Report of the Interagency Aerospace Revitalization Task Force

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I. About the Task Force

In recognition of the unique and ongoing workforce challenges facing the aerospace industry, Congressman Vernon J. Ehlers (R-Michigan, 3rd District) introduced legislation to formally establish an *Interagency Aerospace Revitalization Task Force* to develop a strategy to address the unique and ongoing workforce challenges currently facing the aerospace industry. Endorsed by a bipartisan group of 30 House of Representatives co-sponsors, this bill was passed by Congress and signed into law by President George W. Bush on December 20, 2006.[1]

A. Organization and Objectives

The law appoints the Assistant Secretary of Labor for Employment and Training (ETA) as the chair of the Task Force, and names the Secretary or Administrator of the following Federal departments and agencies to membership on this Task Force:

- Department of Commerce
- Department of Defense
- Department of Education
- Department of Energy
- Department of Homeland Security
- Department of Labor
- Department of Transportation
- National Aeronautics and Space Administration
- National Science Foundation

In addition, two members are to be appointed by the President. The members appointed come from the President's Council of Economic Advisors and the White House Office of Science and Technology Policy.

The legislation requiring the establishment of the *Interagency Aerospace Revitalization Task Force* also includes several specific mandates for the group to carry out to improve the aerospace industry's access to a scientifically and technologically trained workforce:

- Maximize the cooperation and use of resources among Federal departments and agencies in fulfilling the demand for a skilled aerospace workforce across all vocational classifications.
- Develop integrated Federal policies to promote and monitor public and private sector programs in science, technology, engineering, and mathematics (STEM) and skilled trades education and training.
- Establish partnerships with industry, organized labor, academia, and State and local governments to:
  - Collect and disseminate information on occupational requirements and employment projections; and
- Coordinate appropriate agency resources, including grants, loans, and scholarships, for the advancement of workforce education, training, and certification programs.
- Provide an annual report to Congress each year until the termination of the Act that details the findings, strategies, recommendations, policies, and initiatives developed by the Task Force.

The *Interagency Aerospace Revitalization Task Force* is committed to converting these man-

[1] See Appendix A.

dates into actionable strategies for aerospace workforce recruitment, training, and cultivation. To carry out these legislative mandates, the Chair of the newly established Task Force quickly moved to communicate the requirement that member departments and agencies provide a designee as required by law, prior to March 20, 2007, and to convene the Task Force for an initial meeting on April 20, 2007.

During this initial meeting, all members agreed to recognize and build upon the work that had been accomplished by the Commission on the Future of the United States Aerospace Industry in 2002, as well as the work of an ad hoc Aerospace Workforce Interagency Work Group that ETA had convened as a result of that Commission. This Work Group published an inventory of its member agencies' Federal investments in aerospace and STEM workforce related activities (available at www.workforce3one.org), which provided substantial information the Task Force used to prioritize areas for action. The Task Force also recognized the value of a series of discussions with industry leaders held by the Chair on the high-priority workforce challenges currently facing the industry as part of the High Growth Job Training Initiative.

The Task Force has made it a priority to develop an actionable strategic plan to carry out its efforts. One of the first steps in building this plan was to confirm and update information on the workforce challenges facing the aerospace industry, and then to network with industry, educators, public sector partners, and organized labor to focus on solutions and recommendations for future actions.

Throughout the first year of the Task Force members held conversations with industry workforce experts as well as aerospace and STEM education experts, and catalogued information on many of the public and private investments available to help address the need for skilled workers in aerospace. The results of these discussions and data were presented and summarized at a roundtable hosted by the Task Force in October, 2007.[2] Over 160 individuals representing industry, education at all levels, federal agencies, and communities where aerospace has a significant impact on the economy met to identify short and long term solutions and validate key recommendations proposed by the Task Force.

This report contains the findings and recommendations from the *Interagency Aerospace Revitalization Task Force's* first year of activity, and is being transmitted to relevant Congressional committees as required under law, as well as to senior officials in the executive branch. The report will also be shared widely with industry, academia, State and local governments, the public workforce system, and others. Section II provides background and discussion of the aerospace workforce challenges validated by the Task Force. Section III includes strategies that the Task Force intends to pursue to address these challenges.

[2] See Appendix B.

B. CHRONOLOGY OF ACTIVITIES

November 2002

Final Report of the Commission on the Future of the United States Aerospace Industry

2004-2005

Ad Hoc Interagency Aerospace Working Group: The Employment & Training Administration worked with an ad hoc committee to begin coordinating aerospace workforce resources across federal agencies.

December 20, 2006

Task Force Becomes Official: On December 20, 2006, President Bush signed legislation to establish an "Interagency Aerospace Revitalization Task Force" that is directed to develop a strategy for aerospace workforce development. This Act (Public Law 109-420), appoints the Assistant Secretary of Labor for Employment and Training (ETA) to serve as the chair of this eleven member Task Force, and directs the Secretary or Administrator to appoint a member to this Task Force, along with two designees from the White House.

Executive Order signed on Aeronautics R&D Policy: The order was accompanied by the release of a supporting Policy document from the National Science and Technology Council, with the goal of advancing U.S. technological leadership in aeronautics by fostering a vibrant and dynamic aeronautics R&D community that includes government, industry, and academia. One guiding principle of this policy is that the United States should continue to possess, rely on, and develop its world-class aeronautics workforce.[3]

2007

Task Force Convenes

April 2, 2007

Industry Discussion: The Chair convened a discussion with aerospace industry workforce experts regarding the Interagency Aerospace Revitalization Task Force on April 2, 2007, and engaged in an important dialogue on the unique workforce challenges currently facing the aerospace industry. While the business environment has improved over the past 5 years, the aerospace workforce landscape has not changed appreciably since the critical workforce challenges were identified in the Final Report of the Commission on the Future of the U.S. Aerospace Industry in November 2002.

April 20, 2007

Interagency Aerospace Revitalization Task Force First Meeting: The Task Force convened a quorum on April 20, 2007 to discuss the group's mission and recent conversations with industry leaders regarding the high-priority workforce challenges previously identified in the November 2002 report and those currently facing the aerospace industry.

June 22, 2007

Education Discussion: The Chair convened aerospace and STEM education experts to

[3] National Aeronautics Research & Development Policy: http://www.ostp.gov/html/PressReleaseNationalAeronauticsResearchDevleopmentPolicy12-20-2006.pdf

discuss the changing educational landscape and issues facing the aerospace industry. During the meeting, the Chair engaged the group in a dialogue to share information about existing efforts that may inform the Task Force and identified challenges and best practices in STEM and aerospace education and training.

June 25, 2007

Interagency Aerospace Revitalization Task Force Second Meeting: The Chair provided an update on the Task Force activities and shared recent discussions with leaders from academia regarding the high-priority challenges currently facing the aerospace industry. The Task Force spent considerable time reviewing a draft implementation plan that captured action items discussed during the first meeting of the group. Finally, the Task Force reviewed a proposal from the Employment and Training Administration (ETA) and the Aerospace Industries Association (AIA) to develop a roundtable session on STEM education to be held in mid-October.

October 18, 2007

Aerospace Roundtable: The *Interagency Aerospace Revitalization Task Force* hosted a roundtable in partnership with ETA, the U.S. Department of Education, the National Aeronautics and Space Administration (NASA), and the Aerospace Industries Association (AIA). This daylong session was designed to build on the Task Force implementation plan recommendations to raise awareness and drive the national dialogue on aerospace and STEM education and workforce needs. The session included federal partners, Aerospace States Association members[4], key industry representatives, leading educational institutions, representatives from regions of the country that are economically driven by aerospace, media members, and representatives of the youth pipeline.[5]

November 8, 2007

Final Task Force Meeting to Review Recommendations and Report to Congress

January 2008

Report Issued to Congress

II. The Industry and Its Workforce Challenges

The aerospace industry is a powerful force within the U.S. economy and is one of the nation's most competitive industries in the global marketplace. Total sales for aerospace and defense products and services in 2007 were a record $198.8 billion, with total combined orders for all sectors rising by 9 percent and an order backlog of $360 billion.[6] The aerospace industry's record performance is forecast to provide a $56.6 billion positive trade balance in 2007, accounting for the largest trade surplus of any U.S. manu-

[4] Aerospace States Association: http://www.aerostates.org/

[5] See Appendix B.

[6] 2007 Year-End Review and 2008 Forecast, Aerospace Industries Association – An Analysis, AIA Aerospace Research Center. p 1-2 (November 2007), http://www.aia-aerospace.org/pdf/yearender07_analysis.pdf

facturing sector during an era of persistent trade deficits.[7] In 2007, 676 million passengers relied on U.S. commercial air transportation, with over 22.2 billion pounds of freight transported by air.[8] Meanwhile, 224,000 general aviation aircraft flew over 27 million hours, carrying over 166 million passengers.[9] Aerospace capabilities have enabled e-commerce to flourish with overnight mail and parcel delivery, and just-in-time manufacturing, with virtually every other sector of the economy, public and private, relying on its effective functioning.

However, the industry finds itself with a graying workforce skilled in science, engineering and manufacturing. 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. Compounding these industry-specific issues are growing 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 these industries. This section of the report highlights the importance of the industry to our economy and summarizes the primary workforce challenges the industry faces.

A. ABOUT THE INDUSTRY

The aerospace industry is critical to the national and economic security of our nation and also helps to improve America's position in the global marketplace. Other sectors depend on aerospace businesses, supplier networks, the downstream economic impact of products, and related disciplines for technical skills and technologies that are critical elements of our security infrastructure. These diverse sectors of the aerospace industry include:

- Civil
- Air (e.g., air traffic management system, safety regulation, accident investigation, environmental permitting, noise and emission standards)
- Space (e.g., weather satellites, air- and space-based Earth monitoring, International Space Station, Space Shuttle, Hubble Space Telescope, robotic missions to the planets
- Commercial
- Air (e.g., aircraft manufacturing, air carriers, general aviation, airport operations)
- Space (e.g., space launch, launch vehicles and satellite manufacturing, telecommunications, remote sensing)
- National Security[10]
- Defense
  - Air (e.g., combat aircraft, airlift, unmanned aerial vehicles, guided missiles)
  - Space (e.g., space launch, communications, navigation and reconnaissance satellites)
- Intelligence (e.g., air- and space-based communications, reconnaissance)

[7] 2007 Year-End Review. AIA. p 3.
[8] National Summary (U.S. Flights), Bureau of Transportation Statistics, U.S. Department of Transportation. http://www.transtats.bts.gov/
[9] GAMA Annual Industry Review & 2007 Outlook. p 2. http://www.gama.aero/events/air/dloads/2007GAMAAnnualIndustryReview.pdf
[10] Aerospace Commission, p 1-3.

The workforce of each sector reflects a wide array of talents and competencies, from researchers and engineers to technicians, mechanics, and skilled machinists.

AIA projects industry sales in 2007 totaled $53.3 billion for civil aircraft, $54.8 billion for military aircraft, $17.7 billion for missiles, and $605 million in space sales. Robust growth is anticipated again in 2008, with projections that industry sales will grow 6 percent, or $12 billion, driven largely by increase deliveries of civil aircraft, engines, and related parts and components.[11]

The importance of the aerospace industry to the economy and the public is best summarized the Massachusetts Institute of Technology (MIT) Labor Aerospace Research Agenda and Lean Aerospace Initiative:[12]

- It enables the global movement of people and goods;
- It enables the global acquisition and dissemination of information and data;
- It advances national security interests; and,
- It provides a source of innovation by pushing the boundaries of exploration and inspiration.

Not only is the industry of national importance, it is of particular importance in certain states' and specific communities' economies. For example:

- The California Space Authority 2007 Space Enterprise Strategic Plan states that California represents 19 percent of the global space market, accounting for $21.7 billion of global space revenues.[13]
- Florida's non military aviation and aerospace industries comprised almost 1,600 companies, employed almost 90,000 people and generated almost $50 billion in direct sales, according to the 2003 Aviation/ Aerospace Assessment.
- Texas is home to three major airlines, two of the world's busiest airports, the United Space Alliance, the Johnson Space Center, and business operations for most global aerospace and defense companies. Including air transportation and related services, the state-level aerospace workforce in Texas is in excess of 137,000 workers.

Forecasts and performance statistics from aerospace companies indicate increased demand for products and services, which will increase the need for a pipeline of skilled workers. For example:

- Ball Aerospace develops spacecraft, sensors and instruments, radio frequency systems and other advanced technologies for the civil, commercial and national security aerospace markets, with a contract backlog of $886 million at the close of 2006 [16]
- The Boeing Company forecasts commercial airplane revenue growth in 2008 of approximately $35 billion, with airplane

[11] U.S. Census Bureau, "Projected Population of the United States by Age and Sex: 2000 to 2050" (Washington, DC, 2007), http://www.census.gov/ipc/www/usinterimproj/.

[12] MIT Labor Aerospace Research Agenda. http://web.mit.edu/ctpid/lara/

[13] California Space Enterprise Strategic Plan 2007-2010. p 6. http://www.californiaspaceauthority.org/images/pdfs/strat-plan-2007.pdf

[14] 2003 Aviation/Aerospace Assessment, Florida Workforce. p 2. http://www.workforceflorida.com/bcs/councils/aaa2.pdf

[15] Texas Aerospace and Aviation Industry Report, October 2005. p 8-9 http://www.governor.state.tx.us/divisions/ecodev/bidc/industryreports/files/2005txaerorpt.pdf

[16] 2006 Annual Report, Ball Corporation. http://media.corporate-ir.net/media_files/irol/11/115234/reports/2006annual_10k.pdf

deliveries for the year sold-out and the number of units produced expected to be between 480 and 490.[17]

- Lockheed Martin Corporation reported 2007 Year-to-Date increased sales and operating profits across all four operating business segments of the corporation, including:[18]
- Aeronautics net sales of $9.3 billion and operating profits that increased 30 percent comparable to the same nine-month period in 2006.
- Electronic Systems net sales of $8.3 billion and operating profits that increased 17 percent comparable to the same nine-month period in 2006.
- Information Systems & Global Services net sales of $7.4 billion and operating profits that increased 17 percent comparable to the same nine-month period in 2006.
- Space Systems net sales of $6.1 billion and operating profits that increased 11 percent comparable to the same nine-month period in 2006.

Aerospace employment has rebounded from the decline that saw the industry reach its lowest workforce levels since the Great Depression, but the industry still totals fewer workers than before 9/11. The AIA 2007 end of year review recently reported that employment will continue to increase for the fourth consecutive year, with the total workforce averaging over 637,000 for the year. The increase in production workers represented nearly 26,000, but the total industry employment gain was only 7,700, indicating a decline in the non-production workforce.[19] The Bureau of Labor Statistics reported 90,000 aerospace engineers employed in the United States during 2006, and projects a 10 percent growth in employment over the next decade, a rate that is average for all occupations.[20]

While the aerospace industry is critical to the prosperity of the American economy, its vitality is largely dependent on ensuring that a qualified workforce is able to carry out its business functions. In order to design and implement strategies to support the recruitment and training of a qualified workforce, the *Interagency Aerospace Revitalization Task Force* has confirmed that the following three critical workforce challenges remain a priority for the industry including:

- Recruiting and Retaining Talent
- The Skills Challenge and the Importance of STEM Education
- Image of the Industry

B. RECRUITING AND RETAINING TALENT

The Commission on the Future of the United States Aerospace Industry reported in 2002 from a variety of sources that the aerospace workforce is "aging" and that approximately 26 percent of aerospace workers would be eligible to retire by 2008.[21] A 2007 study by Aviation

[17] Third Quarter Earnings Statement, The Boeing Company. October 2007. http://www.boeing.com/news/releases/2007/q4/071024a_nr.pdf

[18] Lockheed Martin Third Quarter 2007 Results. October 2007. http://www.lockheedmartin.com/news/press_releases/2007/1023hq_3Q2007Earnings.html

[19] Aerospace Related Employment, 1993-2007. AIA. http://www.aia-aerospace.org/stats/yr_ender/tables/2007/table9-ye07.pdf

[20] BLS Report on Engineers, 2006. http://www.bls.gov/oco/ocos027.htm

[21] Aerospace Commission, p 8-4

Week found that by mid-year, there were no fewer that 40,000 job openings in the aerospace industry. The five most difficult disciplines to fill, according to the study, are engineering-related positions in avionics, electro-optics, propulsion and power systems, complex enterprise architecture and integration software, and systems engineering. These job openings were sustained by the current industry revenue growth of 6 percent, paired with voluntary attrition and an industry retirement rate of 2 percent. With the average age of workers within the industry at 45, concerns persist that the aging workforce will begin to retire in much greater numbers over the next 3-5 years.[22] Voluntary attrition coupled with the retirement of many senior workers would result in a disastrous loss of intellectual capital for the industry.

While evidence of significant numbers of retirements taking place is not yet apparent, it is the preparation for potential retirements, the so-called "demographic cliff," that must be addressed. The industry also cites challenges to retaining the workforce that is not currently eligible for retirement. A recent National Defense Industrial Association (NDIA)-AIA workforce study found that entry-level workers left jobs in aerospace because they found other careers more stimulating.[23]

Surveys indicate feelings of disillusionment among the industry's personnel, whether they are production/technical workers, scientists, or engineers. Eighty (80) percent of nearly 500 U. S. aerospace engineers, managers, production workers, and technical specialists responded to a survey indicating that they would not recommend aerospace careers to their children.[24] Engineering students have given the aerospace industry low ratings for its physical work facilities, exciting and meaningful tasks, opportunities for professional development and growth, and supportive and encouraging management.[25]

MIT found that recruiting the new aerospace industry pipeline of workers is difficult. Traditionally, innovation has been among the biggest draws for prospective and current technical employees. However, the industry ranks last among the number of patents per employee.[26] Finding ways to attract and retain employees by providing innovation opportunities may be a key challenge to the industry.

Another concern that is consistently raised by aerospace employers is the need for high level security clearances for many of the industry's employees as well as the existing lengthy and cumbersome clearance process. The Task Force understands that every year, tens of thousands of industry personnel are subject to security clearances and renewals in order to perform many critical national security services for government customers, a key requirement for national security-related occupations is U.S. citizenship. Another key requirement is that individuals be free from "disqualifying life events" such as current drug use, arrest, or other such events, that could prohibit employment

[22] Aviation Week 2007 Workforce Study. www.aviationweek.com/workforce/awst08202007_01.htm
[23] Workforce at a Crossroads, March 2007: http://www.usra.edu/symposium/presentations/USRA-workforce-2007-3-30.pdf
[24] MIT Lean Aerospace Research Agenda.
[25] The Job Seeker's Report Card on the Aerospace Industry: A College Student's Perspective, (MIT, 2001)
[26] MIT Lean Aerospace Research Agenda.

in national security-related occupations.[27] Both of these requirements potentially limit the pool of recruits. For example, many young people remove themselves from industry consideration because they are unaware of the necessity and rigor of security screenings and clearances prior to employment in national security related occupations. Promoting the scrutiny that national security applicants will be under earlier in the talent development cycle will help the interested and potential applicants avoid potentially disqualifying events or activities that would prohibit their employment in national security positions requiring a clearance.

Another challenge is the lack of diversity within the current workforce and the industry's need to consider attracting and retaining non-traditional labor pools, including women and minorities. A 2007 Aviation Week survey notes that while women comprise 26 percent of the aerospace workforce, they only comprise 10 percent of engineers and 17 percent of program managers. Meanwhile, minorities comprise 25 percent of the aerospace workforce, but only constitute 18 percent of engineers and 10 percent of program managers.[28]

In addition to this data, the Task Force has heard the following points regarding attracting and retaining talent through engagement with experts from industry and academia:

- The Task Force received substantial input regarding generational differences and the potential impacts on the aerospace industry, as it transitions from a workforce dominated by Baby Boomers to a workforce where Generations X and Y play an increasingly larger role.
- While Baby Boomers have traditionally been characterized as "work-centric", Generations X and Y are characterized as "family-centric" or "dual-centric."[29]

C. THE SKILLS CHALLENGE AND THE IMPORTANCE OF STEM EDUCATION

There are various types of jobs within the aerospace industry including jobs that are part of the Aircraft and Spacecraft Design and Manufacturing Professions, such as Aerospace Engineers, Engineering Technicians, Machinists, Tool and Die Makers, Technical Writers, Blue Collar Supervisors, and Managers and Executives. The industry also employs individuals in the Airline and Transportation Infrastructure Professions, including Air Traffic Controllers, Pilots, Flight Engineers and Aircraft Mechanics and Service Technicians.[30] While these professions require a great diversity of skills, they all have a primary emphasis on STEM competencies, and there is significant concern that students who are participating in the K-12, postsecondary, apprenticeships, and/or career and technical education are not adequately prepared for employment in STEM careers.

[27] National Security Requirements of the United States Demand Reformation of the Security Clearance Process: The Need for a 21st Century Solution. http://www.ndia.org/Content/NavigationMenu/Advocacy/PDFs27/Security%20Clearance%20Reform%20Coalition%20White%20Paper%20-%202006%20ver%203%20-%20FINAL.pdf

[28] Flexibility for Employees Key to U.S. Aerospace & Defense Future. Aviation Week. August 2007. www.aviationweek.com/workforce/awst08202007_03.htm

[29] Generation & Gender In the Workplace, American Business Collaboration. http://www.abcdependentcare.com/docs/ABC-generation-gender-workplace.pdf

[30] Bureau of Labor Statistics. www.bls.gov

Over the past decade, overall science and mathematics achievement have been relatively stable through the eight grade, but have been on the decline for 12th graders. Currently, fewer than 5 percent of students score at advanced levels in mathematics and science. While there have been major increases in the percentage of students taking advanced courses necessary to continue in mathematics and the sciences, still fewer than 30 percent take physics and fewer than 25 percent take pre-calculus.[31]

While studies vary about the teacher characteristics that are highly correlated to student achievement, there is general agreement that teacher quality has an impact on student achievement. This appears to be particularly true in mathematics, where the students of teachers with strong mathematics backgrounds have higher standardized test scores than do other students. Teachers in highly effective elementary schools have been found to be more apt to possess quality indicators such as advanced degrees, higher attendance and more college-level mathematics and science courses.[32]

The industry is also challenged in ensuring that an adequate supply of individuals with higher educational achievement is available to work. A 2006 report by the Government Accountability Office found that while the total number of students enrolled in postsecondary institutions has increased over the past decade, the proportion of students obtaining degrees in STEM fields has fallen, from 32 percent of all degrees awarded in 1995 to 27 percent of all degrees awarded in 2004.[33] The Science and Engineering Indicators published by the National Science Foundation indicate that among students intending to major in STEM fields, the percentage increase over the past decade for all science and engineering disciplines is less than one-half of one percent, and for mathematics/statistics the enrollment levels are flat.[34] In addition, while overall graduate enrollments in science and engineering have increased over the past decade, this growth is largely attributable to an increase in foreign-born student enrollments.[35] However, the aerospace industry continues to suffer as many of these students choose to return to their country of origin or cannot obtain appropriate security clearance for employment opportunities for which they otherwise qualify.

Task Force discussions held throughout the year and at the Roundtable event confirmed these challenges. Experts from industry and academia point to the following difficulties that restrict the size and the overall availability of the potential workforce pipeline of talent for the aerospace industry:

- Industry is disconnected from influencing the curriculum taught to students, from junior high school students to Master's degree candidates.
- Aerospace employers have a bias that traditional education pathways are the most desirable for entry into the industry. There

[31] Engagement, Capacity, and Continuity: A Trilogy for Success. September 2004. http://www.smm.org/static/about/ecc_paper.pdf
[32] http://www.smm.org/static/about/ecc_paper.pdf
[33] Higher Education: Science, Technology, Engineering, and Mathematics Trends and the Role of Federal Programs, p. 6. GAO-06-702T. May 2006.
[34] NSF Science and Engineering Indicators, 2006. http://www.nsf.gov/statistics/seind06/append/c2/at02-06.xls
[35] First-Time, Full-Time Graduate Student Enrollment in Science and Engineering Increases in 2006, Especially Among Foreign Students. National Science Foundation. December 2007. http://www.nsf.gov/statistics/infbrief/nsf08302/

needs to be a stronger focus on credentials based on industry identified competencies, as well as alternative education and training pathways, such as those available through apprenticeships and career and technical education. Many students are getting interested in aerospace too late (11-12th grade versus 7-8th grade) and have difficulty catching up in math and science as a result. Coursework is not always linked to aerospace careers and the potential these careers present.

- Skill and academic gaps in student performance exist in STEM education and in teacher preparation for teaching these disciplines. Teacher preparation in math and science is lagging behind the capacity to educate in STEM fields.
- Participants noted anecdotal evidence that students perform better under the tutelage of teachers who have a degree in science and/or math rather than in education as support for teacher preparation that include both science and math competencies as well as education competencies to maximize results. This appears to be particularly true in high school mathematics, where the students of teachers with strong mathematics backgrounds tend to achieve at higher levels than do other students.
- Current technology is not being adapted by many educators for teaching STEM academics and skills. Teachers need to incorporate up to date technology or use alternate learning methodologies for tech-savvy students who learn differently than prior generations of students. There is increasing support showing applied learning can lead to higher academic performance, although many educators are not using applied learning techniques with business and industry developed curriculum.

D. 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. Some students believe that math and science careers are out of reach and beyond their capabilities. Other students view the boom-and-bust cyclicality of the industry as an impediment that affects recruitment and interest in aerospace. As a result, the industry has been more likely to look to short-term solutions rather than long-term investments. The Aerospace Commission noted that many students are discouraged from entering the industry because of job instability. While recent data are promising regarding potential earnings in the industry, there is still an image issue that the industry needs to address in order to recruit new talent.[36]

The Task Force has gathered the following information regarding challenges with the image of the industry:

- While aerospace program enrollments are at full capacity, recruitment remains the most challenging problem, and graduate retention in aerospace careers is ultimately low as workers go elsewhere because they fail to see where or how they fit in the industry.
- Many students, teachers, counselors, and parents do not identify aerospace with other "high-tech" industries

[36] Aerospace Commission, p 8-10

and are unaware of the wide array of career opportunities, skills needed, and education pathways to gain access to those opportunities. There is a strong need for enhanced career awareness activities at all levels of education focusing on educators, counselors, parents, and students.

The Task Force is committed to partnering with industry, academia, labor-management organizations and other interested stakeholders to address these challenges. The Task Force has utilized NASA's framework to design strategies that inspire, engage, educate and/or employ to implement solutions to resolve these challenges. These strategies are discussed in Section III.

III. Task Force Strategies

The *Interagency Aerospace Revitalization Task Force* developed three targeted strategies to address the most significant challenges related to ensuring a skilled aerospace workforce over the course of the year that relies on comprehensive research and input from the key strategic partners that are critical to moving to solutions to the challenges identified. Addressing these issues requires a comprehensive and systemic approach that includes both short term and long term strategies. These strategies will ensure that strategic partners are at the table continuously to not only address the issues identified today, but also focus on the changing workforce needs of the aerospace industry over time. It will be important to continuously reassess workforce challenges and develop new solutions as skill needs change with innovation and technology and the global economy shifts and changes with new market players.

The strategies presented below are designed to directly address specific issues as well as establish a framework to enable a long term approach to sustained collaboration. These include:

- *Sustained Collaboration:* Developing a long-term Federal inter-agency collaboration in support of the aerospace industry to address critical workforce challenges;
- *Integrated Investments for Aerospace Workforce Solutions:* Developing an integrated, cross-agency and public/private investment strategy; and
- *Knowledge sharing, inventory of model solutions, and dissemination of results:* Developing an industry cyber-community to share model strategies, products, tools, and information.

Suggestions for the possible commitment of any federal agency's resources to the investment strategy will be considered in a series of inter-agency planning meetings to begin in the first quarter of calendar year 2008. Below is a more in depth description of the strategic approach in each area.

A. SUSTAINED COLLABORATION

The Task Force should ensure the availability of resources, tools, and guidance developed under its leadership and direction beyond the statutory sunset established by law and address critical workforce challenges such as security clearance.

The *Interagency Aerospace Revitalization Task Force* recognizes it was established to provide the Federal stewardship necessary for the aerospace industry as it advances workforce revitalization efforts. The Task Force also understands

that the Federal government serves as a key customer as well as a partner to the aerospace industry and the need for guidance, resources, and tools will continue beyond the statutory sunset of the Task Force. The Task Force will address this need by exploring the establishment of a permanent collaboration mechanism for Executive Branch departments and agencies to contribute to and manage the tools and resources developed at the direction of the Task Force. The Task Force believes the current structure established under law aligns with recent interagency recommendations, including the call from the National Academy of Sciences for government, academia, and industry to work together in development of effective workforce "ecosystems." Suggestions for the possible commitment of any federal agency's resources to this strategy will be considered in a series of interagency planning meetings to begin in the first quarter of calendar year 2008.

The Task Force's first critical action item that requires federal agency collaboration is security clearance. There are two key, but distinct issues related to security clearances: clearable talent and clearance process and portability. Every year, tens of thousands of industry personnel are subject to security clearance and renewal processes in order to perform many critical national security services for government customers. A key requirement, in most instances, for national security-related occupations is U.S. citizenship. Another key requirement is that individuals be free from "disqualifying life events" such as current drug abuse, arrest, or other such events, that could prohibit employment in national security-related occupations. The youth pipeline is often unaware of the necessity and rigor of security screenings and clearances prior to employment in national security-related occupations.

The Task Force will address this issue by exploring ways to promote an understanding of security clearance requirements among youth entering the pipeline early in the training and recruitment process, including working with the public education system to counsel students. By promoting the scrutiny that national security applicants will be under earlier in the talent development cycle, interested and potential applicants will be able to avoid potentially disqualifying events or activities that would prohibit their employment in national security positions requiring a clearance.

As for clearance process and portability concerns, the current process for industry to obtain an initial security clearance or periodic reinvestigation is to provide all required department or agency-specific forms to the respective security office. The agency then forwards the request to the Office of Personnel Management (OPM) to conduct the actual background investigation. OPM is also responsible for all of the industry's requests as well as the clearances of nearly all other federal agencies. This current system of channeling all requests through OPM often results in a backlog of up to one year or longer and produces security clearances that are not portable between departments and agencies.

The Task Force will address this issue by exploring how the interagency partners can streamline the background investigation process, while still meeting the needs and requirements for the national security workforce. The Task Force recognizes that the post-9/11 environment has increased the requirements for background investigations; scarce resources such as time, funding, and personnel may create difficulties in expeditiously completing the background investigation process. However, the Task Force

also understands that delays in the clearance of talent can ultimately stifle industry innovation and cooperation, as personnel are unable to contribute to providing solutions across agencies or departments without having appropriately cleared personnel. Delays in obtaining or transferring security clearances can ultimately increase costs to the federal government by impeding the use of the most qualified personnel on critical programs, thus potentially delaying the delivery or implementation of industry solutions. Recommendations for how the Task Force might explore streamlining background investigation processes will be developed in a series of interagency planning meetings to begin in the first quarter of calendar year 2008.

B. INTEGRATED INVESTMENTS FOR AEROSPACE WORKFORCE SOLUTIONS

The Task Force should develop a coordinated approach to identify, invest, and promote model strategies in aerospace workforce and STEM education solutions. These strategies should include the provision of comprehensive technical assistance tools that provide guidance in replicating best practices of existing aerospace employment centers (see Appendix C).

The *Interagency Aerospace Revitalization Task Force* will develop a cross-agency and public/private investment strategy designed to fund model strategies that fully leverage the assets and resources of all participating agencies. A joint communication plan will be developed as part of the strategy to highlight upcoming investment opportunities. A broad-based dissemination plan will also be developed to distribute content and materials through a Task Force designed cyber-community. To maximize inter-agency cooperation, Task Force member agencies will align new and existing investment strategies with aerospace industry policies and objectives. No investment strategy developed by the Task Force will negatively impact any participating agency's ability to meet its existing education, human resource, or other obligations

Investment strategies related to education and training will be in two key areas. The first focus will be on building a stronger pipeline of skilled workers through more traditional education pathways. These pathways will concentrate heavily on industry driven STEM curricula and use "pull" strategies such as dual enrollment and strategies designed to provide applied learning opportunities related to the aerospace industry. A second focus will be on more non-traditional education pathways such as models that support apprenticeship and adult workers transitioning to the aerospace industry.

New investments will build on and leverage current assets within each Task Force member agency where feasible. These assets will also be inventoried and featured as part of the cyber-community. Examples of Current Investments & Activities:

- ETA began an initiative in 2006 called Workforce Innovation in Regional Economic Development (WIRED)[37] to leverage innovation assets, integrate

[37] U.S. Census Bureau, "Projected Population of the United States by Age and Sex: 2000 to 2050" (Washington, DC, 2007), http://www.census.gov/ipc/www/usinterimproj/.

economic and workforce development activities, and demonstrates that talent development can drive economic transformation in regional economies across the United States.[38] Several of these regions, Metro Denver, the California Innovation Corridor, Florida's Great Northwest, the Tri-State Delaware Valley, and the Alabama/Tennessee Valley Innovation Alliance have targeted aerospace as the focus of their regional economic growth strategies. These regions are in the process of building regional partnerships to invest in talent development strategies. The Task Force can assist these regions by ensuring that federal resources and other available private resources are targeted to complement one another. However, there are other distinct regions across the country where the aerospace industry is an economic driver, but too few of those regions engage in local and/or regional talent development strategies. They focus recruitment efforts on relocating skilled workers from other regions instead of building a local skilled workforce. The Task Force will identify, develop, and promote technical assistance models and tools to replicate best practices and expand strategic solutions for current and prospective aerospace employment centers or regional economies. These tools will enable regional economies to evaluate their existing assets, identify education and training gaps, and replicate best practices by leveraging existing expertise.

- The Deficit Reduction Act of 2005 established an Academic Competitiveness Council (ACC)[39] to be led by the Secretary of Education. Officials from Federal agencies with education programs aimed at improving America's STEM competitiveness were asked to conduct an inventory of their investments through this effort. The Task Force recommends that departments and agencies utilize the ACC's STEM education goals and metrics for K-12 education, Undergraduate education, Graduate and Postgraduate education, and Informal Education and Outreach, to implement the ACC guidance and focus the attention of agency investments.
- The Department of Education's Career Cluster Initiative[40] provides a way for schools to organize instruction and student experiences around sixteen broad categories that encompass virtually all occupations from entry through professional levels. Partnerships involving states, schools, educators, employers, industry groups, and other stakeholders are creating curriculum guidelines, academic and technical standards, assessments, and professional development materials for sixteen career clusters. Two examples of these clusters related to the work of the Task Force are Manufacturing and STEM. The Task Force can work with the partnerships that are designing the curriculum for these clusters to influence the skills taught, teaching methodologies and information given to students about the industry and its potential career pathways.
- The Department of Defense (DOD) is authorized to support education enrichment activities across the continuum of education to provide for an educated and

[38] WIRED Conceptual Framework: http://www.doleta.gov/wired/tools/

[39] Report of the Academic Competitiveness Council: http://www.ed.gov/about/inits/ed/competitiveness/acc-mathscience/report.pdf

[40] States' Career Clusters Initiative: http://www.careerclusters.org/index.php

prepared STEM workforce. The Task Force will work with DOD to leverage these assets and interests in communities across the United States to ensure a pipeline of skilled and clearable future workers.

- Undergraduate Laboratory Research Internships at the Department of Energy (DOE) have been established to enhance the nation's supply of proficient scientists and engineers, as well as proficient K-12 science, mathematics, and technology teachers. The program provides mentoring opportunities for undergraduate students by scientists and engineers at DOE National Labs.

These examples are just a highlight of ongoing areas for action. The Task Force will continue to emphasize the need to ensure that resources are linked and leveraged at the implementation phase, and inform changes in these program areas based on lessons learned through a coordinated approach to implementation. This information serves as part of an inventory of assets that will be used by stakeholders in major aerospace centers around the United States (See Appendix C) to provide STEM education and training solutions through regional economic development strategies. This inventory is only one example of the type of information that would be posted and disseminated via the proposed cyber-community. Recommendations for how participating agencies might contribute to this effort will be developed in cross-agency planning meetings to be held during the first quarter of 2008.

C. KNOWLEDGE SHARING, INVENTORY OF MODEL SOLUTIONS AND DISSEMINATION OF RESULTS

The Task Force should ensure that information from its partners and other public/private sources is compiled and promoted in a consistent manner for multiple audiences. Qualitative and quantitative information should be made available for specific programs and resources whenever possible.

The Task Force plans to work with its industry partners to develop an Internet-based resource that serves as a central, interactive tool for sharing information with diverse communities that utilizes a myriad of currently available resources and activities that describes lessons learned on the ground about what works and what does not work. This tool would serve to promote promising workforce solutions such as STEM education and training, outreach and mentoring, and industry recruitment, across public and private sources, to meet the needs of multiple audiences. The Task Force envisions an interactive site that features a wide array of content and takes advantage of new technologies for communication and that facilitates peer to peer learning, communities of practice around key issue areas, and ongoing discussion related to leverage points sometimes outside the purview of the Task Force.

This tool would also serve as an organizational vehicle where *all* stakeholders have clearly articulated roles and responsibilities: Federal, State, and local governments would invest in the infrastructure, industry would take leadership to define skill competencies and update content, and educators would share curricula and

best practices. Recommendations for forming a cross-agency team to accomplish this task will be developed in a series of planning sessions to be held during the first quarter of 2008.

The Task Force has determined that this cyber-community should be crafted to initially meet the needs of, and facilitate collaboration among, the following communities:

- *Professional to Professional:* The cyber-community will contain a clearinghouse of public and private investments/solutions from across the continuum of education that would be updated regularly. This content will include available quantifiable information (resource dollars and numbers trained), provide an understanding of the nature of investments or curriculum (type of program and use of unique content, people, or facilities), and categorize investments according to the NASA Education framework to Inspire, Engage, Educate, and Employ the future aerospace workforce.[41]
- *Industry to Government and Academia:* The cyber-community will provide a platform for industry to communicate current and predictive workforce needs and professional development opportunities to academia to inform education/training curricula and investments. An example of this is the State Scholar Initiative that operates in states across the country and utilizes business leaders to motivate students to complete a rigorous course of study in high school to give them a boost in college and their careers.[42] Communication could include industry development and maintenance of a competencies framework that details the skills needed for the aerospace workforce that does not currently exist. The cyber-community could also serve as a forum for the promotion of industry-developed consensus standards for certification, should they be produced.
- *Student to Student:* The cyber-community will develop unique outreach, partnerships, and content to target career awareness information that inspires and engages young candidates. The Task Force recognizes the need for a multi-pronged marketing/career awareness campaign supported by industry and government, which includes targeted messaging for educators, counselors, parents, and most importantly, students. The cyber-community investment should combine electronic and interactive recruiting with traditional recruiting methods to "meet the youth pipeline where they are," attract the increasingly savvy young candidates the industry needs.
- *Mentors:* The cyber-community will specifically promote best practices designed for mentoring and engaging the talent pipeline. An example of this is the U.S. Air Force Jr. ROTC[43] mentoring program that aggressively searches for talent by engaging 9th grade teachers to identify promising students early. Additionally, the Task Force recognizes that more needs to be done to mentor non-traditional populations for this industry. The Task Force understands that women, minorities, and disadvantaged

[41] NASA Education Fact Sheet: http://education.nasa.gov/about/factsheet/index.html
[42] State Scholars Initiative: http://www.wiche.edu/statescholars/
[43] Air Force Jr. ROTC Program: http://www.afoats.af.mil/AFJROTC/index.asp

youth have not been aggressively pursued or mentored for careers in math and science. The Task Force recognizes the value of industry experts providing classroom expertise and mentoring for these populations but these individuals have difficulty in the transition process into the classroom. The Task Force will explore promising practices at the State and local level in easing this transition into the classroom and promote these processes via the cyber-community.

- Separating Military: The cyber-community will provide resources directed specifically toward separating military personnel. Many individuals of this group possess the training and skills necessary to enter industry employment or provide education and training to the youth pipeline. The Task Force has found that the industry does not fully utilize the valuable talent produced by the U.S. Armed Services upon their return to the private sector. These individuals possess the core skills needed for careers within the industry. These Service men and women will be able to pursue promising opportunities within the aerospace industry or transition into a mentor or educator role through education and training opportunities promoted by the Task Force.

IV. Strategies Into Action for 2008

The *Interagency Aerospace Revitalization Task Force* will work throughout the 2008 calendar year to implement the strategies and recommendations contained in Section III of this report to address the workforce challenges of the aerospace industry. The Task Force plans to implement the specific strategies included in this report through the division of work into cross-agency, staff-level project teams. The Task Force will convene the project teams in the first quarter of 2008 to discuss the conversion of strategies into concrete action plans across the Task Force member departments and agencies. The agencies that have participated in the development of this report are committing to work with the task force under the leadership of the Department of Labor to explore and identify ways to accomplish the goals laid out in the report. No potential commitment of any agency's resources will be made prior to a full and open process of planning and agency concurrence.

The Task Force has developed a framework for managing the work of implementing the proposed strategies. Recognizing the full Task Force will continue to oversee the entire process, the framework identifies primary agencies responsible for staffing each of the strategies. Project teams will be formed for each strategic area based on departmental and agency areas of expertise and alignment to the three major strategies:

- Sustained Collaboration
  - Interagency Structure:
    - Department of Education
    - Department of Labor
    - Department of Transportation
  - Security Clearances:
    - Department of Defense
    - Department of Energy
    - Department of Homeland Security
- Integrated Investments for Aerospace Workforce Solutions
  - Investment Strategies:

        - National Aeronautics and Space Administration
        - National Science Foundation
    - Portfolio of Tools:
        - Department of Commerce
        - Department of Labor
- Knowledge Sharing, Inventorying of Model Solutions, and Dissemination of Results
    - Cyber-Community
        - All Members

The Task Force will continue to foster collaboration among Federal departments and agencies in an effort to meet the demand for a skilled aerospace workforce. This effort saw the coordinated establishment of the Task Force in 2007, with multiple meetings to convert the Task Force mandate into an actionable implementation plan. During 2008, the Task Force intends to strengthen its horizontal partnerships and deepen vertical collaborations with the member departments and agencies in an effort to cultivate resources, enhance information, and maximize impact.

The Task Force will also continue to develop appropriate partnerships with industry, organized labor, educators, and government, as established by the mandate under law and as required to effectively address the workforce challenges faced by the aerospace industry. Future Task Force activities may include, but are not limited to: convening additional expert meetings; participating in conferences, meetings, and events to discuss the mission and progress of the Task Force; and facilitating appropriate collaborations with member departments and agencies, and regional centers of aerospace employment. The Task Force will host a series of web-based learning sessions (webinars) via ETA's www.workforce3one.org portal to promote model strategies with the first session targeting the U.S. Lieutenant Governors who comprise the membership of the Aerospace States Association, detailing the Task Force recommendations. Following this session, the Task Force will host additional webinars for a wide array of audiences to highlight aerospace best practices identified through its work.

APPENDIX A

Public Law 109–420
109th Congress

An Act

To establish an interagency aerospace revitalization task force to develop a national strategy for aerospace workforce recruitment, training, and cultivation.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. FINDINGS.

Congress finds the following:

(1) The aerospace industry generates nearly 15 percent of the gross domestic product of the United States, supports approximately 11,000,000 jobs in the United States, and leads the United States economy in net exports.

(2) The aerospace industry contributes directly to the economic and national security of the United States through military, space, air transport, and information technology applications.

(3) A skilled and educated workforce represents the most valuable asset of the United States economy.

(4) In 2004, total employment in the aerospace industry fell to its lowest point in 50 years.

(5) 27 percent of the aerospace manufacturing workforce will become eligible for retirement by 2008.

(6) Students in the United States rank near the bottom of the leading industrialized countries of the world in mathematics and science test performance.

(7) To ensure the stability of high-skilled jobs and the global competitiveness of the domestic aerospace industry, the United States requires coordinated Federal Government policies to sustain and expand the science, mathematics, engineering, and manufacturing workforce.

SEC. 2. INTERAGENCY AEROSPACE REVITALIZATION TASK FORCE.

(a) ESTABLISHMENT.—There is established a task force to be known as the "Interagency Aerospace Revitalization Task Force" (in this section referred to as the "Task Force").

(b) DUTIES.—The Task Force shall develop a strategy for the Federal Government for aerospace workforce development, including strategies for—

(1) maximizing cooperation among departments and agencies of the Federal Government and the use of resources of the Federal Government in fulfilling demand for a skilled workforce across all vocational classifications;

(2) developing integrated Federal Government policies to promote and monitor public and private sector programs for science, engineering, technology, mathematics, and skilled trades education and training; and

(3) establishing partnerships with industry, organized labor, academia, and State and local governments to—

(A) collect and disseminate information on occupational requirements and projected employment openings; and

(B) coordinate appropriate agency resources, including grants, loans, and scholarships, for the advancement of workforce education, training, and certification programs.

(c) MEMBERSHIP.—

(1) NUMBER AND APPOINTMENT.—The Task Force shall be composed of 11 members who shall be appointed as follows:

(A) One member shall be the Assistant Secretary of Labor for Employment and Training.

(B) One member shall be a representative of the Department of Commerce and shall be appointed by the Secretary of Commerce.

(C) One member shall be a representative of the Department of Defense and shall be appointed by the Secretary of Defense.

(D) One member shall be a representative of the Department of Homeland Security and shall be appointed by the Secretary of Homeland Security.

(E) One member shall be a representative of the Department of Education and shall be appointed by the Secretary of Education.

(F) One member shall be a representative of the Department of Transportation and shall be appointed by the Secretary of Transportation.

(G) One member shall be a representative of the Department of Energy and shall be appointed by the Secretary of Energy.

(H) One member shall be a representative of the National Aeronautics and Space Administration (NASA) and shall be appointed by the Administrator of NASA.

(I) One member shall be a representative of the National Science Foundation (NSF) and shall be appointed by the Director of the NSF.

(J) Two members shall be appointed by the President.

(2) CHAIRPERSON.—The Assistant Secretary of Labor for Employment and Training shall serve as the chairperson of the Task Force.

(3) DEADLINE FOR APPOINTMENT.—Each member shall be appointed to the Task Force not later than 90 days after the date of the enactment of this Act.

(4) VACANCIES.—A vacancy in the Task Force shall be filled in the manner in which the original appointment was made.

(5) PROHIBITION OF COMPENSATION.—Members of the Task Force may not receive pay, allowances, or benefits by reason of their service on the Task Force.

(d) MEETINGS.—

(1) IN GENERAL.—The Task Force shall meet at the call of the Chairperson.

(2) FREQUENCY.—The Task Force shall meet not less than two times each year.

(3) QUORUM.—6 members of the Task Force shall constitute a quorum.

(e) ANNUAL REPORTS.—Not later than one year after the date of the enactment of this Act, and annually thereafter for four years, the Task Force shall submit to Congress, and make available to the public, a report detailing the activities of the Task Force and containing the findings, strategies, recommendations, policies, and initiatives developed pursuant to the duties of the Task Force under subsection (b).

(f) TERMINATION.—The Commission shall terminate on the date of the submission of the final report under subsection (e).

Approved December 20, 2006.

APPENDIX B

TASK FORCE ROUNDTABLE SUMMARY

The Interagency Aerospace Revitalization Task Force hosted a roundtable in partnership with the U.S. Department of Labor's Employment and Training Administration (ETA), the U.S. Department of Education, the National Aeronautics and Space Administration (NASA), and the Aerospace Industries Association (AIA) on Thursday, October 18, 2007. This daylong session was designed to build on the Interagency Aerospace Revitalization Task Force implementation plan recommendations to raise awareness and drive the national dialogue on aerospace and STEM (Science, Technology, Engineering, and Mathematics) education and workforce needs. The session included Federal partners, membership from the Aerospace States Association, key industry representatives, leading educational institutions, representation from aerospace-driven regions, as well as members of the media and several STEM-savvy students.

A planning committee representing the four host partners circulated materials developed and referenced by the Task Force in creating its implementation plan prior to the roundtable. The planning committee developed an agenda for the roundtable that framed the Task Force recommendations in the context of the NASA Education framework of Inspire, Engage, Educate, and Employ. The agenda provided for experts that would build upon previous asset-mapping efforts to define promising practices, programs, technical tools and resources that may be leveraged to benefit the future work of the Task Force. The roundtable also offered aerospace-driven economies an opportunity to learn about how they can build the STEM pipeline in their regions and put ideas into action to leverage available resources and address their workforce needs at the regional level.

Roundtable Goals

- Review and validate the Task Force implementation plan recommendations.
  - Facilitate alignment and integration of public and private STEM resources.
  - Promote evidence-based national, state, and regional strategies for STEM and aerospace industry talent development in support of economic growth in regional economies.
  - Improve alignment of programs that target STEM education.
  - Better utilize existing public and private resources (financial and technical) across all partners.

Key Discussion Points

The roundtable kicked off with a message regarding the importance of the aerospace industry as a growth industry and the critical relationship between the industry and national security. Participants were encouraged to consider and discuss throughout the day both short-term corrections and long-term solutions the Task Force has recommended or should consider as it creates a blueprint for action. Major themes from the discussant remarks follow below (complete session notes and expert presentations are located at http://www.workforce3one.org/content/public/aerospace.cfm):

- **STEM Literacy**
  - It is essential that average Americans understand basic scientific principles, not just to provide a supply of scientists and engineers, but to ensure the public

is equipped with the essential literacy for civic and economic participation. Civic engagement is required from taxpayers who fund NASA; if they do not understand the essentials of science then they will not support the continued investment in programs and infrastructure.

- **Demographics**
  - The industry must consider other demographic communities to tap into, including further outreach to minorities, women, and alternative labor pools.
  - The achievement gap for young women in STEM has been reduced to within 1 percent. However, women only enter quantitative research fields one-fourth as often as men. Meanwhile, high school males with a "B" average in math report a greater sense of ability in the subject than females with an "A" average. Greater effort must be made with women and minorities to foster a greater sense of accomplishment.
- **Opportunities**
  - Efforts must be made to develop effective partnerships and programs at the State and local level, as it is difficult to affect the process form the Federal level. The United States is at a disadvantage compared to other countries in the area of educational reform due to the strong heritage of local control.
  - Average students spend less than one-quarter of a day in school. They will have only spent nine percent of their life in school by the time of high school graduation. This presents a stunning opportunity for engagement if those young people invest the time beyond that nine percent.

Outcomes

Roundtable participants referenced the advance reading materials provided by the planning committee and received presentations from experts to consider the validity and utility of the Task Force recommendations. The following represents the output from each participant session team presented at the conclusion of the day:

- **Inspire**
  - The participants endorsed a focused approach to public awareness and outreach for aerospace careers that:
    - Contains messages that are relevant and personal.
    - Conveys impact, meaning, and purpose.
    - Demonstrates a coordinated national agenda, deployed through a variety of means to appropriate audiences.
  - Participants validated the cyber-community recommendation of the Task Force, stressing the need that it be created as an organizational vehicle where *all* stakeholders have a role. The Federal, State, and local governments should invest in the infrastructure, with industry taking leadership to define competencies and update content, and educators sharing curriculum and best practices.
  - The participants validated the Task Force recommendation to develop an Investment Strategy that identifies and funds best practices.
  - The group challenged the Task Force, when implementing its recommendations, to clearly articulate the roles and responsibilities of stakeholders in the key areas of public awareness and development of the cyber-community.

- **Engage**
  - The participants validated the Task Force recommendation to identify, define, evaluate, fund and disseminate best practices in the area of engagement, through the cyber-community.
  - Participants endorsed the need for a template to build and scale strategic partnerships to leverage and link resources, which include federal, state, and local government, K-Gray education, industry, non-profit and local businesses.
  - The participants endorsed the need for a multi-pronged marketing/public awareness campaign, which includes educating teachers, counselors, parents, and students with targeted messaging supported by industry and government.
- **Educate**
  - Participants endorsed the need for greater professional development opportunities for teachers. These recommendations include:
    - Greater funding, expertise, and facilities for teacher and faculty fellowships and externships.
    - Greater emphasis on pre-service teacher preparation in work-relevant content.
    - Greater support for research from curiosity level to problem-solving level through applied research, with full engagement of the continuum of students and faculty along the way.
    - Clearly articulated roles and responsibilities for stakeholders.
  - The participants endorsed the need for addressing STEM education as part of lifelong learning. These recommendations include:
    - Creation of a liaison for the K-12 system to connect superintendents and other local officials with industry experts to identify and leverage resources for the classroom.
    - Industry expansion of tuition incentives for undergraduate degrees in STEM-related fields and providing authentic aerospace projects for the teaching of engineering processes and practices.
    - Expanded funding of basic research to challenge graduate students in solving problems, as well as providing the next set of innovative aerospace solutions and advancements.
    - Seed funding at the state level to develop and expand professional schools aimed at the continuing education for the aerospace and STEM workforce.
  - Participants validated the Task Force recommendation to establish a cyber-community containing an inventory of resources and best practices in aerospace and STEM education and workforce development. The participants encouraged the Task Force to consider the development of common resource terminology and the streamlining of processes where possible.
- **Employ**
  - The participants validated the Task Force cyber-community recommendation, with the suggestion that it serve as a central resource to serve a diverse community.
  - The participants validated the Task Force recommendations related to

security clearances, with the suggestion that the Task Force consider portability of clearances and development of common clearance criteria.

- Participants endorsed the need to develop systemic STEM and aerospace solutions that first address variability in education/training quality, and include industry-developed consensus standards for certification of technicians.
- Participants suggested the development of a computer model to ensure that human resource needs are met in a timely manner. This model should include policy measures that come into play in case there is a shortage of trained personnel.

Next Steps

Following the four sessions, the Chair closed the roundtable by committing the Task Force to the following next steps:

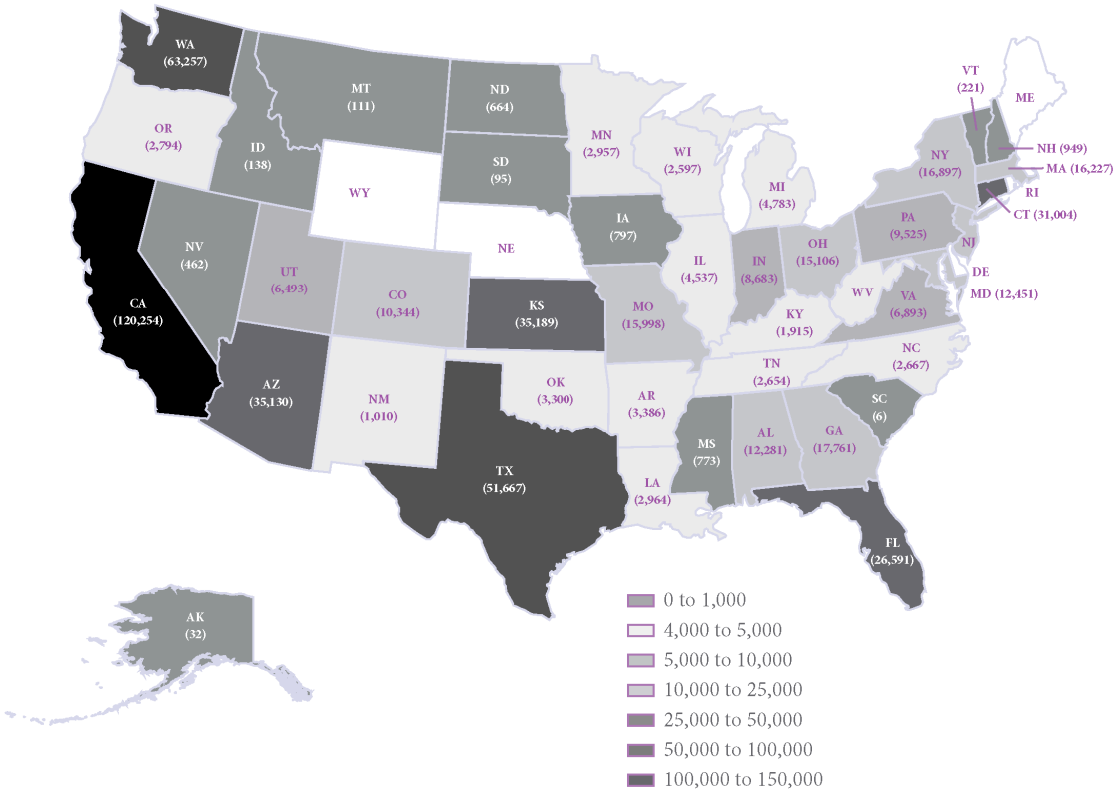
- The Task Force will collect and post all presentations, session notes, and recommendations produced for and during the roundtable to www.workforce3one.org.
- The Task Force will provide an annual report to Congress by December 20, 2007, detailing the activities and recommendations from the first year of the Task Force. Upon transmission of this report to Congress, the Task Force will make the findings available publicly.
- During 2008, the Task Force will conduct a series of aerospace webinar sessions hosted through ETA's www.workforce3one.org portal during 2008. The first session will be a session designed for members of the Aerospace States Association who were unable to attend the roundtable, detailing the session findings and the Task Force recommendations. Following this session, the Task Force will host additional webinars to highlight aerospace best practices identified through the work of the Task Force following this session.

APPENDIX C

AEROSPACE CENTERS OF EMPLOYMENT

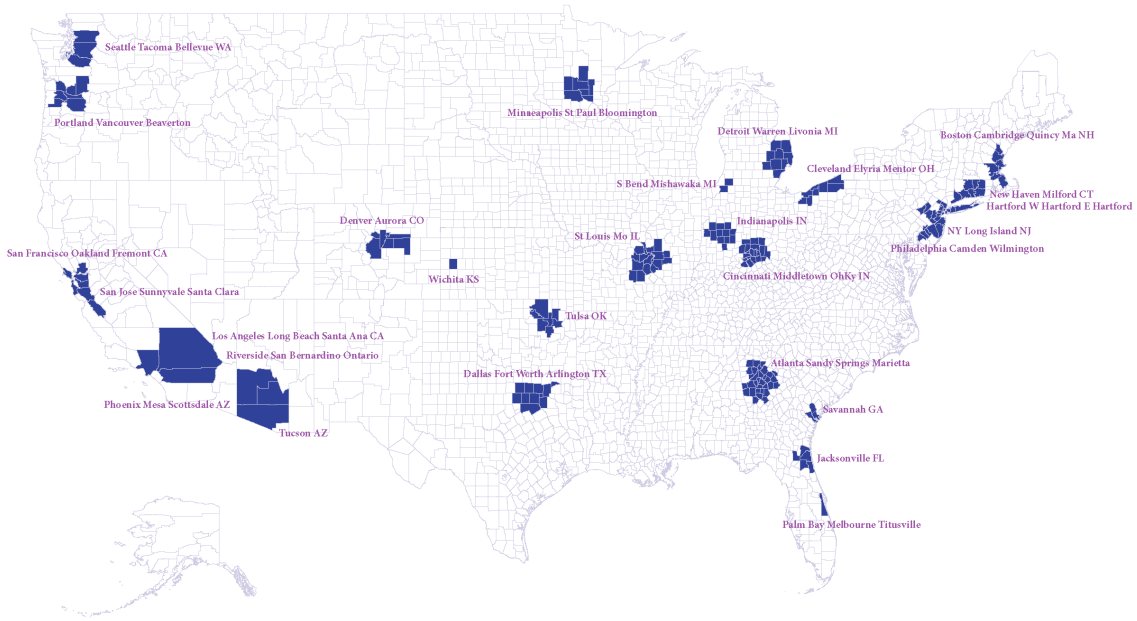
Aerospace Employment by State

Source: 2004 AIA Aerospace Statistics



Major Aerospace Industry Employment Centers

Source: 2004 AIA Aerospace Statistics



* AIA data reflects industry data only and does not account for government employees such as those employed at the Johnson Space Center in Texas or Kennedy Space Center in Florida.