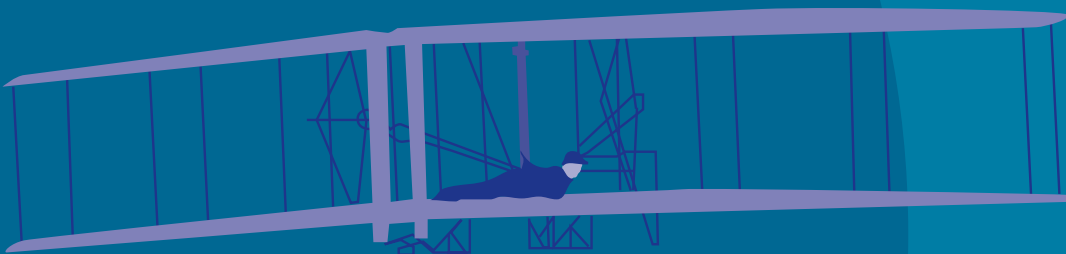


ready to
SOAR

Aviation & Aerospace in North Carolina





Ready to Soar: Aviation and Aerospace in North Carolina

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Ready to Soar: Aviation and Aerospace in North Carolina

As legacy industries — textiles, apparel, furniture and tobacco-dominated agriculture — continue their decline, and barriers to international trade fall, North Carolina is taking a more proactive approach to economic development. Low-cost labor is no longer the banner on our recruiting efforts. North Carolina looks to develop leading-edge industry clusters that have growing domestic and international markets. This strategy will be based on competitive advantages built through continued innovation, highly skilled and productive workers, and the utilization of advanced infrastructure and technology.

As early as 2000, the air transportation/shipping/logistics cluster was identified as an emerging target of interest. Aviation and aerospace have the potential to achieve critical mass in several of North Carolina's seven economic development regions, thereby catalyzing the transformation of economies tied to sectors facing extinction.¹ This report highlights evidence that documents the potential that aviation and aerospace hold to transport North Carolina to a more competitive future.



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I. Introduction

When the Wright brothers lifted off from Kitty Hawk's sands, they launched more than the first powered airplane. An industry was born that has transported the world to a technology-based, global market platform. Competitiveness in this environment depends on the capacity to link companies and communities to information, resources, and markets anytime and anywhere. Today, as technological advances erase the boundaries between traditional aviation and aerospace, the concept of anything, anytime, and anywhere takes on an expanded and exciting meaning.

Led by the North Carolina Space Initiative, state and national leaders from government, industry and education have engaged in serious examination of the status of aviation and aerospace in North Carolina. Beginning in 2005, discussions have sparked a set of white papers and industry assessments that have underwritten the overview and planning documents presented in this report.

A first study, "The Aero/Space Economy in North Carolina, A Preliminary Assessment of Current Performance and Future Prospects"² focused on the aerospace sector of the air transportation industry. The study concluded that aviation and aerospace is a growing industry that presents an opportunity for North Carolina.

This white paper led to a more extensive inventory of the state's aviation and aerospace resources, "The Aerospace Economy in North Carolina: Poised to Take Off, An Assessment of Current Performance and Future Industry

Prospects".³ This study benchmarked North Carolina against states leading in the industry and found that there is reason for optimism about North Carolina's prospects for growth in both of these important sectors. This study also found that limitations and concerns uncovered by national panels mirrored the situation in North Carolina. Challenges cited include:

- The need for greater awareness of the needs of this industry and its promise in coming years
- Projected shortfalls in skilled workers that will impede development in both aviation and aerospace
- Continued process and technological innovations will be needed to meet the demands of more sophisticated and diverse markets

Collectively, these documents highlight findings, provide the context and support for forward action, provide strategic recommendations for addressing challenges, and present a suggested best-practice implementation model that can be used to catapult North Carolina to the front of the global queue that is forming in this critical industry.

The assessment of this industry and its potential to contribute to growth and prosperity across North Carolina has been thorough and the conclusion clear: aviation and aerospace should be central elements in North Carolina's economic development strategies.



II. Aviation and Aerospace: Definitions and Distinctions

Aviation and aerospace are not separate industries. Rather, they are related sectors that segment along physical operating zones and markets served (Table 1). These segments are more finely arrayed into 17 distinct North American Industry Classification System (NAICS) categories.⁴ Beyond the defined industry there is a broader aviation and

aerospace industry cluster that encompasses the manufacturing and service sectors that supply the needs of aviation and aerospace firms. To understand the full potential of this industry in North Carolina, we need to also consider all the players that are part of the broader aviation and aerospace cluster.

Table 1 Segments of the Aviation and Aerospace Sectors

Segment	Aviation	Aerospace
<i>Commercial</i>	Aircraft manufacturing, air carriers, general aviation, airport operations	Space launch, launch vehicles and satellite manufacturing, telecommunications, remote sensing
<i>Civil (non-defense government)</i>	Air traffic management system, safety regulations, accident investigation, environmental permitting, noise and emission standards	Weather and telecommunications satellites, air and space-based earth monitoring, Space Shuttle, International Space Station, Hubble Space Telescope, interplanetary missions
<i>National Defense</i>	Combat aircraft, airlift unmanned aerial vehicles, guided missiles	Space launch, communications, navigation and reconnaissance satellites
<i>Intelligence</i>	Air-based communications, reconnaissance	Space-based communications, reconnaissance

Source: Final Report of the Commission on the Future of the United States Aerospace Industry November 2002⁵



III. Environmental Scan

A Global Industry in Transition

Aviation and aerospace are in the throes of major transformation. As distinctions between the two sectors diminish, other forces are injecting additional turbulence into their combined marketplace (Table 2). Significant shifts in global threat, mobility, environmental awareness, economic growth and technology create the context for major changes in the air transportation industry.

Table 2 *Descriptors in Aviation and Aerospace*

Historic Descriptors	Emerging Descriptor
Foreign Adversaries	International Partners and Competitors
Hub-and-Spoke	Point-to-Point
Airlines	Range of Air Vehicles
Local/ Regional Markets	National and Global Markets
U.S. Companies	Multi-national Companies
Large Physical Infrastructure	Virtual and Flexible Infrastructure
Mass Production	Custom Built Atom-by-Atom
Threats from Explosives	Cyber, Chemical and Bio Threats

Source: Commission on the Future of the U.S. Aerospace Industry 11/2002³

New opportunities are emerging as global markets heat-up, new alliances form, rising energy costs spark technical innovations in materials and design, and the digital revolution continues to drive growing demands for satellite-platformed services. The once-dominant U.S. market share is being threatened by a growing number of global competitors. As the commercial space economy becomes more viable, commonalities of technology, infrastructure, regulations and polices and workforce mean that investments in one sector can realistically leverage returns in the other.⁷

Workforce Challenges Defining the Future

Potentially crippling workforce shortages at all levels are challenging prospects in the aviation and aerospace sectors. It is an issue of quantity and quality as current workers rapidly age out and the availability of new workers with adequate skills declines. Impacts of these shortages are being felt across the globe, the nation and our state. The severity of the problem is immediate and large; solutions are neither quick nor easy. Potential longer-term ramifications pose a threat to the broader economy and to national security. Factors contributing to the problem include:

- Increasing competition for talent from other sectors as the technology component of all industries increases⁶
- An aging workforce: 26 percent of aerospace workers will be eligible for retirement by 2010⁷
- Dwindling resource pools, with the number of prime aerospace contractors in the U.S. shrinking from 50 in the early 1980s to five in 2003⁸
- Shortage of new entrants with education/training in critical fields of science, technology, engineering and mathematics (STEM) as K-12 performance in the U.S. relative to international peers declines⁸
- Declining innovation capacity as a shortage of STEM skills undermines innovation in this industry
- Aviation ranks last among industry sectors in the U.S. in the number of patents per employee⁶

Aviation and Aerospace in North Carolina: A Rich Heritage

History is rich with examples of North Carolina providing the resources and support needed to move aviation and aerospace forward (Table 3). From the beginning, forward-thinking North Carolinians recognized the value that this industry holds for improving the local economy. Few know that Bill Tate, local postmaster who was intrigued by Wilbur Wright’s description of his scientific kite flying, actively recruited the Wright brothers from Ohio to Kitty Hawk. Tate conveyed to Wilbur the availability



of telegraph service, daily mail, healthy climate, and support services. Tate closed the first-ever aerospace recruiting letter with this promise:⁹

“If you decide to try your machine here and come I will take pleasure in doing all I can for your convenience and success and pleasure, and I assure you, you will find a hospitable people when you come among us.”

– Portion of a letter written to Wilbur Wright by Bill Tate

The welcome mat is still out. North Carolina continues to attract innovators in this industry. Recent decisions by Fed Ex, Honda Jet and Commerce Overseas Corporation to move major operations and production centers to regions of North Carolina that have experienced a loss of jobs from legacy industries have been particularly welcome. As traditional industries wane and new

technology and knowledge-intensive industries wax, North Carolina needs to understand that aviation and aerospace are platform infrastructures that enhance the ability of all of the state’s businesses to compete in global markets. Criteria for targeting the aviation and aerospace sectors for major economic development investment are discussed in the following section.

Table 3 Aviation and Aerospace Milestones in North Carolina

1873	First American airplane built in Hertford County by James Henry Gatling, an odd-looking hand-powered machine with many features of modern aircraft. It crashed. ¹⁰
1903	First successful aerospace industry recruitment by Bill Tate in letter to the Wright brothers. ⁹
1903	First powered flight by Orville and Wilbur Wright in Kitty Hawk N.C.
1907	First machine to lift itself straight up off the ground. A prototype helicopter, the Bumble Bee, built by Luther Paul in Carteret County. ¹⁰
1923	First demonstration of aerial bombardment by Billy Mitchell off N.C. Coast, a major milestone in the establishment of the U.S. Air Force. ¹¹
1926	First Coast Guard Air Station established at Morehead City, N.C. ¹²
1942	Mackall Army Air Field established in southeastern N.C. as tactical testing and training facility for glider pilots preparing for critical role in D-Day and the Battle of the Bulge in WW II. ¹³
1942	First blimp airship produced and launched from Weeksville Air Station, beginning coastal patrols that cut the loss of ships to German submarines from 3-4 per week to 1 every 10 weeks. ^{10, 14}
1947-48	First Balloon Barrage Training Center and “Operation Bumblebee”, an experimental rocket testing program on Topsail Island that proved the ramjet engines, the platform for jet engines used today ^{15,16,17}
1948	Piedmont Airlines established in Winston Salem as one of the first regional commercial airlines. ¹⁸
1959-75	62 astronauts who participated in the Mercury, Gemini, Apollo, Skylab and Apollo-Soyuz programs trained in celestial navigation at Morehead Planetarium in UNC-Chapel Hill. ¹⁰
1981	Marine Corps Air Station at Cherry Point serves as alternate emergency launch abort landing and support site for NASA. ¹⁹
FUTURE	First...

IV. Aviation and Aerospace as Economic Development Targets

Limited economic development resources require North Carolina to target projects and efforts that hold the greatest return on investment potential. Best practice priorities for investment include those that demonstrate the following:

A. Strategic importance

B. Potential for growth

C. Creation of high quality, value-added jobs

D. Support for balanced (geographic) growth objectives

These investment criteria are adopted as an organizing framework to summarize the findings of supporting studies that were undertaken over the past two years.^{2,3} These studies addressed this question from two equally critical perspectives.

- 1) Are the Aviation and Aerospace sectors promising enough to warrant the state's investments of its limited economic development resources?
- 2) Can North Carolina be broadly attractive to this industry and succeed in attracting new aviation, aerospace and emerging commercial space companies?

The short answer to both questions is "YES".

North Carolina already has competitive advantages in key segments of the aviation industry. Further development of these advantages will only add to the number of firms that are already being drawn to the state. As to aerospace, an initial examination is encouraging of both the growth prospects of the sector and North Carolina's ability to attract those elements of the industry and its suppliers.

A. Strategic Importance

Organizations that successfully direct their energy, resources and competencies into arenas where competitive advantage can be achieved are acting strategically, moving to support and sustain economic and community growth. Factors and characteristics of the aviation and aerospace industry that affect its strategic importance to the U.S. and to North Carolina are highlighted in Table 4.

Table 4 U.S. Aviation and Aerospace Quick Facts

Contributes over 15% U.S. Gross Domestic Product
Supports more than 15 million high quality jobs
Largest trade surplus of any U.S. manufacturing sector
600 million passengers flew commercial transport in 2006
More than 150 million passengers flew via general aviation in 2006
Enables e-commerce through overnight, mail and parcel delivery and just-in-time-manufacturing
26% aerospace personnel eligible for retirement by 2010; age of average production worker is 53 years, of engineers is 54 years

Source: Commission on the Future of the U.S. Aerospace Industry⁵

1. Globalization – Anyone, Anything, Anytime, Anywhere

Globalization is a major force driving interest and growth in both the aviation and aerospace sectors, with aviation delivering people and goods worldwide while satellites deliver information and support real-time communications that are necessary to worldwide operations. The picture is complex, turbulent and exciting as new players emerge, dominant companies re-engineer and the prospect of technological breakthroughs bridge the divide between air and space travel. In all areas, a limited but growing number of international firms recognize the irrelevance of borders



in their search for competitive advantage.

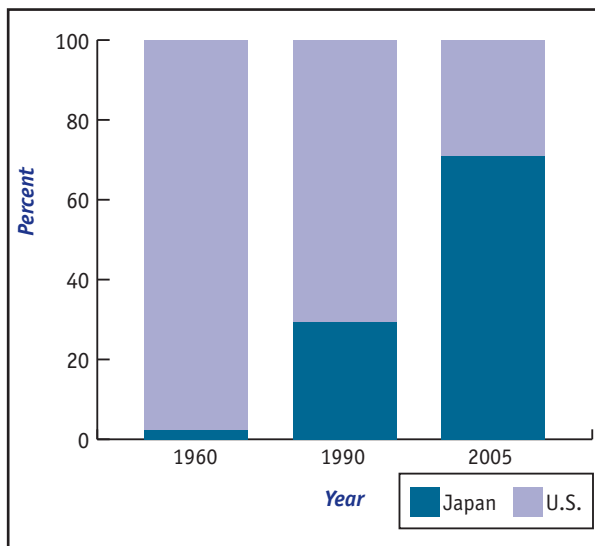
Consider the following:

- Emerging powers in Asia are moving rapidly to become dominant market makers in the next decade. Led by China and India, Asian countries currently place more than 40 percent of orders booked by Boeing and Airbus; by 2020 China alone is expected to account for 60 percent of these firms' orders.⁸
- Strategic partnerships in the industry are increasingly multinational. Italy's Fimmechanica partners with Northrup Grumman and other U.S. firms to make helicopters, satellites and space products.^{8, 19}
- The declining value of the dollar in global markets is increasing export opportunities for U.S. aerospace supply chains and raising demand from foreign aviation and aerospace firms for U.S. operations sites.
- France's Airbus already buys \$6 billion in U.S. goods each year, supporting 140,000 jobs in 40 states. Airbus' Greenplate product is produced in Europe but equipped in Louisiana.²⁰
- A growing proportion of components in Boeing's models, including its 787 Dreamliner, is being produced offshore (Figure 1). This is balanced against the large number of foreign firms locating operations in the U.S. France's Airbus Super Jumbo A380 has a greater proportion of U.S. supplied components than Boeing's 787.²¹

2. Leveraging Capacity and Complementary Assets

In 1903, North Carolina's strategic advantage for aviation was geography. Technology has caused that advantage to fade in importance. Today, with the industry "poised to embrace Earth orbit and the moon as full-fledged economic development zones"¹, our advantage has to be grounded in assets critical to technology-based development. Global businesses and military operations require

Figure 1 *Source of Parts in Major Boeing Models*⁸



world-class transportation and logistics capabilities, stellar professional education and skilled workforce training, and the innovative research and product development capacity to be competitive. Improving the state's capacity to build, operate and support leading-edge air and space transportation is strategic and benefits economic development efforts across all sectors and regions of North Carolina.

Strategic economic development efforts and investments enhance existing strengths and leverage complementary assets to achieve competitive advantage in arenas with potential for growth. Aviation and aerospace are recognized as strategic targets critical to the United States' national and economic security.^{8,22} Investments by North Carolina in these sectors will leverage existing capacities in education, workforce development, research and innovation, and transportation infrastructure. Investments in aviation and aerospace will enhance the ability of the state's businesses and industry to compete globally and will contribute to the state's ability to support and enhance another important economic asset, the military sector.

Education:

North Carolina’s colleges and universities have active education and research programs that span the full spectrum of disciplines that comprise traditional aviation and aerospace. The following institutions of higher learning in North Carolina have programs, departments, research thrusts or centers focused on topics relevant to aviation and aerospace:

- NC State University
- NC A&T State University
- UNC-Chapel Hill
- Duke University
- East Carolina University
- Elizabeth City State University
- Western Carolina University
- UNC-Charlotte

More than 1,200 degrees in fields relevant to aviation and aerospace were awarded in 2006 from North Carolina universities (Table 5).

In addition, various crosscutting university programs and centers directly support and enhance North Carolina’s aviation and aerospace firms’ ability to innovate and grow. As the industry continues to develop commercial space, the sorts of research and prototyping services offered by the research

and education centers is expected to grow in importance. Specializations and offerings available at North Carolina institutions include:

- Advanced research in aviation safety, flight systems and air traffic systems
- Advanced materials
- Accelerated stress testing of aircraft parts
- Agile manufacturing applied to low volume production
- Applied research in vertical lift aircraft
- Certification as aircraft parts manufacturers
- High confidence research systems
- Logistics
- Supply chain research
- Innovation management
- Maintenance science and technology
- Planetary, atmospheric and flight sciences
- Rapid prototyping
- Reverse engineering

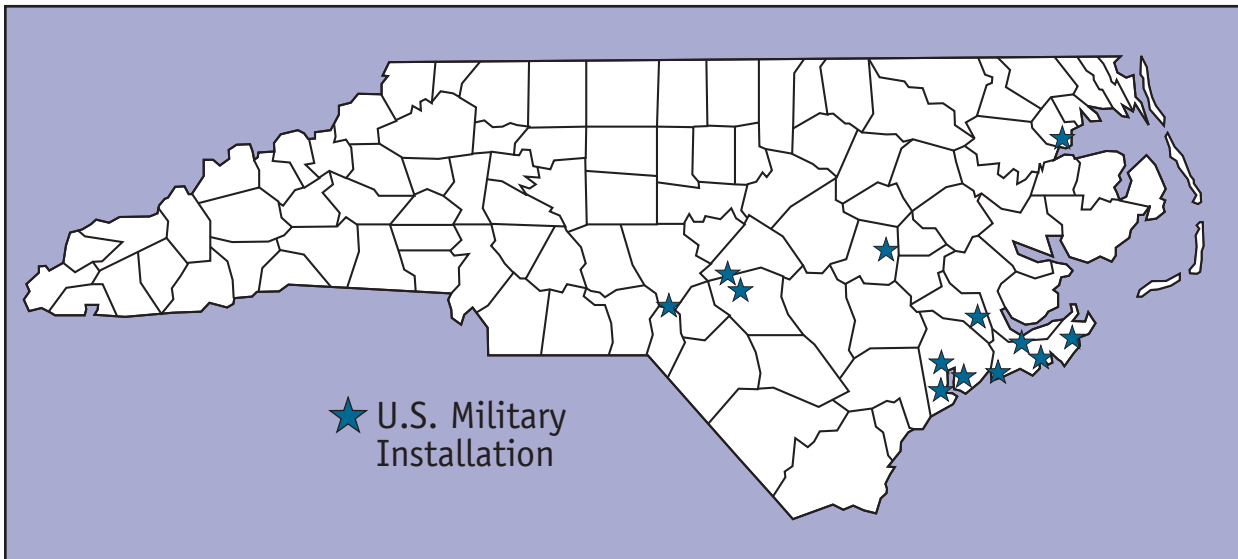
Complementary to the state’s university system is the North Carolina Community College System (NCCCS). The NCCCS produces highly skilled graduates trained in the specific skills needed in the aviation and aerospace industry (see **Meeting the Demand – Blueprint for a Solution**).

Table 5 N.C. Aviation and Aerospace-Related Degree Programs in 2006 ³

Program	Level and Number of Degrees		
	B.S.	M.S./M.E.	Ph.D.
Aerospace Engineering	32	10	3
Computer Engineering	185	37	12
Industrial Engineering	84	38	8
Materials Engineering	31	14	4
Mechanical Engineering	280	76	19
Mechanical Engineering & Materials Science	41	9	7
Computer Engineering Technology	30		
General Engineering Technology	12		
Engineering Industrial Management	15		
Industrial Technology	122	76	
Manufacturing Technology	21		
Mechanical Technology	76		
Total	929	260	53



Figure 2 Major U.S. Military Installations in North Carolina

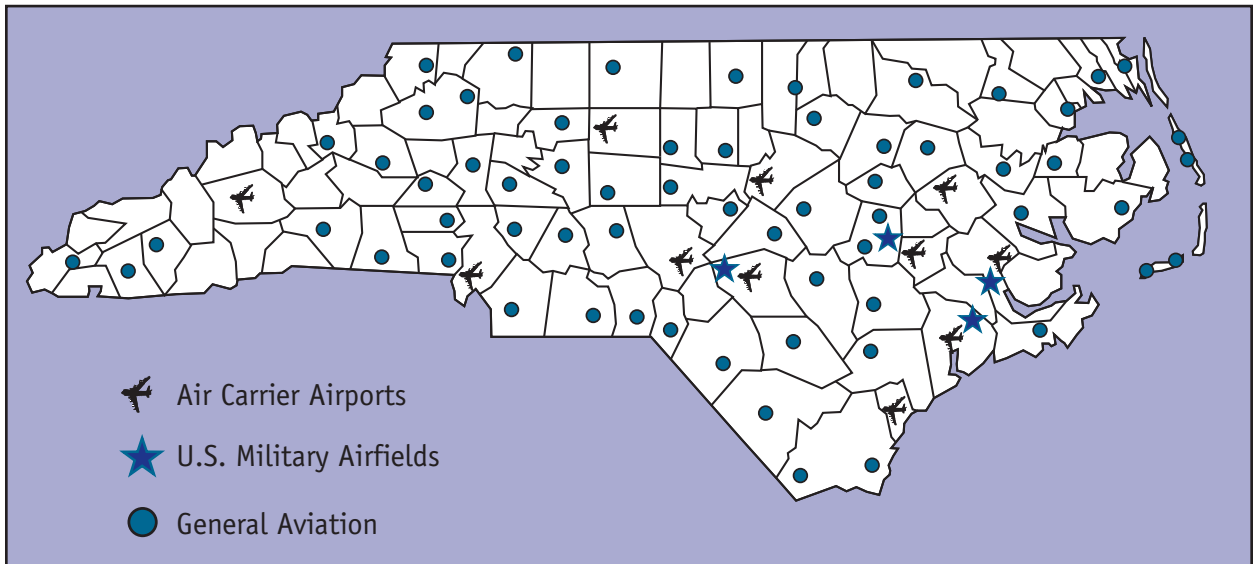


Military:

Defense-related contracts account for 86 percent of aviation and aerospace spending nationwide.²² Globalization is blurring the distinction between domestic and foreign defense companies overall, with the aviation and aerospace sectors leading other defense segments in the development of global operations. Technology transfer between the two sectors of the industry is raising security concerns among the U.S. military. There is increased interest in shortening the supply chain and avoiding a growing dependence by the military on foreign manufacturers and services.⁸ Given the large scale of military operations in North Carolina, this is a promising development for North Carolina aerospace and aviation firms.

Eastern North Carolina has a number of major military installations with almost 120,000 active duty personnel and another 26,000 contract and National Guard employees (Figure 2). An influx of between 25,000 to 40,000 additional military and support personnel in strategically important units is expected over the next five years due to a realignment of base capacities and missions. Collectively, the military accounts for seven percent of the total state gross product, with more than \$18 billion in direct economic impact, a portion of which is injected into each of the state's 100 counties.²² Personnel separating from the military represent a workforce base that could be a great resource for the aviation and aerospace industry.

Figure 3 *Aviation and Aerospace Infrastructure in North Carolina*



Source: N.C. Department of Transportation, Division of Aviation

Infrastructure:

With airports and related facilities geographically dispersed throughout the state (Figure 3), North Carolina has the capacity to support efforts to grow the aviation and aerospace industry statewide. More specifically, three attributes are identified as being critical to expanding the state’s presence in this industry: runway facilities, repair operations and room to grow. Fifteen of the state’s airports have the runway capacity and complementary assets to be of significance to efforts to grow this industry; three additional large airports are military. Fourteen of the airports have major repair operations on-site. Two, Piedmont Triad in Greensboro, and the Global Transpark (GTP) in Kinston, combine long runways with facilities for major repairs, low levels of commercial air traffic and specialized training facilities. These facilities are among the very few training locations on the East Coast that have ready access to aircraft and settings for training purposes. GTP is home to a state-of-the-art training facility that houses Lenoir Community College’s Advanced Machining Center. Guilford Technical Community College’s Davis Aviation Center location on airport property facilitates its training programs for pilots, aviation managers and maintenance personnel.

3. Competitive Advantage

North Carolina has established its reputation for forward thinking strategic investment in technology-based economic development. This has been the basis of the state’s competitive advantage over the past fifty years. Evidence of this is the investment in the Research Triangle, which has transformed our economy and placed the state at the forefront of developments in biotechnology, pharmaceuticals, computer networks, and imaging and gaming technologies. The state has made significant investments in infrastructure and training that supports advanced manufacturing. North Carolina’s universities have in place established mechanisms to transfer product and process technologies from university labs into the state’s industries. These investments and practices are enhancing the competitiveness of even the most traditional of our industries. This model has been reduced to practice, making the path to follow in developing aviation and aerospace in North Carolina a familiar one.



Economic development efforts are more likely to succeed when they leverage existing strengths, not when they pursue the latest trend. While one might argue that a fully developed air and space transportation cluster does not exist in any region of North Carolina, the state overall does have a sizable presence in this industry that can serve as the basis for targeted development efforts (Table 6). The state has a diverse and expanding base of producers, suppliers and support organizations active in growing segments of the aviation industry. Seven of the top ten global air defense companies have North Carolina operations (Table 7). Concentrated in the Piedmont and Eastern regions of the state, these air defense companies operate a total of 26 facilities that employ over 2,500 workers. Although geographically dispersed, the state’s centers of aviation activity and research could coalesce to form the critical mass needed to make North Carolina as a whole more competitive in the aviation and aerospace industry.

In the emerging commercial space sector (including global information systems, global positioning systems and remote sensing satellites) the state has only a limited presence. However, North Carolina’s strengths in aircraft and parts manufacture and its rich innovation resources can be extended into the space sector through targeted workforce development and research and development programs.

The ultimate leverage in economic development terms comes in the form of building a true industry cluster, a mutually supporting system of producers, suppliers and support organizations. The basis for cluster development already resides in North Carolina’s strong manufacturing and technology supply sectors (Table 8).³ Further strategic investments to grow the aviation and aerospace cluster will also enhance the competitiveness of other industries in the state that are served by the cluster’s suppliers. The many industries and institutions that are dependent on strong air transportation services will benefit as well.

Table 6 N.C. Aviation and Aerospace Quick Facts

353 aviation and aerospace companies
23,422 aviation and aerospace workers
More than \$1.6 billion in earnings
65,000 additional jobs provided by broader aerospace cluster
\$11.8 billion total economic impact
35% higher average wages than overall N.C. average

Table 7 Top-Ten Global Air Defense Companies in N.C.

U.S. Rank	World Rank	Company	Percent Revenue from Defense
1	1	Lockheed Martin*	98
2	2	Boeing*	56
3	3	Northrup Grumman*	76
4	5	Raytheon*	83
5	6	Gen. Dynamics*	78
6	8	L-3 Communications*	91
7	10	Halliburton	36
8	12	United Technologies	16
9	13	Scientific Applications Int’l.	69
10	14	General Electric*	2

*Indicates operations in N.C.

Table 8 N.C. Aerospace Manufacturing Supply Chain Strengths

Aircraft Engines and Engine Parts
Architectural and Engineering Firms
Electronic Components
Management of Companies and Enterprises
Plastics and Plumbing Fixtures
Professional and Technical Services
Semiconductors/Device Manufacturing
Wholesale Trade

B. Potential for Growth

States, like individuals, seek investment options with the greatest growth potential. The alignment of a number of factors is improving prospects for return in this sector. Growing demand from developing nations, the declining value of the dollar in global markets, technological advances strengthening the bridge between aviation and commercial space, advances in technology and materials, new space-based applications and services and increased defense spending are all contributing to growth in the aviation and aerospace industry. Illustrative examples include the following:

1. Aviation

Growth in the aviation sector is strong as it recovers from spiraling losses dating from the events of September 2001. For example, industry giant Boeing Corporation set sales records this year with both civilian and military demand for aircraft increasing. Across the industry, developing nations account for much of the growing demand. China alone accounted for 300 new orders in 2005.⁸

2. Commercial Space

Approximately one-tenth the size of the aviation sector, commercial space is significant and growing. Total U.S. space employment exceeds 550,000 and has total economic impact of almost \$100 billion. Satellite sales have grown 6.7 percent annually since 2000 to \$88.8 billion, while the U.S. share of the market has dropped from 46 percent to 33 percent since 2004.²³ Expected increases in outsourcing by NASA will create opportunities for states, such as North Carolina, with nascent space clusters that concentrate in the supply chain segments.

3. Defense

Increased international trade is raising concerns in the aerospace industry about inappropriate technology transfer and competition for critical natural resources and raw materials for production. Security concerns are increasing pressure on the military to develop resources locally. Proximity to

suppliers and to critical resources (such as titanium mined in North Carolina) is becoming a factor that favors development of North Carolina's aerospace cluster to better serve the state's growing military installations. With the third highest military population in the U.S., North Carolina ranks 15th in the nation in the number of companies with Department of Defense aviation and aerospace contracts, but ranks 33rd in contract dollar amount.³ In an environment favoring increased activity with local firms, there is strong potential for significant growth in this sector.

4. Refurbishing, Maintenance and Overhaul (RMO)

Aviation is just entering a rapid expansion phase, with projections of the number of passenger aircraft in service set to double, going from 12,676 at the end of 2005 to 27,307 by 2025. The pace and scale of the extra demand means that one-third of the planes currently in service will be retired.²⁴ Growing pains from this demand surge will result in ever-increasing need for refurbishment, maintenance and overhaul (RMO) of aging equipment. Reverse engineering and advanced and agile manufacturing will become even more important factors in operations. North Carolina already has programs and resources in place to support the full spectrum of repair, reverse engineering and rapid prototyping required to support turnkey RMO operations in both civilian and military markets.

5. Technological and Process Innovation

Innovation happens at the juncture of discipline-based research and its applications. Co-location in North Carolina of active research and development centers and supply chains that cross the boundaries between military and civilian clients and between aviation and aerospace applications creates an environment where technological and process innovation are much more likely to occur. North Carolina has already made significant investments in advanced manufacturing, logistics, material science and information and nano-technologies that could generate spillover benefits and early adopter advantages in the state's aviation and aerospace sectors.



C. Creation of High Quality, Value-Added Jobs

1. Needed — More and Better Jobs

North Carolina is a state of extremes when it comes to jobs. The state has highly educated and skilled workers that make it strongly competitive in a number of growing sectors, placing it high in the second quartile in the U.S. in its percentage of high tech companies. Countering this is a steady and permanent loss of jobs in our legacy industries of textiles, apparel, furniture and tobacco-dominated agriculture, all of which have been vanishing from the U.S. for lower-wage locations.

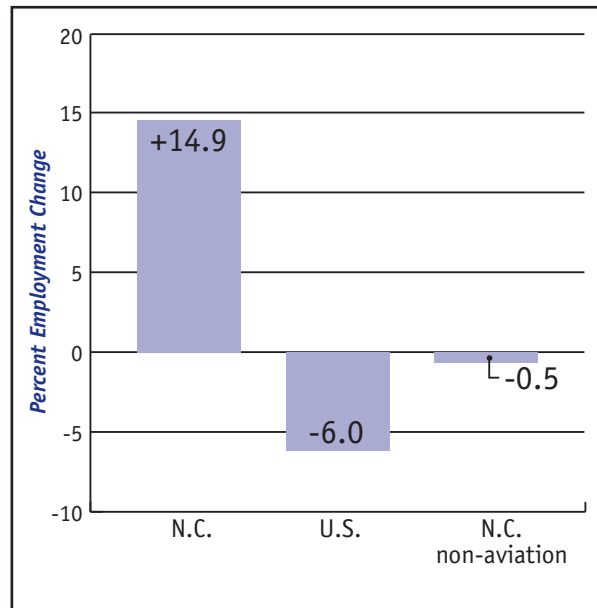
Two intertwined and disturbing employment forces should focus attention on the critical need to invest in areas with more promise, such as aviation and aerospace. The North Carolina Department of Commerce reported in 2007 that *twenty-one of the twenty-five fastest declining jobs are in the manufacturing sector, while twenty-one of the twenty-five fastest growing industries pay less than 80 percent of the manufacturing wages they are replacing.* In other words, North Carolina is creating lower-wage jobs faster than higher-wage jobs.

Aviation and aerospace could be part of the solution our state needs. Extensive analysis indicates that there is strong skills compatibility between many of the jobs in decline and those in several of the aviation and aerospace segments.³ Programs to refocus and fine-tune these existing job skills to a new industry setting and related apprenticeship programs already exist in the state.

2. Quality Job Growth in Aviation and Aerospace

While the industry baseline in North Carolina is generally small, it is growing and it spans the spectrum of aviation sectors (14 of 17 NAICS sectors) as well as the state's geography. Job growth in aviation and aerospace in the state has outpaced that in the nation overall since 2001. When scheduled air transport was removed, North Carolina experienced a nearly 15 percent increase in aviation employment between 2001 and 2006, whereas the national total decreased

Figure 4 Aviation Employment Change (2001-06)³



nearly six percent and non-aviation sectors experienced a one-half percent loss (Figure 4). Sizable increases in aircraft manufacturing, aircraft engine and engine part manufacturing, instrument manufacturing, schedule freight operations, non-scheduled passenger transportation, aircraft maintenance and repair, satellite communication and flight school training fueled the sector's growth in the state.³ Moreover, the jobs are highly desirable, with wages averaging approximately 30 percent higher than the state's average annual pay — \$46,582 compared to \$35,764 in 2005.³

3. Meeting the Demand – Blueprint for a Solution

Sustaining this growth will be challenging if serious workforce development issues are not resolved. Projections for new and replacement workers at all levels in the industry are seriously out-of-balance with the supply graduating from existing training and education programs (Table 9). There are too few workers with appropriate education and skills. With 25 percent of the state’s workforce scheduled to retire by 2020, North Carolina will face the problem of too few workers in general. The problem is even more acute in the aviation and aerospace sectors where the average age is higher than in most sectors. There is a strong need to

raise awareness among incumbent workers and students regarding the opportunities that exist for high-value employment in this industry.

The N.C. Community College System (NCCCS) is a critical partner in solving this skilled worker gap. This statewide system of 58 campus locations includes a number with intensive aviation and aerospace programs. Along with eight universities with programs in aviation and aerospace (page 8), this education and training infrastructure can provide the hands-on training needed for many of these occupations. However future job demand indicates a need to ratchet-up the NCCCS apprenticeship programs, in cooperation with companies in this sector.

Table 9 *Projected Demand for Aviation and Aerospace Workers in N.C.*³

Occupation	Projected Demand			Projected Output of Existing Training/Ed Programs
	New Positions	Replacement Workers	Total Projections	
Aerospace Engineers (AE)	330	221	551	195
AE and Operations Technicians	50	27	77	0
Machinists	748	1,453	2,201	1,020
Assemblers	138	76	214	NA
Aircraft Mechanics/Service Technicians	429	601	1,030	8
Airline Pilots	449	849	1,298	NA
Flight Attendants	150	114	264	NA
Total Positions	2,294	3,341	5,635	1,223

D. Support for Balanced Geographic Growth Objectives

Balanced growth is an established goal for economic development in North Carolina that translates as “No region left behind”. The diversity of geography, population densities, infrastructure and socio-economic mix have made this goal challenging. Aviation and aerospace represents an especially promising opportunity to integrate the goals of balanced growth and economic development because this sector already has strong presence in all regions of the state (Figure 5).

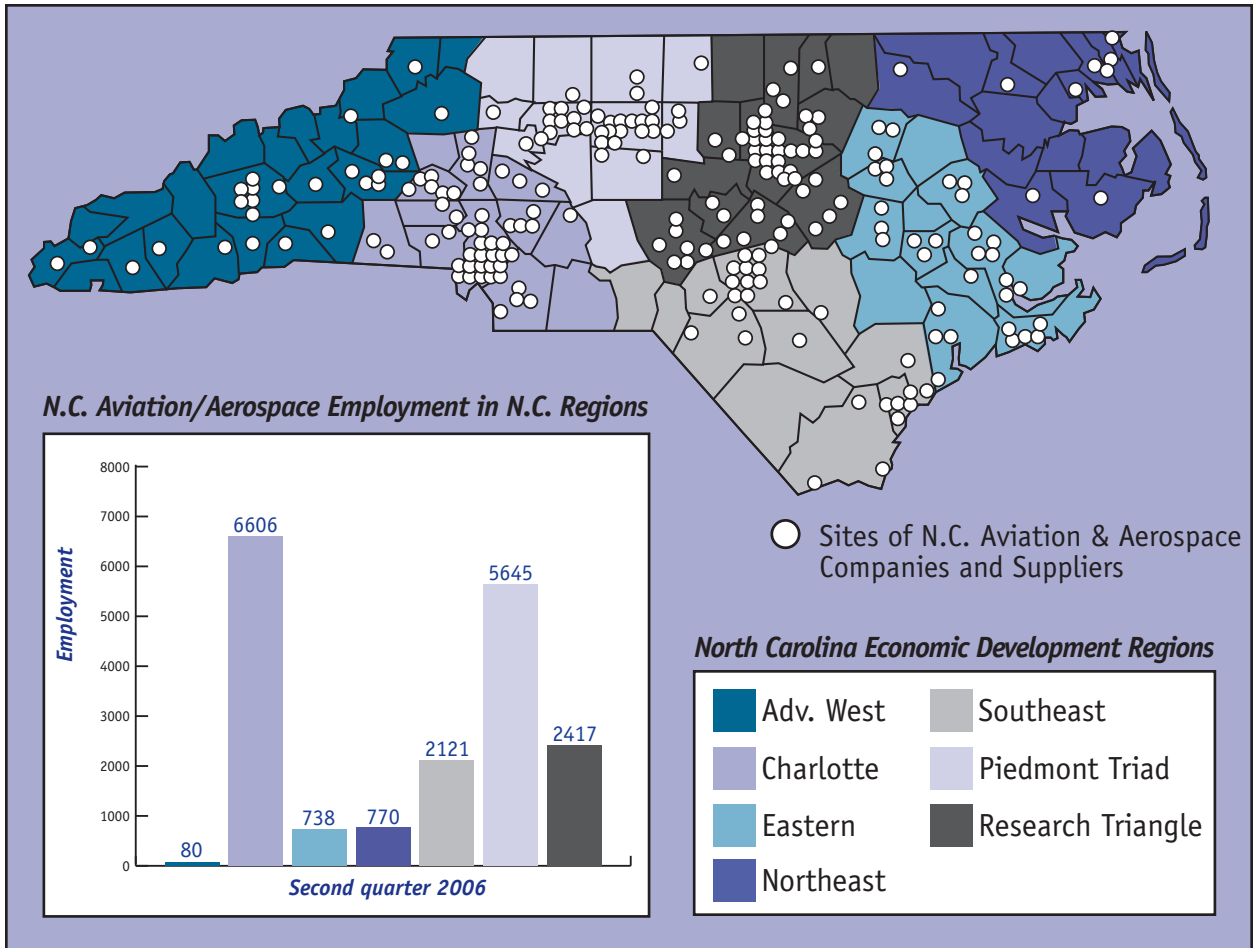
Policies and investments that build a skilled workforce, nurture innovations, and encourage interactions among the players in the aviation and aerospace cluster will inevitably have spillover benefits in all regions. Groundwork to build local awareness and support for pursuing this industry has already been laid through local presentations of regional cluster studies that examined existing and growing strengths in aviation and related support services¹ to leaders in each of the seven economic development regions of the state. Three of the seven regions self-identified aviation and aerospace as a promising cluster, including aviation in North Carolina’s Eastern Region and logistics and distribution in the Piedmont Triad, Eastern and Southeastern regions.

1. Existing Aviation Infrastructure

Quality, location and relative congestion factors are key determinants of success in the aviation and aerospace industry. North Carolina’s air transportation resources are well distributed according to size, geography and type (Figure 3). The Federal Aviation Administration lists 415 aviation facilities in North Carolina.²⁵ The state is home to 74 publicly owned airports, including 11 commercial airports and 63 general aviation airports that support chartered and private air service. In addition, there are more than 300 privately owned airports, 4 stolports (airports with very short runways), 78 heliports, 3 ultralight-only facilities, 1 balloonport, and 1 gliderport.

Of special note are the Piedmont Triad Airport in Greensboro and the Global TransPark in Kinston. These are attractive locations with long runways, limited congestion, room for expansion, and education resources to help transition displaced workers through targeted training. What they offer prospective aviation and aerospace tenant companies are turnkey industrial sites with exemplary support and training services. What these locations offer the state is an opportunity to link these regions’ economic futures to a growing, technology-based global sector that can catapult the regions beyond their traditional industrial past.

Figure 5 N.C. Aviation and Aerospace Companies/Suppliers Locations and Employment



2. Innovation Resources

As with other technology-intensive sectors, including biotechnology, nanotechnology, and information technology, innovation is the competitive lifeblood of the aviation and aerospace industry and the cluster of supply and service organizations that support it. Fortunately, the statewide distribution of resources critical to developing innovative processes and technologies in air and space transportation that

already exist adds support to this industry's capacity to broadly benefit the entire state. Basic and applied research and development, contract research, reverse engineering, defense-related business incubators, defense technology transfer facilitators, seed capital, R&D tax credits, and a robust entrepreneurial services network combine to offer a rich array of support to develop, prototype, test, and bring to scale aerospace innovations.

V. Questions Answered: Aviation and Aerospace Can Contribute to Economic Development in North Carolina

The basic premise behind industry cluster-based economic development is one of leverage, where the whole is greater than the sum of its parts. We know what is here in North Carolina in terms of firms, R&D programs and support services that are active in the aviation and aerospace sectors of the air transportation industry. Primary findings are summarized below.

- North Carolina has critical mass in the aviation and aerospace sector and this sector is geographically dispersed in the state.
- North Carolina has a favorable mix of aviation and aerospace segments, with the strongest presence in those sectors that are growing fastest – engine, engine parts and replacement parts manufacturing, maintenance and repair and emerging very light jet markets.
- Aviation and aerospace makes significant and growing contributions to North Carolina's economy, paying wages that exceed overall state average earnings.
- North Carolina's innovation support system related to aviation and aerospace is strong, including NC State University, NC A&T University, UNC Chapel Hill, UNC Charlotte, Duke University, the NC Community College System, the NC Aerospace Alliance, and the Golden LEAF Foundation.
- The availability of a skilled workforce is documented as a rate-limiting factor in the development of the aviation and aerospace cluster in the U.S. and worldwide. However...
- North Carolina's already considerable military aviation operations are expanding significantly, with thousands of military and civilian contractors coming to the state's six military installations as a result of national base realignments, and...
- Annually, 12,000 skilled military personnel retire from N.C.-based installations, many with training relevant to potential aviation and aerospace employers.

Two primary conclusions can be drawn from these findings:

- 1) Aviation and aerospace sectors have prospects that are promising enough to warrant the state's investment of its available economic development resources; and
- 2) North Carolina has in place the infrastructure, innovation resources and workforce development capacity to be more broadly attractive to this industry. We can provide an environment that can build competitive advantage to aviation and aerospace and the emerging commercial space sectors.

In North Carolina, synergies exist between the aviation/aerospace and commercial space sectors. Real potential for growth, complementary technologies and workforce benefits for other industries suggests that a window of opportunity is open to create a true, self-sustaining global aviation and aerospace cluster in North Carolina. We can, and should, act on this opportunity.

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