Economic Development Planning, Summary 24

Unless otherwise noted, summaries represent findings and analyses by the listed source, not by Morrison Institute for Public Policy or Arizona State University.

**Title:** Aerospace & Defense Industry in Arizona: An Intellectual Roadmap for Economic Development

**Year:** 2011

**Source:** L. William Seidman Research Institute, W.P. Carey School of Business, Arizona State University

**Authors:** Dennis Hoffman, director of the L. William Seidman Research Institute and professor of economics at the W.P. Carey School of Business; Alex Castelazo, senior research associate with the L. William Seidman Research Institute; and Anthony Evans, senior research fellow with the L. William Seidman Research Institute.

**Prepared for:** Science Foundation Arizona, with support from the Governor’s Office of Economic Recovery and Science Foundation Arizona.

**Length:** 48 pages

**Website:** seidmaninstitute.com

**Summary:** The aerospace and defense industry in Arizona is a complex cluster of systems that faces several challenges to its growth and would benefit from greater connections and collaborations between industry, research and the military. The creation of an Arizona Aerospace and Defense Institute is needed to align research and development among the different entities. The stakes are high with Arizona’s aerospace and defense industry, including military installations, generating $17.9 billion in annual economic impact and some 190,000 jobs.

As Arizona seeks to expand its A&D base, it should focus on core competencies, including national defense, intelligence and surveillance and special operations. Also, the state should explore opportunities with cyber warfare and counter terrorism.
The state also must acknowledge gaps in its A&D industry, including a lack of second-tier suppliers supporting large manufacturers in the state; lost opportunities within value engineering, directed energy and optics; intellectual property ownership issues, which undermine collaboration between industry and universities; and a failure to correlate the development of new technologies with the needs of both military and consumer consumers.

Arizona also needs to nurture its STEM (science, technology, engineering and math) programs to ensure qualified students for higher education, and then potential work in the aerospace and defense industry.

**Sectors:** Aerospace, defense, security, cyber warfare, intelligence and surveillance, special operations, counter terrorism, border security, unmanned vehicle systems.

**Geographical impact:** Arizona.


**Major challenges:** Defense budget cuts, sequestration cuts, highly competitive states such as Alabama, Florida and Virginia pursuing military missions and funding, military’s changing technological needs, an evolving economic landscape, low number of second-tier suppliers, weak commitment from congressional delegation, lack of communication between researchers, industry and the military, negative image of state, poor development of STEM education, weak marketing of advantageous state policies and research not closely aligned with industry needs.

**Progress to date:** In fiscal 2012, the Department of Defense awarded $13 billion in defense contracts to Arizona, the sixth largest for a state. The impact of the sequestration cuts is viewed as a “game changer” by GPEC, which reports that smaller firms having already reported a decline in contracts in the past year. The state’s congressional delegation is viewed as more positive in its efforts to listen to the concerns of Arizona’s aerospace and defense industry. The classified Air Force Research Laboratory in Mesa is in the process of being transferred to the city
of Mesa. The renamed Arizona Laboratories for Security and Defense Research is intended for use by companies doing aerospace and defense research requiring high-level security.

Efforts to create an Aerospace Institute to coordinate the research efforts of Arizona’s leading research facilities and assist in other ways, including pushing for recommendations in this report, have not gone very far despite the formation of an impressive board. Money is tight and the major aerospace and defense companies doing business in Arizona are based elsewhere and have interests around the country and world.

Arizona, under the leadership of the Arizona Commerce Authority, has submitted its proposal to the FAA to become one of six national test sites for unmanned aircraft systems. Selection could position Arizona as a national leader in the research and development of unmanned aircraft systems, with possibly manufacturers and suppliers to come. Luke Air Force Base and the Marine Corps Air Station Yuma have been assigned the new F-35 aircraft, which should ensure their viability for decades.

In 2012, Science Foundation Arizona launched a five-year STEM program to integrate STEM learning into schools and districts, including improving the ability of teachers to convey science and math.

**Major implications:** Arizona’s military installations seem to be holding their own with the securing of the F-35 aircraft and fending off a bid to move the Tucson-based 612th Air Operations Center out of state. But the sequestration cuts are being felt by industry and military installations. Some $55 billion is expected to come out of the overall defense budget in 2013 because of the cuts. The state is banking on winning designation as a national test site for the testing and development of unmanned aircraft vehicles to become a leader in the UAV field. With Fort Huachuca home to the world’s largest UAV training center and given Arizona’s airspace and testing ranges, state leaders view the state as an ideal location for becoming a civilian and military center for testing, research and manufacturing of unmanned aircraft.

**Opportunities for alignment:** Arizona universities must work closely with the business development teams at Boeing, Raytheon and other large manufacturers to identify research dollars, and produce work of commercial and military value. The second-tier suppliers must work closer with the very large manufacturers to meet their needs and pursue larger military and security contracts. The state needs to review the potential for future development of the six core competencies that were identified: national defense, cyber warfare, intelligence and surveillance, special operations, counter terrorism and border security.

**Background:** Arizona’s aerospace and defense research contributes $8.8 billion to the economy and is responsible for 93,800 jobs. The four major contractors in the state – Raytheon Missile Systems, Boeing Co., Honeywell Aerospace and General
Dynamics C-4 Systems – account for 83 percent of the A&D jobs in Arizona. The state’s military installations contribute another $9.1 billion to the economy and account for 96,328 jobs.

Seven common themes
Interviews with five key leaders in aerospace and defense identified seven common themes to improving Arizona’s A&D industry. They are:

1. Small business support and entrepreneurial development. Small businesses and entrepreneurs are needed to support the operations of medium and large manufacturers in Arizona. They also help drive the development of new technologies or their application.

2. Focus upon existing state competencies. Arizona’s aerospace and defense industry would benefit most from collaboration between research, industry and the military working within established operations and competencies.

3. Secure congressional support. Arizona’s congressional delegation should take a more proactive role within industry caucuses, and encourage greater levels of investment in Arizona by the Department of Defense.

4. Align research and development. An Arizona Aerospace and Defense Institute (ADI) is needed to engage with and serve as a link between all of the players in the industry.

5. Nurture STEM education. The Aerospace and Defense Institute could play a key role in coordinating the efforts of government and private industry to advance STEM education in Arizona.

6. Acknowledge existing gaps. Arizona’s A&D industry suffers from a number of gaps, partly due to a lack of coordination between research, industry and the military. These include:
   - A lack of second-tier suppliers supporting large manufacturers in the state.
   - Lost opportunities within value engineering, directed energy and optics.
   - Intellectual property ownership issues which undermine collaboration between industry and universities.
   - A failure to correlate the development of new technologies with the needs of both military and consumer consumers.
   - However, not all of these gaps should be addressed.

7. Leverage strengths to foster growth: Arizona has several strengths on which to build a solid foundation for future industry growth. For example, the state’s research and education entities and proximity to Mexico offer the Department of Homeland Security some of the U.S’s best research and testing capabilities. Targeted tax incentives and economic development programs position Arizona as a prime location for A&D operations.

Identifying clusters
Arizona’s A&D industry can be segmented into five clusters that can be further leveraged to pursue large government contracts. They are:

1. **Very large manufacturers.** Arizona has nine A&D firms that are very large manufacturers, employing 500 to 12,000 people. They receive the majority of DOD dollars and rely on a network of second-tier suppliers within the state. The companies are Raytheon Missile Systems (11,835 employees), Honeywell Aerospace (9,716), Boeing Co. (4,853), General Dynamics C-4 System (4,000), Orbital Systems Corp. (1,317), L-3 Electro-Optical Systems, Goodrich Interiors (630), BAE Systems (607) and Hamilton Sunstrand Aerospace (520).

2. **Second-tier suppliers.** Second-tier suppliers support the large manufacturers and usually specialize in a few key competencies with relatively lower operating costs. Arizona has a relatively small number of these suppliers compared with other states, presenting a potential opportunity for growth. These companies stand to benefit the most from training, networking and collaborating with other entities. Examples of these suppliers include Nammo Tally Inc. (275 employees), Universal Avionics Systems Corp. (275), Alliant Techsystems Inc. (226) and Paragon Space Development Corp. (74).

3. **Research entities.** Arizona has four lead research entities, representing one of the state’s greatest resources. They are Arizona State University (core competencies include aerodynamics and fluid mechanics, helicopter electromagnetics, nanofabrication, planetary sciences, aeronautical management technology, and security and defense systems initiative; University of Arizona (core competencies include optics, spacecraft design, aerodynamics, aircraft structures, manufacturing, propulsion systems, signal processing, telecommunications and modeling and simulation; Northern Arizona University (core competencies include environmental, ecosystem, and sustainable energy); and Embry Riddle Aeronautical University (core competencies include flight engineering, space physics, global environment and management, global security and intelligence studies, computer science, aviation business administration, meteorology, safety science, UAV, autonomous helicopters, airport runways and fatigue analysis of aircraft structures.

4. **Workforce.** The A&D industry requires engineers and scientists from the four universities, along with skilled technicians, machinists and other trades in science, technology, engineering and math from technical schools and community colleges. The more than two dozen institutions include DeVry University, East Valley Institute of Technology, ITT Technical Institute, Universal Technical Institute Phoenix, Maricopa Community Colleges, Pima Community College, Mohave Community College and Cochise College.

5. **Military.** Arizona’s major military installations are a big part of the state’s economy, employing 96,328 and generating an annual $9.1 billion. This cluster is the final consumer of the products made by the aerospace and defense industry. Arizona needs to take advantage of having so many large
military installations by working with them to determine what they need and want. The feedback can then be used to pursue defense contracts in areas aligned with the future missions of installations in the state. The primary military installations in Arizona are Davis-Monthan Air Force Base, Fort Huachuca, Luke Air Force Base, Marine Corps Air Station Yuma, Army Proving Grounds in Yuma, Air National Guard’s 161st Air Refueling Wing, Air National Guard’s 162nd Fighter Wing, Army National Guard and Western Army National Guard Aviation Training Site.

**Six core competencies**
Building upon the industry clusters and four themes of military activity – traditional (national defense, cyber warfare, homeland security, intelligence and surveillance and special operations), irregular (counter-terrorism, international piracy, weapons trafficking, internal security), emerging (border security, cargo inspection, immigration and control, narcotics interdiction and cyber crime), and underlying (energy and security, religious extremism, legal and policy issues, global disparities and root social causes) – six areas were identified that Arizona could leverage to its competitive advantage.

These six areas represent Arizona’s core competencies and should serve as a focal point around which industry, research and the military could work together. This collaboration ideally would be served by the creation of an Aerospace Institute to facilitate the exchange of ideas and needs between all stakeholders. The six areas are: national defense, cyber warfare, intelligence and surveillance, special operations, counter terrorism and border security.

**TOWS analysis of A&D industry**
TOWS initially focuses upon the threats (T) and opportunities (O) of the external environment to formulate a strategy for success rather than starting with weaknesses (W) and strengths (S).

Threats to Arizona’s A&D industry include:

- A lack of communication between researchers, industry and the military.
- Difficulty transitioning from prototype to operational technologies.
- The inability of some entities to operate in the classified domain makes it difficult to coordinate statewide efforts.
- Competition from other states to compete for scarce federal and private monies.

Opportunities include:

- Building collaborations with a statewide focus by leveraging the strengths of large and small firms to pursue military and security contracts.
• Pursuing border security technology research and testing, a largely untapped source of federal contracts for Arizona. The state enjoys a competitive advantage due to its geographic location.
• Increase in the research and testing of unmanned aerial vehicles with Arizona offering some of the best research and testing resources in the country.
• Both industry and research could benefit from the opportunities that lie in improving existing technologies through the Department of Defense VE program.
• Aligning the efforts of research and industry with the military’s Technology Horizons recommendations for new technologies in a bid for large contracts.
• Leveraging Arizona’s excellent legal and policy experts in warfare to provide more solutions to the military’s future needs.

Weaknesses include:

• Low number of second-tier suppliers, which allows federal dollars to potentially leak out of the state as business goes to out-of-state firms.
• Weak commitment from the state’s congressional delegation compared to such states as Florida.
• Outside perceptions of Arizona have been shaped by such controversial issues as gun laws and immigration, potentially tarnishing Arizona’s image to at least some out-of-state firms thinking of doing business in the state.
• A general unwillingness among firms to share ideas due to an insular, silo mentality.
• Although significant progress has been made, research has not been closely aligned with industry needs.
• Weak national marketing of advantageous state policies has hampered efforts to secure more defense contracts.

Strengths include:

• A large amount of restricted airspace, setting Arizona apart from other parts of the country.
• A large number of military installations and testing and training ranges whose needs and wants should be ascertained in pursuit of contracts.
• A large population of active and retired military personnel that injects a significant amount of dollars into the state economy.
• A sufficient number of very large manufacturers, which attract the majority of defense contract dollars to the state.
• A strong presence of civilian airports, including Phoenix’s Sky Harbor, Goodyear and Deer Valley, which generate a total economic impact of $33 billion a year.
Three research universities (ASU, UA and NAU) and Embry Riddle Aeronautical University, which perform most of the state’s university-based R&D and also help train a skilled workforce to the A&D industry.

Such unique facilities as the Air Force Research Laboratory in Mesa, which serves as a “high-level security facility” for research.

Incentives such as the Angel Investment Tax Credit and a lower corporate tax that have made Arizona more appealing to businesses.

The Arizona Commerce Authority and affiliated statewide entities, including Science Foundation Arizona, provide key resources that support business growth.

Some of the best weather for flying in the world.

Conclusions and recommendations for future research include:

Arizona’s aerospace and defense industry would benefit from greater connections and collaborations between industry, universities and the military. Historically, the A&D industry has been focused on aerospace and neglected other core competencies such as unique facilities like the Air Force Research Laboratory in Mesa, federally funded research facilities and second-tier suppliers in new technologies (directed energy, security and optics).

The points of intersection analysis identified six core competencies that Arizona could encourage: national defense, cyber warfare, intelligence and surveillance, special operations, counter terrorism and border security.

A TOWS analysis suggests various strategies for success, including focusing on core competencies, leveraging restricted airspace and testing ranges to obtain large federal contracts, gaining greater support from the congressional delegation, pursuing opportunities within homeland security and narcotics intervention, promoting value engineering, building synergies between firms, and removing barriers to collaboration.

Arizona should establish an Aerospace Institute to coordinate the research efforts of Arizona’s leading research facilities, to seed intermediary entities such as the Aerospace and Defense Research Collaborative, and to coordinate and enhance links between research, industry and the military. The Institute would offer the Department of Defense beginning-to-end solutions based on competitive advantages.

Further study is required to address the lack of second-tier suppliers, including:

- Which suppliers do Arizona’s very large manufacturers use the most and why?
- Do such suppliers in other states enjoy competitive advantages not available in Arizona?
- Does the lack of such suppliers hurt the ability of very large manufacturers to win contracts?