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ENVIRONMENTAL SCAN

AEROSPACE INDUSTRY TECHNICIANS

Los Angeles County

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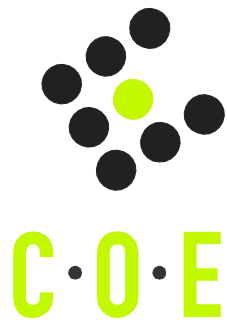
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CENTERS OF EXCELLENCE
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Mission: The Centers of Excellence, in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development.

Vision: We aspire to be the premier source of regional economic and workforce information and insight for community colleges.

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Centers of Excellence, Economic and Workforce Development Program

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Ten mid-level skilled technician occupations in the aerospace industry that require an associate degree or postsecondary certificate will provide an 11% increase or 2,060 new and replacement jobs in Los Angeles County over the next five years (2009-2014.)

– Source: Economic Modeling Specialists, Inc.

Executive Summary

The aerospace industry's workforce development needs are of major interest to the community colleges. The number of new and replacement jobs in the industry is projected to rise slowly over the coming 5 to 10 years and there are many unfilled mid-level skilled technician positions in aerospace companies that represent good career opportunities for community college graduates. The industry also deserves the attention and resources of the community colleges because it is an important sector of the Los Angeles County economy. The question is, "How can the community colleges best support the workforce development needs of the aerospace industry in Los Angeles County?"

The current economic downturn is beginning to affect the industry negatively, although a large backlog of orders has kept employment steady through the first quarter of 2009. In addition to the economy, the industry may be negatively affected by the Obama Administration's stated intention to reduce defense spending. On the other hand, worker demand will be positively affected as many baby-boomer aged employees retire in the coming decade.

Aside from projected changes in job demand, the industry continually faces the challenge of hiring and retaining highly skilled and talented employees. Though most occupations (mid-level, skilled technicians, and professionals) of interest to community college students and graduates are expected to increase very little in the coming five years, the industry reports a large number of unfilled (and apparently unfillable) positions, so it is expected that there will still be many job opportunities for well-educated community college graduates and certificate completers. In a selected group of 10 occupations requiring an associate degree or postsecondary certificate for entry, there are 2,060 new and replacement jobs projected for 2009-2014.

Existing comprehensive surveys of aerospace employers conducted by various organizations were analyzed to obtain employer input for this report. Several key findings of these employer surveys and interviews imply an opportunity for greater involvement by community colleges:

- Science, Technology, Engineering, and Math (STEM) education improvement efforts are crucial to the industry, due to its need for highly skilled labor.
- Community college graduates are perceived as well-trained for jobs in small and mid-sized companies, but not adequately trained for jobs in large companies.
- The lack of skilled production workers is identified as the most serious problem of the next three years.
- Only 20 to 40% of aerospace companies currently use community colleges to provide employee training.

Though it is difficult to match community college programs in the region directly with aerospace occupations where their graduates are needed, it appears that there is an undersupply of graduates to fill the current and projected job openings. Rather than institute new programs, this

report recommends strategies for aligning the current programs more closely with the aerospace industry, and in this way building the programs, their enrollments, and their completers. In the few cases where the industry has asked for new degree programs, colleges have responded with those programs, like the new “Mechatronics” program at Antelope Valley College.

Introduction

As a vital segment of the Los Angeles County economy, the health of the aerospace industry impacts the state of the region in many ways. The successes and challenges of the aerospace industry have a direct impact on owners, workers, and shareholders in the major aerospace companies and thousands of smaller suppliers that support the industry.

The Aerospace Industry has been called a “strategic industry in the nation’s economy, homeland security and national defense.” The major sectors of the industry are:

Civil

- **Air** (e.g., air traffic management system, safety regulation, accident investigation, environmental permitting, noise and emission standards);
- **Space** (e.g., weather satellites, air and space-based Earth monitoring, International Space Station, Space Shuttle, Hubble Space Telescope, robotic missions to the planets)

Commercial

- **Air** (e.g., aircraft manufacturing, air carriers, general aviation, airport operations);
- **Space** (e.g., space launch, launch vehicles and satellite manufacturing, telecommunications, remote sensing)

National Security

- Defense
 - **Air** (e.g., combat aircraft, airlift, unmanned aerial vehicles, guided missiles);
 - **Space** (e.g., space launch, communications, navigation and reconnaissance satellites)
- Intelligence (e.g., air- and space-based communications, reconnaissance).¹

The manufacturing side of the industry is comprised of companies producing aircraft, guided missiles, space vehicles, aircraft engines, propulsion units and related parts, and performing aircraft overhaul and rebuilding.²

This report explores the status and future of this critical industry in the Los Angeles regional economy. The Economic and Workforce Development (EWD) Network has been charged by the California Community Colleges System to identify industries and occupations with unmet employee development needs and introduce partnering potential for the colleges’ programs.

¹ Report of the Interagency Aerospace Revitalization Task Force, February, 2008, found online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

² Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

The following pages will expand on the multiple issues impacting this industry. It will look at a selection of mid-level technical occupations that are of critical importance to Aerospace. A section of how colleges are already responding to this need is included, as well as resources and partnerships that will better assist the community colleges to continue to play a vital role in Aerospace in Los Angeles County. An extensive list of references can be found in the appendices and includes multiple reports focusing on the industry.

Industry Overview

Aerospace in California

California has the largest concentration of aerospace in the United States, representing 27% of the nation's aerospace industry and 31% of the U.S. space industry. The annual economic impact of California aerospace is \$53 billion. This includes over 250,000 jobs that average over \$60,000 a year in wages. It is difficult to track the magnitude of the industry because 80% of the companies claiming aerospace business fall outside of the aerospace industry codes. The importance of the industry is felt throughout the business community since "Space technology supports all California industries of critical importance and space provides state-of-the-art solutions for key California concerns."³

Aerospace and the Economy

The Aerospace industry came into the 2008 recession from a position of relative growth compared to the past two decades. Industry employment increased during the first quarter of 2008, despite an overall decline in manufacturing employment during the same period. All sectors of aerospace reported a record backlog of orders and industry sales, which reached \$198.8 billion in 2007. In December, 2008, the Aerospace Industries Association (AIA) correctly predicted that 2008 sales would hit \$204 billion – an increase of 2.1% over the prior year – which was lower than recent years but still a record sales figure for the industry for the fifth consecutive year.⁴

As of mid-April, 2009, "the aerospace business reported that production activity 'continued at high levels', although ongoing reductions in airline passenger and cargo capacity have started to cause order cancellations and delivery deferrals for new aircraft."⁵ In previous recessions, aerospace deliveries halve and remain depressed for a very long period of time (as they did in the 1970s and through the 1980s.) Before the current economic recession, the rising cost of fuel was affecting the commercial/civil airline sector positively by speeding up the orders for newer, more fuel efficient aircraft.⁶ However, early in 2009, Goldman Sachs predicted the downturn in civil aerospace was expected to be more severe than previously estimated due to decreased world air traffic and global gross domestic product. A double-digit drop in world international air traffic (-10.1%) in February, 2009, represents the worst decline since the

³ Aerospace Advisory Committee Report to the Commission on Economic Development, November, 2008 (not yet published online).

⁴ AIA News 2008, Aerospace Shows Strength in Harsh Financial Atmosphere," Aerospace Industries Association, December 10, 2008, found online at http://www.aia-aerospace.org/newsroom/aia_news/2008/Aerospace_Shows_Strength_in_Harsh_Financial_Atmosphere/

⁵ Petruno, Tom, "Fed sees some signs of bottoming in western states," Los Angeles Times, April 15, 2009, found online at http://latimesblogs.latimes.com/money_co/2009/04/fed-economy-beige-book.html

⁶ Beachey, Anthony, "Analyst Warns of Catastrophic Downturn," Aerospace-Technology.com, September 8, 2008, found online at <http://www.aerospace-technology.com/features/feature41429/>

beginning of the recession and will undoubtedly begin to affect production schedules.⁷ Because of the long lead time in the aerospace infrastructure, there may be a lag in the impact into late 2010 or 2011.⁸

Other Factors Influencing the Aerospace Industry

In addition to the general cyclical fluctuations of the economy, the aerospace product and parts manufacturing industry is also influenced by unique production cycles within the industry. Job openings in the industry rise rapidly when major new aircraft or systems are in development and production. However, job openings become scarcer after the initial production run. Both the civil and military segments of the industry have their own cyclical variations, corresponding to the introduction of major civil aircraft and military aircraft and systems.⁹

Because of past reductions in defense expenditures and intense competition in the commercial aircraft sector, there have been and may continue to be mergers in the industry, resulting in lay-offs. Even though the number of large firms performing final assembly of aircraft has been reduced, hundreds of smaller manufacturers and subcontractors will remain in the county.¹⁰

An added challenge for the Defense sector is the stated intention of the Obama Administration to reduce spending on Defense. This will be in contrast to increased defense spending from 2000-2008 by the Bush Administration which was the highest since the Reagan years.¹¹ Perhaps in response to this and the other economic factors influencing the industry, the Aerospace Industry Association has launched a campaign called, "Aerospace and Defense: The Strength to Lift America,"¹² urging the government to continue to fund the industry and allocate support for NextGen, a major upgrade of air transportation modernization technologies.¹³

Aerospace companies tend to be large and over 62% of the workers in the industry work in facilities that employ over 1 000 people. The subcontractors that supply the industry with parts tend to be small and employ fewer than 100 workers.¹⁴

⁷ "Goldman: Civil Aerospace Downturn May be More Severe," Reuters Press Release, April 9, 2009, found online at <http://www.reuters.com/article/ousivMolt/idUSTRE5381YX20090409>

⁸ Beachey, Anthony, "Analyst Warns of Catastrophic Downturn," Aerospace-Technology.com, September 8, 2008, found online at <http://www.aerospace-technology.com/features/feature41429/>

⁹ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

¹⁰ Ibid.

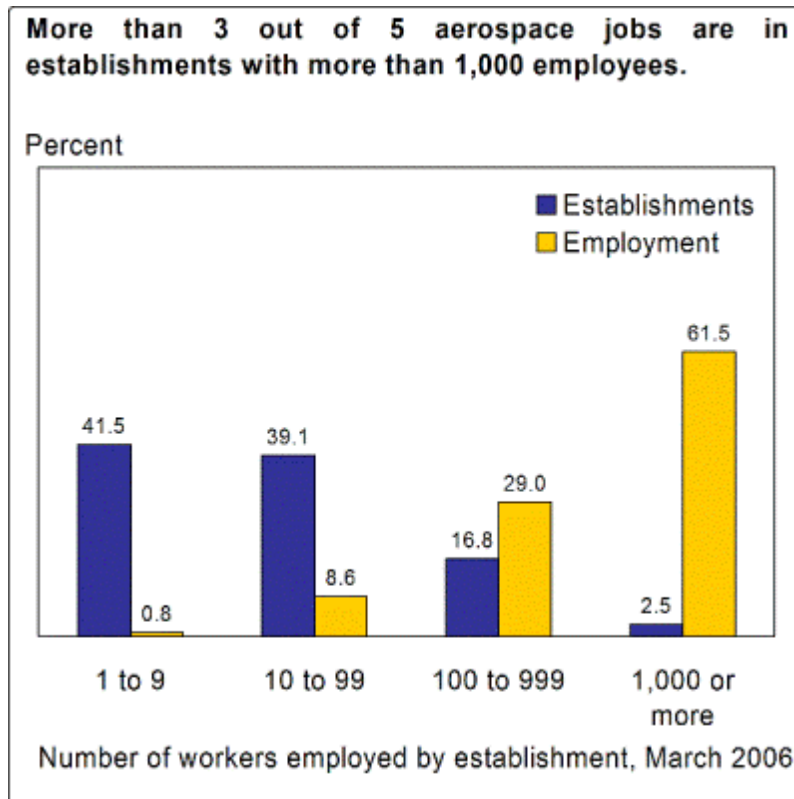
¹¹ Pae, Peter, Northrop Plans to Lay Off up to 750 Workers, Los Angeles Times, March 5, 2009, found online at <http://theenvelope.latimes.com/la-fi-northrop5-2009mar05,0,6576325.story>

¹² Aerospace Industry Association, details online at <http://www.aia-aerospace.org/strength/>

¹³ AIA News 2009, "AIA Advocates Increased Investment in NextGen at House Aviation Subcommittee Hearing,"

March 18, 2009, found online at http://www.aia-aerospace.org/newsroom/aia_news/2009/aia_advocates_increased_investment_in_nextgen_at_house_aviation_subcommittee/

¹⁴ Ibid.

Exhibit 1: Overall Aerospace Industry Employment by Size of Company¹⁵***Changes in the Industry***

The way in which commercial and military aircraft are designed, developed, and produced continues to undergo significant change in response to the need to cut costs and deliver products faster. Firms producing commercial aircraft have reduced development time drastically through computer-aided design and drafting (CADD). Firms bring together teams composed of customers, engineers, and production workers to pool ideas and make decisions concerning the aircraft at every phase of product development. Even the military has changed its design philosophy, using commercially available, off-the-shelf technology when appropriate, rather than developing new customized components.¹⁶

The Interagency Aerospace Revitalization Task Force recognizes that there are three critical workforce challenges facing the industry: recruiting and retaining talent; the skills challenge; and the importance of STEM (Science, Technical, Engineering and Math) education.¹⁷ As skilled workers in the industry retire, aerospace employers must rely on youthful and diverse workers. Public perceptions of the industry are critical to retaining talent and generating interest in

¹⁵ AIA News 2009, "AIA Advocates Increased Investment in NextGen at House Aviation Subcommittee Hearing," March 18, 2009, found online at http://www.aia-aerospace.org/newsroom/aia_news/2009/aia_advocates_increased_investment_in_nextgen_at_house_aviation_subcommittee/

¹⁶ Ibid

¹⁷ Report of the Interagency Aerospace Revitalization Task Force, February, 2008, found online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

aerospace careers. Reducing turnover, improving retention and improving high-tech skills in existing workers are also key objectives in bolstering aerospace's workforce system.¹⁸

Aerospace in Los Angeles County

An example of the importance of the aerospace industry in this region can be seen in this federal report of the largest metropolitan concentrations of Aerospace Engineering and Operations Technicians (SOC 17-3021). Note the size of the employment in the Los Angeles region (670) as compared with the other metropolitan service areas (MSA).

Table 1: Metropolitan Areas with the Highest Concentration of Aerospace Engineering and Operations Technicians

Metropolitan Service Area (MSA)	Employment	Hourly mean wage	Annual mean wage	Percent of MSA employment
Wichita, KS	330	\$24.11	\$50,150	0.111%
Fort Worth-Arlington, TX Metropolitan Division	470	\$32.33	\$67,240	0.056%
Seattle-Bellevue-Everett, WA Metropolitan Division	260	\$27.97	\$58,180	0.018%
Los Angeles-Long Beach-Glendale, CA Metropolitan Division	670	\$29.25	\$60,840	0.016%
Tulsa, OK	60	\$36.31	\$75,520	0.014%

Source: Bureau of Labor Statistics

For the past two decades, the aerospace industry in Los Angeles has been shifting from a manufacturing base to a research and development/supplier base. The Boeing C-17 plant in Long Beach is the last assembly line in Los Angeles County and is continually threatened with closure by federal defense budget reductions that could cut the number of orders.¹⁹ However, the Los Angeles Economic Development Corporation's 2009-10 Economic Forecast notes these positive trends: there are several classified programs underway at various research and development facilities around the region, Boeing and Airbus have large order backlogs (which also benefits their subcontractors), SpaceX of Hawthorne recently obtained a \$3.1 billion contract for rockets for the space shuttle replacement, and Torrance-based Robinson Helicopter "seems to be doing well."²⁰

The current recession may bring a restructuring or re-engineering of some of the larger aerospace companies. For example, a March, 2009 Los Angeles Times article reported that 750 administrative jobs would be lost at Northrop Grumman (the region's second largest employer), but 850 skilled technical jobs in engineering and manufacturing were currently

¹⁸ United States Department of Labor, "High Growth Industry Profile," found online at http://www.doleta.gov/BRG/Indprof/Aerospace_profile.cfm

¹⁹ Pae, Peter, "Boeing C-17 factory in Long Beach May Stay Open," Los Angeles Times, March 14, 2009, found online at <http://www.latimes.com/business/la-fi-boeing14-2009mar14,0,3545719.story>

²⁰ Kyser, J., Sidhu, N., Ritter, K. and Sedgwick, S., 2009-10 Economic Forecast and Industry Outlook, February 2009, p. 46, found online at <http://www.laedc.org/reports/Forecast-2009-02.pdf>

being advertised and filled. Thus, a spokesperson for the company predicted that there could be a net gain in jobs during 2009.²¹

Demand

In a “High Growth Industry” profile compiled by the U.S. Department of Labor, the demand for aerospace workers is analyzed in a way that takes into account the unique circumstances facing the industry. Though growth is projected to be slower than average for all occupations, demand is still growing and cannot be ignored because of the strong connection between the aerospace industry and national security. Demand is being driven by the mature workforce in the industry and the expected retirements as baby boomer workers hit retirement age. “Thus, the challenge will be to recruit a talented labor pool to replace the experienced workers who are leaving the industry. Creating this talented labor pool will be partly the responsibility of the community colleges. Attracting capable students into college programs will be possible only if public perceptions of the industry and its career opportunities are good. Working together, the industry and the colleges can develop an effective workforce.”²²

Occupational Overview

Although the Los Angeles Economic Development Corporation predicts very little loss in jobs in the aerospace industry, demand projections for almost all aerospace industry occupations in Los Angeles County show limited growth.²³ The large aerospace employers are projecting a continuation in the downward trend in the number of professionals and employees at almost every level. “During slowdowns in production, companies prefer to keep technical teams intact to continue research and development activities in anticipation of new business. Production workers, on the other hand, are particularly vulnerable to layoffs during downturns in the economy, when aircraft orders decline.”²⁴ The occupations included in Table 2 represent mid-level, skilled technician jobs that require an associate degree and/or a postsecondary certificate. As the table illustrates, the occupations expect limited growth over the next five years. However, there will be continued demand for workers to fill existing jobs and replace workers as they leave the workforce. It is important to also keep in mind, that while these occupations are employed by aerospace companies, many of these occupations are also found in additional industries. The following table is not exclusive to aerospace.

²¹ Pae, Peter, Northrop Plans to Lay Off up to 750 Workers, Los Angeles Times, March 5, 2009, found online at <http://theenvelope.latimes.com/la-fi-northrop5-2009mar05,0,6576325.story>

²² United States Department of Labor, “High Growth Industry Profile,” found online at http://www.doleta.gov/BRG/Indprof/Aerospace_profile.cfm

²³ Kyser, J., Sidhu, N., Ritter, K. and Sedgwick, S., 2009-10 Economic Forecast and Industry Outlook, February 2009, p. 28, found online at <http://www.laedc.org/reports/Forecast-2009-02.pdf>

²⁴ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

Table 2: Ten Occupations Requiring Community College Degrees or Certificates in Aerospace in Los Angeles County

Description	Employment		Change	% Change	New & Replacement Jobs	2009 Median Hourly Earnings
	2009	2014				
Mobile heavy equipment mechanics, except engines (SOC 49-3042)	3,474	3,742	268	8%	608	\$30.09
Electrical and electronic engineering technicians (SOC 17-3023)	4,118	4,180	62	2%	464	\$26.20
Engineering technicians, except drafters, all other (SOC 17-3029)	2,002	2,028	26	1%	221	\$28.13
Aircraft mechanics and service technicians (SOC 49-3011)	3,829	3,772	(57)	(1%)	195	\$29.07
Mechanical drafters (SOC 17-3013)	1,120	1,125	5	0%	165	\$24.69
Mechanical engineering technicians (SOC 17-3027)	917	938	21	2%	110	\$23.94
Industrial engineering technicians (17-3026)	1,093	1,089	(4)	(0%)	107	\$20.58
Aerospace engineering and operations technicians (SOC 17-3021)	861	795	(66)	(8)	84	\$27.65
Electrical and electronics installers and repairers, transportation equipment (SOC 49-2093)	514	525	11	2%	66	\$26.65
Avionics technicians (SOC 49-2091)	764	741	(23)	(3%)	39	\$25.68
Total	18,690	18,935	245	1%	2,059	

Source: EMSI Covered Employment, 3rd Quarter 2009

Though not shown in Table 2, there are pockets of greater growth within the aerospace industry. One of these is in parts manufacturing, which would indicate that employment among suppliers will be stronger than that among aerospace companies.²⁵

One puzzling aspect of the demand profile for aerospace that is not reflected in the labor market projections is the large number of positions that are unfilled at this time. A December 2008 Los Angeles Times article, "Jobs go Begging at Northrop Grumman," notes, "Despite perhaps the biggest pool of unemployed workers looking for jobs in decades, Northrop officials say they haven't been able to fill the open positions. This year it has hired 1,800 workers for its Integrated Systems division in Southern California but still has another 1,800 openings for engineers, machinists, mechanics, and computer programmers."²⁶ Because these are highly skilled and specialized positions, Northrop Grumman is unable to find job candidates to fill them. This article illustrates a key problem with the labor market information for this industry. Labor market data for current and future positions is based on funded

²⁵ Economic Modeling Specialists, Inc. (EMSI), Covered Employment, Spring 2009, for NAICS Code 336413: Other Aircraft Parts and Equipment, for Los Angeles County (<http://www.economicmodeling.com/>)

²⁶ Pae, Peter, "Jobs Go Begging at Northrop Grumman," Los Angeles Times, December, 2008, found online at <http://articles.latimes.com/2008/dec/20/business/fi-aerojobs20>

positions, not actual incumbents. In the case of aerospace, the number of positions may go down over the next 5 to 10 years but there may still be unfilled positions! In other words, **even though projections are limited, the industry clearly needs support from the community colleges to prepare successful candidates for these positions. This represents opportunities for new and/or expanded programs.**

One additional factor driving demand in the aerospace industry is the security clearances required of workers. These clearances are a barrier to employment for many otherwise qualified job candidates, in that some cannot obtain clearance for any number of reasons and some will not submit to the clearance check process. Students need to be informed early-on about the security clearance issue. The Report on Revitalization of the Industry made several recommendations for improving this situation, including the creation of common security standards across the industry and a plan for “portability” of clearances so that workers do not have to be subjected to multiple processes when changing jobs or companies.²⁷

Industry Occupational Overview

The wide variety of occupations employed in the aerospace industry includes many that are open to community college students and graduates. According to the U.S Department of Labor’s “High Growth Industry” analysis of the Aerospace Industry, most employers prefer a minimum of a two-year Associate degree in engineering technology to qualify for engineering technician jobs.²⁸ Many engineering technicians assist in design work, therefore creativity is desirable. Because these workers often are part of a team of engineers and other technicians, good communication skills and the ability to work well with others also are important.

The more highly skilled occupations require a formal apprenticeship. Machinists and electricians complete apprenticeships that can last up to four years and may include classroom instruction and shop training. Within the industry, it is common for employers to provide education and training for all workers and/or to reimburse employees for educational expenses, encouraging workers to complete four-year degrees and postgraduate studies.²⁹

Aerospace Industry Competency Model

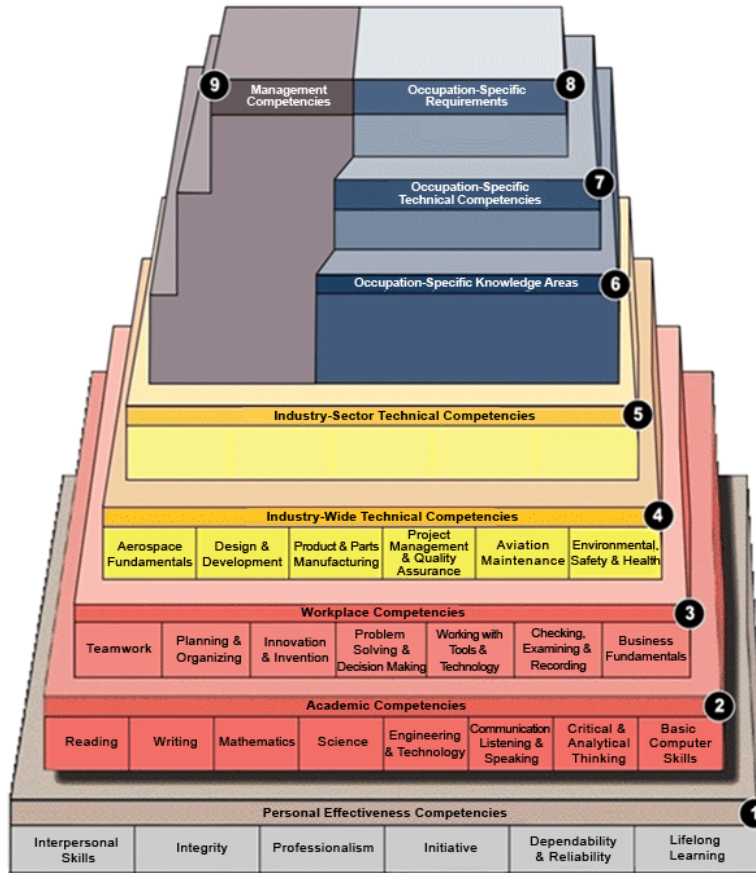
In collaboration with the Aerospace Industries Association (AIA) and the National Defense Industrial Association (NDIA), the Employment and Training Administration (ETA) has worked with industry leaders to develop a comprehensive competency model for the aerospace industry. The model is designed to evolve along with changing skill requirements. AIA and NDIA have committed to working with their industry partners to keep the model current. A detailed explanation of all elements of the model is available at **careeronestop.org**.

²⁷ Report of the Interagency Aerospace Revitalization Task Force, February, 2008, p. 25-26, online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

²⁸ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

²⁹ Ibid.

Exhibit 2: Aerospace Competency Model



Source: Career One Stop. See Appendix D for larger graphic.³⁰

Aerospace careers examined in this report fall into three major categories: Production Occupations, Maintenance Occupations, and Professional Occupations. Those categories are discussed in the following section and a sampling of the jobs in each category is shown in Appendix B.

Production Occupations

One of the groups of occupations available to community college students and graduates is production, installation and transportation, in which 40% of aerospace workers are employed. Although many of these jobs are not specific to aerospace, employers in the industry prefer job candidates with special vocational training after high school.³¹ Aerospace suppliers have identified skilled production workers as the category of workers most likely to be in short supply during the next five years.³²

³⁰ Career One Stop, Aerospace Competency Model, found online at <http://www.careeronestop.org/COMPETENCYMODEL/pyramid.aspx?AEO=Y>

³¹ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

³² Chen, C, Purcell, C, Younglove, T, and Uhasy, L, California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness: Characterization of the California Aerospace Supply Base Identification of Common Industry Training Needs through Surveys, Forums and Industry Input, California Space Authority and Antelope Valley College, October, 2008, pp. 27-29, found online at innovatecalifornia.net.

Forbes has identified aircraft structure, surfaces, rigging and systems assemblers as one of the 20 fastest growing jobs in America in 2007 with a 24.31% gain in employment. Miscellaneous assemblers and fabricators also saw a 14.6% gain that year.³³ Other occupations in this category are illustrated in these Bureau of Labor Statistics specifications: "Aircraft structure, surfaces, rigging, and systems assemblers usually specialize in one assembly task; hundreds of different assemblers may work at various times on producing a single aircraft. Assemblers may put together parts of airplanes, such as wings or landing gear, or install parts and equipment into the airplane itself. Those involved in assembling aircraft or systems must be skilled in reading and interpreting engineering specifications and instructions. Machinists make parts that are needed in numbers too small to mass-produce. Machinists follow blueprints and specifications and are highly skilled with machine tools and metalworking. Tool and die makers are responsible for constructing precision tools and metal forms, called dies, which are used to shape metal. Increasingly, as individual components are designed electronically, these highly skilled workers must be able to read electronic blueprints and set up and operate computer-controlled machines. Inspectors, testers, sorters, samplers, and weighers perform numerous quality-control and safety checks on aerospace parts throughout the production cycle. Their work is vital to ensure the safety of the aircraft."³⁴

Maintenance and Repair Occupations³⁵

Another group of aerospace occupations suitable for community college graduates include aircraft mechanics, also called airframe mechanics, power plant mechanics, and avionics technicians, who specialize in preventive maintenance. They inspect aircraft engines, landing gear, instruments, pressurized sections, accessories—brakes, valves, pumps, and air-conditioning systems, for example—and other parts of the aircraft, and do the necessary maintenance and replacement of parts. They also keep records related to the maintenance performed. They gather diagnostic information from aircraft monitoring systems and/or by examining engines and measure parts for wear by using x-ray and magnetic inspection equipment. They complete repairs and test the equipment to ensure that it works properly.

Airframe mechanics are authorized to work on any part of the aircraft except the instruments, power plants, and propellers. *Powerplant mechanics* are authorized to work on engines and do limited work on propellers. *Combination airframe-and-powerplant mechanics*—called A&P mechanics—work on all parts of the plane except the instruments. Avionics technicians repair and maintain these systems. Their duties may require additional licenses, such as a radiotelephone license issued by the U.S. Federal Communications Commission (FCC).

Aerospace Engineering and Operations Technicians (Professional Occupations)

Aerospace Engineering and Operations Technicians are just one of several engineering technician occupations in aerospace. (A number of other engineering technician occupations are being studied by the Center of Excellence in Los Angeles County.) Aerospace engineering and operations technicians construct, test, and maintain aircraft and space vehicles. They may calibrate test equipment and determine causes of equipment malfunctions. Using computer and communications systems, aerospace engineering and operations technicians often record and

³³ Forbes.com staff, "America's Top 20 Growing and Disappearing Jobs," July 2, 2008, found online at http://www.forbes.com/2008/07/02/employment-careers-jobs-leadership-careers-cx_pm_0702topjobs.html

³⁴ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

³⁵ Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, Aircraft and Avionics Equipment Mechanics and Service Technicians, on the Internet at <http://www.bls.gov/oco/ocos179.htm>

interpret test data. Aerospace Engineering Technicians work in mechanics (building and servicing aircraft fuselage, hydraulic and pneumatic systems, such as wings, engines and landing gear) or avionics (installing and testing electrical and electronic systems used in navigation, communications and flight control).³⁶

Skills2Compete has identified Aerospace Engineering and Operations Technicians as part of their “20 High Demand Middle Skill Jobs that America Cannot Live Without”³⁷ (In California, about 49% of all jobs fall into this middle skill category).³⁸ Other aerospace occupations that were also identified in this same category were air traffic controllers, several categories of engineering technicians that are frequently employed in aerospace, and airplane mechanics and machinists (see above).³⁹

Certification of Selected Aerospace Occupations

Mechanics and Technicians

The Federal Aviation Administration (FAA) requires at least 18 months of work experience for an airframe or powerplant certificate, although completion of a program at an FAA-certified mechanic school can be substituted for the work experience requirement. Mechanics and technicians also must pass an exam for certification and take at least 16 hours of training every 24 months to keep their certificate current.

The FAA also offers the Airframe & Powerplant (A&P) certificate which is a combined certification as both an airframe and a powerplant mechanic. For a combined A&P certificate, mechanics must acquire at least 30 months of experience working with both engines and airframes, or experience combined with the completion of an FAA-certified mechanic school program. FAA regulations also require current work experience to keep the A&P certificate valid. Most airlines require that mechanics have a high school diploma and an A&P certificate.

Avionics technicians need an FAA mechanics’ certificate. They also must be trained and qualified and have the proper tools to work on avionics equipment. Many have avionics repair experience from the military or from working for avionics manufacturers.⁴⁰

Engineering Technicians

The National Institute for Certification in Engineering Technologies (NICET) has established a voluntary certification program for engineering technicians. Certification is available at various levels, each level combining a written examination in one of about 30 specialties with a certain amount of job-related experience, a supervisory evaluation and a recommendation.⁴¹

³⁶ Bureau of Labor Statistics, U.S. Department of Labor, Occupations Outlook Handbook, “Engineering Technicians,” found online at <http://www.bls.gov/oco/ocos112.htm#top>

³⁷ Skills2Compete, found online at http://www.skills2compete.org/site/c.fhLIKYPuF/b.3354373/k.55CD/About_Skills_2_Compete.htm

³⁸ California’s Forgotten Middle-Skills Jobs, Skills2Compete, found online at <http://www.skills2compete.org/atf/cf/%7B8E9806BF-4669-4217-AF74-26F62108EA68%7D/California%20S2C%20MSFS.pdf>

³⁹ Middle Skill Job Demand, Skills2Compete, found online at <http://www.skills2compete.org/atf/cf/%7B8E9806BF-4669-4217-AF74-26F62108EA68%7D/FS%20Middle-Skill%20Jobs%20FINAL.pdf>

⁴⁰ Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, Aircraft and Avionics Equipment Mechanics and Service Technicians, on the Internet at <http://www.bls.gov/oco/ocos179.htm>

⁴¹ United States Department of Labor, “High Growth Industry Profile,” found online at http://www.doleta.gov/BRG/Indprof/Aerospace_profile.cfm

Employer Needs and Challenges

Employer Input and Surveys

Aerospace companies are frequently surveyed by government and private studies, commissions and task forces. Rather than try to duplicate those continuous and comprehensive surveys, for this report an analysis of input provided by aerospace employers (both large companies and suppliers) to a number of other groups and agencies was conducted. The results of that analysis have been integrated into this report. The primary workforce surveys and participating employers are shown in Table 3. (See the Reference section at the end of this report for more information on where to find these reports online.)

Table 3: Employer Surveys, Commissions, and Taskforces
(those included in this scan)

Date	Employers Involved/Type of Input	Relevant Findings for This Report
Final Report of the Commission on the Future of the United States Aerospace Industry		
Nov. 2002	Hundreds of briefings and public testimony provided extensive industry input along with other sectors like education	Along with one of the earliest recommendations regarding STEM, “lifelong learning” and individualized instruction” are seen as key elements of needed education reform to support the present and future talent needs of the industry
America’s Aerospace Industry: Identifying and Addressing Workforce Challenges, Report of Findings and Recommendations for The President’s High Growth Job Training Initiative in the Aerospace Industry		
May 2005	High level representatives of all major aerospace employers Identified Key Problems and Proposed Solutions for Workforce Development	Employers and other stakeholders recognized that the “skill gap” starts in K-12 system and encouraged ongoing development of STEM efforts. Also recommended a campaign to improve aerospace’s image among school children. Called for curricula to be research-based, evaluated and tied to industry requirements. Increase hands/on education, internships, industry-supported mentors
The California Space Enterprise Strategic Plan 2007-2010, facilitated by the California Space Authority		
2006	Hundreds of “space stakeholders” incl. representatives of aerospace companies of all sizes: employers and suppliers Education and Workforce Development is one of five areas examined in the plan The Strategic Plan for Education and Workforce Development includes 36 action items	Problems identified include weak science and technical education in CA, lack of student interest in science and math, lack of real work expertise in schools, shortage of key 21 st century skills Recommendations include strengthening the STEM network and creating collaboration to bring more education into industry and more industry into education Expand 21 st century worker skills to support aerospace needs
Report of the Interagency Aerospace Revitalization Task Force		
Feb. 2008	Task force composed of high level Administration officials but input came from a large number of industry and academic representatives Recommendations focused on ways to revitalize aerospace through the cooperation and collaboration of major federal agencies	One of the 3 strategic areas that were identified and addressed was “The Skills Challenge and the Importance of STEM Education.” Greater professional development for teachers in the STEM disciplines was recommended. An inventory of STEM resources was proposed and has since been created. Encourage investment activities to foster applied learning opportunities related to aerospace.

Date	Employers Involved/Type of Input	Relevant Findings for This Report
<p>California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness: Characterization of the California Aerospace Supply Base Identification of Common Industry Training Needs through Surveys, Forums and Industry Input</p>		
Oct. 2008	<p>288 Survey Respondents from aerospace companies and suppliers, with over 1/2 of responses coming from company CEOs or vice-presidents</p> <p>Survey results covered a wide variety of topics about the importance of training and community colleges' role in training</p>	<p>Lack of skilled production workers in next five years seen as area of greatest shortage by small and mid-sized companies.</p> <p>3/4 of those surveyed said this shortage negatively affects their ability to meet customer needs</p> <p>60% identified "highly trained workforce" as key to their success in the next 3 years</p> <p>Reasons for providing training: keep up with new technology and increase skill level of entry level employees</p> <p>20-40% use Community Colleges for training</p> <p>Majority of small and mid-sized companies think community college graduates are well prepared/Most large companies do not agree</p>
<p>Energizing California Aerospace: Recommendations to Retain, Expand, and Grow 21st Century Aerospace in California</p>		
Nov. 2008	<p>Aerospace Advisory Committee includes CEOs of Boeing, Stellar Solutions, Ace Clearwater, VP of Northrop Grumman, and VP of Lockheed Martin</p> <p>Recommendations for supporting, retaining, and recognizing the aerospace industry and applying its technologies to other California industries</p>	<p>Align science, technology engineering and math (STEM) education at all educational levels and with industry needs for a high-tech professional workforce. Initiate a statewide STEM strategy in partnership with industry.</p> <p>Ensure multiple student choices in reaching the high-tech workforce, including Career Technical Education (CTE) options that provide certifications and/or community college technical degrees.</p> <p>Create center for air and space technology and entrepreneurship, ensuring linkage with education.</p>
<p>Recommendations to Improve Science, Technology, Engineering and Mathematics (STEM) Education in California, HIGH STAKES: STEM Education – The Essential Ingredient for California Competitiveness</p>		
Nov. 2008	<p>California Space Education and Workforce Institute (CSEWI) produced report with input by hundreds of participants from education, government, and industry</p>	<p>Attract students into STEM careers</p> <p>Provide rigorous Career/Technical Education</p> <p>Create hands-on internships and fellowships in industry for students and teachers</p> <p>Variety of other recommendations to strengthen STEM education</p>

Source: Varies - See Reference Section of this report for information on reports cited here.

Industry Identification of Workforce Needs

The process of identifying aerospace as one of the High Growth industries by the federal Department of Labor also included extensive interviews with industry representatives from all levels of the industry. Those industry representatives identified the following workforce needs:

- Expand the pipeline of youth entering the aerospace industry;
- Help alternative labor pools gain industry-defined skills and competencies;
- Develop alternative training strategies, such as apprenticeship, distance learning, and accelerated training, for training aerospace professionals;
- Develop tools and curriculum for enhancing the skills of aerospace professionals for nationwide distribution;
- Enhance the capacity of educational institutions to train to industry-defined competencies;
- Develop industry-defined career ladders and lattices and corresponding competency models and curriculum;
- Develop strategies to retain and help incumbent workers move into higher level positions;
- Assist transitioning individuals from declining industries to high growth industries by building on their existing skills and training them for high growth aerospace occupations.⁴²

Summary of Significant Employer Issues and Needs

From all of the input discussed above, the following items offer the most important information for the colleges at this time:

- Efforts to improve STEM education are essential to training the skilled workforce needed in aerospace at the present time and in the future.
- Curricula needs to be connected to competencies and tied to industry requirements.
- Increase hands-on education, internships, apprenticeships, and industry-supported mentors.
- Lack of skilled production workers in next five years seen as area of greatest shortage by small and mid-sized aerospace companies. Three-quarters of those surveyed said this shortage negatively affects their ability to meet customer needs.
- Only 20-40% of aerospace suppliers use Community Colleges for training.
- Majority of small and mid-sized aerospace companies think community college graduates are well prepared. Most large companies do not agree.

⁴² Aerospace: Local Solutions with National Applications to Address Aerospace Industry Workforce Needs found online at <http://www.doleta.gov/BRG/Indprof/Aerospace.cfm>

Community Support and Resources

STEM

Almost every strategic plan, task force report, and commission finding that involves the aerospace industry touches on building STEM (Science, Technical, Engineering and Math) education as an integral workforce development goal.

Writing in its 2008 report, the Interagency Aerospace Revitalization Task Force noted: “There are various types of jobs within the aerospace industry ... While these professions require a great diversity of skills, they all have a primary emphasis on STEM competencies, and there is significant concern that students who are participating in the K-12, postsecondary, apprenticeships, and/or career and technical education are not adequately prepared for employment in STEM careers.”⁴³

The California Space Authority’s Space Enterprise Strategic Plan for 2007-2010 has as its first workforce development goal, “Strengthen California infrastructure for STEM education.”⁴⁴ The strategies suggested to meet that goal include: increase real world expertise in schools and education expertise in industry; improve continuity across public/private sectors; and, expand key 21st century worker skills to support space enterprise needs.

The Aerospace Industries Association has been very active in supporting congressional bills that would strengthen STEM education by fully funding federal scientific research and education initiatives. They also sponsor the Team America Rocketry Challenge, which is the world’s largest rocket contest and involves about 7,000 middle and high school students each year, giving them aerospace experience as they design, hand-build, and launch their rockets.⁴⁵

Relevant legislation includes Senate Bill 747. At the time of publication of this report, SB 747 was placed in “suspense” by the Appropriations Committee. ARRA funding is being sought to help fund this bill, which will then release it for vote by the full senate. SB 747 has strong industry support. This bill establishes a pilot pre-apprenticeship program, to be implemented by the California Community Colleges for the purpose of preparing high school students to work in the aerospace industry.

El Camino College and El Camino College Compton Center will be the pilot sites for the program. The El Camino CACT will form an industry and education task force to train up to 50 high school students in aerospace manufacturing technology programs that will include Machining Technology, Robotics, Aerospace Fastener Manufacturing, and Welding. The objective is to capture students that are not targeting four-year colleges after high school and provide them with relevant training that will enable them to secure well paying jobs in aerospace manufacturing after graduating high school.

⁴³ Report of the Interagency Aerospace Revitalization Task Force, February, 2008, p. 9 found online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

⁴⁴ California Space Authority Project Team, California Space Enterprise Strategic Plan 2007-2010, California Space Authority, 2006, pp. 34-38, found online at <http://www.californiaspaceauthority.org/images/pdfs/strat-plan-2007.pdf>

⁴⁵ Blakey, Marion C., President and CEO, Aerospace Industries Association, “House Commerce, Justice, Science, and Related Agencies Subcommittee” Testimony given April 2, 2009 found online at http://www.aia-aerospace.org/assets/speech_hac_cjs_040209.pdf

Though it has received less publicity, a related challenge of concern to the aerospace industry is the lack of diversity in its workforce. A survey completed by Aviation Week in 2007 found that although women comprise 26% of the aerospace workforce they represent only 10% of engineers and 17% of program managers. Minorities comprise 25% of the workforce but only 18% of engineers and 10% of program managers.⁴⁶ This challenge is seen as closely tied to the STEM initiatives, since one objective of STEM programs is to interest and attract more women and minorities into careers in the STEM disciplines.

Grants

The Department of Labor ETA has invested \$12,475,953 in the aerospace industry over the past five years. This includes seven High Growth Job Training Initiative grants totaling \$8,856,453 and two Community-Based Job Training Grants totaling \$3,619,500.⁴⁷ These grants initially were in response to the President's Commission on the Future of the United States Aerospace Industry⁴⁸. These funds have also been allocated as a result of the designation of aerospace as a High Growth Industry. The primary purpose of the grants is to build the capacity of community colleges to train workers to develop the skills required to succeed in high growth/high demand industries.⁴⁹

Aerospace Advisory Committee

In 2007, the California Commission on Economic Development (CED) Aerospace Advisory Committee was formed to assist the CED in investing to develop the workforce of the future.⁵⁰ The Committee's 2008 report included these recommendations, which will become a focus of future CED advocacy:

- Ensure statewide economic development innovation infrastructure by linking California's diverse corporate, R&D, entrepreneurial, academic and federal assets.
- Align science, technology, engineering and math (STEM) education at all educational levels and with industry needs for a high-tech professional workforce. Initiate a statewide STEM strategy in partnership with industry, building on the foundation of the STEM Collaborative Action Plan.
- Ensure multiple student choices in reaching the high-tech workforce, including Career Technical Education (CTE) options that provide certifications and/or community college technical degrees enabling high school graduates and others to earn a good family wage.
- Create a center for air and space technology and entrepreneurship, ensuring linkage with education.

⁴⁶ Report of the Interagency Aerospace Revitalization Task Force, February, 2008, p. 9 found online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

⁴⁷ United States Department of Labor website, High Growth Industry Profile - Aerospace, online at http://www.doleta.gov/BRG/Indprof/Aerospace_profile.cfm

⁴⁸ Commission on the Future of the United States Aerospace Industry, Final Report of the Commission on the Future of the United States Aerospace Industry, November, 2002, found online at <http://research.amnh.org/users/tyson/pdfs/publications/AeroCommissionFinalReport.pdf>

⁴⁹ Aerospace: Local Solutions with National Applications to Address Aerospace Industry Workforce Needs, found online at <http://www.doleta.gov/BRG/Indprof/Aerospace.cfm>

⁵⁰ Website of Lieutenant Governor John Garamendi, 11.8.07 Garamendi Announces CED Aerospace Advisory Committee Members found online at http://www.ltg.ca.gov/index.php?option=com_content&view=article&id=235:110807-garamendi-announces-ced-aerospace-advisory-committee-members&catid=67:press-releases&Itemid=347

College Response and Issues

“California’s global leadership in both space enterprise and green technologies cannot be sustained without adequately investing in our workforce. Whether employed as a technician on an Earth observing satellite or in one of the emerging green economies, having adequate contextual, hands-on learning experiences is essential for success,” stated Andrea Seastrand, Executive Director of the California Space Authority. “If California is to take advantage of new economic opportunities, restoring respect to career and technical education courses will be required. Innovation and creativity will abound when we provide those who think with their hands an outlet.”⁵¹

One of the issues in matching educational programs to the industry is that there are only a few education programs that specifically serve the aerospace industry, like Aerospace Engineering Technicians, but many more that serve the entire manufacturing community (including aerospace.) For example, there are twice as many Industrial Engineering Technicians in aerospace companies as there are Aerospace Engineering Technicians. In colleges with programs for Industrial Engineering Technicians, it is impossible to track how many of the graduates go into aerospace as opposed to other manufacturing companies.

Additional community college programs that provide students with skills that are related to aerospace include: Composites Technology; Computer Aided Design/Drafting/Drafting Technology; Electromechanical Technology; Electronics; Engineering/Pre-Engineering; Engineering Technology; Machine Tool Technology; Machine Shop Technology, Computer Numerical Control (CNC); Robotics; Quality/Quality Assurance; and Welding. While these programs are not listed in the tables below, it is important to keep them in mind when thinking about occupations connected to the aerospace industry.

Table 4 attempts to report information for Los Angeles County community college programs that are directly connected to aerospace or that are connected to one of the 10 mid-level, skilled occupations analyzed in Table 2. Information on engineering technician graduates can be found in an upcoming report by this Center of Excellence which focuses on Engineering Technicians.

Table 4: Programs in Los Angeles County Community Colleges that Provide Students for Mid-Level, Skilled Occupations in Aerospace

College/Program	Program Notes	2007 Program Completers
Antelope Valley College Aeronautical and Aviation, Technology	Oriented toward FAA General Mechanic certification. Prerequisite to airframe or powerplant programs	52 certificates 5 AS degrees
College of the Canyons Manufacturing Technology	Centered around a computer-aided three dimensional interactive application (CATIA), an advanced form of CAD/CAM software for manufacturing operations applicable to electronics, aerospace, scientific/ pharmaceutical	1 AS degree

⁵¹ California Space Authority, “The Green Economy Echoes Industry Demand for CTE Training,” April 22, 2008 http://www.californiaspaceauthority.org/images/press-releases/pr080423-1_EarthDay.pdf

College/Program	Program Notes	2007 Program Completers
El Camino College Manufacturing Technology	Certificate of Completion (2.0 gpa) available.	2 certificates
Glendale College Aviation Administration	Intended for transfer to CSULA. Includes business and aviation courses.	1 AS degree 2 certificate
Glendale College Mfg. Technology/Technician		1 certificate
Long Beach City College Aviation Maintenance (Airframe/Powerplant Mechanic)	Day program: 55 units; evening program: 56-64 units.	11 Certificates 4 AS degrees
Los Angeles Valley College Manufacturing Technology		1 AS degree
Mount San Antonio College Airframe & Aircraft Powerplant Maintenance Technology	Separately organized day and evening sequences. Combined program for airframe or powerplant certifications.	37 certificates 1 AS degree
Mount San Antonio College Manufacturing Technology		1 AS degree 33 certificates
West Los Angeles College Aviation Maintenance Technician	Combination airframe and powerplant.	31 certificates 6 AS degrees

Source: Economic Modeling Specialists, Inc.

In addition to the completers noted in Table 4, Redstone College of Aviation, located near the Los Angeles International Airport, shows 249 completions in 2007 of students in Airframe and Powerplant and Avionics.

Cerritos College Engineering Design Program

In addition to the community college programs listed in Table 4, Cerritos College’s Engineering Design Technology (ENGT) Department offers a head start in the aerospace industry through engineering design software courses such as AutoCAD, Autodesk; MAX 3-D Designer, Mechanical Desktop, MAP 3-D, Inventor, SolidWorks, and CATIA. These programs are seen as highly desired by aerospace industry companies.⁵²

El Camino College STEM CAP Programs

El Camino College has participated in several activities for the U.S. Department of Labor “Workforce Innovation in Regional Economic Development – WIRED” Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP). They participate in two main areas: in the STEM CAP forums and development activities, and in the Pre-Engineering “Project Lead the Way” (PLTW) program (which is also supported by a QuickStart –SB70 – grant.) PLTW supports STEM education by having the high school students participate in a hands-on, activity-oriented program that utilizes team efforts. The courses, which include computer Integrated Manufacturing, and Principles of Engineering, complement math and science college

⁵² Cerritos College Website, “Cerritos College Now Offers In-Demand Engineering Design Software Training”, July 8, 2008, Press release found online at <http://cms.cerritos.edu/releases-2008/07/engt>

preparatory programs to establish a solid background in engineering and technology.⁵³ In 2008, an AS degree certificate was added to the Engineering Technology program.

***El Camino College Compton Educational Center,
Aerospace Fastener Manufacturing Technology Program***

A new program, launched in 2008, was created to train production level technicians in aerospace fastener manufacturing. Fastener manufacturing is a specialized industry closely related to general machine tool technology. Los Angeles County is home to the three largest aerospace fastener manufacturers in the world: Alcoa Fastening Systems based in Torrance has operations in Carson, City of Industry and Valencia; LSI Aerospace based Torrance has operations in City of Industry and Los Angeles; and SPS Technologies has operations in North Hollywood. In addition, there are dozens of medium and small manufacturers throughout Los Angeles County. Compton Center is creating an AS and Certificate of Completion in Aerospace Fastener Manufacturing Technology under a recently awarded Industry Driven Regional Collaborative grant from the California Community College Chancellor's Office. The first Certificates are expected to be awarded in 2010/2011.

CACT Resources for Aerospace

There are a number of Centers for Applied Competitive Technologies (CACT) in Los Angeles County. These centers, which are run through the Economic and Workforce Development Initiative of the California Community Colleges, offer workforce training and development solutions to high technology companies in California. An example of how one of the CACTs offered support to BE Aerospace, is the training support designed and delivered by the El Camino CACT when the ISO9000/9100 certification system required the company to consolidate its quality auditing system at several remote facilities in order to maintain certification. BE Aerospace selected auditors from different facilities and El Camino provided training under an ETP (Employment Training Panel) grant. Training was provided at BE Aerospace and trainees were awarded a certificate recognizing their accomplishment. The solution was custom designed and gave the company a cost effective way of maintaining its high standards of manufacturing. For those community colleges that do not have a contract education capacity of their own, the CACTs offer that interface. The employers surveyed indicated that only 20 to 40% are currently using community colleges to provide training for employees, so there is significant opportunity to expand this service to the industry.

University Programs in Aerospace in Los Angeles County

Local universities offer a variety of programs in aerospace. These include California Institute of Technology (Pasadena), California State University at Long Beach, University of California at Los Angeles, and University of Southern California. These universities graduated 158 students in their Aeronautical and Aerospace Engineering programs in 2007, along with 105 students who earned master's degrees and 12 students who earned doctoral degrees. Community college students who are interested in these programs can plan a transfer program that will prepare them in the general education and foundation courses needed to transfer into these 4-year degree programs. (See the AIA's website, "Launch into Space" for more details on university programs at http://www.launchintoaerospace.org/plot/schools_aero.cfm.)

⁵³ The California Space Education and Workforce Institute (CSEWI), "Recommendations to Improve Science, Technology, Engineering and Mathematics (STEM) Education in California, HIGH STAKES: STEM Education – The Essential Ingredient for California Competitiveness," November 2008, p. A-4 found online <http://www.innovatecalifornia.net/documents/STEMCAPDOC.pdf>

Conclusion and Recommendations

The aerospace industry's workforce development needs are of major interest to the community colleges. The number of new and replacement jobs in the industry is projected to rise slowly over the coming 5 to 10 years and there are currently many unfilled mid-level skilled positions in local companies that represent good career opportunities for community college graduates. As an important sector of the Los Angeles County economy, the industry also deserves the attention and resources of the community colleges. The question is, "How can the community colleges best support the workforce development needs of the aerospace industry in Los Angeles County?"

An examination of the community college programs that have the potential to produce graduates (or completers) for the aerospace industry (See Table 4) indicates small numbers of students each year who are prepared to enter the workforce, especially with associate degrees. However, keep in mind that numerous additional programs, as was stated earlier in this report, may also prepare students for positions within aerospace. It appears that the problem is not one that requires new programs or services (except in a few cases where the industry has specifically asked for new degree programs) but rather that the existing programs need to find ways to increase the number of students completing the programs AND to improve the programs' connections to the aerospace industry. The recommendations that follow arose from the employer survey results cited in Table 3 and are meant to provide a roadmap to the colleges for finding new ways to partner with the industry and serve its needs.

Be Active in Appropriate STEM Programs and Connect these to Aerospace

The request/recommendation voiced most often, most vigorously, and most consistently by industry employers is the need for ongoing, improved STEM strategies. Science, technical, engineering, and mathematics faculty at the community colleges can provide leadership for these efforts, which should be college-wide and should infuse the curriculum and instruction at every community college in the county. STEM faculty can also look for connections with the aerospace industry through their involvement in various STEM activities and projects.

One example comes from the HIGH STAKES: STEM Education report, which includes two recommendations to improve community college programs:

- Create Industry partnerships directly engaged with educators to deliver relevant, motivational and exciting instruction to reinforce and enhance STEM curriculum while setting the foundation for building a competitive and qualified workforce in tune with emerging work realities.
- Create hands-on internships and fellowships for students, teachers, and faculty with employers in industry, academia, informal science networks, and civic organizations.

In support of these recommendations, the CSEWI has further proposed:

- Collaborate with science and technology-based industries to identify the future demand in their sectors and to integrate projections of workforce demand, STEM careers, and STEM knowledge and skills as factors in planning reforms within the K-16 educational system.⁵⁴

⁵⁴ California Space Education and Workforce Institute (CSEWI), "Recommendations to Improve Science, Technology, Engineering and Mathematics (STEM) Education in California" November 2008, p. 4-9 found online at innovatecalifornia.net.

One example of how the colleges have already done this is the Aurora Project, in which Pasadena and Santa Monica Colleges have participated along with aerospace partners like NASA, to “pipeline” students into teaching careers in mathematics and the sciences.⁵⁵

Another model is El Camino College’s participation in the U.S. Department of Labor “Workforce Innovation in Regional Economic Development – WIRED” Science, Technology, Engineering and Math Collaborative Action Plan (STEM CAP) centered around two main areas: participation in the STEM CAP forums and development activities, and the Pre-Engineering “Project Lead the Way” (PLTW) program, considered a model for the STEM Collaborative Action Plan. PLTW supports STEM education by having the high school students participate in a hands-on, activity-oriented program that utilizes team efforts. The courses, which include Computer Integrated Manufacturing, and Principles of Engineering, complement math and science college preparatory programs to establish a solid background in engineering and technology.⁵⁶

Create New Programs and Certificates for Space/Aerospace Technicians

Allan Hancock College in Santa Maria has provided an example of this strategy in the development of its “Mechatronics” degree. The development of this cutting-edge degree program was sponsored by CWESI with funds provided through the WIRED project to the California Space Authority. Technicians with this degree are in high demand because the program combines mechanical, electrical and software engineering, emphasizing links between machines and computers. Classes are taught via interactive, hands-on, and “nuts and bolts” activities.⁵⁷

The California Space Authority’s Space Enterprise Strategic Plan for 2007-2010 has as its first workforce development goal, “Strengthen California infrastructure for STEM education,” by developing a community college manufacturing technician certification program. Antelope Valley College is participating in this effort and other colleges with Manufacturing Technology programs (See Table 4) could also consider this program recommendation.⁵⁸

Participate in Industry-Driven Education Projects and Strategies

One outcome of the special task forces and studies of the aerospace industry is a series of specific strategies for which employers and their public-sector partners are seeking support. Antelope Valley College has provided a model of this type of participation through its involvement in The California Aerospace Supply Base Project, funded by WIRED grant to the California Space Authority. The project identified these “Desired Next Steps that require additional funding”:

- Design, pilot and implement an “Industry in Residence” program, which requires sustained onsite education enhancement by an industry professional to develop, pilot and implement a statewide applied technology career readiness assessment certification process and hands-on learning lab for high wage high tech industries, including space;

⁵⁵ The Aurora Project : The Community College Component of the CalTeach Science and Mathematics Initiative,, PowerPoint presentation found online at www.ctc.ca.gov/seminars/CCCU-files/aurora.ppt

⁵⁶ California Space Education and Workforce Institute (CSEWI), “Recommendations to Improve Science, Technology, Engineering and Mathematics (STEM) Education in California” November 2008, p. 4-9 found online at innovatecalifornia.net.

⁵⁷ California Space Education and Workforce Institute, “Career Builder: Cutting Edge ‘Mechatronics’ Degree Launched by CSEWI Partner,” Press Release issued on January 22, 2008 found online at csewi.org.

⁵⁸ California Space Authority Project Team, California Space Enterprise Strategic Plan 2007-2010, California Space Authority, 2006, pp. 34-38, found online at <http://www.californiaspaceauthority.org/images/pdfs/strat-plan-2007.pdf>

- Design, develop and implement a Supplier Resources Center to include assessment, training and access to high performance computing and tools for optimizing product development;
- Develop, pilot and implement an Employment Training Panel (ETP)-approved integrated training model to include formal training, mentoring and experiential training integrated with basic skills with technical content.” The BE Aerospace project discussed in the CACT section of this report is a good example of how the colleges, working with and through the CACTs, can meet this last recommendation.

Antelope Valley College, which was a key partner in the development of this study and report, will continue working on a Supply Management Certificate program in order to fully implement the report’s recommendations.⁵⁹ Antelope Valley will also take the lead on a supply chain management overview seminar to address supply chain principles in a global environment, supply chain relationships and structure including working in a global, dynamic, complex system, regulation, cross-functional systems engineering basics, and project management basics. Though not funded as part of the WIRED program, this seminar could be developed into a full California (CCC) Supply Chain Management certification program, which could be made available throughout the CCC system. The WIRED Supply Chain Seminar will be offered by Antelope Valley College in conjunction with industry co-hosts.⁶⁰

Respond to Industry Requests for Internships/Apprenticeships

Throughout the employer input, the need for more internships and apprenticeships as integral parts of college programs was voiced again and again. This change is needed throughout the STEM curriculum. Even in some of the more highly skilled aerospace production occupations where workers must go through formal apprenticeships (like machinists and electricians) none of the community college apprenticeship programs seem to be geared specifically to the aerospace industry.⁶¹ This shortage was also noted in the Aerospace Commission report, which called for a stronger focus on credentials based on industry identified competences as well as alternative education and training pathways available through apprenticeships and career and technical education.⁶²

Be Active in Industry/Education Collaborations

Community college faculty and workforce development staff, along with economic development project staff, should become active collaborators in the various programs that have been funded to support the aerospace industry. It is through these long-term relationships that the colleges can be positioned to develop creative solutions to the workforce needs of the industry. An example of such a program is the California Space Education and Workforce Institute (CSEWI) which is supported by the U.S. Department of Labor’s 2006 Workforce Innovation in Regional Economic Development (WIRED) initiative. CSEWI was established by the California Space Authority (CSA)

⁵⁹ Chen, C, Purcell, C, Younglove, T, and Uhasy, L, California Aerospace Supplier Transformation Requirements for 21st Century Global Competitiveness: Characterization of the California Aerospace Supply Base Identification of Common Industry Training Needs through Surveys, Forums and Industry Input, California Space Authority and Antelope Valley College, October, 2008, pp. 27-29, found online at innovatecalifornia.net.

⁶⁰ Ibid.

⁶¹ Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

⁶² Report of the Interagency Aerospace Revitalization Task Force, February, 2008, p. 10-11 found online at http://www.doleta.gov/pdf/REPORT_Aerospace_2008.pdf

to partner and lead strategies and programs that address innovation support and talent development. Cerritos and Antelope Valley Colleges have been involved in these programs and have developed model programs, degrees, and certificates to serve the industry. Another way for colleges to improve this connection is by working with and through the CACTs.

Tap External Funding Sources for Projects to Support Workforce Development

In addition to funds and grants available through the traditional state and federal sources, colleges (and their aerospace industry partners) can seek other funding for collaborative projects.

- One example of this is California State University San Jose's STEM Talent Expansion Program grant from the National Science Foundation (NSF) which provides support for counseling of (potential) community college (transfer) students.⁶³
- 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.
- Many aerospace companies are funding program development for the industry's workforce. For example, Honeywell has invested, along with the federal government, in an innovative School-to-Apprenticeship program that begins with high school seniors and takes them through a four-year program ending with an associate degree in Manufacturing Technology. Analysis of the economic benefits of apprenticeship shows an impressive \$50 return for every dollar of Federal investment.⁶⁴

Data Limitations

Two problems limited the collection of labor market projection data for this report. The first problem was isolating the appropriate data for Los Angeles County. Although it is possible to find data for NAICS Code 3364, that data tracks only Aerospace Manufacturing and Parts. In Los Angeles County, the manufacturing base has been decreasing over the past two decades and Research and Development has been increasing. However, there is no distinct NAICS code for aerospace research and development. Thus, the primary segment of the industry in Los Angeles County is not represented in the labor market data for this report. The second data collection issue is related to the high security requirements of a large part of the industry. This results in data suppression at the government level. Labor market information from specific companies and/or segments of the industry are suppressed for reasons of national security. Data used in this report should be considered with both of these limitations in mind.

⁶³ The Aurora Project : The Community College Component of the CalTeach Science and Mathematics Initiative,, PowerPoint presentation found online at www.ctc.ca.gov/seminars/CCCU-files/aurora.ppt

⁶⁴ America's Aerospace Industry: Identifying and Addressing Workforce Challenges - Report of Findings and Recommendations For The President's High Growth Job Training Initiative in the Aerospace Industry, May 2005, p. 11, found online at http://www.doleta.gov/BRG/Indprof/Aerospace_Report.pdf

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Appendix A: How to Utilize this Report

This report is designed to provide current industry data to:

- Define potential strategic opportunities relative to an industry’s emerging trends and workforce needs;
- Influence and inform local college program planning and resource development;
- Promote a future-oriented and market responsive way of thinking among stakeholders; and,
- Assist faculty, Economic Development and CTE administrators, and Community and Contract Education programs in connecting with industry partners.

The information in this report has been validated by employers and also includes a listing of what programs are already being offered by colleges to address those workforce needs. In some instances, the labor market information and industry validation will suggest that colleges might not want to begin or add programs, thereby avoiding needless replication and low enrollments.

About the Centers of Excellence

The Centers of Excellence (COE), in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor’s Office, California Community Colleges, Economic and Workforce Development Program. The total grant amount (grant number 08-305-019 for \$205,000) represents funding for multiple projects and written reports through the Center of Excellence. The Centers aspire to be the premier source of regional economic and workforce information and insight for California’s community colleges.

More information about the Centers of Excellence is available at www.coecc.net.

Important Disclaimer

All representations included in this report have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings; however, neither the Centers of Excellence, COE host District, nor California Community Colleges Chancellor’s Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon components or recommendations contained in this study.

Appendix B: Aerospace Occupations Discussed in this Report by Category

Professional and related occupations
Drafters
Aerospace engineering and operations technicians
Electrical and electronic engineering technicians
Industrial engineering technicians
Engineering technicians, except drafters, all other
Installation, maintenance, and repair occupations
Avionics technicians
Electrical and electronics repairers, commercial and industrial equipment
Aircraft mechanics and service technicians
Industrial machinery mechanics
Maintenance and repair workers, general
Production occupations
Aircraft structure, surfaces, rigging, and systems assemblers
Electrical and electronic equipment assemblers
Team assemblers
Computer-controlled machine tool operators, metal and plastic
Machine tool cutting setters, operators, and tenders, metal and plastic
Machinists
Multiple machine tool setters, operators, and tenders, metal and plastic
Tool and die makers
Welders, cutters, solderers, and brazers
Inspectors, testers, sorters, samplers, and weighers

Source: Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

Appendix C: Partnership Models

http://www.boeing.com/news/releases/2009/q1/090227c_nr.html

CHICAGO, Feb. 27, 2009 -- The Boeing Company [NYSE: BA] today announced a four-year national partnership with FIRSTTM (For Inspiration and Recognition of Science and Technology), valued at \$4 million, to encourage students to explore careers in math and science. This expanded relationship builds upon an ongoing commitment by Boeing employees to help shape the future of technology innovation in the United States.

FIRST is a not-for-profit organization, founded in 1989 by inventor Dean Kamen, to inspire young people to participate in science and technology. Beginning in January, teams of high school students collaborate with adult mentors during an annual six-week period to design, build and program robots from a common kit of parts for competition.

"We view the excitement created by FIRST as an opportunity to positively influence the perception of math and science by young people," said Rick Stephens, Boeing senior vice president of Human Resources and Administration. "For more than 10 years, our employees have inspired participants through their experience applying teamwork and technical skills to creatively solving complex problems. Expanding our involvement with FIRST will help us encourage more students to experiment with technology and make new discoveries as the future workforce of our industry."

LUNACYTM, the 2009 competition challenge, commemorates the 40th Anniversary of the Apollo 11 mission by staging all events on a low-friction floor to simulate gravity on the moon. During the match, teams recall the discoveries from the first manned mission to land on the moon as they maneuver robots to toss nine-inch "moon rocks" into trailers. FIRST attaches these moving targets to robots designed by the opposing teams as part of the challenge.

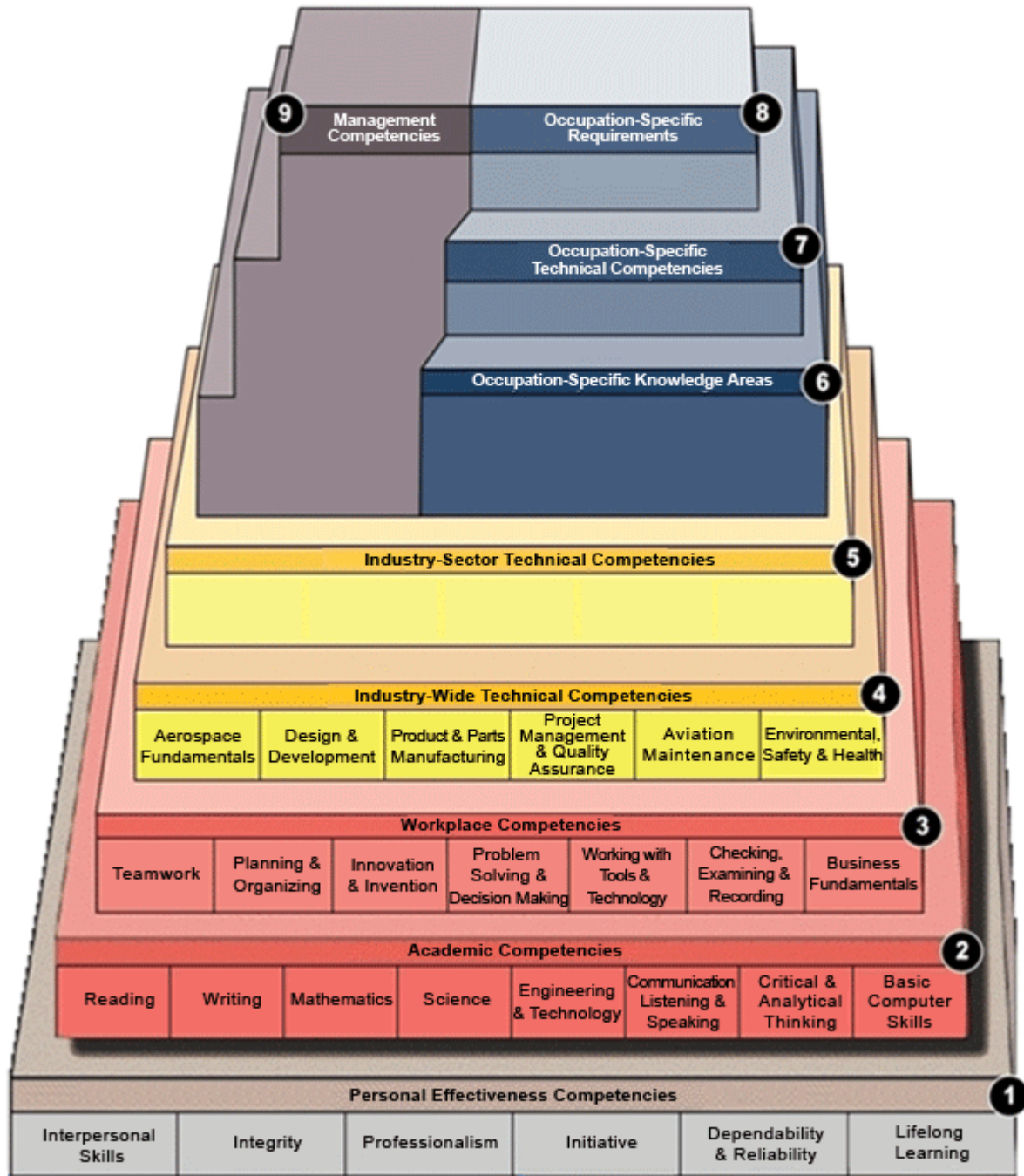
"Connecting FIRST teams with Boeing, a company involved in the future of space exploration, will assist us in preparing the next-generation for meeting the economic, environmental and business challenges ahead," said FIRST Founder Dean Kamen. "We are honored Boeing chose FIRST as a partner to help develop its future workforce. The company is committed to producing innovative scientists, engineers and technicians, and these future leaders are in our schools right now at every grade level."

The FIRST Board of Directors recently recognized Boeing as one of nine "Strategic Partners" dedicated to helping the organization further its mission to reach young minds. This designation reflects the company's national, multi-year partnership with FIRST to encourage emerging talent to innovate with math and science.

FIRST is part of a comprehensive investment Boeing makes annually to education initiatives that focus on teacher and leadership development, as well as curriculum enhancements. Projects supported by Boeing reflect a clear set of criteria that emphasize the application of new approaches to solving critical community issues.

Source: Bureau of Labor Statistics, U.S. Department of Labor, Career Guide to Industries, 2008-09 Edition, Aerospace Product and Parts Manufacturing, on the Internet at <http://www.bls.gov/oco/cg/cgs006.htm>

Appendix D: Aerospace Industry Competency Model



Source: <http://www.careeronestop.org/COMPETENCYMODEL/pyramid.aspx?AEO=Y>