

POLICY BRIEF



March 2010

Defense and Aerospace in Arizona

The Arizona Chamber Foundation (501(c)3) is a non-partisan, objective educational and research foundation. The Foundation produces research studies on Arizona public policy issues such as health care, budget, education, regulation, energy, and others in an effort to inform policy makers, business leaders, and the general public.

Highlights

Major Manufacturing Employer

- 37,000 jobs
- 21% of total Arizona manufacturing jobs

High Skill, High Wage Jobs

- \$85,000 average annual salary
- 41% above the average Arizona manufacturing salary
- More than double the average Arizona wage across all industries

Major Prime Contractors

- Boeing Defense, Space, & Security (BDS), Mesa facility. 4,700 employees
- General Dynamics C4 Systems, Scottsdale headquarters. 3,100 employees
- Honeywell International, including Honeywell Aerospace headquarters in Phoenix. 11,700 employees
- Raytheon Missile Systems, Tucson headquarters. 11,700 employees

Military Programs

- 9 Military installations:
 - 4 National Guard
 - 2 Army
 - 2 Air Force
 - 1 Marine Corps
- Ground Based Midcourse Defense Program

Chancellor Level:

AMAGINE
COMMUNICATIONS

APS

THE POWER TO MAKE IT HAPPENSM

**BlueCross
BlueShield
of Arizona**

An Independent Licensee of the Blue Cross and Blue Shield Association

SCF *Arizona*
At work for you

**WELLS
FARGO**

Dean Level:

COX

VANGUARD
HEALTH SYSTEMS

Introduction

State and regional economic developers from across the country strive to attract and retain sustainable, high wage, export oriented industries. Arizona is fortunate to host a historically strong defense and aerospace industry whose firms manufacture products that meet the defense community's immediate needs and simultaneously develop the new technologies that will be used to confront future challenges. However, as other states recognize the economic impact of this industry and become increasingly aggressive in their pursuit of defense and aerospace firms, Arizona's leaders need to unite in support of this important industry.

Maintaining the strength of Arizona's defense and aerospace industry requires a coordinated effort among state and federal leaders. At the state level, the Arizona Aerospace and Defense Commission, consisting of representatives from the business, government, and education communities, is

Defense and Aerospace in Arizona

tasked with developing goals and objectives for advancing defense and aerospace activity in Arizona. Due to the importance of federal defense spending to this industry, Arizona's Congressional delegation plays a key role in achieving these goals.

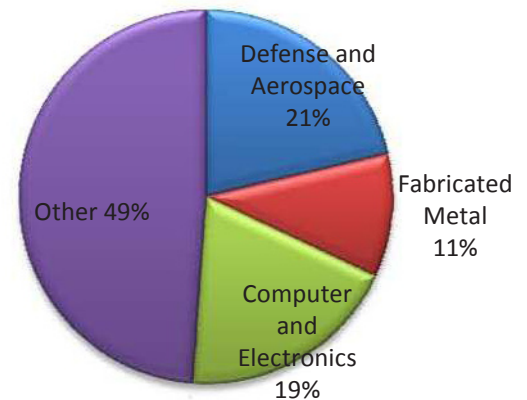
In 2008, Arizona firms fulfilled around \$10 billion in defense related federal contracts. Large scale Department of Defense (DoD) programs at prime contractors like Raytheon, Boeing, Honeywell, Lockheed Martin, and General Dynamics drive the industry and support a well developed supplier network throughout Arizona. Continued funding for defense programs in Arizona not only supports 37,000 current manufacturing jobs, but also provides firms of all sizes the resources to invest in research and development of technologies that will shape the future of the defense and aerospace industry.

Defense and Aerospace Income and Employment

Arizona's defense and aerospace industry and military presence are both strengths of the state economy. The Army, Air Force, Marine Corps, and National Guard employ 45,000 military and civilian personnel at the nine major military installations in Arizona. Defense and aerospace manufacturers employ another 37,000. While the military makes a significant contribution to the state economy, as evidenced in a 2008 report commissioned by the Arizona Department of Commerce, this analysis will focus on the impact of private sector defense and aerospace manufacturing firms.

Defense and aerospace employers represent a major component of Arizona's manufacturing base and they make a significant contribution to the overall state economy. The 37,000 employees of the industry earned over \$3.1 billion in salaries during 2008 while manufacturing products such as aircraft, aircraft parts, small arms, missiles, and communication equipment. Chart 1 depicts the industry's share of total manufacturing employment in Arizona.

Chart #1
AZ Manufacturing Employment

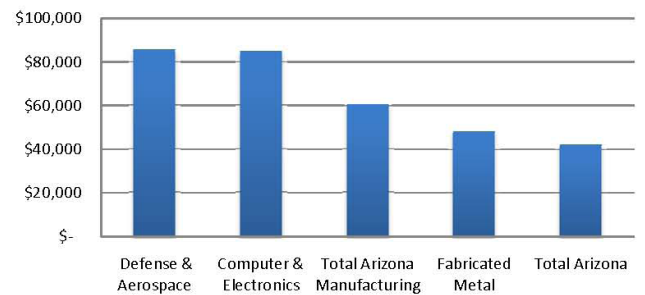


See "Methodology Note 1" for industry definitions

Defense and aerospace industry employees earn an average annual wage of \$85,000, which is similar to computer and electronics manufacturing, 41% higher than the average Arizona manufacturing wage, and more than double the average Arizona wage across all industries.

Chart #2

Average Annual Salary



See "Methodology Note 1" for industry definitions

Prime Contractors

The catalyst of the defense and aerospace industry in Arizona is the prime contractor. These firms rely on highly skilled employees and a vast supplier network to fulfill orders from the DoD. Four of the major Arizona prime contractors include:

Boeing

Boeing’s 4,700 employee Defense, Space & Security facility in Mesa is best known for producing the AH-64 Apache attack helicopter for the U.S. Army. Additional work at the Mesa facility includes production of electrical subassemblies for the F/A-18, F-15, and C-17 aircraft.

General Dynamics

With 3,100 employees at its Scottsdale headquarters, General Dynamics C4 Systems specializes in command and control, communications networking, computing and information assurance for defense, government and select commercial customers in the U.S. and abroad.

Honeywell International

With over 11,700 employees at 21 Arizona facilities, Honeywell International contracts with the DoD through both their Aerospace and their Automation and Control Solutions business units. In particular, Honeywell Aerospace is headquartered in Phoenix, with major facilities in Tempe, Glendale, and Tucson.

Raytheon Missile Systems

Headquartered in Tucson with 11,700 Arizona employees, Raytheon Missile Systems designs, develops, and produces weapon systems for the U.S. military and the armed forces of more than 50 countries.

Suppliers

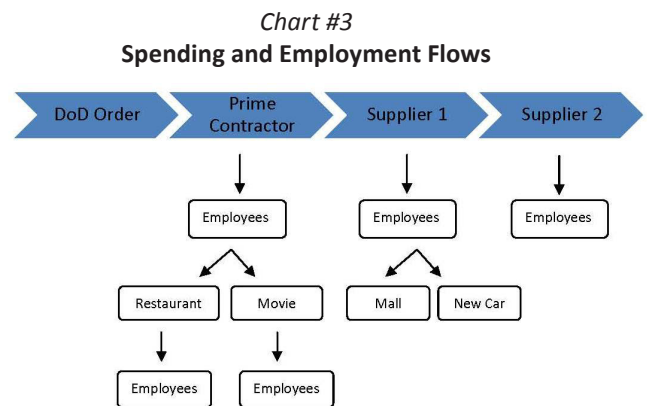
Many of the products that are manufactured by prime contractors in Arizona require thousands of components that are produced by outside sources. The supplier network that meets the demand for these components represents a significant source of employment for many Arizonans. In 2005, Boeing’s Mesa facility made purchases totaling \$116

million from 129 local suppliers. In 2008, Raytheon’s \$303 million in local supplier purchases supported 2,500 Arizona jobs.

In addition to supporting prime contractor operations in Arizona, the suppliers also export their products to other regions of the country. For example, Boeing’s non-Arizona defense operations made an additional \$643 million in purchases from local Arizona suppliers that supported 5,500 jobs.

Multiplier Effect¹

The economic impact of the defense and aerospace industry is not limited to the employees of prime contractors and their suppliers. Studies from Boeing and Raytheon suggest that every 100 jobs at a prime contractor or supplier support another 95-97 induced jobs in other sectors of the Arizona economy. The employment and economic activity stimulated by the prime contractors also generates significant state and local tax revenues. The following chart combined with data from Boeing’s economic impact study depicts how money from a DoD prime contract flows through a simple two supplier network and into other sectors of the economy.



Direct Effect

The process begins when the prime contractor receives an order from the DoD. In order to fulfill

¹ See Methodology Notes 2 & 3

the order, the contractor needs labor and materials. This creates jobs for Arizona residents employed by the prime contractor as well as downstream demand for parts from a supplier. For example, in 2005, Boeing’s Mesa facility directly employed 4,600 in Arizona. These employees paid \$32.2 million in state and local taxes, while Boeing itself paid another \$2.1 million.

Indirect Effect

As a result of the order from the prime contractor, supplier 1 now needs labor and materials. This creates jobs for Arizona residents employed by supplier 1 and also creates downstream demand for more parts from supplier 2. For example, the indirect effect of Boeing supplier purchases supported 998 jobs at local suppliers, and these suppliers and their employees paid \$4.1 million in state and local taxes. At the same time, the employees of the prime contractor now have money to go out and spend in the community.

Induced Effect

The process continues as supplier 2 fulfills the order from supplier 1 by employing more people and purchasing additional inputs. Simultaneously, other businesses in the community need to employ more people in order to meet the consumption demand of the prime contractor employees while supplier 1 employees now have money to spend in the community. Consumer spending initiated by Boeing employees and the subsequent multiplier effect supported an additional 4,132 Arizona jobs and generated \$15 million in state and local tax revenue.

The spending by supplier 1 employees will support additional jobs in the same way that spending by Boeing employees supports additional jobs. The multiplier effect associated with purchases by Boeing supplier employees supported 1,333 Arizona jobs and generated \$5.1 million in state and local tax revenue. The total employment and tax impact of the Mesa facility is summarized in Table 1.

Table #1
Employment and State and Local Tax Impact of Boeing’s Mesa Facility

	Direct Effect		Indirect Effect		Total Mesa Facility Impact
	Boeing	Suppliers	Boeing Employee Spending	Supplier Employee Spending	
Employment	4,600	998	4,132	1,333	11,063
Tax Revenue	\$34,312,000	\$4,126,000	\$14,987,000	\$5,184,000	\$58,609,000

Exports²

Due to the size of Boeing’s national operations, they can also be used as an example to illustrate the impact of purchases made by out of state firms from Arizona suppliers. In addition to purchases by the Mesa facility, out of state operations of Boeing spent another \$643 million on products from Arizona suppliers. These purchases supported 5,500 supplier jobs and triggered another round of induced employment totaling 7,300 jobs.

Defense Budget Process

Government contracts drive the defense and aerospace industry. The size and scope of these contracts depend on the annual DoD funding decisions. Congress must pass two bills every year in order to fund the DoD:

1. National Defense Authorization Act
2. Defense Appropriations Bill

The process begins as individual agencies, such as the Army or Navy, submit budget requests to the DoD. The DoD then submits its overall request to the White House’s Office of Management and Budget. OMB incorporates the defense budget request into the President’s Budget, which is then submitted to Congress. Four separate committees act on the defense portion of the President’s budget proposal:

1. House Armed Services Committee
2. Senate Armed Services Committee
3. House Appropriations Committee

² See Methodology Note 4

4. Senate Appropriations Committee

Each Armed Services Committee passes a Defense Authorization Act, which authorizes, but does not require, spending levels for specific defense programs. The committees have full discretion to add programs to or remove programs from the President's proposal.

Each Appropriations Committee passes a Defense Appropriations Bill, which sets the spending level that will actually occur for specific programs, not to exceed the levels set in the Authorization Act.

The final bills are passed after the House and Senate versions of each bill are merged and voted on.

Once the funds have been authorized and appropriated, a complex competitive bidding process occurs to determine which firms will win the contract for each project.

Major Arizona Programs

Ground Based Midcourse Defense (GMD) Program

The GMD program is a central element of the Ballistic Missile Defense System (BMDS), designed to defend the U.S. from intermediate and long range ballistic missile attacks. Boeing serves as the prime contractor for the GMD program, and key components of the system are produced by Orbital Sciences in Chandler and Raytheon Missile Systems in Tucson.

Raytheon Missile Systems

Based in Tucson, Raytheon Missile Systems produces a wide range of weapons for the U.S. military and its allies. Products of note include the Sidewinder air combat missile, SeaRAM anti-ship missile defense system, and the Javelin man-portable anti-armor weapon system.

AH-64 Apache

Boeing produces the AH-64 Apache attack helicopter in Mesa for both the U.S. Army and 10 foreign countries. The AH-64D Block II is the version currently produced for the U.S. Army and international customers, while the advanced AH-64D Block III is being tested and nearing production. In addition to new-build Apaches, Boeing continues to remanufacture AH-64A airframes for domestic and international customers, incorporating performance and technological improvements that convert these older aircraft into the modernized AH-64D Apache configuration.

Combat Operations Centers

General Dynamics C4 Systems, headquartered in Scottsdale, produces U.S. Marine Corps Combat Operations Centers. Acting as the focal points of decision-making for Marine commanders and their staffs, the 295 Combat Operations Centers currently in use enable command and control operations for Marines deployed in Afghanistan and Iraq, from division or air-wing headquarters to the regimental level. They also support pre-deployment training at locations in the United States.

Conclusion

The strength of Arizona's defense and aerospace industry depends on continued federal investment in our nation's defense. Arizona-based operations have a long history and strong capabilities to provide these services. Continuation of existing programs in Arizona will support the 37,000 current industry jobs and future investments could stimulate the technological innovation that will sustain the industry going forward.

Methodology

Note 1: Industry Definitions

Employment and wage data was compiled using the North American Industry Classification System (NAICS).

Industry	NAICS Code
Total Arizona	All NAICS codes, public and private
Total Arizona Manufacturing	31-33
Defense and Aerospace	332994, 334511, 33641
Fabricated Metal	332, less 332994
Computer and Electronic	334, less 334511
Other Manufacturing	31-33, less 332994, 334511, 33641

Note 2: Boeing Mesa Facility Calculations

The data used to calculate the impact of Boeing’s Mesa facility was based on the 2005 economic impact study. There are 4 categories of employees and taxes generated that make up the total employment impact, and the data in Table 1 was modified from the impact report as follows:

Boeing: 93% (4,600 of 4,948) of the Arizona employees work at the Mesa facility. Both of these numbers are given in the study.

The amount of taxes paid by Boeing and its employees totaled \$34,312,000. The number given in the study for employee generated taxes is \$34,630,000. Assuming employees of the Mesa facility generated 93% of this tax revenue, the number adjusts to \$32,206,000. Finally, Boeing paid \$2,265,000 in Arizona taxes. Again, we will assume that 93% of this is generated in Mesa, which equals \$2,106,000. Adding Mesa employees (\$32,206,000) and Boeing in Mesa (\$2,106,000) together, total state and local tax revenue generated by Boeing and its employees totaled \$34,312,000.

Suppliers: 998 Arizona supplier employees are supported by the Mesa facility. The number given in the study is 9,416. However, 9,416 represents the jobs supported by Boeing’s companywide purchases from Arizona suppliers. Two pieces of given supplier sales data was used to estimate the number of jobs attributable to the Mesa facility. The Mesa

facility generated \$116 million (10.6%) of Boeing’s \$1.1 billion in companywide purchases from Arizona suppliers. This same percentage (10.6%) was used to estimate the number of employees. 10.6% of 9,416 is approximately 998 jobs.

Mesa facility suppliers and their employees generated \$4,126,000 in state and local tax revenue. The number given in the study is \$38,927,000, which represents the taxes generated by Boeing’s companywide suppliers. The 10.6% was used to calculate the share attributable to the Mesa facility suppliers. 10.6% of \$38,927,000 is \$4,126,000.

Boeing Employee Spending: 4,132 employees from other industries are supported by the consumption of Boeing employees. The number given in the study is 4,445, which reflects the employment generated by the full 4,948 workforce, not the 4,600 from the Mesa facility. The Mesa facility represents 93% of Boeing’s Arizona employment, so it was assumed that the Mesa facility also accounted for 93% of the employment in other industries. 93% of 4,445 is approximately 4,132 jobs.

Mesa facility employees generated \$14,987,000 in state and local tax revenue. The number given in the study is \$16,115,000, which represents the taxes generated by the spending of Boeing’s full Arizona workforce. 93% of this revenue can be attributed to the spending of the Mesa facility employees. 93% of \$16,115,000 is \$14,987,000.

Supplier Employee Spending: 1,333 employees from other industries are supported by the consumption of Boeing’s supplier employees. The number given in the study is 12,508, which reflects the jobs supported by companywide purchases, not just purchases from the Mesa facility. The Mesa facility accounted for 10.6% of Boeing’s companywide purchases from Arizona suppliers, so it was assumed that the Mesa facility accounted for 10.6% of the employment generated by the supplier employees. 10.6% of 12,508 is approximately 1,333 jobs.

Spending by employees of Mesa facility suppliers generated \$5,184,000 in state and local tax revenue. The number given in the study is \$48,904,000, which represents the taxes generated by the employee spending of Boeing's companywide suppliers. It was assumed that 10.6% of this tax revenue can be attributed to the spending of the Mesa facility supplier employees. 10.6% of \$48,904,000 is \$5,184,000.

Note 3: Other Sector Job Calculations

Based on the data in Table 1, the ratio of induced jobs to the sum of direct and indirect jobs is .976. Multiplying this ration by a factor of 100 suggests that every 100 direct and indirect jobs yields an additional 97 induced jobs

Raytheon directly employs 11,700 and indirectly employs 2,500 at local suppliers. The induced employment associated with these jobs totals 13,500. The ratio of induced jobs to the sum of direct and indirect jobs is .951. Multiplying this ratio by a factor of 100 suggests that every 100 direct and indirect jobs yield an additional 95 induced jobs.

Note 4: Employment impact of exports

The impact of supplier purchases made by Boeing's out of state operations was based on the 2005 economic impact study and an interview with a Boeing employee. The study indicated that purchases made by Boeing's companywide operations supported 9,416 Arizona supplier jobs. This number reflects purchases by both the commercial and defense business segments within Boeing. Based on the interview, 69% of the spending was related to defense projects. Therefore it was assumed that 69% of the jobs supported were attributable to the defense segment, which is the focus of this analysis. Applying 69% to 9,416 yields 6,497. The 998 jobs supported by the Mesa facility was subtracted from 6,497 leaving 5,499 additional jobs supported by Boeing's out of state purchases from Arizona suppliers.

The same steps and assumptions applied to the

calculation of induced jobs attributable to spending by Boeing's out of state operations. The study indicated that supplier employee spending supported 12,508 induced jobs. Again, it was assumed that 69% of these jobs could be attributed to spending by Boeing's defense segment, yielding 8,630. The 1,333 jobs induced by the Mesa facility was subtracted from 8,630, yielding 7,297 induced jobs from Boeing's out of state purchases from Arizona suppliers.

Sources

Employment and wage data from Arizona Workforce Informer (www.workforce.az.gov)

Federal contract data from www.fedspending.org

Arizona Aerospace and Defense Commission website, located at www.azcommerce.com

"Arizona Aerospace, Defense, and Avionics Industries Study." 2008. Prepared for the Arizona Department of Commerce by Angle Technology Group.

"The Boeing Company. Economic Impact in Arizona." 2005. Prepared for Boeing by L. William Seidman Research Institute, W.P. Carey School of Business, Arizona State University.

"The Economic Impact of the Ground Based Mid-course Defense Program in the State of Arizona." 2007. Produced for Boeing by L. William Seidman Research Institute, W.P. Carey School of Business, Arizona State University.

"Economic Impact of Arizona's Principal Military Operations." 2008. Prepared for the Arizona Department of Commerce by The Maguire Company in collaboration with ESI Corporation.

"Raytheon in Arizona." 2008. Prepared for Raytheon by L. William Seidman Research Institute, W.P. Carey School of Business, Arizona State University.