2-2015

Waste and Duplication in NASA Programs: The Need to Enhance U.S. Space Program Efficiency

Bert Chapman
Purdue University, chapmanb@purdue.edu

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Abstract: The U.S. Government faces acute budgetary deficits and national debt problems in the Obama Administration's second term. These problems have been brought about by decades of unsustainable government spending affecting all federal agencies including the National Aeronautics and Space Administration (NASA). An outgrowth of this fiscal profligacy is the presence of wasteful and duplicative programs within NASA that prevent this agency from achieving its space science and human spaceflight objectives. These programs occur due to mismanagement of these programs by NASA and from the creation of these programs by the U.S. Congress and congressional committees. This occurs because congressional appropriators tend to be more concerned with economically enhancing their states and districts and promoting their reelections instead of providing effectively targeted funding and oversight of their programs to ensure they meet national space policy goals and provide tangible value for taxpayers. This work will examine recent examples of wasteful and duplicative NASA programs and suggest ways to improve their utility.

1. Introduction

The U.S. Government faces acute budgetary and national debt pressures during early 2014. The federal budget deficit is $301 billion representing 1.75% of a $17,649.6 trillion Gross Domestic Product (GDP) as of April 30, 2014[1] and the national debt exceeded $17.472 trillion as of May 12, 2014 having risen from to this level from $10.626 trillion since the beginning of the Obama Administration[2] This situation requires federal agencies and congressional appropriators to carefully scrutinize federal programs for duplication and waste and determining whether they are critical enough to spend taxpayer dollars on during this period of protracted fiscal restraint. All federal agencies, to varying degrees, are being forced to reduce the growth of their expenditures, if not their actual expenditures, by political and economic constraints such as 2012 federal budget sequestration legislation. In March 2013, the National Aeronautics and Space Administration (NASA) reported that the 5% of its Fiscal Year (FY) budget of $17.896 billion which it was required to sequester was $918 million [3].

NASA is one agency being forced to cope with heightened scrutiny of its programs. While it has had significant scientific and political successes during its more than half century history, NASA has not been immune to programmatic waste, duplication, inefficiency, and uncertain institutional purpose during this

time period. This article will examine recent and ongoing problems NASA has with waste and duplication which, if allowed to persist, will jeopardize its ability to meet national space policy objectives and maintain political support for continued funding of its programs which can be seen by Americans irrelevant to their daily needs. NASA's ambivalent popular standing is reflected in recent public opinion polling. A March 2012 General Social Survey Poll asking U.S. Government space exploration spending found 40% of respondents saying the U.S. was spending the right amount while 29% said it was spending too much. A May 2013 Gallup Poll seeking public opinion on NASA's performance found that 32% of respondents had a good opinion of NASA; 32% had a fair opinion of NASA; and 10% had a poor opinion of NASA. Finally, an October 2013 Pew Research Center poll on overall opinion of NASA revealed 22% held a very favorable opinion; 51% a mostly favorable opinion; 3% a very unfavorable opinion; and 12% a mostly unfavorable opinion of this agency[4].

Duplication and waste is common to NASA and other federal agencies. Documentation on such duplication and waste can be found in many sources including U.S. Government Accountability Office (GAO) reports, agency inspector general (IG) reports, and congressional committee publications. An important factor to remember is that responsibility for much of this duplication and waste

occurs through congressional earmarking as part of annual federal appropriations as members of Congress seek to enhance economic development in their states and districts and their own reelection prospects by placing NASA facilities in their constituencies (particularly in southern and western states) and maintaining government spending for these facilities even if they no longer meet national space policy needs[5].

2. Multifaceted Waste and Duplication

GAO is responsible for issuing numerous reports on the management performance of government programs. A particularly important category of reports GAO issues are its High Risk reports. This series of reports are issued approximately every two years at the beginning of each two year congressional session. Their purpose is documenting "high risk" government operations and focusing on government agencies and program areas which achieve the high risk category due to their vulnerabilities to fraud, waste, abuse, and mismanagement or are in acute need of broad reform. The "high risk" reports have been issued from 1990 until 2013 and various NASA programs have been included on this list every time[6].

NASA acquisition management programs were targeted as high risk in the February 2013 edition of these GAO reports. These programs were targeted as

high risk due to NASA's continuing history of persistent cost growth and scheduling delays in the majority of its major programs. GAO asserts that various causal factors including obsolescent financial management systems, poor cost estimating, and underestimating risks associated with developing major systems keep NASA acquisition management programs in the high risk category[7].

GAO credited NASA for meeting cost and schedule baselines in 2011 for the Juno and the Gravity Recovery and Interior Laboratory spacecraft projects. However, GAO also determined that same year that NASA increased lifecycle costs of the James Webb Space Telescope (JWST) by $3.7 billion and a 52 month launch delay. In December 2012, GAO reported that JWST costing and scheduling confidence developing and scheduling levels could impact the program's overall reliability. GAO also mentioned that in 2011 NASA lacked common measurable and proven criteria such as engineering drawings employed at a key point in the development lifecycle to give decision-makers requisite knowledge, insight, and evidence to allow individual projects to proceed[8].

Since 2011 GAO has also issued annual reports on government agency program duplication and included recommendations for eliminating this duplication. In its April 2013 report on this topic, GAO focused on the possibility of reducing

government satellite program costs. Besides NASA, federal agencies involved in using satellite assets and technologies for various programs include the Department of Defense (DOD), National Oceanic and Atmospheric Administration (NOAA), Federal Aviation Administration (FAA), and the U.S. Coast Guard. In recent years, over $25 billion annually has been appropriated to agencies for developing space systems. These systems are launched and put into orbit by rockets which can cost from $80-$200 million per launch[9].

Recommendations from GAO to reduce such duplication and costs include launching government payloads on commercial space industry satellites; increased launch ride-sharing by federal agencies, and resolving agency cultural challenges such as DOD being reluctant to adopt technologies from unfamiliar commercial providers. Additional complicating factors include government agencies being concerned that commercial agencies may not be flexible about changing launch dates if instruments or satellites experience delays and existing federal legal and policy challenges such as the 2004 U.S. Space Transportation Policy mandating that government payloads be launched on U.S. manufactured space launch vehicles unless otherwise exempted[10].

GAO noted that while the U.S. Space Transportation Policy was intended to support the U.S. space industry, it limits the government's ability to utilize available foreign commercial launch options which commercial satellite providers take advantage of. GAO recommends that Congress and the President should consider revisiting U.S. space transportation law and policy to give federal agencies additional flexibility to use foreign space transportation and launch vehicles to encourage cost savings. GAO believes hosted payloads and ride sharing could reduce government launch costs and produce savings in the hundreds of millions of dollars over project lifespans but is unable to quantify the potential for further financial benefits due to a limited pool of available data[11].

Political figures like to target what they consider as wasteful government spending and NASA was heavily criticized by Senator Tom Coburn (R-OK) in the October 2012 edition of the *Waste Book* compiled by his staff. One example of questionable NASA spending cited in this presentation included $947,000 to researchers at Cornell University and the University of Hawaii as part of NASA's Advanced Food and Technology Project to develop recipes for pizza and other foods that could be served on Mars even though human expeditions to Mars are not likely until the 2030s. Other characteristics of this program included six volunteers heading to a barren area of Hawaii to simulate a 120-day Mars

mission, wearing space suits, and consuming only instant foods and foods prepared from shelf stable ingredients in order to determine the best food options for long-term travel to Mars and eating on this planet[12].

This report also revealed NASA had spent $1.5 million developing a massive multiplayer online game simulating a journey to Mars and astronauts life on that planet; developed the online rock radio station Third Rock with a Houston company targeting 18-34 year olds which is accessible on mobile phone apps; the NASA website, and iTunes, and spent $94,000 developing a Mars Rover video game for Xbox[13]. It also spends $771,000 annually for an obsolete and poorly used "Lessons Learned" database allowing NASA managers to document best practices and other information gained from completed projects. NASA's IG, however reports that these managers rarely contribute to or access this database and that agency employees found it to be user unfriendly and unhelpful[14].

NASA has also spent $12.4 million funding a cutting edge visitor center to replace an existing facility five miles away from the Stennis Space Center in Mississippi. Despite receiving approximately 100 visitors per day in 2007, NASA and other federal, Mississippi state agencies, and private organizations collaborated to build a new 72,000 square foot science center which opened in

2012. The new facility is five times larger than the previous visitors center and aspires to attract over 300,000 visitors annually[15]

3. Unused and Ineffectively Used Facilities

NASA's real estate holdings encompass eighteen facilities in Washington, DC and the following twelve states: Alabama, California, Florida, Louisiana, Maryland, Mississippi, Ohio, New Mexico, New York, Texas, Virginia, and West Virginia[16]. These make NASA the U.S. Government's ninth largest real property holder with over 124,000 acres and 4,900 buildings and other structures whose replacement value exceeds $30 billion[17]. Over 80% of these facilities are forty or more years old and NASA faces a deferred maintenance backlog of $2.5 billion. The 2010 NASA Authorization Act required the agency to reduce its real property to fit current and future missions and expected funding levels. NASA's OIG warns that with mission focus changes and budget constraints NASA managers must balance reducing its real property footprint with retaining and maintaining currently underutilized facilities which may be needed to support future missions[18].

Specific concerns this report found with NASA property management practices include:

- Not having clear guidance to ensure that property identified for leasing to prospective commercial users was not excess to agency needs;
- NASA guidance for identifying potential lease property is clear and ineffective;
- NASA lacks a comprehensive inventory of property available for lease. For instance, managers at its Ames, Kennedy, and Stennis facilities only had partial inventories of buildings or land available for lease while managers at the Glenn and Michoud facilities were unable to provide a formal inventory of available products.
- Centers inadequately market their properties for leasing. They generally relied on "word-of-mouth" efforts to attract prospective tenants and did not take additional steps to enhance marketing of leasing opportunities such as working with the General Services Administration's Office of Client Solutions to identify potential federal clients.
- Internal controls need to be strengthened to ensure best value to the government and fairness to partners. Centers did not consistently use competition for agreements with non-federal entities, three Centers failed to conduct a required market analysis or used the analysis inappropriately

when developing pricing, and three of the Centers entered into lease agreements signed by unauthorized personnel[19].

Additional problems in NASA property leasing include funds generated from such leases going directly to the U.S. Treasury instead of to NASA; parts of its Ames Center in California being part of the Shenandoah Plaza Historic District which NASA is required to preserve under federal law; not using the government website FedBizOpps https://www.fbo.gov/ to market to non-federal entities; and Mississippi's Stennis facility charging Rolls Royce $2.14 annually per square foot for office space when a local market analysis prepared by officials 40 miles away at New Orleans-based Michoud, determined that their local office space rents ranged between $8.50 and $13.50 per square foot[20].

4. Constellation Program/Multi-Purpose Crew Vehicle (MPCV)

NASA's Constellation and MultiPurpose Crew Vehicle (MPCV) programs have also been plagued with management problems. Constellation's origins begin with the desire to replace the space shuttle. Early articulation of this was specified by President George W. Bush in his January 2004 "Vision for Space Exploration" which emphasized sending NASA astronauts beyond low earth orbit. Characteristics of this vision included developing a Crew Exploration Vehicle (CEV), later renamed Orion, to provide transportation for missions beyond the

International Space Station and low earth orbit; conduct an initial crewed Orion flight by 2014; conduct lunar surface exploration between 2015-2020; and conduct human missions to Mars after successfully demonstrating sustained missions to the Moon and robotic missions to Mars[21].

Lockheed Martin was chosen as the contractor to develop Orion in 2006 and its first crewed flight was scheduled for 2012. However, the program has been plagued by delays and cost increases due, in part, to its design requirements focusing on exploration beyond low-earth orbit. Orion was initially intended to have a crew of six which was reduced to four to save weight. It's proposed launch vehicles were called Ares I and Ares V and patterned after the Space Shuttle's solid rocket boosters, external tank, and propulsion systems[22].

Ares experienced a mostly successful launch in October 2009 but overall Constellation program costs reached $9 billion as of February 2010[23]. This program has received numerous critical evaluations for uncertain cost estimates, cost growth, major technical problems, and consisted delayed timelines. A July 2006 GAO report to the House of Representatives Science Committee's chair and ranking members determined that NASA could not give a firm estimate of what it will take to meet Constellation program architecture within its projected budget estimated at $31 billion through Fiscal Year 2011[24].

In April 2009, the Congressional Budget Office (CBO) issued a report saying that meeting Bush Administration "Vision for Space Exploration" goals would require NASA to reduce its aeronautics research and science budgets by over 40%. CBO went on to mention that current NASA program development costs would increase by 50% on average saying that if overall annual NASA funding was maintained at $19.1 billion and NASA realized cost growth consistent with historical data, that its planned exploration schedules would be significantly delayed. It went on to contend that Ares I and Orion launch would be delayed until at least late 2016, human return to the moon until 2023, and 15 of 79 projected science missions would be delayed past 2025[25].

An August 2009 GAO report mentioned that Ares I and Orion represent up to $49 billion of the estimated $97 billion to be spent on Constellation through 2020. It went on to add that even though it has spent over $10 billion in program contracts, that NASA did not know how much Ares I and Orion would cost until technical and design problems were addressed[26]. These continual problems with Constellation resulted in its congressional cancellation in the 2010 NASA Authorization Act[27].

Section 303 of this statute directed NASA to develop the Orion Multi-Purpose Crew Vehicle (MPCV) to use existing contracts, investments, workforce, and

capabilities from Constellation and the Space Shuttle programs to achieve full operational capability for MPCV by December 31, 2016 with the following minimum capabilities funded at $1.2 billion annually for Fiscal Years 2011-2013:

- Serving as the primary crew vehicle for missions beyond low Earth orbit;
- Conducting regular in-space operations, including rendezvous, docking, and extra-vehicular activities and delivering payloads to the International Space Station (ISS);
- Providing an alternative means of delivering crew and cargo to ISS if commercial or partner-supplied vehicles cannot; and
- Having the capacity for efficient and timely evolution including insertion of new technologies[28].

Three years after its creation, MPCV faces continuing problems. A March 2012 GAO report noted that, contrary to congressional intent, that MPCV's first non-crewed flight is not scheduled until 2017 and the first crewed flight until 2021. In addition, MPCV budget estimates for short-term planning were found to be sufficient but inadequate for developing a program baseline. At this time, NASA had not conducted a program risk analysis and program financial reserves were determined to be insufficient. Further complicating matters is the program not

having a specific mission guiding its design. GAO contended that NASA was currently considering 15 potential missions ranging from ISS low earth orbit utilizations, to lunar surface operations, to landing on Mars[29].

Congressional frustration with MPCV program development has been acute. On May 18, 2011, the Senate Commerce, Science, and Transportation Committee and its Space Subcommittee's chair and ranking member sent a letter to NASA Administrator Charles Bolden expressing displeasure with program progress. They requested that NASA provide them and committee staff with bi-monthly meetings on program developments and demanded information on the progress of various reports required by the 2010 NASA Act by June 3, 2011[30]. NASA provided only a partial response to the May 18 letter and withheld documents describing its compliance with the 2010 law. This resulted in a subsequent June 22, 2011 letter from Senators Jay Rockefeller (D-WV) and Kay Bailey Hutchison (R-TX), the Committee's chair and ranking member, to Boldin informing him that the committee would subpoena him if these documents were not received by June 27, 2011[31]. The committee subsequently issued a subpoena on July 27, 2011[32].

On September 14, 2011, NASA announced the design of its commercial launch system but this could not stop continued congressional frustration with NASA over MPCV program progress. This was reflected in a September 12, 2012 hearing by the House Science Committee's Subcommittee on Space and Aeronautics as Committee Chair Rep. Ralph Hall (R-TX) noted saying he could see no evidence that MPCV service module development which is required to support multiday missions has begun, that NASA had not designated a mission beyond landing on an asteroid, and that it was unbelievable that a trip beyond low-earth orbit would not include the moon as a destination[33].

NASA Deputy Associate Administrator for Exploration Systems Development Dan Dumbacher attempted to assuage committee concerns by saying that the MPCV's Orion service module would be used in a uncrewed flight exploration test in 2014 which would be a two-orbit high-energy reentry test mission intended to obtain critical performance data to confirm spacecraft design and eventually reduce cost. Lockheed Martin Vice President and Orion Program Manager Cleon Lacefield appealed to congressional parochialism by emphasizing business suppliers in 41 states contributed to Orion program development and that program testing occurred in states such as Alabama, Colorado, Florida, Mississippi, and Virginia[34].

Subcommittee Chair Rep. Steve Palazzo (R-MS) asked Dumbacher how MPCV and related NASA programs can address development challenges occurring under flat funding through the scheduled December 2017 uncrewed flight. Dumbacher contended that this program was set to deliver on its planned 2017 and 2021 launches stressing the critical importance of funding stability to meet program objectives. He also reassured Rep. Mo Brooks (R-AL) that the Obama Administration was committed to this program and that it would not be cancelled as Constellation was[35].

Rep. Dana Rohrabacher (R-CA) expressed concern about the lack of certainty in MPCV program budget requests and questioned whether MPCV could be launched from existing Delta rocket assets. Rep. Hanson Clarke (D-MI) expressed concern with avionic and electronic supply chain problems this program has had finding such materials in the U.S[36].

Continuing concern about MPCV viability was expressed an August 2013 NASA OIG report. Programmatic technical risks documented in this analysis include:

- Spacecraft weight exceeding launch safety recommendations by 7%;
- Vehicle Test and Verification Plan being high risk because of eliminating or combining several tests due to funding constraints;

- The Avcoat heat shield, serving as a protective barrier during atmospheric reentry, has shown tendencies to crack under thermal conditions comparable to those the capsule will experience in the deep space environment prior to reentering the Earth's atmosphere;
- The heat shield production schedule may not be completed and delivered to the Kennedy launch center in time to begin assembly, testing, and launch operations due to parts availability, fabrication complexity, and staffing and training problems. Avocoat's material uniqueness gives NASA no substitute material alternatives; and
- Computer systems problems in managing engineering data and drawings cause design engineers to experience 3-5 hours of delays when trying to extract drawings from the database. This increases the possibility that a December 2017 scheduled flight date cannot be met[37].

A related program impacting MPCV is the Ares I mobile launcher which will launch MPCV. NASA OIG has emphasized that NASA has generally met cost, schedule, and performance milestones for this launcher. However, it also cautioned that NASA's ability to identify additional technical risks in modifying the launcher and accurately estimate future operating costs through the program life cycle is limited by the launch program's relative immaturity and the evolvable

nature of these vehicles. OIG urged NASA to develop a functional Exploration Systems Integration Strategy to monitor planned modifications and related cost estimates and that failure by MPCV and other programs to effectively communicate their requirements will compromise the accuracy of mobile launcher budget and schedule estimates and overall program utility[38].

5. James Webb Space Telescope

The James Webb Space Telescope (JWST), mentioned earlier, has also proven to be financially and managerially problematic. JWST was originally called the Next Generation Space Telescope and its provenance dates back to 1997 when its cost was projected at $500 million and launch date was scheduled for 2007. JWST was intended to be the Hubble Space Telescope's successor and its main technical features included a 6.5 meter diameter mirror optimized for observing infrared light which Hubble could not and orbit nearly one million miles from earth which would enable it to produce scientific discoveries, glimpsing the origins of galaxies, and providing insights into early planet and star formation[39].

This telescope was identified as a top priority in the National Academy of Science's 2001 Decadal Survey *Astronomy and Astrophysics in the New Millenium* with an estimated program cost of $1 billion[40]. However, the subsequent

decade has seen JWST plagued by continual delays and cost increases. In summer 2002 the cost was estimated to be $2.5 billion; Northrop Grumman was awarded prime contractorship; and 2010 was targeted as the launch date. By March 2005, NASA reported further cost growth and increasing life-cycle costs which reached $4.5 billion and a two-year schedule slippage. During 2006, NASA appointed independent review teams who concluded that while JWST had sound scientific performance and technical content acute concerned over program early year funding constraints remained[41].

A July 2008 program confirmation review placed JWST baseline lifecycle cost at $5 billion and launch date in June 2014. In June 2010, Senator Barbara Mikulski (D-MD), the Chair of the Senate Appropriations Committee's Subcommittee on Commerce, Justice, and Related Agencies requested an independent review of JWST. An Independent Comprehensive Review Panel (ICRP) lead by John Casini, the Assistant to the Jet Propulsion Laboratory Director was established and it issued its report in October 2010. ICRP report findings attributed JWST problems to budget and program management while praising its technical performance, noted that the earliest possible launch date was July 2015, that program costs would increase to between $6.2-6.8 billion, and restructuring JWST's Project

Office at the Goddard Space Flight Center to ensure its managed with emphasis on life cycle cost and launch readiness date[42].

In September 2011 new JWST planning was reapproved with a new baseline cost estimate of $8.8 billion and an October 2018 launch readiness date. Testifying before the House Science Committee on December 6, 2011, NASA JWST Program Director Rick Howard stressed NASA's determination to improve JWST's program performance and delivery schedule for NASA, the Obama Administration, and Congress. He went on to mention that remaining program technical challenges included developing and testing instruments, sunshield, spacecraft, and primary mirror backplane support structure, and integrating and testing systems for validating in-space performance and integrated observatory models. Howard also stressed that JWST would be 100 times more sensitive than Hubble; that its mirror collecting area is six times larger than Hubble; that it will see solar systems forming in our galaxy; significantly advance dark matter and dark energy knowledge; and potentially detect the presence of liquid water on planets around other stars consequently indicating if such a planet could support life[43].

Some committee members expressed skepticism when NASA witnesses were unable to specify what other NASA priority programs they favored reducing if JWST was such a high priority for NASA despite its repeated cost overruns within the context of multitrillion dollar national debt[44].

A December 2012 GAO assessment of JWST revealed some improvements but continuing problems. GAO said that the current program cost estimate is not fully consistent with some of the best practices for developing reliable and credible cost estimates. It also mentioned that JWST has taken several steps to improve communications and project oversight with its contractors including taking over responsibility for mission systems engineering from the prime contractor; instituting meetings including various levels of NASA, contractor, and subcontractor management; and implementing a new risk management system for facilitating better risk tracking[45].

Remaining JWST problems include instrument difficulties having delayed the first integration and test effort; key long-term risk on subsystems requiring significant work which will not be completed until 2016; travel budget reductions may require JWST to adjust its oversight approach; and NASA officials not having a plan in place to address this contingency. A key finding is that JWST will experience significant challenges throughout its duration given the significant size

and complexity of remaining work with four of six major program systems: spacecraft, sunshield, ground system, and optical telescope element, and integrated science instrument module having nearly 50% or more of their work remaining based on current budget information[46].

6. Weather Satellite Management

NASA collaborates with the National Oceanic and Atmospheric Administration (NOAA) and the Air Force in managing the National Polar Orbiting Operational Environmental Satellite Program System (NPOESS) to provide critical forecasting and global climate monitoring through 2026. This program began in 1994 when a Presidential Decision Directive required NOAA and DOD to converge existing satellite programs into a single program capable of meeting both civilian and military needs. The contract for this was initially awarded in August 2002, but NPOESS has been plagued by continual problems including its cost estimate doubling to nearly $15 billion dollars; launch dates have been delayed by over 5 years; significant functionality has been removed from the program; and GAO reported that the tri-agency management structure has proven ineffective in a September 11, 2013 report to the House Science Committee's Chair and Ranking Member[47].

These ongoing NPOESS problems were so persistently severe that GAO designated gaps in weather satellite data a high-risk problem in its February 2012 High-Risk report series. This designation occurred because there is a substantial risk of a gap in polar satellite data in the afternoon orbit; between the time the current polar satellite is expected to be in orbit and operational which could cover from 17-53 months or more depending on the current satellite's lifespan and potential delays in launching or operating the new satellite. Further coverage gaps may occur if forthcoming DOD satellites do not work as intended since two remaining satellites have been in storage for over a decade and will be old by the time of their launch. In addition, NOAA officials contend a satellite data gap would produce less timely weather forecasts and warnings of extreme events including hurricanes, storm surges, and floods. An example of the potential consequences of less timely and accurate weather forecasts was provided by the European Union supported European Centre for Medium Range Weather Forecasts which said NOAA forecasts of Hurricane Sandy's Track could have been hundreds of miles off without polar-orbiting satellites and could have shown this storm remaining at sea instead of identifying a New Jersey landfall within 30 miles 4 days before landfall[48].

GAO recommended NOAA take the following steps to remove NPOESS from the High-Risk designation including:

- Deciding whether and how to expend support for legacy satellite systems so their data could be available if needed;
- How much time and money it must invest in improving satellite models so they can assimilate data from alternative sources;
- Determine whether to pursue international agreements for access to other satellite systems and the best way to resolve security problems with foreign data;
- When and how to test the value and integration of alternative data sources' and;
- How such preliminary mitigation plans are to be integrated with long-term agency plans for sustaining weather forecasting capabilities and identifying time frames when such decisions will be made[49].

Congressional frustration with NPOESS was noted in a June 27, 2012 hearing when Rep. Paul Broun (R-GA), the chair of the House Science Committee's Subcommittee on Oversight and Investigations, noted that this was the ninth hearing held on this program and its predecessor since 2003 and this did not

include hearings held on the Geostationary Observational Environmental Satellite (GOES-R) weather satellites in general. Broun went on to maintain that NPOESS was originally supposed to produce six satellites operating in three separate orbits, carry thirteen instruments, and launch in 2010 before lamenting that it now only had three satellites, operated in one orbit, cost twice as much as intended, and did not have a baseline cost or schedule[50].

He also went on to mention that the Senate Appropriations Committee had proposed transferring weather satellite programs from NOAA to NASA, that the Obama Administration had proposed moving NOAA to the Interior Department, and that the Senate proposed removing the satellite program from NOAA consequently removing $2 billion of that agency's $5 billion budget. In addition, he contrasted NPOESS' anemic performance which he noted appeared to be progressing in delivering its spacecraft and ground system within cost and schedule[51].

September 2013 GAO recommendations on NPOESS recommended the following actions to NOAA:

- Tracking the extent key satellite data users groups are using the Suomi National Polar-Orbiting Partnership and Joint Polar Satellite System (JPSS) products and obtaining feedback on these products;
- Establishing a complete JPSS program integrated master schedule which includes logically linked sequence of activities;
- Addressing shortfalls in ground system and spacecraft component schedules;
- Completing the integrated master schedule and addressing component schedule shortfalls and updating the JPSS-1 joint cost and schedule confidence levels if warranted and justified; and
- Establishing a comprehensive contingency plan for potential satellite data gaps in polar orbit including specific contingency actions and defined roles, responsibilities, timelines, and triggers, along with analysis of the impact of lost data from morning orbits[52].

7. Congressional Dysfunction

Although NASA has frequently exhibited poor management performance in producing program delay and waste, this is at least equally matched by congressional oversight and budgetary dysfunction. A key problem is congress' troubled annual agency budget appropriation process. Congress passes agency

appropriation bills in twelve separate chunks covering multiple agencies. For instance, NASA's budget is part of annual budget appropriations for agencies including the Commerce and Justice Departments and science agencies[53]. The appropriations process gives committees the ability to place significant and often burdensome controls on agencies ability to spend and transfer funds, and restrict agencies room to maneuver which has often produced presidential signing statements expressing frustration with certain legislative limitations on agency programming[54].

When these factors are added with significant personnel changes on relevant committees, the desire of committee members and staff for career advancement, volatility in partisan control of Congress and the presidency over the past decade, and conflict between the House and Senate stemming from volatility in partisan control over these chambers from 2007-present, it is no wonder NASA and other federal agencies have had difficulty fulfilling their operational responsibilities. The last time a "clean" NASA budget was agreed to by Congress and signed by the President was Public Law 109-108 signed by President George W. Bush on October 22, 2005[55].

During the subsequent decade, NASA's annual appropriation bill has been inserted into either omnibus appropriation bills or continuing resolutions due to

the failure of presidential and congressional leadership of both parties to achieve agreement on program funding levels and oversight priorities to achieve timely funding for NASA programs within the traditional budget process. The regular use of continuing resolutions makes it necessary for some programs to be funded for as little as a few weeks until lengthier appropriations periods can be achieved. This has made it difficult for NASA and other agencies to develop continuity and efficiency in program performance management due to irregular and frequently dysfunctional congressional leadership and oversight in providing consistent funding streams for agency programs[56].

A further example of dysfunctional congressional oversight affecting NASA is the excessive number of reports it requires NASA to compile. A May 4, 2014 *Washington Post* story mentioned that the number of congressionally required federal agency reports has risen from 303 in 1928, to 759 in 1970, to 3,448 by 1990, to 4,673 by April 2014[57]. Examples of legally mandated reports NASA was required to file to Congress in 2013 included the semiannual *Activities Report* of NASA's Inspector General, a report determining if it's in the public interest to use noncompetitive procedures for a specific procurement, a report documenting the disposal of land exceeding $50,000, a strategic plan for minimizing job losses when the space shuttle transfers to a successor program, reports on NASA's

contribution to innovation and its establishment of space settlements, and collaborations on biomedical research with the former Soviet Union. It defies logic to expect the members and staff of the House and Senate Science Committees and their appropriations committees to have time to read and digest all of these reports to perform effective oversight. Congress must examine which reports can be consolidated or eliminated to facilitate more effective oversight[58].

8. Conclusion

Like all federal agencies, NASA faces acute management challenges and fiscal constraints in an era of increasing public skepticism about its programs and U.S. Government programs in general. NASA must restructure itself to improve its managerial efficiency and institutional viability. It should explore consolidating its geographically dispersed facilities even if this causes economic and political pain in the communities and congressional districts where these facilities are located. NASA should also transfer its aeronautics programs, whose budgets are expected to average $566 million per year through FY 2018 to the Federal Aviation Administration so it can concentrate exclusively on space science and policy. NASA should also make prudent and selective use of the U.S. commercial space

industry which generated $340 million in revenue during 2013 to expedite launch schedules and allied foreign countries commercial space industries[59].

Congressional oversight committees and appropriators need to make sure they fund space programs which are truly oriented toward advancing national space policy goals instead of serving as economic stimuli for local programs for advancing their reelection prospects. These programs must use top private sector best practices in project management and administration and Congress must implement and strictly enforce program progress and spending goals to ensure taxpayers receive tangible results on how their tax dollars are spent. Congress must also be willing to terminate these programs if they exceed spending targets and fall behind in achieving program goals regardless of how politically unpopular such action may be or how scientifically meritorious such programs may be.

Considering the problems NASA has had with NPOESS, it should withdraw from this program and let it be administered by NOAA and DOD and explore possible cooperation with the European Centre for Medium Range Weather Forecasts. JWST should have October 2018 set as its final launch date or face potential termination and the MPCV should also have a specific initial launch date set in 2017 as mentioned in the 2012 GAO report on this program or face termination.

NASA's space programs must be seen by the public as being timely and cost effective and meeting national space priorities if they are to survive in these fiscally constrained times. NASA, the Presidential Office of Science and Technology (OSTP) and congressional oversight and appropriation committees must work diligently, collaboratively, and with realistic goals to achieve these objectives if the U.S. civilian space program is to survive. These same prescriptions for timeliness, fiscal and managerial efficiency, and realistically meeting broad national objectives, instead of parochial local interests, also apply to other U.S. Government supported and sponsored science and technology programs.

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