effort in the 1980s and early 1990s" (Ragsdale 1997, 144). That is, the "small policy" was the incrementalism typified by Reagan and Bush. Into this incremental process these presidents were attempting to package grandiose objectives in space. "The shuttle protected the future of the space station through incrementalism" (Ragsdale 1997, 145).

What is more, with the rise of neoliberalism in the 1980s Reagan "also encouraged

private sector investment and involvement in space activities. By 1983, this encouragement took

the form of a presidential pronouncement on the commercialization of space" (Ragsdale 1997,

146). The shuttle and the space station were to be used to "manufacture pharmaceuticals,

computer chips, and metal alloys in space" (Ragsdale 1997, 147). However, cost overruns for

the shuttle, a major accident for the shuttle, and an unanticipated lack of interest in space from

industry would mean that nascent policies to privatize aspects of space would not get off the

ground until future administrations. Regarding the first Bush's grandiose policy in the early

1990s to return to the Moon and eventually take humans on missions to Mars, "the political

climate of budget cuts, divided government, congressional parochial interests, and a faded Soviet

space race precluded the successful exercise of presidential leadership" (Ragsdale 1997, 163-

164).

Presidential decision making is ultimately very important for the space program. Usually

when the public is inattentive to the issues, which is the case most of the time in space,

Presidents have a free hand to craft and implement policy. However, it appears that when it

comes to the policy process for space, the President's officials in his administration and the

Congress are at least as important, if not more so, in crafting policy for space. It most definitely

appears that in the case of the phenomenon of privatization in the space program under the

second Bush and Obama, the Presidents' officials were the prime movers behind the policies.


**Chapter 6: Privatization**

As noted above the phenomenon of privatization in the American national space program began as early as the Reagan administration. However, it has been with the second Bush and Obama administrations that the privatization phenomenon has come to fruition with the COTS and CCDev programs. Therefore, further analysis about broader privatization in government in both the United States and internationally is warranted. As such, the privatization of government assets and functions more broadly is explored in an effort to shed further light on the privatization phenomenon in the American space program.

There are a multitude of private organizations that are heavily involved in both the creation and the solution of a multitude of significant politico-economic issues that the Earth faces. These organizations come in a variety of shapes and sizes ranging from nonprofits to multinational corporations. They differ in the ways that they are organized as well as their legal status "but also in governing processes, purpose, degree of transparency and public participation, and the nature of their connection to the government" (Rudder 2008, 899). These organizations often have activities that are governmental in nature which are extremely complex and sophisticated. The unifying feature of the variety of roles that they fulfill on behalf of the central government is that their decisions are binding for the society that they intend to serve. And for most members of the society that they intend to serve there is no chance or desire to become actively involved in the decisions that are made on their behalf by these organizations which impact them to varying degrees (Rudder 2008). If, indeed, according to Laswell, politics is largely a question of "who gets what, where, and how" then the political significance of these organizations stands to increase exponentially as the American government increasingly relies on them in the development of policy (Rudder 2008). What is more "private governing is distinct

from participating in the decentralized, competitive market system, from the working of quasi-governmental organizations, from the lobbying of government, and from privatizing the administration of public programs" (Rudder 2008, 899). As with the privatization of services once provided by a central government, private governing is not a recent political development for the United States. It, however, is developing so rapidly that new political and international tools are becoming increasingly necessary to regulate these activities. In addition, these organizations' governmental activities are becoming increasingly necessary as the expertise that they possess is becoming increasingly critical for the politic-economic maintenance of society (Rudder 2008).

"As a self-conscious movement with genuine influence at the national level, privatization came later to the United States than to several other nations" (Henig 1989, 649). With the arrival of the Reagan administration into power at the beginning of the 1980s, privatization progressed rapidly from a concept on the political extreme to having a much more central role in the development of public policy. Once in office the Reagan administration very quickly started implementing many privatization initiatives by determining that a variety of public programs and government assets should be taken over by the private sector. An example of such an initiative was at the beginning of 1987 when the federal government sold its 85 percent stake in Conrail. Conrail was a freight rail corporation created by Congress in 1976 for the Northeast corridor (Henig 1989). The Reagan administration carried such policies further when in September 1987 it created the President's Commission on Privatization that "proposed further efforts to increase private participation across a abroad range of policy areas including low-income housing, air-traffic control, the postal service, prisons, and schools" (Henig 1989, 650). This political

philosophy would be expanded upon and carried further by the next president, George H. W. Bush, when this president proposed utilizing the market mechanism for school reform and appointing officials to his cabinet who supported the sale of government housing to its tenants at the time (Henig 1989). Indeed, with the rise of privatization in the American political discourse such concepts as new public management and devolution have also gained credence (Hasenfeld and Garrow 2012).

Before privatization initiatives had gained political credence in the United States the United Kingdom was an early innovator of privatization initiatives and pursued such initiatives expansively. However, the history of privatization initiatives in the United States deserves significant study to determine the antecedents of a political philosophy that has had such an important impact on American and global public policy. Indeed, as it would turn out most of the intellectual foundation developed to give privatization political and economic legitimacy was derived from academic circles in the United States, particularly from economists (Henig 1989). What is more, the United States has been a global leader in the implementation of many privatization innovations beyond the most straightforward policies involving the sale of public assets and enterprises including "contracting out, imposition of users' fees, and vouchers" (Henig 1989, 650). Also, as the American federal system does not possess the same kind of centralized command style economic controls as do other states, its privatization initiatives can serve to demarcate the entire sphere of privatization policy and determine the possibilities for success of many privatization initiatives that may be attempted internationally. Additionally, as the American federal system differs greatly from those of many other states who engage in privatization initiatives, the experiences that it has with the success or failure of these policies

can become important empirical evidence for any scholarly attempt to determine how political institutions can affect the success or failure of privatization initiatives (Henig 1989).

But while American governments at all levels, in addition to many other governments around the world, are increasingly relying on the private sector in the development of their policies contradictions have emerged in the pursuit of their policy objectives. Such contradictions include questions about sovereignty and responsiveness. This has certainly been the case as governments have increasingly subjected their policies to the influence of market forces in the provision, production, and delivery of services for their communities. Indeed, in a very gradual and incremental fashion more and more services that governments have historically been responsible for have been privatized (Morris 1997). While this trend has typically involved the provision of government services, the phenomenon has been expanded in scope by successive federal, state, and local governments to now involve the administrative and managerial aspects of public programs (Morris 1997). The Obama administration's space policy, involving crew and cargo transportation to the ISS by commercial entities, is a fantastic example of this policy trend. But prior to this policy, the wave of Republican congressional elections in 1994 saw a retrenchment and expansion of the ideology following the Reagan administration. The Republican congress of this era saw privatization as a way to limit the expansion of the federal bureaucracy and reduce the scope of government's role in society.

Traditionally, conceptions of privatization have not expanded beyond scenarios where the private sector entity produces or delivers a good or service, such as garbage removal or the furnishing of the space shuttle. In such scenarios government contracts with an entity to deliver the service or produce the good. "But when privatization is expanded into the administrative and

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managerial functions of government, the role of the private sector in the privatized arrangement

is altered substantially" (Morris 1997, 57).

There is some compelling evidence that privatization does in fact enable the more

efficient and effective delivery of public goods and services—at least in certain scenarios. In this

regard, there are two studies conducted decades ago that demonstrate this phenomenon. They

involved fire protection and waste removal services. Conducted by Roger Ahlbrandt and E.S.

Savas, the two studies have had a measure of influence in the political debate:

> "Ahlbrandt investigated fire protection services in Scottsdale, Arizona, which had
> contracted with the private Rural-Metropolitan Fire Protection Company. He concluded
> that Rural Metropolitan was providing services at slightly over half of what it would cost
> if the city had chosen to provide comparable services publicly. The private firm spent
> more on research and development than public fire departments, and accordingly found
> several innovative means of minimizing capital and labor costs. These included the use
> of smaller fire trucks and smaller and lighter fire hoses. Rather than purchase its
> equipment, Rural-Metro built most of what it needed itself, or subcontracted the
> construction to other firms. And rather than pay full-time firefighters to sit idly in the
> station waiting for a call, the company trained city workers in other departments in fire-
> fighting techniques. These 'wranglers' worked only when needed and were paid only
> when they worked" (Henig 1989, 657-658).

And:

> "E. S. Savas compared public and private refuse collection in the New York metropolitan
> area. He concluded that 'it costs the city more than twice as much as the private sector to
> collect a ton of garbage....' In Douglaston, an area within New York City, the public
> sanitation department made two curbside pick-ups each week at a yearly cost of $207 per
> dwelling. In nearby Bellerose, New York, Savas found that a private firm was able to
> make three weekly pickups from the back of residents' homes at a cost of only $72 per
> dwelling per year" (Henig 1989, 658).

Proponents of privatization have distilled the logic behind the concept by observing that

governments provide services, as is also the case with industry. In this regard, a government is

also a producer. Citizens pay for these services when they are taxed in a somewhat similar

fashion when they procure services from a private sector provider (Hasenfeld and Garrow 2012).

The idea is that if it were possible to extend the nonmonopolistic, competitive conditions of the private sector to the sphere of government then citizens, or clients, will receive a better deal for the services that would otherwise be rendered by their government (Hasenfeld and Garrow 2012). Furthermore, it is thought that by introducing market mechanisms, such as competition, a government's industry partners in good or service delivery will be forced by these mechanisms to provide a greater quality and quantity of these goods and services than would otherwise be provided by a government that was not subject to these mechanisms. Such dynamics will also improve efficiencies throughout the process as well. Supporters of privatization would maintain that not only would this result in higher quality of goods and services for the public but would also lead to cost savings for their governments (Hasenfeld and Garrow 2012).

Supporters of privatization believe that the philosophy gained currency in American politics because it could potentially lead to increases in efficiency, competition, and innovation, as well as reductions to the deficit, which are all goals of both political parties and the state they seek to govern. However, those who only focus on the economic aspects alone do not get the whole picture in the political debate. Indeed, the privatization movement is intensely political (Henig 1989). "Privatization initiatives are political because they redistribute costs and benefits among diverse and competing groups" (Henig 1989, 669). Those who seek to situate advocacy for privatization initiatives in a fiscal perspective fail to account for the multitude of other policy options that policy makers could have pursued. What is more, those who seek to understand why privatization initiatives were selected solely on fiscal grounds also do not possess a full accounting of all the partisan tactics that may have been employed by policy makers in addition to all of the pressure there may have been from interest groups (Henig 1989).

Nevertheless, even if one were to fully account for the broad array of political aspects that impacted any policy decision to privatize, over and above those of an economic nature, there still would be many more questions in the way of understanding how those inclinations emerged or evolved. Regardless, "it is through their effect on the way that individuals and groups come to identify their distinct and common interests that ideas come to play a major role in shaping political dynamics. Emphasizing interests to the exclusion of ideas treats such important collective enterprises as persuasion, learning, and conversion as derivative epiphenomena; and this interprets policy change solely as the result of shifts in the balance of power among a stable of relatively fixed interest groups" (Henig 1989, 669).

The ideology behind privatization is very important in American politics of course because it is the source of critical attempts to recast both economic and political aspects of debate in the public arena. In this respect the ideology has achieved a modicum of success because it has effectively changed the way that politicos talk about politics. The way that policy makers determine and weigh their political options are certainly different in the modern era due to the possibility of privatization. This new dynamic has necessarily meant that those who would support a centralized and authoritative role for the government increasingly need to justify their position (Henig 1989).

In any event, the forces that were responsible for making privatization a new phenomenon in American politics are different from those that have ultimately meant that privatization initiatives would be adopted and implemented. Debates about privatization, and then the implementation of privatization policies, have been somewhat separate. Indeed, it has

been observed that privatization initiatives have been most successful politically when they were least visible (Henig 1989).

However, it is by no means certain that privatization will prove to be the most effective policy in all scenarios. There is still some question about whether or not private industry is more efficient than the public sector in all governmental undertakings. In some examples where privatization initiatives have been pursued these initiatives were rather conventional policy choices that were recast due to political expedience (Henig 1989). In still other examples many obstacles arose for privatization initiatives because of various political and economic issues. And in yet more examples, privatization initiatives have galvanized and catalyzed substantial political opposition from mobilized interests who have succeeded in turning some of the logic behind privatization in their favor and then began to reverse the privatization trend (Henig 1989).

What is more, it has been observed that "privatization creates a 'hollow state' in which there is a fundamental shift from the perspective that citizens are principals and officials are agents to the view that officials are principals and private providers are agents. This shift is accompanied by a change in the way that public services are delivered: offerings formerly delivered by a public bureaucracy are now distributed through a network of private providers. In the 'hollow state,' government officials 'are continually faced with problems that can lead to instability—negotiating, coordinating, monitoring, holding third-parties accountable, and writing and enforcing contracts—all for organizations that are relatively independent of the funder'" (Hasenfeld and Garrow 2012, 306).

Regarding the ability of governments to retain control over service delivery and remain accountable to their constituencies it is widely acknowledged that the public sector must at all

times "maintain the provision function in the privatization arrangement" (Morris 1997, 58). Such arrangements must necessarily entail that public officials exercise control over public funds, and exercise significant oversight over agents empowered to carry out critical duties on behalf of the public. In the United States, the public sector has typically held the private sector to account in the provision of public goods and services with a legal contract that obligates the industry partner to the government (Morris 1997).

Scholars have maintained that accountability in government places special burdens on public officials (Morris 1997). In the first instance, the public sector is responsible for critical goods and services—the things that are so vital for society that only the government is entrusted to provide them. Additionally, the culture of the United States is so diverse that its interests have also become comparatively diverse. What this essentially means is that the public sector has more exposure to a broad array of factors that could lead to the failure of its policies if the needs of a segment of the culture are not accounted for (Morris 1997). Furthermore, as many governments have traditionally had the power to deprive their populations of rights a certain amount of tension has existed between public administrators and their clients, or the communities they serve. Obviously in the case of the United States the Constitution has built in mechanisms to ensure that the people's rights are not infringed upon (Morris 1997). Nevertheless, the system is not fool proof and can and does break down in certain instances. Regardless, historically, political actors in the United States have tried to make the system as accountable as possible to the public.

Concerning accountability, many see a growing interdependence between governments and the communities they intend to serve. In this regard, good governance involves a process by

which the initiatives of the public sphere and the needs of the private sphere are increasingly linked. However, some scholars believe that the goals of government are more important than those of the private sector (Morris 1997). Nevertheless, when it comes to the creation of public-private partnerships governments must go to great lengths to ensure that the goals of the private sector are accounted for because if they are not the government's industry partners will be disinclined to agree upon the arrangements, which will ultimately mean that the government will lose out on all the benefits that the private sector can bring to the partnership (Morris 1997).

There is an additional aspect that is vital to any effort to harmonize government and industry goals in any partnership. For governments, goals are agreed upon as a result of the political process. Most of the time these results are complicated, unclear, and at odds with one another. Furthermore, public administrators are unable to exercise enough control over the objectives that are handed to them (Morris 1997). In the private sphere, objectives are typically more unambiguous, with all efforts aimed at maximum efficiency. Industry managers, as opposed to public administrators, are often able to exercise significantly more discretion in their approach to the attainment of objectives. "Successful interdependence must come to terms with two very different cultures—one for whom goals are often complex and uncontrollable, and another for whom goals are both clear and manageable. Successful privatization can take place when the social and political environment in which privatization occurs is structured to encourage public accountability. The contract alone is not enough to secure accountability; rather, accountability can be achieved when the contract, the legal environment, and the regulatory context mesh in such a way as to promote it. Furthermore, there is evidence to show

that accountability is greatly enhanced when both parties in a public-private arrangement openly share information related to the joint venture" (Morris 1997, 58-59).

Regardless, as more and more public-private partnerships emerge the industry side of the arrangements are increasingly in positions where they are necessarily crafting and implementing what appears to many observers to look like public policy. "Private authority surfaces when corporations take 'the lead in establishing norms, rules, and institutions that guide the behavior of the participants and affect the opportunities available to others'" (Rudder 2008, 907). The industry partners in the public-private partnership, while subject to market forces, nevertheless find themselves in positions of authority that are undifferentiated from that which is exercised by governments (Rudder 2008). Indeed, there is significant evidence to suggest that the authority exercised by industry and the authority exercised by government are increasingly intertwined in the public sector as the phenomenon of public-private partnerships grows. "This private authority exhibits the same kind of 'structuring effects' that governmental policy exhibits. Examples include rules for online commerce, the work of bond-rating agencies, and environmental management guidelines established in conjunction with the International Standards Organization." (Rudder 2008, 907).

Furthermore, industry-government partnerships are somewhat of a paradox. The arrangements are usually intended to privatize a certain measure of government activity, however, the dynamic that typically results is one where the industry partner becomes much more involved in the policy and administrative apparatus of the government. Such a dynamic is the opposite of any intention to reduce the size of government (Morris 1997). When such dynamics occur the industry side of the arrangement typically takes on more characteristics of

the government than the other way around. "The message is clear. When privatization works—that is, when accountability mechanisms are in place, when goals are coaligned, and when feedback mechanisms are functioning—the private sector takes on attributes and characteristics of the public sector. The coalignment of goals thus results in the adoption of those goals, to no small degree, by the private sector actor" (Morris 1997, 60).

Such dynamics are becoming increasingly relevant not only for the American national space program but for the American military as well. Indeed, as there is much policy and technological overlap between the American military and the American space program the developments involved with the privatization of the military are increasingly relevant for the space program.

For many decades now what was once a dominant American position in the global economy is slowly eroding. Simultaneously new enemies for the United States are emerging while still others are reconstituting. One example would be the Islamic State in Iraq and the Levant (ISIL). Another would be the military rise of China. Still another would be a resurgent Russia. The new dynamic that is emerging is leading to several questions for American policy makers. One of the most important is whether the United States military can retain its technological edge in the emerging arms race with China while at the same time confronting ISIL. The capabilities necessary to counter these two potential threats differ widely.

As early as 1989, 1991, and 1992 there were a number of studies commissioned by the Office of Technology Assessment of the American Congress that determined that the Department of Defense was unable to control the way technology was developed and proliferated (Cronberg 1994). In this regard, the typical process whereby a military need

necessitated the development of a technology that would later be spun off to be utilized for civilian purposes was becoming replaced by technologies whose development was initiated by the private sector and that which would become spun on to suit the military's needs (Cronberg 1994). With the emergence of these new technological and acquisitions dynamics warfare itself was also in the process of substantial changes throughout the spectrum of conflict. "At high intensity levels of conflict, the military operations of great powers have become more technologic and thus more reliant on civilian specialists to run their increasingly sophisticated military systems" (Singer 2001, 195). Indeed, in this new era of warfare when American forces are deployed across the globe, vital elements of their operations have come to be controlled by more and more contractors. Many of these contractors are considered privatized militaries, or mercenaries, but they nevertheless are responsible for operating many of the military's systems, especially information technology (Avant 2007).

What is more, "not only has commercial technology taken the lead, military procurement has also become inefficient. The military industrial technology base is deteriorating" (Cronberg 1994, 211). Beginning in the 1990s a new approach to procurement was adopted that sought to integrate civilian and military technologies. At this time technical experts at the Defense Advanced Research Projects Agency (DARPA) recognized the emerging technological trend whereby industries that were solely military in scope would atrophy and would need to increasingly adopt commercial technologies to adapt to the new military-industrial dynamic. The gap between the security and civilian sectors would need to be replaced by a new dynamic that promoted technologies with dual uses that each sector could exploit to the maximum in pursuit of their missions or objectives (Cronberg 1994).

Furthermore, as the possibility of future warfare between great powers, such as the possibility of Air-Sea battle between the United States and China, evolves into more and more sophisticated modes of combat utilizing the most advanced technologies, the necessity of specialized expertise is becoming increasingly paramount. In many cases such expertise must be procured from private elements. At the beginning of the 21$^{st}$ century the reality facing the United States Army was that its future forces would possess so much technological and operational sophistication that they would require private operators to provide significant amounts of technological and logistical support for their operations (Singer 2001).

The privatization of militaries has also been an increasing trend for other nations with sophisticated forces. Indeed, in the years following the 1999 Kosovo conflict the United Kingdom reorganized its forces to allow for private firms to operate "its aircraft support units, tank transport units, and aerial refueling fleet" (Singer 2001, 196). Such forces are indispensable for sophisticated military operations.

The revolution in military affairs (RMA) has also meant that cyber operations are an increasingly central aspect of conflict. Perhaps the most significant attribute of the RMA is the information oriented nature of this new mode of warfare. As cyber power is an increasingly vital attribute of modern forces, for not only Western powers but China as well, their militaries are finding it increasingly necessary to dominate this spectrum of conflict. Indeed, full spectrum dominance cannot be had without information dominance. As such, the United States military has recognized the need to incorporate contractors with critical IT skills even into the midst of battle (Singer 2001). Such efforts will be critical for maintaining the functionality of its most sophisticated systems in combat. "Information-warfare, in fact, may well become dominated by

mercenaries" (Singer 2001, 196).  However, the United States military may well find this a very difficult dynamic to deal with due to the difficulty of retaining personnel with the most in demand IT skill sets who have a variety of other professional outlets that would compensate them more highly (Singer 2001).

The situation that prevailed in the Iraq War is telling of the new and growing privatization dynamic for advanced militaries.  After the initial triumph of US forces following the quick invasion of Iraq in 2003, US forces included "between one in ten to one in six employees of private security companies performing the work that used to be done by soldiers" (Avant 2007, 457).  When it appeared that the American military was stretched too thin in the years that followed massive amounts of private military contractors surged into Iraq "to train the Iraqi police force, the Iraqi army, and a private Iraqi force to guard government facilities and oil fields, and to protect expatriates working in the country" (Avant 2007, 457).  "In May 2004, Secretary of Defense Donald Rumsfeld estimated that in excess of 20,000 private security personnel were in the country (making private soldiers the second largest member of the 'coalition of the willing').  In fact, if one combines the set of support and training personnel with the estimated set of private and site security personnel, the numbers are much higher than that. As many as 58,000 private security personnel may have been working in the country at that time. The Pentagon's first census of the number of contractors in Iraq, released in December 2006, counted 100,000 contractors working for the U.S. government alone.  In addition to this 100,000, countless others work for various governments, private firms, and international non-governmental organizations (NGOs)" (Avant 2007, 457).

One of the most important benefits of using private military companies is the ability to surge their forces on short notice (Avant 2007). This attribute was a critical aspect of the policy decision to employ them in Iraq. Indeed, one of the primary benefits of utilizing the private sector in the Bush and Obama administrations' space policies was the belief that the private sector firms could constitute space systems in a more timely fashion than the United States government. In this regard, private sector firms are not typically subject to the same political and bureaucratic constraints as are elements of the American government and as a result can mobilize resources more quickly. Such was the case in Iraq where private security contractors were able to deploy forces to the theater of operations "to accomplish a wide variety of tasks. As quickly as these forces can appear, they can disappear; once dangers pass or local forces are trained and deployed, contracts can lapse and these personnel can be quickly de-mobilized" (Avant 2007, 457).

What is more, according to Singer (2001):

"the last few decades have been characterized by a normative shift toward the marketization of the public sphere. As one analyst puts it, the market-based approach toward military services is 'the ultimate representation of neoliberalism.' The privatization movement has gone hand in hand with globalization: Both are premised on the belief that the principles of comparative advantage and competition maximize efficiency and effectiveness. Fueled by the collapse of the centralized systems in the Soviet Union and in Eastern Europe, and by successes in such places as Thatcherite Britain, privatization has been touted as a testament to the superiority of the marketplace over government. It reflects the current assumption that the private sector is both more efficient and more effective. Harvey Feigenbaum and Jeffrey Henig sum up this sentiment: 'If any economic policy could lay claim to popularity, at least among the world's elites, it would certainly be privatization.' Equally, in modern business, outsourcing has become a dominant corporate strategy and a huge industry in its own right. Global outsourcing expenditures will top $1 trillion in 2001, having doubled in just the past three years alone. Thus, turning to external, profit-motivated military service providers has become not only a viable option but the favored solution for both public institutions and private organizations" (Singer 2001, 197-198).

Regardless, there are matters of perception that could be potential drawbacks to the use of private military contractors. In this respect, the profit motivation behind private military contractors makes their use less desirable in crises and conflict areas than forces who are fighting for their country. Private military contractors may not be as dedicated to the mission as national troops. Nevertheless, when political and economic demands necessitated troop reductions after the Cold War had concluded, the Pentagon created the LOGCAP program, a policy innovation involving the outsourcing of logistics, as a means to support the military's operations without as many troops (Avant 2007). Also, many observers were of the opinion that a long-term commitment by the United States would be necessary to sustain the political and economic gains that were made in Iraq but quickly realized that such a commitment would not be politically viable from a public opinion standpoint in the United States and that the election cycle would not permit one. It was therefore surmised that the employment of private military contractors would allow the United States government to carefully avoid the American public's aversion to troop casualties and sustain support for engagement in Iraq (Avant 2007).

"The blurring of lines between what soldiers and what private security personnel do may also inhibit military innovation. Costly changes may be less attractive than outsourcing. It also may erode the professional ethos of the military. Opportunities in the private sector have already had an impact on retention and some worry that if forced to compete with the private sector, the military will lose unique and important professional qualities that are crucial to successful security operations in a democratic setting" (Avant 2007, 459).

Privatization is a growing phenomenon for the American government. This was seen with Republican administrations beginning with Reagan, but can also now be seen with even a

Democratic administration in the case of the Obama administration's space policy. At issue in the privatization debate are questions of costs, efficiencies, and accountability. However, a new arrangement that combines the best of government and industry is emerging as well. This arrangement is known as the public-private partnership and is a combination of both government and the private sector.

## Chapter 7: Public-Private Partnerships

The public-private partnership is an innovative industry government combination that entails a measure of partial privatization but nevertheless allows government to retain ultimate control over the project. Critically, the public-private partnership enables industry and government to combine the resources of both sectors. This combination is the phenomenon that has emerged with the American national space effort.

In any event, when considering the dynamic between the private and public sectors scholars have historically seen it "as a zero-sum game" where the vitality of one sector is expanded to the detriment of the other (Moe 1987, 460). However, in modern societies the reality is such that the vitality of each sector is increasingly dependent on the other (Moe 1987).

One of the most critical roles of the public sector is the provision of infrastructure, such as "bridges, highways, streets, jails, and airports" (Engel et al 2011, 8). Such infrastructure is necessarily meant to serve the needs of society for a manageable expenditure of public resources. As these projects typically involve a significant amount resources that are invested at the beginning of the projects, it is absolutely vital that public agencies make informed and intelligent decisions about the projects to be undertaken regarding construction as well as the projects'

design and features (Engel et al 2011). Further along these lines, once completed, the infrastructure in question will need resources for ongoing maintenance and operations.

"Traditionally, these infrastructure projects have been publicly provided; a public agency would award the construction of a project designed by the public agency to a private firm. The private firm would build the project; after receiving the agreed payment, its contractual link with the project would end" (Engel et al 2011, 8). However, a number of issues with the traditional arrangement have arisen. One such concern is that, in a number of cases, the distinction between construction and operation did not give the builder enough incentive to include the operational costs over the life of the facility into the design of the facility. This reality, coupled together with the propensity of public agencies to allocate monies to new projects as opposed to the maintenance of existing facilities, has resulted in greater expenses and lower quality standards (Engel et al 2011). In the United States years of neglect for infrastructure, in addition to below average service provision, have created public demands for improved maintenance of public infrastructure. The critical consequence of which has been the necessity of government to rethink and reimagine the ways in which public agencies can provide services and build and maintain infrastructure.

Regarding this emerging political dynamic, there are a variety of ways that governments can offer services to their citizenries and provide infrastructure. One such way involves outsourcing. "Outsourcing is the contracting by a public agency for the completion of government functions by a private-sector organization" Norment 2002, 4). With outsourcing a government agency offers financial compensation for services and/or infrastructure to a private sector organization to perform roles that were previously undertaken by the government agency.

Another way in which governments readjust their service and infrastructure provision is through privatization. "Privatization is the sale of a government owned asset to the private-sector, for private operation of a function that might have previously been done by the public-sector" (Norment 2002, 4).

While scholars may define privatization in a variety of ways, efforts to privatize have been linked by a common view that the government is too big and that the private sector could do a better job providing the same services as the government (Moe 1987). Or at least that the provision of these services would become more efficient if they were subject to market forces. Moe (1987) maintains that proponents of privatization believe that many government functions can be performed more efficiently and economically by the private sector. Underlying the beliefs that proponents of privatization share is the idea that industry and government are largely similar in that both are subject to identical economic incentives and disincentives (Moe 1987). Most of the services that each would provide are largely interchangeable. The main question is then which side will provide the service most efficiently and at the least cost (Moe 1987).

Regardless, by far the biggest attribute that distinguishes "the public and private sectors, especially at the federal level, is the concept of sovereignty. The federal government possesses the rights and immunities of the sovereign; organizations functioning in the private sector do not, or at least ought not, possess such rights and immunities" (Moe 1987, 464).

As far as sovereignty is concerned there are a number of characteristics that it possesses according to Moe (1987). The first characteristic is its monopoly on the legitimate use of force in society. "The sovereign can coerce organizations, groups, and individuals to conform to the laws it makes. The sovereign may, for instance, tax citizens and corporations and impose

penalties on those who resist paying their taxes" (Moe 1987, 464).  Sovereigns are the only

entities with the legitimate right to make war.  While wars do occur that involve organizations

which are not sovereigns, those non sovereign entities participating in the war typically do not

have as much legitimacy as do sovereigns in the conflict and often wage their campaigns beyond

the politically acceptable scope of warfare.

Moe (1987) maintains further that "sovereigns can do no wrong.  If a sovereign is to be

preeminent over all others within a territorial jurisdiction, it cannot be subject to constraint or

injury except by its permission.  Thus, sovereigns are immune from suit except by their

permission" (464).

What is more "a sovereign is indivisible" (Moe 1987, 464).  In this regard, a sovereign

cannot give away its powers to a private entity and continue to be sovereign.  "Similarly, a

sovereign cannot share its powers with another body claiming sovereignty" (Moe 1987, 464).

A sovereign has the ability to renege on the debts it has outstanding but cannot go

bankrupt outright.  One method by which observers can determine if an organization should be

considered an element of the American government is to ascertain if, indeed, its financial

commitments "are backed by the full faith and credit of the United States Treasury" (Moe 1987,

465).  If so, the organization in question is usually considered to be part of the federal

government.  Individuals within society have the personal or private right to declare bankruptcy,

which is to be considered absolved by law of any financial commitments owing to their persons,

but this is not a characteristic of a sovereign.  "Debate over the status of the Federal National

Mortgage Association ('Fannie Mae'), a privately-owned corporation whose stock is traded on

the New York Stock Exchange, revolves, in large measure, around the question of whether or not

its notes are backed by the full faith and credit of the Treasury" (Moe 1987, 465).

"The sovereign has the right to establish the rules for protection and transference of

property, both public and private.  Thus, the sovereign has the right to take private property,

'eminent domain,' to promote a public purpose.  Sovereigns must provide the means of contract

enforcement and other safeguards for the transaction of business" (Moe 1987, 465).

At present public agencies from bottom to top (federal, state, and local) are being

challenged with maintaining quality services and constructing a vast array of new infrastructure.

Constraints on government budgets, overdue projects, maintenance backlogs, and rising

populations have created new questions about how to increase government responsiveness.  A

concept that continues to develop in this regard attempts to combine both the public and private

sectors into industry-government partnerships known as Public-Private Partnerships (PPPs or

P3s).  These partnerships are contractual arrangements between industry and government that

allows private entities to deliver services or facilities to the public while the government

continues to maintain a measure of sovereignty over the process (Meyer 2012).  This is the

phenomenon emerging with the American national space effort.

In response to the above mentioned difficulties that governments face in the delivery of

services, or in the provision of infrastructure, PPPs are becoming an increasingly viable

alternative for governments wherein they contract with private firms.  In these arrangements the

private firms will typically construct, maintain, and operate facilities, in addition to providing

services, for lengthy periods of time.  This arrangement is made possible for the firm as the firm

is then able to receive user fees or other periodic payments over the life cycle of the project

(Engel et al 2011). All the while the government continues to exercise a measure of sovereignty over the project.

The National Council for Public-Private Partnerships officially defines a PPP as "a contractual agreement between a public agency (federal, state or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility"" (Meyer 2012, 2).

"P3 concessions are public–private agreements in which the private sector takes on some of the risks and rewards of financing, constructing (or leasing), and operating and maintaining a transportation facility in exchange for the right to future revenues or payments for a specified term" (DOT 2010, 3).

Usually when a government undertakes to provide a service or construct infrastructure it will have a public agency create a design to start the project and then ask for proposals from industry to provide the service or construct the facility. Typically the agency would then contract with the firm that provides the lowest proposal and have that firm develop the project. After the firm completes the project "the public agency is then responsible for future operations and maintenance. A P3 concession is an alternative way for a public agency to deliver a public-purpose project. A P3 concession has three primary elements: a concession goal, a compensation structure, and a term or length of time. Each element is established by the public agency that implements the P3 concession, sometimes in negotiation with the private partner" (DOT 2010, 4).

PPPs can best be characterized by a process whereby the resources of industry are employed in such a way that combines outsourcing and privatization. PPPs typically entail the mobilization of both industry and government resources to provide services to publics and/or to design, construct, finance, operate, and maintain infrastructure. PPPs are usually financially self-sufficient in so far as they are financed by private sector methods and operate on their ability to derive revenues from the provision of facilities and/or services (Norment 2002).

The critical reason for the PPP's greater solvency than purely government projects is the possibility of the PPP to create better financial arrangements over longer periods than a government can as well as the increasingly nimble ways in which the PPP can secure the financing. But in addition to everything that the private sector brings to the operation public-sector assets—personnel as well as facilities—are also included to create a critical mass of resources. PPPs operate under official, legal agreements that constitute contractual relationships between governments and industries (Norment 2002). The idea in this regard is to bring the best qualities from both worlds to bear on the project. In this way PPPs strive to deliver the same services and infrastructure that a government otherwise would but only in a more efficient and economical way with tremendous savings to publics (Norment 2002). In the process governments strive to become closer to the populations that pay and benefit from these services and facilities. As such PPPs provide governments with another option to meet the demands of their citizenries more quickly and at reduced cost (Lloyd 2013).

However, beyond simply making such innovative arrangements to provide services and infrastructure to their citizenries, governments need to do more for their publics in this regard. One way for governments to do more for their publics is to educate them about all the expenses

and benefits of public-private projects.  This should not mean that public agencies should ever endorse one qualified private entity over another, or ever relinquish their right to cancel a project if it is going to run into financial difficulty, but governments should never less provide important information to their publics about public-private projects and keep them abreast of all important developments (Lloyd 2013).

A PPP typically involves significant up-front costs that have to be recouped in a long-term contractual arrangement.  This necessarily entails that the private side of the relationship construct, operate, and maintain the project while managing the expenses of the service and/or facility over its life-cycle.  As the private operator is compensated for the delivery of services and/or for providing facilities, it is in the firm's interest to maintain the service and/or facility efficiently and economically while limiting the expenses to be incurred over its life-cycle (Engel et al 2011).  With such arrangements the service and/or infrastructure typically will end up being returned to the control of governments.  Schools, jails, and hospitals are some of the various ways that PPPs are utilized to provide and services and infrastructure.  The transport sector is a significant area for industry-government collaboration as well.  In this regard, one of the ways that PPPs are able to more efficiently deliver services and provide infrastructure is to "bundle maintenance and operations" with the development of the facilities in question (Engel et al 2011, 8).  "Because the private partner builds, operates, and maintains the project, the incentives for durable construction and efficient maintenance and operation are aligned" (Engel et al 2011, 8).

## Finance

Perhaps the most critical aspect about the public-private partnership that makes it so attractive to public administrators is financial.  The PPP offers many financial benefits to projects to provide services and infrastructure to the public.  Indeed, the financial capacity of such projects can be significantly expanded by various financial techniques such as equity contributions, commercial loans, or other debt that the industry side can manage for the partnership (DOT 2010).  This aspect becomes increasingly critical for the development of projects when the government does not have the political or financial capacity to borrow for badly needed projects.  But while expanded ability to finance vital projects is typically what leads public administrators to first consider PPPs, the incentives made possible by concessions to industry will typically result in situations that create more value for governments due to the partnership's increased ability to manage assets and deliver services and infrastructure in a timely fashion and within the confines of its budget.  Additionally, the manner in which risk is shared by both government and industry necessarily allows the two partners to protect themselves better from the expense and consequences of problems that may arise with projects, including unforeseen new costs, design flaws, and systematic failures (DOT 2010).

There are many more financial advantages to this innovative approach to service and infrastructure delivery as well.  As previously discussed, "PPPs can reduce development risks, provide more cost effective and timely infrastructure delivery, offer the potential for better ongoing maintenance, and leverage limited public sector resources, all while maintaining the appropriate level of public control over the project.  While PPPs may not be appropriate in all cases, these partnerships can address public needs in the areas of facilities, real estate development, energy, information technologies, transportation, education and healthcare, and

water/wastewater.  In each case, unlike under privatization, the public sector retains a high level

of ownership and control over the project and its outcomes" (Meyer 2012, 1).

Nevertheless, despite these advantages, the PPP still comes under a certain amount of

criticism from certain quarters in the political arena.  In this regard, the criticism that arises most

of the time, besides ideological criticisms about the intrusion of capitalism into the public sector,

is financial.  Sometimes PPPs are considered a more expensive way to provide services and

infrastructure.  Critics generally get this idea due to the prevailing "differences in interest rates

for tax-exempt municipal bonds, or general revenue sources," in comparison to the typical costs

of financing projects entirely by industry methods (Meyer 2012, 1).  In this regard, Meyer (2012)

holds that if public administrators develop ways to properly evaluate all the financial

possibilities, including a Value for Money (VfM) assessment, the comparison will present a

clearer picture about all the expenses involved with the various approaches to develop projects

that will generally favor the industry government partnership.  As such, both proponents and

opponents of the partnership approach may be surprised to find that the PPP can deliver better

services and infrastructure in more economical ways than those most commonly associated with

government financing, thus providing greater value to populations.

Meyer (2012) holds further that evaluating the financial aspects of projects in their

entirety will necessarily include a number of issues that are typically left out when the traditional

evaluation for public financing is conducted.  One doesn't get the whole picture of all the total

costs involved with the entire life span of a project.  While conducting the VfM assessment is

more complex than a traditional public financing assessment, the potential benefits to be had

make it far more desirable to proceed in this fashion.  "The analysis can expose the potential

benefits and drawbacks to both project delivery options, and choosing the right option for each scenario may make the difference between being able to deliver a project and leaving needs unmet" (Meyer 2012, 1).

Regarding the PPP the various players include: "federal, state, and local governments; equity investors, commercial lenders, and bond holders" (Meyer 2012, 5). This mix is critical to providing financial flexibility to projects as "state and local decision makers who employ traditional approaches to project delivery face a multi-dimensional problem: they often lack capital to fund necessary infrastructure projects but then also face added costs associated with inaction or deferral of projects" (Meyer 2012, 5). By including equity investors, commercial lenders, and bond holders PPPs create a vast array of financial options to public administrators seeking to develop projects in a timely fashion with limited resources.

Indeed, one way to increase the amount of expenditure that public administrators would want to initially provide is to include private equity in the project. By including private equity in the initial capital contribution public agencies can provide themselves with much wider financial options to increase the amount of resources they would expend at the beginning of the project (DOT 2010). One example would involve a highway project that would cost $1 billion overall for a public agency, but the toll revenues would only suffice to create $800 million with traditional public financing (DOT 2010). The problem herein would lay with the public agency's lack of other financial options necessary to generate the additional $200 million to fill the financial gap. However, if private equity were to become involved it would have the potential to provide the extra initial investment necessary to develop the project. But while the private equity concern would then expect a portion of the toll revenues to not only recoup its

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investment but deliver a reasonable return, there would be no guarantee of such a return. Private

equity could just as easily lose their investment if the project does not meet performance

expectations (DOT 2010). Such a result would be similar to what happens in the stock market.

Regardless, such an innovative way of financing projects meant for the public could be

much more desirable for public administrators than the traditional approach which typically

entails "the planning and design of a project, appointment of advisors to issue public debt, and,

after securing funds, selection of a contractor to complete the project. Once the construction

phase is complete, assets are turned over to the public for continued operations and maintenance

(O&M). The costs of O&M then become subject to annual appropriations debates, opening up

the potential for budget cuts, deferred maintenance and repairs, and politicized concerns about

the use of adequate user rates or tax increases to cover continuing costs" (Meyer 2012, 5). This

process generally unfolds in a sequence with the O&M accounted for only after the development

has finished. In comparison, a PPP is able to combine the designing, financing, building,

operating, and maintaining of a project in one contractual arrangement that accounts for the

entire life-cycle from construction through operations. This approach necessitates that public

administrators consider the development of projects in their entirety as opposed to viewing each

phase separately (Meyer 2012).

The financial options that the private sector can bring to the table in a partnership get

even more attractive when public administrators consider that the total debt capacity for the

project becomes greater than with traditional means of financing government projects alone.

Indeed, private structures for projects most definitely create a greater capacity to manage higher

levels of debt. In this regard, public agencies operating alone often become hindered by legal

constraints on the levels of debt that can be raised.  They can also be hindered by rigid debt-issuance policies that constrain the ability of governments to raise funds.  Furthermore, governments are often loathe to make financial risks if there are other options (DOT 2010).  "In addition, public sector borrowing policies may require higher 'coverage levels' (the ratio between future anticipated revenues and debt service payments) than what private lenders would seek.  Private lenders or equity partners may be more comfortable with longer term borrowings or may count on operational or construction cost savings that will increase the amount of value that can be delivered for a given level of revenue" (DOT 2010, 5).

Traditionally, public debt was raised to develop projects due to the low interest rates that have been a hallmark of securities that are not taxed.  The benefits of tax-exempt savings of around 2 to 4% compared to private sector financing made bond issuance quite common and the preferable way to raise funds for capital projects (Meyer 2012).  However, in the modern era limitations on tax exemptions have developed which have made the traditional option less advantageous, while ever lower interest rates on taxable securities from the private sector have narrowed the advantages of the traditional option.  Indeed, due to present financial circumstances the historic advantage of municipal bonds has decreased markedly over private sector alternatives.  And yet "while the market for public investment has become more challenging, there remains a very strong interest in infrastructure investment by many private capital sources including banks, institutional investors, pension funds, and private equity firms. This leaves a potentially viable option in the form of using PPPs to finance public capital projects" (Meyer 2012, 7).

A prudent approach to such projects for public administrators would be to jointly manage revenues and risks with industry. There are definitely tradeoffs to such an approach but it will limit the downsides even if the upside of a successful project is limited as well. In fact, a significant motivation of public agencies in a PPP is the ability to allocate risk to their private sector partners. If a project goes badly for a government increased financial strain will arise for its other operations. Therefore, governments are often unable or unwilling to make other revenue arrangements as a result of a difficult project in an increasingly unfavorable economic environment (DOT 2010). One example mentioned previously is a toll road undertaken by a public agency. With traditional financial models, governments could be forced to use other tax revenues to bridge the gap if the toll revenues do not cover the debt raised for the initial expenditure to undertake the project. In contrast, a financing structure made available by a PPP would enable such risks to be managed by spreading a certain amount of it, or indeed all of it in its entirety, to the industry partner (DOT 2010). With such an arrangement the government will lose most or all of the future revenues generated by the project if it succeeds, but it will, at the same time, limit its exposure to the financial risks if the project does not generate the expected revenues. However, even with this reality, in many cases, governments are still able to secure a portion of excess revenues even in the event that it allocates the risk of revenue shortfalls to its industry partner (DOT 2010).

In dynamic, fluid, and ever changing political and economic environments projects undertaken with the traditional government model are subject to project risks as well. "When a design flaw causes construction costs to increase, or a change in environmental regulation increases operating costs, the public sector bears the full cost of these events. In a PPP, by

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contrast, the public and private sectors can negotiate who will be responsible for managing each type of risk and paying the costs when unanticipated events increase costs. The private sector will generally take on risk in exchange for some kind of compensation" (DOT 2010, 5).

In a great many examples, the compensation which the private sector receives is due to the ability to increase profits through the deft management of all the additional risks. In one case, the industry partner will take on the risk of additional unforeseen development costs if it has the potential to pocket the difference if the development costs are less than predicted. With another example, the industry partner may account for additional risks by including them in the rate of return that it anticipates for the development. Such financial aspects are "known as the risk premium—the additional return expected by the private sector in exchange for accepting additional project risk. If the public sector believes it can manage a risk at a lower cost than the risk premium, it can choose to retain the risk" (DOT 2010, 5).

And yet still there is an important distinction to make between privatization and the PPP. A PPP does not involve the privatization of public services or assets (Meyer 2012). While many less informed observers may believe that a PPP and privatization are necessarily the same thing, a PPP still allows governments to retain stakes in the projects and ultimate control over the projects.

Additionally, governments are better able to exercise oversight over the project with a PPP. Such arrangements not only benefit governments financially but also allow them to avoid the politically disadvantageous misperception that they are selling responsibilities and assets that have historically been the preserve of the public sector (Meyer 2012).

In the development of public-private partnerships there are two basic factors involved with financing the projects: debt and equity. Typically the industry side of the partnership would bring in investors to contribute funds, or capital, in exchange for equity. Usually this process would take place at the outset of the projects, and then the industry partner would finance the rest of projects through other forms of borrowing (DOT 2010). The industry partner would then utilize future revenue streams to pay back those from whom it borrowed funds. In this process the industry partner must provide projections for future earnings that lenders must concur with as there will be no revenues until the service or infrastructure is actually ready for use. If these financial estimates are inaccurate the industry partner may have to deploy some of its own resources to cover the cost of borrowing. If, however, the revenue streams are in excess of what was projected the industry partner will then have additional monies available after repaying the borrowing costs that can be returned to investors as dividends (DOT 2010).

A PPP is, indeed, an innovative way of financing projects. In a partnership the industry side will typically employ some of its own financial resources for the project but then bring in additional monies that it borrows, usually from commercial banks. Regarding an infrastructure project, if the project is already complete, the industry partner will utilize a mix of equity and debt to compensate the government partner for the right to manage the facility for a specified period of time. But in most cases where the facility has not been constructed, or is in need of significant rehabilitation, the industry partner will then finance the development of the project through the appropriate mix of debt and equity (DOT 2010).

While the industry side can bring much to the financial table in regard to PPPs, the government side has much to offer partnerships as well. Governments are also able to raise

monies through borrowing to contribute to partnerships in order to cover some of the project expenses and future repayments.  If a government raises monies through debt issuances it is implicitly recognizing that future revenue streams may not be adequate to cover the costs of the project.  However, it is also recognizing that it might be possible to receive additional government revenues if the project's revenues are in excess of what was projected (DOT 2010).

In such industry government combinations "thorough analysis often reveals that cost savings are possible, with many estimates providing a 7-10 percent savings over the life of the project, though one study reflected a 24 percent advantage.  Admittedly, procurement and financing costs may be higher for PPPs; however, FLC analysis shows savings over time due to the reduced costs associated with risk allocation, design, construction, and long-term O&M" (Meyer 2012, 10).

Regarding the implementation of a public-private partnership there are many steps.  They include:  "the gathering of debt and equity capital by the private partners; beginning and completing design build by the private partner; operating and maintaining by the private partner; the monitoring of performance by the public partner; and evaluating the success of the PPP and lessons learned by the public partner" (Meyer 2012, 11).  "The benefits to the public sector include:

- · Maximization of public and private sector strengths
- · Reduction or sharing of risks
- · Reduction in public capital investment
- · Mobilization of excess or underutilized assets
- · Improvement of efficiencies/faster project completion/guaranteed maintenance
- · Better environmental compliance
- · Improved service to the community while maintaining public oversight
- · Improved cost effectiveness" (Meyer 2012, 11-12).

In addition to all of the above mentioned benefits to the public sector the PPP also provides "incentives for better asset management and on-time and on-budget delivery" (DOT 2010, 6). When organized appropriately, a PPP can easily increase these incentives substantially. With traditional plans for public sector procurement a private sector firm undertakes to develop a service or a facility with the design specifications that the public agency provides. The firm then hands the project over to the public agency which then undertakes to operate and maintain the service or facility. "With a long-term concession model, the private partner has an incentive to consider making a greater investment in the initial construction of a facility in order to reduce future operations and maintenance costs—essentially, optimizing life-cycle costs" (DOT 2010, 6).

In this regard PPPs have consistently proved that they can provide a wide variety of services and infrastructure in greater time and with lower budgets than with traditional government projects. If governments make acquisitions decisions based on PPP financial arrangements while holding long-term views of the projects in question, public agencies may find themselves more able to provide economical services and facilities but also projects that may have proved too costly for them to undertake in the short term. Furthermore, the traditional approach to government projects necessarily entail higher construction costs at the outset of the projects, while additional O&M costs then become included throughout the projects life-cycle (Meyer 2012). In comparison, the ability of PPPs to make use of financing with private sector methods for the initial startup costs allows public agencies to make more reasonable payments back to the industry side as the process unfolds. Additionally, as private monies can be utilized for the initial startup costs, there will likely be much fewer delays in the process leading up to

construction, thereby expediting the design and build phases of the project. Government

payments then happen later on in the entire process, after the infrastructure is complete and is

generating "user fees or other revenues. Particularly for large-scale, high-value projects, the use

of private funds for capital expenses can mean that PPP-based projects achieve faster

groundbreaking and more rapid construction once negotiations are complete, rather than waiting

to secure public financing" (Meyer 2012, 13).

"In any serious analysis of a proposal to assign the performance of a function to the

public or the private sector, the first question should be: Does the performance of this function

necessarily involve the powers properly reserved to the sovereign? Or, is the function largely

private in character requiring none of the coercive powers of the sovereign" (Moe 1987, 465)?

The public-private partnership, however, is an innovative way to answer these questions by

combining the best attributes of both industry and the sovereign. "In a constitutional democracy,

a major societal value is the idea that public officials should be held accountable for their actions

to elected officials and through these officials to the public. When a public function is assigned

to a private entity, usually through a contract, there is an inevitable weakening in the lines of

political accountability. While a government agency is directly accountable to elected officials,

a private entity under contract has only an indirect and tenuous relationship to elected officials.

What occurs, in variant forms, is the emergence of 'third-party government'" (Moe 1987, 465-

466). The public-private partnership, however, is an innovative way to leverage the best

qualities of the private sector while still allowing for a significant measure of government

control, making such partnerships still accountable to publics.

The public-private partnership is an innovative combination of industry and government that governments at all levels are increasingly utilizing in the development of public policy. Indeed, the public-private partnership is the new phenomenon emerging for the national space effort of the United States.

## Chapter 8:  Civil Policy

There were several differences in the Bush and the Obama administrations' policies for civil space.  The first one, and the one that received the most publicity, is the aforementioned policy decision to cancel Constellation and proceed with Commercial Crew.  Additionally, the Obama administration canceled the Bush administration's plans to return to the Moon in favor of conducting a mission to an asteroid which was later adjusted to redirecting an asteroid to cislunar space.  Another difference was in the amount of time it took each administration to produce their national space policies.  The Bush administration was surprisingly slow in producing their national space policy.  The Obama administration was surprisingly fast in producing their national space policy.  The data reveal that the primary differences in civil space policy were because the Obama administration loathed the Bush administration so much that they were intent on pursuing a different space program.  However, growing private sector competence and perceptions of industry efficiencies were also critical factors in the Obama administration's policy decisions for the civil space effort.

### The Bush Policy for Civil Space

In regard to the Bush administration's space policy, the Vision for Space Exploration was seen as a way to energize critical constituencies. According to Official 1, who was central to the implementation of the Bush and Obama administrations' space policies at the Pentagon, there was a lot of continuity in tone and substance with prior administrations space policies. There was about 80% to 90% commonality.[1] Evidently the commonality between the Bush administration's space policy and its predecessors was greater than that between the Obama and Bush administrations.

However, Official 1 likes the way that the Obama administration acknowledges that the strategic environment had changed.[2] For decades the space policies of American presidential administrations had practiced strategic restraint. The United States did not actually do a lot of the things that it could have in space in an effort to maintain the status quo. The hope was that this strategic restraint would be reciprocated by the Russians and the Chinese. But evidently this has not been the case. And according to Official 1 it is well past time to move past strategic restraint. The United States should achieve peace through strength.[3] Currently there is no incentive for the Russians and Chinese to practice restraint. Therefore, the United States needs to make it more painful for the Russians and the Chinese so that they moderate their behavior.

In any event, in regard to the comparison between the Bush and Obama administrations there were similar concerns in their policy formulations for the medium of space that largely revolved around domestic politics. Providing direction for NASA has been a challenge for all administrations. As such, the Bush administration comes under some criticism in the mind of

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[1] Interview with Official 1
[2] Interview with Official 1
[3] Interview with Official 1

Official 1 because it took them six years to produce a policy for the medium of space.[4]

Evidently the Bush administration did the piece parts first—position, navigation, and timing;

space transportation; remote sensing; and space exploration. Official 1 is critical of the Bush

administration for not having a policy that captured the aforementioned blocks quick enough.[5] It

appears that policymakers in the Bush administration were unnecessarily arguing over minor

points for far too long, most notably the security aspects of the policy.

Regardless, the Bush policy was rolled out to little to no fanfare. As such, this led

observers to think that the Bush administration had something to hide.[6] But a couple of months

later the Chinese tested their direct ascent kinetic ASAT weapon. Therefore, what the Bush

administration was largely concerned about actually came to fruition. However, the Bush

administration still created controversy because their policy was released before the Chinese

ASAT. In the lead up to the release of the policy the director of the NRO had raised the alarm

about the Chinese lasing American satellites mainly to dazzle the optics of the systems.[7]

In regard to the Bush administration's program for commercial cargo Official 1 believes

that the Bush administration was looking to achieve some kind of efficiencies as the Obama

administration is attempting to do today with both crew and cargo.[8] But Official 1 believes that

space policies should enjoy bipartisan support.[9] Nevertheless, any policy that can use the

commercial sector to do things cheaper, better, and faster is a good policy. Official 1 does not

know if the Bush administration foresaw that the policy for commercial cargo would be

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[4] Interview with Official 1
[5] Interview with Official 1
[6] Interview with Official 1
[7] Interview with Official 1
[8] Interview with Official 1
[9] Interview with Official 1

expanded by the next administration to include crew as well.[10]  Evidently at the time the Bush

administration was in office there was less concern for considerations about crew transport

because the United States was still flying the shuttle.  Still inside the Bush administration and

NASA there was internal debate about what the plan would be after the shuttle was no longer in

service.[11]

According to Logsdon it was the 2003 accident with the shuttle Columbia that galvanized

the Bush administration into shifting their space policy which led to the Vision.[12]  After the

accident with Columbia there was an investigation board.  A Congressional act came to include

the board's assessment in their report of the program.

According to Logsdon prior to these events the space program under the Bush

administration lacked strategic goals and focus.[13]  Then there was a report in August 2003.  The

Bush White House then acted to provide goals and focus.  As such the main goal and focus was a

human return to the Moon.  But according to Logsdon, when Bush's officials were discussing

this with the President Bush said something to the effect of "why don't you add Mars."[14]

Columbia revealed the lack of clear cut goals for the space program under Bush.  In the

Bush administration's policy formulations the predominant concerns prevailing at the time were

how long to fly the shuttle and American international commitments to finish the ISS.

According to Logsdon the Bush administration wanted to determine how quickly they would not

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[10] Interview with Official 1
[11] Interview with Official 1
[12] Interview with Logsdon
[13] Interview with Logsdon
[14] Interview with Logsdon

fly the shuttle.[15]  Then they were concerned with what systems would replace the shuttle.  The

most central issue, however, was the goal.  This was determined to be the Moon.

In their deliberations the Bush administration was very concerned about costs.  There

were increased costs.  According to Logsdon Bush was unwilling to provide enough resources to

cover those costs.[16]  This was the fatal flaw of the Bush administration's space policy.  Logsdon

maintains that Bush said the words but did not provide the resources.[17]

Then there was a year of wasted time.  There was a commission—ESAS—to design

equipment to conduct missions.  The result was a set of rockets and spacecraft which became

Constellation.  NASA set about implementing Constellation from 2006 on.  But by the time the

Obama people looked at it in 2008 way it was way behind schedule and subject to a certain

amount of technical criticism.[18]

Still, Logsdon maintains that the policy addressed concerns about strategic focus.[19]  In

his view the 2004 policy was good.  It, however, failed in implementation primarily because it

was not funded well enough.  According to Logsdon what was more debatable were the technical

choices, such as the decision to use solid propellant over liquid propellant for Ares I.[20]  Perhaps

these choices may have been wrong.

Then in the fall of 2005 NASA administrator Mike Griffin explained the rationale for

Commercial Orbital Transportation Services (COTS), commercial cargo, in a speech.  At the

time NASA was under pressure to innovate—to do things in different ways.  They were also

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[15] Interview with Logsdon
[16] Interview with Logsdon
[17] Interview with Logsdon
[18] Interview with Logsdon
[19] Interview with Logsdon
[20] Interview with Logsdon

under pressure to engage the private sector.  The confluence of these influences ultimately led to an experiment by Griffin to see if a public-private partnership would work to give NASA new capability.  The Bush administration wanted to see if such an industry government partnership would be viable.[21]  The policy that emerged included the possibility of extending the program for commercial transport of cargo to the commercial transport of crew as well.  The clause in the policy is known as Option D.  In any event, Griffin was skeptical of the program for crew but the option was there from the start.[22]

The main criticism that Logsdon has for American human spaceflight over the successive administrations is that it should not be subject to change every time government changes.[23]  The main issue is that a well-designed program with societal consensus should be implemented.  The program should not change every time the White House changes.  Logsdon believes that the United States should have returned to the Moon instead of Obama's policy to go after an asteroid.[24]

According to Pace the Bush administration did not perceive a need to rewrite the Clinton policy in their policy formulations.[25]  The Clinton policy was perceived by the Bush administration as broad and flexible.  There was, nevertheless, an effort to look at the future direction of the American national space effort.  This effort included deliberations about human exploration.  Evidently an orbital space plane was considered.  But a central concern was what would come after the shuttle.  The Bush administration also wanted to look beyond LEO.

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[21] Interview with Logsdon
[22] Interview with Logsdon
[23] Interview with Logsdon
[24] Interview with Logsdon
[25] Interview with Pace

Additionally, the Bush administration was concerned about management reform, procurement reform, financial reforms, and improving government operations with egovernment activities.[26]

Initially, the Bush administration was focused on completing the assembly of the ISS. Then the Columbia accident happened. According to Pace, it wasn't clear that the United States could return to human spaceflight.[27] It also was unclear about whether or not it would be possible to operate the ISS without the shuttle. The United States did, of course, return to human spaceflight. Pace maintains that it was clear to the Bush administration that it had to try to complete the ISS with Europe in order to preserve the honor of the United States.[28]

While these policy deliberations were proceeding apace Pace holds that NASA was trying to do too much with too little.[29] NASA did not have the resources to adequately execute the missions it was tasked with. There was also no clear sense of direction. NASA needed clear direction. According to Pace, the US space program should not be a race but rather a journey.[30] Then the Vision was pronounced. But the Bush administration gave very little more money. The Vision was not adequately funded.

The national space policy followed two years later in 2006. The 2006 policy was basically a consolidation, update, and clean-up effort. Pace observers that there was a long ongoing fight between the Department of Defense and the intelligence community about the security aspects of the policy.[31] There were many revisions over the national security elements of the policy. The civil side of the policy had been set long before. The policy was basically

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[26] Interview with Pace
[27] Interview with Pace
[28] Interview with Pace
[29] Interview with Pace
[30] Interview with Pace
[31] Interview with Pace

ready by 2004 but it still took until 2006 to be released.  Evidently arms control was a major issue in the policy deliberations.  The wording of the policy came across as harsh and unilateral. It played into the negative international image of Bush.  This was very unhelpful for the Bush administration.  According to Pace the Department of Defense forgot that they working for the president and were fixated on preserving their own programs.[32]  The language in the policy document was very provocative and did not do anything to further the Bush administration's policy objectives.

However, regardless of the language that was used in the 2006 national space policy Pace maintains that the overall substance of the policy was very similar to that of Obama's 2010 policy document.  The main difference was in the tone of the documents.  As such, Pace believes that the 2006 policy adequately covered all of the concerns that the Bush administration had in its development.[33]  Pace would have worded it differently but the substantive points were fine in his view.[34]

In regard to COTS, Pace holds that the program was NASA's choice.[35]  NASA was hoping to get the cost per pound to orbit down by involving the commercial sector in NASA's operations.  But NASA did not get as close as it would have liked in getting the cost per pound to orbit down with COTS.  Still, the program was very decent in Pace's view.[36]  It did work, even though it was not as low cost as NASA would have liked.

However, as we shall see with Logsdon's points on commercial crew relative to the Obama administration's effort to develop technology Pace maintains that COTS was largely a

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[32] Interview with Pace
[33] Interview with Pace
[34] Interview with Pace
[35] Interview with Pace
[36] Interview with Pace

side experiment and not the main thrust of the Bush administration's policy.[37] It may be easy to see why programs such as COTS and CCDev get a lot of publicity and become the central focus of those observing NASA's operations but for those at NASA, such as Pace, COTS and CCDev were not actually central aspects of the program that NASA was running. Nevertheless, in Pace's view the policy with COTS was still a smart evolution of roles between government and industry.[38]

One issue with COTS is that it poses different technical problems from just launching satellites. But even with the variety of technical problems that could arise the policy that the Bush administration sought to promulgate presented a fall back option for operations in LEO with Orion and Ares I. Although, Pace holds that NASA definitely would not have wanted to use Orion and Ares I for operations with the ISS.[39] These were just a backup option. In any event, according to Pace the Bush administration did foresee that the policy for commercial cargo could evolve to include commercial crew as well with future administrations.[40] The Bush administration created a clause in the policy known as COTS D that allowed for commercial crew as well.

According to Pace the two biggest differences between the Bush and Obama administrations' were their respective relationships with the private sector and the international community.[41] It may seem surprising and counterintuitive to observers of the Bush and Obama administrations' overall policies but Pace maintains that the Bush administration took the

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[37] Interview with Pace
[38] Interview with Pace
[39] Interview with Pace
[40] Interview with Pace
[41] Interview with Pace

international community into greater account with the Vision.[42]  Human exploration in space was developed by the Bush administration as a global strategy.  The Bush administration created a forum to talk with other nations and share plans and coordinate policies and operations.  When Obama pursued a policy for Mars and asteroids the international community just shrugged.[43]

Evidently for the Obama administration's plans in space it was difficult to come up with a common architecture.  There were two architectures.  However, when the Obama policy evolved from a mission to an asteroid to the redirection of an asteroid toward cislunar space the administration was able to rejoin the consensus about exploring cislunar space.

But according to Pace the Bush and Obama policies were staunchly different in terms of risk, international purpose, and bipartisan support in Congress.[44]  The 2005 and 2008 bills for NASA passed back to back.  In contrast 2010 was a year-long acrimonious fight in Washington D.C.  The Congress did not accept the Obama administration's policy.  And then the Obama administration had to accept the Congressional plan.  But both sides were unhappy.[45]

Regarding COTS and CCDev Pace maintains that these privatization efforts are able to hide costs more than elsewhere.[46]  However, it is still possible to spread the benefits of the programs among the states.  It necessarily disguises the size of government.

The central question is still what role and mission should NASA have.  According to Pace NASA is a foundation for technology in the United States.[47]  NASA oversees contractors with people who know what they are talking about.  Even though the civil space program in the

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[42] Interview with Pace
[43] Interview with Pace
[44] Interview with Pace
[45] Interview with Pace
[46] Interview with Pace
[47] Interview with Pace

United States has been partially privatized by both the Bush and Obama administrations a disciplined smart customer, such as NASA, is still necessary. Pace maintains that it is necessary for the United States government to retain some in house capabilities to steward public funds.[48] The partial privatization of the United States civil space program is not necessarily a question of good or bad but rather a question of the right mix for what you are trying to achieve. Pace believes that NASA is a repository of expertise that the country needs to retain.[49]

According to Official 2, who played a central role in the development of the Bush administration's space policy on the National Security Council, the initial factor that the Bush administration considered in its policy formulations was the need to update the Clinton policy simply because time had passed.[50] The Bush administration sought to define the agenda by drafting a new policy. Therefore, the Bush administration looked at the civil, national security, and commercial aspects of the space policy that it was seeking to develop. Official 2 grouped the defense and the intelligence communities together under national security.[51]

In the development of the policy Official 2 identified remote sensing, GPS, space transportation, and launch issues.[52] But there were no substantive changes from the Clinton policy. However, it was nevertheless still important for the Bush administration to put its stamp on national space policy for the United States.

When the accident with Columbia occurred this upended the policy process for the Bush administration. The rate of progress on remote sensing, GPS, etc. slowed. Then the focus shifted to the Moon and Mars. These became the prime motivations.

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[48] Interview with Pace
[49] Interview with Pace
[50] Interview with Official 2
[51] Interview with Official 2
[52] Interview with Official 2

According to Official 2 the White House staff was not heavily concerned with issues in space until after the Columbia accident.[53]  On the National Security Council, staff decide to put forward issues onto the agenda.  Personnel on the National Security Council hold the agenda.  But depending on issue portfolio the broader White House staff has its own agenda.  This means a greater or lesser role for National Security Council staff depending on the policy inclinations of the broader White House.  Still, it is up to the National Security Council to identify topics for review.  It is up to these personnel to identify what areas in policy need significant changes compared to the previous guidance.  They need to determine if there are any new things in the policy portfolio that the White House should consider.  But when the nation lost Columbia the Bush administration's priorities in space abruptly changed.[54]

Nevertheless, Official 2 thinks that the Bush administration's policy addressed all of the concerns that the administration had in its formulation.[55]  For Official 2 it was all about a series of tradeoffs.[56]  Sometimes initiatives required compromise.  With regard to remote sensing and GPS the Bush administration checked all the boxes.  With space transportation the Bush administration made a conscious decision to not propose a policy to direct NASA to use an expendable launch vehicle (ELV).  The Bush administration gave up on ELVs.  Official 2 knew that the nation needed a new space transportation policy but thought that NASA would object.[57]

In regard to the national space policy Official 2 believes that there should have been greater emphasis on protection of space systems to address growing threats.[58]  In regard to COTS

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[53] Interview with Official 2
[54] Interview with Official 2
[55] Interview with Official 2
[56] Interview with Official 2
[57] Interview with Official 2
[58] Interview with Official 2

and the partial privatization of the civil space effort this policy decision came about after the decision to retire the shuttle.  According to Official 2 if the Bush administration had not made the decision to retire the shuttle the United States would still be flying the shuttle at a very high cost.[59]  Official 2 holds that in operations and maintenance the shuttle consumed about 25% of NASA's resources but it would have risen to 40% by the present if it had not been retired.[60] NASA would be going bankrupt keeping the shuttle flying or it would have killed another crew. Therefore the Bush administration believed the country needed an overhaul of orbiters. However, questions remained about all the billions of dollars that this would have cost. Regardless, if the shuttle would have killed another crew the country might have lost the human spaceflight program indefinitely.

In any event, the Vision coalesced all debate that Washington was having about what NASA should be doing according to Official 2.[61]  Everyone was arguing about the same subject. The most important decision that came out of the Vision was the one to retire the shuttle. However, upon reflection Official 2 recalls that the Bush administration did not even think about what the next administration would do in their policy formulations.[62]  The Bush administration did however think about a larger role for the commercial sector.  The Bush administration highlighted the American government's need to make the maximum use of commercial partners.

## The Obama Policy for Civil Space

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[59] Interview with Official 2
[60] Interview with Official 2
[61] Interview with Official 2
[62] Interview with Official 2

According to Peter Marquez history played a major role in the development of the Obama administration's policy for civil space.[63]  In this regard every president issues his own space policy.  By issuing the policy the president sets the tone and provides direction for the national space effort.  Usually for each administration the national space policy is in need of updates.  Evidently the Obama administration believed the national space policy was in dire and major need of updates because they rushed the policy into being in 2010 in less than two years after taking office.[64]  This was substantially different from the Bush administration whose space policy was not enacted until 2006 almost six years after this administration took office.  Evidently the Bush administration did not believe it was necessary to quickly update the policy that was already in existence from the Clinton administration.  Indeed, according to Marquez previous administrations typically put out there space policy at the end of their administrations.[65]  The Obama administration, however, believed it was important and necessary to get their policy out at the beginning of their administration.  This was due in large part to a variety of geopolitical issues, such as increasing threats and the growing commercial capability.[66]  The environment for everything—from national security to commercial to civil—had changed.  According to Marquez the policy that was produced addressed all of these factors.[67]  Marquez is sure the policy addressed all of these factors.

The policy in large measure was based on the aforementioned report that was produced by Norman Augustine and his committee.  Accordingly, as has been discussed, the Augustine commission concluded that at current funding levels the Constellation program was

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[63] Interview with Marquez
[64] Interview with Marquez
[65] Interview with Marquez
[66] Interview with Marquez
[67] Interview with Marquez

unaffordable. Therefore it was necessary to either increasing funding for Constellation or to do something else. Marquez maintains that the National Security Council was not a part of this discussion.[68] The National Security Council wanted to be a part of the discussion on policy for Constellation but was told no. Nevertheless, Marquez still has important insight into the development of this policy. Evidently the OSTP chief of staff was largely responsibility for the decision to cancel Constellation. The biggest concern for this policy decision was the budget according to Marquez.[69] The administration did not want to increase NASA's budget. The main motivation was definitely the budget.

Additionally, according to Marquez there was an allergic reaction to anything that was done in the Bush administration.[70] Evidently the Obama administration loathed the Bush administration so much that they were intent on killing programs that were started under the Bush administration. Therefore, the Obama administration wanted to cancel the Constellation program.

As has been discussed the policy that took the place of Constellation was Commercial Crew (CCDev), whereby NASA would provide a measure of financing to the private sector to develop spacecraft to transport astronauts to the ISS. Once the private spacecraft were ready NASA would then purchase space on them for NASA astronauts.

Commercial Crew largely evolved from the COTS policy. COTS was started under the Bush administration and involved the commercial transport of cargo to the ISS. This was certainly an ironic development as the Obama administration was loath to continue programs that

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[68] Interview with Marquez
[69] Interview with Marquez
[70] Interview with Marquez

were started under the Bush administration but they nevertheless expanded COTS to the

development of CCDev.  Mike Griffin, a NASA administrator under Bush, started the cargo

program or COTS.  According to Marquez the main successes were started under Griffin.[71]

Nevertheless, Marquez maintains that the decision to cancel Constellation and proceed

with Commercial Crew did not address all of the Obama administration's concerns.[72]  The main

issue is that the budget is not high enough to do NASA's mission.  Marquez maintains that the

Obama administration observed the lesson but did not learn the lesson.[73]  It was missing a real

plan.  And, according to Marquez, when there is no real plan the Congress and OMB can

determine the plan and budget.[74]  When you don't stand for anything everyone can determine

what your policy is.[75]

Official 1 was heavily involved in the implementation of security issues for the Obama

administration and noted some critical differences in the Bush and Obama administrations' space

policies in regard to space situational awareness (SSA), a very critical aspect of the national

space policy.[76]  SSA enables the entire space enterprise for the United States because it allows

all aspects of the national space effort, from security to commercial to civil, to keep track of

threats in space, right now most prominently from orbital debris.  Evidently in the past the

Secretary of Defense was solely responsible for SSA.  Under the Obama administration the

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[71] Interview with Marquez
[72] Interview with Marquez
[73] Interview with Marquez
[74] Interview with Marquez
[75] Interview with Marquez
[76] Interview with Official 1

Secretary of Defense and the Director of National Intelligence (DNI) are jointly responsible for SSA.  However, the DNI's role is still transitioning in regard to SSA.[77]

Regardless, for Official 1 the most critical aspect of the Obama administration's space policy is that they wanted to distinguish themselves from the Bush administration.[78]  The Bush administration was so hated and reviled by the Obama administration that they were intent on doing a lot of things differently from the Bush administration when they came into office.  This is precisely why the Obama administration produced their national space policy right away as opposed to the usual process whereby an administration produces the national space policy in the latter stages of their tenure in office.[79]  This was a critical difference—producing the national space policy right away.  In the past the formulation of the national space policy was an incremental process.  But the Obama administration was so intent on distinguishing themselves from the Bush administration that they started drafting their national space policy very quickly.[80]  Therefore, the policy was released much earlier than it typically was for previous administrations.  Evidently, according to Official 1 the Obama campaign's staff was overzealous about the distinction.[81]

In this regard, the Obama administration focused on the national policy before the piece parts that typically precede the national policy in the formulation process.  As has been discussed, the piece parts include:  position, navigation, and timing; space transportation; remote sensing; and space exploration.  Most administrations usually attempt to develop all of these

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[77] Interview with Official 1
[78] Interview with Official 1
[79] Interview with Official 1
[80] Interview with Official 1
[81] Interview with Official 1

aspects before combining them all into one overarching national space policy.[82]  But this was not

so with the Obama administration.

Nevertheless, despite the Obama administration's obsession with distinguishing

themselves from the Bush administration according to Official 1 80% to 90% of the two

administrations' policies are still common.  The main difference is in the tone of the two policies,

as has been discussed.  In this respect, the Obama administration urged more multilateral

cooperation and peace and harmony.  The Obama policy was not zero sum, it was relative and

not absolute.  The Bush and Obama administrations' did not value space in the same way.  The

Obama administration did not want to unilaterally expand the power of the United States in

space and elsewhere vis a vis other states.[83]

Concerning the policy decision to cancel Constellation and proceed with Commercial

Crew Official 1 maintains that what happened with Constellation was a self-inflicted wound.[84]

Evidently the Obama administration came under a significant amount of criticism and political

fire for this decision that could have been avoided according to Official 1.[85]  According to

Official 1 the Obama administration had not coordinated with anyone when making this

decision.[86]  The policy process they went through was sophomoric.  Little thought went into it.

Constellation had bipartisan support in Congress and elsewhere.  Official 1 maintains that the

Obama administration got rid of something for nothing.[87]  Additionally, Official 1 maintains that

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[82] Interview with Official 1
[83] Interview with Official 1
[84] Interview with Official 1
[85] Interview with Official 1
[86] Interview with Official 1
[87] Interview with Official 1

Holdren of OSTP basically lied when describing Augustine's findings.[88] Constellation was un-executable at current funding levels. But Holdren suggested that constellation was un-executable period.[89]

According to Official 1 the Obama administration's biggest foul was that they replaced something with nothing.[90] They unnecessarily dismantled the space program for nothing. This left NASA floundering. The Obama administration's level of analysis was weak.[91]

In the process of canceling Constellation for LEO activities the Obama administration also shifted the focus of the civil space effort more broadly. The Bush administration produced the Vision for Space Exploration which called for humans to return to the Moon and then go onto Mars. However, as the Obama administration was so zealously interested in distinguishing themselves from Bush they canceled these efforts and instead pursued the goal of sending humans to an asteroid, which was then adjusted to redirecting an asteroid to cislunar space where astronauts would then be sent.

But according to Official 1 the Moon presents the building blocks for all space efforts.[92] If there is water on the Moon, and there is, then the US space program has to go back. Official 1 was somewhat irritated by what Obama said about this policy adjustment in regard to the Moon, something to the effect of "been there, done that, got the t-shirt."[93] Official 1 maintains that the Moon is the stepping stone to everywhere else in the cosmos.[94] It will enable the US space

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[88] Interview with Official 1
[89] Interview with Official 1
[90] Interview with Official 1
[91] Interview with Official 1
[92] Interview with Official 1
[93] Interview with Official 1
[94] Interview with Official 1

program to pursue a variety of other activities in the inner solar system. Accordingly, Official 1 maintains that there was not good analysis backing Obama's decision.[95]

In addition, the international partners of the United States were blindsided by this policy decision.[96] The Moon was a much more achievable goal for the concert of nations that were working with the United States in space. This was so for the international community not just technically but financially as well.

In spite of all of this the Obama administration was still intent on distinguishing themselves from the Bush administration. And indeed, this was the biggest factor in their policy decision to cancel Constellation and proceed with Commercial Crew.[97] According to Official 1 financial considerations played little part in this decision.[98] Indeed, around the time that the Obama administration announced the demise of Constellation President Obama was announcing a high speed rail initiative in Tampa, Florida for the exact amount of money that was required for Constellation.[99] This development irritated Official 1. And according to Official 1 it was amateur hour in figuring out policy priorities for key constituencies.[100] As such, the space program is more important to the economy of Florida than high speed rail. What is more, the fields of science, technology, engineering, and math, or STEM as they are known, are far bigger for space than high speed rail.

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[95] Interview with Official 1
[96] Interview with Official 1
[97] Interview with Official 1
[98] Interview with Official 1
[99] Interview with Official 1
[100] Interview with Official 1

Official 1 believes the policy decision process for the Obama administration was really amateurish.[101]  The Obama administration did not adequately proactively engage the right interest groups and explain why it went from x to y in the policy process.  Evidently space was not important to them.  The Obama administration's policy could have been financially neutral.  They could have explained the transition to the private sector better.  But the transition to the private sector was still a good idea according to Official 1.

According to Logsdon, perhaps one of the foremost historians of space in the world, formulations for the Obama space policy got started before the administration entered office with the Obama space transition team.[102]  Evidently the transition team was lead by Lori Garver who later became deputy administrator of NASA.  The team was responsible for NASA's transition following the 2008 presidential election.  It was agency specific but there were many transition teams across the administration and not just for space.

Logsdon holds that Garver brought her own point of view to the task.[103]  But the administration sensed the need to take a careful look at the policy that she was planning before Obama would embrace the program as his own.  Nevertheless, there were questions about the viability of the previous administration's program as early as 2009.  As such, in order to establish a viable program and provide direction for NASA the administration hoped to have a NASA administrator identified and nominated early on in the administration's tenure in office.[104]

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[101] Interview with Official 1
[102] Interview with Logsdon
[103] Interview with Logsdon
[104] Interview with Logsdon

However, senator Nelson of Florida raised objections to the Obama administration's favored nominee for the position of NASA administrator.[105] Nelson had his own favored candidate for the position. Nelson's favored candidate was Charlie Bolden. Evidently Bolden was the pilot of Nelson's own mission into space and the two had formed a bond over the course of these activities.[106] Beyond posing difficulties for the administration's process to nominate a NASA administrator Nelson also threw a wrench into the idea of a commission to review NASA's programs.[107] Despite these political complications finally in April of 2009 there was a decision from the science office and Garver to go ahead with the study. Accordingly Holdren of OSTP commissioned Augustine to undertake a review of NASA programs. The study took the rest of the summer of 2009. The results of the study—the Augustine commission—were very critical of Constellation, particularly of Ares I.

Around this time the White House relented in the face of pressure from Nelson and nominated Bolden to be NASA's administrator. According to Logsdon Bolden and Garver were not a matched pair.[108] But Garver was politically connected so she retained a significant amount of influence in government. Despite the fact that Bolden and Garver were not a matched pair as Garver was well connected politically she was still able to pursue her own agenda at NASA.[109]

While these political developments were proceeding apace NASA was simultaneously engaged in preparing its budget. The process was somewhat lengthy, taking about a year in duration. In the course of preparing the budget around September and October of 2009 NASA largely ignored the results of the Augustine commission. According to Logsdon when NASA's

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[105] Interview with Logsdon
[106] Interview with Logsdon
[107] Interview with Logsdon
[108] Interview with Logsdon
[109] Interview with Logsdon

budget went to the White House Jim Kohlenberger of OSTP and Garver raised objections to what NASA had prepared and did not want the budget that NASA had presented.[110] Kohlenberger and Garver wanted a budget for NASA that reflected the results of the Augustine commission.[111] Nevertheless NASA stonewalled. NASA wanted Constellation and Ares I. Logsdon maintains that administration officials in meetings with Obama himself claimed that NASA was not responsive.[112] Kohlenberger, Garver, and OMB wanted to put together a budget that reflected what the Augustine commission had produced.[113] As had been discussed this process was very secretive according to Logsdon.[114] It took place over the course of December 2009 and January 2010. It occurred without the consultation of Congress or of NASA. This secretive process unfolding in the Obama administration resulted in a top down surprise for NASA.

The fundamental element of the policy that was produced in such a secretive fashion was that NASA would not build anything for five years. A significant amount of NASA's resources were to flow into efforts to develop technology. Another step was efforts to engage the private sector in partnerships. In this regard, Commercial Crew got most of the attention in the media and from political observers but according to Logsdon it was not the core of the Obama strategy.[115] The core of the new strategy was technology development. Regardless, the policy for Commercial Crew did solve the immediate problem surrounding the situation with the ISS. Most of NASA's planning under Bush called for an early American exit from the ISS.

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[110] Interview with Logsdon
[111] Interview with Logsdon
[112] Interview with Logsdon
[113] Interview with Logsdon
[114] Interview with Logsdon
[115] Interview with Logsdon

The space policy that emerged from such secretive formulations produced a political

firestorm in 2010.  The main reason was the developments involving Commercial Crew and the

demise of Constellation but the hiatus from human spaceflight in favor of renewed efforts to

develop technology was also criticized for having a lack of goals.  There appeared to be no goals

in space with the new policy that emerged in 2010.  NASA would be investing in technology but

there appeared to be no focus for the agency.  As would be expected Congress was very negative

due to the critical constituencies that benefited tremendously from the government space

program.  Logsdon maintains that the new policy would have redistributed the NASA budget

away from traditional contractors to research grants for universities.[116]  Obviously these

contractors stood to lose significant amounts of money and jobs.  A political firestorm ensued.

According to Logsdon the political firestorm that resulted from this policy decision led

administration officials to recommend to President Obama that he make a speech about the space

program.[117]  In the speech President Obama called for the United States to send astronauts to

Mars at some point in the 2030s.  The asteroid mission, however, was not rolled out for another

two years.

In spite of the Obama administration's best efforts to manage the political firestorm that

unfolded after the policy decision was made, in the summer of 2010 the Congress nevertheless

continued to present significant opposition to the administration's agenda in space.  The

Congressmen and women who led the opposition were senators Nelson, Hutchinson, and Shelby.

These members of Congress came up with an alternative plan.  Their plan called for NASA to

build a multipurpose crew vehicle known as Orion and to undertake development of a massive

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[116] Interview with Logsdon
[117] Interview with Logsdon

rocket known as the space launch system (SLS). The bill that these members of Congress

presented had bipartisan support and passed both houses of Congress. Rather than fight the bill

and the new direction for NASA President Obama caved and signed it. Therefore, according to

Logsdon, the program that NASA was executing during the Obama administration was actually

Congressionally designed.[118] It was not designed by the Obama administration. As such, the

2010 authorization act was the death of the Obama plan for NASA. The idea of developing

technology disappeared. Previously the proposal to develop technology had been the central

focus. Nevertheless, the program that eventually did emerge accomplished Augustine's and

Garver's goals according to Logsdon.[119] The proposal reflected their views.

Pace maintains that space policies are typically updated about every ten years, as has

been previously discussed.[120] When they are in fact updated the updates largely reflect what the

policymakers think are the biggest problems. According to Pace the Obama administration did

not like the policy that Bush laid out, known as the Vision, so it took a pause on human

spaceflight in the 2010 budget.[121] Pace corroborates Logsdon's assessment of the situation by

maintaining that the Obama administration commissioned a committee to review the space

program because the administration did not like the direction it was on.[122] According to Pace the

overwhelming factor in the Obama administration's decision process was that it wanted to do the

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[118] Interview with Logsdon
[119] Interview with Logsdon
[120] Interview with Pace
[121] Interview with Pace
[122] Interview with Pace

opposite of what the Bush administration proposed, which corroborates Marquez's assessment of the situation.[123]

A central concern of the Obama administration in the policy process was the high costs of human spaceflight. The Obama administration was also very concerned that the space program was not innovative enough and wanted the space program to focus on developing new technology. Which, as previously discussed, led to the policy to redistribute scarce resources to technology development. The Obama administration also wanted the space program to contribute more to economic growth more broadly.[124]

Regardless, the overriding concern that the Obama administration had about NASA's programs was the traditional costs associated with human spaceflight. Evidently the shuttle was far too expensive in the Obama administration's view. They thought that the technology currently prevailing at the time was far too expensive and basically unaffordable. Therefore, the Obama administration wanted to take a pause to develop technology which could bring costs down and then return to human spaceflight once the costs were more manageable.[125]

However, according to Pace, and not without a measure of irony, the Obama administration's space policy was missing any connection to geopolitical or international concerns.[126] Human spaceflight was viewed largely as a domestic problem. Pace corroborates Logsdon when he maintains that the policy decision that emerged was made by a small group.[127] The results of the Augustine commission provided support to the views of this group. According

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[123] Interview with Pace
[124] Interview with Pace
[125] Interview with Pace
[126] Interview with Pace
[127] Interview with Pace

to Pace, by the end of the program after this group had accumulated enough knowledge to make a policy decision they would have qualified as junior staff for Pace's bureaucratic organization.[128] What is more, Pace maintains that the policy did not address all of the critical factors that the group was considering.[129] The group had a political position first and then tried to fill in the plan later. They did not have a plan to adequately replace the previous administration's policy.[130] The policy that did emerge was open ended and vague. It incurred opposition from Congress on both sides of the aisle. This opposition ultimately resulted in the emergence of Orion and SLS as previously discussed. The Congressionally designed program was basically the same as Constellation but without the transition elements of Ares I and missions to the Moon.

It is interesting to note that the Bush administration foresaw the evolution of the program for the transport of cargo to the ISS by commercial organizations to that of the transportation of crew as well. The Bush administration included an option D in COTS that allowed for Commercial Crew. The plan was to see how commercial cargo worked, gain experience, and then proceed with crew. The Obama administration, however, wanted to develop the program for crew in parallel to that of cargo. This development is again interesting to observe because while the Obama administration was so eager to distinguish themselves from the Bush administration in space they nevertheless expanded the Bush administration's policy for commercial space transportation. But according to Pace the effort was no longer sequential.[131] Commercial Cargo would not precede Commercial Crew and allow NASA to gain experience

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[128] Interview with Pace
[129] Interview with Pace
[130] Interview with Pace
[131] Interview with Pace

but rather the two efforts would develop simultaneously.  Pace maintains that this made the

program more risky.[132]  Human transportation of course would be much harder and the portfolio

mix would be more risky.  Also, there would be no cost tradeoffs.  The Obama administration

just asserted that Commercial Crew was the way to go.  They did not think about phasing in

programs and then phasing them out.  According to Pace the compromise lacked clear policy

direction and purpose because the Obama administration did not have one.[133]

Regarding the Obama administration's policy decision to scrap a human mission to return

to the Moon in favor of one to an asteroid Pace holds that there was no real analysis to back up

the policy decision for an asteroid mission and then to go onto Mars.[134]  Evidently, as has been

discussed, the Obama administration was so eager to change the direction that the Bush

administration had set for NASA that they made policy decisions without fully thinking them

through.  The Obama administration did not look at alternatives to an asteroid mission.  The

asteroid mission would be far more difficult than one to the Moon largely due to flight time.  It

was also less safe.  Indeed, it is unsafe.  According to Pace, science and engineering maintain

that the asteroid mission is a bad idea.[135]

Then the asteroid redirect mission (ARM) emerged whereby NASA would engage an

asteroid and shift its trajectory so that it would enter cislunar space.  Then NASA could visit the

redirected asteroid with the Orion spacecraft and the SLS.  This mission could be done more

safely.  Still, Pace maintains that the flaw in this policy is that it is not really leading

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[132] Interview with Pace
[133] Interview with Pace
[134] Interview with Pace
[135] Interview with Pace

anywhere.[136]  What is more, there would be no international partners for this asteroid mission. Missions to the Moon would be difficult for other countries but they would not be impossible. Missions to asteroids and Mars, however, could not be done by the international community either technically or financially.

There were a variety of differences between the Bush and Obama policies for civil space—most notably the decision to cancel Constellation and proceed with Commercial Crew, but also cancelling a return to the Moon in favor a new mission to an asteroid, and then to redirect an asteroid to cislunar space.  In addition, the Obama administration rushed their national space policy into being very quickly whereas the Bush administration did not release their national space policy until the end of the Bush administration.  The data reveal that the primary reason for these differences is because the Obama administration loathed the Bush administration so much that they were intent on pursuing a different space program.  However, growing private sector competence and perceptions of industry efficiencies were also critical factors in the Obama administration's policy process.


### Chapter 9:  Variables for Civil Space

According to Peter Marquez there were no undue outside influences that impacted the Obama administration's policy decision to partially privatize the civil space effort.  There were no outside political forces influencing the decision on CCDev or NASA in general.  Everything that unfolded in the policy formulations were internal.

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[136] Interview with Pace

**Financial Pressure in the Bush Administration**

Official 1 did not know the budgetary issues prevailing in the Bush administration.[137]

But Logsdon maintains that the policy decision for COTS was not driven by budget concerns.[138]

According to Pace there were no budgetary issues with COTS.[139] The primary budgetary

concerns of the Bush administration at the time were with return to flight and revitalizing the

area devastated by hurricane Katrina. Pace maintains that COTS did not have a big budgetary

impact.[140] Other programs were more important—COTS was just noise. For Official 2, who

was instrumental in the development of the Bush administration's space policy, the budgetary

issues happened after he was gone.[141] Still, Official 2 recounts that there was a longstanding

lack of consensus to fund levels for civil space as needed in the Bush administration.[142] This

was true of Bush, but even more true of Obama. Evidently it is a pay as you can basis for these

administrations.


**Financial pressure owing to the 2008 crisis**

According to Marquez the 2008 financial crisis played no role whatsoever in the Obama

administration's decision making for NASA, and certainly not with respect to CCDev.[143] There

was some focus on jobs in critical constituencies. The Obama administration knew that by

canceling Constellation a significant amount of jobs would be lost in states that traditionally

provided significant support to NASA.

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[137] Interview with Official 1
[138] Interview with Logsdon
[139] Interview with Pace
[140] Interview with Pace
[141] Interview with Official 2
[142] Interview with Official 2
[143] Interview with Marquez

Marquez maintains that even if revenues to the United States treasury were high enough the Obama administration still would have cancelled Constellation.[144] There was just no inclination in the Obama administration to give NASA more resources. The Obama administration believed that NASA was funded correctly but doing the wrong mission.[145]

However, according to Official 1, who was closely associated with the implementation of the security aspects of the Obama administration's space policy, the 2008 financial crisis did play a role in their decision making at some level.[146] Official 1 maintains that due to the crisis it was not a good financial environment to do anything in government.[147] Yet still, most of the impetus to transition to Commercial Crew was not coming from the White House but instead coming from Lori Garver. Obama was not directly involved in the decision making for space. According to Official 1 policymakers in the administration just attempted to "glom" onto something that seemed appealing.[148] Nevertheless, in Official 1's view Commercial Crew was still a good idea.[149] It just was not rolled out as a policy alternative but instead was backed in much later.

According to Logsdon the 2008 financial crisis played little to no role in the Obama administration's policy decisions for NASA.[150]

According to Pace the 2008 financial crisis played no role in the Obama administration's policy decision.[151] Evidently $3 billion was removed from the budget for human spaceflight at

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144 Interview with Marquez
145 Interview with Marquez
146 Interview with Official 1
147 Interview with Official 1
148 Interview with Official 1
149 Interview with Official 1
150 Interview with Logsdon
151 Interview with Pace

the beginning of the Obama administration's tenure in office. But in 2011 the top line of

NASA's budget went back up to the level that it was at in 2009. It was just that the composition

of the budget had changed. As has been discussed there was more emphasis on technology and

Earth science and less for exploration. The 2012 budget was then flat. In 2013 and 2014 the

situation got worse. But then in 2016 the budget is going to go up again. Despite all this Pace

holds that the $18 billion in the budget is just lost in noise in Washington.[152]

Therefore, based on the information that was obtained from these officials it is concluded

that the first independent variable of financial pressure owing to the 2008 financial crisis has no

explanatory power in this study. Financial pressure owing to the 2008 financial crisis, or

previous budgetary pressure, does not explain the policy decisions that these administrations

made for the civil space effort. As a potential explanatory variable financial pressure owing to

the 2008 crisis, or previous budgetary pressure, had no impact on the policy process for space in

these administrations.


**Growing Private Sector Competence During the Bush Administration**

According to Official 1 the impact of the private sector's competence on decision making

in the Bush administration was similar to that in the Obama administration.[153] During the Bush

administration there was overall worldwide big growth in commercial expertise in the space

industry. The industry was building stuff that typically takes longer for government. This was

due to the unique profit motive of the private sector.

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[152] Interview with Pace
[153] Interview with Official 1

According to Logsdon the anticipation of growing private sector competence played a role in the Bush administration's policy formulations for the civil space effort.[154] For the Vision there was a study on how to implement the Vision where Aldridge recommended an increased role for the private sector. Griffin implemented that recommendation with COTS.

In regard to growing private sector competence during the Bush administration Pace maintains that the private sector had a good degree of competence already.[155] Pace notes the existing argument that government is intrinsically dumber, less efficient, and flawed.[156] Nevertheless, Pace believes that there are different characteristics for each.[157] In any event, in contrast to the Obama administration, Pace recounts that there was a thoughtful discussion of the relative role of government and industry that occurred in the Bush administration.[158] Pace observes that the Obama administration made decisions first before engaging in any meaningful discussion of these roles.[159]

For Official 2, who was central in the development of the Bush administration's space policy, the role of growing private sector competence is a chicken or egg question.[160] The relative role of government and industry is actually a symbiotic development.[161] During the Bush administration it became apparent that the commercial sector was growing in directions it previously had not. This was so from comsats to Space X. Therefore, all in government had to hear of viable alternatives in their policy decision making processes. In any event, the prime

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[154] Interview with Logsdon
[155] Interview with Pace
[156] Interview with Pace
[157] Interview with Pace
[158] Interview with Pace
[159] Interview with Pace
[160] Interview with Official 2
[161] Interview with Official 2

motivation for government was still to save money.  This was the case with NASA.  This was also the case with the Department of Defense.  Regardless, Official 2 notes that all bets will be off if another crew is killed in the CCDev arrangement.[162]  Yet in spite of such an event the role of the commercial sector in space policymaking is definitely growing—from satcams to imagery to launch to support to the ISS.  What is more, it is Official 2's firm belief that if government makes the right choices commercial operations in space will be competitive with if not superior to those of government.[163]

### Growing Private Sector Competence During the Obama Administration

According to Peter Marquez the Obama administration was very comfortable with growing private sector competence in the space industry.[164]  Evidently the competence that companies such as Space X were demonstrating made the Obama administration comfortable in their policymaking process.  Marquez maintains that it was cheaper to pay the private sector than to do it in house.[165]  If Space X had never launched a vehicle there would have been no CCDev according to Marquez.[166]

Official 1 was in favor of transitioning the civil space effort to the commercial sector.[167]  However, Official 1 believes that human space exploration will still be a government function for a long time.[168]  There are just not that many commercial entrepreneurs talking about space colonization aside from Elon Musk.  Regardless, Official 1 believes that the Obama

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[162] Interview with Official 2
[163] Interview with Official 2
[164] Interview with Marquez
[165] Interview with Marquez
[166] Interview with Marquez
[167] Interview with Official 1
[168] Interview with Official 1

administration was politically naïve in their reliance on the commercial sector for the civil space policy.[169]  They did not offer CCDev as an alternative but rather backed into it later.

According to Logsdon private sector competence played a significant role in the Obama administration's policy formulations for civil space.[170]  In fact, the Augustine report details growing private sector competence.  What is more, the whole idea of relying on the private sector has bipartisan appeal.  The combination of all of this influenced the Obama administration's willingness to depend on the private sector.[171]  In addition, as COTS was started under the Bush administration the Obama administration's policy was a natural evolution of policy already in existence (even though the Obama administration was intent on distinguishing themselves from the Bush administration).  According to Logsdon commercial crew was simply one more step up—the policy decision was incremental and not a radical departure even though skeptics wanted to paint it that way.[172]  The policy decision did, however, change the procurement process.  This started with COTS.  The traditional contract changed.  There became space act agreements.  With these it was intended that the private sector share costs and risks.  According to Logsdon, the policy that naturally evolved and emerged over these successive administrations in large part resembles a public-private partnership.[173]

According to Pace the private sector has always been competent.[174]  He rejects the notion that it was actually growing.  Pace maintains that Boeing and Lockheed were always competent

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[169] Interview with Official 1
[170] Interview with Logsdon
[171] Interview with Logsdon
[172] Interview with Logsdon
[173] Interview with Logsdon
[174] Interview with Pace

and that their competence was not in fact growing.[175]  The policy for cargo with COTS was

largely an experiment with contacting according to Pace.[176]  Pace maintains that COTS and

CCDev are not really commercial.[177]  The companies involved put little of their own money up.

Pace thought that something like $200 million was private funds whereas $2.6 billion was public

money in the policy arrangement.[178]  Therefore, it was not actually private but rather innovative

contracting.  Additionally according to Pace these companies were still in need of a lot help with

such things as software from the Johnson space center and other NASA centers.[179]

Therefore, based on the evidence that these officials present it can be surmised that the

second explanatory variable, growing private sector competence, did indeed play a large role in

the decision for the space policy of both the Bush and Obama administrations.  As an

independent variable growing private sector competence has much explanatory value in relation

to the dependent variable of the Bush and Obama administrations' policy decisions to partially

privatize the civil space effort.  Growing private sector competence in part allowed the Bush and

Obama administrations to partially privatize the civil space effort and create a public-private

partnership with the aerospace industry for LEO space travel.

### Perceptions of Industry Efficiency in the Bush Administration

Regarding perceptions of efficiency in the Bush administration Official 1 does in fact

maintain that the Bush administration perceived that industry was more efficient than

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[175] Interview with Pace
[176] Interview with Pace
[177] Interview with Pace
[178] Interview with Pace
[179] Interview with Pace

government.[180]  Official 1 notes the dysfunction of the ESA with their member states and observes that this is not economically rational.  Accordingly, the Bush administration perceived that the transportation of cargo by the private sector would be more efficient.[181]

Logsdon thinks that perhaps the Bush administration perceived efficiencies with the private sector because that is the ideology.[182]  There was definitely a perception in the Bush administration that the private sector could conduct civil space operations more efficiently than government.  However, according to Logsdon efficiency is not the dominant variable.  Innovation in policy is the dominant variable.[183]

According to Pace NASA perceived that COTS would be more efficient than government cargo transportation but the Bush administration was not sure.[184]  Official 2 maintains that commercial could be more efficient than government.  However, according to Official 2 this phenomenon is not applicable across government but has application with the civil policy.[185]  Evidently, in the realm of national security the Department of Defense does not have the culture, procedures, and processes in place to make efficient use of commercial goods or services such as navigation and imagery, etc.

**Perceptions of Industry Efficiency in the Obama Administration**

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[180] Interview with Official 1
[181] Interview with Official 1
[182] Interview with Logsdon
[183] Interview with Logsdon
[184] Interview with Pace
[185] Interview with Official 2

According to Marquez the Obama administration believed that industry was more efficient than government.[186]  If the government could buy the service from industry it would decrease overhead costs and in turn make government more efficient as well.  However, there were questions about if a potential accident would increase costs for government and what this would ultimately cost NASA.  Marquez emphasizes oversight, review, safety as important aspects of the industry government relationship in space.[187]  Marquez also pondered the potential costs of moving the capability back in house.  Nevertheless, Marquez maintains that the Obama administration hoped that operations would become more efficient in the medium as well.[188]  An important aspect of this is keeping schedule cost.  Marquez agrees with Griffin that it is a good idea to move things off of NASA's ledger.[189]  Therefore, LEO activities such as CCDev is a good concept in Marquez's view.  He is glad it is working out.  It is the right thing to do.

Official 1 believes that the Obama administration hoped for greater efficiencies when they were formulating their policy.[190]  Official 1 observes that it is hard to get less efficient structures than government.[191]  FAR is quite byzantine in this regard.  Official 1 maintains that at times there can be too much oversight.[192]  However, Official 1 is confident that efficiencies can be achieved by increasingly relying on the commercial sector in the development of policy.[193]  The question was:  what was the proper level of oversight?  Obviously the government has a role to play in regulating human spaceflight.  But Official 1 would rather have separate entities

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[186] Interview with Marquez
[187] Interview with Marquez
[188] Interview with Marquez
[189] Interview with Marquez
[190] Interview with Official 1
[191] Interview with Official 1
[192] Interview with Official 1
[193] Interview with Official 1

promoting rather than regulating.[194] Official 1 also observes that the Obama administration

hoped that operations in the medium would become more efficient as well by increasing relying

on the private sector in the development of policy.[195] The #1 issue is: how can government best

incentivize things that are not inherently government functions. This applies to mission areas as

well as transportation, including imagery and space situational awareness.

For Logsdon the ideology in America has always been that industry is more efficient than

government.[196] Logsdon observes that this made Republican opposition to the Obama policy

strange.[197] However, Logsdon does not believe that operations in the medium would become

more efficient by increasingly relying on the private sector in the development of policy.[198]

Accordingly, the private sector must meet the same safety and performance standards that

government has always met. The private sector cannot cut corners either technically or

operationally.

According to Pace the Obama administration did perceive more efficiencies by

increasingly relying on the private sector in the formulation of their policy.[199] But Pace

maintains that what was less perceived was the degree to which public tax payers would be

protected.[200] In the Obama administration there was more awareness of helping companies than

protecting tax payers. If something went wrong government had no recourse. Pace holds that

the policy looked like it was presenting contracts to the companies involved but it was really

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[194] Interview with Official 1
[195] Interview with Official 1
[196] Interview with Logsdon
[197] Interview with Logsdon
[198] Interview with Logsdon
[199] Interview with Pace
[200] Interview with Pace

more like giving grants to them.[201] Pace believes that operations in the medium were not

perceived as more efficient by the Obama administration.[202] Nevertheless, industry could make

decisions faster and be more flexible which helped to drive down costs. Development was also

much cheaper than the traditional method. But still, Pace observes that players in space must

have experience to do operations.[203]

Therefore, based on the results that proceeded from these officials it can be surmised that

as an explanatory variable perceptions of efficiency ultimately did have an impact on the

dependent variable of the Bush and Obama administrations' policy decisions to partially

privatize the civil space effort and create what is akin to a public-private partnership with

elements of industry for LEO space travel. Thus, the third independent variable of perceptions

of efficiency provides an adequate explanation for why the Bush and Obama administration

pursued their respective policies for COTS and CCDev. However, it appears that this variable is

only applicable in the realm of civil space and does not apply to the national security space

effort. In addition, it appears that the desire to be innovative in policy making has more

explanatory power for why these particular policy decisions were made than do perceptions of

efficiency.


**The Dominant Variable**

It is surmised that when the Bush and Obama administrations developed the COTS and

CCDev policies the private sector's growing competence signaled to these administrations that

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[201] Interview with Pace
[202] Interview with Pace
[203] Interview with Pace

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these administrations could rely on them in the development of policy. In regard to growing private sector competence reports from both NASA and the aerospace media indicate that NASA's COTS and CCDev industry partners have indeed demonstrated such competence, but not without a few issues of course. Therefore, it is concluded that, notwithstanding perceptions of efficiency, that growing private sector competence was indeed the main factor behind the policy decisions of these administrations. Indeed, some officials maintain that the private sector's competence was never growing and was always there, which would confirm the view that industry's competence signaled to these administrations that these administrations could rely on industry in the development of their policies. However, reports from both NASA and the aerospace media indicate that, at least in regard to the civil policy, industry still had to demonstrate a significant measure of competence to NASA before they could fulfill the COTS and CCDev contract arrangements. Interestingly enough this was not only the case for new space companies like Space X but for established aerospace companies like Boeing as well.

Coverage of growing private sector competence begins with Space X's demonstration of the suitability for flight of their man-rated capsule. In 2012 "Space Exploration Technologies (Space X) finished an important evaluation of a prototype Dragon spacecraft designed to carry people into orbit. This key milestone was part of Space X's partnership with NASA under a funded Space Act Agreement to advance the design of crew transportation vehicles. The primary goal of the tests was to determine whether the layout would allow astronauts to maneuver effectively in the vehicle. Several veteran space shuttle astronauts and NASA engineers conducted the evaluation during a pair of two-day-long reviews" (Braukus, Thomas, and Brost Grantham 2012).

Following this demonstration Space X attempted operations on orbit in 2012. These first few operations were intended to demonstrate Space X's competence to NASA and to show NASA that Space X could indeed fulfill the contract arrangements that were in place. As such in May of 2012 "Space X, after replacing a faulty first-stage check valve, readied the Falcon 9/Dragon combination for a second attempt to launch the first US commercial resupply mission to the International Space Station (ISS) in the early morning hours of May 22…'During rigorous inspections of the engine, Space X engineers discovered a faulty check valve on the Merlin engine. The failed valve was replaced on May 19 and, after thorough analysis, the vehicle was cleared for launch,' spokeswoman Kirstin Brost Grantham said in a May 21 Space X statement" (Carreau 2012). Following these preparation activities "Space X's Falcon 9 rocket and Dragon lifted off at 3:44 a.m. EDT Tuesday from Cape Canaveral Air Force Station in Florida. During the flight, the Dragon capsule conducted a series of checkout procedures to test and prove its systems, including the capability to rendezvous and berth with the space station. One of the primary objectives for the flight was a flyby of the space station at a distance of approximately 1.5 miles to validate the operation of sensors and flight systems necessary for a safe rendezvous and approach. The spacecraft also would demonstrate the ability to abort the rendezvous. Once Dragon successfully proved these capabilities, it was cleared to berth with the space station" (Perrotto and Byerly 2012). "The Space X Dragon capsule rendezvoused with the International Space Station (ISS) May 25, overcoming some late tracking issues to become the first US commercial resupply spacecraft to dock with the six-person orbital science laboratory…The final stages of the robot arm capture took longer than anticipated, as the NASA Mission Control team in Houston and Space X flight control team in Hawthorne sorted through some tracking

discrepancies between Dragon's thermal imager and lidar guidance systems that surfaced with 250 meters separating the two spacecraft. As the freighter closed to nearly 30 meters, the lidar locked up on a reflector on the station's Japanese Kibo module. That prompted a momentary retreat of the capsule to 70 meters, while Space X adjusted the lidar to ignore the uninvolved reflector. Subsequently, one of two Dragon lidar trackers failed—leaving the capsule primed to abort the capture operation if there was a second failure" (Carreau 2012).

After these operations "Space Exploration Technologies Corp. (Space X) was one small step closer to beginning routine supply runs to the international space station (ISS) now that NASA has verified that the company safely returned 35 kilograms of time-sensitive cargo from the orbiting outpost. This so-called early return cargo, packed into four bags, reached NASA's Johnson Space Center in Houston June 2—57 hours after splashing down aboard Space X's Dragon Capsule in the Pacific Ocean. Preliminary assessments by ISS program officials at Johnson showed that the shipment was in good condition, NASA spokesman Josh Byerly said June 7. The safe return of this cargo was one of the objectives Space X had to fulfill for its historic demonstration flight to be considered a success" (Space News Staff 2012).

In addition to Space X even an established aerospace company such as Boeing had to demonstrate its competence by achieving a significant amount of key technical milestones before it could fulfill its CCDev contractual arrangements with NASA. One of the first milestones that Boeing achieved involved a demonstration of its parachute equipment for its capsule's landings in May of 2012. "The Boeing Company successfully completed the second parachute drop test for its Crew Space Transportation (CST) spacecraft Wednesday, as part of its effort to develop commercial crew transportation capabilities that could ferry US astronauts to and from low-Earth

orbit (LEO) and the International Space Station…A helicopter lifted the CST-100 crew capsule to about 14,000 feet above the Delamar Dry Lake Bed near Alamo, Nev.  A drogue parachute deployment sequence was initiated, followed by deployment of the main parachute.  The capsule descended to a smooth ground landing, cushioned by six inflated air bags.  The test demonstrated the performance of the entire landing system" (Braukus, Thomas, and Wells 2012).

Following the parachute test later in May of 2012 Boeing sought to demonstrate the capabilities of its software for its capsule.  In this regard, "the Boeing Company successfully completed a new milestone in the development of software that will operate its Crew Space Transportation (CST) spacecraft…With the Preliminary Design Review (PDR) of its software on May 18, the company completed more than 40 milestones at the time under partnerships supporting NASA's Commercial Crew Program (CCP)…Software is essential to all operational aspects of the spacecraft, including launch, orbital maneuvering, docking with and separating from the space station, re-entry and landing.  The testing is part of a NASA-funded Space Act Agreement under the second round of the agency's commercial crew development (CCDev2) activities, which could eventually lead toward human spaceflight certification of the CST-100. The Boeing team was on schedule to complete its remaining CCDev2 milestones in the following months in 2012, including an orbital maneuvering/attitude control engine hot fire test that would provide additional data on significant elements of the spacecraft design" (Perrotto, Thomas, and Wells 2012).

Following this milestone "Boeing was on track to meet its milestones in the second phase of NASA's Commercial Crew Development (CCDev-2) competition, after completing the preliminary design review earlier in May of 2012 for software needed to operate its CST-100

crew capsule.  Still to come were CCDev-2 milestones that included an orbital maneuvering/attitude control engine hot-fire test, NASA says, adding that 'all of NASA's industry partners, including Boeing, continue to meet their established milestones in developing commercial crew transportation capabilities'" (AWAD Staff 2012).

Meanwhile, at the same time that Boeing was surpassing critical technical milestones that would demonstrate its competence to fulfill the CCDev contractual obligations Space X proceeded with its effort to surmount similar milestones.  In this regard in 2012 Space X conducted a review to determine the technical stage that it was at with its spacecraft.  "The review examined the company's strategy for design, development, and testing of its integrated assets as well as initial plans for managing ground, launch, ascent, in orbit, re-entry and landing operations.  Earlier Space X milestones previewed the use of the previously flown but unpiloted Falcon 9 rocket and Dragon spacecraft for crewed missions as well as plans for ground operations, including launches from the company's Cape Canaveral pad and Mission Control facilities in Hawthorne" (Carreau 2012).

However, the technical developments with Space X were not without setbacks.  In October of 2012 Space X had a number of technical issues with its first commercial resupply mission as part of its COTs contractual arrangements.  "NASA says that in addition to the shutdown of a Falcon 9 first stage engine, Space X's Oct. 7 Commercial Resupply Services (CRS) mission to the International Space Station encountered a number of potentially minor anomalies, including the loss of one of three flight-computer units aboard the company's Dragon cargo vessel due to a suspected radiation hit.  The computer, which shut down while Dragon was preparing to depart the space station, was rebooted but not re-synched to the remaining flight

computer units onboard, a process that Space X says was rehearsed numerous times on the

ground but would have proved time-consuming during the mission." Nevertheless, even though

these glitches were somewhat of an issue for Space X the company nonetheless "'met every

requirement that NASA had, even with one computer down,' according to Muratore. Although

Space X was considering 'slight procedural or software changes' to Dragon for the company's

second CRS mission on March 1, Muratore says there was no requirement to do so. 'Every piece

of hardware that had any kind of hit recovered 100 percent, completely,' he says. The design

functioned exactly the way it was intended to function'" (AWAD 2012). "Preparations for

Space X's second Commercial Resupply Services (CRS) mission had included extensive

troubleshooting, analysis and testing to determine why a Falcon engine shut down early during

launch of CRS-1 in October (2012). 'There was a material flaw that went undetected in the

jacket of the Merlin engine, resulting in a breach…causing depressurization of the combustion

chamber' Shotwell told reporters during a prelaunch press conference Feb 28. 'The flight

computer recognized that depressurization and then it commanded shutdown,' Shotwell said.

The Falcon's eight other engines compensated for the loss of power and the Dragon capsule

successfully reached the station. The situation, however, triggered a contract stipulation with

NASA that barred Space X from restarting the engine, leaving an experimental Orbcomm

satellite as a secondary payload in a lower-than-intended orbit. 'This vehicle has been designed

to accommodate an engine-out. Though you never necessarily want to see it happen, it's nice

that we demonstrated the vehicle as it was designed,' Shotwell said. She declined to provide

details about the material flaw, citing an ongoing State Department review of Space X's report

for potential International Traffic in Arms Regulations (ITAR) violations" (Klotz 2013, 5).

Despite these issues Space X would press ahead with its operations and in early March of 2013 Space X transported scientific experiments to the ISS with Dragon. However, again there would be glitches for Space X's mission. "Shortly after spacecraft separation from the rocket's second stage, the Dragon lost three of its four thruster pods. Solar array deployment was delayed while Space X engineers worked to purge blocked valves and get the pods back online. Ninety minutes after launch, Dragon's arrays were deployed. By 3 pm, all four thrusters pods were online and attitude control was regained. Following a series of tests to ensure the spacecraft could safely approach the space station, Dragon was approved to approach the orbiting laboratory Sunday morning, one day after its originally planned arrival, which was not expected to impact any of the scientific investigations being delivered" (Perrotto and Byerly 2013). "The CRS-2 mission, launched March 1, delivered 2,090 lb. of internal and external cargo to the six-person orbiting research lab and returned with 3,256 lb. of frozen medical specimens, a range of other research gear and unneeded equipment, according to the company's final mission accounting. Musk pointed to a subtle design change and a lapse in qualification testing as the cause of three sticky check valves in the Dragon thruster system that prompted a one-day delay in the supply vessel's scheduled March 2 rendezvous with the space station. All three valves were forced open with the rapid uplink of a software change that increased pressure in the system. Space X was not made aware of the design change by its supplier, and while company engineers conducted a pre-mission low-pressure functionality test of the hardware, they elected to skip a high-pressure test that might have revealed the problem, he said" (AW&AD 2013).

In regard to the early March of 2013 issues on orbit "NASA's top human spaceflight official, meanwhile, praised the Space X team for displaying grace under pressure after Dragon's

propulsion anomaly. 'They did everything right,' William Gerstenmaier, NASA associate administrator for human exploration and operations, said during the conference call. 'They did a phenomenal job of pulling that all together. They showed the patience that it takes to operate in space, to not give up'" (Klotz 2013, 5).

While Space X and Boeing were making progress toward eventual commercial human spaceflight the other COTS industry partner, Orbital, was attempting to develop it systems as well. "Before Dulles, Va.-based Orbital can begin routine deliveries, however, it must carry out two successful Antares demonstrations, the second of which will carry a station-bound Cygnus capsule. The first will attempt to place a simulated Cygnus capsule into the initial orbit used for space station deliveries" (Leone 2013, 5).

Thus, notwithstanding the Obama administration's loathing of the Bush administration as an explanation for why its policy differed from the Bush administration, it is nevertheless surmised that growing private sector competence is what ultimately enabled the Obama administration to cancel Constellation and formulate the policy for Commercial Crew. Growing private sector competence has important implications for the American national security space enterprise as well. Indeed, it is the growing competence of both established corporations and new entrants that has enabled the Obama administration to increasingly rely on them for routine imagery needs and bandwidth for data and communications.

## Chapter 10: Security Policy

The differences prevailing between the Bush and Obama administrations' policies for national security space are largely attributable to a threat environment that had completely

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changed. ASATs proliferated and export restrictions on the American space industry reduced their international competitiveness which damaged national security. As such, the space environment became more congested, contested, and competitive (the 3 Cs).

### Security Space Policy in the Bush Administration

According to Pace the highest security priority in the medium of space during the Bush administration was space situational awareness.[204] However, removing space debris was definitely not a priority in the Bush administration. Pace recounts that partnerships with industry and the international community were also a priority as well for the Bush administration.[205]

For Major General Armor there were two important security aspects at the Pentagon under the Bush administration for the medium of space. The zero aspect was that there was no real fundamental change from the Clinton administration.[206] The policy was just reworded. In any event, under the Bush administration the Pentagon wanted to preserve its freedom of action in the medium for national security space. But the second aspect was that the Pentagon also wanted to encourage the commercial exploitation of space under the Bush administration.[207]

According to Armor the Pentagon under the Bush administration was concerned with growing global activity that was looking at constraining the space activity of the United States.[208] The United Nations and other groups of nations that had space interests were talking about rules of the road. Evidently these nations were against the proliferation of nuclear weapons and other ASATs in the medium. But Armor recounts that the Pentagon under Bush

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[204] Interview with Pace
[205] Interview with Pace
[206] Interview with Armor
[207] Interview with Armor
[208] Interview with Armor

wanted to reiterate the Clinton policy.[209]  The Pentagon sought to assert its right of self-defense.

It wanted to convey that into operations in space.  The Pentagon observed that there was nothing

that stipulates that the United States cannot protect its interests in space.  To this end the

Pentagon under Bush did not want any more rules in the medium.  However, Armor qualifies this

stance by maintaining that the Pentagon was open to rules and regulations but just not at the

international treaty level.[210]  Evidently at the bilateral level these types of relations would be

acceptable.  In any event, the Russians and the Chinese were stirring up disenfranchised space

people to reign in the United States during the Bush administration's tenure in office.  But Armor

observes these activities would not have constrained the Russians and the Chinese because they

would not have followed the rules that were being proposed anyway.[211]  Armor believes that

only the United States would have followed the rules while its main competitors would not

have.[212]

In addition, Armor recounts that the Pentagon under the Bush administration wanted a

robust commercial space sector.[213]  To this end the Pentagon sought to encourage companies in

the private sector.  Armor maintains that this would not have happened with extra rules in the

medium.[214]

According to Armor the policy that the Pentagon produced under the Bush administration

addressed all of the Pentagon's concerns.[215]  The Pentagon was comfortable with the policy.

The Pentagon was empowered to pursue national security space.  It did not feel constrained.  It

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[209] Interview with Armor
[210] Interview with Armor
[211] Interview with Armor
[212] Interview with Armor
[213] Interview with Armor
[214] Interview with Armor
[215] Interview with Armor

felt empowered to develop the full range of systems that it was looking at at the time. These

systems included intelligence assets, the GPS, weather assets, etc. Yet still, Armor recounts that

it was still necessary to defend these assets and hold back adversaries using space systems

against you.[216] Armor believed that the United States military must be able to deny the

operations of the adversary.[217] Under the Bush administration the Pentagon felt free to explore

the systems that would do that. Armor maintains that the Clinton policy basically stated the

same things but the rest of the world had become rambunctious during the Bush administration's

tenure in office.[218] Therefore, the Bush administration felt compelled to restate the Clinton

policy in its own words to give the Pentagon backing.

Lieutenant Colonel McGibney recounts that the Pentagon's space policy under the Bush

administration was very concerned with trying to make sure that it clearly articulated its

position.[219] McGibney reflects that each word could mean something different.[220] In any event,

the Pentagon under the Bush administration was mainly focused on unhindered access to space.

But the Pentagon was also concerned with allowing others to have access.

According to McGibney the Pentagon was concerned with others' interpretation of how

the United States military used space.[221] Interpretation of words was a major issue when the

Pentagon under the Bush administration formulated its security policy for the medium of space.

The Pentagon was concerned with how people would perceive things as weapons. But at the

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[216] Interview with Armor
[217] Interview with Armor
[218] Interview with Armor
[219] Interview with McGibney
[220] Interview with McGibney
[221] Interview with McGibney

same time there would be ASAT testing by other nations.  Additionally, McGibney observes that

ballistic missiles could become ASATs.[222]  Co-orbital satellites could become weapons.

Regardless, McGibney maintains that the Pentagon tried not to change the tone of its

policy in comparison to the previous policy.[223]  The Pentagon did not want people to get worried

according to McGibney.[224]  Nevertheless, the Pentagon was trying to preserve space.  It did not

want others to perceive that the United States was weaponizing the medium.  McGibney recounts

that the Pentagon did not want others to misinterpret its intent.[225]  Evidently behind the scenes at

the Pentagon during the policy formulations there was a lot of scrutinizing of words to determine

what others might claim.  Still, McGibney believes that the policy addressed all of the concerns

that the Pentagon had at the time.[226]  The Pentagon tried to tie it back to historical policies

without changing the tone.  In this regard, it met the intent.  In addition, McGibney reflects that

the Pentagon sought to energize the industrial base and the STEM fields with the policy.[227]

According to Colonel MV "Coyote" Smith the Pentagon under the Bush administration

received direction to partner and cooperate internationally.[228]  The people at the National

Security Space Office were to reach out to the international community.  Coyote reflects that

there was direction to remove or soften belligerent language in the Clinton space policy.[229]

Coyote was surprised by the reaction of the arms control community to the Bush policy.[230]

According to Coyote the Bush policy was the first space policy that drove to international

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[222] Interview with McGibney
[223] Interview with McGibney
[224] Interview with McGibney
[225] Interview with McGibney
[226] Interview with McGibney
[227] Interview with McGibney
[228] Interview with Coyote
[229] Interview with Coyote
[230] Interview with Coyote

cooperation.[231]  With respect to whether or not the policy addressed all of the concerns that the

Pentagon had Coyote maintains that anything could be done better but the policy did in fact

address all of the aforementioned concerns.[232]

## Security Space Policy in the Obama Administration

Regarding security policy in the medium of space during the Obama administration

Marquez notes that international aspects played a deciding role in the formulation of the

policy.[233]  Marquez observes that many in the political arena painted the policy as conciliatory

and cooperative.[234]  However, Marquez stresses that the Obama policy for national security

actually doubled in size from the predecessor administration and became more aware of the

current threat environment.[235]  This was so not because Marquez, the author of the policy,

believed that the Bush policy was wrong but rather because the Bush policy was outdated.[236]

The new security policy that Marquez drafted reflected a variety of updates from Chinese to

Russian to North Korean capabilities.  The Obama security policy reflected an evolving

geopolitical threat environment against US space systems.  Marquez stresses that the security

aspects of the 2010 national space policy are one giant declarative deterrent statement.[237]

Some aspects involved in this effort included signaling, attribution, denial of benefit, and

a cost imposition strategy.  Marquez recounts that through signaling the United States wanted to

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[231] Interview with Coyote
[232] Interview with Coyote
[233] Interview with Marquez
[234] Interview with Marquez
[235] Interview with Marquez
[236] Interview with Marquez
[237] Interview with Marquez

work with allies.[238]  The United States definitely did not want to put up with weapons in space. To this end the arms control aspects and TCBMs were signaling statements.  For attribution the United States intended to further develop space situational awareness.  However, with space situational awareness Marquez envisioned only a limited role for small satellites.[239]  Evidently small satellites don't have the duration necessary for significant space situational awareness operations.  Therefore, Marquez notes that space situational awareness needs to be resident on the satellite.[240]  Small satellites don't have enough fuel to move around and conduct extensive proximity operations according to Marquez.[241]  Thus, optical imaging and laser detection should be onboard critical satellites.  Dedicated space situational awareness assets such as the ANGELS need to be more robust with more fuel to move around.

Marquez applied various aspects of deterrence theory in the policy.[242]  There was a cost imposition aspect as well as a denial of benefit aspect.  With benefit denial Marquez notes that the United States was striving to deny benefits to adversaries who may want to attack.[243]  To do this the United States attempted to build in resiliency.  With cost imposition the United States was intent on striking back against adversaries much harder.  The United States strove to develop capabilities so that if it was attacked it could respond in an appropriate manner.  According to Marquez that United States was intent on gaining control of space.[244]  The security policy that Marquez drafted is one deterrence plan put together.

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[238] Interview with Marquez
[239] Interview with Marquez
[240] Interview with Marquez
[241] Interview with Marquez
[242] Interview with Marquez
[243] Interview with Marquez
[244] Interview with Marquez

According to Shawn Steene the most important attributes of the Pentagon's space policy under the Obama administration can be found in paragraph 4 section C of the 3100.10 policy document:[245]

"In order to deter attacks on U.S. or allied space systems, DoD will:

(1) Support the development of international norms of responsible behavior that promote the safety, stability, and security of the space domain.
(2) Build coalitions to enhance collective security capabilities.
(3) Mitigate the benefits to an adversary of attacking U.S. space systems by enhancing the resilience of our space enterprise and by ensuring that U.S. forces can operate effectively even when our space-derived capabilities have been degraded.
(4) Possess capabilities, not limited to space, to respond to an attack on U.S. or allied space systems in an asymmetric manner by using any or all elements of national power" (DOD 3100.10 2012, 2).

According to Steene there were four layers to deter attacks.[246] These included norms, coalitions, efforts to enhance resilience to deny benefit, and capabilities to respond to an attack not limited to space.

If the action in space were limited to symmetrical tit for tat engagements then the adversary could control escalation according to Steene.[247] If the adversary does not have important assets in the medium but the United States does then the United States cannot respond in kind because it doesn't hurt the adversary. Therefore, the United States would have to respond against an adversary's terrestrial assets. Thus, there was a joint operational concept of deterrence. The United States can impose costs in this way. This would influence the decision making of an adversary by putting the thought in his mind that the response will be so damaging that it would not be worth it to attack US space assets. The strategy of the Pentagon was also to create resiliency with its space assets as well as redundancy. The ability to withstand the fight

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[245] Interview with Steene
[246] Interview with Steene
[247] Interview with Steene

though would also play into deny benefits—the 4th layer—according to Steene.  This meant that

the action would not be limited to space on space only.  There would be some combination of

deny benefit and impose cost with the net calculus being to sustain deterrence.  But if deterrence

should fail this policy would nevertheless create the strategic, operational, and tactical conditions

that would allow the United States to prevail in the conflict.

The Pentagon also sought to look beyond just military activities in its deterrence calculus.

Other cost imposition strategies were financial and diplomatic in nature.  The end game was still

to bolster the in-space strategic situation as well as non-space strategic situation according to

Steene.[248]

Under the Obama administration the Pentagon was very interested in transparency in the

medium.  It was also very interested in international cooperation.  The Pentagon under the

Obama administration believed that all spacefaring nations and entities had a right in space.

According to Steene this contrasted from the Pentagon under the Bush administration which at

the time placed more focus and emphasis on US systems and US sovereign rights.[249]

According to major general Santee there were a few significant things about the 2010

national space policy and the Pentagon's 3100.10 document.[250]  Both took into account how the

environment in space changed from the 1960s when only the United States and the Soviet Union

were the main participants in the medium to the space environment of today which is much more

populous.  Santee maintains that the threat increased drastically from other nations in the

medium.[251]

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[248] Interview with Steene
[249] Interview with Steene
[250] Interview with Santee
[251] Interview with Santee

In any event, according to Santee the policy tells what to do and the strategy tells how to do it.[252] Thus, there were three major things that the Pentagon was considering in their policy and strategy formulations for the medium of space under the Obama administration. The first was that the medium became contested, as evidenced by the 2007 Chinese ASAT test. The second was that the medium became congested, as evidenced by the iridium and Russian satellite collision but also with frequencies as well. And the third was that the medium became competitive, as was evidenced by how 10 years prior to their policy and strategy Santee recounts that the United States had about 60% of the market which then dropped precipitously to 30% of the market.[253] In light of this reality Santee recounts how export control reform was needed.[254] Evidently national security was threatened because industry could not compete with the export control restrictions that were in place.

Additionally, Santee observes that the Pentagon had to make changes in a cost constrained environment.[255] According to Santee, just because things had changed money was not going to rain down.[256] Nevertheless, Santee maintains that the policy that the Pentagon created and implemented under the Obama administration for the medium of space addressed all of the concerns that the Pentagon had.[257] The Pentagon developed a pragmatic and timely approach to addressing all of the aforementioned issues. And, indeed, according to Santee the Department of Defense validated their policy work done in 2009.[258]

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[252] Interview with Santee
[253] Interview with Santee
[254] Interview with Santee
[255] Interview with Santee
[256] Interview with Santee
[257] Interview with Santee
[258] Interview with Santee

According to Santee previous administrations were very similar to the Obama administration from a national security aspect in the formulation of their policies and strategies.[259]  But Santee believes that the Obama administration sets the world on a good path to a sustainable, safe, and secure domain in space.[260]  Santee holds that the Pentagon's space policy under Obama was a pragmatic way forward given the new environment in the medium of space.[261]  Santee maintains that the Obama administration was more willing to discuss security issues in the medium with other nations than was the Bush administration.[262]  In addition, export control reform was different.  There was collaboration with allies in the Obama administration.  The idea of what was in the vital interest of the United States in the medium had changed as well between the Bush and Obama administrations.  Therefore, in the policy documents there was a change in wording or overall meaning.  This was intended to promote different outcomes according to Santee.[263]

In any event the trend lines with the three Cs (contested, congested, and competitive) were terrible.  Santee recounts that as part of the Pentagon's strategy for deterrence the Pentagon wanted to impose costs against adversaries.[264]  The Pentagon also wanted their space systems to be resilient and redundant and to have backups with coalitions and allies.  Santee observes that there were issues in this regard in Afghanistan.[265]  Evidently in Afghanistan 11 coalition countries had imaging capabilities with less than a meter resolution but only the United States provided imagery.

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[259] Interview with Santee
[260] Interview with Santee
[261] Interview with Santee
[262] Interview with Santee
[263] Interview with Santee
[264] Interview with Santee
[265] Interview with Santee

Santee also maintains that with the prevailing trends in the medium the populous nature required norms and rules of the road.[266] Commerce in and from the medium would slow down without them. In this regard, rules support long term sustainability of the domain. Santee believes that the unilateral dominance from the 1960s doesn't make sense today.[267] Therefore, the thought prevailing in the Bush administration for security in the medium of space no longer makes sense. Santee believes that everything changed from when the Bush administration entered office in 2000 to the conditions prevailing in the medium today.[268] Not only did exports decline but ASATs proliferated. Regardless, it was historically important for each administration to have a new policy. In addition, Santee believes that it was equally important for the Pentagon under the Obama administration to write something that was pragmatic and that which could be done.[269]

According to Audrey Schaeffer the most important attributes of the Pentagon's space policy under the Obama administration can be found in section 4 C of the 3100.10 policy document.[270] As has been discussed this section contains the four layers of deterrence. For Schaeffer the main issue that the Pentagon was dealing with was how to protect or enhance the national security advantages that the United States derived from space.[271] In this regard, the Pentagon was primarily concerned with how to deter attacks and how to make sure the attacks that might be launched were unsuccessful. According to Schaeffer the Pentagon's thought on security policy in the medium of space evolved over time beginning with the 2010 Interim Space

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266 Interview with Santee
267 Interview with Santee
268 Interview with Santee
269 Interview with Santee
270 Interview with Schaeffer
271 Interview with Schaeffer

Posture Review, which was a report to Congress.[272] She recounts that this was in March 2010 and the concerns it presented drove the policy documents that then unfolded in the following years.[273] Evidently the Pentagon under the Obama administration was most concerned about the aforementioned 3 Cs in the medium. Schaeffer believes that the policy that was produced at the Pentagon adequately addressed these concerns.[274] The policy provided a strategy that assured the use of space in an environment that was increasingly challenging. However, Schaeffer raises a question of how well the policy was implemented.[275]

An important security issue for Schaeffer was norms for shaping responsible behavior.[276] For any observer of the Pentagon's security policy under the Obama administration Schaeffer maintains that it is important to keep in mind the order of the policy and strategy documents that emerged.[277] Evidently the Pentagon was well along the path even before the policy was written. Schaeffer observes that an interesting study would be the evolution of thinking with the order of the documents.[278] In any event, today the predominant security issue in space for the United States is an assured space strategy or operations.

The differences prevailing between the Bush and Obama administrations' policies for national security space were largely due to a threat environment that had completely changed. ASATs began to proliferate towards the end of the Bush administration while at the same time restrictions on the American space industry damaged their international competitiveness which

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[272] Interview with Schaeffer
[273] Interview with Schaeffer
[274] Interview with Schaeffer
[275] Interview with Schaeffer
[276] Interview with Schaeffer
[277] Interview with Schaeffer
[278] Interview with Schaeffer

was detrimental to national security.  As such, the space environment became more congested,

contested, and competitive (the 3 Cs) under the Obama administration.


## Chapter 11:  Independent Variables Applied to Security Space Policy

The independent variables of financial pressure owing to the 2008 crisis, growing private

sector competence, and perceptions of efficiency were taken into account as they apply to

security policy in the medium of space in addition to the role that they played in the civil space

policy.


### Increasing Role for the Private Sector in the Bush Security Space Policy

### Due to Financial Crisis

According to Armor the Pentagon under the Bush administration definitely considered

increasing industry's role in the management of its national security assets as a result of fiscal

pressure owing to a financial crisis.[279]  However, under the Bush administration it appears that

the Pentagon considered increasing industry's role in the operation of its national security assets

irrespective of budgetary pressure owing to any potential financial crisis.  But Armor maintains

that the Pentagon under Bush was unpracticed and naïve in how it did this.[280]  This was due to

institutional inertia according to Armor.[281]  The Pentagon simply did not know how to do it.

Armor made a second attempt to put contractors in charge of the GPS ground segment.

Contractors had already typed code and provided feedback to the factory.  The military was

doing check lists.  Armor wanted to reverse the roles and have the military in the background

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[279] Interview with Armor
[280] Interview with Armor
[281] Interview with Armor

monitoring.  Armor noted how Intelsat has fewer people operating its larger satellite constellation.[282]  In any event, Armor stressed that it was still necessary to have government oversight.[283]

Ultimately Armor's initiative failed.  The United States military still wanted to give young officers training flying satellites.  In addition, the United States military did not know how to privatize according to Armor.[284]  But with classified operations there is a larger acknowledged role for contractors.

What is more, Armor thought that Mike Griffin's COTS initiative was brilliant.[285]  But Armor does not believe that anything like COTS could be done by the United States Air Force.[286]  Regardless, Armor reenergized the space industrial base council across the intelligence community and the Department of Defense to the Department of Commerce to the State Department and to SIBC.  At issue were considerations for how to encourage the commercial base.  Evidently export controls were a huge problem.  This was primarily because Congress was opposing sales to the Chinese.  As such the ITAR export control regime emerged.  With ITAR the United States government moved control of even comsats from the Commerce Department to the State Department.  This started in1999.  Armor noted that there was a hard data look at the impact that ITAR was having on the United States space industry.[287]  According to Armor ITAR was well intentioned but it was killing the United States space industry.[288]  Evidently ATK saw real damage from ITAR.  According to Armor, prior to ITAR, ATK had about 80% of the heat

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[282] Interview with Armor
[283] Interview with Armor
[284] Interview with Armor
[285] Interview with Armor
[286] Interview with Armor
[287] Interview with Armor
[288] Interview with Armor

pipe market.[289]  But after ITAR was imposed ATK's market share dropped down to around 20%.

Evidently with these export restrictions other countries began investing in their own space

industries and built up their capabilities.  Then the United States Air Force was going to industry

to acquire systems and services but its suppliers were hurting.  This dynamic drove up costs for

the United States Air Force.  It also limited the innovation of the American space industrial base.

Evidently the American space industrial base became uncompetitive and could not export.  This

dynamic ultimately convinced Congress to change the system.  When the Obama administration

came into office it changed the export control laws.  Technology was transferred back to the

Commerce Department from the State Department.

Armor believes that with ITAR commercializing the Pentagon's space activities would

have been much harder.[290]  When Obama came into office his administration reemphasized

collaboration with allies.  Armor believes that budget constraints would prompt the Pentagon to

consider increasing industry's role in the management of its national security space assets.[291]  In

fact, this is already under way now with commercial imagery and other data.  The Pentagon is

thinking about changing the crew force for GPS.  The Pentagon has been actively seeking

arrangements whereby other nations host its payloads onboard their satellites.  This arrangement

would include sensors on commercial satellites.  An example would be the CHIRP system, an

infrared missile detection system on the comsat of a foreign country.

As McGibney recollects there was not as much consideration for increasing industry's

role in operating the Department of Defense's assets on orbit.[292]  One of the foremost concerns

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[289] Interview with Armor
[290] Interview with Armor
[291] Interview with Armor
[292] Interview with McGibney

was the aging aerospace workforce.  Another concern was the mergers taking place in the aerospace industry.  As with Armor, McGibney recounts the export restrictions that were imposed and how these presented a challenge for the industrial base that the Pentagon depended on.[293]  According to McGibney the questions was:  are we competitive enough?[294]  Indeed, it was of utmost importance for the national security of the United States for its companies to maintain their position of asymmetric advantage.  McGibney also reveals that another concern the Pentagon had at this time was whether there was enough skill sets in industry.[295]

In any event, McGibney does in fact recall that there was some discussion about what was the right way to manage on orbit assets at the Pentagon.[296]  But the Pentagon was not considering increasing industry's role in these operations at the time.  There was a question about whether space situational awareness was primarily a military or civil function.  McGibney compares the situation in space to that of shipping lanes on the ocean and air traffic control.[297]  But the Pentagon was not considering corporate partnerships.  It was concerned mainly on the awareness side.

However, in regard to a financial crisis like the one the nation in experienced in 2008 McGibney maintains that nothing would be off the table in terms of finding savings.[298]  At issue would be whether the asset or function was primarily civil or military and who should have control.  If the United States military better understood partnerships then they might make sense.  Indeed, the United States military already leases bandwidth from the commercial sector.

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[293] Interview with McGibney
[294] Interview with McGibney
[295] Interview with McGibney
[296] Interview with McGibney
[297] Interview with McGibney
[298] Interview with McGibney

McGibney thinks this arrangement might be a model if partnerships make sense.[299]  But the focus should be on cost savings and not just buying a service according to McGibney.[300]

As Coyote recollects under the Bush administration the Pentagon was not considering expanding public-private partnerships to the management of its assets on orbit.[301]  According to Coyote this was due to organizational inertia.[302]  Coyote observes that people always talk about leveraging off of the commercial sector and allies.[303]  But allies don't have a lot of capability and the commercial sector does not want the Department of Defense to lay out requirements that they have to meet.  Questions in this regard are:  how secure is cryptography; is fidelity adequate; is ground exploitation adequate to manipulate data.[304]

Nevertheless, Coyote observes that under the Obama administration there was a desire to spend less on space so money can be spent elsewhere.[305]  As such, Coyote maintains that Obama was surprised to discover that American scientific and technology investments primarily flow through NASA and other space labs.[306]

But the primary issue with public-private partnerships between the United States military and the commercial sector is not necessarily financial or fiscal but rather cultural.  According to Coyote the cultural aspect cannot be overstated.[307]  In this regard, the United States military enjoys the confidence of the American people.  This dynamic allows the military's culture to persist.

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[299] Interview with McGibney
[300] Interview with McGibney
[301] Interview with Coyote
[302] Interview with Coyote
[303] Interview with Coyote
[304] Interview with Coyote
[305] Interview with Coyote
[306] Interview with Coyote
[307] Interview with Coyote

**Increasing Role for the Private Sector in Obama Security Space Policy**

**Due to Financial Crisis**

According to Steene there were informal discussions at the Pentagon under the Obama administration of the management of day to day operations of the United States military's assets in the medium of space by its contractors.[308]  These involved care for the assets as well as feeding information back to the factory, which evidently was already taking place.  But in addition the Pentagon discussed station keeping by contractors as well as issues concerning bandwidth.  However, according to Steene orbital slot movement to high interest areas was always still considered a government function by its uniformed personnel.[309]

Nevertheless, Steene recounts that discussions to increase industry's role in the management of the United States military's assets took place.[310]  Anytime there are fiscal constraints these types of discussions take place depending on if they are more or less severe.  There is a trade-off of course.  The main concern is if the function can be done faster, better, or cheaper.  But the Pentagon has to address what the trade off is and for this contract definition is important according to Steene.[311]  Both the Pentagon and its contractors need to be aware of land mines in the contracts.  In any event, overhead imagery performed by the private sector is already happening.  The Pentagon also already leases satcom bandwidth.  Steene stresses that the Pentagon must consider the pros and cons of this dynamic—operationally, economically, and all

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[308] Interview with Steene
[309] Interview with Steene
[310] Interview with Steene
[311] Interview with Steene

the way around.[312]  However, Steene observes that the role of the private sector in space is

growing and that the Pentagon would be delinquent if it did not consider increasing the private

sector's role in its space operations.[313]  Indeed, without doubt the dynamic with launch services

means the role of the private sector is growing.

In regard to increasing the private sector's role in the United States military's space

operations as a result of fiscal pressure owing to a financial crisis Butterworth observes that

industry already does all the heavy lifting for the Pentagon in space.[314]  However, Butterworth

also observes that the smaller crews that operate satellite constellations for companies such as

Intelsat seem more efficient because their operations are less complex.[315]  It is easier for

companies such as Intelsat to have smaller crews than the United States military for this reason.

Regardless, Butterworth maintains that the United States government with respect to

national security, meaning the Department of Defense, doesn't begin to understand commercial

industry.[316]  The government has tried to provide incentives but hasn't really gotten the effects.

According to Butterworth more than half the time the government screws things up.[317]  In this

regard, the United Launch Alliance was the result of commercial companies responding

appropriately to incentives from government but government did not know what it was doing.

In any event, Butterworth recounts that during the Clinton years the Clinton

administration attempted to use defense money to create a commercial market that would take

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[312] Interview with Steene
[313] Interview with Steene
[314] Interview with Butterworth
[315] Interview with Butterworth
[316] Interview with Butterworth
[317] Interview with Butterworth

off.[318]  It was thought that such an initiative would reduce costs and overhead.  However,

according to Butterworth the effort failed.[319]  The gap was unbridgeable between how industry

sees the world and how government sees the world.

Butterworth maintains that things have only gotten worse.[320]  Maybe it was during the

1990s when this shift began to materialize.  Previously government could be on the factory floor

and was able to deal with engineers and make trade-offs with capabilities.  Government could

make decisions on the spot.  But by the mid 1990s relations got litigious.  An army of attorneys

materialized in between the industry and government partners.  Things got more expensive and

the processes became slower.  Butterworth recounts that it used to be a team effort then it

became more contract negotiation.[321]  An example would be how the fiber on an antenna became

a process instead of just doing.

In addition, the fear of losing technology to adversaries has crippled industry.

Nevertheless, Butterworth maintains that the key to the long term success of the American

national security space effort is the vibrancy and dynamism of its industrial base.[322]  Butterworth

stresses that politicians have to let the American industrial base make money in space.[323]  If the

United States government overdoes it on export limits then this will make American industry a

ward of the Department of Defense.  But the Department of Defense needs American industry to

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[318] Interview with Butterworth
[319] Interview with Butterworth
[320] Interview with Butterworth
[321] Interview with Butterworth
[322] Interview with Butterworth
[323] Interview with Butterworth

be leading in technology and innovation.  According to Butterworth some things need to be protected but now other nations are making ITAR free satellites.[324]

With respect to whether the Pentagon under the Obama administration considered increasing industry's role in the management of its national security space assets as a result of the 2008 financial crisis Santee maintains that at the level of written policy no specific private activity was pursued.[325]  However, according to Santee the Pentagon did want to encourage commercial and international partnerships.[326]  The Pentagon did not want the United States to be isolated.

Regardless, Santee stresses that the Pentagon has to look at warfighting and whether or not it makes sense to bring in industry partnerships.[327]  In this regard, the Pentagon was hoping to promote them in some areas.  According to Santee 80% of unprotected satcams are leased.[328]  There is significant sharable electro-optical images that come from the commercial sector.  So there was some discussion of outsourcing at the Pentagon under Obama.  The Pentagon always had contractors behind the scenes helping.

Schaeffer had no knowledge of whether the Pentagon was considering increasing industry's role in the management of its national security assets as a result of fiscal pressure owing the 2008 financial crisis.[329]  But the Pentagon was looking to what extent it could rely on the commercial sector.  It was looking at leasing bandwidth.  Evidently contractors were already embedded in the op centers.  So, according to Schaeffer, there is a continuum from these

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[324] Interview with Butterworth
[325] Interview with Santee
[326] Interview with Santee
[327] Interview with Santee
[328] Interview with Santee
[329] Interview with Schaeffer

dynamics that extends from the civil policy for LEO space travel to military space. But the primary considerations are not just fiscal but rather a combination of things. Schaeffer believes that it isn't just as simple as a fiscal issue.[330] A primary concern is to what extent the Pentagon is comfortable relying on the commercial sector.

In regard to the explanatory power of considerations to increase industry's role in security space activities as a result of fiscal pressure owing to a financial crisis this independent variable has a measure of explanatory power but does not encompass the entire phenomenon. Evidently some security space activities are already privatized—from bandwidth to imagery. But the Pentagon's understanding of industry operations is so inadequate that it is not prepared to engage in more substantial partnerships with industry on orbit. However, it might seek to do so in a more difficult and constrained fiscal environment.

### The Effect of Growing Private Sector Competence on the Bush Administration's Propensity to Increase the Private Sector's Role in Security Operations

According to Armor the American space industrial base is peerless.[331] It has always been competent. Therefore, as with Pace Armor maintains that private sector competence is not a phenomenon that has been growing.[332] It was always there. The American space industrial base is without doubt technically good.

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[330] Interview with Schaeffer
[331] Interview with Armor
[332] Interview with Armor

Nevertheless, according to Armor industry sometimes has come up short with managing programs—this would involve delays with systems.[333] Armor observes an important aspect in the United States military's relationship with its contractors as it relates to their competence— mission assurance.[334] The dynamic with mission assurance is such that the United States government feels more accountable because the nation is more dependent on it than other areas of society. Therefore, the government is unwilling to compromise on assurance. An example of this is the United Launch Alliances 122 straight successful launches. But Armor observes that the United States government paid a premium for this.[335] It incessantly checks and double checks. The United States government manages risk with mission assurance. However, Armor believes that it is only a matter of time before government transitions from mission assurance to a risk management approach.[336] This would involve a transitioning scenario where 100% of launches are successful vs 10 out of 12 succeeding. With the latter scenario the government would except risk and manage it. Armor believes this process is underway now.[337]

According to McGibney the Pentagon under the Bush administration did not think about growing private sector competence in these terms at the time of their policy formulations.[338] But Coyote maintains that growing private sector competence would prompt the Pentagon to consider increasing industry's role in the management and operation of its assets on orbit.[339]

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[333] Interview with Armor
[334] Interview with Armor
[335] Interview with Armor
[336] Interview with Armor
[337] Interview with Armor
[338] Interview with McGibney
[339] Interview with Coyote

Coyote observes that space assets are like mercenaries.[340] In this regard any asset on orbit whose services are procured by the United States military have had their services effectively denied to the enemy. Comsats can't be used by the enemy when leased by the American military. Therefore, according to Coyote a public-private partnership in space between the American military and industry, perhaps globally as well as nationally, is a 3 to 1 value in so far as the American military would be augmenting its capabilities while at the same time denying the enemy the ability to augment theirs.[341]

**The Effect of Growing Private Sector Competence on the Obama Administration's**

**Propensity to Increase the Private Sector's Role in Security Operations**

According to Steene growing private sector competence would prompt the Pentagon under the Obama administration to consider increasing industry's role in the management and operation of its assets on orbit.[342] One example would involve launch services. A successful demonstration of capability by Space X with the Falcon 9 would prompt the Pentagon to make use of such a rocket for its launch activities. In addition, according to Steene the example of resupply with the ISS is useful.[343] It would be better for the private sector to demonstrate capability with ISS activities before it begins operations for the military. Steene maintains that it would be better if the private sector fails with a government launch for the ISS as opposed to with a NRO satellite.[344] Therefore, Steene believes that it would be best to let companies such as

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[340] Interview with Coyote
[341] Interview with Coyote
[342] Interview with Steene
[343] Interview with Steene
[344] Interview with Steene

Space X develop a track record of performance in civil operations before they begin security

operations for the Pentagon.[345]  Media reports corroborate Steene's view:

> "With the third successful flight of its Falcon 9 rocket, Space Exploration Technologies
> Corp. (Space X) may find the door to a long-desired but recalcitrant customer cracking
> open—the US military.  The Hawthorne, Calif.-based company nailed an ambitious test
> flight to send a Dragon cargo capsule to the international space station.  That mission,
> which wrapped up successfully May 31 with Dragon's splashdown in the Pacific Ocean,
> not only laid the groundwork for Space X to begin working off its 12-flight, $1.6 billion
> contract with NASA to fly space station cargo, it also demonstrated the rocket's
> reliability, a condition for competing to launch US national security payloads under
> guidelines unveiled last year.
> The US Air Force, National Reconnaissance Office and NASA jointly developed a
> strategy to certify new commercial launch vehicles in an attempt to draw competition for
> future contracts.  'The new entrant criteria did say three launches are required before
> certification can happen for national security payloads,' Space X spokeswoman Kristin
> Grantham told Space News.
> 'It's a lot more complicated than, 'If you do three successful launches, you're certified,''
> Air Force spokeswoman Tracy Bunko said.  'Some of the criteria depend on what
> technical data is available from those launchers.  One thing we've told (interested
> companies) all along is that there's no way they're going to get completely certified using
> government launches.  It has to be a mix of government, civilian and commercial'''
> (Klotz 2012).

In any event, in general the trend is toward privatization.  This is the case not just in

space but in other military activities such as base security.  Steene observes that the private

sector tends to be cheaper and more efficient.[346]  But to a large extent this depends on contract

flexibility.  Regardless, as the private sector demonstrates capability the willingness of the

Pentagon to involve them in its operations in space goes up according to Steene.[347]  The

important point for Steene is to write the contract really well because the Pentagon would not

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[345] Interview with Steene
[346] Interview with Steene
[347] Interview with Steene

want to leave the private sector hanging.[348]  There could be tension between doing the right thing and what is palatable from the bottom line.

According to Santee industry is already competent.[349]  There is not really a phenomenon that would indicate that this competence started growing recently.  This view is similar to Pace's on the civil side of space operations.  Nevertheless, Santee maintains that if the United States military is going to partner in a deliberate manner it has to go beyond leasing bandwidth to protective measures for command and control (C2) and battle management.[350]  The primary issue is how to grow capacity to ensure resilient capabilities.  But the American commercial sector is already pretty competent according to Santee.[351]  Still, trust must be built between the United States military and its potential industry partners.  Because, of course, these industry partners might become a target.  Therefore, for Santee it is important to weigh the pros and cons of any arrangement.[352]

Schaeffer maintains that questions of industry competence are not an issue in the military world.[353]   It is not a question of either or.  Boeing may sell comsats to both government and Intelsat.  Intelsat is no less capable.  Industry does not have to prove itself in national security according to Schaeffer.[354]

In regard to the explanatory power of whether growing private sector competence would prompt the Pentagon to consider increasing industry's role in the management and operation of its security assets on orbit it is found that this independent variable does have explanatory power.

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[348] Interview with Steene
[349] Interview with Santee
[350] Interview with Santee
[351] Interview with Santee
[352] Interview with Santee
[353] Interview with Schaeffer
[354] Interview with Schaeffer

The Pentagon definitely would consider increasing industry's role in security operations if it demonstrated competence. Indeed, as was the case with the civil policy some officials do not believe that the private sector's competence is actually a growing phenomenon. It was always there.

**The Effect of Perceptions of Efficiency on the Propensity of the Bush Administration to Increase the Private Sector's Role in Security Operations**

Armor maintains that the Pentagon under the Bush administration perceived industry efficiencies but thought that industry was charging too much.[355] However, buying commercial data was gaining more acceptance. In this regard, Armor draws an analogy between the relationship of government and industry with the advent of computers.[356] At first the American government developed its own computers but then began to rely on the commercial sector for its computing needs as the commercial sector's technology matured. Armor believes the space industry is turning that corner.[357] An example would be the explosion of cube sats. Small sats are purely commercial according to Armor.[358]

McGibney maintains that the Pentagon under the Bush administration did not perceive greater efficiencies with industry.[359] There was no discussion about efficiencies. Coyote maintains that the Pentagon under the Bush administration did not see programs that could be

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[355] Interview with Armor
[356] Interview with Armor
[357] Interview with Armor
[358] Interview with Armor
[359] Interview with McGibney

more efficiently managed by the private sector but talked about this dynamic informally.[360]

However, according to Coyote the Pentagon under the Bush administration always wanted to

find the best commercial practices and emulate them.[361]  An example would be the

aforementioned one about Intelsat—only about 8 are involved in the daily operation of their

satellite constellation according to Coyote.[362]


**The Effect of Perceptions of Efficiency on the Propensity of the Obama Administration to**

**Increase the Private Sector's Role in Security Operations**

For Steene the primary issue with efficiencies that the private sector could bring to the

United States military's space operations is that any contract that is written must be written

right.[363]  Because if it is not it could lead to more costs for the United States military.  The

United States military would definitely not want to undermine the rationale for efficiency with

increasing costs.

For Santee the Pentagon's measure of effectiveness is not efficiency but resiliency.[364]

Therefore, questions of efficiency are not apt for the American military.  Santee observes that if

the military gets too efficient than this may remove redundancy.[365]  According to Santee

efficiency is the same as saving money but the Pentagon is trying to promote resiliency.[366]

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[360] Interview with Coyote
[361] Interview with Coyote
[362] Interview with Coyote
[363] Interview with Steene
[364] Interview with Santee
[365] Interview with Santee
[366] Interview with Santee

Schaeffer does not see efficiency as an issue for the Pentagon.[367]  For her the question is rather to what extent government would get out of ops and just buy data.[368]  The issue is not about the management of assets on orbit.  Schaeffer believes that there will always be a role for government to operate satellites.[369]

In regard to the explanatory power of whether perceptions of efficiency would prompt the Pentagon to consider increasing industry's role in the management and operation of its assets on orbit it is found that this independent variable has little explanatory power.  Evidently the Pentagon is not that concerned about how efficiently their assets are managed and operated but rather with how robust, resilient, and redundant they are.  Therefore, questions of industry efficiencies would play little to no role in any policy decision at the Pentagon to privatize any of their assets or operations.

Thus, as with civil space, growing private sector competence is an important factor in American security policy for the medium of space.  However, it remains unclear if whether or not financial crises have a large impact on the policies that the Pentagon pursues in space.  What is for certain is that the Pentagon is not concerned with how efficient their space systems and operations are but rather with how robust and resilient these systems and operations are.  In addition to considerations for the role of industry in the operation of the United States military's assets on orbit there are a number of other issues in space that the Pentagon was contending with from the Bush administration through the Obama administration.

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[367] Interview with Schaeffer
[368] Interview with Schaeffer
[369] Interview with Schaeffer

## Chapter 12:  Security Issues Facing the Pentagon

There were a number of other security issues the Pentagon was contending with during the Bush and Obama administrations.  Foremost among them was probably arms control and transparency and confidence building measures (TCBMs).  In addition, the Pentagon was very concerned about space situational awareness under the Obama administration so space situational awareness was addressed with Bush officials as well.  Space debris appeared to be of limited importance to these administrations, but the 2006 and 2010 national space policies address the issue.  These administrations were very concerned about ensuring the resiliency and redundancy of their space assets.  Therefore, they were looking at new architectures to achieve this.  To this end, officials in the Obama administration proposed separating the capabilities of large satellites onto multiple smaller platforms.  This is known as disaggregating the architecture.

### Efforts to Improve Space Situational Awareness in the Bush Administration

According to Armor the Pentagon under the Bush administration did not give that much thought to space situational awareness.[370]  Armor maintains that real space situational awareness goes back to freedom of action.[371]  The United States wanted to be able to attribute activity in space—to determine if it was space weather affecting their satellites or the Russians.  Armor observes that the Pentagon under the Bush administration held small sats to be just toys.[372]  Their employment in space operations was not that serious.  According to Armor the technology just wasn't there.[373]

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[370] Interview with Armor
[371] Interview with Armor
[372] Interview with Armor
[373] Interview with Armor

For McGibney efforts to improve space situational awareness at the Pentagon under the Bush administration were primarily about awareness and sharing information.[374] There were some allies that were relying more on satellites. Evidently there was an effort to include them in the United States military's activities on orbit. There was more interaction at strategic command. Allies were more embedded. The Pentagon under the Bush administration included allies more in war games. It was thought that allies could learn more in that environment.[375]

Coyote recollects that the Pentagon under the Bush administration wanted to put space-based sensors on orbit to do surveillance.[376] The Pentagon was committed to the fence. But it also wanted other nations to share data. Coyote observes that when the Obama administration came into office it discovered that data sharing in space was already being done.[377]

**Efforts to Improve Space Situational Awareness in the Obama Administration**

Regarding efforts to improve space situational awareness in the Obama administration Steene observes that the space fence is moving forward.[378] But there is still room for improvement in cooperation with the private sector according to Steene.[379] There is a private group in Philadelphia that shares space situational awareness telemetry. Steene maintains that the primary issue for the Pentagon in regard to space situational awareness is getting better

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[374] Interview with McGibney
[375] Interview with McGibney
[376] Interview with Coyote
[377] Interview with Coyote
[378] Interview with Steene
[379] Interview with Steene

access to information that is already out there.[380]  But in addition, some labs have proposed developing and utilizing cube sats.

For Butterworth the primary issue with space situational awareness is making sure disasters are avoided without betraying national capabilities.[381]  Butterworth observes that using small sats for space situational awareness has been a recurrent dream for some in the defense and intelligence communities.[382]  This dream was particularly big and powerful in 1995 according to Butterworth.[383]  Some were pushing the idea that small sats could do everything that big satellites could.

Santee had not heard a lot of recent discussion of how to improve space situational awareness.[384]  But he believed that the Pentagon should look at nontraditional data sources in situations that were not life and death.[385]  Santee maintains that there are a lot of ways to make space situational awareness unaffordable but the Pentagon cannot do this.[386]  However, there are roles for a lot of sensors to put together space situational awareness pictures.  Santee believes that there is absolutely a role for nanosatellite such as the ANGELS.[387]

According to Schaeffer the Pentagon was partially trying to improve space situational awareness by improving data from its sensors and also by proceeding with the fence.[388]  Schaeffer also observed that the United States military moved a telescope to Australia to improve

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[380] Interview with Steene
[381] Interview with Butterworth
[382] Interview with Butterworth
[383] Interview with Butterworth
[384] Interview with Santee
[385] Interview with Santee
[386] Interview with Santee
[387] Interview with Santee
[388] Interview with Schaeffer

the space situational awareness picture.[389]  But Schaeffer stressed that the Pentagon was trying to integrate foreign and commercial sources into the US catalogue.[390]  The Pentagon was trying to integrate data better.  It was trying to improve mission assurance and resilience.

### Disaggregated Architectures:  Fractionated, Distributed Satellite Systems Under the Bush Administration

According to Armor the development of fractionated, distributed satellite systems got started after the Bush administration left office.[391]  But Armor was unsure about whether or not the development process was already underway in national laboratories during the Bush administration.[392]

According to McGibney there were pockets of people at the Pentagon under the Bush administration who talked about small sats but any conversations there may have been were not prevalent.[393]  Small sats were looked at as a demonstrator and not a robust mission ready application.  The first time that McGibney had heard of disaggregated architectures was from DARPA around 2008 or 2009.[394]  Evidently this was well after the Pentagon under the Bush administration had things written.  McGibney observes that small sats raise questions about shipping lanes to draw a maritime analogy.[395]  Therefore, some discussion must proceed about the appropriate distances between satellites so that there are no near misses.  McGibney also

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[389] Interview with Schaeffer
[390] Interview with Schaeffer
[391] Interview with Armor
[392] Interview with Armor
[393] Interview with McGibney
[394] Interview with McGibney
[395] Interview with McGibney

stresses that there must be awareness of where people are planning to insert their satellites.[396]

Additionally, other space participants need to have enough ground infrastructure to monitor their

assets on orbit.  McGibney is somewhat concerned that universities are putting up their small

satellites and other space participants are not aware of them.[397]  According to McGibney this

creates harm for the orbital regime.[398]

According to Coyote the Pentagon under the Bush administration was indeed considering

a role for small satellites.[399]  There was really big interest.  Coyote recalls that fractionated,

distributed satellite systems were in fact being discussed under the Bush administration at the

Pentagon.[400]  Evidently Aerospace corp. spent a good deal of time analyzing the situation

according to Coyote.[401]  What is more, the possibility of small satellite proliferation contributing

to the problem of orbital debris was also being discussed at the Pentagon under Bush.[402]


### Disaggregated Architectures:  Fractionated, Distributed Satellite Systems Under the Obama Administration

With respect to the Pentagon's under the Obama administration efforts to create and

ensure resilient space systems by separating the capabilities of large assets onto smaller assets

and dispersing them in space, otherwise known as disaggregating the architecture, Steene

observes that the ship turns slow with fractionated, distributed satellite systems.[403]  According to

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[396] Interview with McGibney

[397] Interview with McGibney

[398] Interview with McGibney

[399] Interview with Coyote

[400] Interview with Coyote

[401] Interview with Coyote

[402] Interview with Coyote

[403] Interview with Steene

Steene there are factors that push in the direction of bigger space systems.[404] There are still

those who will argue in favor of giants from a capability standpoint.

Steene observes that with Skybox there are numerous strings on orbit.[405] The fidelity of

image isn't as great but there are a lot of them. At issue is trading image fidelity for timeliness,

latency. Steene believes that the intelligence community needs to have an epiphany.[406] It should

be more interested in the overhead imagery business and not just "kick ass" pictures.

However, to some degree the Pentagon under the Obama administration is concerned

with any congestion that may arise from the proliferation of smaller assets. It has to be

concerned with the shelf life of smaller assets. Concerns that the Pentagon should have in this

regard should be a function of a satellite's life according to Steene.[407]

According to Butterworth the Pentagon under the Obama administration is nowhere near

fielding fractionated, distributed satellite systems.[408] Santee does not know about fractionated,

distributed satellite systems.[409] But for him the question is how can the Pentagon ensure that it

does not leave small sats behind.[410] The Pentagon should want to cause its small assets to

degrade and deorbit faster. In any event, Santee does not believe there is any real concern that

small sats would make the medium too congested.[411]

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[404] Interview with Steene
[405] Interview with Steene
[406] Interview with Steene
[407] Interview with Steene
[408] Interview with Butterworth
[409] Interview with Santee
[410] Interview with Santee
[411] Interview with Santee

According to Schaeffer the Pentagon under the Obama administration is moving in the direction of disaggregated architectures but the process is hard and takes a long time.[412] Nevertheless, Schaeffer maintains that the Pentagon is not concerned about its own capabilities adding to orbital debris.[413] It is, however, concerned about other small sats proliferating. The problem is that these may have a low level of technology, no ability to maneuver, and are not going to reenter.

### Considerations for Orbital Debris Removal in the Bush Administration

According to Armor the Pentagon under the Bush administration was not concerned with the potential of small satellites contributing to the problem of debris.[414] But the Pentagon was concerned about big debris. According to Armor the 2007 Chinese ASAT test was the point of departure for issues with debris.[415]

In any event, the Pentagon under the Bush administration wanted to retain its freedom of action in the medium and was not interested in any treaties. Still, the Pentagon at this time was not considering removing space debris. Armor recalls that except for the big stuff or dead satellites efforts were geared more towards tracking.[416]

According to McGibney the Pentagon under the Bush administration was not considering removing space debris.[417] Budget constraints were a part of it. Most people were trying to

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[412] Interview with Schaeffer
[413] Interview with Schaeffer
[414] Interview with Armor
[415] Interview with Armor
[416] Interview with Armor
[417] Interview with McGibney

catalogue, track, and predict the behavior of debris according to McGibney.[418] McGibney recalls

that there was not enough ground infrastructure to deal with the problem.[419] Debris was a

concern but there was more emphasis on characterizing the environment. The Pentagon wanted

to understand the problem and catalogue as much debris as possible. The Pentagon also wanted

to determine if the debris had a predictive nature and if some things were deorbiting on their

own. McGibney was not part of any dual use weapons discussions involving debris.[420]

Coyote recalls that the Pentagon under the Bush administration did in fact discuss how to

clear out orbits.[421] Debris removal was part of Coyote's portfolio in the Dreamworks office at

the National Security Space Office.[422] As such, the Pentagon under the Bush administration was

considering removing debris. In this regard, there were a few important issues the Pentagon was

grappling with according to Coyote.[423] The first was that debris was a violation of the outer

space treaty because it precludes large volumes of outer space. Although, Coyote observes that

there is so much volume in orbit that this was not a real issue.[424] Additionally, the Pentagon

under Bush did not like seeing boosters explode. Sunsychronous orbit is a chokepoint for

imaging satellites. There was also concern about the dual uses. According to Coyote if debris

removing systems became possible then kinetic kill ASATs would become more permissive

because it would be possible to clean up the environment after war.[425] In any event, the

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[418] Interview with McGibney
[419] Interview with McGibney
[420] Interview with McGibney
[421] Interview with Coyote
[422] Interview with Coyote
[423] Interview with Coyote
[424] Interview with Coyote
[425] Interview with Coyote

Pentagon under the Bush administration always wanted debris removal to be done by a

commercial company under the control of an insurance company according to Coyote.[426]

Coyote feels that, in regard to debris, there is a need to back up on the code of conduct

because of the outer space treaty.[427] Nevertheless, according to Coyote there was no role for

budget constraints for debris removal at the Pentagon under Bush.[428] Debris was just not a

sufficient priority to get more resources. Evidently debris fell off as a priority at the Pentagon

after Coyote left Dreamworks.[429]

But Coyote recalls that there was a huge role for the dual use weaponization dynamic in

considerations to remove debris because of the arms control community.[430] But, as with most

officials, Coyote observes that any satellite can be used as a weapon.[431] Coyote observes that if

it becomes possible to remove debris the argument of the arms control community against kinetic

space weapons goes away.[432] Although, Coyote also observes that one does not need a kinetic

weapon to put a satellite out of operation.[433]


**Considerations for Orbital Debris Removal in the Obama Administration**

In regard to issues with orbital debris in the medium Steene maintains that the

Department of Defense is tightening the screws on complying with debris regulation.[434] Such

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[426] Interview with Coyote
[427] Interview with Coyote
[428] Interview with Coyote
[429] Interview with Coyote
[430] Interview with Coyote
[431] Interview with Coyote
[432] Interview with Coyote
[433] Interview with Coyote
[434] Interview with Steene

efforts necessarily entail design changes in launch systems and space systems. Steene believes that it is best to include these design changes at the outset of any program in space.[435]

Additionally, Steene observes that there could potentially be a problem with small satellites that involves the orbits used and the lifespan of these systems.[436] Regardless, removing space debris is a highly contentious issue in the national security arena. Steene believes that the real issue is not with big pieces of debris but with little pieces.[437] Presently the United States military attempts to maneuver around debris but such operations will become more and more difficult as the amount of smaller pieces in the medium grows.

From the perspective of funding debris removal the dual use weaponization dynamic complicates the picture. The question becomes: what is a weapon? If the Pentagon creates a space tug could this be considered a weapon? But anything in space with enough propellant could potentially become a weapon. Still, with political pressure from the arms control community any effort to remove debris is complicated by the dual use weaponization dynamic.

In any event, there is no consensus on the severity of the problem according to Steene.[438] Steene observes that some people don't actually think we have to remove space debris.[439] And in a constrained budget environment people argue that is not where the Pentagon should be spending limited dollars. Steene also notes the absence of debris removal in updates to space transportation policies.[440]

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[435] Interview with Steene
[436] Interview with Steene
[437] Interview with Steene
[438] Interview with Steene
[439] Interview with Steene
[440] Interview with Steene

But the main reason why the United States military is not now doing or even considering debris removal is due to budget constraints according to Steene.[441]  Steene maintains the other reason is due to the dual use weaponization dynamic.[442]  But the bigger issue for why the Pentagon is definitely not considering removing debris is the budget according to Steene.[443]

Regarding debris removal Butterworth believes the concerns with the 3 Cs are all wrong.[444]  When observing the emphasis on the 3 Cs Butterworth maintains that the chances of collision have not really increased.[445]  In addition, Butterworth is not aware of any considerations to remove orbital debris.[446]  Butterworth maintains that there must be some calculation of costs and benefits in regard to debris.[447]  One must consider a variety of technical factors.  But the bottom line is if there were only two collisions in 25 years removing debris is not worth the effort.  Butterworth also does not see any role for dual use considerations because anything on orbit with enough fuel could potentially be an ASAT.[448]

However, according to Santee the space policy asked the Department of Defense to work with NASA to remove debris.[449]  Evidently this direction led the Pentagon to get elements of the scientific community together to think about the issue and share ideas.  Santee believes this activity was successful.[450]

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[441] Interview with Steene
[442] Interview with Steene
[443] Interview with Steene
[444] Interview with Butterworth
[445] Interview with Butterworth
[446] Interview with Butterworth
[447] Interview with Butterworth
[448] Interview with Butterworth
[449] Interview with Santee
[450] Interview with Santee

Still, Santee observes that the Kessler syndrome is not imminent but coming decades into the future.[451] Nevertheless, Santee believes that the Pentagon is going to have to find a solution for debris with NASA.[452] So far the Pentagon and NASA have not found a practical way to remove it.

Regarding whether or not budget constraints play a role in considerations to remove debris Santee says yes but no.[453] Evidently the Pentagon is now spending money to ensure that debris is not produced. The Pentagon is spending money to not make more debris but not to remove debris.

Santee holds that there are just no practical solutions to remove debris at present and that the Pentagon will have to cross that bridge when it comes to it.[454] Regarding the dual use weaponization dynamic Santee observes that the policy and strategy hit on norms and not weapons.[455] As with Butterworth, Santee observes that anything on orbit could be used as a weapon.[456]

According to Schaeffer the State Department is grappling with debris issues.[457] Schaeffer also believes the Pentagon is considering debris issues but there is a low technology readiness level (TRL).[458] Schaeffer observes that there are labs that are doing research on debris removal.[459] But the Pentagon is not there in terms of answering budget questions because the technology isn't ready yet. However, with the Phoenix program, where there is some overlap in

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[451] Interview with Santee
[452] Interview with Santee
[453] Interview with Santee
[454] Interview with Santee
[455] Interview with Santee
[456] Interview with Santee
[457] Interview with Schaeffer
[458] Interview with Schaeffer
[459] Interview with Schaeffer

capability, DARPA has tried to be transparent with its activities. DARPA has shared

information with the international community to reduce dual use fears. Evidently there could be

the potential for mistrust and misperceptions. Therefore, DARPA has broadcast live streams of

its operations on orbit and announced maneuvers.[460]


### Security Space Vis a Vis China in the Bush Administration

According to Armor the role that space would have played in any conflict with China

during the Bush administration would have largely been that of an enabler.[461] The GPS,

comsats, etc. would have enabled terrestrial forces in any conflict with China.

Armor observes that China had been developing ground mobile launch capabilities for a

long time.[462] By 2005-2007 Armor suspects that China could have used these systems for

ASATs.[463] Armor's first concern in this regard was for LEO.[464] He would not say if he knew

that China could launch ASATs into higher orbits with these capabilities.

McGibney maintains that in any conflict with China during the Bush administration space

would have primarily played the roles of force multiplier and enhancer.[465] This was how space

was mainly thought of at the time. According to McGibney space was not thought about in

kinetic terms but mainly as an enhancer.[466] McGibney was not aware of China's mobile ground

launch capabilities during the Bush administration.

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[460] Interview with Schaeffer
[461] Interview with Armor
[462] Interview with Armor
[463] Interview with Armor
[464] Interview with Armor
[465] Interview with McGibney
[466] Interview with McGibney

For Coyote space is the glue that would connect terrestrial forces in any conflict against China.[467] The capabilities that space provides are similar to communications with blitzkrieg. Sensors in space feed in one way communications to terrestrial forces. These coordinate targeting with aircraft across the globe. All aircraft converge at once upon a target on the Earth. The effect could be termed astrokrieg according to Coyote.[468] With astrokrieg American forces can overwhelm the systems of adversaries.

Space will be the eyes and ears in regard to China Coyote maintains.[469] Space will provide 80% first look. There will be warnings, tipoffs, and indications from space.

However, Coyote also observes that satellites have other customers worldwide.[470] The United States military cannot turn off services to other worldwide customers when there is conflict. Therefore, Coyote maintains that the primary value of space systems is not for warfare but for the sustainment of the global economy.[471] In any event, Coyote notes that the United States has not hardly done anything to defend its satellites.[472] Coyote could not say what was going on inside the intelligence community in regard to China's mobile ground launch capabilities.

**Security Space Vis a Vis China in the Obama Administration**

During the Obama administration much attention was given to concepts for Air Sea Battle at the Pentagon. Such conceptions were largely in response to the anti-access/area denial

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[467] Interview with Coyote
[468] Interview with Coyote
[469] Interview with Coyote
[470] Interview with Coyote
[471] Interview with Coyote
[472] Interview with Coyote

(A2AD) capabilities that the Chinese were developing to stop the United States military from projecting power in the Pacific. Therefore, consideration for the role that American space capabilities would play in concepts for Air Sea battle was given priority in this work.

In this regard, according to Steene space assets are necessary in order for the United States military to project power—to see, shoot, move, and communicate.[473] Therefore, according to Steene the role that American space assets would play in Air Sea battle is primarily to see and communicate.[474] However, Steene observes that the United States military would have to figure out how to fight through attacks in space and have some other work around for terrestrial operations.[475]

But Steene makes another interesting observation—China might have to use space for its A2AD over the horizon capabilities.[476] Evidently China has been growing these capabilities. Therefore, there is some incentive for the United States to deny and degrade China's capabilities on orbit.

Additionally, China has made great efforts to develop ground mobile launch capabilities not only for long range terrestrial strikes but to be used as ASAT weapons as well. Steene was not sure if China's mobile launch ASATs could reach MEO. He observed that the Chinese would need really big rockets and these may not be possible with mobile launch systems.[477] As such, there is some question if these capabilities could also reach GEO. Steene believes there are other things to worry about than China's ground mobile launch capabilities.[478]

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[473] Interview with Steene
[474] Interview with Steene
[475] Interview with Steene
[476] Interview with Steene
[477] Interview with Steene
[478] Interview with Steene

According to Butterworth the role that American space assets would play in any conflict with China would mainly revolve around communications—both classified and unclassified.[479] Communications are necessary to move forces. Butterworth was not sure about the peculiar needs for Air Sea battle as distinguished from Air Land battle.[480] But as things progress Butterworth expects needs to come forward.

Butterworth was concerned about China's ground mobile launch capabilities.[481] Butterworth was surprised at the progress the Chinese have made. He maintains that their engineering is top notch.[482] Butterworth maintains that the ability to hit to kill on a satellite is something and the Chinese did it.[483]

Nevertheless, Butterworth believes that kinetic space weapons are a stupid way to go.[484] Now the Chinese are doing other things according to Butterworth.[485] This is primarily because one satellite with a kinetic kill weapon doesn't help if there is a large constellation. A constellation makes it hard to track what is going on.

In regard to whether or not nuclear weapons could be utilized as ASATs with China's mobile launch capabilities Butterworth observes that as long as one doesn't need space one can detonate nukes.[486] Once a nuclear weapon is detonated in orbit the radiation gradually moves away from Earth. Therefore, even if a nuke is detonated in LEO it might affect satellites in

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[479] Interview with Butterworth
[480] Interview with Butterworth
[481] Interview with Butterworth
[482] Interview with Butterworth
[483] Interview with Butterworth
[484] Interview with Butterworth
[485] Interview with Butterworth
[486] Interview with Butterworth

higher orbits.  Butterworth did not know if China's ground mobile launch capabilities can reach

MEO or GEO.[487]

Regarding the role of space in Air Sea battle in the Pacific Santee holds that effects are

most efficiently delivered from the heights of space.[488]  The role of space in Air Sea battle is the

same as everywhere else according to Santee.[489]  At issue is the ability of space to enable

terrestrial forces to find, fix, and target.  Space enables systems across Air Sea battle to function

properly.

Santee observes that security issues with ground mobile launch systems are not limited to

China.[490]  Evidently the Pentagon is very concerned about these capabilities.  Santee believes

that it is a hard problem.[491]

For Schaeffer US power projection in Air Sea battle is dependent on space.[492]  Space

systems enable carriers to be directed etc.  Space is central to any power projection strategy.

Schaeffer recognizes that at issue is mission assurance and the utilization of alternative sources

to enable forces.[493]

**Transparency and Confidence Building Measures in the Bush Administration**

With respect to transparency and confidence building measures (TCBMs) during the

Bush administration Armor recounts how this approach became a more formal strategy under

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[487] Interview with Butterworth
[488] Interview with Santee
[489] Interview with Santee
[490] Interview with Santee
[491] Interview with Santee
[492] Interview with Schaeffer
[493] Interview with Schaeffer

Obama.[494]  Armor believes that this was a way to implement policies that were common to

Clinton and Bush.[495]  Armor thinks this is a good approach.[496]

However, TCBMs imply signing treaties according to Armor and the Bush administration

did not want to go that far.[497]  But the Bush administration did want to demonstrate a good

example.  It wanted to do so with precedents that were transparent and that would build trust.  As

such, the programs and procedures for the Bush and Obama administrations were similar

according to Armor.[498]

According to McGibney the Pentagon under the Bush administration always tried to carry

themes from its policies through.[499]  It was transparent throughout.  The Pentagon tried to make

distinctions between launches into space and missiles.  The Pentagon tried not to send mixed

messages.  McGibney recalls that the Pentagon tried to draw distinctions between scientific and

military activities.[500]

According to Coyote the Pentagon under the Bush administration was considering

somethings like TCBMs but this was not the term it used.[501]


**Transparency and Confidence Building Measures in the Obama Administration**

With respect to TCBMs in the Obama administration Steene maintains that it is not

necessary to have binding treaties.[502]  The Pentagon was trying to establish norms and rules of

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[494] Interview with Armor
[495] Interview with Armor
[496] Interview with Armor
[497] Interview with Armor
[498] Interview with Armor
[499] Interview with McGibney
[500] Interview with McGibney
[501] Interview with Coyote

the road.  In this regard, there are rules for air activities that are not law but are practices according to Steene.[503]  Steene believes that the Pentagon should grow these organically as time passes.[504]  Some aspects of these measures might include launch notification and space object registration.  Steene observes that there is no law in space that is analogous to the sea.[505]  There is, however, a question of debris according to Steene.[506]  Can the United States remove an upper stage without Russian approval.  In any event, Steene notes that maritime rules didn't happen with the United Nations.[507]  Steene stresses that the Pentagon should pursue rules that make sense and that which they can grow organically.[508]  These rules would be useful for the Pentagon according to Steene because the Pentagon cannot identify who is breaking rules without a guide for responsibility.[509]

With respect to TCBMs under the Obama administration Butterworth was mainly concerned with people who didn't know anything about space doing negotiations with the Russians and Chinese.[510]

For Santee at issue with TCBMs was the need for the Pentagon to establish norms.[511]  As such, the Pentagon needs space situational awareness to understand when people are not abiding by these norms.  The Pentagon needs space situational awareness to show when this happens to the international community.  Santee notes that other nations don't test ASATs the same way

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[502] Interview with Steene
[503] Interview with Steene
[504] Interview with Steene
[505] Interview with Steene
[506] Interview with Steene
[507] Interview with Steene
[508] Interview with Steene
[509] Interview with Steene
[510] Interview with Butterworth
[511] Interview with Santee

anymore because of efforts to establish rules.[512]  Santee stresses that timely, accurate information

is necessary so that the rest of the world can see when rules are violated.[513]

According to Schaeffer confidence building measures (CBMs) have been around for a

long time.[514]  They have been utilized with nuclear forces.  Their purpose is to increase trust and

reduce risk of conflict between states.  At issue is to what extent states will establish these

mechanisms.  According to Schaeffer a lot of TCBMs have not been finalized or agreed to.[515]

## Arms Control in the Bush Administration

According to McGibney the Bush administration was not considering arms control in the

medium because SALT and other treaties had the issue well in hand.[516]

According to Coyote the Bush administration was not interested in negotiating treaties

that would limit anyones freedom of action in space.[517]  The arms control community wanted to

constrain the United States.  But the United States under the Bush administration was not

interested in being constrained.  Coyote notes that the arms control community characterized the

Bush statement on the topic as "terse and unilateral."[518]  Coyote then recalls that Putin used the

same term—"terse and unilateral"—in one of his speeches.[519]  Coyote then wonders who wrote

the script.  He suspects the arms control community wrote the script for the Russians as well.[520]

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[512] Interview with Santee
[513] Interview with Santee
[514] Interview with Schaeffer
[515] Interview with Schaeffer
[516] Interview with McGibney
[517] Interview with Coyote
[518] Interview with Coyote
[519] Interview with Coyote
[520] Interview with Coyote

## Arms Control in the Obama Administration

According to Steene there were no arms control initiatives at the Pentagon under the Obama administration.[521] The main difference between the Bush and Obama security policies in space is that the Obama administration was considering arms control and the Bush administration was not. But according to Steene in the Obama administration's terms arms control would have sounded good to the Bush administration as well because there were no proposals that met the standards of the Obama administration.[522] According to Steene the Obama administration got a lot of diplomatic mileage out of the arms control language just by saying that they might consider arms control even if their standards for it were strenuous.[523] But as a practical matter the Bush administration and the Obama administration end up in the same place in regard to arms control. The difference is that the Obama administration stated that they would consider arms control but had standards that were so high that no other nation could have presented an acceptable arms control initiative whereas the Bush administration stated bluntly that they would not even consider arms control.

According to Butterworth there was no sustained attention for space arms control during the Obama administration.[524] But nuclear arms control was a big emphasis during Obama's first term. For Butterworth at issue were goals—primarily perception management.[525] According to Butterworth there are perceptions that are believed to be true but are not.[526] If you believe that space is a sanctuary then you get concerned about anything that looks like the militarization of

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[521] Interview with Steene
[522] Interview with Steene
[523] Interview with Steene
[524] Interview with Butterworth
[525] Interview with Butterworth
[526] Interview with Butterworth

space.  Things can be mischaracterized as militarization of space that have always been done.

An example would be an activity with MSTI 3—multi spectral tech integration.  The activity was

funded by BMDO.  The military tested a laser against the satellite to determine how to protect it

better.  The military was just going to test the asset's receptors.  According to Butterworth this

was in around 1996 or 1997.[527]  Evidently the military was not trying to deploy laser weapons

but was rather just trying to test the defenses of satellites against lasers.  At issue was perception

management, not deception.  Butterworth maintains that space is not a sanctuary and that the

United States needs to know how to protect its satellites.[528]

　　　With respect to arms control in space at the Pentagon under the Obama administration

Santee maintains that everything had to be evaluated against whether or not it was equitable and

verifiable etc.[529]  These were the standards of which Steene was referring.  According to Santee

against these standards all international arms control initiatives were found wanting.[530]

Therefore the United States could not support anything.  Santee maintains that one has to think

back to behaviors.[531]


## A Code of Conduct in the Bush Administration

　　　Armor recounts that the Pentagon under the Bush administration was not interested in a

code of conduct in space.[532]  The Pentagon saw any potential code as a way to constrain US

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[527] Interview with Butterworth

[528] Interview with Butterworth
[529] Interview with Santee
[530] Interview with Santee
[531] Interview with Santee
[532] Interview with Armor

superiority and freedom of action in the medium.  Armor recalls that the Pentagon could deal with rules of the road but it wanted to help write them.[533]

McGibney was not familiar with a code of conduct during the Bush administration.[534]  It may have been discussed but not in those terms according to McGibney.[535]  The Pentagon was trying to do education.  Things were blowing up as other nations were utilizing space.  There was more need for education.  Another issue for McGibney was responsibility—there was great need to have more clarity of intent.[536]  This went to trust.  By intent McGibney holds that it was important to determine what dual uses were really for.[537]

Regardless, McGibney observers that space is unforgiving.[538]  Satellites are fragile boxes. McGibney hopes that other nations will respect what it takes to get into space.[539]  Therefore, McGibney thinks that a code that promoted awareness but did no restrict would be a good thing.[540]

Coyote recollects that the Pentagon under the Bush administration was not interested in a code of conduct in space.[541]  But the Pentagon had talked about norms establishment at this time. Coyote laments that Krepon and the arms control community started the drafting process for the code of conduct.[542]  Krepon did the original writings for the European code.  But according to

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[533] Interview with Armor
[534] Interview with McGibney
[535] Interview with McGibney
[536] Interview with McGibney
[537] Interview with McGibney
[538] Interview with McGibney
[539] Interview with McGibney
[540] Interview with McGibney
[541] Interview with Coyote
[542] Interview with Coyote

Coyote the status quo in space at the time was no fighting or weapons.[543] The Bush administration was interested in preserving the status quo. But the arms control community wanted a new status quo and to force it on the United States military.

### A Code of Conduct in the Obama Administration

According to Steene the Pentagon was interested in a code of conduct during the Obama administration.[544] But it was not the lead agency. The Pentagon was supporting the State Department in this regard. In any event, the United States under the Obama administration was trying to establish rules of the road and then to proceed with the code. According to Steene the code would be valuable to the Pentagon because if the United States can define responsible behavior in the medium then it could better identify people who are irresponsible.[545] This goes back to level one of the Pentagon's policy. It wanted to be able to outcast those who broke the code.

Butterworth maintains that the code was overreach from Europe.[546] But the United States worked hard to make it more constructive. The code talked a lot about operations and behavior in space. But nobody except the United States can see what they are talking about. Evidently other nations have some space tracking but not enough. Therefore, the code was unverifiable according to Butterworth.[547] Besides, Butterworth holds that the only country that obeys such things is the United States.[548]

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[543] Interview with Coyote
[544] Interview with Steene
[545] Interview with Steene
[546] Interview with Butterworth
[547] Interview with Butterworth
[548] Interview with Butterworth

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Santee recalls that the Pentagon under the Obama administration was interested in a code.[549]  It was interested in norms of behavior.  The Pentagon wanted to adopt something that would prohibit the production of space debris.  Santee recollects that the Pentagon wanted to link the code of conduct with ASAT testing.[550]  It was in the Pentagon's interest to be involved with the development of the code so that the Pentagon could shape it.  The idea was to limit debris.  This would be good for the code.

Schaeffer recalls that the Pentagon was interest in a code of conduct and that Hilary Clinton made a speech declaring support for the EU's code initiative.[551]  According to Schaeffer the Department of Defense was part of the decision.[552]  The Department of Defense wanted to make sure the code would be consistent with its activities in space.  Schaeffer maintains that the Pentagon was very interested in bringing other countries that were not as responsible as United States military in space up to the same level as the United States military.[553]  At issue was what would increase transparency and predictability in space with other states.  Schaeffer observers that one does not find public security documents coming out of China for space.[554]  The United States is more transparent.

Arms control and TCBMs are perhaps the biggest differences between the Bush and Obama administrations in security policy for the medium of space.  The Bush administration would not consider arms control and did not develop mechanisms like TCBMs to a large extent.  By stating that they would consider arms control and attempting to create TCBMs the Obama

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[549] Interview with Santee
[550] Interview with Santee
[551] Interview with Schaeffer
[552] Interview with Schaeffer
[553] Interview with Schaeffer
[554] Interview with Schaeffer

administration got a lot of diplomatic mileage with the international community. However, because no other nation could present an acceptable arms control initiative the Bush and Obama administrations still end up in the same place on the issue as a practical matter. With respect to space debris, small satellites, and any potential confrontation with China the Bush and Obama security policies for space at the Pentagon were very similar.

## Chapter 13:  Congressional Testimonies

Regarding the Obama administration's policy decisions to cancel Constellation in favor of CCDev and to forego a return to the Moon in favor an asteroid mission, there were many former astronauts, including a legend such as Neil Armstrong, who were vehemently opposed to these policy decisions. In addition, the man who initiated the innovative public-private policy approach to space travel with the COTS program, former NASA administrator during the Bush administration Mike Griffin, was very critical of the CCDev policy decision and the asteroid mission over a Moon mission. In a House spaceflight committee hearing in 2011 Armstrong, Cernan, and Griffin expressed their frustration and exasperation with the Obama administration's space policy.

At the hearing in 2011 Armstrong (2011) said that "this past year has been frustrating for NASA observers as they tried to understand NASA's plans and progress." Armstrong (2011) began by observing that while the NASA leadership in the Obama administration attempted to assure the American population, somewhat overenthusiastically perhaps, that NASA would be engaging in a new era of exciting discovery in space, the hard reality was that the administration was simultaneously terminating the Shuttle program, cancelling new rocket and spacecraft

programs in the pipeline, and "laying off thousands of aerospace" personnel with vital technical skills. Armstrong (2011) went on to observe that the real outlook for the national space effort over the course of the present decade was irreconcilable with the assertions that the NASA leadership in the Obama administration had been making. Armstrong (2011) also noted that in the face of what he thought was the Obama administration's lamentable decision to cancel "the Constellation Ares launchers and Orion and Altair spacecraft" early in 2010 the House Committee before which he was testifying, other House Representatives, Senators, and citizens concerned about the space program worked very hard to develop alternatives to what Armstrong believed were the most important missing elements of the national space effort.

Echoing Armstrong at the hearing Cernan (2011) wondered aloud "what measures are needed to reverse this inertia of today? Based upon history, the long-term solution appears obvious. One only has to look back and learn from history to understand what it will take to once again be the world's leading space-faring nation. We need an administration that believes in and understands the importance of America's commitment to regaining its preeminence in space, an administration which will provide us with a leader who will once again be bold, just as JFK was, and challenge our people to do what history has now told us is possible." Cernan (2011) went on to imply that the NASA leadership in the Obama administration did a poor job of advising the President. Cernan (2011) then maintained that the national space effort required an independent NASA that is forward looking who can not only provide adroit advice to the President, but that which can also manage expansive future programs while working effectively across both sides of the aisle in Congress in efforts to move out with a national space effort that will provide real and tangible benefits to the American population. Cernan (2011) also held that it was important for

NASA leaders to understand lessons from history—to learn from previous mistakes while at the same time building on the foundation of "the successful culture of a government-private industry partnership that has endured" for decades since the inception of the national space effort that has allowed for the development of "safe and cost effective space exploration systems."

Griffin (2011) began his testimony by noting the tremendous amount of news coverage that the retirement of the space shuttle and the space program in general had generated and stated that he was honored to appear before the House committee to testify about the future direction of the space program. However, Griffin (2011) maintained that the United States government had yet to address the most important issue before the committee which was, according to Griffin, that the leaders of the United States had to decide if "we want to have a real space program or not?" Griffin (2011) then maintained that, based upon the American government's behavior at the time, "most people would be forced to conclude that the answer is not." Griffin (2011) then wondered aloud what were the real attributes of a serious national space program by stating "let us return to NASA's chartering legislation, the Space Act of 1958. In that seminal work, we find, among other things, that 'the aeronautical and space activities of the United States shall be conducted so as to contribute materially to the preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof.'"

Armstrong (2011) commended the Congress's work that attempted to shore up the national space effort by noting how the Congress modified the Obama administration's initiative to study for five years the development of heavy lift launchers in favor of the immediate initiation of projects to quickly design and construct such systems. Armstrong (2011) praised the Congress's efforts to transform the Obama administration's initiative to create a Crew Rescue

Vehicle out of the canceled Orion program into a far more important Multi-purpose Crew

Vehicle.  Nevertheless, in spite of the Congress's efforts Armstrong (2011) noted that NASA

continued to be held back by cumbrous limitations and was still "unable to articulate a master

plan that excites the imagination" and allows for a measure of predictability for the American

government's industry partners.

Cernan (2011) went further than Armstrong by stating that the Obama administration's

real agenda was "to dismantle a space program that has been five decades in the making."  In this

regard, Cernan (2011) believed that the short-term solution to counteract this agenda was much

more complicated for the Congress because of the Obama administration's disposition toward

the national space effort.  Cernan (2011) then observed that when the Obama administration

decided to cancel Constellation they were cancelling "a $10 billion investment five years in

development."  What was more, Cernan (2011) maintained that this decision was particularly

grievous for the national space effort because "embedded in the Constellation architecture was

the culture of a long-range building block that could not only service the ISS, extend the life of

Hubble, provide national security, but additionally, would be capable of carrying us back to the

Moon and on to Mars.  To replace Constellation was a 'mission to nowhere' which had no near-

or long-term goals, timetable, specific destination, and no direction for human spaceflight, and

nowhere were there any specific plans for a design and building of hardware should any part of

this agenda be overridden by Congress."

Cernan (2011) was also dubious of the Obama administration's reliance on industry for

the national space effort as a substitute for centralized government run space travel initiatives.

Particularly foolish for Cernan (2011) was the subsidy that the Obama administration was

planning to give to NASA's industry partners in the CCDev program.  Cernan (2011) was

particularly critical of how it appeared that there would be few limits to the amount of subsidy

required to make the private sector initiative a success.  But most problematic for Cernan (2011)

was what he perceived to be a lack of transparency or oversight into and over NASA's private

sector partners.  Cernan (2011) maintained that there was bound to be many technical problems

that would arise for NASA's industry partners for the CCDev program and the lack of

transparency and oversight would only make matters worse.  Cernan (2011) did not believe the

CCDev industry partners claims that they could safely put astronauts into LEO within a few

years and held that this would not be possible until "the end of the decade."

Griffin (2011) concurred with Cernan in his Congressional testimony and observed that,

due to the Obama administration's policy decisions, the United States had become reliant on a

foreign power, namely Russia, for human spaceflight, a critical element of the nation's

comprehensive national power.  Griffin (2011) went on to maintain that the Obama

administration's plan to recover from the human spaceflight situation in existence at the time was

woefully inadequate as the Obama administration was critically dependent on "certain

companies which have yet to show that they can deliver the laundry to the International Space

Station, never mind the crew that would wear it."  Griffin (2011) held that the Obama

administration's leadership was lacking and that they were "simply not living up either to the

letter or to the spirit of the Space Act."  Griffin (2011) then paraphrased Boeing Commercial

Aircraft CEO Jim Albaugh by stating that the Obama administration's "view of our Nation's

future in space offers no dream, no vision, no plan, no budget, and no remorse" (Griffin 2011).

Armstrong (2011) was in total agreement with Cernan and Griffin at the hearing. Armstrong (2011) also observed that due to the Obama administration's policy decision the United States was left with no access to LEO "for an unpredictable time in the future." Armstrong (2011) was understandably embarrassed by the situation. Having been the first man to set foot on the Moon it seemed unacceptable to him to think that the United States could not even access LEO. Armstrong (2011) seemed to think that the tremendous investment that the United States had made in the space program for all those decades had been wasted and squandered by the Obama administration.

Cernan (2011) believed that the Obama administration's policy decisions did not portend well for the future of the country, let alone the space program. Accordingly, Cernan (2011) believed that the United States had come to a crossroads in space. That if, under the Obama administration, the United States abdicated its leadership position in space not only would "human spaceflight and space exploration" be at risk, but the "future of this country and thus the future of our children and grandchildren as well" (Cernan 2011). Cernan (2011) then urged the Congress to override the Obama administration's policy decision, which he believed was a pledge to mediocrity. By doing so the nation could reestablish its commitment to excellence in space and more broadly across its society.

Armstrong (2011) lamented the effect that the Obama administration's policy decision had on the aerospace industry in the United States. Armstrong (2011) stated "the severe reductions in space activity have caused substantial erosion in many critical technical areas and are creating negative economies of scale cost increases throughout the aerospace industry. Most importantly, public policy must be guided by the recognition that we live in a technology-driven

world where progress is rapid and unstoppable. Our choices are to lead, try to keep up, or get out of the way. A lead, however earnestly and expensively won, once lost, is very difficult and expensive to regain" (Armstrong 2011).

Cernan (2011) echoed Armstrong's observations on the policy decision's effect on the American aerospace industry. "As a consequence of the cancellation of Constellation, the termination of the Space Shuttle, and NASA's continued unwillingness to accede to Congressional mandates, thus causing unnecessary delays over the past two and one-half years, the risks and challenges to NASA and the aerospace community are numerous. My immediate concerns are the deterioration of our technological base, the lack of stability of the NASA budget when considering the present state of the economy, the absence of the Administration's commitment to cooperate with Congress and forge an ambitious program, the question of continued bi-partisan Congressional support, and perhaps the most important risk with lasting effect, is the loss and dismemberment of our skilled workforce" (Cernan 2011).

For Armstrong (2011) it was critically necessary to have political leadership that could clearly and cogently articulate a master plan and strategy which would have broad and lasting bipartisan support. It was also important for the Obama administration and the Congress to work together in a bipartisan fashion to implement the policy with a consistent budget. By doing so, the national space effort would inspire and motivate young people to achieve excellence in the STEM fields while at the same time supporting industry and once again earning the respect and admiration of the world (Armstrong 2011).

Griffin (2011) went to the heart of the matter when he described what should be the features of the American national space effort in his testimony before Congress:

"What does a real space program look like, and not look like?  A real space program sets and meets stable national strategic goals for leadership on the space frontier by developing, evolving, and preserving national capabilities to operate on that frontier.  It does not allow that capability to be held hostage to the good will of other powers, or to the vagaries of a nascent and fragile marketplace.

A real space program may, and indeed should, offer a stable market to be addressed by commercial providers, but it cannot be dependent upon such providers for strategic capabilities.  A real space program recognizes that this Nation has interests that rise above the fortunes of individual private contractors, and it protects those interests.  The proper role of government is to reward winners, not to pick them, nor to step in as an investor in enterprises which cannot pass the tests that the capital markets impose.

A real space program is grounded in physics, not politics.  In stepping outward beyond low Earth orbit and the ISS, a human return to the Moon is the next logical goal from a host of scientific, engineering, operational, and even commercial perspectives.  From there, and with the experience thus gained, we should proceed onward to Mars, and should do so in a timely way, else Mars will always be the destination of the future.  With the new systems built for those purposes, it will then be both possible and interesting, as an ancillary mission, to visit one or more near-Earth asteroids, and we should do so when opportunity permits.  This is a plan which fits the geography of the Solar System in which we live.  A real space program would be built around that fact" (Griffin 2011).

Despite Griffin's testimony, and while observing that some progress had recently been made, Armstrong (2011) still lamented that the national space effort lacked the resources to effectively carry out its missions and lacked direction.  NASA was unsuccessfully trying to follow the directives of the Obama administration while at the same time carrying out the mandates that it was given by the Congress.  According to Armstrong (2011) the result was "a fractious process that satisfies neither."  Armstrong (2011) believed that most in government, industry, academia, and the rest of society were understandably frustrated by the lack of a comprehensive plan for NASA.  For Armstrong (2011) the onus was on NASA to provide hope and confidence to its perplexed and discouraged personnel in the face of all the conflicting political forces and the letdowns of canceled programs.

Cernan (2011) maintained that uncertainty and instability were rife at NASA due to these factors.  Cernan (2011) lamented that as a result of these policy decisions a young generation of

enthusiastic minds would lose inspiration and pursue other fields. As this dynamic would be

combined with the gradual retirement of all the older and experienced technicians who were

working at NASA for decades inertia would take hold at NASA and the agency would continue

on its downward trajectory. This downward trajectory would be exceedingly difficult to reverse

according to Cernan (2011). Cernan (2011) observed that there was an entire generation of

students in high school and college that had their hopes and dreams dashed by these policy

decisions. They were hoping to return to the Moon and go much further beyond, but with the

cancellation of these programs they began questioning their futures in the STEM fields. Cernan

(2011) observed further that the outlook at NASA was bleak for those who were still fortunate to

be at work there or on a contracting team. Indeed, due to the cancellation of the Constellation

program and a return to the Moon there was a cloud of uncertainty hanging over NASA and

many talented people there were opting to take their talents elsewhere in order to provide

stability for their families. Cernan (2011) noted that, due to these factors, there were tremendous

risks and challenges that the nation would face in the development of systems for human

spaceflight.

Griffin (2011) expounded on the problems that the national space effort would face as a

result of these policy decisions:

> "NASA appropriations are being used to provide funds in advance of product delivery
> (i.e., front-end government 'investment' in private concerns) for several commercial
> space launch, cargo, and crew vehicle development enterprises. There are numerous
> risks inherent to this aspect of the overall program.
> The most obvious concern is that limited NASA funds are being spread too broadly
> across a nascent commercial space industrial base. The ISS crew and cargo market is
> insufficient by itself to support several commercial providers, and quite possibly even
> one. Other commercial human spaceflight markets are not immediately apparent. Thus,
> if the several firms selected to receive funds under the CCDEV–2 program (Boeing,

SpaceX, Sierra Nevada, and Blue Origin) should all succeed technically, one wonders how they will be supported thereafter, other than via out-right government subsidy. Indeed, the administration's reliance on so-called 'commercial' means of acquiring human space flight capabilities does not withstand a conventional business case analysis. Understanding that commerce remains a consequence of exploration, the elimination of the Moon as the next logical exploration goal makes no sense. As I stated earlier, it is unlikely that the ISS market alone can sustain even a single commercial vendor, and yet there is no clear plan to provide even that market beyond ISS. However, a straightforward economic analysis shows that the market for the cargo resupply of a human outpost on the lunar surface could indeed be sustainable over the longer term when sound business practices are assumed. Thus, the administration's present exploration strategy to bypass the Moon as a near-term human space flight goal impedes the long-term sustainability of the very commercial sector they are trying to cultivate."

Cernan (2011) urged the Congress to override the Obama administration and to enact a program that would provide direction and stability for all of the technicians, engineers, and scientists that came to NASA after the Apollo program but were still inspired to return to the Moon and then eventually to go on to Mars. Cernan (2011) lamented that without such direction all of these critical personnel at NASA would be gone. Cernan (2011) did not believe that they were inspired to pursue STEM careers so that they could "design windmills or redesign gas pedals, but to live their dreams of once again taking us where no man has gone before." Cernan (2011) was very upset that after these policy decisions thousands of jobs across the American aerospace industry had quickly been lost.

Griffin (2011) continued to expound on his criticisms and raised a number of issues regarding oversight of NASA commercial partners in the CCDev program. Griffin (2011) noted that of all the companies that NASA was working with for CCDev only one of them that was selected to receive government funds for the CCDev-2 contractual arrangements had any previous experience with human spaceflight. Griffin (2011) noted further that only the one company that he mentioned had developed a launch vehicle that had demonstrated its reliability

with regular service. Griffin (2011) then stated that the problem for NASA is that it did not have any oversight or control over the companies that it was working with for CCDev. The CCDev firms were developing their systems mainly following their own standards and not the standards of the United States government. Griffin (2011) stated that such activities would be fine if the CCDev firms were financing all of their systems with private funds and their services were going to be sold according to the prices that the market dictated. However, with CCDev that would not be the case. "Public funds have been provided in advance of product delivery to meet a government demand, a fact normally accompanied by the requirement for government oversight and control of product design, development, manufacturing, and operational standards. It is in this fashion that the requirement for public responsibility and accountability for the expenditure of public funds is assured. That requirement" was absent in the Obama administration's plan (Griffin 2011). Griffin (2011), however, believed that that situation could continue only up until there was an accident with the private companies, there was a misuse or abuse of the public funds, or there was some other unforeseen event. In the event that any of these events occurred many questions would then be asked about where NASA's oversight was. Griffin (2011) did not believe that the answers would be acceptable.

## Media Coverage of the Criticisms

The media coverage of the criticism of veteran astronauts and other NASA veterans was quite sharp for the Obama administration. Much of the media focused on the criticisms that Neil Armstrong had for the Obama administration and noted that Armstrong rarely ever made public appearances. This appeared to make Armstrong's criticism all the more noteworthy. The New York Times called Armstrong "the most famous man in the history of NASA" (Chang 2010, 20)

which appeared give his criticism much credence.  Armstrong, of course, sharply criticized the Obama administration.  "'If the leadership we have acquired through our investment is allowed simply to fade away, other nations will surely step in where we have faltered,' Mr. Armstrong said in testimony before the Senate Committee on Commerce, Science and Transportation. 'I do not believe that would be in our best interests'" (Chang 2010, 20).

The New York Times also had coverage of an official letter that Armstrong, Gene Cernan, and Jim Lovell authored for the Obama administration in which they called the Obama administration's policy decision on Constellation devastating (Chang 2010).  Cernan told the Congress "that the three men had carefully chosen the words in the letter: 'slide to mediocrity' and 'third-rate stature.'  'We did not want to be misunderstood nor did we want to be misinterpreted,' Mr. Cernan said" (Chang 2010, 20).

In other media coverage of the letter the astronauts "blasted the decision to cancel NASA's back-to-the-moon program, Constellation, to focus on things such as monitoring earth's climate" (IBD Editorial 2010, A16).  But the Obama administration provided a vigorous defense of the policy.  "Obama administration officials—including John P. Holdren, the president's science adviser, and Charles F. Bolden Jr., the NASA administrator"—insisted they were not abandoning human spaceflight (Chang 2010, 20).  "Instead, they said that by relying on commercial companies and developing new technologies, NASA would end up with a more affordable and more sustainable way of getting people to space" (Chang 2010, 20).

However, in spite of the Obama administration's defense of the policy decision the veteran NASA astronauts remained unconvinced that the policy would succeed (Chang 2010).

Armstrong in particular, found a "number of assertions, which, at best, demand careful analysis and, at worst, do not deserve any analysis" (Chang 2010, 20). Cernan was even more blunt and called the Obama administration's policy "a blueprint for a mission to nowhere" (Chang 2010, 20). Cernan said before the Congress: "now is the time for wiser heads in the Congress of the United States to prevail. Now is the time to overrule this administration's pledge to mediocrity" (Chang 2010, 20).

Armstrong, in particular, took issue with all of the secrecy that enshrouded the process by which the Obama administration came to their policy decision. Armstrong stated: "lack of review normally guarantees that there will be overlooked requirements and unwelcome consequences" (Chang 2010, 20). The New York Times also noted how remarkable it was that Armstrong made public comments. Ever since the Apollo Moon landings Armstrong had largely hid from his fame and barely ever appeared in public (Chang 2010). This dynamic appeared to give more credence to the criticisms.

The New York Times also noted how aghast was Cernan at Bolden's comments about subsidizing the commercial space sector in order to ensure the success of the policy. "'I can say with authority, because I wrote this down and I put the word 'wow' right next to it,' Mr. Cernan said. 'Because Charlie did say, 'It may be a bailout like GM and Chrysler. As a matter of fact, it may be the largest bailout in history'''" (Chang 2010, 20). However, in his Congressional testimony Bolded maintained that "he did not remember making such a remark" (Chang 2010, 20).

Other media coverage of the astronauts' letter noted that the policy decision would mean that the "$10-plus billion investment in Constellation" would be wasted (IBD Editorial 2010,

A16).  The letter went on to state that "for the United States, the leading space-faring nation for nearly a half a century, to be without carriage to low earth orbit for an indeterminate time into the future, destines our nation to become one of second- or even third-rate stature" (IBD Editorial 2010, A16).

In addition to Armstrong's, Cernan's, and Lovell's letter there was another letter that was authored by over two dozen veteran astronauts and other NASA officials that stated that the policy decision to cancel a "return to the Moon was wrong for our country for many reasons" (IBD Editorial 2010, A16).

However, when attempting to rebut the astronauts' criticisms Bolden said in an interview "'I'm not trying to take Neil Armstrong on.  Neil is absolutely right.  We have got to continue to pursue human space exploration.'  But he added, 'the manner in which we do it is probably where we differ, and it's because I don't think they had a full understanding of the difficulties the Constellation program is experiencing'" (Chang 2010, 20).  Nevertheless, there were some members of Congress that continued to be skeptical of the benefits that human spaceflight brings to the nation.  One of them was Senator John D. Rockefeller IV, Democrat of West Virginia, chairman of the commerce committee (Chang 2010).

Obama's policy decision to cancel Constellation and rely on commercial operators for transport to LEO was not popular with everyone.  Indeed, there were a number of NASA veterans, including the most prominent astronauts in NASA's history, who were extremely critical of the policy.  In their view the policy decision would lead to the dismantling of the American human spaceflight program.  They did not believe that the commercial operators who would replace a centralized NASA human spaceflight program could do the job adequately.  The

following chapter analyzes the track record of NASA's commercial partners with the COTS program.

### Chapter 14:  The Ups and Downs of the Commercial Space Sector

As crewed flights for CCDev have not started yet this analysis will focus on the activities of NASA's commercial partners for the COTS program—Space X and Orbital.  The analysis begins with the first commercial resupply services (CRS) mission conducted by Space X—CRS 1.

### Space X

### CRS 1

In this regard, "the first official commercial resupply mission to the International Space Station (ISS) successfully passed the critical phase of its arrival at the orbital outpost, as SpaceX's CRS-1 Dragon was 'tamed' by the Space Station Remote Manipulator System (SSRMS) ahead of schedule, at 6:56am Eastern.  The vehicle was then successfully berthed to the Harmony module" (Bergin and Graham 2012).

Before the Dragon spacecraft could dock with the ISS it had to perform a number of tasks.  These included C2+ test objectives that required the Dragon spacecraft to briefly encircle the ISS in order to test the spacecraft's communication assets.  Once these tests were concluded the spacecraft was cleared, or qualified, to dock with the ISS.  This occurred "on Flight Day 3 of its mission" (Bergin and Graham 2012).

The actual process of docking was rather uneventful but required sophisticated capabilities.  "The spacecraft made a series of thruster burns, each taking it closer to the station;

holding at distances of 2,500, 1,200, 250, 30 and 10 meters (2,735, 1,310, 273, 33 and 11 yards),

before finally being grappled by the Canadarm2 Remote Manipulator System, and attached to the

nadir port of the Harmony module.  Akihiko Hoshide operated Canadarm2 during capture, while

Sunita Williams will later use it to berth the Dragon.  However, as always, Dragon was required

to pass a series of 'Go No/Go' points during its rendezvous, ensuring it provides no risk to the

$100 billion Station" (Bergin and Graham 2012).


## CRS 2

Space X's second commercial resupply services (CRS) mission—CRS 2—was a success

as well.  Following the mission the Dragon spacecraft landed in the Pacific Ocean.  However, the

mission encountered a few technical difficulties.  "Following a nominal launch from Cape

Canaveral's SLC-40—with the launch vehicle showing no signs of repeating it's Engine 1 issue

from the previous ride uphill—Dragon began its journey to the ISS.  However, a challenging

issue was noted—just moments after it separated from the Falcon 9's Second Stage—relating to

the spacecraft's propulsion system—which consists of a set of four 'quads', each hosting

thrusters on the Dragon, vital for attitude control and required burns en route to the Station.

Although SpaceX, NASA and even the US military assets all worked together to resolve the

issue, Dragon missed the key Coelliptic Burn, resulting in a one day delay to its rendezvous and

berthing with the ISS" (Bergin and Harding 2013).

Nevertheless, despite these brief technical difficulties, Space X's mission went according

to plan and the Dragon spacecraft successfully docked with the ISS and delivered its cargo.

Indeed, after the mission overcame its initial technical difficulties the Dragon spacecraft "was

also part of a first for a commercial spacecraft at the ISS—as the Space Station Remote

Manipulator System (SSRMS) carefully removed a pair of grapple bars from the spacecraft's trunk" (Bergin and Harding 2013).

## CRS 3

Space X continued the successes of its previous CRS missions with CRS 3. The mission was rather uneventful regarding technical glitches. There appeared to be no major technical problems to speak of. At the end of the mission the Dragon spacecraft easily unbearthed from the ISS and splashdowned in the Pacific with the aid of its parachute (Bergin 2014).

The Dragon spacecraft flew on "Space X's Falcon 9 v1.1 launch vehicle" and successfully completed all essential tasks in space at the ISS (Bergin 2014). In addition to the previous 2 CRS missions Space X completed a trial run of the Dragon spacecraft to the ISS before the CRS missions. Therefore, CRS 3 was the fourth time that the Dragon spacecraft successfully completed a mission to the ISS. These mission successes boded very well for a spacecraft that Space X would like to make crew-rated (Bergin 2014).

When the Dragon spacecraft reached the ISS it was once again "grabbed by the tail by Canada's Space Station Remote Manipulator System (SSRMS)," and then "Dragon was carefully translated towards her orbital on the Earth facing port of the Harmony module" (Bergin 2014). "Riding uphill with the Dragon was a cargo compliment of 476 kilograms (1,050 pounds) of supplies for the crew, 715 kg (1,600 lb) of equipment for scientific research, 204 kg (450 lb) of replacement parts and hardware for the space station, 123 kg (270 lb) of equipment for conducting extra-vehicular activities, 600 grams (1.3 lb) of computer equipment" (Bergin 2014).

## CRS 4

Space X once again continued the successes of its previous CRS missions with CRS 4. As with CRS 3, the mission was rather uneventful regarding technical glitches. There appeared to be no major technical problems to speak of. At the end of the mission the Dragon spacecraft easily unbearthed from the ISS and splashdowned in the Pacific with the aid of its parachute (Bergin 2014).

The Dragon spacecraft flew on "Space X's Falcon 9 v1.1 launch vehicle" and successfully completed all essential tasks in space at the ISS (Bergin 2014). CRS 4 was the fifth time that the Dragon spacecraft successfully completed a mission to the ISS. These mission successes boded very well for a spacecraft that Space X would like to make crew-rated when it develops a more advanced version of the Dragon spacecraft known as Dragon V2 (Bergin 2014).

When the Dragon spacecraft reached the ISS it was once again "grabbed by the tail by Canada's Space Station Remote Manipulator System (SSRMS)," and then "Dragon was carefully translated towards her orbital on the Earth facing port of the Harmony module" (Bergin 2014). "Riding uphill with the Dragon was a cargo compliment of almost 5,000 pounds of supplies and experiments to the International Space Station during a month-long stay" (Bergin 2014).

## CRS 5

Space X once again continued the successes of its previous CRS missions with CRS 5. As with CRS 3 and 4, the mission was rather uneventful regarding technical glitches. There appeared to be no major technical problems to speak of. At the end of the mission the Dragon spacecraft easily unbearthed from the ISS and splashdowned in the Pacific with the aid of its parachute (Bergin 2015).

The Dragon spacecraft flew on "Space X's Falcon 9 v1.1 launch vehicle" and successfully completed all essential tasks in space at the ISS (Bergin 2014). CRS 5 was the sixth time that the Dragon spacecraft successfully completed a mission to the ISS. These mission successes boded very well for a spacecraft that Space X would like to make crew-rated when it develops a more advanced version of the Dragon spacecraft known as Dragon V2 (Bergin 2015).

When the Dragon spacecraft reached the ISS it was once again "grabbed by the tail by Canada's Space Station Remote Manipulator System (SSRMS) two days after launch," and then "Dragon was carefully translated towards her orbital on the Earth facing port of the Harmony module" (Bergin 2015). "Riding uphill with the Dragon was a cargo complement of almost 5,000 pounds of supplies and experiments to the International Space Station during a month-long stay. A number of specific payloads rode uphill, including the Microbial Observatory-1, the Flatworm Regeneration payload, the 'Wearable Monitoring' ASI payload, the Free-Space PADLES (Passive Dosimeter for Life-Science Experiment in Space) payload for JAXA and the Fruit Fly Lab-01. Dragon's array of cargo will support more than 250 experiments that will be conducted by the Station's Expeditions 42 and 43 crews" (Bergin 2015).

**CRS 6**

Space X's sixth CRS mission was trouble-free as well, as with its three previous missions CRS 3-5. The Dragon spacecraft was easily "released from the grip of the Station's 'Big Arm,'" and then glided safely to a landing in the Pacific with the aid of its parachute (Bergin 2015). The splashdown occurred around six hours after leaving the ISS (Bergin 2015).

Space X once again employed the Falcon 9 v1.1 to launch the Dragon spacecraft for its seventh mission to the ISS. The Dragon rendezvoused with the station three days after being

launched (Bergin 2015). This time an Italian astronaut, Samantha Cristoforetti, used the

Canadarm to grapple the spacecraft (Bergin 2015).

"The CRS-6 Dragon berthed with a total cargo mass of 2,015 kilograms (4,387 lb; 1,898

kg or 4,184 lb without packaging). This included 500 kilograms (1,102 lb) of items and

provisions for the station's crew, 518 kilograms (1,142 lb) of station hardware and equipment, 16

kilograms (35 lb) of computer and electronic equipment and 23 kilograms (51 lb) of hardware

for EVAs. The remaining 844 kilograms (1,860 lb) of the Dragon's payload was taken up by

scientific hardware and experiments, including critical materials to directly support about 40 of

the more than 250 science and research investigations" (Bergin 2015).

## CRS 7

While Space X's first six CRS missions were successes, in addition to its maiden flight to

the station to test its systems, Space X, however, encountered a very serious setback with its

seventh CRS mission. The mission was a dismal failure. The mission was once again intended

to transport cargo to the ISS and included "a docking adaptor for future manned missions.

However, the launch failed just over two minutes into the ascent from Cape Canaveral's Space

Launch Complex 40 at 10:21 local time (14:21 UTC), due to a presumed second stage issue"

(Graham 2015).

"The mission was lost 139 seconds into first stage flight, resulting in SpaceX's first major

failure since the loss of the third Falcon 1 launch. The first stage was expected to fire for around

159 seconds before its engines shut down—with stage separation occurring four seconds later.

However, just prior to the point staging was to occur, visual issues were noticed with the vehicle

during the live webcast, showing a problem potentially between the first and second stage. The

view was obscured by the failing rocket, prior to the vehicle being destroyed.  It was later revealed by SpaceX's Elon Musk that there was an overpressure issue in the LOX tank of the second stage, which is the initial root cause of the loss of the vehicle.  A post failure press conference noted the review of the data was still ongoing" (Graham 2015).

## Orbital

Following coverage of Space X's CRS missions the analysis proceeds with NASA's second CRS partner Orbital and the three missions that Orbital conducted.

## ORB CRS 1

Orbital's spacecraft, known as Cygnus, successfully completed its first CRS mission to the ISS.  ORB-1 was released by the station's equipment, but unlike with Space X's Dragon spacecraft, the Cygnus destructively reentered the Earth's atmosphere to complete its mission (Bergin 2014).

The Cygnus was launched with Orbital's rocket, Antares, which uses engines designed by the Soviet Union, and was able to rendezvous with the ISS without any trouble a few days after launch (Bergin 2014).  "ORB-1 delivered 1,466 kilograms (3,232 lb), out of a maximum of 2,000 kg (4,400 lb).  The ISS crew soon got to work, unloading the cargo contained within the vehicle's PCM.  This involved the crew removing the 'top layers' on PORT and STBD pallets to make room in PCM" (Bergin 2014).

## ORB CRS 2

Following the success of its first CRS mission Orbital continued its success with a technically uneventful ORB-2 CRS mission.  The Cygnus unberthed with the ISS and once again

destructively reentered the Earth's atmosphere after delivering its cargo and spending an additional two days on orbit (Bergin 2014).

The Cygnus was once again launched with the Antares. The launch took place at the Wallops spaceport which is in Virginia (Bergin 2014). "The spacecraft was carrying a total of 1,664 kg (3,669 pounds) of supplies, including research investigations, crew provisions, hardware, and science experiments from across the country" (Bergin 2014).

## ORB CRS 3

While Orbital's first two CRS missions were successes the company nevertheless encountered a devastating setback with its third CRS mission. "Orbital's Antares launch vehicle—tasked with lofting the CRS-3 Cygnus to the International Space Station (ISS)— dramatically failed after around ten seconds of flight, exploding and falling back on to the launch center. There is extensive damage to the Wallops facility, although it has been confirmed all personnel are accounted for, with no injuries reported" (Graham and Bergin 2014).

Orbital's first launch attempt with Antares for its third CRS mission was scrubbed because there was a "boat in the Range Safety area" (Graham and Bergin 2014). Evidently, the boat did not leave the area in enough time for "Antares to launch within her 10 minute window" (Graham and Bergin 2014).

The second launch attempt was when the devastating failure occurred. The launch "vehicle was recycled for a launch at a T-0 of 18:22 local time. The launch ended in failure after around six seconds" (Graham and Bergin 2014). "The mission, Orbital CRS-3, was to mark the first flight of the upgraded Antares 130 rocket, which featured a more powerful second stage to accommodate larger future payloads. As such, the upgrade would have had no relevance to the

failure. First flown in April 2013, the launch was the fifth flight of Orbital's Antares rocket which was developed specifically to launch the Cygnus spacecraft. However, it was the first time a problem of any kind was seen during her career. The Antares 130 made use of the same first stage as its predecessors. Of Ukrainian design and based loosely on the first stage of the Zenit rocket, the stage was developed by the Yuzhnoye Design Bureau. It is powered by a pair of AJ26-58 engines, which are themselves reconditioned NK-33 engines left over from the Soviet Union's cancelled N-1F rocket. The USSR abandoned the N-1F in the early 1970s after all four test flights of a prototype, the N-1, ended in failure" (Graham and Bergin 2014). Cygnus will ride on an Atlas V in December 2015 before resuming with a modified Antares.

Accordingly, out of the 10 CRS missions that NASA's commercial partners for COTS—Space X and Orbital—flew 8 were successful. When compared to the United Launch Alliance's 122 straight successful launches this is not a very good track record. While the setbacks are not insurmountable, there is some question as to whether a cargo program operated by NASA might have been better from a technical perspective. As CCDev crewed missions have not started yet it is too early to tell if the Obama policy is a success or not. However, if Space X and Boeing kill two crews in the space of just a few years the policy will undoubtedly be a failure. Hopefully, the experience that Boeing already has and the experience that Space X is getting with COTS will allow these commercial partners to create and operate systems that will safely transport American and international astronauts into space for the foreseeable future..

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