America's Aerospace Industry: Identifying and Addressing Workforce Challenges

Report of Findings and Recommendations
For
The High Growth Job Training Initiative in the Aerospace Industry

May 2005

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Preface

This report details the efforts of former President George W. Bush's High Growth Job Training Initiative in the aerospace industry. It builds on the information gathered, and recommendations made, by The Commission on the Future of the United States Aerospace Industry (Final Report, November, 2002). It provides an overview of the aerospace industry, outlines the High Growth Job Training Initiative in the aerospace industry, examines the workforce challenges and discusses possible solutions to address the industry's challenges.

A top priority of the U.S. Department of Labor, Employment and Training Administration (ETA) is serving America's workers by effectively meeting the workforce needs of business. Currently, the federal government invests over $15 billion each year through a nationwide network, the public workforce investment system, which provides employment, unemployment, and job training services across the United States. As part of its ongoing efforts to use taxpayer dollars more effectively and efficiently, ETA is implementing the High Growth Job Training Initiative. The Initiative is designed to demonstrate the power of a demand-driven workforce system that tailors local workforce investment activities to reflect the workforce needs of local employers. Recognizing the relationship between workforce development and economic development, ETA promotes partnerships between education, employment, and economic development. Through these partnerships, workers can gain the skills they need to succeed through training programs designed by local employers and delivered through community colleges and other education and training institutions. Effective partnerships must be driven by, and responsive to, the needs of employers. The High Growth Job Training Initiative models the power of this approach in 12 high-growth industries. The Aerospace Industry is being considered as a separate subset under the Advanced Manufacturing Industry. See Appendix A for a complete listing of the high-growth industries selected.

The aerospace industry was selected for the High Growth Job Training Initiative in large part because of its significant impact on the economy overall, as well as its impact on the growth of other industries. The former President established a Commission on the Future of the United States Aerospace Industry to call attention to how the "critical underpinnings of this nation's aerospace industry are showing signs of faltering—and to raise the alarm." The aerospace industry is a powerful force within the U.S. economy and one of the nation's most competitive industries in the global marketplace. It contributes over 15 percent to our Gross Domestic Product and supports over 15 million high-quality American jobs. Aerospace products provide the largest trade surplus of any manufacturing sector. Last year, more than 600 million passengers relied on U.S. commercial air transportation and over 150 million people were transported on general aviation aircraft. Over 40 percent of the value of U.S. freight is transported by air. Aerospace capabilities have enabled e-commerce to flourish with overnight mail and parcel delivery, and just-in-time manufacturing.

"The industry is confronted with a graying workforce in science, engineering and manufacturing, with an estimated 26 percent of industry employees available for retirement within the next five years. New entrants to the industry have dropped precipitously to historical lows as the major manufacturing companies continue to consolidate. Compounding the workforce crisis is the failure of the U.S. K-12

education system to properly equip U.S. students with the math, science, and technological skills needed to advance the U.S. aerospace industry." [1]

ETA recognizes and supports the aerospace industry's need to meet its human capital issues very strategically due to the economic, national security and political importance of the industry. We will seek to support them as they reaffirm the goal of stabilizing and increasing the number of good and decent jobs in the industry and to prepare a workforce to meet long term employment shortages expected between 2008 and 2010. As this report details, the aerospace industry faces a number of pressing workforce development challenges, including the aging workforce and the loss of technical talent. Comprehensive partnerships among education, employment, and economic development are needed to effectively address these challenges, and ETA seeks to partner with industry to model such collaborations.

This report is a review and analysis of ETA's work with the aerospace industry under the High Growth Job Training Initiative. It is intended, in part, to provide employers, educators, the workforce investment system, policymakers, and funding sources with a strategic guide to the most critical workforce challenges facing the industry and identify some of the preliminary solutions developed through the partnerships of private industry, the public workforce system and education.

To those who gave generously of their time, effort, and other resources for this work, thank you for your thoughtful contributions. To those reading about the High Growth Job Training Initiative for the first time, ETA looks forward to your input in building a system to train a world-class aerospace workforce for our country that will ensure our global competitiveness.

[1] Final Report of the Commission on the Future of the United States Aerospace Industry, Executive Summary, pg V, 2002

Executive Summary

An Industry in Need

Both the Commission on the Future of the United States Aerospace Industry and the High Growth Job Training Initiative for the Aerospace Industry, heard loud and clear from employers within the industry the need for dramatic personnel and training reform. They articulated the critical need to attract and retain necessary intellectual capital, sustain a robust workforce for the future, and develop dynamic, results oriented workers with the talents, multidisciplinary knowledge, and up-to-date skills necessary to ensure America's preeminence in the field of aerospace and its economic well-being. This industry enhances the vitality of the national economy by providing hundreds of thousands of high-skilled, well-compensated manufacturing jobs and by constantly developing sophistical new technologies that benefit the entire economy. The U.S. must continue to have a highly skilled, stable, secure, and growing aerospace workforce. In order to accomplish this enormous task, we must have a citizenry well prepared in mathematics and science. We must identify and develop training for the skills necessary at all levels and create strategies and opportunities that will keep the aerospace workforce "pipeline" filled.

The High Growth Job Training Initiative

The High Growth Job Training Initiative is designed to provide national leadership for a demand-driven workforce system that ensures no worker is left behind. It is a strategic effort to prepare workers for new and increasing job opportunities in high growth, high-demand and economically vital industries and sectors of the American economy. Through the initiative, the Employment and Training Administration (ETA) works with industry leaders to determine the industry's key workforce challenges, and invests in demonstration projects that help ensure individuals gain the skills that they need to get good jobs with good wages in rapidly expanding or transforming industries. The foundation of this initiative is partnerships among the publicly funded workforce investment system, business and industry representatives, and education and training providers, such as community colleges. The purpose of these partnerships is to develop innovative solutions or replicate models that address a targeted industry's workforce issues.

Why Aerospace is included in the High Growth Job Training Initiative

The aerospace industry was identified as one of the high growth industries because the industry is critical to the national and economic security of our nation. Aerospace has played a vital and exciting role in the growth of the United States and the nation's future is bright with the vast potential these two components, air and space, offer. General data provided by the Bureau of Labor Statistics (BLS) indicates that aerospace engineers and related professions will decline between 2002 and 2012. However, the events of September 11, 2001 have magnified the aerospace industry's importance to the national and economic security of our nation, and economic trends show the workforce picture is beginning to turn around. Other sectors of the economy depend on aerospace businesses and related disciplines for technical skills and technologies that are critical elements of our security infrastructure and improve America's position in the global marketplace. The diverse sectors of aerospace include commercial, civil and military aviation, space, and defense. They encompass a wide array of talent and competencies. The industrial base includes researchers, engineers, technicians, mechanics, skilled machinists, and precision production jobs. According to the Aerospace Industry Association, the aerospace industry, including its supplier

network and the economic impact of products, totaled nearly $900 billion in sales and accounts for one in seven U.S. jobs. Even with aerospace employment at its lowest level since the great depression, the industry accounts for four percent of the U.S. manufacturing workforce. This key industry is facing a critical human capital crisis.

Workforce Challenges and Solutions Identified

The High Growth Job Training Initiative began by conducting baseline research of the industry's needs. The Final Report of the Commission on the Future of the United States Aerospace Industry, issued in November, 2002, was also used as a key reference source for identifying challenges and solutions.[2] On March 10, 2004, an Executive Forum was held in Washington, D.C. with leaders in the aerospace industry; ETA agreed to host a solutions forum that would be comprised of business, industry, education and the public workforce system to begin prioritizing challenges and developing innovative solutions.

ETA hosted the Aerospace Workforce Solutions Forum on June 9-10, 2004, in Washington, D.C. Thirty-five aerospace stakeholders representing industry, education, labor organizations, the public workforce investment system, the states and federal government participated in the Aerospace Workforce Solutions Forum. The group developed 136 solutions (See Appendix B – Solutions Developed at the Workforce Solutions Forum), twenty-one solution matrices (See Appendix C – Aerospace Workforce Solutions Forum Matrices) and identified six overall priority solutions, clustered in two priority areas, the Aging Workforce and the Loss of Technical Talent. The following is a brief overview of the key challenges and types of solutions identified:

The Aging Workforce—Stakeholders representing the aerospace industry expressed concern about the aging workforce. About 26 percent of aerospace workers will be eligible to retire by 2008. The average production worker is 53 years of age[3] and the average engineer is 54 years of age.[4] Participants wanted to establish an annually updated national database of skills/competency gaps focusing on training program money on 1 year and 5 year gaps (projected) identified by centers, companies and agencies and managed by them; establish the relevance of the aerospace industry in education and the workforce; and establish a phased retirement program.

The Loss of Technical Talent—The industry is having a difficult time retaining its existing workforce, attracting young people into the field and building its skills base. Some solutions examined include sponsoring a meeting with industry partners and educators where future specific skill sets are identified, and educators transfer these skill sets into new curricula and courses; increasing hands-on interactive learning in the classrooms, including increasing technology access, teachers with experience, gearing classes toward specific interests and teaching what industry needs; and identifying high-tech skills, including identifying and training vital skills sets as defined by industry, certifying skill sets to standards after hands on training, rewarding training with pay and creating baseline core competencies and technical skills levels.

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[2] http://www.ita.doc.gov/td/aerospace/aerospacecommission/AeroCommissionFinalReport.pdf
[3] MIT, 2001
[4] AIA, 2004

Stakeholders also discussed the following key issues:

Promotion of science, technology, engineering and mathematics education – There are not enough young people entering these key disciplines.

The need for innovation – There are fewer engineers to promote innovation and few opportunities to participate in innovative projects. The Aerospace Industries Association (AIA) cited that there are only approximately 20,000 engineers currently working in the industry.[5] Students also do not possess the key systems engineering skills that combine decision-making skills in design, operation, or construction with interdisciplinary understanding of the systems or environment that the products will operate in.

The shrinking workforce – Since 1987, nearly 600,000 jobs in mathematical, scientific and technical fields in the aerospace industry have been lost.

The need for policy changes impacting industry stability, phased retirement, security clearances and off-shoring – Stakeholders identified key issues that have affected the aerospace industry's economic competitiveness.

Space policy – Several aerospace executives identified support for the former President's new space policy as a critical factor driving industry growth into the future. The Commission on Implementation of United States Space Exploration Policy agrees, stating that "further exploration will generate new jobs within current industries and will likely spawn entire new markets involving leading-edge manufacturing and flight support services."

Based on the challenges identified by the aerospace industry and highlighted in this report, DOL has made a series of investments totaling more than $6.9 million to address the industry's workforce needs. These investments include providing dislocated workers with technical training and employment in the aerospace industry; training incumbent aerospace workers for new high-tech manufacturing processes; providing hands-on learning opportunities for students to develop technical aerospace skills and improve awareness of the skills required for aerospace careers; develop advanced aerospace technician curriculum, career ladders and distance learning approaches associated with the Boeing 787 supply chain; providing aerospace mentors and 25 teacher externships for technology teachers to improve hands-on knowledge and awareness of skills required for aerospace careers; and a program designed to reduce H-1B visa worker dependency in several high-tech, high-skill aerospace job occupations. For more information on these grants please go to http://www.doleta.gov/brg.

Next Steps

ETA is committed to identifying successful models and resources through the High Growth Job Training Initiative. The results, products, and knowledge gained from these demonstration projects will be disseminated widely to the public workforce system and our strategic partners in business, industry, and education. The Department has launched the www.Workforce3one.org web site to provide information and tools for employers, educators, and workforce professionals as well as the Career Voyages (www.careervoyages.gov) web site so Americans can access information and tools to build careers in high-growth, high-demand industries and occupations.

[5] AIA, 2004

Introduction

Through work on the High Growth Job Training Initiative, the Employment and Training Administration (ETA) of the U.S. Department of Labor (DOL) recognizes that workforce development is not separate from economic development and that employment, education, and economic development professionals must work together to solve the workforce challenges of the 21st century economy.

Clearly, there is a major workforce crisis in the aerospace industry. According to the Commission on the Future of the United States Aerospace Industry, November, 2002, our nation has lost over 600,000 scientific and technical aerospace jobs in the past decade. Layoffs initially began as a result of reduced defense spending following the end of the Cold War. Subsequent contraction of the industry through mergers and acquisitions and the events of September 11, 2001 have made the situation worse. The number of major U.S. aerospace prime contractors shrank from more than 70 to just five. With fewer aerospace employers, many skilled engineers and technical experts have left the industry, resulting in a loss of intellectual capital. Many senior workers retired, while the more junior workers were laid off and migrated to other more promising industries. A consequence of this environment has been an overall aging of the aerospace workforce, which risks the loss of intellectual capital.

Overview of this report

This report is a review and analysis of the work of the High Growth Job Training Initiative in the aerospace industry. It also builds on the findings and recommendations of the Commission of the Future of the United States Aerospace Industry, Final Report – November, 2002. It is organized into the following four sections:

- **Section I**: Overview of the Aerospace Industry and its market – This section summarizes the key elements and trends in the aerospace market.
- **Section II**: The High Growth Job Training Initiative – This section describes the process by which the High Growth Job Training Initiative engaged the aerospace industry.
- **Section III**: The Aerospace Industry's Workforce Challenges and Solutions – This section discusses aerospace workforce development needs, challenges and priorities and shows the stakeholder recommendations on the model solutions in which ETA should consider strategic demonstration investments.
- **Section IV**: Implementation of Solutions and Conclusions – This section provides insight into implementation strategies as well as describes ETA's investments.

The issues and solutions generated will provide a road map to address the industry's key workforce development challenges and priorities, identified by aerospace stakeholders, the Commission on the Future of the United States Aerospace Industry, and other outside research.

Section I
Overview of the Aerospace Industry and its Market

The Commission on the Future of the United States Aerospace Industry indicated that the aerospace industry contributes more than 15 percent to our Gross Domestic Product (GDP) and supports more than 15 million high quality American jobs throughout the supply chain. Further, more than 40 percent of the value of U.S. freight is transported by air. States, such as California, Florida and Oklahoma have also quantified the importance of the aerospace industry to their respective economies:

- The California Space Authority 2004 Space Enterprise Strategic Plan states that California represents 24 percent of the 2002 $83 billion global space marketplace;
- In 2003, 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; and
- The Oklahoma aerospace industry has $12 billion in revenue, and is comprised of more than 400 companies and 143,000 jobs, according to Lt. Governor Mary Fallin.

A policy white paper prepared by members of the Massachusetts Institute of Technology (MIT) Labor Aerospace Research Agenda and Lean Aerospace Initiative cited the following as key public interest functions of the aerospace industry:

- Enabling the global movement of people and goods;
- Enabling the global acquisition and dissemination of information and data;
- Advancing national security interests; and,
- Providing a source of inspiration by pushing the boundaries of exploration and inspiration.

MIT's "Developing a 21st Century Aerospace Workforce" also identifies a sample of the aerospace professions, which provide a sense of market segmentation:

<u>Aircraft and Spacecraft Design and Manufacturing Professions</u>

- Aerospace Engineers
- Engineering Technicians
- Aircraft Assemblers
- Computer Engineers
- Drafters
- Precision Assemblers
- Metalworking and Plastics working Machine Operators
- Machinists
- Too and Die Makers
- Painters
- Welding and Soldering Technicians
- Technical Writers
- Blue Collar Supervisors
- Managers and Executives

Airline and Transportation Infrastructure Professions

- Air Traffic Controllers
- Aircraft Pilots
- Flight Engineers
- Aircraft Mechanics and Service Technicians

In addition, the United Kingdom aerospace industry assessed the components of its market, most of which are analogous to U.S. market elements. "The aerospace market, as defined for the purposes of this (UK market) report, includes airframe manufacture, aircraft components and engines, missiles, avionics, satellite and space launch equipment and refurbishment work. Avionics covers electrical and electronic control systems for use on aircraft, and also ground-based software and systems for flight management. Space equipment covers communications and earth observation satellites, (The U.S. market would also include launch systems and launch vehicles). Refurbishment work includes maintenance work carried out by the major manufacturers where such work cannot be distinguished from the remainder of the company's turnover." [6]

Size of the Aerospace Industry and Projected Growth

Despite the clear importance to the U.S. economy and the public interest, significant pressures – largely from the end of the cold war – have led to dramatic consolidation "from 70 major suppliers in 1980 down to five prime contractors today."[7] Since 1987, more than 600,000 jobs in mathematical, scientific, and technical fields in the aerospace industry have been lost. This is the lowest level of aerospace employment since before the great build-up prior to World War II. Part of these losses can be attributed to productivity gains, part due to loss of global market share and part due to other economic factors.

However, several anecdotal economic forecasts from aerospace companies indicate some increased demand for products and services, which may result in the greater need for a technical aerospace workforce. Several of these forecasts include:

- Rolls-Royce forecasts the demand for an additional 950 new cargo aircraft (including 520 large) plus 2,200 used aircraft conversions in the period 2001-2020[8]
- Boeing forecasts a market of $5.2 trillion for new commercial airplanes and aviation services over the next 20 years.[9]
- Boeing also estimates that the commercial aviation support services market will be worth about $3.3 trillion over the next 20 years, with annual revenues considerably more than that for the new airplane market, including:
    - $1.5 trillion for aircraft maintenance, repair and overhaul
    - $930 billion for airport and route infrastructure services
    - $460 billion for aircraft servicing
    - $150 billion for major aircraft modification

[6] http://www.researchandmarkets.com/reportinfo.asp?report_id=3474
[7] Commission, 2002
[8] http://www.rolls-royce.com/civil/outlook
[9] http://www.boeing.com/news/releases/2003/q2/nr_030616g.html

Why the Aerospace Industry Will Grow

There is every indication that the aerospace industry's economic and employment outlook is improving. Aerospace Industries Association President and Chief Executive Officer John Douglass stated that "with $161 billion in sales and 9 percent contribution to our GDP, U.S. aerospace is a strategic industry in the nation's economy, homeland security, and national defense." There are two primary reasons that future growth is likely:

1. National security and homeland security investments are increasing. In fact during the 2004 fiscal year, military spending continued to show faster growth than any other U.S. budget element. Defense outlays were 55 percent higher in 2004 than in 2000.[10]
2. The aerospace industry has a positive trade balance of between $20 billion and $40 billion in trade exports, which is equal to the rest of the economy, put together.[11]

Salary Information in the Aerospace Industry

BLS has reported that median annual earnings of aerospace engineers were $72,750 in 2002. The middle 50 percent earned between $59,520 and $88,310. The lowest ten percent earned less than $49,640, and the highest ten percent earned more than $105,060. According to a 2003 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in aerospace engineering received starting salary offers averaging $48,028 a year, master's degree candidates were offered $61,162, and Ph.D. candidates were offered $68,406.[12] For blue collar workers, the average salary is approximately $54,000.[13]

Education and Training in the Aerospace Industry

The National Science and Technology Council (NSTC) draft report on science, technology, engineering and mathematics (STEM) education indicates that "as the current STEM workforce ages, the annual average growth rate in employment in science and engineering occupations (excluding math/computer science) has continued to exceed that of other professions from 1980 to 2000. During this same period, the number of college graduates and post graduates has lagged behind this growth rate." The NSTC report also identified the following key issues: 1) "the growing gap between the needs of employers and the skill sets of potential workers, including skills at advanced levels; and, 2) a lack of solid data on the composition and dynamics of the workforce, which limits our ability to determine we have an adequate pool of well-qualified STEM workforce."[14]

Aerospace stakeholders stressed that this issue originates in the K-12 system and an associated lack of interest by young people in these fields. The Commission on Implementation of the United States Space Exploration Policy supported this notion, finding that "at present, there are insufficient methods for students to acquire hands-on experience in scientific and technical disciplines necessary for space commerce exploration. This Commission called for the formation of a Space Exploration Steering Council to provide "better integration of existing STEM education initiatives across governments, industries and professional organizations." [15] The aerospace solutions sets developed during the

[10] Congressional Budget Office, 2004
[11] Douglass, 2004
[12] http://stats.bls.gov/oco/ocos028.htm
[13] IAM, 2004
[14] NSTC, 2004
[15] The Commission on the Implementation of United States Space Exploration Policy, 2004

High Growth Job Training Initiative, Aerospace Industry, Workforce Solutions Forum, are aligned with providing this kind of integration and hands-on experience.

The Commission on the Future of the United States Aerospace Industry stated that "the education system must be prepared to deliver training and education to meet these changing skill requirements and meet labor market needs. U.S. community colleges are doing this job well." A large number of aerospace stakeholders at the Aerospace Workforce Solutions Forum were community college representatives, thus, many of the partnerships discussed model solutions involving community colleges.

Aerospace technicians require a "core" set of skills or competencies, including areas such as aerospace processing, aerospace manufacturing, aerospace electrical, space vehicle maintenance, space vehicle systems and quality. Tasks are grouped into general categories such as Communication Skills, Math Skills, Basic Science, Safe Work Practices, etc. Transferable certifications and cooperative work experience are also helpful. [16]

Aircraft and power plant (A&P) mechanics require an A&P certificate from the Federal Aviation Administration. To be eligible for the FAA certificate examinations, a candidate must have 18 months experience in either airframe or power plant work, or a combination of 30 months in both. Related military service may be used to meet certification requirements. Courses in math, physics, chemistry, electronics, computer science, and mechanical drawing are helpful for students wanting to enter the field.[17]

Innovative Approaches to Training

Many innovative approaches to training for the aerospace industry have already begun. The need to attract and retain a quality workforce requires immediate, as well as long term approaches. The following are just a few notable examples:

- The National Science Foundation funded the SpaceTEC program. SpaceTEC is a consortium of twelve community colleges nationwide developing a national entry level aerospace technician certification. This aerospace center of excellence provides an aerospace best practice example of meeting aerospace industry needs for technician level workers.

- The Aviation Center of Excellence. Florida Community College in Jacksonville, Florida, has developed four programs to address the shortages of aviation mechanics, managers, administrators and professional pilots in the state. The Aviation Center of Excellence is certified by the FAA and offers Associate of Science degree programs in Aviation Maintenance Management, Aviation Operations, Professional Pilot Technology and a Post Secondary Adult Vocational certificate in Aviation Maintenance Technology.

- Honeywell School-to-Apprenticeship Program. Honeywell has invested in an innovative apprenticeship program that begins with high school seniors and takes them through a four-year program ending with an associate's degree in Manufacturing Technology. Analysis of the economic benefits of apprenticeship shows an impressive $50 return for every dollar of Federal investment.

[16] SpaceTEC, 2004
[17] CalJobs, 2002

- Aviation High School. Aviation High School, located just outside New York City, is a unique public magnet high school that prepares students to enter the aviation field. Students take all the academic course requirements to earn a high school diploma, plus vocation course requirements to earn a Federal Aviation Administration (FAA) aircraft mechanic license. More than 90 percent of graduates pass the FAA certification exams and 75 percent of graduates go on to either a four-year university or attend a two-year college or technical school.

- United Technologies Employee Scholar Program. UTC pays 100 percent of the costs, for professional development in any field of study including registration, tuition, fees and books. Chairman and CEO George David said his aim was for UTC to have "the best educated work force on the planet". All full-time employees are eligible for participation, and employees laid off by UTC or one its subsidiaries are also eligible for one year after separation. Through December 2003, UTC spent a total of $287 million on tuition, books, and fees and $108 million on stock awards. There have been 13,507 graduates and 1,846,848 shares have been awarded (split-adjusted). The present value (1/1/04) of these shares is $174 million.

It should also be noted that aerospace executives identified other ongoing success, including Honeywell's fifty schools in fifty states initiative with NASA, which focuses on promoting science and technology education for 7th and 8th graders. Executives also mentioned a partnership at Georgia Tech University which brings practical applications of math and science into the classroom. The core of the program is teacher development in everyday uses of math and science curriculum.

Section II
The High Growth Job Training Initiative

The High Growth Job Training Initiative is designed to provide national leadership for a demand-driven workforce system that ensures no worker is left behind. It is a strategic effort to prepare workers for new and increasing job opportunities in high-growth, high-demand and economically vital industries and sectors of the American economy. The initiative is designed to ensure that worker training and career development resources in the public workforce system are targeted to helping workers gain the skills and competencies they need to obtain jobs and build successful careers in these industries. Through the initiative the Employment and Training Administration (ETA) of the U.S. Department of Labor identifies high-growth/high-demand industries, works with industry leaders to determine their workforce challenges, and invests in demonstration projects that help ensure individuals can gain the skills they need to get good jobs in rapidly expanding or transforming industries.

The foundation of this initiative is partnerships among the publicly funded workforce investment system, business and industry representatives, and education and training providers, such as community colleges. The purpose of these partnerships is to develop innovative solutions or replicate models that address a particular industry's workforce issues. These solutions demonstrate how a demand-driven workforce system can more efficiently serve the workforce needs of business while effectively helping workers find good jobs with good wages and promising career paths.

The High Growth Job Training Initiative process engages each partner in its area of strength. Industry representatives and employers define workforce challenges facing the industry and identify the competencies and skills required for the industry's workforce. Community colleges and other education and training providers assist in developing competency models and training curricula and train new and incumbent workers. The publicly funded workforce investment system accesses human capital (youth, unemployed, underemployed, and dislocated workers), assists with training programs, and places trained workers in jobs.

ETA is modeling the power of this partnership at the national level through investments in demonstration projects in twelve high-growth industries, including the aerospace industry. Each of the 12 industries (See Appendix A – List of High Growth Job Training Initiative Industries) were selected because they meet one or more of the following criteria: (1) is projected to add substantial numbers of new jobs to the economy; (2) has a significant impact on the economy overall; (3) impacts the growth of other industries; (4) is being transformed by technology and innovation requiring new skills sets for workers; or (5) is a new and emerging business that is projected to grow.

Investments in these industries are designed to achieve four broad outcomes:

1. Targeted investment of workforce development resources and support for private and public sector partnerships to ensure the development of workers' skills in demand occupations based on industry need.
2. Increased integration of community and technical college efforts with business and the public workforce system activities to meet the skills training needs of high-growth industries.
3. Increased opportunities for employers to use apprenticeship training as skills development methodology, combining on-the-job training and academics, to ensure a pipeline of skilled workers.

4. Providing workers with paths to career enhancing opportunities in high-growth occupations.

By expanding the local workforce system's capacity to be market-driven, responsive to local economic needs, and a contributor to the economic well-being of the community, ETA is promoting workforce quality, enhanced productivity, and economic competitiveness.

The High Growth Job Training Initiative Process in the Aerospace Industry

The aerospace industry was selected for the High Growth Job Training Initiative in large part because of its significant impact on the economy overall, as well as its impact on the growth of other industries. The former President established a Commission on the Future of the United States Aerospace Industry to call attention to how the critical underpinnings of this nation's aerospace industry are showing signs of faltering—and to raise the alarm. The aerospace industry is a powerful force within the U.S. economy and one of the nation's most competitive industries in the global marketplace. It contributes over 15 percent to our Gross Domestic Product and supports over 15 million high-quality American jobs. Aerospace products provide the largest trade surplus of any manufacturing sector. Last year, more than 600 million passengers relied on U.S. commercial air transportation and over 150 million people were transported on general aviation aircraft. Over 40 percent of the value of U.S. freight is transported by air. Aerospace capabilities have enabled e-commerce to flourish with overnight mail and parcel delivery, and just-in-time manufacturing.

Gathering Information

The Department of Labor's involvement with the aerospace industry began early in 2002, with former U.S. Secretary of Labor Elaine L. Chao tasking the Employment and Training Administration (ETA) to serve as the workforce liaison to the Commission on the Future of the U.S. Aerospace Industry.
ETA played a significant role in researching the workforce needs of the aerospace industry and in crafting the Commission's workforce recommendations. The information gleaned and the recommendations development by the Commission served as the foundation for ETA's efforts to engage the aerospace industry in the High Growth Job Training Initiative. Baseline research of the industry was conducted to assess aerospace workforce needs. After completing the research, staff from ETA's Business Relations Group (BRG) met with representatives from two industry associations (Aerospace Industries Association and the Aerospace States Association), key stakeholders within the industry and other Federal partners, such as the U.S. Departments of Commerce and the U.S. Department of Education to further validate the information gathered, discuss the structure of the industry and key trends, and begin to identify pressing workforce challenges. This phase of the Initiative culminated with a meeting among ETA Assistant Secretary Emily Stover DeRocco, U.S. Department of Commerce's International Trade Administration Deputy Assistant Secretary Joseph Bogosian, and the Aerospace Industries Association Workforce Committee on December 4, 2003. More than 20 key aerospace stakeholders, comprised of industry, education, labor, federal and state representatives shared their views on the state of the aerospace workforce and committed to support efforts to develop innovative solutions to ensure the industry has the workforce necessary now and into the future.

The Executive Forum

On March 10, 2004, ETA Assistant Secretary Emily Stover DeRocco then convened an Executive Forum with 13 senior executives in the aerospace industry. Hosted by the Aerospace Industries Association

(AIA) Executive Committee, the forum served as an opportunity for industry leaders to discuss their current and future workforce issues and concerns with ETA.

Forum Outcomes: Aerospace Industry Workforce Challenges

Industry leaders confirmed a wide range of workforce challenges during the forum. Examples of specific challenges which surfaced repeatedly validated those challenges identified by the Commission on the Future of the U.S. Aerospace Industry as well as information gathered by the Business Relations Group during the information gathering phase of the process. Specific challenges identified included:

- The Aging Workforce
- Failure to Attract and Retain Workers
- Failure of Mathematics and Science Education in the K-12 System
- Loss of Technical Talent
- The Image of the Industry

The Aerospace Workforce Solutions Forum

Following the Executive Forum and an analysis of industry leaders' input on workforce challenges, an Aerospace Workforce Solutions Forum was convened on June 9-10, 2004. More than 35 stakeholders representing industry, education, labor, the public workforce investment system, the states and Federal government developed model solutions to address the aerospace industry's workforce development priorities. Stakeholders developed 136 potential solutions to the industry's workforce challenges (See Appendix B – All Solutions Developed). Participants determined that 21 of those solutions were the highest priority and developed them in more detail using a "solutions matrix" that provided strategic guidance and suggested areas where public and private resources should be invested (See Appendix C – Solution Matrices). These solutions are broadly identified under two priority areas, the Aging Workforce and the Loss of Technical Talent.

Section III
Workforce Challenges and Solutions in the Aerospace Industry

Through the High Growth Job Training Initiative in the aerospace industry, the Employment and Training Administration (ETA) of the U.S. Department of Labor (DOL) has engaged more than 97 individuals representing 62 organizations from the aerospace industry, education, labor, the public workforce investment system, the states and the federal government to identify the primary workforce challenges facing the aerospace industry, as well as possible solutions to address those challenges. The following section of this report provides background on the two broad categories of challenges facing the aerospace industry and a brief overview of the solutions to each of those challenges that attendees identified during the Aerospace Workforce Solutions Forum.

Challenge #1: The Aging Workforce

The Commission on the Future of the United States Aerospace Industry reported from a variety of sources that the aerospace workforce is "aging" and that approximately 26 percent of the aerospace workers are eligible to retire by 2008. The average age of production workers is 44 in the commercial sector, 53 in defense and 51 at the National Aeronautics and Space Administration (NASA). They also indicated aerospace workers industry wide, 30 years of age or younger, fell by almost two-thirds, from 18 percent in 1987 to 6.4 percent in 1999. An Aviation Week and Space Technology article questioned whether this exodus from the industry will threaten the industry's vitality in the near term. In a comprehensive employment study, Aviation Week found that just 1.9 percent of the workforce represented by the companies in the study retired in 2003. It is the preparation for potential retirements four to five years from now, the "so-called demographic cliff," that must be addressed. These statistics reflect a legitimate concern about the loss of intellectual capital and the aging of the U.S. aerospace workforce.

Core competencies or "soft skills" were at the center of aerospace discussions regarding national certifications, apprenticeship training, and maintaining institutional memory. Many of the solutions sets discuss developing and/or promoting competency-based skills building and training approaches to help address issues with the aging workforce and loss of institutional memory.

Recommended Solutions

The following are the nine recommended solutions to address the aging workforce issue:

Develop a self perpetuating "knowledge management" system – Aerospace stakeholders proposed a concept to maintain the industry institutional memory to limit the impact of workforce turnover and aging. The system should be flexible and not static, offer an interpersonal feedback mechanism and capture intellectual intent and process used to create work product. This "knowledge management" system should be self sustaining. Potential barriers include difficulty capturing process and product, the proprietary nature of the information, national security, high cost, privacy issues and the time needed to identify and document processes.

Develop a model for cross-training workers in employment industries that are declining – After establishing data and a baseline of information that identifies critical shortages, stakeholders proposed a

retraining initiative to take advantage of highly skilled workers in declining segments of the aerospace and similar industries. The model would:

- Identify those individuals within the aerospace industry that have skills that can be upgraded to demand occupations
- Identify other manufacturing sectors/companies in decline
- Provide incumbent worker system training whenever possible
- Communicate to education training organizations pending shortages and the need to upgrade or retrain employees in demand industries
- Create a formal communication process to allow educational organizations to be prepared

Develop phased retirement program – The need for phased retirement was discussed by stakeholders as a key barrier to retaining older workers' institutional memory and skills base. Current retirement rules preclude retirement age employees from receiving certain benefits and at the same time continuing to provide required mentoring of the younger workforce.

Develop multiple institutes focused on preserving skills base and key technologies – Stakeholders called for connecting current activities through an "alliance business model." Current activities include:

- Industry and government have identified skills base and key technologies
- Institutes are actively performing research
- Educational institutions are actively engaged at all levels
- Government and industry are funding competitions that encourage industry/education teams to perform real projects and research to maintain key skills
- Institutes are recognized as government/industry resources for each skill

The proposal included the need to take the skills base outside the "company gate" by developing multiple institutes focused on preserving the skills base and furthering key technologies needed by and supported by government and industry, by performing real projects and research (a one-stop for industry-base skills). The institutes would establish an ongoing series of funded competitions between industry/university teams focused on key technologies and skill sets as defined by industry and government customers having workforce emerge with emerging technologies. In addition, they would recognize and support technology transfer, process improvements, material and science by supporting research, education and industry partnerships.

Establish and improve relevance of aerospace industry in education and other industries – Building the image of the aerospace industry, which is discussed in more detail in the loss of technical talent challenge, is essential to establishing the critical importance of the industry to national and economic security. Local processes would improve awareness among elementary students and other industries regarding relevance of aerospace industry/skills base. Elements of such a solution include:

- A promotional campaign
- Aerospace experts need to promote aerospace in elementary schools
- Aerospace experts need to promote the industry to local mayors and regional players (workforce boards, local governments, and support organizations)

- Aerospace stakeholders need to cross-talk with other industry advocacy groups to promote skills required currently and in the future for the aerospace industry

Develop a model program around the aerospace industry identified "soft skills" using SCANS as a baseline – Stakeholders proposed aerospace industry professionals to be involved in the educational framework by providing student performance standards for specific occupations. Programs provide ongoing intensive involvement of personnel from the aerospace industry. The major barrier includes Federal and state testing requirements to teach hard skills.

Establish an annually updated national database of skills/competency gaps – The group called for helping to preserve the industry institutional memory, an updated database of skills and competencies, focusing on training money on one year and five year gaps identified by centers, companies and agencies and managed by them. The purpose of this database would be to promote and expand scholarship programs targeting anticipated high-demand positions.

Validate the demographic cliff as an issue – There is no definitive data that the demographic cliff exists or will persist. Stakeholders wanted to obtain aerospace industry statistics (age demographics, number of employees that are retirement eligible, and who is actually retiring), determine criticality of skills at risk with a skills forecast and skills inventory and determine the root cause of attrition, including:

- Financial portfolio
- Job satisfaction
- Utilization

Develop a retiree alumni network – The group called for the creation of an environment where retired employees with institutional, product and system knowledge can stay engaged with company activities and be available when critical need arises. The proposal called for paying retirees to create a training program for their replacements capturing their class on video and in writing, working with professional trainers and educators.

Challenge #2: Loss of Technical Talent

Loss of technical talent is related to the ability of the industry to not only increase its skills base but retain the talent it has. Key issues discussed included ensuring high-tech skills, reducing turnover, engaging non-traditional labor pools, and improving industry image.

The aerospace industry, once the employer of choice for the "best and brightest" technically trained workers, now finds it presents a negative image to future workers. Surveys indicate feelings of disillusionment among its personnel, whether they are production/technical workers, scientists or engineers. In a survey of nearly 500 U. S. aerospace engineers, managers, production workers, and technical specialists, 80 percent of respondents said they would not recommend aerospace careers to their children.[18] Engineering students also gave the aerospace industry low ratings for its physical work facilities, exciting and meaningful tasks, opportunities for professional development and growth, and

[18] Lean Aerospace Research Agenda and Lean Aerospace Initiative. P. ll

supportive and encouraging management.[19] An Aviation Week and Space Technology article similarly indicated that aerospace engineering ranks low on the choices of engineering disciplines selected by students. However, stakeholders mentioned that this data may not be as meaningful as it once was because engineers in the aerospace field are now comprised of other engineering disciplines. Most of the solutions sets discussed herein have image and outreach elements.

The International Association of Machinists (IAM) discussed the pipeline issue in the context of apprenticeships. They indicated the pipeline is vacant and that out of 160 of their participating companies only two have apprenticeship programs. They cited the need to determine "what are our capacities right now" to remain internationally competitive." Participants indicated that this issue was directly related to ensuring high-tech skills.

The Massachusetts Institute of Technology (MIT) found that recruiting the new pipeline of workers is difficult in the aerospace industry. Traditionally, innovation has been among the biggest draws for prospective and current technical employees. Aerospace detractions include:

- The opportunities to be part of break-though innovation in the defense and commercial aircraft industry has been declining; and,
- Aerospace ranks last among the number of patents per employee, also showing that being part of innovation is difficult.

One of the key issues discussed by aerospace stakeholders was the need to look at non-traditional labor pools, including women and minorities. According to the U.S. Council on Competitiveness, "boosting participation of women and minorities in the science and engineering workforce presents the single greatest opportunity to expand the nation's pool of technical talent." The Aviation Week study noted women and minorities comprise 24.6 percent and 19.3 percent of the aerospace workforce, respectively.[20] The article also cited success stories such as Rockwell Collins, which have demonstrated "several common factors:

- Strong relationships with historically black colleges and universities
- Awareness of local demographics and connections with the community
- Balanced hiring between new college graduates and experienced professionals"

The Florida Aviation Aerospace Alliance has also recently assessed minority employment trends in the industry. In a June 2004 report, the Alliance found that African-Americans only make-up 10.1 percent of the air transportation workforce. The report provides a series of 43 recommendations that should be studied for their applicability and replicability in other states.

Recommended Solutions

The following are the twelve recommended solutions to address the loss of technical talent issue:

Cutting-edge curricula – Curricula needs to be research-based, evaluated and tied to industry requirements. Recognition of state authority for education must be accounted for during curriculum design. Stakeholders envisioned this as a continually updated process identified to stay cutting edge.

[19] The Job Seeker's Report Card on the Aerospace Industry: A College Student's Perspective, (MIT, 2001)
[20] *Aviation Week and Space News*, 2004

They also believed that schools could be used as test beds for technology and application. Barriers to success include a lack of interest, prohibitions of money for capital investments, accreditation of faculty to allow experts to teach, as well as school schedules typically not being responsive to industry time constraints.

Increase "hands on"/interactive learning in classrooms by increasing technology in classroom, increasing the number of teachers with experience in the field, increasing the number of classes geared toward specific interests, and teaching what the industry needs – Participants called for "hands on" materials (kits, equipment); comprehensive and systematic improvements (not ad hoc), publicized successes and replicability efforts; externships; institutes and continual processes keeping up to date with industry needs. Barriers include accreditation of retired industry staff and education recognition of industry accreditation.

Identify, create, teach, and certify vital baseline core competencies and skills sets as defined by industry, as well as high-tech skills and technical competencies as defined by industry – Participants were interested in developing agreement on core competencies and standardizing them across states. The model called for looking at what already has been developed by industry for core competencies and developing pilot sites and replication of successful programs. In addition, community colleges must be integrated with four-year schools.

National public image campaign that focuses on the positive impact of the aerospace industry – Image was identified as a major issue for stakeholders and the Commission. The campaign would celebrate successes (i.e., Hubble telescope – knowledge of the universe, aviation records), stop dwelling on negatives only in the media, i.e. accidents or near accidents in aviation and space and ensure broad representation. Participants also believed that all the pertinent government agency stakeholders must agree to a new public image campaign for the industry.

National media campaign through video games, mainstream media, pop culture, merchandise, young executives promoting the industry, creating an aerospace personality – Ideas included "Aerospace Idol," "American Astronaut" reality shows that would allow students to compete for a chance to go into space. It was noted that several aerospace analysis software companies already have the tools and desire to do this kind of programming development. Games can be distributed through normal channels. The gaming industry in some fashion exists in and is influential across all races and genders, allowing all kids to learn about aerospace in a fun and engaging way outside the classroom and realize that aerospace really can be cool. Stakeholders would develop a campaign to attract youth at several age-appropriate levels through mainstream media, pop culture and merchandise.

Modify career clusters and pathways for adult learners – a component of adult education – This model was based on the current U.S. Department of Education/state partnership on career clusters, callings for breaking down communication barriers, identifying sub-categories of aerospace and applying technology skills terms.

Publicize aerospace career options via career days, career clusters, career pathways, academic tracks (dual enrollments), websites, career packages, guidance counselors, etc.– This model would have an allegiance between all the "key" K-12 players, and the higher education industry. It calls for a voice of private industry and the right person to coordinate between different groups, associations and states. Participants

mentioned that it is important for states to share best practices and information to cause a "domino effect" of success.

Develop industry and post-secondary partnerships that focus on internships/cooperatives and curriculum development, mentorship's, scholarships, etc. – Stakeholders proposed ongoing partnerships with all stakeholders and publicizing internships and teacher opportunities. The model would fund a state-based pilot project that establishes a network of aerospace education mentors to put resources in the classroom, align the resources to education standards and train teachers on how to use them. It is critical to include national coordinated state based efforts and assessment components.

Educational assistance/support for student loan forgiveness and industry-sponsored scholarships/loans in return for work commitment – The model proposes student-loan forgiveness with time and finance limitations, guaranteed job and paid education (subsidized), loan pay off with working and scholarships for non-college "vocational" classes (ACTE). Association coordination on scholarships would be aligned with aerospace curriculum.

Create internship/fellowships to offset cyclical nature of the industry and study financial benefits of retention vs. layoffs/retraining – Participants were interested in work continuity, executive education with long-term implications (cost factors) of layoffs and hiring costs versus retention and retraining and government programs to accept employees while new work is created – return to pipeline (intern/fellow-type opportunities).

Provide industry supported cooperatives, professional and trained mentors, internships – This proposal included peer buddies within corporations to improve student/young professional retention in the aerospace industry. The following are elements of such a model:

- Mentors mentor during 8-hour day
- Mentoring Advocacy: Company One encourage Company Two to mentor
- Co-ops not employed
- Internships employed
- Relationships developed with educational institutions
- Educate individuals about one industry (peer to peer counseling)
- Inter-company (Company One and Company Two) have networking opportunities
- Intra-company networking opportunities

Section IV
Implementation of Solutions and Next Steps

The Employment and Training Administration (ETA) supports comprehensive business, education, and workforce development partnerships to develop innovative approaches or replicate models that operationally demonstrate how a demand-driven workforce system can more effectively serve the workforce needs of business while also effectively helping workers find good jobs with good wages and promising career pathways. Grants awarded under the High Growth Job Training Initiative implement unique and innovative, industry-driven skills training, certification, and career ladder development programs that support identified construction workforce and economic development needs.

Based on the challenges identified by the aerospace industry and highlighted in this report, DOL has made a series of investments totaling more than $6.9 million to address workforce needs in the areas identified in this report. These investments include providing dislocated workers with technical training and employment in the aerospace industry; training incumbent aerospace workers for new high-tech manufacturing processes; providing hands-on learning opportunities for students to develop technical aerospace skills and improve awareness of the skills required for aerospace careers; develop advanced aerospace technician curriculum, career ladders and distance learning approaches associated with the Boeing 787 supply chain; providing aerospace mentors and 25 teacher externships for technology teachers to improve hands-on knowledge and awareness of skills required for aerospace careers; and a program designed to reduce H-1B visa worker dependency in several high-tech, high-skill aerospace job occupations. For more information on these grants please go to http://www.doleta.gov/brg. These model solutions must account for and leverage key public workforce investment system capabilities, including the following seven key workforce areas:

- Expanding the pipeline of youth entering the aerospace industry;
- Enhancing the capacity of secondary schools to prepare youth to enter post-secondary programs and employment in the aerospace industry;
- Providing career lattice and career ladder approaches to the recruitment, education, training and professional development and job placement of aerospace workers;
- Helping alternative labor pools, such as women and minorities, learn about career opportunities and gain skills in the aerospace industry;
- Enhancing the capacity of community colleges and the public workforce investment system to help alternative labor pools enter the aerospace industry; and,
- Creating comprehensive partnerships that help entry-level workers enhance their skills and utilize apprenticeship and other on-the-job-training programs.

ETA is committed to identifying successful models and resources through the High Growth Job Training Initiative. The results, products, and knowledge gained from these demonstration projects will be disseminated widely to the public workforce system and our strategic partners in business, industry, and education. The Department has launched the www.Workforce3one.org web site to provide information and tools for employers, educators, and workforce professionals as well as the Career Voyages (www.careervoyages.gov) web site so Americans can access information and tools to build careers in high-growth, high-demand industries and occupations.

Additionally, on March 26, 2004, ETA Assistant Secretary DeRocco had the pleasure of convening an Aerospace Workforce Interagency Task Force Meeting. The Commission's Final Report to the former President and the Congress recommended that an interagency task force be created to develop a strategy on the aerospace workforce to attract public attention to the importance and opportunities within the aerospace industry. The Commission urged Congress and the Administration to make long-term investments in education and training with a major emphasis in math and science so that the aerospace industry has access to a scientifically and technologically trained workforce. Since the aerospace industry is among those critical industries in which the Department of Labor is working in the High Growth Job Training Initiative, ETA wanted to bring together those federal agencies deeply interested in developing such a strategy for additional discussion and coordination of efforts. It is the intention of ETA to reconvene the Principals in late June, 2005 to review the findings and develop a plan of action to pursue jointly.

ETA continues to engage directly with the Aerospace Industry through industry association meetings, quarterly aerospace industry grantee networking conference calls, and Workforce3one.org webinars.

Conclusion

The commitment from all partners, the Administration, the industry, education, the public workforce system and state and federal partners has been encouraging. Together we can make a difference in how the aerospace workforce will look now and into the future. The workforce projection needs are beginning to grow. The aerospace industry has added 18,900 jobs in the final six months of 2004.[21] Reasons include an increase in passenger traffic and a good year for defense contractors. Certain skilled jobs, such as machinists, are becoming more difficult to fill.[22] The International Association of Machinists indicated that 80 percent of their members are in approximately 20 counties nationwide. Engaging local Workforce Investment Boards in these locations may be the first step in providing a solid target for clustering aerospace workforce solutions to continue the upward employment trend in the industry.

Building on the Commission on the Future of the U. S. Aerospace Industry workforce recommendations, the High Growth Job Training Initiative has engaged a broad range of aerospace stakeholders to better understand the workforce challenges of this important industry. ETA has made key investments in several innovative partnerships intended to address these challenges. These partnerships will demonstrate how the demand-driven public workforce investment system can better meet the needs of business and provide good jobs with good wages and promising career pathways.

However, these investments and partnerships are just the beginning in a long implementation process. ETA will continue to work with the aerospace industry to gather and disseminate best practices and lessons learned from its current investments and other ongoing education and training activities nationwide. ETA will also work with the grantees to ensure that the projects are sustainable and can be appropriately replicated in other areas of the country and within other high-growth/high-demand industries of the American economy. Together, industry, education and the public workforce system can make a difference.

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[21] AIA, 2004
[22] The Herald (Everett, Wash.), 2004

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Section V
Appendices

Appendix A: High Growth Job Training Initiative Industries

Appendix B: Solutions Developed at the Aerospace Workforce Solutions Forum

Appendix C: Aerospace Workforce Solutions Forum Matrices

Appendix A

High Growth Job Training Initiative Industry Industries

- Automotive
- Advanced Manufacturing (Including Separate Aerospace Industry)
- Biotechnology
- Construction
- Energy
- Financial Services
- Geospatial
- Health Care
- Hospitality
- Information Technology
- Retail
- Transportation

Appendix B

All Aerospace Workforce Solutions Forum Solutions Developed

Aging Workforce: Preparing for the Demographic Cliff

1. Increase the number of people in the pipeline through aggressive marketing strategies (6 votes)
2. Modify incentives in DB plans to retire early
3. Develop partnership between (formal education) U.S. Department of Labor (DOL), DGH of U.S. Department of Education (DOEd), National Association of Workforce Boards, aerospace industries association and other societies to develop career components to be taught K-12 in science, technology, engineering and mathematics (STEM) classes (science, math verses traditional technology classes) and textbook supplemental activities (5 votes)
4. Create an incentive plan for employees to identify retirement intentions (approximate date of retirement) to allow for workforce planning (recruitment and training) (2 votes)
5. Use retired or near retirement employees as community ambassadors to promote interest in the aerospace profession. (through civic organizations, business, associations, outreach community and media)
6. Develop a strategic plan for skilled replacements, such as college and field experience, to help fix experience curve
7. Promote aggressive recapitalization of intellectual capital – Heavy recruitment of entry level professionals
8. Create (2 education + 2 internship + 3 education) program to get more people in workforce sooner and reduce the slope of the cliff; Build awareness programs for K-7 and promote certificate employee education
9. Develop alternate retirement programs for targeted specialties, such as early outs to move from Federal to private sectors companies (one vote)
10. Place U.S. Department of Labor funds into other agency aerospace development programs to support work force development so that work force and product emerge simultaneously (1 vote)
11. Bring in more diverse workforce through 2 to 4 years of college articulation in critical skill areas
12. Since the industry is highly concentrated in a limited number of geographic areas, investigate non-site specific employment models for appropriate jobs (5 votes)
13. Utilize "Bill Nye" excitement over drill and kill approach; Build publicity on "how cool" it is to solve problems
14. Develop industry/education partnerships to include student and employee internship programs
15. Work with Space TEC or similar group to develop high school to community college transition programs, dual enrollment (deliver on-line education facilitator w/ on-line test (4 votes)
16. Develop market driven solutions including pay and benefits (1 vote)
17. Approach retirement eligible employees on desires relative to re-employment as consultants; provide training on operating as consultant
18. Develop supplemental science, technology, engineering and mathematics curriculum for use by K-17 educators; Include activities with aerospace tie and strong career component; Deliver nationally using broadcast, on-line plus broadband resources. (4 votes)
19. Promote aerospace stakeholders working with educators to publicize careers and the academic tracks that lead to them at crucial "gateway" stages for middle and high school. (11 votes)

20. Develop dual enrollment courses between highs school and community colleges to "hook" students into aerospace programs and save on college tuition (1 vote)
21. Target marketing of career pathways to 5th-8th graders
22. Use rocketing contests to work with aerospace career days
23. Partner with U.S. Department of Education State Directors of Career and Technical Education (NASDCTEC) and League for Innovation in the community college to implement career clusters and career pathways approach (6 votes)
24. Attract youth by showing there is a need and a career path for those who enter the aerospace industry; "They will go where the jobs are!" This can be done by showing guidance and college counselors the need, so that it can be passed onto students when considering career options; Get youth involved with Math and Science at young age with camps, career days etc. Work to end the stereotype that "math and science are for boys" so more women and minorities become involved (7 votes)
25. Develop Career Days (aerospace and other High growth Job Training Initiative industries) in: middle schools; inner city high schools; one stop career centers…diverse/non traditional (5 votes)
26. Build awareness in high school students of options via: guidance counselors; easy to find web sites; fairs; parents; and, current members in the field.
27. Leverage Space TEC published recruitment package for use by community colleges in local areas high schools; Teams include industry representatives that tell parents and students local jobs, benefits, additional career ladders, interview guides, scholarships, cool programs etc
28. Involve the private sector in partnerships that interface with education mentorship's, internships, industry specific scholarships- industry sponsored career days or weeks
29. Apply design co-op model developed as a partnership between Thomas Nelson Community College (TNCC) and Northrop Grumman Newport News and Tech Prep train counselors on program (3 votes)
    A. Market to high school students & parents using business facility teams
    B. offer paint tuition & fees
    C. offer employment upon completion of AAS
    D. articulate courses/programs to 4 year university
30. Form a partnership between the aerospace companies, universities and community colleges that highlight the aerospace industry and ensure that classes are develop[ed which meet the industry needs
31. Push teachers to use their connections to get students into aerospace related internships/ co-ops; Companies need to contact teachers and get the word out that they want to get students involved (14 Votes)
32. Promote recruiting concepts such as:
    - Conduct air & space camps
    - Count the # of camps & participants
    - Not unique
    - Can be duplicated everywhere
    - Conducted annually
    - Bring a parent to school day (job fair reverse)
    - Include industry scholarships
    - Involve experimental aircraft association – EAA young eagles
    - EAA goal 1,000,000 incentive flights by 2003

- Identify "potentials" and then exposing career fields, space camp, ace, shadowing
- Initiate Summer Programs in Aerospace for Middle and/or High School students to acquaint them with opportunities in aerospace. Example in space scholars Institute run by Space Tec at Prince Georges Community College, MD – two week 8:30 – 3:30 PM. Programs with field trips to NASA and contractor. Develop Space Robot, do math on "as needed basis."

33. Fund summer employment programs for teachers in aerospace industry; Give math and science teachers opportunities to have hands – on experience in aerospace facilities so that they can blend that into their presentation of those subjects (7 votes)
34. Fund Project-lead-the-way training for teachers in areas not connected to the aerospace community PLTW is a free curriculum for pre-engineering; Teacher training is the largest cost, presuming schools have computers; Expose greater number of students to engineering as well as insure their teachers so they can be better advocates (6 votes)
35. Develop a "mentoring" program for youths and industry leaders; Need to include every job level and every gender and ethnic group: (8 votes)
    - Provide a robust mentoring system that allows younger students and prospective workers to help them understand all of their opportunities available to them; include a group of industry representatives to be responsible here; They should probably begin with middle school students and work their way through adults who have been in the workforce (but not aerospace); The idea is to show the aerospace industry has jobs in many disciplines with many skill sets to make people understand that they can contribute in many ways and not be pigeonholed into one job
    - Promote a stakeholder (industry, education, federal government, policy makers) partnership to address recruiting issues by engaging Boy/Girl Scouts & Big Brothers/Sisters, Girls Inc. rocketry clubs, after school programs, etc through mentoring, volunteering, formal programs, workshops and in-kind support
36. NASA has excellent educational resources that can stimulate math and science learning while encouraging careers in aerospace. Unfortunately, NASA's distribution network does a poor job of getting these materials into our K-12 schools (13 votes)
    - SOLUTION – Fund a state-based pilot project (in Florida) that established a network of aerospace education mentors to put resources in classrooms, align the resources to state education standards, and train teachers how to use them.
    - Actionable – grant (NASA, USDOEd, USDOL)
    - Measurable – track standardized test scores
    - Unique- probably
    - Innovative- opportunity overlooked by NASA
    - Replicable- Pilot demonstrates how NASA can work with all states
    - Sustainable – states can match investment
37. Use diverse and non-traditional individuals in all recruiting activities; This included printed materials and group recruiting sessions (6 votes)
    - involve OBAP AWAM 99's Rosie Riveters
    - organization of black aviators and pilots
    - association of women aircraft mechanics
    - go to schools to recruit
    - non unique

- traveling road shows of women in business conduct annually
- develop a states program based on success already achieved by a handful of aerospace states, and work with associations and government to get out a positive message on recruitment for aerospace employment and opportunities
- recruiting lead by industry- people want jobs
- actionable- industry and government partnerships CEO/Governors/Labors
- All 50 states replicable
- Annual or Bi- annual reaffirmation by all parties
- Equip react teams with ability to immediately offer retraining to affected workers, thru use of vouchers etc.
- Target military spouses of transferring military member; recruit before arrival at new base. Recruit based on aerospace

38. Leverage Space TEC's educational launch complex for sounding rockets with small payloads to hold national USDOL competition for scholarship (2 votes)
    - Get students into field: tours, simulators, events such as air shows, launches, one-on-one interaction (plane ride)
    - Interaction will get them excited and interested in aerospace
    - Provide guided tours of aerospace facilities for students
    - Give them opportunities to meet with successful people in the associated field
39. Develop a matrix (measurable) to ensure that all K-12 teachers in region are familiar with and utilize visitors Centers at NASA. (2 votes)
    - Publicize what exists
    - Space TEC has created educational modules for use in three levels of K-12 to employ space themes in the classroom—these are free on the Space Tec website
    - Space Tec has cataloged the NASA center educational resources which again are free to K-12 teachers/ school on request
40. Through collaboration with U.S. DOEd, provide incentives to develop technology based information flows about careers to inform non-traditional affinity locations. This includes inner-city schools, after school programs, community activity centers, Senior Citizens Centers, rehabilitated unites. May require some $ to be spent on infrastructure such as wiring, ISP connection cost and computers. (4 votes)
41. Create a national USDOL website that ties into the Space TEC recruitment outreach
    - Space TEC networks through: civil air patrol (nationwide), AFJROTC (1100 + high school), 12 college websites, national Tech-Prep (1 vote)
42. Develop pre-apprenticeship training for students in high-schools so they don't have to wait until they are 18 to start focusing on a pathway (1 vote)
43. Adopt a school program with emphasis on a whole range of aviation jobs—not just pilot/flight attendant (1 vote)
44. Industry needs to provide students "in" field with scholarships. Promote tech fields
45. Allow more flexible use of Workforce Investment Act Youth dollars to sere non-economically eligible youth & youth under the age of 16 to be able to address K-12 interventions promoting math, science, labor market/ career path education
46. Conduct job fair recruiting events near technical schools (community colleges, advanced degree institutions) with speakers and demonstrations or simulators to attract and educate potential

candidates on career options/ requirements; Organize by industry and government organizations, including minority and disabled associations

47. Work with industry to pilot job redesign to create jobs that hone different groupings of technical and physical tasking regents. This would enable placement of senior citizens who had not been in as prior as well as the physically challenged
48. Where appropriate, offer veterans transition centers where transferable skills pathways are explored, credentialing facilitated, and connections to existing training or employment opportunities are featured.
49. Set up high school or college next to new Dulles Steven F. Udvar Hazy Museum; Exploit all public relations implications and options
50. Engage the education system to make teachers more effective in order to capture student's attention and build their capabilities – stop students from slipping through math and science cracks
51. Develop supplemental science, technology, engineering and math curriculum for use by K-12 education. Include activities with aerospace tie and strong career component; Deliver nationally using broadcast, online and broadband resources. (4 votes)
52. Approach retirement eligible employees on desires relative to re-employment as consultants. Provide training on operating as consultants
53. Develop a market driven solution including pay and benefits (1 vote)

Aging Workforce: Addressing the loss of institutional memory, experience and intellectual capital

54. Develop skunk works mini departments for individual rotations to avoid lay offs talent, take up slack in employment through program cycles, encourage innovation and personal challenges/ growth (24 votes)
    - When a program is cancelled-heed mechanisms put in place to retain technical talent, possibly for use as government "fellows" trainers, etc.
    - Industry must minimize layoffs
    - Need to realize that workers are humans not "resources"
    - Provide a partnership between aerospace companion and other industries to create an industry assistance program to retain technical talent during the downturn in the aerospace business cycle
    - Industry and government should work together to come up with ways to share talent from project to project-instead of lay-offs to project; Would probably require some government law changes
55. Promote educational assistance with commitment for service, including: 15 votes) (2 on second vote)
    - Use industry supported scholarships and loans to improve student retention in aerospace programs
    - Students must work in industry one year for each year of tuition support or pay back loan
    - Forgiveness of student loan debts for student entry into service to the aerospace industry
56. Use industry supported cooperatives, mentorships, internships to improve student retention in aerospace programs. Need trained mentors, reducing turnover and improving retention, mentors

used to counsel young professionals when considering other career options and provide peer buddies inside corporations (14 votes) (6 on second vote)

57. Have industry experts critique textbooks and education frameworks to prevent "dumbing down" college education (7-20 grade tab)
58. Make it easy to move from industry into all levels of education to teach and mentor potential and new employees (6 votes)
59. Place pay experienced (pre-retirement) personnel in Universities mentoring undergraduate/ high School students in an industry sponsored research projects (3 votes)
60. Outsource smartly – do not trade away critical knowledge and skills for the short-term gain; Focus on competitive advantage. Innovation comes from doing!
61. Facilitate knowledge transfer through "mentor" or "job shadow" program, where new or lesser skilled employees would learn from the more experienced employees (3 votes)
62. Establish aerospace imperative similar to Apollo
63. Develop a session involving future retirees and request that they look into the future and catalog future needs of the industry, and provide training to all new employees on the ideas using retirees and resources (2 votes)
64. Identify and publicize Best Practices used to specify and assess critical knowledge, skills and functional capabilities requirements for key jobs in aerospace industry (2votes) (key competency model)
65. Develop creative layoff programs, including:
    - Voluntary layoff
    - Part-time employment w/ full time benefits
    - Pay differential for higher/ additional education
    - Pay differential for requiring training focusing on upward mobility
66. Develop pool of recent retirees to speak at community colleges and universities on aerospace experiences
67. Develop an "Ask Jeeves" system for aerospace answers that survey part-time workers at home on-line (1 vote)
68. Develop flat bonus amount for retention for 50 years of age or older workers that will encourage them to remain full-time with their company.
69. Develop one-on-one mentoring programs that capture mature workers in last 2 years before retirement. (dedicated only to that purpose)
70. Have industry experts engage media to engage K-7 via arcades/TV/ movies
71. Organize "informal learning" on the job and join new employees with experience and retired employees
72. Develop a shared talent pool at the state level between education and aerospace that both draw upon; Educational institutions get expertise and perspective not normally available; Aerospace can better deal with cyclical business (4 votes)
73. Implement a "retiree task force" program that allows retired employees to return to the workplace on a limited tie basis to address critical skills knowledge requirements
74. Get industry to tell educators what skills of future need to be taught today and at what level (K - 20)
75. Create distance learning course by industry experienced retirees and polished by education experts-students, funded by industry (3 votes)
76. Promote incumbent worker training (7 votes)

- Have continuing education training courses that quality aerospace workers for advancement: quality inspectors, instructors, supervision
- Industry must approve, support training
- Offer "studies" to be continued and paid for by industry, thus becoming an asset to both company and individuals

77. Provide benefits within the industry (5 votes)
    - Standby flights
    - Buddy passes
78. Aggressively invest in employee skills development and training (5 votes)
79. It comes down to an image problem again; Initiatives should be developed to bring together representatives from all sectors and companies. They should work to come up with a positive-thinking campaign that they can take back to teach of their employees spouting the current virtues and future of the industry. People need to understand that leaving for the next best thing may not be the best for their future. Case study: the dot-comers when to dot-bombers while the aerospace industry continues. Need for PR campaigns that promote the future growth of aerospace and that helps to regain the excitement. (6 votes)
80. More sharing of best practices needed for retention from low turn-over companies (2 votes)
81. Encourage employee research and development and entrepreneurial new business development approaches (2 votes)
82. Ensure quality preparation (1 vote)
83. Develop education assistance for aerospace families
84. Secure support for long term vision that will engage the industry & allow for strategic career planning
85. Develop visual career paths to promotion

Aging Workforce: protecting the skills base, including improving the basic employability skills of entry level workers

86. Attract youth (23 votes)
    - Develop video games based on aviation and space that teach fundamental STEM concepts
    - Excite kids on the realities of aerospace and not force them to stray from what they really love. Several aerospace analysis software companies already have the tools and desire to do this.
    - Games can be distributed through normal channels.
    - The gaming industry in some fashion exists in and is influential across races and genders allowing all kids to learn about aerospace in a fun and engaging way outside the classroom and realize that aerospace really can be cool.
    - Stake holders develop campaign to attract youth at several age appropriate levels through mainstream media, pop culture and merchandise.
    - Identify female model young aerospace executives and ask their assistance in promoting aerospace.
    - Create MTV-type buzz through the media (i.e. Calvin Kline commercials).
    - Find or develop an "in-house" personality to be a new and different voice in aerospace. Not a celebrity but a real-life aerospace personality who speaks out to others on the virtues of the present and future of aerospace. Think "crocodile Hunter for space. The idea is to

create a space-educated society by creating a targeted and sustainable campaign through several traditional and non-traditional media. Starting small with public service announcements and working our way up through radio and print ads through full-length TV shows our hero will be the identity, the advocated, the role model, the champion for space that we have not had since we left the moon.

87. Modify career clusters and pathways for adult learners- component of adult education (11 votes)
88. Celebrate successes and stop dwelling on negatives in the media (26 votes)
    - Have all the pertinent government agencies stakeholders agree to a new public image campaign for the aerospace industry
    - Ensure that aerospace promote materials include broad representations of population
    - Develop AD campaigns to show the positive impacts of aerospace programs on our day to day lives
    - Develop a marketing video featuring successful employees in current jobs who can passionately talk about what they do; Feature non traditional employees
89. Display all levels aspects of field from "rocket scientist" to programmers, buns, controllers, helicopters pilots, human factor and so on. Mini reality shows like trump but with aerospace, dealing with training of an individual. (1 vote)
90. Market how technology in one arena spins off into new application in other industries (8 votes)
91. Market the industry innovation-what tomorrow looks like (8 votes)
92. Develop a program based on "aerospace leadership in the 21st century" Putting positive image and story together for recruitment. Need a new story. (7 votes)
93. Publicize average salaries of industry – kids want money (6 votes)
94. Develop a presentation matrix that displays the wide spectrum of AS jobs from design through supplies and manufacturing. The will expand the view of AS from "the right stuff" and unattainable to more everyday so that more people can envision themselves in aerospace (2 votes)
95. Augment or replace NASA and FAA public affairs roles with a national "Madison avenue" public relations firm (2 votes)
96. Get parents involved through their employers in reinforcing positive images of math and science through inquiry-based activities (1 vote)
97. Declare annual aviation awareness months (1 vote)
    - Centennial of flight
    - Charlie Taylor celebration
    - Number of participants
    - Similar to other "focus" months
    - Can be duplicated
98. Emphasize flexibility of career field, including jobs have progressions (2 votes)
99. Support academic and job skill excellence on par with athletic excellence: perks for honor roll; public recognition; and, employer buy-in to GPS checks.
100. Because of the aging workforce in aerospace, jobs may not be seen as attractive to young college/community college graduates. To offset this potential of feeling as though a new graduate does not "fit in" set up strong mentoring programs for young employees and also recreational activities etc, to promote bonding with the industry.
101. Aviation maintenance technology is a stealthy industry. It is behind the scenes and not visible. Limit visibility if it is negative only

Loss of Technical Talent/Improving High-Tech Skills

102. Sponsor a meeting with industry partners and educators where future specific skill set are identified by industry and educators transfer these skill sets into mew and improved courses and curricula (28 votes)(5 on second vote)
103. Increase "hands on" interactive learning in classrooms (23 votes) (1on second vote)
104. Increase of technology in the classroom
105. Promote and recruit teachers with experience in the field
106. Make classes geared towards specific interests
107. Teach what industry needs
108. Utilize industry to identify the "high-tech" skills (13 votes) (9 on second vote)
109. Identify and train vital skill sets as defined by industry
110. Certify skill sets to standards after training with h ands on testing
111. Reward training with pay (e.g. Boeing pays for employee education awards 50 hours of company stock for completing program)
112. Create baseline core competency technical skills level, including social aspects as well as basic math science
113. Hand out aerospace materials
114. Develop cutting edge curricula and cutting edge educator training. In support of this, cutting edge educational resources
115. Create an ongoing local and national partnership system, linking Industry-post secondary and secondary institutions to continually update knowledge and skill requirements
116. Work with the aerospace industry to ensure that the universities are using the same software packages up to date course material that the student will use once they go to work at the aerospace company.
117. Establish improved coordination between industry and education to keep curriculum and professional development up to date (K-12 and higher education)
118. Review schools current curriculum – more interest and programs needed
119. Sponsor scholarships and educational programs in high need and value areas such as science math and technical related studies
120. Participate with local secondary schools and colleges to create pilot programs which tailor curriculum to the future needs of industry
121. Develop industry partnership with education to provide training "train the trainer"
122. Increase the use of aerospace in math and engineering materials curricula and other resources in K-12 classrooms
123. Implement training programs already in place into a states program through the aerospace industry (10 votes)
124. Enlarge government aerospace contracts, encourage outsourcing of training requirements to community colleges, instead of in-house corporate training. This makes training curricula available to all, instead of keeping it proprietary. It also allows students to pursue training at their own cost, rather than at governments cost. (5 votes)
125. Industry should sell at deep discount or donate training assets and support equipment "engine tools cost $30,000 per set" (5 votes)
126. Provide a vocational school system similar to community college that combines training for varies so skills auto mobility, aerospace, medical that can be flexible and meet the needs of the industry (4 votes)

127. Encourage more multi-cultural training to help the workers of tomorrow interface globally (4 votes)
128. Develop 1+1 programs for expensive programs expensive programs i.e. bio life/ support (1 vote)
129. Coordinate all (NASA, USDOL, industry) career materials, skills curriculum, teaching resources at Kiosks in the Air and Space museums downtown DC and Dulles to focus field trips students and families to channel excitement (sell image media stuff in museum store) "Is your future up in the air" start your take off here!
130. Encourage cross industry research plus exposure; get outside of your own traditions
131. Government /military industry should have a summit where industry discusses their solutions to government needs. So often we have government trying to re-event the wheels that industry is already driving on. By freeing up more time and money, government can focus on sponsoring innovation and skill development and allow industry to keep pushing the envelope. This will also serve to bring in talent and also help to retain the current superstars.
132. Bring in other "high-tech wiz-kids" in a job fair, job sharing, mentoring program planned and designed by industry associations. Stakeholder issue
133. Encourage internal development of "spin-off" businesses
134. Add U.S. Department of Labor funding to NASA's Space grant consortia, or Aerospace States Association specifically for state matching to fund grant programs for aerospace research and development that is consistent with each states priorities.
135. Develop employee development plans, including subsidizing training.
136. Develop "modulazation" of courses online materials (i.e. what is the skill needed?)

Appendix C

Aerospace Workforce Solutions Forum Matrices

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Loss of Institutional Memory, Intellectual Capital				
Solution: 1 – Develop a self perpetuating "knowledge management" system				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who is needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Has to be flexible, not static • Offer an interpersonal feedback mechanism • Capture intellectual intent and process used to create work product • Must be self sustaining	• Incumbent and retired workers • Company management • Other Federal agencies (FAA, NASA)	• Aerospace society partners • Venders/contractors to build and maintain system • Federal agencies	• Difficult to capture process and product • Proprietary information • National security • High cost • Privacy issues • Time needed to identify and document processes	

Provide funding to industry and/or government to create a media and written archive of lessons learned and history lessons making the library available on the Internet and in regional centers. Utilize aerospace society partners working with online repository applications to preserve national lecture series, researchers, designs and interviews. Document process and problem solving solutions provide new workers access to what worked. Develop a knowledge management system that captures, documents, records unique or specialized knowledge that cannot be easily replicated (videos, web-based tutoring, written documentation).

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Preparing for Demographic Cliff				
Solution: Develop a model for cross-training workers in employment sectors that are declining – declining due to retirement or decline				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• After establishing data and a baseline of information that identifies critical shortages in 2A (Develop a self perpetuating "knowledge management" system), process to: 1. Identify those that within aerospace industry that have some of the skills to upgrade to demand occupation 2. Identify other manufacturing sectors/companies in decline 3. Provide incumbent worker system training whenever possible 4. Communicate to education: training organization pending shortages and potential employee sectors to upgrade or refrain information demand sectors • Create a formal communication process to allow education organization to gear-up	• Aerospace industry • Labor unions • Education/training orgs • U.S. Department of Labor (DOL) • State/WDC organization • Unions • Industry • Education	• Through survey and date identified in 2A • To assess worker's skills • Federal (WARN) Dislocated works • State data systems • Surveys/structured conversations – $ for convening • Federal training for incumbent worker • Dislocated worker resource (Federal and state) • State education programs and resources • Company and industry training funds	• No formal systems established • Proprietary information issue in industry • No formal system beyond WARN • Tendency for companies to wait until WARN notices are issued • Difficulty or forecasting in unstable workers	

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Loss of Institutional Memory, Intelligence Capacity				
Solution: Phased retirement program (See below for further descriptions)				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Changes in ERISA and social security laws • Electronic letters of support (website) • Partnerships with other groups with stake in changing laws • Enable plan sponsors to develop defined benefit (DB) plan designs that are neutral (win for various stakeholders) and allow employees to reduce active employment while receiving an incrementally longer benefit under DB plan • Affordability • Actuarial neutrality – "trust impact neutrality" = benefits • Hours adjusted incrementally	• Congress, staff • Sects of Labor • Employee benefits trade associations • Human resources organizations • Employee organizations (labor, professional societies, etc.) • AARP, retiree organizations • Employers, employers organizations • Social Security Administration	• U.S. Department of Labor • Foundations • Unions • Company lobbying arms • Secretary's task force on phased retirement • Prior legislation (Grassley) • Society of actuaries (funding/design issues)	• Social Security's earning's limit • Requires change in ERISA, IRC law • Perceived lack of urgency • Employee relations sensitivities	• Public awareness campaign to develop support for needed changes in laws • Reenergizing existing work on issue

Develop and implement a "phased retirement" program that provides retirement eligible employees an opportunity to work on a limited schedule (i.e., part time). True phased retirement provides retirement eligible employees with an option to disengage slowly by working part time and receive partial defined benefits. Work with industry to change labor laws to allow more "flexible" retirement. Develop a pilot project to test the feasibility of using a phased retirement program to retrain older workers with critical knowledge, skills and experience. Revise the policies/procedures, which prohibit retirees from active participation in the industry to allow for part time contractual services. Progressive retirement: 80%-two years; 60%-2years; 40%-two years; 20%- two years; and, on call x years.

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Protect the Skills Base				
Solution: Develop multiple institutes focused on preserving skills base and key technologies (See below for complete description)				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Industry and government have identified skills base and key technologies • Institutes are actively performing research • Education players are actively engages at all levels • Government and industry are funding competitions that encourage industry/education teams to perform real projects and research to maintain key skills • Institutes are recognized as government/industry resources for each skill • All players are connected through "alliance business model"	• Government • Industry • Educators • Employees	• Department of Labor/Department of Education – initially • Industry/unions/employee associations – sustain	• National programs involve massive funds (initial investment of manpower prior to money) • Proprietary rights • International Trade Armament Restrictions • Security of skills base (technology transfer)	

Take the skills base outside the company gate by developing multiple institutes focused on preserving the skills base and furthering key technologies needed by and supported by government and industry by performing real projects and research (A one-stop for industry-base skills). Establish an ongoing series of funded competitions between industry/university teams focused on key technologies and skill sets as defined by industry and government customers having workforce emerge with emerging technologies. Recognize and support technology transfer, process improvements, material and science by supporting research, education and industry partnerships (research and development).

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Protect (sustain) the skills base (intellectual capital)				
Solution: Establish and improve relevance of aerospace industry in education and other industries				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Promotion campaign 1. Aerospace experts need to promote aerospace in elementary schools (show & tell) 2. Aerospace experts need to promote the industry to local mayors and regional players (workforce boards, local governments, and support organizations) 3. Aerospace need to cross-talk with other industry advocate groups to promote skills required currently and in the future for aerospace industry (Develop common skills matrices across industries [high-tech workers]) • End result/MSN? Local/regional player/ elementary students/ and other industries are aware of relevance of aerospace industry/skills base	• Industry foundations • Department of Education (DOEd) • DOL • NASA • Large corporations (Boeing, Lockheed Martin, General Motors, Ford) • Industry Associations • Unions (teachers, industry) • Lobbyists • Chambers • Industry • Unions or employee new union groups • DOL • One stops	• Fund right now later	• No child left behind (NCLB) • Budgetary focus • Proprietary nature of industry • Union turf issues	Focuses on Testing Aerospace industry not integrated in math, science, and reading

Why is it important and what will I do with it?

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Protect the skills base					
Solution: Develop a model program around the aerospace industry identified "soft skills" using SCANS as a baseline					
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**		**Implementation Barriers**	**Anything Else???**
• Programs provide on-going intensive involvement of personnel from aerospace industry • Aerospace industry professionals are involved in the educational framework by providing student performance standards for specific occupations • Education environment matches industry environment • Aerospace investors have been educated with teaching skills	• Aerospace industry associations • Industry corporations • Department of Education • Aerospace industry • Other educators (school boards) • Department of Education • Aerospace industry • Department of Education	NOW Industry Perkins Grant *Industry *Education *"6 to 6" program *Department of Education *Teacher's unions	LATER Team of Educators and Industry DOL	• NCLB – states must teach hard skills • Department of Education • Lack of universal involvement (buy in) from industry/education players (all) • State education leaders • Lack off awareness • Lack of involvement by industry	

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Preparing for the Demographic Cliff				
Solution: Establish an annually updated national database of skills/ competency gaps (See below for a complete description)				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
1. Develop and implement annual survey w/ year. 1 actual year 5 projected A. Skill gap analysis B. Identify competencies to fill skills gaps 2. Build and maintain database for information 3. Develop programs to help fill gaps A. Scholarships B. Apprenticeships C. Training D. Curriculum development	• Aerospace industry manufacturers • Labor unions • Department of Labor • Bureau of labor strategies for historical perspective • Aerospace supply teams ALL ALL	• Consulting team (Aerospace industry university, national institutes) • Aerospace industry Associations Workforce committees • Human Resources Aviation consortium • Host site (national institute, university, society partner) • Department of Education • Aerospace and society foundations	• Agreement to share information • Commitment to follow through • Money and ongoing resources	1/B Work with Space TEC (Florida), Boeing, etc to identify competencies that are already established

Establish annually updated database of skills/competency gaps focusing on training money on one year and five year gaps identified by centers, companies and agencies and managed by them. Promote/expand scholarship programs targeting anticipated high demand positions.

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Preparing for the demographic cliff.				
Solution: Validate the demographic cliff as an issue				
Critical Attributes (What attributes are needed for success?)	Key Stakeholders (Who are needed for success?)	Resources (Financial, Human, and Technical)	Implementation Barriers	Anything Else???
1) Obtain aerospace industry statistics (age demographics, number of employees that are retirement eligible and who is actually retiring) 2) Determine criticality of skills at risk A) Skills forecast B) Skills inventory 3) Determine root cause of attrition a. Financial portfolio b. Job satisfaction c. Utilization	*Aerospace industry manufacturers *Labor unions *Department of Labor *Aerospace supply teams Other industries	Aerospace companies Third party consultants (such as the Saratoga Institute)	↑ 1) Availability of data 2) Reluctance to share data |	

Validate the "demographic cliff" as an issue: 1) What percentage of eligible employees retire? 2) What will motivate or trigger employees to retire or stay? i.e., stock market, 401K, etc; and, 3) What is the timing?

Validate and verify the extent of the "demographic cliff;" 1) Determine the root cause; and, 2) Document and establish to prevent recurrence.

Aerospace High Growth Job Training Initiative Matrices

Issue: AGING WORKFORCE: Loss of Institutional Memory				
Solution: Retiree Alumni Network (See below for a complete description)				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Policy Barriers**	**Anything Else???**
• Conduits that would allow retirees to prior employment to pay • Retiree centric" • Self nomination • Subject matter experts • Company could identify and contact subject matter experts • Functionality needed companies to select retirees for specific purposes (education and training programs)	• Companies • Retirees • Service providers (vendors)	• Service providers (system set-up) • Employment and Training Administration (pilot project) • Companies • Human Resources • Hosted internet site • Ongoing maintenance • Contracting mechanism (to facilitate recall) • Contractors to provide expertise in curriculum development	• "Retirees are high maintenance" • Potential for mobilization of negative energy • Perceived lack of urgency	

I. "Retiree alumni network" –create an environment where retired employees with institutional, product and system knowledge can stay engaged with company activities and be available when critical need arises.

II. Pay retirees to create a training program for their replacements capturing their class on video and paper working with professional trainers and educators. It could be a lecture series.

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Ensuring high-tech skills				
Solution: 1 - Cutting-edge curricula				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Curricula needs to be research-based and evaluated • Curriculum needs to be tied to industry requirements • Recognition of state authority for education in curriculum design • Continually updated (process identified to stay cutting edge) • Use schools as test beds for technology and application	• Industry • Education • Policy Makers	• Up-to-date technology (software, etc.) • Infrastructure and capability issues • Industry experts to loan to schools	• Lack of interest • Prohibitions of money for capital investments • Accreditation of faculty to allow experts to teach • School schedules that aren't responsive to industry time constraints	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Ensuring high-tech skills				
Solution: 2 – Increasing "hands on"/interactive learning in classrooms by increasing technology in classroom, increasing the number of teachers with experience in the field, increasing the number of classes geared toward specific interests, and teaching what the industry needs				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• "Hands on" materials (kits, equipment) must be available • Comprehensive, systematic improvements (not ad hoc) • Publicize success and replicability • Externships and institutes • Continual process keeping up-to-date with industry needs	• Teachers • Industry professionals and retirees • Dislocated workers (e.g. troops to teachers) • Policy makers	• Donations from industry • Industry experts • Training time for existing teachers	• Accreditation of retired industry • Education recognition of industry accreditation	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Ensuring high-tech skills				
Solution: 3 - Identify, create, teach, and certify vital baseline core competencies and skills sets as defined by industry, as well as high-tech skills and technical competencies as defined by industry				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Look at what already has been developed by industry for core competencies • Standardization of competencies across states • Community colleges must be integrated with 4-year schools • Pilot sites and replication of successful programs	• Industry • Academies • Policy makers • State directors of technical education, community college • Workforce development • Supply chain • Contractors providing training for industry	• Funds from Department of Education and Department of Labor, industry, workforce development	• Interstate commerce issues (state training dollars at WIBs) • Accepting credits across colleges • Implementing standardized competencies at state levels	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Image				
Solution: National public image campaign that focuses on the positive impact of the aerospace industry				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**

• Can't "look" like a government ad
• Put a real face on aerospace
• Connect the dots from airplane mechanics to shuttle astronauts
• Connect space to cell phones, cable, everyday technologies and answer the John Q. Public "So what?"
	• Industry, media, education, popular magazines
	• Private associations (industry group with promotion money)
	  • PAMA
	  • EAA
	  • AOPA
	  • NBAA
		• Money	• Allowing access (Department of Defense), federal regulations)	

- Celebrate successes (i.e., Hubble telescope – knowledge of the universe, aviation records
- Stop dwelling on negatives only in the media, i.e. accidents or near accidents in aviation and space
- Have all the pertinent government agency stakeholders agree to a new public image campaign for the industry
- Ensure that aerospace promotional materials include broad representation of population
- Develop ad campaigns to show the positive impacts of aerospace programs in our daily lives
- Develop a marketing video featuring successful employees in current jobs who can passionately talk about what they do.
- Feature non-traditional employees

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Image

Solution: National media campaign through video games, mainstream media, pop culture, merchandise, young executive promoting the industry, creating an aerospace personality

Critical Attributes (What attributes are needed for success?)	Key Stakeholders (Who are needed for success?)	Resources (Financial, Human, and Technology)	Implementation Barriers	Anything Else???
• "Aerospace Idol," "American Astronaut" reality show that would allow students to compete for a chance to go into space • Better publicity for FIRST, TARC, other competitors and tie them to job opportunities • Go mass media, not PSA • Competition among common people • Age appropriate • Bionic woman	• John Travolta, Tom Hanks, Tom Cruise, Moby • A **real** aerospace figure, a "Crocodile Hunter" for this industry • Hollywood production companies that work with Discovery, networks • Private associations – National Business Aircraft Association (NBAA), fractional owners	• Agreement from industry to open up with information, facilities, technologies • Cooperation among industry leaders • Money	• Access	

Develop video games abased on aviation and space that teach fundamental STEM (Science, Technology, Engineering, and Math) concepts, excite kids in the realities of aerospace, and not force them to stray from what they really love. Several aerospace analysis software companies already have the tools and desire to do this. Games can be distributed through normal channels. The gaming industry in some fashion exists in and is influential across races and genders, allowing all kids to learn about aerospace in a fun and engaging way outside the classroom and realize that aerospace really can be cool.

Stakeholders develop a campaign to attract youth at several age-appropriate levels through mainstream media, pop culture and merchandise.

Identify female/male young aerospace e executives(s) and ask their assistance in promoting aerospace. Create a MTV-Type buzz through the media, i.e. Calvin Klein commercials.

Find and/or develop an "in-house" personality to be a new and different voice in aerospace. Not a celebrity, but a real-life aerospace personality who speaks out to others on the virtues of the present and further of aerospace. Think "Crocodile Hunter" for space. The idea is to create a space-educated society by creating a targeted and sustainable campaign through several traditional and non-traditional media. Starting small with public service announcements and working our way up through radio and print ads through full-length TV shows, our hero will be the identify, the advocate, the role model, the champion for space that we haven't had since we left the moon.

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Image				
Solution: Modify career clusters and pathways for adult learners – a component of adult education				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Breakdown communication barriers • Identify sub-categories of aerospace • Applied technology skills terms academic/theoretical	• Functional representations (not just the people who do the job, not human resources, or the program manager • Academies and administrators • HR and recruiting • Dept. of Labor • Policy makers at state level (regents, Board of Education, etc.)	• Materials to train with • Equipment • Current process maps (e.g., no ordering)	• Export control considerations • State control of education policy	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Non-traditional labor pools				
Solution: Publicize aerospace career options via career days, career clusters, career pathways, academic tracks (dual enrollments), websites, career packages, guidance counselors, etc.				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Have an allegiance between all the "key" players(K-12, higher education, industry) • Voice of private sector has to be presented • Right person to coordinate between different groups, includes associations and states • States sharing best information – "domino effect"	• State directors/association • AIA • Industry • Schools • Labor • Workforce investment • Guidance counselors	• Industry-based scholarships • Web-based coordination • Funding for a state-based program	• Unfamiliar with grant writing, need multi-year funding	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Non-Traditional Labor Pools				
Solution: Develop industry and post-secondary partnerships that focus on internships/cooperatives and curriculum development, mentorships, scholarships, etc…				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Ongoing partnerships with all stakeholders • Publicizing opportunities of internships and opportunities (teachers)	• Industry • Education • Associations • Workforce Investment Boards (WIBs)	• Association grants any used by states • Web-based coordination • Grants	• Competition between resources • WIBs specific to aerospace industry	Instead of student to industry – bring industry to students

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Reducing turnover				
Solution: 1 - Educational assistance/support for student loan forgiveness and industry-sponsored scholarships/loans in return for work commitment				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Student-loan forgiveness with time and finance limitations • Guaranteed job and paid education (subsidized) • Pay-off loans working • Scholarships for non-college "vocational" classes (ACTE) • Association coordination on scholarships aligned with aerospace curriculum, including AIA	• Industry • Government • Associations	• Financial investment by industry/government to subsidize education • Tool reimbursement	• Labor rules, union limits • Funding investment • Tax treatment for company loan forgiveness (make tax credit)	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHNICAL TALENT: Reducing turnover				
Solution: Create internship/fellowships to offset cyclical nature of the industry and study financial benefits of retention vs. layoffs/retraining				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Implementation Barriers**	**Anything Else???**
• Work continuity than cycles • Executive education of long-term implications (cost factors) of layoffs and hiring cost vs. retention and retraining • Government program to accept employees while new work is created – return to pipeline (intern/fellow-type opportunities)	• Industry executives • DOL investment • Industry associations	• Long-term financial savings and retention of technological expertise	• Information sharing of best practices within industry • Corporate buy-in • Law change for benefits	

Aerospace High Growth Job Training Initiative Matrices

Issue: LOSS OF TECHICAL TALENT: REDUCING TURNOVER				
Solution: 3 – Provide industry supported cooperatives, professional and trained mentors, internships				
Critical Attributes (What attributes are needed for success?)	**Key Stakeholders (Who are needed for success?)**	**Resources (Financial, Human, and Technology)**	**Policy Barriers**	**Anything Else???**

• Mentors mentor during 8-hour day
• Mentoring within company: company 1 encourage company 2 to mentor
• Cooperatives not employed
• Internships employed
• Relationship developed with educational institution
• Educate individuals about one industry (peer to peer counseling)
• Inter-company (company 1 and company 2) have networking opportunities
• Intra-company networking opportunities
	• Industry
	• Educational Institutions
	• Employee
	• Unions, where applicable (maybe conduit success)
	• Affinity groups
	• Local industry clusters
	  • Dallas cluster-contact Judy Northrop at VOUGHT (Carlisle Group)
		• Educational Institutions
		• Affinity groups
		• Local industry clusters
		  • Judy Northrup at VOUGHT (Carlisle Group)
		• AFL
		• Association of Professional Employees
			• Affinity groups tend to be national – do not typically reach out to students
			• Competitive issues, drinking age
			• Stone pipe (narrow), job description arranged by union of employees, collective bargaining agreements	

Peer buddies within corporations to improve student/young professional retention in the aerospace industry