The Aerospace States Association

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Agenda
Capitol Hill Hearing on STEM Education, Aviation and Space
March 9, 2009
Cannon House Office Building – Room 210

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Remarks
Lt. Governor Jari Askins
March 9, 2009
ASA Hearing on STEM Education, Aviation and Space

Good afternoon. My name is Jari Askins, and I am Lieutenant Governor of the State of Oklahoma. I will be chairing today's program organized by the Aerospace States Association. I send you greetings from ASA's Chair, Vermont Lt. Governor Brian Dubie, who is with an Aspen-Institute delegation to the middle east this week and regrets not being present at today's hearing. The ASA is a non-profit organization comprised of Lieutenant Governors and Governor-appointed delegates, who are focused on aerospace and how it affects state government interests such as education and economic development.

It is my pleasure to welcome you to the Aerospace States Association Capitol Hill Hearing on science, technology, engineering and mathematics (STEM) education,
Aviation, and Space. Over the past three years, the Aerospace States Association has held hearings on STEM education, NASA funding, FAA Reauthorization, and Export Controls. We took the results of the resolutions resulting from those hearings and created an ASA Aerospace Agenda that we presented to President Obama's Transition Team.

However, much has changed in the past three years. We now have a new administration in the White House and new members in Congress. The nation's economic landscape is quite different today than it was three years ago, too.

The decisions made by the Obama Administration and Congress have the potential to shape the direction of the nation's aerospace industry for years to come. Coordinated policies, increased resources, and strategies to ensure a business-friendly operating environment could boost innovation in aerospace and bring much needed economic benefits throughout the economy.

Today's hearing is a chance to revisit the issues addressed in the past as well as national security space and air transportation modernization. We have assembled distinguished panelists representing government, industry and nonprofit perspectives as a means to inform Washington policy makers about the issues that are important to the aerospace industry in each of our states.

The United States has been at the forefront of aerospace development since the early days of the 20th century. According to the Aerospace Industries Association, the industry supports 2 million middle-class jobs spread out over 30,000 companies in all 50 states. Cutting-edge technological advances in aerospace have contributed greatly to the nation's economic, scientific and national security leadership. However, our competitive advantage in aerospace is being challenged as other nations increase their investments in aerospace research and development as well as STEM and Career Technical Education, graduating significantly more scientists and engineers than the United States.

We start today's program with a panel on STEM education since it is the foundation upon which a strong aerospace sector is built. According to the National Academies report titled, *Rising Above the Gathering Storm*, American youth spend more time watching television than they spend in school. About one-fifth of 4th graders and one-third of 8th graders are unable to perform basic mathematical computations. In addition, those teaching math and science often lack degrees or certifications in the subjects they are teaching.

If these trends continue we will fall far short of developing the scientific, technically qualified, and numerically literate workforce that we need to sustain a robust and globally competitive aerospace industry in the 21st century.

I commend Congressman Mike Honda for introducing H.R. 6104, the Enhancing Science, Technology, Engineering and Mathematics Education Act of 2008, designed to improve the coordination of STEM programs at the federal level.

Following the STEM education panel will be the panel on aviation, specifically the Next Generation Air Transportation System (NextGen). The current system is insufficient to keep pace with projected demand. A safe, secure, and efficient air transportation system is essential to US prosperity and competitiveness in the global economy.

We will conclude with the Space panel, which will be divided into two segments, civil space and national security space. Landing on the moon was the pinnacle of America's achievements in science, engineering and technology. Space technologies have improved our standard of living through such advancements as the modern day GPS, precision farming, pharmaceutical manufacturing, and e-commerce. Today, space systems improve the operational responsiveness of the war fighter and enable policy makers to make informed decisions about the nation's security. I look forward to hearing the recommendations from our panelists for ensuring America's continued leadership in space.

Following the panel discussions, my fellow Lieutenant Governors, appointed delegates, and I will consider a resolution on each topic area. Once approved, copies of the resolution will be made available to you.

At this time, I would like to introduce Lieutenant Governor John Garamendi of California to make introductory remarks. He brings 32 year of public service to the office of Lieutenant Governor, having started his career as a Peace Corps Volunteer, then serving in the California State Assembly, Senate, as the State's first elected Insurance Commissioner, and as the Deputy Secretary of the US Department of the Interior.

[Lieutenant Governor Garamendi provides brief remarks.]

Thank you, Lieutenant Governor Garamendi.

It is now my distinct pleasure to introduce our next speaker, the Honorable Marion Blakey, President and CEO of the Aerospace Industries Association. Ms. Blakey assumed leadership of the AIA following a five-year term as administrator of the Federal Aviation Administration. Ms. Blakey will set the stage for today's hearing with her remarks and provide us with AIA's views concerning all three panels' issues.

[Ms. Blakey provides remarks.]

Questions for Ms. Blakey?

Thank you, Ms. Blakey for your insightful remarks that lay the foundation for the discussions to follow. We appreciate you sharing your time with us this afternoon and for your continued support of the ASA.

As we begin the panel sessions of today's program, I would like to remind my colleagues that a time has been reserved at the end of each panel for questions. I would now like to introduce our first panel that will address Science, Technology, Engineering and Mathematics—or STEM—education.

The first panelist to address this topic is Dr. Wanda Ward, Acting Assistant Director for Education and Human Resources at the National Science Foundation. Throughout her tenure at NSF, Dr. Ward has served in a number of science and engineering policy, planning, and program capacities. Please welcome, Dr. Ward.

Next, I would like to introduce Dr. Joyce Winterton, Assistant Administrator for the Office of Education at NASA Headquarters. She is responsible for the development and implementation of the agency's education programs that strengthen student involvement and public awareness about NASA's scientific goals and missions.

Our next panelist is Ms. Gay Gilbert, Administrator of the Office of Workforce Investment. In this role, she provides federal oversight and leadership for America's workforce investment system. A key focus for her office is ensuring that the nation's workers have the critical skills needed to succeed and that businesses have the talent they need to be competitive in the global economy.

Our next panelist is Mr. Jack Harris, Director of Advanced Manufacturing Technology for Rockwell Collins in Cedar Rapids, Iowa. Mr. Harris is involved in a number of local and national initiatives focused on improving STEM education.

And, concluding our STEM panel is Mr. Jim McMurtray, Executive Director of the National Alliance of State Science and Mathematics Coalitions. Thank you for joining us today.

[STEM panel provides remarks.]

Thank you, Mr. McMurtray, and to all of our panelists for shedding light not just on the STEM crisis but also on innovative ways to address this issue. I would now like to entertain questions for the panelists.

[Q&A session – up to 20 minutes]

Our next panel discussion will focus on aviation, specifically NextGen air traffic management. I would like to introduce our first panelist, Mr. Charles Leader, Director of the Joint Planning and Development Office, which is responsible for developing and coordinating the Next Generation Air Traffic Management System. Please welcome, Mr. Leader.

Next, we have Mr. John Meenan, Executive Vice President and Chief Operating Officer of the Air Transport Association. In this capacity, Mr. Meenan focuses on the technical, safety, security, environmental, economic and legal policy issues impacting the airline industry.

Representing the General Aviation Manufacturers Association is President and CEO, Mr. Pete Bunce. An active pilot himself, Mr. Bunce travels the world promoting general aviation on behalf of GAMA's membership of airframe, avionics, engine and component manufacturers. Please welcome, Mr. Bunce.

And, rounding out the aviation panel is Mr. Greg Principato, President of Airports Council International- North America. In this capacity, Mr. Principato oversees the association of airports and airport-related businesses in North America.

Thank you to all of our panelists for sharing your concern about the state of the nation's air traffic management system and for your support for the NextGen system. I would like to ask my colleagues if they have any questions for the panel.

[Q&A session – up to 20 minutes]

The final panel of our program today will focus on both Department of Defense space and Civil space. It's my honor to introduce Mr. Gary Payton, Deputy Under Secretary of the Air Force for Space Programs to provide his insights on this issue. In this capacity, Mr. Payton provides guidance, direction and oversight for the formulation, review and execution of military space programs including all space and space-related acquisition plans, strategies and assessments for research and development, test, evaluation and space-related industrial base issues.

Following Mr. Payton will be Dr. Peter Wegner, Director of the Operationally Responsive Space Office at Kirtland Air Force Base in New Mexico. In this role, Dr. Wegner oversees the development, demonstration, and fielding of space capabilities focused on timely satisfaction of Joint Force Commanders' needs.

Our next panelist, Dr. Richard O'Toole, will begin the civil space portion of our program. Dr. O'Toole is a member of the Jet Propulsion Laboratory's Executive Council in California. He is currently the Executive Member of the Office of Legislative Affairs and he serves as Vice Chairman of JPL's Strategic Management Council.

Next, we have Mr. Lawrence Williams, who serves Vice President for Strategic Relations Space Exploration Technologies (SpaceX), a new space company founded by dot-com entrepreneur Elon Musk. SpaceX is developing a family of launch vehicles intended to reduce the cost and increase the reliability of access to space.

Finally, I would like to welcome Dr. Thomas Zurbuchen, Professor at the University of Michigan in the Aerospace Engineering Department and representative for the Universities Space Research Association.

Thank you, Dr. Zurbuchen. I would like to ask if my colleagues if they have any questions for the space panel.

[Q&A session.]

I would like to thank all of our panelists today for your time and for imparting such valuable information on the pertinent issues impacting aerospace in each of our states. I would like to thank my colleagues for your thought provoking questions and our audience for their attention.

At this time, I would like to ask the Lieutenant Governors and their delegates to join me in deliberations on Resolutions of each of these issues that will reflect the presentations made today as well as propose solutions and actions.

[End of panels, Lt. Governors convene to discuss Resolutions.]

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Talking Points for
Lt. Governor John Garamendi
ASA Hearing
March 9, 2009

With the new leadership in Washington at both ends of Pennsylvania Avenue, this is an opportune time to hold a hearing to inform members of Congress and the public about the key concerns of aerospace states, namely aviation, space and the importance of science and technology—or STEM—education and Career Technical Education.

I would like to thank Lieutenant Governor Brian Dubie for his leadership of the Aerospace States Association and [Lieutenant Governor Jari Askin's for moderating] today's hearing.

Aerospace has played a large role in the development of California. Early aerospace entrepreneurs such as Jack Northrop, Glenn Martin, Allan and Malcolm Loughead, Donald Douglas and Howard Hughes, just to name a few, came to California in the early part of the 20th century and started companies that have become national aerospace treasures.

California has contributed thousands of aerospace "firsts" such the development of early US military and commercial aircraft and the development of more modern technologies such as the first jet engine and Explorer I, America's first satellite. Californians also lead the development of GPS navigation at the Air Force's Space and Missile Systems Center.

California space enterprise is responsible for most of the US earth observation systems and major space-based observatories. The economic impact of California space enterprise alone is estimated to exceed $76 billion. California space enterprise employs over 370,000 workers in high-wage jobs.

When we talk about aerospace, it is important to point out the broad reach that aerospace has in other aspects of our lives. In California, for example, space technology supports many other industries important to the state's economy such as entertainment, tourism, agriculture, biotechnology and global goods movement.

California has many aerospace assets, including the strong presence of NASA. California is the only state in the nation that is home to three NASA centers: the Jet Propulsion Laboratory in La Canada/Flintridge, the Ames Research Center in Mountain View, and the Dryden Flight Research Center located at Edwards Air Force Base.

While NASA's economic benefits to the state are significant with approximately $1.9 billion in direct contracts flowing into the State in fiscal year 2006 and total jobs exceeding 7,100 so too are the services that NASA provides to the State. For example, during the recent wildfire seasons, NASA images from space were used by firefighters on the ground.

NASA Ames Research Center works collaboratively with the Federal Aviation Administration toward the advancement of air traffic management, a topic of one of today's panels.

Another California aerospace asset is the Air Force's Space and Missile Systems Center located in Los Angeles. As the Air Force's premier space acquisition center, SMC is responsible for delivering operationally responsive space capabilities to the war fighter. Another topic which we will hear more about during today's panels.

California's assets are national assets and all are in jeopardy without more attention, investment and focused strategies targeted at addressing the education and workforce crisis facing the aerospace industry in California and across the nation.

I am pleased that today's program is highlighting the importance of science, technology, engineering and mathematics (STEM) education to the aerospace industry. I am particularly interested in the technology aspects and wish to publicly state my support for Career Technical Education (CTE).

To remain competitive in the 21st century global economy, California and the United States must better prepare students for high-wage science, engineering and technician jobs. We must prepare as many students as possible for degreed educations at universities and colleges, but we must also ensure that others are provided opportunities for success after high school or with certificated educations. Aerospace technicians are the foundation of the industry and without them the designs and research of the engineers and scientists would go unrealized.

I look forward to hearing the STEM and CTE recommendation to be offered by today's panelists.

Upon conclusion of this hearing, I encourage my fellow Lieutenant Governors to support Resolutions that address STEM and CTE issues, balanced and stable funding for national civil space programs as well as national security space programs, and support for air traffic modernization.

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JAMES R. AIONA, JR.
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TESTIMONY

Lt. Governor James R. "Duke" Aiona, Jr.
Office of the Lieutenant Governor

Aerospace States Association Hearing
Washington, D.C.
March 9, 2009

Aloha, and greetings from Hawai'i. As Lt. Governor of the 50th State of the Union, I am proud to be a part of the Aerospace States Association and the ongoing activities it supports nationwide. We also are delighted to be the *first* state in the nation to participate in the online ASA Forum sponsored by Aviation Week & Space Technology, and look forward to sharing our perspectives and recommendations on the future of aerospace with our ASA colleagues in all fifty states.

The aerospace industry has played a pivotal role in both diversifying our national economy and strengthening our national defense. From aviation to space exploration, aerospace research and development has forged new inroads in science and technology; dramatically advanced our national engineering and manufacturing expertise; enhanced our surveillance of our planet and understanding of the factors that drive weather systems and climate change; and ultimately afforded new frontiers for humankind to explore and develop.

Our nation's future leadership in aerospace will require the development of innovative technologies and protocols – articulated and sustained through both public-private partnerships and multinational alliances – that can augment aviation efficiency and safety, enhance stewardship of our planet, and take us back to the Moon, to Mars, and beyond.

To meet this challenge, substantial resources will need to be devoted toward developing, testing and evaluating innovative technologies that can support both robotic and human missions throughout our solar system; training new scientists, engineers and other professionals to help design, validate and implement these technologies; reforming regulatory constraints such as ITAR that impede international collaboration toward common development goals; and, most importantly, educating and engaging the public at large.

The State of Hawai'i is not a newcomer to aerospace, and has been a major player in the global aerospace industry – beginning with the training of Apollo astronauts in the 1960s and the development of world-class observatories on the "Big Island" of Hawai'i, and continuing over the past fifty years with pioneering programs in basic and applied space research, space-based remote sensing, and deep space surveillance.

Today, I would like to highlight two "stellar" projects we have initiated to support aerospace research and education in Hawai'i. The first is to help establish the Thirty Meter Telescope, also called the "TMT", at our State Science Reserve atop Mauna Kea on the Big Island of Hawai'i. The TMT will be the largest ground-based astronomical observatory in the world, with a 30 meter (98 foot) diameter segmented mirror that will enable astronomers to better understand the formation of stars, the development of galaxies, and ultimately the origins and fate of the Cosmos.

We also are actively promoting aerospace education and training in the islands, and recently launched a statewide program to engage K-12 teachers and students as

members of NASA's telemetry team that will monitor the upcoming LCROSS mission to the Moon. LCROSS will send an impactor to the lunar poles to investigate the composition of the lunar soil and search for the presence of water ice that could support future human outposts on the Moon's surface. This mission will provide unique opportunities for both teachers and students to gain real-time, hands-on experience in applying STEM-related disciplines to an actual NASA mission, as well as to learn first-hand how space scientists and engineers use advanced technology to explore other worlds – clearly a tremendous opportunity for our state and our nation.

In summary, we believe Hawai'i's strategic assets, coupled with our State's mid-Pacific location, Moon- and Mars-like terrain, and long-standing ties with Asia-Pacific nations, will enable Hawai'i to advance our national aerospace agenda – especially in the development of next-generation aviation technologies, space-based solar power systems, aerospace education and training, and the formation of trans-Pacific, multinational alliances for future space missions.

We would welcome the opportunity to partner with other states interested in these areas to strengthen our national aerospace resources and capabilities, and encourage you to contact our Office of Aerospace Development in Honolulu for additional information.

Mahalo, and Aloha!

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Marion C. Blakey
President and CEO
Aerospace Industries Association

Aerospace States Association
Captiol Hill Hearing on STEM Education, Aviation and Space

Monday, March 9, 2009
Cannon House Office Building

Good morning. Thank you for that introduction, Lt. Gov. Askins. It's great to be here again with this group of selfless public servants from all over the nation as well as our partners in industry and the federal government uniting for this excellent cause – promoting the aerospace industry. Those of us based here in Washington really appreciate hearing about the important role our industry plays in so many communities all over the country. So it is especially gratifying to me to come together with the Aerospace States Association.

It is also appropriate that this bipartisan group is meeting in the house office building named after former Speaker Joe Cannon. Now, Cannon had a well-earned reputation for being tough to the point of intimidation and extremely strong-willed. They didn't call him the "Iron Duke of American politics" for nothing!

One time when the House was debating funding for forestry projects, Cannon famously said "Not one cent for scenery!" And regarding his nemesis, President Theodore Roosevelt, Cannon once remarked that Roosevelt had "no more use for the Constitution than a tomcat has for a marriage license."

Despite the demeanor of the feisty Republican, and perhaps surprising in today's political climate, Cannon was very bipartisan, working with Democrats to build consensus in the House. Even after a group of Republicans and Democrats curtailed his powers as speaker, and despite losing his seat in the election of 1912 to a Democrat, Cannon still had a positive bipartisan outlook. He gave a series of farewell speeches to the House – premature, as it turns out, since he won his seat back two years later. But in one, he said the following: "I hope we will work under whatever we call ourselves, whether Democrats or Republicans … that we may accomplish the greatest good to the greatest number."

I think that sentiment is very applicable to what we are talking about today. The aerospace industry – in many different ways – accomplishes the greatest good to the greatest number. Whether you are talking about jobs and other positive economic impacts or contributions to national security, law enforcement, emergency response, and humanitarian relief, the benefits our industry provides are undeniable. And advocating for the continued health of our industry is why we are all here!

I'm going to talk about some of the most important issues for our industry today. But before I start, I want to talk very briefly about the extraordinary economic circumstances we find ourselves – not only here, but all over the world. As we all know, we are in uncharted waters at this point. There are some indications that aerospace is in relatively good position to ride out the economic hardships, but we also are feeling direct negative impacts as well.

The budget proposal unveiled by the Obama Administration two weeks ago included top-line totals for the Defense Department and NASA that are encouraging, since they reflect sound levels of investment. Now, there are very likely to be some changes within those agency budgets, but they actually both include modest increases over the previous year. Civil aviation is more concerning.

Demand for flying has dropped markedly, affecting airlines' bottom line, and it has gotten much harder to secure financing for aircraft. Airframers have substantial backlogs of orders, but companies all along the supply chain have laid off workers. So overall we are still feeling pretty O.K. about our economic positioning, but we are also keeping a very close eye on the situation.

AIA launched an outreach campaign in December underscoring the point that our industry is a cornerstone of the economy and a built-in stimulus. The ads carry the tag line "Aerospace and Defense: The Strength to Lift America" and carry a list of industry facts:

- More than 2 million middle class jobs
- More than 30,000 suppliers from all 50 states
- Exports totaling $95 billion last year, fueling a foreign trade surplus of $57 billion

We are continuing with this effort, including ads in the Washington Post and inside-the-beltway publications, as well as NPR. In these tough economic times, it is important that we continue to remind lawmakers and others just how important our industry is – providing the greatest good to the greatest number.

I wanted to mention some of the priorities AIA is currently working on here in Washington. Looking over the ASA agenda, we obviously have many issues in common, as you would expect.

The first is one that is near and dear to me, and that's the NextGen air transportation modernization effort. I think most of you are familiar with this initiative, but it is the complete transformation of our air traffic control infrastructure, in the sky, on the ground and in space. Ground-based systems like radar have served us well, but the satellite-based technology of NextGen has far passed them by.

NextGen is actually a family of inter-related technologies, including ADS-B, that will make flying safer and more efficient, with more point-to-point travel. After years of planning and design, it's exciting to see NextGen enter the implementation phase!

As you may know, late last year deployment of the system officially began. A total of 11 ADS-B ground stations are installed, commissioned and in-use in South Florida. Nationwide implementation of all 793 stations is on schedule for 2013. While these are very good steps, we need to make sure NextGen's other anchor programs don't fall behind. Datacom, backup systems, equipment standards and certification, RNP/RNAV procedures – all need to keep pace. This involves specific goals and objectives for operational changes, a timeline for meeting those objectives and metrics to measure progress. And, of course, we absolutely need adequate and stable NextGen funding. When you consider that civil aviation contributes $640 billion – or 5.4 percent of our country's Gross Domestic Product – it's clear it is worth the investment.

Now, there's a whole panel coming up on this topic, so I won't elaborate further on the many benefits that NextGen provides. But I look forward to that exchange.

The next topic I wanted to touch on is space. AIA has always advocated for a robust and balanced space program as well as sufficient funding for NASA. As I mentioned earlier, the budget proposed by the Obama Administration two weeks ago is sound, with a top line $1.4 billion more than the enacted fiscal 2008 budget. The stimulus package that passed recently had even more good news for the agency, boosting it by another $1 billion.

The proposal affirms the new administration's commitment to space exploration, including returning astronauts to the moon by 2020, completing the International Space Station and retiring the space shuttle. The

budget also had a policy statement saying that NASA will renew its commitment to cutting-edge research in traditional and emerging disciplines in aeronautics.

While we are encouraged by these developments, AIA has some ideas about how to improve our nation's efforts on all fronts – civil space, national security space and commercial space.

One of the ideas we are advocating is for the administration to look at all space capabilities as a single enterprise, with a national coordinating body overseeing a national space strategy. We can no longer approach these aspects of space as separate, disparate activities, an idea in a detailed report AIA released in January. The report – "The Role of Space in Addressing America's National Priorities" – also recommends adequate and stable funding profiles for NASA.

Another important issue that is a little less visible is commercial space launch indemnification. Current law protects provides for risk-sharing regarding possible third-party liability claims resulting from FAA-licensed launch activities. But that's scheduled to expire at the end of the year, and if it is not renewed it will put U.S. launch providers at a distinct disadvantage against international competition. We have other important space priorities that need to be supported, including Operationally Responsive Space programs to ensure military satellite capabilities and Space Situational Awareness to give as an accurate appraisal of space assets.

Space has never been more important in our lives. We use satellites many times a day, at ATMs, in our cars, radios, televisions. At the same time, we are seeing more international competition for space leadership, with surging programs in places like China and India. It is absolutely imperative that in this critical juncture in space exploration that we maintain our international leadership in space.

There is another issue that is challenging our international leadership, and that is the U.S. export control system. Many of you know that AIA has been working for years to make improvements to the way we regulate what military goods we sell to our friends and allies overseas. The importance of this trade is underscored by something I mentioned earlier – our industry exported $95 billion last year, logging a $57 billion positive foreign trade balance. And defense trade is also vital to military interoperability with our allies, who fight shoulder-to-shoulder with us.

We have actually made some strides with the way our export control rules are administered over the last year. Following many of the recommendations made by the AIA-led Coalition for Security and Competitiveness, the Bush Administration made the system more efficient, reducing the time it takes to process an export license significantly.

But there is still work to be done. The Senate can take a major step forward by approving defense trade treaties with the UK and Australia. These treaties will streamline the relationship with two of our closest allies and result in better equipped military men and women in all three nations. The Senate should approve these treaties as soon as possible, a sentiment we have shared with Sen. Kerry – who now chairs the Foreign Relations Committee – and many others.

Another area that needs attention in this regard is the U.S. Munitions List, which dictates what items require export licenses. As it stands, it is overly broad in its interpretation of what military goods are subject to review. We need a system in place that moves non-essential items off the munitions list and onto the Commerce Department list, which is more appropriate for non-military items.

One item in particular bears mentioning – commercial communications satellites. The once-dominant U.S. communications satellite industry has been losing huge amounts of market share since the satellites were placed on the list. And we are talking about technology that is essentially commercial, not military!

These issues – just a few of the many we are working on at AIA – cover different aspects of divergent topics. But they all have one thing in common; they result in the greatest good to the greatest number, in and out of the aerospace industry.

I wanted to mention one final thing, and that's one of the thrusts of this meeting today – STEM education and workforce. All these important priorities and issues I have mentioned are dependant on a strong, highly skilled workforce. ASA members know this first-hand – these are the citizens of your states who boost your economies with their well-paying aerospace jobs! The challenge in our industry is to replace a wave of aging workers that is nearing, or has reached, retirement eligibility. I can tell you, the need to support STEM education and workforce initiatives is always part of our discussions with lawmakers and others in Washington.

You may also be familiar with AIA's Team America Rocketry Challenge, the world's largest model rocket contest. It exposes thousands of middle and high school students to direct aerospace engineering experience and – we hope – sparks interest in our industry as a career. Most companies have individual programs in place with the same goal.

AIA is currently working on an industry-wide approach to STEM education. We have established a steering committee composed of high-ranking executives from many of our member companies. The goal is to craft a methodology that complements the individual company efforts, but also presents a united front for the industry to boost STEM education. AIA has also released two special reports over the last year mapping out the workforce challenges before us, and making recommendations on how to meet them.

I want to mention that the ASA is an extremely important force in advocating for our industry, especially when you hold events like this one today. It bridges the distance between aerospace communities and Capitol Hill, and underscores how important our industry is all over the country. With your help, we will continue accomplishing the greatest good to for the greatest number.

Thank you, and I'm happy to take a few questions if we have time.

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Statement of
Dr. Joyce Winterton
Assistant Administrator for Education
National Aeronautics and Space Administration

Presented at Aerospace States Association Panel Discussion Regarding STEM Education
March 9, 2009

Lieutenant Governors, Congressmen, and Members of the Aerospace Space Association, thank you for the opportunity to participate in this Science, Technology, Engineering, and Mathematics (STEM) Education Panel to discuss NASA activities that support STEM educational and workforce programs.

NASA recognizes the important role education plays in developing the diverse scientific and technological workforce required to advance this Nation's economic leadership. The United States has a tremendous need to build, sustain, and deploy the skilled talent required to continue America's pre-eminence in space and aeronautics research and development in the coming decades. NASA's missions, workforce, facilities, research, and spinoff technologies contribute to achieving our Nation's goals.

NASA continues to inspire the next generation of explorers, innovators, and future leaders through its educational investments, which are designed to:

1. **Strengthen NASA and the Nation's future workforce –** NASA will identify and develop the critical skills and capabilities needed to ensure achievement of exploration, science, and aeronautics.

2. **Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty** – To compete effectively for the minds, imaginations, and career ambitions of America's young people, NASA will focus on engaging and retaining students in STEM education programs to encourage their pursuit of educational disciplines critical to NASA's future engineering, scientific, and technical missions.

3. **Engage Americans in NASA's mission –** NASA will build strategic partnerships and linkages between STEM formal and informal education providers. Through hands-on, interactive, educational activities, NASA will engage students, educators, families, the general public, and all agency stakeholders to increase America's science and technology literacy.

Experience has shown that exciting and compelling NASA missions truly can inspire the next generation of explorers, innovators, and leaders. NASA's unique program content, people, and facilities can be leveraged to spark interest, capture imaginations, and guide students toward careers in STEM fields while increasing their scientific and technologic literacy to the benefit of the Nation.

NASA manages its education portfolio across the Agency through the Education Coordinating Committee which is chaired by the Assistant Administrator for Education and includes representatives from the ten NASA Centers, the four Mission Directorates and cross-functional offices.

To support the National Education Agenda, the NASA Education portfolio includes the following programs:

Higher Education Program - focuses on supporting institutions of higher education in strengthening their research capabilities and providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by the institutions contributes to the research needs of NASA's Mission Directorates.

Minority University Research and Education Program (MUREP) - engages underrepresented populations through a wide variety of initiatives. Multi-year grants are awarded to engage minority institutions, faculty and students in research

pertinent to NASA missions. The program focuses on retaining underrepresented and underserved students in STEM disciplines through completion of undergraduate or graduate degrees and entry into the scientific and technical workforce.

Elementary and Secondary Education Program - provides K-12 educators with tools, experiences, and opportunities to further their education and participate in unique NASA learning experiences to enhance their knowledge of STEM and inspire pursuit of STEM careers. The program supports the role of educational institutions that provide the framework to unite students, families, and educators for educational improvement.

Education Technology and Products (e-Education) – leverages multimedia-rich products and technology infrastructures to deliver exploration-related content to diverse audiences while partnering with NASA's Mission Directorates, professional education organizations and others to create effective learning simulations, visualizations, immersion, online educational games, intelligent tutors, learner networking, e-professional development, and digitized building blocks of content.

Informal Education Program – inspires learning by educating students, educators and the general public on specific STEM areas utilizing NASA content and missions, and inspiring the Nation's future STEM workforce. Projects within the program produce supplemental educational materials that are standards based and support lifelong learning in the STEM fields. Self-directed learners and education professionals are engage through NASA-themed, hands-on activities.

Education Trends

Education trends indicate a need for increased access to education information, as well as a need for innovative application of new knowledge, recruitment of a more diverse and highly skilled pool of students, and greater coordination and collaboration with the Office of Human Capital Management to identify jobs and competencies for the future.

NASA's Office of Education's response to new education trends has resulted in technological improvements, which provides opportunities to students and teachers. Specific examples include the development of Podcasts, Vodcasts, and student virtual communities that create access to new NASA content and resources. NASA Higher Education programs provided opportunities to over 3000 summer interns in 2008 to work with scientists and engineers at NASA Centers. Space Grant Consortium internships provided students and faculty from all fifty states, Puerto Rico and the District of Columbia, with an opportunity to apply new mission discoveries in STEM to research projects.

Through new projects, such as the Endeavor Teacher Certificate Project, science teachers improve their knowledge and teaching strategies using NASA content and resources. The Endeavor Trust Fund will partially support this effort and will use NASA content to train in-service and pre-service teachers. There will be collaboration with selected school districts, state departments of education, and universities. Currently, NASA content is integrated into curricula at selected universities such as Stanford and Columbia Teachers College.

The Office of Education works with the Office of Human Capital Management's Cooperative Education Program (COOP) to align identified workforce skills and competencies with university majors and degree requirements. This collaboration allows the two offices to jointly plan recruitment efforts based upon identified university majors, level of degrees, and prior NASA experiences.

NASA's priorities for education will be realized in several ways including the following:

- Stimulate competitive research, through grants to universities and support to our nation's Minority Serving Institutions. Student activities are directly tied to real-world experiences (i.e. Constellation, Mars Exploration; global climate change; aeronautics) to prepare students for future employment at NASA, in the aerospace industry, or academia.

- Provide opportunities for student flight projects to gain access to space. Through partnerships (NASA Centers, universities and industry), students gain research experiences and hands-on engineering experience on a variety of

real-world flight platforms including high altitude balloons, reduced gravity flights, sounding rocket payloads, airborne sensors, and space satellites.

- Prepare pre-college students for studies in science and mathematics and increase the number of science and engineering majors/graduates. High school students will intern under mentorship of NASA scientists and engineers, and university students will participate in ongoing space and aeronautics research missions. Many will contribute to original research and support designing hardware to fly on future NASA missions. Scholarships are offered to the Nation's most talented students to support STEM majors and to make college affordable.

- Recruit NASA scholarship, internship & fellowship recipients into cooperative-education (co-op) and Federal Career Intern Program (FCIP) positions open at NASA.

- Invest in strengthening curricula of our nation's community colleges; which are critical to ensuring students are prepared to successfully transition to work or four-year institutions. Ensure graduating students have skills, knowledge, and hands-on experience to make them competitive when applying for employment with NASA, academia, or aerospace industries.

- Immerse students and educators in current NASA science using social networks, internet collaborations, virtual magnet schools, and online resources. From web disseminated information, to remote control of scientific instruments, to learning in virtual worlds, NASA will make extensive use of telepresence technologies.

- Inspire learning through participating in authentic experiences via NASA's Digital Learning Network (DLN). Student design competitions will be tied to NASA's ongoing missions, allowing teachers to engage students in real-time, cutting edge science and engineering problems. DLN will "beam" NASA scientists, engineers, and astronauts into any classroom in the nation for real-time videoconferences on topics related to NASA science & engineering.

- Develop an electronic professional development system for pre-service, in-service, and informal educators scheduled to go live in 2010.

- Capitalize on flights of Educator Astronauts Ricky Arnold and Joe Acaba, former science teachers, now fully-trained NASA astronauts, who will make their first journey into orbit on space shuttle Discovery's upcoming mission to the International Space Station. During the STS 119 mission, Arnold and Acaba will step outside the station to conduct critical spacewalking tasks. Dorothy Metcalf-Lindenburger, will be aboard Shuttle Atlantis on STS-131 to help Americans excel in, and embrace science and engineering.

Collaboration and Coordination with Other Federal Agencies

NASA's Office of Education is continually engaged in collaboration with other Federal agencies, including: the Department of Education, National Science Foundation, Federal Aviation Administration, Smithsonian Institution, as well as the following other Departments: Interior, Labor, Commerce, Agricultural and Energy. Additionally, NASA collaborates with state STEM education coalitions, through the National Alliance of State Science and Mathematics Coalitions, the District of Columbia, Puerto Rico, and the U.S. territories. Each NASA Center works closely with state and local departments of education to ensure that our resources are tailored to support the needs of the education community.

Collaboration and coordination also occur in a number of forums in the Federal government to ensure that NASA's activities in STEM education are complementary and not redundant with the programs of other federal agencies. NASA actively participated in the Congressionally-mandated Academic Competitiveness Council (ACC), which reviewed effective practices and activities in STEM education and made recommendations to integrate and coordinate federal STEM programs.

In February 2007, NASA and the National Science Foundation (NSF) signed an historic agreement to work together and coordinate efforts to expand opportunities for promoting STEM education and to broaden the participation of underrepresented populations. The Memorandum of Understanding (MOU) between NASA and NSF promotes a comprehensive knowledge base to be shared between the agencies to address national challenges and manage the agencies' resources more effectively. It reflects the goals of the American Competitiveness Initiative, whose cornerstone is a commitment to increase investments in basic research in the physical sciences and engineering, strengthen K-12 math and science education, and build a well-educated, skilled workforce. One of the first results of the collaboration was a three day joint NASA-NSF Research Education Opportunity Conference for Principal Investigators, Faculty, and Partners. Over three hundred members of the academic community gathered to be trained on ways to strengthen their ability to compete for research grants and to leverage their partnerships with the agencies.

Additionally, NASA and the Federal Aviation Administration (FAA) signed an MOU to foster the development of students' skills in STEM. The agreement supports the FAA's mission to provide the safest, most efficient airspace system in the world and NASA's mission to pioneer the future in space exploration, scientific discovery and aeronautics research. The partnership includes a broad range of cooperative outreach activities. The agencies' initial focus is on a NASA resource called, “Smart Skies.” Smart Skies is an online air traffic control simulator for students in fifth through ninth grades. It offers a fun and exciting way to learn math and skills central to air traffic control while providing multiple modes of problem solving for students who learn in different ways. The agreement unites the strengths of both agencies to provide the best of aviation-related educational products and experiences to the widest possible population of students and educators.

The Role of Partnerships

Strategic alliances with non-governmental organizations provide an immediate springboard as unfunded collaborators to produce, market, and distribute educational information about NASA’s projects and programs. NASA’s partnership with the International Technology Education Association is one of many venues the Agency uses to reach students and educators across the country. Other organizations include National Institute of Aerospace, National Science Teachers Association, AOL's Kids On-Line, the Girl Scouts of the USA, Imaginary Lines, and Reader's Digest to reach students and educators.

Sharing Best Practices

In 2007, NASA Education established performance measure baselines that reflect its strategic outcomes and objectives. For the Higher Education program these data demonstrate that NASA Education is successfully contributing to the STEM workforce, encouraging pursuit of advanced STEM degrees, and reaching a diverse audience. For example in 2008, of students receiving a significant level of support from NASA, completing a terminal degree, and choosing to enter the workforce, 51% found employment at NASA, within the aerospace industry, or in STEM academia. An additional 27% of students found employment in the non-NASA related STEM industry sector. Of students receiving degrees, 44% opted to pursue advanced degrees. In terms of reaching traditionally underserved and underrepresented audiences, the NASA Higher Education Program reached 6,646 students in 2008.

Through NASA’s work with the National Science and Technology Council Subcommittee on Education, it is strengthening evaluation methodologies and sharing best practices, for example:

The **Harriett G. Jenkins Pre-doctoral Fellowship Program** (JPFP) is a model of a STEM education pipeline program that can be replicated by other agencies as a best practice. The success of the JPFP can easily be quantified by counting the number of student participants (151), the number of awards provided to conduct research at a NASA center (90) or the number of successful mentoring relationships that were established through this program (151). However, the greatest accomplishment of the program is an exceptionally diverse group of underrepresented STEM scholars who are excited about pursuing NASA-related advanced degrees that will equip them to participate in the space exploration workforce. To date, the Jenkins project has produced 45 M.S. degrees and 51 Ph.D. degrees in NASA-related disciplines.

Another stellar NASA project identified as a best practice is the **Science, Engineering, Mathematics, and Aerospace Academy** (SEMAA). The Ash Institute for Democratic Governance and Innovation at Harvard University's John F. Kennedy School of Government announced that SEMAA was among the top eighteen programs in the 2007 Innovations in the American Government Awards competition.

Conclusion

The educational achievement of America's next generation is an issue that reaches our Nation at all levels. NASA will continue to partner with Federal, industry, state and local organizations and invest our resources toward a shared vision to secure those jobs critical to the 21st century workforce. This means not only inspiring the next generation of leaders and explorers, but also providing educators with unique resources to support educational excellence in STEM, while improving scientific literacy.

Thank you for the opportunity to participate in this important hearing. I am prepared to respond to any questions you may have.

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Remarks of Gay Gilbert

Administrator, Office of Workforce Investment

United States Department of Labor

Employment & Training Administration

Before the Aerospace States Association

March 9, 2009

Good afternoon. As Administrator of the Employment and Training Administration's Office of Workforce Investment, and on behalf of the U.S. Department of Labor, I would like to thank the Aerospace States Association for the invitation to participate in today's session.

As you are aware, ETA has been named by law to chair an Interagency Task Force to develop a national strategy for aerospace workforce recruitment and training that helps ensure the stability of high-skilled jobs and the global competitiveness of the aerospace industry. This afternoon I would like to provide you with an overview of ETA's work to support aerospace and science, technology, engineering and math (STEM) talent development, as well as an update on the activities of this Task Force.

ETA has long sought to understand and implement industry-identified strategies to confront critical workforce shortages in the aerospace industry. We have listened to employers, industry association representatives, and taken into account the key workforce challenges identified in the final report of the Commission on the Future of the U.S. Aerospace Industry. Since June 2003, the Department of Labor has announced a series of investments through the High Growth Job Training Initiative and the Community Based Job Training Grants to address these workforce needs.

ETA's investments in aerospace talent development have funded solutions to: expand the pipeline of youth entering the aerospace industry; develop tools and curriculum for enhancing the skills of aerospace professionals; enhance the capacity of educational institutions to train to industry-

defined competencies; develop strategies to retain and help incumbent workers move into higher level positions; and assist transitioning individuals from declining industries move into high growth industries by building on their existing skills and training them for high growth aerospace occupations.

Throughout 2004 and 2005, ETA also convened an ad hoc Aerospace Workforce Interagency Work Group, in direct response to a recommendation of the Aerospace Commission. In December 2005, this Work Group published an inventory of Federal investments in aerospace and STEM workforce related activities.

On December 20, 2006, legislation was enacted to establish an Interagency Aerospace Revitalization Task Force to be chaired by the Assistant Secretary of Labor for Employment and Training. This eleven member Task Force is directed to develop a strategy for aerospace workforce development, and includes high level members from the Departments of Commerce, Defense, Education, Energy, Homeland Security, Transportation, the National Science Foundation, and NASA, along with two members named by the White House.

On March 19, 2008, the Task Force released its first annual report to Congress that confirmed the following three critical workforce challenges remain a priority for the aerospace industry: (1) Recruiting and Retaining Talent - The aerospace industry finds itself with a graying workforce skilled in science, engineering and manufacturing. The industry also cites challenges to retaining the workforce that is not currently eligible for retirement. Surveys have indicated feelings of disillusionment among the industry's personnel, whether they are production/technical workers, scientists, or engineers; (2) the Skills Challenge and the Importance of STEM Education - There are concerns across the country that American students are not exiting the education system in sufficient numbers and equipped with the math, science, and technological skills needed to sustain a

competitive edge in this industry; and (3) the Image of the Industry - The aerospace industry was once the employer of choice for the "best and brightest" technically trained workers. However, now the industry finds that it presents a negative image to future workers. New entrants to the industry have dropped to historical lows as the major manufacturers have consolidated, reflecting concern about the long-term growth potential of the industry.

The first annual Task Force report identified targeted strategies to address these significant challenges. In 2008, the Task Force reviewed these strategies and established Project Teams to transform them into actionable solutions.

First, in the area of sustainability, the Task Force worked to ensure collaboration across Federal agencies and the availability of resources, tools, and guidance developed under its leadership and direction beyond the statutory sunset established by law. The Task Force took an important step to achieve this goal through the identification of key career staff at each member agency to retain the institutional knowledge of the Task Force and to aid in the transition of Task Force leadership during calendar year 2009.

Second, the Task Force is working to identify and promote model strategies in aerospace workforce and STEM education solutions, program evaluation metrics, and technical assistance tools that provide guidance in replicating best practices of existing aerospace employment centers. The Task Force completed the development of an industry reviewed aerospace skills competency model and will work in 2009 with stakeholders to ensure the model keeps pace with industry innovation.

Finally, the Task Force is working to ensure that information from its partners, as well as other public and private sources, is compiled and promoted in a consistent manner for multiple audiences and has recommended the development of a cyber-community for this purpose. This activity includes a redesign of the aerospace web page at the ETA sponsored Workforce3 One website

(www.workforce3one.org) to serve as the home for Task Force-developed information. The Task Force has committed that the design of this page and population with information will occur in Spring 2009

The Task Force recognizes that 2009 marks a transition in leadership and membership for the eleven-member panel as a result of the change in Administration. Through the establishment of cross-agency, staff-level Project Teams, the Task Force has begun the work of institutionalizing its mission within the career-level staff of the member Departments and Agencies and should be well-positioned to support the ongoing mission of the Task Force during this transition period and beyond.

To conclude, thank you again for the opportunity to speak with you this afternoon. I will be happy to respond to any questions you may have.

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Testimony of Jack R. Harris
Senior Director, Advanced Technology
Rockwell Collins

The Aerospace States Association
Capitol Hill Hearing on STEM Education, Aviation and Space
March 9, 2009

Lieutenant Governor Askins, Lieutenant Governor Garamendi and Lieutenant Governor Kottkamp, Congressmen, and Members of the Aerospace States Association, I am Jack Harris, Senior Director of Advanced Technology at Rockwell Collins, headquartered in Cedar Rapids, Iowa.

On today's panel, I will be discussing the values and challenges of Science, Technology, Engineering, and Mathematics or STEM Education from a Business perspective. I will also discuss how our Rockwell Collins partnership programs and activities support STEM education and workforce issues.

The challenges of attracting the necessary talent and knowledge we need in our workforce and preparing that future workforce with the skills necessary in science, math and engineering is an issue that is of critical importance to Rockwell Collins and U.S. industry as a whole.

Thus on behalf of our CEO Clay Jones, and the more than 20,000 Rockwell Collins employees around the world I am grateful to have the opportunity to testify before you this afternoon.

Today … our federal … state … and local governments … businesses large and small … and Americans across our nation … are focused on the worst financial crisis in our lifetimes.

But … while things are tough right now … we can be optimistic that … at some point … the global economy will get better … and that the actions underway here in the U.S. and around the world to try to address this crisis … will have some measure of success. At some point … the mortgage and credit crises will end … the banks will finish consolidating and fix their balance sheets … consumers will feel more confident and start spending again … and the world economy and global equity markets will ramp back up to where they were in 2007 … and higher.

But smoldering beneath these immediate crises … is a much longer term challenge – a challenge that has the potential to inflict systemic damage to the economy of the United States in the future … and our standing in the world economic markets. In fact … this challenge threatens America's position as the most powerful economy in the world … and I fear it is being overshadowed by the issues I've just described. And that challenge is: producing the <u>intellectual capital</u> required to ensure this country retains it's position as the global leader in the future.

That challenge arises from the fact that new global competitors have recognized that to fuel tomorrow's technology in a wide range of industries … <u>education</u> is fundamental. Witness the reports that China graduates 600,000 undergraduate engineers annually … while the United States graduates only about 70,000. Or … to put it another way – to account for population differences – 50 percent of all undergraduates in China receive their degrees in natural science or engineering … and the corresponding figure in the U.S. is 15 percent.

So what does this mean to the United States … its industry … and our quality of life? Well … for one thing … it means we need to get serious about … and take a new approach to … science … technology … engineering … and mathematics … or STEM … education.

I won't reiterate the steady stream of reports over the past decade or so … regarding the impact of the current trends … but suffice it to say … in the aggregate those reports have warned that if the U.S. does not respond quickly:

- We will lose quality jobs to other nations … and without such jobs … our citizens will not have the purchasing power to support the standard of living which they seek.
- Tax revenues will not be generated to provide strong national security, healthcare, or other priorities.
- And the lack of a vibrant domestic consumer market and skilled workforce will provide a disincentive for companies to invest in jobs in America.

So … in an era in which advanced knowledge and education is becoming increasingly widespread globally… and low-cost labor is becoming progressively more available … America's market for talent and traditional advantages in the marketplace … specifically in engineering and technology … are eroding.

Those reports have made it clear that the lines between the world's economies are blurring … and America's ability to remain competitive … depends on our commitment to research and development … and technologies and workforce development.

This is a particularly troubling issue for companies like Rockwell Collins. About a third of our 20,000 employees worldwide are engineers … and more than a third of our sales are outside the United States. That means we contend every day with international competitors and … as a result … have a fairly good understanding of how our competition stacks up. We understand from experience that we can't <u>out-price</u> them. We understand that we aren't <u>bigger</u> than they are. Almost every single company we compete against is larger than Rockwell Collins.

The only thing we can do… is <u>outsmart</u> them … which means we have to have the most highly educated … most innovative … most creative people that we can find….but competition is fierce.

So what are we doing to ensure the supply of innovative technology workers will be available in the U.S. for years to come … and reverse the trends in STEM education that we've all seen? Well … at Rockwell Collins … we've long realized how important it is for teachers … parents … and our company to work together to help motivate children to pursue math and science studies.

That's why … in 1991 … we established a formalized K-12 Partnership Program with seven schools to support the effective teaching of basic K-12 curricula … including math … science … technology … and creative thinking … and to increase parental support for the educational process and programs.

We also benchmarked how others are making a difference across the nation … and learned that success most often comes from **grassroots initiatives**.

So … we are partnering with others in grassroots programs aimed at engaging Iowa communities to help shift the culture and mindset around STEM … to better meet the challenge of global competition.

That's why we've participated in education partnerships that have become an integral priority of every national business association … ranging from the Business Roundtable's "Education for

Innovation Initiative" to the "Dream It … Do It" campaign at the National Association of Manufacturers.

That's why more than 200 businesses in our area got together to sponsor the Workplace Learning Connection which has become a nationally recognized intermediary for providing students and teachers with opportunities to participate in first-hand career and worksite experiences.

That's why businesses across Iowa invest with state government and local school administrators in the "Iowa Jobs for America's Graduates" program. A program that helps school districts to serve youth needing additional assistance in completing their education … and either pursuing further post-secondary education or entering the workforce.

That's why Rockwell Collins and other businesses launched the Corridor Stem Initiative in 2006 to increase the access to non-traditional STEM learning activities … such as after-school … and out-of-classroom activities. CSI has disseminated information across the state of Iowa to encourage replication of this regional cooperative math and science learning model. And groups in five Iowa cities are benchmarking CSI … and our community engagement activities … for insights to start similar programs in their regions.

Another grassroots example just being defined … and receiving enthusiastic support from students in local high schools through Iowa … and at the State Departments of Education and Economic Development … is a Rockwell Collins led initiative partnering with the Department of Education using virtual reality technologies to enhance student learning. Based on the success of this initiative, we hope to develop a working relationship with the National Science Foundation in the future.

But at Rockwell Collins … we also recognize the need to do more … to help face the challenge of revitalizing our education system. Now … what I've personally seen … is that when you excite students with hands-on experiences … and reinforce classroom learning with meaningful, creative applications of the content they've studied in textbooks … kids get motivated … and they want to learn. This can often take the intimidation factor out of science and math education … and make these subjects fun and exciting for kids. It is that excitement … that is an accelerator for learning.

And it was our quest to create more of those opportunities that led us to establish an initiative we call … **Engineering Experiences**. It has extended our K-12 Partnership Program … to provide more students and educators across all our U.S. locations … with opportunities for those hands-on experiences. It has put all of our hands-on programs under one umbrella that is all about inspiring students … and hopefully the next generation of engineering talent.

And so today there are a whole host of programs under the Engineering Experiences umbrella. It's EWeek and Future City … it's FIRST LEGO League… and FIRST Tech Challenge … and Project Lead the Way.

But … despite all that's been done in these and other programs … we've only taken the first steps on a very long and difficult journey … and it's clear that no one can do this alone…it starts with strong personal accountability and commitment from each stakeholder and student

We must address the critical shortage in our technology workforce … and create incentives to encourage more college graduates in the technical fields. For America to return to it's

preeminent position in a global economy … I believe we will need to double the number of U.S. students with STEM - related degrees by 2015.

It's not going to be easy … especially when you consider "baby boomer" retirements that are going to siphon off one-third of our scientific and technical workers over that same period.

It will require strong leadership as partners in change … between business … government … educators … in what is one of the most important initiatives we can undertake to ensure America's leadership.

For these reasons, I respectfully ask you to take my comments as an involved business partner as enthusiastic support for ASA's identified priorities. We endorse increased funding and curriculum in STEM subjects, the creation of incentives to encourage more college graduates in STEM career fields and increased partnerships between business, government and education on STEM initiatives in your states.

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Testimony

Of

James W. McMurtray

Executive Director,

National Alliance of State Science and Mathematics Coalitions

To the

Hearing on STEM Education, Aviation and Space
March 9, 2009

Cannon House Office Building

Thank you very much for this opportunity. I am James McMurtray, Executive Director of the National Alliance of State Science and Mathematics Coalitions, NASSMC.

NASSMC is an alliance of 42 state coalitions of business, education, and public policy leaders working to improve mathematics, science, and technology education and long-term workforce development in the states. The state coalitions have been actively engaged in this effort for the past 20 years. The alliance collaborates in a variety of ways with federal agencies and the state coalitions to bring about substantive change at all levels in STEM education.

I am here today to add the voices of those state coalitions to urgently recommend that the National Aeronautics and Space Administration be funded at a level appropriate to its importance to our nation and to our nation's future.

From the business perspective, the impact of NASA programs of exploration and discovery on the US economy cannot be overstated. NASA programs have infused the economies of every state represented by our organization. While NASA's budget is modest when compared to other government expenditures, the return on that investment can easily be seen at the state level in new jobs, new technologies, new industries, new products, and the advancement of science.

The cost of NASA's programs is a matter of open public record. It is significant that in 1996 the cumulative federal spending on NASA over its nearly 40-year history at that time was roughly equal to the 1996 single year budget of the Department of Health and Human Services. It is also important to recognize that the federal investment in NASA is spent *in* the US economy and is multiplied many times over by stimulation of innovation and development.

The state organizations represented by NASSMC are keenly aware of the key role of the nation's aerospace industry in our economy. Aerospace technology is one of our nation's major export markets. It should be noted however that NASA itself does not manufacture space hardware. Rockets and satellites are not built by the federal government but by private industry. In addition to the large aerospace companies who build launch systems and large payloads, there are innumerable smaller companies that build components, materials and systems. It is difficult to identify any industrial sector in the states that does not in some way, either directly or indirectly benefit from NASA research and development. Aerospace development translates into private sector jobs, and not just in aerospace.

In the states, there is an inextricable link between economic factors and education. In the realm of education, NASA's many contributions to state's efforts are well known. This impact extends from NASA-funded basic research at state universities to funding of state STEM Summits, to the enhancement of science education in our high schools, middle schools and elementary schools. The scientific results of NASA's missions of exploration and discovery are shared with the nation's educators.

A scientifically illiterate populace is an economic and social liability that no nation can afford. We are not well served when only a fraction our students are receiving adequate instruction in science, mathematics, and technology. NASA has contributed significantly to changing that equation and to bringing the excitement of science to all students, particularly those in under-served and under-represented populations. We fully recognize that our national efforts in research, innovation and economic development cannot flourish unless they are supported by a technologically literate electorate.

State governments recognize the social and economic impact of NASA programs and research. The tax base of every state is enhanced by the presence of contractors, suppliers, facilities, and workforce development activities directly related to NASA's work.

In good economic times it is easy to support advanced scientific research, development and science education. In bad times however, it is *critical* to support these efforts. Investment in NASA demonstrates the belief that America can continue to flourish, that the American economy can continue to grow and thrive, that our children can enjoy a future rich in promise. In the face of challenging circumstances, we should neither cut back on our commitment to exploration, discovery and development nor allow this enterprise to grow stagnant.

In light of these realities, the National Alliance of State Science and Mathematics Coalitions, on behalf of its forty-two member organizations urges the Congress and the Administration to apply a modest economic stimulus to that segment of our economy where it has proven to produce positive results for over half a century. This will not require a heroic increase of bailout proportions and it is a sound and pragmatic step that has paid off in the past and will continue to do so in the future.

We are a nation of explorers, innovators and problem solvers. We are at our best when we are striving to accomplish difficult tasks and to reach goals that challenge our understanding and our creativity. For fifty years NASA has embodied that spirit and pushed our national capacity and resolve. Let us enable NASA to continue to serve our country.

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ASA CAPITAL HILL HEARING
STATEMENT OF CHARLES A. LEADER
DIRECTOR
JOINT PLANNING AND DEVELOPMENT OFFICE
MARCH 9, 2009

Good afternoon. I would like to thank the Aerospace States Association for scheduling this hearing to address the nationally important issue of transforming the U.S. aviation transportation system. I also thank you for inviting me to participate on this panel. I will focus my comments on the national initiative to transform the air transportation system. This initiative, known as the Next Generation Air Transportation System – or NextGen, is underway and has the potential to bring great economic benefit to the country by increasing aviation transportation capacity, productivity, and safety, and improving aviation's environmental impact.

DEFINING NEXTGEN

NextGen is a **Congressionally mandated** initiative to modernize the National Air Transportation System of the United States in order to:

- Increase **capacity** and **reliability**
- Improve **safety** and **security,** and
- Minimize the **environmental impact** of aviation.

These improvements to the Air Transportation System will be achieved by applying:

- **Space-based surveillance and navigation** to improve upon the current radar and radio beacon capabilities
- **Digital communications and Network Centric** information sharing to expand the capabilities of the current analog voice system and ensure all stakeholders have timely access to needed information
- **Advanced automation** of the Air Traffic Management functions to improve controller and aircrew safety and productivity
- **Advanced aircraft and engine technologies** to reduce environmental impact and improve efficiency, and
- **Advanced screening technologies** and security risk management to improve the efficiency and effectiveness of aviation security.

Said another way, NextGen is to bring to the National Air Transportation System the modern industrial process technologies that make operations in other industries reliable and predictable based on processes repeated with automated precision. That contrasts with the current artisan-based air control system, based on apprentice-developed mastery of hand-eye coordination skills for flight crews and controllers. Advanced automation can eliminate the variability inherent in operator imprecision that creates risk requiring excessive buffers that constrain system safety and efficiency.

NextGen is an effort involving multiple agencies of government, much of the aviation industry, aviation labor, airport operators, and Congress. Although it is an initiative involving technology change, it is also an effort requiring collaborative commitment and organizational change. When Congress legislated the NextGen initiative, it also created the Joint Planning and Development Office (JPDO) to coordinate and facilitate NextGen across government and to provide outreach to aviation stakeholders.

We have the plans to achieve NextGen in the near to mid-term and a planned path to the far-term. We have planning tools to capture the complexity of NextGen and study the implications of potential trade-offs. We understand the technical challenges we face. We increasingly understand the benefits of NextGen in operational

and environmental terms. We require now only the collective will and resources to implement in order to achieve the NextGen benefits.

PARTNER REQUIREMENTS

The breadth and complexity of NextGen require alignment of the efforts of the partner constituencies in government, industry, and labor, with each contributing to the overall effort.

The Administration and Congress have critical roles in leading and sustaining NextGen. As an initiative providing compounding benefits over time as its capabilities are matured, the long-term commitment to the effort by the new Administration and Congress is essential to providing sustaining leadership. The Presidential Executive Order of late last year is an example of such national level leadership, as is active and well informed Congressional involvement and oversight.

Ensuring the resources for NextGen is another critical role for the Administration and Congress. To most effectively and efficiently achieve NextGen benefits, it is essential that the effort have a predictable and stable source of funding in order to simultaneously implement near to mid-term improvements, prove mid-term capabilities, and conduct the research necessary to achieve long-term operating concepts.

Government partner departments and agencies have collaborative roles that are essential to achieving the benefits of NextGen. NextGen is a strategic imperative for the FAA as it addresses the core of its operating mission. The NextGen imperative is less centrally strategic for the partners and it is important that they bear in mind the national implications of NextGen when allocating resources to achieve collaborative goals.

Long-term research is critical to achieving the most advanced stages of NextGen and must be supported at the core of NASA's aeronautics efforts. Aviation surveillance is critical for safety in the air traffic system but is also an important capability in the operations of the Departments of Defense and Homeland Security and of the Director of National Intelligence. Delivering more useful weather information is essential to improving the safety and productivity of air transportation but also of importance to Air Force, Navy, Army, and homeland security operators and a core mission of the Department of Commerce National Oceanographic and Atmospheric Administration. An integrated aviation information sharing system is central to creating shared situational awareness in operations across government in areas of security, defense, and disaster response.

In these areas, and others, there must be a collaborative alignment across government to rationally integrate operations and investments. This is simply good government but it is also essential to the success of NextGen.

Industry and labor play critical roles in ensuring the success of NextGen. The organizations involved have complex and sometimes conflicting agendas to satisfy the goals of their shareholders and members. It is important that those entities involved remain clear in their collective agreement that NextGen is a necessary and valuable national investment. The commitment to the value of NextGen improvements needs to be separated from conflicting views on sources of funding and labor contracts. Without such separation, NextGen benefits will be constrained and delayed.

The intent of Congress in establishing the NextGen initiative was to involve industry and labor. A NextGen Institute was established and currently has nearly 300 industry members. Hundreds of members donate their time to contribute to working groups developing and maturing NextGen operating concepts.

Increased involvement of industry and labor would benefit the quality and speed of NextGen implementation. Industry expertise and creativity can be productively leveraged in demonstrations and proofs of NextGen

operating concepts. Flight crews, controllers, technicians, airport operators, and airline operations experts can all increase the effectiveness of NextGen by reviewing operating concepts, facilities strategies, information sharing architecture and being involved in the development of equipment and procedures.

The new FAA Administrator has a key leadership role in ensuring the success of NextGen. Although maintaining and improving upon an excellent safety record is the clearest responsibility of the Administrator, NextGen must be a clear FAA strategic priority. The Administrator needs to be an active and visible champion of the initiative. Although the specific technical and programmatic activities can be delegated, only the Administrator can lead the FAA through the organizational and cultural changes required to make NextGen a reality.

RECENT PROGRESS

NextGen planning has matured greatly and near to mid-term requirements are increasingly clear while a path to the long-term has also been defined. A joint planning environment has been established that allows the government partners to view and relate the operational improvements, enabling capabilities, research activities, and policy decisions required to achieve NextGen improvements. The planning environment also provides public transparency for the NextGen development path. The NextGen business case continues to evolve as the planning matures and the costs and benefits of alternative paths can be evaluated. This planning will provide the basis for informed decision making and investments.

Collaboration across agencies continues to mature.

- An executive panel of those responsible for weather activities in the National Weather Service, the FAA, NASA, the Air Force and Navy have been meeting regularly and overseeing a collaborative effort to get initial NextGen weather capabilities in place by 2013. The weather panel is also aligning investments and clarifying respective roles and responsibilities.
- As the result of an inter-agency effort coordinated by the JPDO, an integrated surveillance initiative to develop a concept of operations and joint enterprise architecture has been established. This initiative, being coordinated by the JPDO, involves FAA, Defense, Homeland Security, and National Intelligence.
- Defense, Homeland Security and FAA are defining the next sequence of demonstrations of Network Enhanced Operations that explores approaches to creating shared situational awareness and more flexibly manage airspace in response to threats and disasters.
- The Department of Defense has assigned an officer to JPDO and has funded technical support to leverage Defense expertise in net-centric operations to aviation information sharing activities that will support integration of systems within FAA and also across interested governmental parties.
- Research Transition Teams have been formed between FAA and NASA to facilitate the transfer of NASA research to FAA by defining and documenting the maturity of the work being transferred to ensure its productive application.
- The role of the Senior Policy Committee (SPC), chaired by the Secretary of Transportation, as the governance body for the JPDO, is becoming recognized as a unique vehicle. A recent Integrated Surveillance Summit, hosted by Homeland Security, recommended that the SPC become an interim governance vehicle to advance an approach to joint surveillance. The Summit also recommended that the Office of the Director of National Intelligence become a member of the SPC.

In proving the benefits of collaborative planning and action, we believe that the NextGen evolution will be both swifter and more productive.

Integration efforts are underway. FAA began rolling out its new space-based surveillance system in 2007 and is operational in areas of Florida and the Gulf of Mexico. Surveillance in the Gulf is a new capability as it

provides coverage where none exists with radar. This surveillance system, known as Automated Dependent Surveillance – Broadcast (ADS-B), will eventually provide national coverage with a positional accuracy greater than radar. This precision will support the eventual safe reduction of current separation standards and allow greater system capacity. ADS-B is the first of several transformational programs that provide the underpinnings upon which the NextGen operating capabilities will be based.

CONCLUSION

NextGen is an initiative with the promise of significant benefit to the Nation in terms of economic growth while simultaneously improving safety and reducing impact on the environment.

Thank you for your attention.

Click here to go to beginning of document

ATA TESTIMONY

Capitol Hill Hearing on STEM Education, Aviation and Space

Statement of John Meenan
Executive Vice President and COO
Air Transport Association of America, Inc.
before the
Aerospace States Association

March 9, 2009

AIR TRANSPORT ASSOCIATION

Airlines Are a Critical Part of Economic Recovery

Airlines are a vital component of the nation's and the world's economies. The U.S. commercial airlines drive 5 percent of Gross Domestic Product (GDP); they create prosperity; they are the circulatory system for domestic and international commerce, enabling others to create more value and distribute more wealth. Commercial aviation today enables over $1 trillion in economic activity and provides, directly and indirectly, over 10 million jobs. A vibrant commercial airline sector – we believe – is an essential ingredient to revitalizing our nation's economy.

Right now, however, the airline industry is in real trouble. Let me note briefly: $33 billion in losses since 2000 with close to 25 percent fewer jobs – 150,000 fewer – in the same period. In today's tight capital markets, the need to modernize our fleets – to provide both a world-class competitive product and the fuel efficiency and environmental performance that we must have – presents a daunting challenge, particularly for an industry worn down by years of losses and excessive taxation and facing multiple new demands for ever more fees and taxes.

What to do? One thing we know is that the U.S. airline industry is incredibly resilient and creative. In the face of tremendous odds, it has successfully reinvented itself time and again – and it will accomplish that reinvention once again. There are however, a number of things that decision-makers here in Washington, as well as in state capitals and local government offices across the country, can do to help.

We are calling on all of our partners – government leaders at all levels who look to air service as a key link to their constituency's economic strength – to first "do no harm." No more new taxes and fees, no more unfunded mandates and no more counterproductive regulatory burdens. The airline industry is eager to address its problems – but it cannot succeed without being allowed to marshal and utilize its resources; it cannot succeed if government continues to divert those resources for other purposes. We need to concentrate on establishing an industry that can be profitable in the long term in order to make the long-term investments necessary to service the public's need for air transportation – and to continue to create prosperity.

What Are the Industry's Priorities?

- **NextGen/NowGen**
  First on the list, without question, is the accelerated deployment of a GPS-based, digitally enabled air traffic management system. As always has been the case, this needed upgrade will be paid for by the airlines and the flying public, with the airlines paying multiple billions of dollars both for aircraft equipment upgrades to be compatible with the new system and for the system's infrastructure managed by the Federal Aviation Administration (FAA). But it is important to emphasize that this deployment must be advanced with real, measurable benefits to system users – that is the way to incentivize users to make the necessary equipage commitments. It cannot just be about the FAA and its budgetary interests. We are looking for rapid deployment of Area Navigation (RNAV) and Required Navigation Performance (RNP) procedures, making significantly more efficient operations a reality and providing real operational benefits for users who commit to Automatic Dependent Surveillance-Broadcast (ADS-B) equipage. We want, need and expect closely spaced approaches that take advantage of improved precision and safety and performance capabilities. A good place to start would be with regional development in the areas suffering from acute congestion.

As noted, we expect benefits for users, but also for the service provider – a win/win for both. Perhaps even more importantly, this type of responsible acceleration of NextGen technology, NowGen in our preferred terminology, and procedures is also a win for the environment. We know that environmental performance can be improved by at least 10 percent by taking advantage of direct routings and reducing delays. Those steps also lead directly to improved customer service and improved economic performance. As economics improve, investments in the future – both new fleets and aviation system infrastructure, can be more easily made – again a win all around. But it starts with finding and delivering real near-term benefits and leveraging from there.

- **Trust Fund Reauthorization**
  The power of leveraging investments must also be a central principle of the reauthorization of the Airport and Airway Trust Fund. As you know, this debate has been underway for the past several years – and we expect that it will not be resolved until later this year at the earliest. In fact, we are committed to working with the Congress and the administration to take the time to get it right. There is too much at stake to rush the process and it is only fair, in our opinion, to provide the Obama administration sufficient time to fully assess the situation and provide real guidance to a successful result.

  We know that today, the Trust Fund is being rapidly depleted. In 2009, we expect that there will be a shortfall in the Trust Fund collections and that FAA will spend about $15 billion while collections will be about $12 billion. If the FAA is forced to tap the uncommitted trust fund resources for the difference, that will leave only about $200 million in reserve going into 2010 – and something on the order of a $1 billion shortfall.

  With the need for rapid investment in NextGen, of course, there is a need to act responsibly to address this shortfall and move forward with the necessary investments. That is where General Fund investment, as well as creative financing, must play a role. With increased General Fund dollars combined with new bonding authority and/or the establishment of a national infrastructure bank, we can leverage the revenue stream to make essential investments today and pay for those investments over time.

  What we cannot do is continue – as we have in the past – to look to airlines and their customers to pay a disproportionate share of system expenses. Today, for example these parties contribute over 90 percent of Trust Fund revenues but impose only 70 percent of costs. This includes the cost of services that we do not use, such as half a billion dollars to pay for Flight Service Stations and $1 billion for small, noncommercial airports that we do not serve. These are fine, public service investments – but they can no longer be made the responsibility of the airlines and their customers.

- **Airports**
  We also need to work more closely with our friends in the airport community to jointly develop an economically vibrant commercial aviation system that is essential to the industry's well-being. Today, airports have some $27 billion in unrestricted financial assets – and yet there are those insistent upon an untenable increase in the Passenger Facility Charge (PFC) from $4.50 to $7. That could mean an increase in PFC payments from $3 billion to $5 billion per year at a time when those revenues are desperately needed for more pressing ATC, fleet and technology investments.

We expect to properly fund airport facilities – and we do. In 2007 that meant $3.5 billion in Airport Improvement Program spending, almost $7 billion in rents and fees and almost $3 billion in PFC dollars – but like everything else we are doing, airports must find ways to increase efficiency and do more with less.

Airlines and the Environment

Finally on the environment, the commitment of the airlines is clear and not new. This should not surprise anyone since fuel is central to our cost structure and we have long felt the importance of reducing fuel burn and associated greenhouse gas emissions. As a result, our GHG efficiency today has improved 110 percent since 1978, with a commitment to an additional 30 percent improvement by 2025. That allows us to contribute only 2 percent of domestic GHGs (as compared to 25 percent for the rest of the transportation industry) while we supporting two to three times that share of GDP.

But our commitment does not stop there. As mentioned, ATC modernization will enable still greater environmental efficiency. We are also pushing constantly for greater airframe and engine environmental performance and we are a major presence in the search for environmentally friendly alternative aviation fuels. Real progress is being made on this front and a successful conclusion to this work would certainly be "game changing."

We are, however, deeply concerned with misguided plans to dramatically increase industry costs through environmental fees or taxes, including coverage of airlines under a cap-and-trade emissions trading scheme. These schemes are all too likely to divert the limited investment dollars that we know must be devoted to new fleets, ATC infrastructure and other environmentally and corporately responsible investments in the future of our businesses. Under the administration's budget and various legislative proposals, for example, between $1 billion and $5 billion could be diverted from the industry by 2012 – with more to follow. While perhaps well intentioned, this approach would have a devastating effect on the nation's economy – and on the economies of literally every city and state we serve. At the same time, our ability to improve our environmental performance would be drastically curtailed. It is a lose/lose proposition.

The airlines have demonstrated their commitment to the environment and look forward to continuing to expand that commitment. They will do everything possible to see to it that the resources are available to follow through, but we need the cooperation of our government partners to get it right.

Conclusion

In sum, the airlines have tremendous challenges to overcome and we, obviously, want to see them succeed. It is important to recognize that their success is not simply a matter of individual companies prospering or not. Rather, it should be a matter of real concern at every level of government – nationally, as we all work to jump start our struggling economy and at the state and local levels where success means air service and jobs and revenues – or, as we have seen too much lately, their absence.

Statement of Peter J. Bunce
President and Chief Executive Officer
General Aviation Manufacturers Association

Before the Aerospace States Association
Hearing on STEM Education, Aviation and Space
March 9, 2009

Lieutenant Governor Askins, Lieutentant Governor Garamendi, and members of the Aerospace States Association, thank you for the opportunity to testify before you today regarding one of the world's most important and dynamic industries. General aviation is an integral and vital part of a magnificent system operated for the public benefit. It is providing services and fulfilling needs that are more essential to the economy than ever before.

I am here today as President and Chief Executive Office of the General Aviation Manufacturers Association (GAMA), an international trade association based in Washington, D.C. GAMA represents 67 of the world's leading manufacturers of fixed-wing general aviation airplanes, engines, avionics and component and service providers. In addition to building nearly all of the general aviation airplanes flying around the world today, GAMA member companies operate fleets of airplanes, fixed-based operations, pilot and technician training centers, and maintenance facilities.

It is with this membership base that I address the Aerospace States Association today, hopeful that together we can work together to keep this industry a viable and powerful economic engine for economic growth, competitiveness and employment.

GENERAL AVIATION IS CRITICAL TO THE U.S. ECONOMY

Spurred by the subprime mortgage crisis and its effect on credit availability early last year, the U.S. was the first to see the storm clouds on the economic horizon. Even as business jet shipments in the second and third quarters remained strong, the industry took notice of the drop in general aviation flight activity and a continued softening of piston aircraft sales.

As we entered the third quarter of the calendar year, the big question emerged. How much would the sputtering U.S. economy cool off the record hunger for our products? With energy revenues propping up continued demand from emerging markets for general aviation aircraft, there was hope that this momentum would mute the effect of what was occurring in the U.S. economy.

As the fourth quarter arrived, the financial crisis spread to a global level, energy revenue plummeted and manufacturers became evermore focused on skillfully managing their backlogs in order to navigate through this downturn and maximize stability for the next

several years. Concurrently, sustaining a flow of orders for aircraft became an increasing challenge for our worldwide sales force.

As public anger over the deteriorating market environment and job losses intensified, general aviation became collateral damage as policymakers worked to address public concern. In the recrimination that followed, the facts were lost that our industry is a tremendous economic engine for driving growth, competitiveness and employment.

Our industry contributes over $150 billion to the U.S. economy each year and is a critical stimulus for the U.S. economy. General aviation manufacturing is also one of few remaining industries contributing positively to the U.S. balance of trade. In 2008, our manufacturers generated $5.9 billion in new airplane export revenue, which was a 27.8 percent increase over 2007. These exports accounted for 43.9 percent of the total value of U.S. general aviation manufactured airplanes in 2008.

Our industry is also a powerful source of over 1.2 million high-paying, technical jobs whose collective earnings exceed $53 billion. Direct impacts, such as the sale and operation of an aircraft, multiply as they trigger transactions and create jobs elsewhere in the economy. However, as 2008 came to a close, GAMA companies started to feel the impact of the slowing worldwide economy. Our members carefully balanced growth verses backlog during this past decade to mitigate the adverse impact of the inevitable downturn in the business cycle. Preparation notwithstanding, the difficult announcements of layoffs and furloughs, which have become all too frequent over the past few months, shows the severity of the global economic downturn. Our member companies have laid off over 12,000 workers since last November.

Investment in research and development also creates and retains jobs. General aviation manufacturing represents the best of cutting-edge design, investment and ingenuity. In the current economic climate, manufacturers are continuing to invest in the research and development of new products and new fuels, along with an expansion of our service facilities exemplifies our optimism for the future of general aviation. Additionally, our unwavering commitment to NextGen is indicative of our vision for robust growth of air traffic and increased demand for our products in the years ahead.

FEDERAL AVIATION ADMINISTRATION REAUTHORIZATION AND NATIONAL AIRSPACE SYSTEM MODERNIZATION

Delays in the Federal Aviation Administration (FAA) reauthorization process have slowed the United States' ability to meet future air traffic demands. As the new Congress revisits the reauthorization bill in 2009, it is imperative that they make a renewed commitment to finish this bill, capitalize on financing compromises made in the previous Congress, and make the development of a modernized national airspace system a top priority.

To facilitate many of the economic and environmental benefits of a modernized air transportation system, new aircraft equipment must be installed on commercial and

general aviation aircraft. Incentives to support avionics implementation would accelerate the economic benefits of a modernized transportation system as well as hasten emissions reductions and capacity gains while increasing safety.

However, we are concerned that language contained in Section 303 of H.R. 915, the FAA Reauthorization Act of 2009, puts thousands of American jobs at risk from coast to coast. This language, if included in the final FAA reauthorization bill, would lead to retaliatory actions by the European Community, raising costs for repair stations, putting customer relations at risk, and placing these stations at a competitive disadvantage in a very difficult economy. In order to protect these high-paying jobs, we have asked the House Transportation and Infrastructure Committee amend language in Section 303 to allow the United States to honor its international agreements.

ENVIRONMENT

The general aviation industry has long been committed to improving the efficiency, and therefore reducing the environmental impact, of its products. GAMA's member companies have intensified that effort through improvements in airplane and engine design and the development of advanced avionics, which make flight operations more efficient, thus reducing carbon emissions. GAMA's Environment Committee is working with our members and other industry groups on strategies to reduce general aviation's already low contribution to total greenhouse gas emissions. We will strive to ensure that the debate over climate change is informed by sound science and facts, and that it recognizes general aviation's strong record of efficiency improvements.

As stated above, in the case of aviation, an effective way to reduce emissions is to continue the work to implement a more efficient NextGen system based on satellite technology. The Government Accountability Office has cited FAA data showing that the full implementation of NextGen could reduce greenhouse gas emissions from aircraft by up to 12 percent by 2025. It is also important that the government invest in research for the alternative fuels to power the nation's airlines and general aviation.

LOOKING TO THE FUTURE

The last five years have shown what tremendous capability the general aviation manufacturing industry has as a provider of dynamic, high-paying jobs to a tremendous workforce. But make no mistake; our members are facing an extremely difficult economic environment which must not be made worse by regulatory, security or environmental burdens that could threaten more jobs if the consequences of new rules and legislation are not appropriately evaluated. The new administration and Congress should rely upon our industry in this time of economic uncertainty and ensure that all regulations and policies focus on measures that help our industry retain jobs and drive recovery.

General aviation manufacturers are willing and ready to take the steps necessary to keep our industry viable and strong, but we must have partners. We ask that the members of the

Aerospace States Association help carry our message to their governors and to the new Congress and Administration. We need sound regulations and policies that focus on measures to help manufacturers and others in the aviation industry retain jobs and encourage recovery. With your help, we can send this critical message and work together help our industry be well-positioned to ride out this economic storm, and emerge healthy with renewed momentum to grow this industry once again.

Members of the Aerospace States Association, thank you for the opportunity to testify before you today and I look forward to answering your questions.

Testimony of Gregory Principato
President
Airports Council International-North America

before the

Aerospace States Association
"Capitol Hill Hearing on STEM Education, Aviation and Space"

March 9, 2009

Airports Council International-North America
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Thank you for allowing Airports Council International-North America (ACI-NA) the opportunity to participate in this important hearing.

I used to work in state government and I know how important your support is for airports throughout this country. Thank you for recognizing that airports play a critical role in our country's transportation network and are a key driver in economic development for their communities.

This was recently acknowledged when Congress included $1.1 billion for airport infrastructure improvements in the American Recovery and Reinvestment Act, as well as $1 billion for security improvements. This financial assistance allows airports to accelerate key safety, security and capacity projects throughout the United States, creating thousands of jobs and improving the overall infrastructure of the air transportation system.

Congress also provided relief from the alternative minimum tax penalty on private activity bonds used for airport projects, ultimately reducing borrowing and construction costs for airports and airlines.

We know that with your assistance and support we can play an even greater role in the vigorous growth of local economies with if we are successful in passing of legislation to reauthorize the Federal Aviation Administration.

As my colleagues have discussed, there is a critical need to modernize the aviation system. For airports, we need to maintain our infrastructure to provide safe and secure facilities for the traveling public whether one plane or one hundred use an airport on a given day.

Almost 20 years ago, Congress provided airports a financial tool that has proved to be a model for federal-local partnerships and the lifeline for airport financing, the Passenger Facility Charge. The results speak for themselves as PFCs have been responsible for the obligation of $64 billion in airport capital investments since being implemented in 1990. By granting airports the ability to generate local funding through the collection of the PFC user fee, all those who use the system have a voice in infrastructure development in consultation with the FAA on an ongoing basis.

This financing tool has allowed local communities to determine their needs and map out a plan for improvements and development at the airport in coordination with the airport users.

The FAA reauthorization bill, HR 951, includes an increase in the limit on the PFC user fee to $7. But frankly, that is not enough to fund the necessary improvements at airports. ACI-NA strongly supports an increase in the ceiling of this local user fee to at least $7.50, with future increases indexed to match construction cost inflation. The purchasing power of the PFC has been greatly diminished by skyrocketing construction costs. The current maximum PFC of $4.50 is worth only $2.46 today. Fully adjusting the PFC to account for construction cost inflation would place the fee at $8.33.

History has shown that airports carefully evaluate the need for infrastructure projects. History has also shown that if you wait to act till your infrastructure is inadequate, you've waited too long. Traffic may be down now, but we did not have the infrastructure to meet demand last summer. How can we expect to prevent passenger delays and inconvenience when passenger traffic returns?

ACI-NA, in its 2009 Capital Needs survey, found that both commercial and general aviation airports have $94.4 billion in total projects over the next five years that are considered essential by the airport and airport users to meet forecasted passenger and cargo growth. Not surprisingly, over half of these projects are at large hub airports that continue to experience congestion and flight delays. And, yes, our survey found that many airports of all sizes have delayed or canceled the construction of billions of dollars in projects. Even so, the needs are great and the costs are rising.

As you well know, passengers also want price and service competition – which PFCs help facilitate. It is important to remember that PFCs were authorized by Congress because incumbent airlines, especially those dominating large hub airports, would not agree to construction projects that allowed new airlines to serve the community. PFC's provided the solution and today there are numerous examples throughout the United States, such as Baltimore, Denver, Detroit, Burlington and Philadelphia, where the facilities built with the PFCs have ultimately benefited passengers through lower fares. Passengers have proven willing to invest today for lower fares and fewer delays in the future.

Airports are required to be self sufficient in their funding and are unique in the transportation industry in their ability to generate necessary investment predominantly from bonds, the PFC or from airport revenues. Yet, incredibly, our airline partners oppose generating resources for investment; investment which ultimately makes the travel experience more pleasant for their passengers. To me, this is amazing, especially when everyone in the travel industry is concerned about fewer people flying. I bet you have never met a passenger who says we

have done enough to reduce delays and congestion, but airlines have largely succeeded in pushing the passenger out of the way in this debate.

I was on a flight last week and was told I could have a blanket –for $7! It came with ear plugs and eye shades and a drawstring bag with the airlines' logo on it. And the airlines don't want Congress to add $2.50 to the PFC limit to build runways, taxiways, terminals and other important infrastructure. If it weren't so sad, it would be amusing that airlines claim that a $2.50 increase in the PFC user fee proposed by Congress will ultimately reduce passenger traffic when the a la carte pricing in place for the majority of carriers imposes fees that greatly exceed the PFC for services from checking a bag to making a seat reservation to using a pillow.

I would be remiss if I did not mention that airports also use PFC funds, as well as their revenues, to help reduce our environmental footprint and help reduce emissions and improve energy efficiency. I am pleased to say that many of the environmental provisions in the House bill were actually drafted by ACI-NA.

I also want to mention our support for continued work on development and deployment of Next Generation Air Transportation System (NextGen) improvements. It is important to understand that a transition to NextGen will also depend on the ability of airports to handle greater capacity. Airports will play a critical role in implementing infrastructure and procedural enhancements needed to meet identified capacity needs, such as runway and taxiway enhancements. Airports will also be on the front line in providing additional airport terminal and roadway capacity commensurate with the airfield and airspace capacity increases NextGen will provide.

Let me conclude with the most important issue for airports – safety. It is our first priority and we are committed to dedicating the necessary resources to ensure the safety and security of passengers and employees.

ACI-NA staff work with FAA, DHS, TSA and EPA on numerous industry-government committees working to enhance aviation's already impressive safety record. I serve on the FAA Runway Safety Council and we are looking at the best way for airports, airlines, pilots, air traffic controllers and the FAA to reduce runway incursions. This is time and money well spent.

We must ensure careful evaluation of proposals to change regulations to obtain the greatest benefits for our safety dollars. That is why we are concerned about a proposal to mandate specific airport rescue and fire fighting standards, which could actually reduce safety but will certainly increase costs. In December 2008, we

conducted a survey of our members on how much it would cost them to comply with proposed NFPA standards. We found that capital costs for compliance would average $6.5 million and annual operating costs would add $2.5 million per year forcing many smaller airports to consider closing down. The better approach is for FAA to initiate a rulemaking process to evaluate the costs and benefits of any change in the regulations.

Airports are ready to go to invest in the safety and efficiency of air transportation system- a sound investment for our nation's economic future. Congress, by providing funding and allowing more bond financing in the stimulus bill, has given us a good start. It can go even further by raising the limit on the PFC user fee - local money that is project based and does not support a bureaucracy. We encourage you to tell Congress that you support an increase in the PFC user fee, an investment that pays off in enhancing safety, reducing delays and congestion, and providing lower ticket prices. Thank you.

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Mr Gary Payton, SAF/US(D), Testimony to Aerospace States Association Space Panel, March 9, 2009

Lieutenant Governor Askins and members of the Aerospace States Association, thank you for inviting me to join you today to discuss our nation's space capabilities.

Capabilities achieved from space are vital to our nation, and our capabilities are the envy of the world. National security space has served the country well for nearly half a century. Our diplomatic, information, military, and economic (DIME) power relies on space; from peacetime to crisis and conflict. Global situational awareness, global connectivity, strategic reach, and precision strike are all enabled through space. As a result, space has changed the way we fight, and it allows American military forces to know more about their adversaries, to see the battlefield more clearly, and to strike more quickly and precisely than was ever before possible. Space capabilities provide American leaders with current and accurate information on developments, issues, and crises around the world. It provides intelligence that would otherwise be lost, warning that would otherwise be undetected, and communications that would otherwise be impossible.

Some examples of space contributions to national security include:

Global Missile Warning – 24/7/365. No rocket launches anywhere in the world without us knowing about it; including the White House if it's going the wrong way. Fast, accurate detection of missile vectors help us determine vulnerable targets, and quickly decide on a course of action. Real-time warning allows a more effective, successful defense, and provides battlespace awareness to theater.

Worldwide communications - Government and commercial; Protected, Wideband, and Narrowband. From the President controlling our nuclear forces, to a pilot flying a Predator over Iraq from the United States, to a Special Forces lieutenant calling for exfiltration; comms are an essential space-based system.

Global Positioning and Timing. We provide position and timing accuracy down to centimeters and nanoseconds anywhere in the world (land, sea or air), 24/7, in any weather, for free. The Department of Defense and the Intelligence Community depend on GPS to support many different missions and capabilities including weapon system guidance, precise navigation, satellite positioning, and communication network timing. The civil and commercial communities are equally reliant on GPS to provide the commercial underpinning and infrastructure—and it is all free. GPS is used for search and rescue, surveying and mapping, fishing and boating, sports and leisure, and iPhones.

Weather. Not just pictures of tops of clouds—we provide Global, high resolution measurement of atmospheric temperature, density, and volume to populate mathematic models and enable accurate weather prediction of a ridgeline in Afghanistan 48 hrs in the future.

Space Surveillance. We keep track of over 18,000 space objects every day, and provide that information to the world for free.

Space Infrastructure. The Air Force has created a global space infrastructure of launch and range systems, satellite command and control, and a cadre of trained space professionals that is second to none.

The success of our national space program is best illustrated by our unprecedented string of launch successes, 59 national security space launches, which started in 1999 and continues through the present. By national security space launches, I'm referring to all Air Force Space Command, Missile Defense Agency, Navy, National Oceanic and Atmospheric Administration, and National Reconnaissance Office orbital missions. This success is a testament to the knowledge, skill, and commitment of our space professionals. Many cry for lower cost launch systems… me too. But, if I save a few dollars on launch and end up lowering the reliability of the rocket, I'm pushing on the wrong end of the lever. Due to the age and fragility of our satellite constellations, we are dependent on this 100% launch success for the foreseeable future. All our constellations are using satellites that have outlived their intended design lives. Continuity of our key space missions is now as important as modernization. This includes civil, commercial, and international systems to supplement our national security systems for communications, weather, and Intelligence, Surveillance and Reconnaissance.

However, our reliance on space, as a nation, at the national security, civil, and commercial levels, is growing every day. GPS is a perfect example and one that is equally important to the defense, intelligence, civil, and commercial communities. Of the approximately 800 active satellites in orbit, the U.S. owns more than 400, just over 50%. Approximately 100 of those satellites are National Security Space satellites, government-owned satellites that support defense and/or intelligence functions. Russia and China have 2nd and 3rd highest number of space assets, 89 and 35 satellites respectively.

Space is no longer a sanctuary - Our potential adversaries continue to advance technologies and evolve capabilities that can deny our use of space. Anti-Satellite missile attacks and jamming have occurred to civil and commercial satellites. As never before, we need sound national policies and a vigorous industrial base. The space environment we operate in is becoming more contested and will continue to be even more contested in the future. The space environment continues to evolve.

The number of space objects and debris we must contend with will continue to increase. ~18,000 today projected to be ~25,000 by 2025. The number of countries with the means and the desire to access space is increasing. Today, 43 nations have active payloads on-orbit. China has vigorous human spaceflight program. Iran recently launched a satellite. North Korea claimed to attempt a launch, and has announced it is preparing for another one. Technology continues to advance, and the size of many satellites is getting much smaller. As the space

environment and foreign capabilities continue to evolve, we must fundamentally shift the way we think about space protection. In other words…we need to protect the Space Domain – allow everyone to use space for peaceful purposes.

The first step in Space Protection is to improve Space Situational Awareness. With Space Situational Awareness, we need to move from a static catalog of objects to more of a FAA air traffic control capability that maintains "Track Custody" and establishes intent of every object in space. Our current Space Situational Awareness architecture is primarily used for routine cataloging of space objects. The top priority is to support manned space operations, followed by launch safety of flight, awareness of national space assets, and awareness of commercial and foreign entities upon request and as our capacity, manpower, and assessment systems, allow.

The current architecture has many limitations that we must address to enhance future space protection. We are pushing to address gaps in sensor coverage, sensor sensitivity, and sensor integration. To transform the surveillance network in to an integrated Space Situational Awareness network it needs to feed timely, actionable data to enable space protection, enable the network to maintain better custody of space objects, perform combat ID to determine capability & intent, and differentiate attack from anomaly to provide clear attribution in cases of interference or attack.

We need to push forward in three general areas. First, **Integration** – better fusion of the existing sensors (including ones we don't currently use) -- a comprehensive space operating picture. Second, **Timely Data Delivery** – allow predictive planning and real-time response. Dynamic sensor tasking for on-demand access and object tracking. Third, **Improved Sensor Capability** – find and maintain custody of smaller objects and conduct the detailed characterization required to determine capability. Sensors with the sensitivity and capacity to detect, track, and characterize small objects. The desired End State is continuous custody. For example, track a launch event (all stages), what comes off of it, and what orbit those elements remain in. This will enable us to determine if an event was caused by the space environment, an engineering anomaly, or a hostile act.

The end state of space protection is to ensure US freedom of action in space. We achieve this by preserving space as an asymmetric advantage for the US and our allies. US must deploy a defense-in-depth strategy to dissuade, deter, defend, and if necessary, recover/reconstitute space assets. Our actions must shape situations to deter potential adversaries from developing and employing capabilities to adversely affect US space systems. We need tools & courses of action to actively defend our space assets. We need to invest in options that allow us to actively negate threats. We need to know the intent in order to determine attribution. We need a protection strategy that includes recovery and reconstitution of those space capabilities that are critical to victory

However, as I've already stated, the linchpin is a robust, timely, and integrated Space Situational Awareness architecture to enable tactically responsive defenses to protect our critical space infrastructure.

In conclusion, space capabilities are vital to National Security, Economic Growth, Public Safety and Welfare. Space is a challenging, demanding, and contested domain. Like Air Power, Space Power shapes the U.S. approach to warfare, and our space mission serves Joint Forces, our Nation, and the World at large. We need to concern ourselves with protecting space *assets*; but more importantly we need to focus on protecting the *capabilities* afforded by space. In protecting those capabilities, we need to expand our focus to include not only space, but the other mediums as well. Additionally, we need to include our space partners in improving space protection. As we continue to expand / broaden our partnerships with civil, commercial, and international space we spread our dependence on space, and likewise spread the need to protect space.

Thank you for allowing me to discuss our space capabilities with you. I look forward to your continued support of our nation's space program.

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STATEMENT

Dr. Peter M. Wegner
Director, Operationally Responsive Space Office
Office of the Secretary of Defense

Before the Aerospace States Association
Hearing on STEM Education, Aviation and Space

March 9, 2009

MR. CHAIRMAN AND MEMBERS OF THE AEROSPACE STATES ASSOCIATION (ASA), I WOULD LIKE TO THANK YOU FOR THE OPPORTUNITY TO PARTICIPATE IN THIS IMPORTANT HEARING. YOUR LEADERSHIP AND SUPPORT OF THESE SIGNIFICANT ISSUES OF STEM EDUCATION, AVIATION AND SPACE IS APPRECIATED.

(LT. GOVERNOR DUBIE, LT. GOVERNOR ASKINS AND LT. GOVERNOR GARAMENDI), THANK YOU FOR THE WORK YOU ARE DOING TO INVIGORATE THE ASA AND FOR TAKING SUCH A PIVOTAL ROLE IN EMPHASIZING THE NEED FOR THE GLOBAL ECONOMY TO CONTINUE TO BE BUILT UPON A SCIENTIFIC, TECHNICALLY QUALIFIED AND LITERATE WORKFORCE.

ON BEHALF OF THE EXECUTIVE AGENT FOR SPACE, SECRETARY MICHAEL DONLEY, WE APPRECIATE THE OPPORTUNITY TO BE ABLE TO SHARE WITH YOUR ASSOCIATION SOME OF THE ACCOMPLISHMENTS AND PLANS FOR THE OPERATIONALLY RESPONSIVE SPACE OFFICE. I AM ALSO HONORED TO BE JOINED HERE BY MR.GARY PAYTON, WHO I WORK VERY CLOSELY WITH AND MR LARRY WILLIAMS, LEAD FOR GOVERNMENT RELATIONS OF SPACEX.

LET ME START BY PROVIDING SOME BACKGROUND. IN THE JOHN WARNER NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2007, CONGRESS ESTABLISHED A PRIORITY FOR THE NATION BY CALLING FOR DoD TO ESTABLISH AN OFFICE DEDICATED TO OPERATIONALLY RESPONSIVE SPACE. ON MAY 21, 2007, THE DEPUTY SECRETARY OF DEFENSE AND THE DoD EXECUTIVE AGENT FOR SPACE STOOD UP THE ORS OFFICE AT KIRTLAND AIR FORCE BASE IN ALBUQUERQUE, NEW MEXICO AS A PROACTIVE STEP TO ADAPT SPACE CAPABILITIES TO CHANGING NATIONAL SECURITY REQUIREMENTS.

THE LAW ALSO SET FORTH A PLAN TO SUPPORT MILITARY USERS AND MILITARY OPERATIONS. ON JULY 9, 2007 THE DoD PUBLISHED DEPARTMENT-WIDE GUIDANCE THAT LINKED ORS TO NATIONAL SPACE POLICY.

THE DoD OPERATIONALLY RESPONSIVE SPACE MEMORANDUM DESIGNATES ORS AS THE INITIATIVE TO MEET THE NATIONAL SPACE POLICY GOAL THAT “BEFORE 2010 THE U-S SHALL DEMONSTRATE AN INTITIAL CAPABILITY FOR OPERATIONALLY RESPONSIVE ACCESS TO AND USE OF SPACE TO SUPPORT NATIONAL SECURITY REQUIREMENTS.” THE KEY ELEMENT HERE IS THE FORMAL DEFINITION OF ORS WITHIN THE DoD AS “ASSURED SPACE POWER FOCUSED ON TIMELY SATISFACTION OF JOINT FORCE COMMANDERS’ NEEDS.”

THE DEPARTMENT ALSO RECOGNIZED THE FUNDAMENTAL ABILITY FOR ORS TO ADDRESS OTHER USERS’ NEEDS, AND TO POSTURE THE NATION FOR IMPROVING THE RESPONSIVENESS OF SPACE CAPABILITIES TO MEET A WIDE RANGE OF NATIONAL SECURITY REQUIREMENTS. DoD RECOGNIZES ORS TO FULFILL ITS VISION THROUGH CLOSE COLLABORATION WITH MILITARY, INTELLIGENCE, CIVIL, COMMERCIAL, ACADEMIC AND INTERNATIONAL PARTNERS.

ORS WAS DEVELOPED TO BE AN AGENT FOR CHANGE, TO EXPLORE DIFFERENT AND MORE COST EFFICIENT BUSINESS MODELS WITHOUT CHALLENGING DEVELOPMENTS THAT ARE ALREADY UNDERWAY. TO THAT END, CONGRESS ALSO EXEMPTED THE ORS OFFICE FROM THE TRADITIONAL ACQUISITION AUTHORITIES AND REQUIREMENTS PROCESS.

ORS EXISTS AS BOTH COMPLEMENTARY TO CURRENT SPACE CAPABILITIES AND AS A MEANS BY WHICH TO IMPLEMENT NEW CAPABILITIES. SEVERAL OF OUR LARGE, MULTI USE SPACE ACQUISITIONS ARE EXPENSIVE, TAKE A LONG TIME TO DEVELOP AND DEPLOY, AND REQUIRE EXTRAORDINARY TECHNICAL EXPERTISE. ORS, HOWEVER, IS WORKING TO PROVIDE IMPROVEMENTS IN SPACE ACCESS, ON-ORBIT RESERVE CAPABILITY AND COMPLEMENTARY TO THE EXISTING GROUND AND AIR ASSETS.

ANOTHER VERY IMPORTANT ASPECT OF ORS IS THE SCIENCE AND ENGINEERING SKILL BASE WE ARE USING. WITH OUR RAPID FLIGHT RATES AND TECHNOLOGY REFRESH PROJECTS, WE CAN ATTRACT AND HELP GROW A NEW WORKFORCE. WORKING WITH THE DIVERSITY OF ORS PROGRAM ELEMENTS GIVES YOUNG ENGINEERS AN OPPORTUNITY TO RAPIDLY GAIN END-TO-END SPACECRAFT MISSION EXPERIENCE ALL THE WHILE BRINGING INFORMATION AGE TECHNOLOGIES AND PROCESSES TO THE SPACE INDUSTY.

BASED ON THE US STRATEGIC COMMAND'S CONCEPT OF OPERATIONS, ORS HAS TWO MISSION ESSESNTIAL TASKS: FIRST TO SATISFY THE NEEDS OF THE JOINT FORCE COMMANDER IN OPERATIONALLY RELEVANT TIMELINES, AND SECOND, TO BUILD THE ENABLERS TO ALLOW FOR CALL-UP TO LAUNCH IN DAY TO WEEKS. OUR VISION, ALSO CALLED THE "ORS END STATE" IS TO DELIVER RESPONSIVE SPACE CAPABILITIES TO THE WARFIGHTER IN SIX DAYS. THIS VISION PROVIDES FOCUS FOR THE OFFICE AND IS DEFINED AS 'THE ABILITY TO ADDRESS EMERGING, PERSISTENT, AND/OR UNANTICIPATED NEEDS THROUGH THE TIMELY AUGMENTATION, RECONSTITUTION AND EXPLOITATION OF SPACE FORCE ENHANCEMENT, SPACE PROTECTION, AND SPACE SUPPORT CAPABILITIES.

TO ASSURE REPSONSIVENESS TO THE JOINT FORCE COMMANDER, THE ORS OFFICE UTILIZES A RAPID INNOVATION PROCESS AND A MODULAR OPEN SYSTEMS ARCHITECTURE. WHEN I SPEAK OF A MODULAR OPEN SYSTEMS ARCHITECTURE, I AM MIRRORING WHAT HAS ALREADY BEEN SUCCESSFULLY ACCOMPLISHED BY COMPANIES LIKE DELL AND GOOGLE AND IN THE WORLD WIDE WEB. I BELIEVE THAT USING STANDARD INTERFACES AND MODULAR SYSTEMS ENABLE A RECONFIGURABLE ARCHITECHTURE THAT WILL DECREASE DEVELOPMENT AND DEPLOYMENT TIMELINES IN A COST EFFECTIVE MANNER. THIS PROVIDES THE MEANS FOR US TO FACILITATE RAPID ASSEMBLY, INTEGRATION, TEST, DEPLOYMENT, AND OPERATIONS OF SPACE ASSETS INTO THE CURRENT SPACE ARCHITECTURE--DRIVING DOWN OVERALL UNIT COST AND DEVELOPMENT TIMELINES FOR SPACECRAFT, LAUNCH, AND DEPLOYING SPACE CAPABILITIES IN A MATTER OF DAYS INSTEAD OF MONTHS OR YEARS.

WE ARE ALSO CAPITALIZING ON EMERGING AND INNOVATIVE CAPABILITIES AND INTEGRATING THEM WITH RESEARCH & DEVELOPMENT EFFORTS. THE ORS OFFICE ENGAGES THE ENTIRE SPACE COMMUNITY THROUGH COLLABORATION AND COALITION OPPORTUNITIES. FOR EXAMPLE, NASA HAS BEEN AN IMPORTANT PARTNER WITH THE ORS OFFICE. NASA HAS PROVIDED A FULL TIME LIAISON TO THE ORS OFFICE TO COORDINATE NASA SUPPORT. NASA IS PROVIDING TECHNICAL EXPERTISE, INNOVATIVE TECHNOLOGIES, AND EXECUTION OF ORS PROJECTS AND PROGRAMS. THIS HAS ENABLED ORS TO DEVELOP CAPABILITIES AT A MUCH FASTER RATE AND TO MATURE A MODULAR OPEN SYSTEMS ARCHITECTURE THAT CAN BE USED FOR BOTH CIVIL AND MILITARY SPACE SYSTEMS IN THE FUTURE.

WHAT USED TO TAKE MONTHS AND MAYBE YEARS, CAN NOW TAKE JUST HOURS OR DAYS. FOR EXAMPLE, THE AIR FORCE RESEARCH LABORATORY SUCCESSFULLY DEMONSTRATED THE

BUILDING OF THE PNP SATELLITE IN JUST FOUR HOURS, AND WE DEMONSTRATED RAPID AIR TRANSPORT OF THE SPACEX FALCON-1 ROCKET TO REAGAN TEST SITE ON KWAJALEIN ATOLL, AND THE ABILITY TO GO FROM CLEAN-ROOM TO LAUNCH OF A SATELLITE IN SIX DAYS. LAST YEAR WE MADE SIGNIGICANT PROGRESS TOWARD OUR MISSION GOALS. WE RECEIVED THREE NEEDS FROM US STRATEGIC COMMAND AND EXERCISED OUR COMMUNITY-WIDE REQUIREMENTS PROCESS SUCCESSFULLY FOR EACH ONE. WE DEMONSTRATED PIECES OF THE RAPID DEVELOPMENT PROCESS, AND PARTICIPATED IN SEVERAL COLLABORATIVE EXERCISES AND DEMONSTRATIONS.

FOR THE JOINT FORCE COMMANDER'S NEEDS, THE TEAM OF SUBJECT MATTER EXPERTS CAME UP WITH NOVEL SOLUTIONS TO INCLUDE A UHF COMMUNICATIONS HOSTED PAYLOAD, SPACE SITUATIONAL AWARENESS SUPPORTED BY USING EXISTING ASSETS, AND A NEW ACQUISITION FOR AN INTELLIGENCE, SURVEILLANCE, AND RECONNASSIANCE GAP FILLER.

IMPLEMENTATION HAS BEEN AT A MEASURED, STEADY PACE WITH MUCH MORE GROUND TO BE COVERED. UNDER PROACTIVE LEADERSHIP FROM THE DoD EXECUTIVE AGENT FOR SPACE (AS WELL AS MY COLLEAGUE, HERE, MR. PAYTON) AND THE COMMANDER OF US STRATEGIC COMMAND, THE ORS OFFICE CONTINUES TO FOSTER STRONG COLLABORATION WITH ALL SECTORS OF THE SPACE COMMUNITY. WE WILL CONTINUE TO STEADFASTLY CHAMPION THE CASE FOR ORS AND LOOK TO CONGRESS FOR CONTINUED ADVOCACY IN DELIVERING THESE ESSENTIAL CAPABILITIES.

THANK YOU FOR THE OPPORTUNITY TO APPEAR BEFORE YOU TODAY AND THANK YOU AGAIN FOR WHAT YOUR ORGANIZATION CONTINUES TO KEEP AEROSPACE AT THE FOREFRONT OF OUR NATIONAL AGENDA.

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Statement of
Dr. Richard O'Toole
Manager of Legislative Affairs
Jet Propulsion Laboratory
For the
Aerospace State Association
Space Panel
March 9, 2009

Contributions to the Nation's Science, National Needs and Technology

I am pleased to be here this afternoon to explain how JPL contributes to the Nation as one of NASA's 10 field centers and as a Division of Caltech. JPL is unique in NASA as a Federally Funded Research and Development Center (FFRDC) whereby NASA negotiates a contract with Caltech to operate JPL in support of NASA's programmatic responsibilities. In this mode, the entirety of the facilities at JPL is owned by NASA, but the workforce is supplied by Caltech with the exception of a small cadre of NASA employees on site to administer the contract.

A few pertinent facts about JPL is that it has an annual budget of around $1.7 billion with about 85% of that coming from NASA and the rest from DOD, DOE or other governmental agencies. The JPL workforce of about 5,000 is comprised of about 3,200 scientists and engineers with the remainder institutional personnel. The technical staff is almost evenly split among doctorates, masters and bachelor level degrees. Although turnover is quite low, the Lab hires approximately 150 new technical staff fresh out of school each year in order to replenish the workforce with new ideas and the latest techniques.

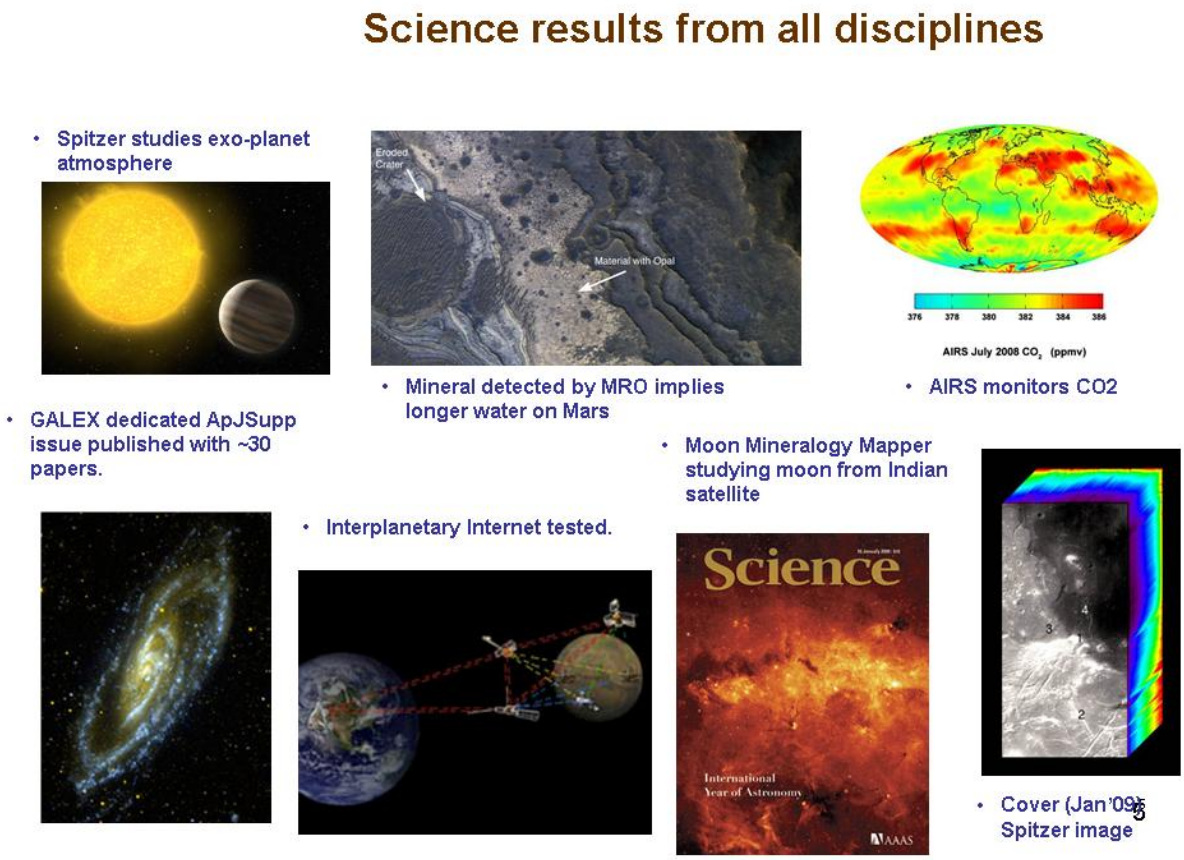
JPL's contributions to the nation come in four complementary areas:

(1) Answering fundamental questions about our solar system and universe,
(2) Increasing our knowledge of our home planet's climate and weather, (3) Applying our engineering and technologies to issues of national concern for non-NASA agencies,
(4) Developing technologies to the point that private sector industries can use that base to make commercial products.

In the pages which follow, I will attempt to illustrate each of these four roles with examples of each role which are in no way intended to be complete.

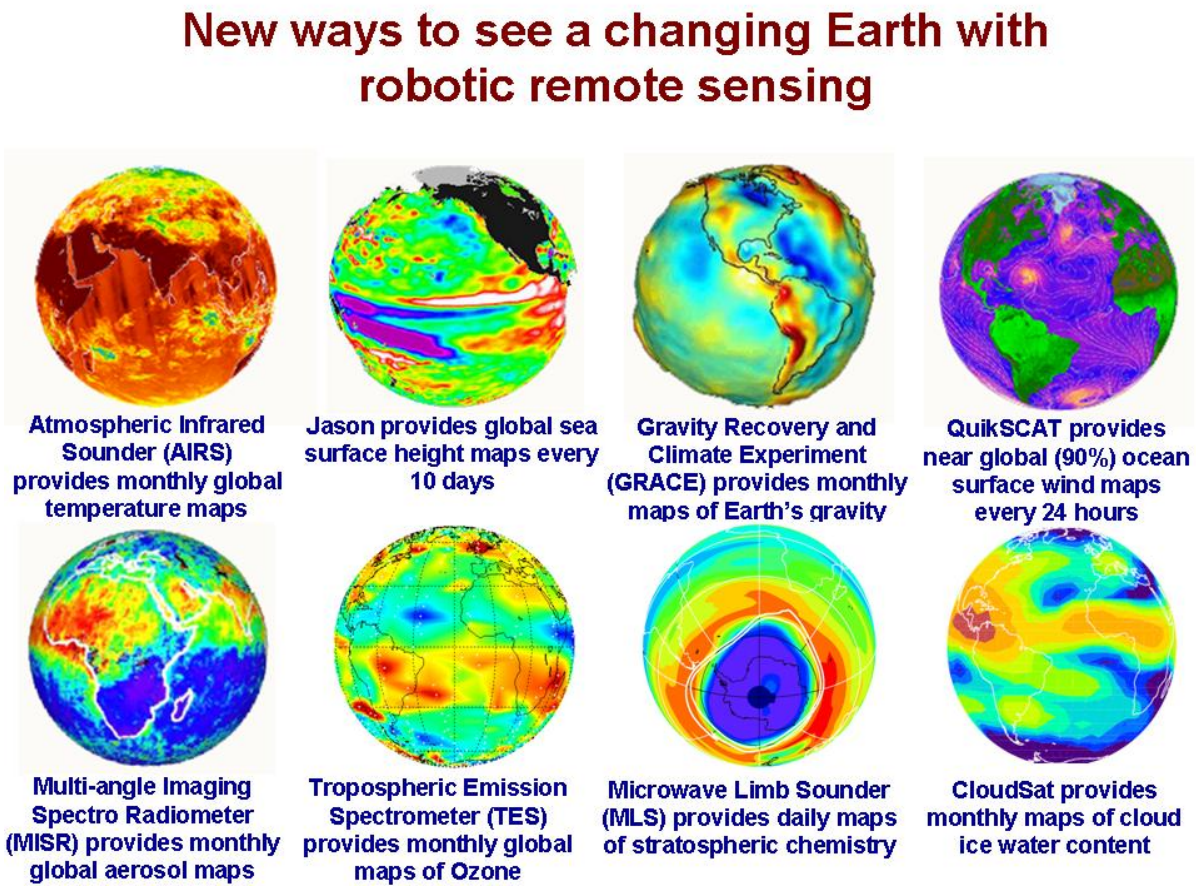
FUNDAMENTAL SCIENCE QUESTIONS:

JPL's primary focus of its NASA work is in support of the Science Mission Directorate which is attempting to answer fundamental questions about how our universe, galaxy, solar system and planet evolved, what is its ultimate fate, and are we alone? JPL has been the manager of the first mission to every planet in our solar system and has led the establishment of a "permanent" presence on Mars which continues with the two MER rovers, Mars Odyssey, and the Mars Reconnaissance Orbiter. As examples of the fundamental science returns from on-going missions the figure below illustrates just a sample.



OUR HOME PLANET'S CLIMATE AND WEATHER

JPL along with the Goddard Spaceflight Center are very active Center's in NASA's Earth Science program, trying to advance capabilities in global Earth observations, models and science understanding to contribute to the nation's understanding of climate and weather. At the current time, JPL is operating eight different earth orbiting spacecraft or instruments that are yielding enormous insights in the Earth as a system. JPL was the leading source of climate data for the most recent report of the IPCC (Intergovernmental Panel on Climate Change). Unfortunately, the loss of the Orbiting Carbon Observatory due to a launch failure last month is a major setback to the progress being made on climate change assessment. Nevertheless, the operating spacecraft are providing continuous measurements of key climate date as shown in the chart below.



ADDRESSING PROBLEMS OF NATIONAL CONCERN

Create a more secure world and improve the quality of life by investing in technologies and collaborating with other agencies, industry, and academia. The mission is to apply JPL's unique skills and assets to solve problems of national importance in a manner that is synergistic with the NASA mission. To accomplish this National Space Technologies Applications Office within JPL develops collaborations with elements of the four national space sectors: Military, Intelligence, Civil and Commercial. Each of these sectors is responsible for specific development of partnerships that expand and enhance the JPL/NASA technology base.

In particular, the Military sector focuses on relationships with Defense Advanced Projects Research Agency (DARPA), Army, Navy, Air Force, the Missile Defense Agency Organization (MDO), etc. Strong collaborations are already underway with DARPA, the Air Force Research Laboratory (AFRL), the Air Force Space and Missile Command (SMC) and MDO, and others to be developed in the near term. Some technology areas of mutual interest with these agencies include: space-based radar, hyperspectral imaging, and advanced communications. The DARPA/Army robotic technology development at JPL is good example of the synergy that exists in these collaborations.

In the Intelligence sector, JPL will be proactive with the National Reconnaissance Office (NRO), the National Imaging and Mapping Agency (NIMA), the Central Intelligence Agency (CIA), etc. Examples of activities include the NASA/NIMA collaboration on the Shuttle Radar Topography Mission and the NASA/NRO collaboration in the NASA Gossamer structures program. Also, NRO awarded JPL the X-SAT Program, which will result in the space demonstration of an Actuated Hybrid Nanolaminate Mirror to enable a new class of low-cost, lightweight, space optical structures.

DEVELOPING TECHNOLOGIES

JPL's role in advanced technology is to enable new measurements and new missions driven by science for NASA. In many cases, however, that fundamental technology intended for NASA missions solves basic problems that enables the private sector to innovate new products for the commercial market. In addition, JPL acts as a first user of that technology (often with industry support) which carries the technology to state where others can carry it to the commercial application. A few examples are shown below:

Space Communications:

- Error Correction Codes to lessen "noise on the line" has been adopted by the wireless communication industry was first used in deep space communications.
- Laser Communications which enables much higher date transmission rates was developed for optical communications in deep space missions.
- Micro-Gyroscopes smaller than shirt buttons has been adopted by commercial space communications companies.

Health Care:

- Digital Imaging developed to send pictures back from space is now used in CAT scans, diagnostic radiography, and other diagnostic imaging.
- AESOP Robotic arm evolved from space used to assist in operating rooms.
- Laser Angioplasty was enabled by the JPL developed excimer laser technology (cool laser) to unblock arteries without damaging artery walls
- Optical coherence tomography (OCT) enables the elevation and size of eye tumors with non-invasive techniques.
- Robotic Arm for Microsurgery enables less invasive surgery techniques

Safety:

- Radiation Blocking Sunglasses block 98% of UV radiation.
- Terrain Collision Avoidance Systems uses digital terrain mapping the GPS to create software which enables small aircraft to avoid hazards.
- Emergency Vehicle Early Warning Safety systems use JPL transponders and microwave sensors to warn motorists of approaching public vehicles.

Transportation:

- Wide Area Augmentation System uses JPL software to enhance airline navigation and hazard avoidance at lower costs.
- Neural Net Chips are used in Ford vehicles to diagnose misfiring and thus control pollution emissions.

Computers and Instruments:

- Charge Couple Device (CCD) development took CCDs from memory devices to high performance low noise scientific imaging arrays.
- Data Compression techniques developed for use in spacecraft computing has enabled increased data transmission in internet networks.
- Active Pixel Sensor technology enables a new imaging sensor which uses far less energy than conventional video cameras.
- Infrared Cameras developed for remote sensing of Earth from space have been commercialized for medical thermal imaging and fire detection.

Environmental:

- GPS Receivers with extremely high accuracy to measure movements of earthquake fault lines have been commercialized for other uses.
- Synthetic Aperature Radar Interferometry enables highly accurate measurement of ocean currents and topographical features
- Radiation Monitoring Chips are used to detect the buildup of charges on commercial communication satellites.

In addition to the technology developed to enable space missions, JPL has an active Small Business Innovation Research (SBIR) program which has funded numerous small firms for R&D in specific technical areas of interest to NASA. A number of these R&D efforts have led to spinoffs for commercial products in addition to the support for the NASA space program.

SUMMARY

In conclusion, perhaps Dr. John Holdren the President's Science Advisor sums it up best in his testimony of February 12, 2009 before the Senate Committee on Commerce, Science and Transportation

> "I want to give special mention to the importance of R&D in our space program. Maintaining and expanding our capabilities in space is sometimes regarded as a "luxury" we should do less of in the face of more pressing earthbound concerns. But that would be false economy. Space is crucial to our national defense; to civil as well as military communications and geo-positioning; to weather forecasting and storm monitoring; to observation and scientific study of the condition of our home planet's land, vegetation, oceans, and atmosphere; and to scientific study and exploration looking "outward" that is increasing our understanding of the physical universe and our place in it."

At JPL we are trying to support all the themes mentioned in the quote above.

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The Aerospace States Association
Capitol Hill Hearing on the Aerospace Agenda for the New Administration and Congress.
March 9, 2009

Mr. Lawrence Williams
Vice President for Strategic Relations
Space Exploration Technologies (SpaceX)

Good afternoon. Thank you for inviting me to speak here today on the need for adequate resources for NASA's programs and missions on behalf of the aerospace industry.

More than fifty years ago, the surprise launch of the Russian satellite, *Sputnik 1*, inspired a national scientific fervor that ultimately led to the creation of the National Aeronautics and Space Agency (NASA). While this early success was a propaganda coup for the Soviets, Americans eventually won the race to land men on the moon with the successful Apollo 11 mission in the summer of 1969. Despite the rich competitive tradition between our countries in the space arena, most Americans would be surprised to learn that in very near future, the United States might have to pay roughly one billion dollars to hitch rides with the Russians to the International Space Station (ISS). This is particularly poignant in light of the country's current economic, fiscal and unemployment crisis.

Because the U.S. Space Shuttle is slated for retirement in 2010, some are proposing that American astronauts utilize Russian vehicles with a checkered safety record to get to the ISS for five years or more at costs that easily could exceed one billion. A recent mission resulted in a crash-landing 260 miles off-course—the second off-target landing in as many launches. This is also problematic for taxpayers, because if Russia controls a monopoly on travel to the space station, prices for future missions could reach stratospheric levels.

Maintaining our capability to send humans and cargo into earth orbit, and beyond, is essential to our national and economic security, space preeminence, and full utilization of the ISS. A gap in U.S. capability to put humans in space between the 2010 retirement of the space shuttle and the initial Orion-Ares I launch in late 2015 would therefore harm the national interest. Current inadequate funding levels may also increase this gap. The projected gap in time between the shuttle's retirement and the functionality of new spacecraft must be minimized. Current law recognizes the importance of a robust spaceflight program. The NASA Authorization Act of 2005 (P.L. 109-155) states: "It is the policy of the United States to possess the capability for human access to space on a continuous basis." Maintaining an independent means for sending human beings and cargo into earth orbit must be considered a national priority by Congress. A lapse in U.S. human spaceflight risks eroding critical workforce and industrial base skills by atrophy and attrition, thereby impacting future national space endeavors. The United States will be wholly dependent on foreign nations for human and ISS cargo space transportation for several years, a situation that compels NASA to procure services from abroad rather than from American industry.

Extending the life of the Shuttle program is a risky and expensive endeavor. Former NASA Administrator, Michael Griffin repeatedly stated that each Shuttle flight runs a serious risk of

catastrophic failure and loss of life. Additionally, this option would require substantial funding for two expensive shuttle programs – the current program and Orion-Ares, which are the next generation vehicles meant not just for ferrying astronauts and supplies to the Space Station, but also for far grander space expeditions, such as manned moon landings as a precursor to Mars voyages. NASA's budget would need to grow by billions of dollars each year to afford both shuttles, an unlikely prospect in today's lean budgetary times.

The most promising and affordable approach to closing the imminent U.S. manned space gap is by increasing the reliance on private, commercial space ventures. During his 2008 campaign, President Obama released a space policy highlighting the following 3 points:

1. Barack Obama is committed to making the necessary investments to ensure we close this gap as much as is technically feasible and to minimize reliance on foreign space capabilities
2. Obama will stimulate efforts within the private sector to develop and demonstrate spaceflight capabilities.
3. NASA's Commercial Orbital Transportation Services [COTS] is a good model of government/industry collaboration.

The COTS program was started by NASA in the Fall of 2005, with 2 major goals:

- Fill the 5-year ISS service gap between Shuttle retirement (2010) and CEV (2015).
- Encourage the growth of the commercial space industry, resulting in lower costs to all buyers.

The program relies upon competition in the private sector to develop and deploy new vehicles and operates under strict performance driven contracts. Companies only get paid if they perform to the satisfaction of NASA. This program is affordable, but to date NASA has only partially funded the cargo capabilities. NASA now needs to fund the next component of the COTS programs to provide for human transport to the ISS.

This is a low-risk bargain when compared to the alternatives. Not only is it a relatively small amount of money, but if companies participating in the COTS program don't show progress then they don't get paid. Unlike the alternatives, the price tag and the timeline for COTS program is a known commodity.

The United States has spent upwards of $27 billion on the ISS, and we should not have to pay almost $1 billion to the Russians just to have access to the station we helped build. The United States has proud, storied history in spaceflight and aeronautics; fully funding the COTS program would give American companies the chance to build on that tradition without breaking the bank or sending money and jobs to Russia in order to carry Americans into space.

In general, investments by the United States in space exploration have been an impetus for global technological and economic advances by focusing our science and industry on new problems and new solutions. We must continue our commitment as the world leader in space exploration to help maintain our cutting edge in discovery and innovation. NASA has led some of the nation's

most exciting and innovative projects: American astronauts have been aboard the International Space Station (ISS) continuously since 2000; our probes are en route to or have reached all the planets of the solar system and have explored the surfaces of some; our telescopes are looking deep into the cosmos; and satellites also look toward the Earth in study. We now are preparing for the logical steps forward to once again take humans beyond low-Earth orbit to the moon, Mars and beyond. To maintain and benefit from our leadership in space exploration, the federal government needs to ensure support for the U. S. space exploration, provide for maximum utilization of the ISS and support NASA's critical science programs.

The International Space Station is a unique laboratory enabled by a substantial national investment. The U.S. should realize the intended rewards by full utilization of the laboratory capabilities. Led by the United States, the ISS Program draws upon the scientific and technological resources of 16 nations including: Canada, Japan, Russia, Italy and 11 members of the European Space Agency. Future U.S. competitiveness will be challenged through International research on ISS. U.S. competitiveness is dependent upon utilization by other government agencies and private industry. Continued support of the Commercial Orbital Transportation Services (COTS) is important to provide commercial resupply, and eventually crew delivery, to the ISS. The ISS budget is highly constrained for cargo delivery after Shuttle retirement. Longevity of the platform is dependent upon delivery of cargo and spare parts. Congress should continue support ISS by providing adequate funding to successfully operate and supply the orbiting laboratory as it enters into the utilization phase. Furthermore, Congress should encourage and enable all U.S. government agencies to utilize the space station's capabilities in order to increase the return on our investment.

The proposed budget for fiscal year 2010 submitted to Congress by President Obama provides a sound foundation for space exploration. The budget included $18.7 billion for NASA, a $1.4 billion increase over the enacted fiscal 2008 budget. NASA's top line also got a $1 billion boost in the recently passed stimulus bill. The proposal affirms the administration's commitment to space exploration, calling for a return to the moon by 2020, completing the International Space Station and retiring the space shuttle by 2010. The much needed top-line budget increase is a step towards adequately funding NASA's robust agenda of programs and missions. The space industry certainly supports this increase and urges Congress to appropriate an amount no less than the President's budget to ensure a balanced civil space program (exploration, science, aeronautics and astrobiology). In the long run, we would urge the President and NASA to move towards the goal of providing one percent of the federal budget for NASA in order to ensure America's leadership in space.

In conclusion, with the retirement of the Space Shuttle fleet currently set for 2010, and given the nation-wide economic downturn, space industry job losses in Florida, California, Alabama, Louisiana and Texas (among others) are mounting. Fortunately, the American Recovery and Reinvestment Act (HR 1) that passed on February 13, 2009 included $400 million for NASA's space exploration mission in order to shorten the gap in time that the Nation does not have a U.S. manned vehicle to access space. Used appropriately, these funds can immediately create a significant number of domestic jobs, develop critical space transportation infrastructure, and reduce the development risk of an important national program. Further, if properly applied, the

funds should dramatically reduce expenditures the United States would otherwise be compelled to make to Russia over the long-run.

One program that would close the imminent gap in manned spaceflight and would result in immediate job creation and infrastructure build-out is the innovative and commercially oriented NASA Commercial Orbital Transportation Services (COTS) program. To date, Congress has only appropriated funding sufficient to pay for COTS Capabilities A-C (cargo). Notwithstanding, COTS Capability D (crew) has already been competed, awarded, and only needs to be exercised. COTS Capability D meets the Administration and Congress' stated goals:

1. Timely – the program is already competed and readily activated;
2. Targeted – the program provides clear value to the Nation by helping to decrease US reliance on Russia and developing U.S. infrastructure; and
3. Temporary – this is not a new start or new program, and the demonstration missions can be accomplished in under two years.

If a portion of the $400 million provided to NASA Exploration in HR 1 is used to exercise COTS Capability D, these funds could be put towards hiring people immediately. COTS Capability D simply extends an efficient, already competed and ongoing procurement. Congress recently authorized NASA to go forward with COTS Capability D, and the FY 2008 NASA Appropriations bill, "encourages NASA to consider exercising its option for the Commercial Cargo Capability (COTS) Capability D (crew transport) as soon as possible from unallocated, uncommitted, or otherwise available funds…" HR 1 provides these necessary funds.

Unless action is taken now, once the Shuttle retires, NASA will be left with no option other than sending hundreds of millions of U.S. taxpayer dollars to Russia for the transport of U.S. astronauts to the International Space Station. We would therefore like to urge you to consider asking NASA to utilize a portion of the stimulus funds provided in HR 1 for NASA Exploration to exercise COTS Capability D as soon as possible.

Thank you for attention. I am happy to answer any questions.

STATEMENT OF THOMAS H. ZURBUCHEN
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BEFORE THE
THE AEROSPACE STATES ASSOCIATION

Capitol Hill Hearing on
STEM Education, Aviation and Space

March 9, 2009

I appreciate the opportunity of being asked to participate in this hearing and provide a perspective, as a representative of the university community. I am a professor of space science and aerospace engineering and director of the Center for Entrepreneurship at the University of Michigan. I also serve as vice chair of the Council of Institutions of the Universities Space Research Association (USRA), a consortium of 102 major research universities founded 40 years ago by the National Academy of Sciences at the request of NASA.

I want to call attention to two pressing issues that adversely impact our nation's ability to remain a leader in space. First, is a continuing decline in opportunities at our nation's research universities for the next-generation of scientists and engineers to gain the hands-on training they will need to succeed in aerospace fields. Our space workforce is the best in the world, largely because it is led by individuals who benefited from hands-on training with actual space projects during their university years. Decades ago were exciting years for a young person to enter space-related work. There were frequent launches of small missions, many of which were led by university-based teams. Students got plenty of hands-on experience, and learned first hand the difficulties of designing and constructing an experiment or engineering system that would operate reliably in space. Many students also learned from designing and building experiments for smaller, suborbital flights on rockets or balloons, or by observing with an airborne telescope.

The Commission on Implementation of United States Space Exploration Policy (Moon, Mars and Beyond Commission) found in 2004 that, "At present, there are insufficient methods for students to acquire hands-on experience in the scientific and technical disciplines necessary for space commerce and exploration." Indeed, according to an analysis undertaken by USRA, the number of flight opportunities through which university students can build hardware and analyze related space data has declined steadily over the last two decades. Since 1970, suborbital experimental launches decreased eighty percent—from 270 launches per year to just 50 planned launches this year.

This problem impacts all sectors of space enterprise, large or small, civilian or military, government or commercial. Concerns are growing about our ability to design and deploy the space systems of the future for meeting needs ranging from space exploration to global climate prediction, from commercial space ventures to national security.

To address U.S. needs, we must increase our investment in proven research programs, such as sounding rocket launches, aircraft-based research, and high-altitude balloon campaigns, all of which provide opportunities for hands-on flight experience at a relatively low cost of failure. The average research payload for sounding rocket projects range from $200,000 to $2.5 million. The average cost of recent sounding rocket payloads was just over $1 million. Balloon payloads range in cost from just $50,000 to $1 million. Launch, labor and infrastructure costs involved with each payload launch adds additional costs that average $2 million.

The National Research Council Committee on Meeting the Workforce Needs for the National Vision for Space Exploration found in 2006 that, "NASA should expand and enhance agency-wide training and mentorship programs, including opportunities for developing hands-on experience, for its most vital required skill sets, such as systems engineering."

The member universities of USRA unanimously adopted a resolution at their annual meeting urging that at least 1% of NASA's total budget be devoted to funding competitive opportunities for university-led hands-on training provided by university missions on sounding rockets, high altitude balloons, remotely piloted vehicles, emerging commercial suborbital flights, and university class space flight missions.

As President Dan Mote of the University of Maryland, a member of the NRC *Gathering Storm* Committee, said at USRA's annual meeting in March of last year, "The USRA can speak to what is needed to attract the best and brightest young space scientists and engineers, such as the hands-on training provided by sounding rockets, balloons, and other small missions. These space professionals are going to be an ever more crucial component of the U.S. workforce, security and prosperity going forward."

But, the educational objectives addressing this crucial national need are adversely affected by the second issue this hearing is centered on. Hands-on projects that go to space are falling under a set of regulations that make them almost impossible to work on at universities across the country, such as the University of Michigan.

In fact, the second issue to which I want to call attention to is the need to balance the adverse impact of ITAR on U.S. space-related scientific research with the needs of U.S. national security. ITAR has had a chilling effect on basic space research carried out at U.S. universities. Current implementation makes university-built space hardware and flight software subject to the full force of ITAR export control restrictions.

The recent National Research Council report, *Space Science and the International Traffic in Arms Regulations*, calls attention to how the implementation of ITAR with respect to

scientific satellites was dramatically altered by the Congress in 1999 by the report of the Cox Committee.

> One of the many consequences of the Cox Committee Report was Congress's mandate that jurisdiction over export and licensing of satellites and related equipment and services, irrespective of military utility, be transferred from the Department of Commerce to the State Department and that such equipment and services be covered as defense articles under ITAR. Scientific satellites were explicitly included despite their use for decades in peaceful internationally conducted cooperative scientific research. It is widely recognized that the shift in regulatory regime from EAR [Export Administration Regulations] to ITAR has had major deleterious effects on international scientific research activities that depend on satellites, space hardware, and other items now covered under ITAR.

For me, this shift occurred right in the middle of the FIPS project – a small plasma sensor bound to planet Mercury. From one day to the other, I was no longer allowed to look at the technical information I generated. The team was stalling, and the University of Michigan did not know how to address this issue. I was lucky – only two months later did this get resolved because I got my greencard. But, that was good luck! I always wonder whether there we would know about Mercury's atmosphere today if my greencard did not show up in time – these first measurements were done by FIPS in 2008!

In space research, university scientists usually work with teams of colleagues who may come from other U.S. or foreign universities, federal laboratories, and U.S. industrial partners. The constraints imposed by ITAR compliance are obstacles to such collaboration. Universities are finding themselves in the position of weighing the costs and risks of participating in our nation's space program versus opting out and thereby depriving their faculties and students of the opportunity to be engaged in space science and technology development.

Ambiguities about how ITAR review and licensing requirements are to be applied and how broad the application should be have created significant confusion on campuses throughout the U.S. For example, uncertainties include a lack of clarity about how to interpret the fundamental research exclusion and about what material can be used in an engineering course curriculum in which non-U.S. students are enrolled. Some professors are being forced to choose between excluding non-U.S. students from their courses and projects or "dumbing down" the curriculum so that the risk of being accused of transferring sensitive technological information is eliminated. Furthermore, ITAR compliance and the burdens that accompany the ITAR approval process also are leading some very able young faculty members to avoid fields such as space research, where the uncertainties and burdens seem most acute.

The financial cost of ITAR compliance at universities is also significant and includes training for contract administrators and faculty about ITAR requirements, documenting university attempts to work within the limits afforded under the fundamental research

exclusion, applying for rulings and/or approvals from the Department of State for activities that may be controlled by ITAR, and the costs resulting from delays in research projects while pursing ITAR approvals.

For economic, scientific, and foreign policy reasons, it is essential that barriers to international collaborations by U.S. universities be reduced. USRA recommends that the following measures be undertaken by the Congress and the Administration:

1. **Modify the basic research exclusion so that it extends to U.S. aerospace firms, Federal laboratories, and non-profit organizations when they are interacting with universities in pursuit of fundamental space research.** The current implementation of the exclusion is ineffective, because space projects almost always entail collaborations between universities and other partners. The extension of the fundamental research exclusion will allow industry and national laboratories to work with universities for the purposes of fundamental research.

2. **Conduct a top-to-bottom review and scrubbing of the items on the U.S. Munitions List (USML) and the Commerce Control List (CCL). The National Security Council should lead an interagency review with support from the Office of Science and Technology Policy to rationalize the lists.** The treatment of space articles in the current list is excessively comprehensive. The list has been described as covering "everything that flies" and includes articles that are of no military significance or that can be readily purchased in the open market in the U.S. and abroad.

3. **Extension to selected agencies, such as NASA, authority to issue a well-circumscribed exemption similar to the Foreign Military Sales exemption accorded the Department of Defense.** For activities conducted for the Department of Defense, there is a foreign military-sales exemption whereby commercial exports are exempt from the licensing requirements of ITAR, if they are in furtherance of a program between a U.S. government agency and a foreign government. A similar exemption should be granted to NASA so that exports by U.S. entities that are in support of an international collaborative space project that is being conducted under a formal government-to-government agreement can be excluded from ITAR licensing requirements.

The product of these measures will be regulations that restore the original intent of export control legislation and balance the vital needs of U.S. national security with the crucial role of university research.

I want to thank the Aerospace States Association for inviting me to participate here today and for organizing this important hearing.