



***The Future of NASA: Perspectives on Strategic Vision for
America's Space Program***

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Chairman Hall, Ranking Member Johnson and distinguished members of the committee, thank you for the opportunity to discuss NASA's strategic vision for America's space program. I am Marion Blakey, President and Chief Executive Officer of the Aerospace Industries Association (AIA), the nation's premier trade association for aerospace and defense manufacturers. Before I begin, I would like to thank Chairman Hall for his leadership on the House Science, Space and Technology Committee. Chairman Hall's tenure as chair has been invaluable in promoting our nation's civil space program. I also want to congratulate Rep. Lamar Smith for being selected as the next committee chairman in the 113th Congress; he has some big boots to fill!

The Aerospace Industries Association (AIA) represents over 350 aerospace manufacturing companies and their highly-skilled employees. These companies make the spacecraft, launch vehicles, sensors, and ground support systems employed by NASA, NOAA, the Department of Defense, the National Reconnaissance Office (NRO), other civil, military and intelligence space organizations throughout the globe, and many of the commercial communication satellites. This industry sustains nearly 3.5 million jobs, including much of the high-technology work that keeps this nation on the cutting edge of science and innovation. The U.S. aerospace manufacturing industry remains the single largest contributor to the nation's balance of trade, exporting \$89.6 billion and importing \$47.5 billion in relevant products, for a net surplus of \$42.1 billion. Our nation's aerospace industry strength is, in large measure, due to the investments made by the U.S. government stretching back more than 75 years to the precursor to NASA, the National Advisory Council on Aeronautics which made fundamental research into airfoils, structures, propulsion and other key technologies. NASA's aeronautics investments continue today and while they are less than they were in the past, they still provide valuable investment in fundamental aeronautical research.

As you know, the space sector within U.S. industry remains closely impacted by U.S. government space programs. In recent years, our nation's space industrial base has been struggling to adapt to reduced demand by government—especially due to the end of the Space Shuttle program—and downward pressures on DOD, NASA, and NOAA budgets that threaten to exacerbate the risk to the industrial base.

AIA believes that any examination of NASA's strategic direction should include consideration of the health of the U.S. aerospace industrial base to ensure that our national space capabilities for U.S. government and commercial markets remain second to none. By maintaining stability in objectives for NASA programs, and proactively strategizing equitable management of possible fiscal austerity at NASA, the industrial base can be put in a position to succeed for the benefit of our nation's security, science, and exploration programs.

Although AIA is highly supportive of policies and laws that encourage stability in the space industrial base, our support for NASA and the nation's space programs is rooted in a fundamental belief that U.S. space programs have been and continue to be a force of good for our nation.

Space exploration is an irreplaceable, transformative intellectual stimulus for steady, sustained growth in STEM workforces. Frequently those students that were inspired by dramatic space activities become our nation's scientists, doctors, mathematicians, engineers, and technicians in a wide variety of highly technical fields that are critical to U.S. competitiveness.

In a new report, *Space in our World*, AIA outlines how space systems help improve our lives in a myriad of ways. Today, it's not just about spin-offs. Astronauts on the International Space Station are researching vaccines in microgravity lab conditions that can't be replicated here on Earth. Earth observation satellites and the Global Positioning System prepare and guide first responders during disasters like the 2010 earthquake in Haiti. Weather satellites provide advanced warning to the emergency response officials and the public about hurricanes and other severe storms like Hurricane Sandy. Missile detection satellites warn warfighters and civilians of impending danger. Robotic space missions shed light on the laws of nature and help us understand how our planet works.

NASA space programs are an awe-inspiring success story of American character and leadership. Successful space programs not only create a culture of innovation across the nation, they require it. Technological innovations developed for space programs are often later applied to other fields like medicine or emergency management—frequently saving lives on Earth, and growing prosperity for our national economy. NASA space programs also play a key role in garnering soft power and enhancing American leadership abroad. Look no further than the 16-nation partnership on the International Space Station for a high-profile example of American leadership in innovation.

AIA sincerely believes that those who lead in space lead on Earth. As a vital source for new STEM professionals, an exceptional symbol of American strength, a foundry of cutting-edge innovation, NASA is an essential investment in our nation's future.

The need for stability in program objectives

In order to succeed, NASA needs stable long-term investment and steady policy goals; it is this stability in the past that has enabled its greatest triumphs, from the Moon landings and the Space Shuttle, to the tremendously successful Hubble Space Telescope and the ongoing International Space Station. Stability in NASA program objectives is essential to both program success and the health of the U.S. aerospace industrial base.

Another major contributor to our success has been a bipartisan commitment to strong space programs. Space is an arena where the magnitude of the challenges involved requires consistent focus and effort despite partisan power shifts in our legislative and executive branches of government and steady investment despite the economy's ups and downs.

Historically, our space program has exhibited remarkable stability. The Apollo lunar landing – first proposed by President Kennedy at Rice University in 1962 – was actually witnessed in 1969 by President Nixon, the same politician who was defeated by Kennedy nine years earlier.

Similarly, the Space Shuttle program, first approved by President Nixon in 1972 during an economic boom was funded through the energy crisis of the 1970s and finally flown under President Reagan during the deep recession of 1981. During the Carter Administration and the troubled energy crisis period of the 1970s, NASA launched the two Voyager missions on their journeys through the solar system and beyond.

The examples continue throughout our nation's space history – the International Space Station, the largest international scientific and engineering initiative in human history began as a NASA proposal to the Republican President Reagan as a Cold War response by the Western allies to a Soviet space station. It was largely funded and built during the Democratic administration of President Clinton – who was often embroiled in highly partisan battles with the Republican led –Congress. On Capitol Hill, bipartisan consensus has been much more the rule than the exception over this five-decade period even as party control has shifted over time.

More recently, the end of the Space Shuttle Program, the cancellation of the Constellation Program, and delays in agreeing upon a path forward between the Administration and Congress brought significant upheaval to the aerospace industrial base. Nevertheless, AIA believes the NASA Authorization Act of 2010, and the 2011 NASA Strategic Plan that implemented the Act, provided much needed stability through bi-partisan agreement. It is precisely this type of stable, clear and consistent objectives that is essential to assure future industry investments and encourage the recruitment of new aerospace talent.

AIA is mindful of the fiscal challenges facing our nation but while funding in this environment may be difficult, so was space program funding for the Russian government after the fall of the Soviet Union. But they persevered and while still have challenges today, Russia has been able to remain a major space power – witness that today, NASA pays them to send astronauts into space. Similarly, in the US, the Shuttle Program was supported in the stagflation of the '70s and for ISS in the early '90s recession. In both cases, perseverance paid off, and we are confident it will once again.

A balanced approach for human spaceflight

In the case of NASA's long-term strategic goals, AIA agrees with the agency's emphasis on three priority programs, which stand to enable a host of nationally important space capabilities.

First, the ISS is an irreplaceable national laboratory for scientific study that must be robustly utilized in order to provide returns on tax payer investment. Full utilization in the post-Space Shuttle era depends on completing new domestic access to ISS for American

astronauts. NASA's Commercial Crew program will re-establish American access to ISS and end reliance on the Russian Soyuz. NASA's commercial initiatives are already paying off as shown by recent commercial deliveries of cargo to the ISS. In addition to independent access to the ISS, these programs develop new commercial space capabilities and free NASA resources to execute its plans for human exploration beyond Earth orbit.

U.S. industry is already investing its capital and innovation to support this new future, and U.S. government agencies and the Congress have also taken key steps that have helped foster these new initiatives. Stability in these programs is needed for industry to demonstrate to investors and industry that government will live up to its commercial commitments.

As the NRC report notes, a consensus has not been widely agreed upon for human space exploration in the out years, however, first, the Orion Multi-Purpose Crew Vehicle and the Space Launch System (SLS) are the essential building blocks for NASA to go beyond Earth orbit, no matter what the destination. Significant progress is being made daily on these programs at our companies. In July, the first Orion capsule for flight was shipped to Florida for launch. Just last Wednesday, the upper stage engine for the SLS was test fired for over 1,200 seconds. Developmental progress of the Orion and SLS must continue to ensure these capabilities are available for mission sets beyond the planned 2017 and 2012 missions. Bringing new launch vehicles and spacecraft on line takes time; strong progress can be made now even if the timeline of destinations is not yet outlined in detail.

For example, the U.S. government's anticipated need for a large and powerful rocket engine initiated the F-1 rocket engine program in the 1950s – well before President Kennedy's Moon Program announcement. Although it was not yet known how the F-1 would be used at the outset of development, the program began in anticipation of likely future needs. In fact, the F-1 took over 7 years to develop, and would never have been ready to enable Apollo without this early start. The F-1 of course, would later power the Saturn V launch vehicle for the Apollo Moon missions, Skylab missions, and Apollo-Soyuz mission – none of which had been defined when F-1 development began in 1955 – three years before NASA was created. The basic F-1 engine capability was foundational to a number of mission profiles for the human spaceflight program, and the Orion and SLS will be used for a variety of beyond Earth orbit destinations that have yet to be defined.

By continuing development of Orion and SLS, work force capabilities and the industrial base are not only preserved but grown. Orion has made major progress leading up to its first test flight in 2014. The core stage of the SLS is well into a technical design and manufacturing phase, and former Space Shuttle engines are ready for utilization by SLS. Continuing SLS and Orion are necessary to enable a human spaceflight missions beyond Earth orbit to a variety of destinations, sustain the health of the space industrial base needed for national programs, and inspire new generations of young people.

In 2009, due to funding and program challenges, the Constellation human exploration program was cancelled, and in 2011 the Shuttle Program ended. Further interruption of the human spaceflight program would be devastating for the program and the industry, yet

funding prospects are at risk. Although the Orion and SLS budgets have planned for an austere environment, repeatedly starting and stopping programs risks the industrial base—many parts and component suppliers to larger prime contractors simply cannot absorb major acquisition disruptions when the order volume of components is already so low in the space industry. Many suppliers design and fabricate unique, one-of-a-kind parts for the entire space industry. Additional program instabilities will put such suppliers out of business, and raise the fixed cost for other U.S. government space programs, just as Shuttle’s retirement raised costs for DOD solid rockets. Finally, major primes or other major companies could decide to exit the business and seek more stable opportunities elsewhere, depriving NASA of their unique capabilities.

The current Orion, SLS, and Commercial Crew program structure is part of a bi-partisan agreement between the White House and the Congress. These systems fulfill the Columbia Accident Investigation Board’s conclusion that exploration beyond Earth orbit is a fundamental reason for human space exploration. This perspective also reflects widespread consensus, codified by law that the United States should enable an expanded commercial presence in, and access to, low-Earth orbit, as elements of a low-Earth orbit infrastructure. In order to achieve this end and protect the space industrial base, the Orion, SLS, and Commercial Crew programs should continue as planned.

Maintaining global leadership in space science

Space science programs at NASA have nurtured crown-jewel capabilities in our space industrial base while answering important questions about our planet, our solar system, and our universe. The agency appropriately emphasizes the need to continue this proud legacy with steady investment for future missions, especially when it comes to the NASA priority science mission, the James Webb Space Telescope (JWST). JWST will be NASA’s premier telescope for answering bold, paradigm-shifting questions, including questions of the origin and nature of the universe, galaxies, stars, and planets. Already the JWST primary mirror is complete, bringing the program one step closer to uncovering groundbreaking, new science insights.

It is important to recognize that U.S. scientific leadership is not a given, it is dependent on the will and commitment to fund innovative space science missions. If new space science missions are not built to carry the torch of progress from previous missions, U.S. world class research programs can be overcome by more aggressive international programs. The benefits of space science investments are far-reaching, and in many ways our leadership pays dividends in knowledge, prestige, and further innovation.

Although there is widespread support for strong space science programs at NASA, considerable stress can sometimes be placed on space science programs to cut costs and speed development. It’s important to remember that as the scientific community looks to answer bold, paradigm-shifting questions, the complexity of space science missions can grow to meet these challenges. As these missions become more sophisticated, the need for steadfast U.S. government commitment becomes all the more critical to success. The resolve of the U.S. government must remain strong to stay the course through to success.

Many space science missions face enormous challenges in accomplishing technical feats that have never been done before. They must also grapple with limited capacity of affordable, domestic space launch systems to low Earth orbit. Couple these challenges with an occasional launch failure and annual budget constraints, and an environment has been created in which space science missions face a daunting future. Look no further than the Earth observation community for evidence of an increasingly difficult situation for space science. The National Research Council recently reported, "that the nation's earth observing system is beginning a rapid decline in capability, as long-running missions end and key new missions are delayed, lost, or cancelled."¹ With such an increasingly difficult environment coalescing on space science, it is all the more necessary for the U.S. government to maintain a steady resolve for future mission development. The space industrial base that has enabled incredible U.S. achievements in space science can only be sustained for future missions if a steady commitment is maintained by the U.S. government to continue these missions.

Interagency Partnerships

NASA's unique capabilities and competencies are world renowned, and incredibly important to other agencies within the U.S. government. NASA's role in reimbursable government agreements is important to the continued operation of several critical government programs. Of special importance remains NASA's reimbursable work for the National Oceanic and Atmospheric Administration (NOAA) on weather satellites. As the developer of the nation's weather satellites, NASA plays an essential part in protecting our safety and our economy from natural catastrophes. Additionally, NASA is also a key partner in the operation of the Landsat program at the U.S. Geological Survey at the Department of Interior. Landsat is a vital Earth observation system for U.S. Government land and coastal surveys. NASA also maintains a partnership with the Department of Energy to ensure the nation's deep space exploration systems have access to non-weapons grade plutonium-238. Without such fuel, space exploration to the outer planets and beyond becomes impossible. AIA encourages the continuation of these reimbursable agreements to meet important national requirements.

International Partners in Space

From the Canadian Tele-robotic Arm and the European Spacelab on the Space Shuttle to the truly International Space Station (ISS) as well as a wide range of programs in between including the Cassini/Huygens mission to Saturn, the SOFIA infrared telescope and even the Curiosity Rover now on Mars, international cooperation has been essential to doing truly great things in space while providing value to taxpayers of all nations and improving relationships among the partners. International partnerships also integrate well with a

¹ Report Warns of Rapid Decline in U.S. Earth Observation Capabilities; Next-Generation Missions Hindered by Budget Shortfalls, Launch Failures," <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=13405>, Accessed 13 June 2012.

capabilities based exploration architecture as new partner contributions can be added over time based on partners' technical and financial ability to contribute. We see international partnerships as essential to NASA's future success with proper regard to national security and other national considerations, including the potential impacts on the U.S. industrial base. AIA will seek to work with NASA to help understand the industrial base consequences of cooperative agreements and assure that such agreements are truly win-win propositions for both sides.

Managing fiscal austerity

In addition to stability in program objectives, budgetary conditions at NASA also threaten to affect program effectiveness and space industrial base health. As of now, the Budget Control Act is law, and without a legislative solution, across-the-board cuts to NASA will begin in January 2013. A cut of 8.2% to NASA's budget next year would immediately eliminate \$1.6 billion from the agency and significantly affect its strategic direction. Should the 8.2% cut be enacted, the impact on programs would likely be magnified by the NASA Authorization Act of 2010 that forbids NASA employee layoffs through FY13.

In a July 2012 AIA report on the effects of the Budget Control Act on federal agencies, it estimated that sequestration will put at risk 2.14 million jobs in 2013 alone.² Today, AIA released a report highlighting the economic impact from sequestration on civil space programs. The analysis conducted for AIA by Dr. Stephen S. Fuller, Dwight Schar Faculty Chair and director for Regional Analysis at George Mason University, revealed that an 8.2 percent cut to the agency's budget would amount to a loss of over 20,000 jobs nationally in 2013 alone. Additionally, the NASA Authorization Act of 2010 prohibits any cuts to the civil servant work force through fiscal 2013. As a result all of these lost jobs would come exclusively from the private sector.

The loss of more than 20,000 jobs would be significant – many of these are scientists, engineers, and technicians that design, manufacture, and operate our nation's spacecraft. In short, these are the best high-skilled jobs our economy has to offer. Such a dramatic collapse in our technical workforce would equate to a major loss in national capability. It's important to remember that much of the same space industrial base that serves NASA also provides essential government capabilities for communications, weather observation, remote sensing, GPS, and other satellite systems that are an integral part of our nation's infrastructure and economy. It should also be noted that an 8.2 percent reduction in the NASA budget would be multiplied by the number of subcontractors, many of which are small and disadvantaged businesses.

A NASA budget sequestration would also deal major damage to those regions with high concentrations of aerospace activity around the country, better known as industry clusters.

² Fuller, Stephen S., *The Economic Impact of the Budget Control Act of 2011 on DOD and Non-DOD Agencies*. July 17, 2012. Retrieved from http://www.aia-aerospace.org/assets/Fuller_II_Final_Report.pdf

Many space companies directly support NASA missions by designing and building spacecraft, and frequently co-locate with NASA centers. Other companies that support NASA are significant economic drivers in other key aerospace clusters that have no NASA center. A NASA sequestration would result in far reaching and lasting losses for major aerospace clusters beyond the space industry. The following appendix tables outline several key space clusters around the country that stand to experience crippling losses from sequestration.

**State Impacts of NASA Procurement Spending Reductions
under the Budget Control Act of 2011
Fiscal Year 2013**

(dollars in thousands, jobs are actual number)

The eleven states examined in this table account for
91.8% of NASA procurement funding.

State	Direct Impact	Total Output *	Labor Income	Jobs Losses
Texas	\$320,171	\$751,121	\$272,799	5,610
California	293,443	699,393	215,676	4,586
Colorado	125,582	291,741	107,301	2,121
Maryland	127,282	238,974	78,022	1,520
Alabama	75,870	153,693	56,661	1,369
Florida	72,100	158,942	59,563	1,366
Utah	47,213	106,768	39,411	963
Virginia	52,524	108,626	37,052	713
Ohio	26,871	53,952	18,578	429
Mississippi	25,990	43,583	15,215	374
Louisiana	24,826	44,415	15,865	359
State Totals	\$1,191,873.80	\$2,651,208.80	\$916,143.60	19,410

Source: George Mason University Center for Regional Analysis

*Reduction from Gross State Product.

**National Impact of NASA Spending Reductions
under the Budget Control Act of 2011
Fiscal Year 2013**

(dollars in thousands, jobs are actual number)

Nationwide	Direct Impact	Total Output*	Labor Income	Job Loss
Totals	\$1,298,190	\$2,843,651	\$1,018,358	20,682

Source: George Mason University Center for Regional Analysis.

*Reduction from Gross Domestic Product.

Regardless of the end result of the Budget Control Act this month, an austere federal budget environment is likely to be in place for some time. AIA therefore believes that NASA should take on equitable strategies maintaining program stability and the health of the aerospace industrial base in an era of leaner budgets.

Throughout NASA's history, from Mercury to Space Shuttle, the agency has seen major transitions from program to program. Although the agency has largely managed its workforce according to its budget and mission, there are some instances where the agency structure has not been specifically crafted for major programs at hand—sometimes with few modifications of the civil service workforce in response to program restructures, cancellations, or developments.

During such eras, the civil service workforce has remained steadily in place as the industrial partners to NASA programs face the brunt of program fluctuations. For example, following the Apollo Program, the agency budget declined by nearly 60%, while the civil service workforce reduction was only about 30%. In the modern era, from 2006 to 2012, the NASA Aeronautics budget went down by about 40%, but staffing levels are only down by 5%.

Despite the fact that it is aerospace companies that make the spacecraft, launch vehicles, sensors, and ground support systems employed by NASA, it is the industry workforce that absorbs almost all of the workforce layoffs during lean years. This puts the space industrial base in a precarious position. The industrial workforce that disproportionately absorbs program changes and cancellations must still serve the needs of NOAA, DOD, NRO, and other government agencies engaged in space operations.

As we face a likely era of lean federal budgets, AIA recommends that approaches be considered which better allow NASA to meet its strategic goals. For example, AIA urges

NASA to widely pursue commercial, academic, and government agency partnerships as a way to maintain and spread the cost of very expensive and unique assets, while making these assets available for NASA programs. And it urges NASA to fully utilize existing authorities (enhanced use lease, etc.) in doing so. The human and physical assets of NASA and its supporting industrial base represent a large and critical national investment that needs continual maintenance and upgrade. As pressures on budgets continue, sharing these assets is an effective way for NASA to strengthen the U.S. economy, to reduce cost of asset ownership, and to keep the assets available for the space program of the future.

Additionally, to allow NASA the freedom to appropriately adjust to space program realities, AIA recommends that future NASA Authorization Acts not include restrictive provisions on NASA civil service workforce like those seen in the NASA Authorization Act of 2010.

Conclusion

AIA is highly supportive of NASA's strategic direction, and the balanced, bipartisan approach that was agreed upon by the White House and the Congress in the NASA Authorization Act of 2010. Without the historically unique priority and resources of the Apollo program, we may have to settle for an incremental exploration program with greater international and private sector involvement, not a dramatic "Moon shot." But this does not mean we should abandon human exploration until all our problems are solved and the Treasury is flush with cash. While not as dramatic, such an approach can still produce a solid exploration program with real STEM education value while producing the technological and soft power benefits of U.S. space leadership—attracting talent and capital to our shores and add to our international reputation as a leading power in the 21st Century.

By steadily investing in the goals of the 2010 Act, the U.S. government can ensure the health of the U.S. space industrial base, while simultaneously building future space successes that have come to define American character and leadership. The resurgence in new human spaceflight system development is incredibly impressive: no other nation in the world is developing such a wide breadth of systems in the public and private sector. The continuous landmark successes in space science are unprecedented in the history of civilization, re-shaping our entire understanding of the universe. By building upon these successes with continued investment and policy support for the goals in the 2010 Act, the U.S. government can be assured its space program will remain worthy of a great nation.

I thank you for this opportunity to testify on behalf of the U.S. space industry and I welcome the opportunity to answer any questions that you may have.