



Kentucky Commission on Military Affairs &
the Commonwealth of Kentucky

The Kentucky Aerospace & Aviation Industry Study

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Aerospace & Aviation Industry Overview



Kentucky Governor Matt Bevin

“As Governor, my vision is that Kentucky would become the center for engineering and manufacturing excellence in the United States. That’s why I am excited about the economic opportunities posed by our state’s growing Aerospace and Defense industries. Aerospace manufactured products have quickly become our state’s #1 export at \$10.85 billion in 2016, a figure that ranks Kentucky second nationally in this category. Kentucky’s tremendous logistical capability, our central geographic location, a low cost of living, and our business friendly environment, are contributing factors to this success and give our state great potential for the future. As aerospace companies seek growth opportunities in the Midwest and South, Kentucky is well positioned to see this industry continue to expand throughout the commonwealth.”

Kentucky Governor Matt Bevin



Kentucky Lt. Governor Jenean Hampton

“Growing up in the 1960’s, I’d often wake up early to watch the rocket launches from Cape Canaveral. NASA and the space program inspired me to dream BIG dreams. Even though I didn’t become an astronaut, I’ve never forgotten the curiosity, optimism and excitement of that period. As Lt. Governor, I’m absolutely thrilled to help Kentucky’s aviation and aerospace industry grow. I helped start the Kentucky Aerospace Industry Consortium, support STEM education programs, and promote advanced manufacturing as a rewarding career path. This study is paramount to help us understand Kentucky’s aerospace/aviation potential as we become a hub of manufacturing excellence.”

Lt. Governor Jenean Hampton



Project Foreword

Over the past five years, aerospace exports in Kentucky have begun to take off. In the early 2000s, aerospace exports hovered slightly over a few billion dollars. By 2013, however, export activity started to change and in 2015, we had generated over \$8.7 billion in exports. This surge was enough to push the Commonwealth to #3 nationally in export activity. This sweeping growth was quickly recognized, and in the 2015 legislative session, the General Assembly passed House Joint Resolution 100 to mandate this study of the aviation, aerospace, and defense supply chains. Through intense and thorough research, it has uncovered and highlighted many of the incredible statistics, companies, universities, and research underway throughout our state. By the end of 2016, Kentucky's aerospace exports had grown to \$10.85 billion, which makes the Commonwealth #2 in the United States, behind only the state of Washington. This industry is poised to have an enormous and positive impact for all Kentuckians.

Aerospace growth goes way beyond just exports for Kentucky. It has also expanded in the number of companies involved and the individuals looking to make an impact in this arena. For many years, we have had an impact in the automobile industry with large and well-known companies like Toyota, Ford, and Chevrolet. Naturally, this has brought many automobile parts suppliers and manufacturers into the area. As aerospace product manufacturing began to rise regionally many of these companies that made pieces and parts for automobiles, began to use their skills and capabilities to do the same thing within the aerospace industry. At the beginning of this study, the Kentucky Cabinet for Economic Development listed 60 companies involved in aerospace in the state. Through the study, we discovered that Kentucky is home to more than 600 businesses involved in the aerospace and aviation cluster. These companies range from large to small and account for over 17,500 jobs.

While many of these 600+ companies are medium to small in terms of size, some are the larger aerospace and defense companies to include; Raytheon, Lockheed Martin, GE Aviation, Belcan, BAE, and Safran Landing Systems. These companies have relocated and expanded in Kentucky in large part due to a pro-business environment, low-energy costs, and low taxes. Safran has continuously expanded its operations and is currently working on its fifth expansion since 1999. In fact, if you fly commercially there is a high percentage chance that the brakes your aircraft landed on were manufactured at the Safran facility located in Walton, Kentucky.

In addition to the many manufacturers, Kentucky is also home to large logistical operations at the UPS Worldport in Louisville (SDF), and a DHL Hub in the Northern Kentucky Airport (CVG). This has given us a large and unique capability in moving and exporting aerospace products throughout the nation and the world. As the aerospace industry continues to grow and expand throughout the Midwest and South, our incredible logistical strength has the potential to make Kentucky the focal point for the export of aerospace products and parts for the entire region. To add to our already overwhelming logistical capabilities, Amazon Prime announced early in 2017, that it would be investing \$1.5 billion in a prime air hub at the Northern Kentucky Airport. This will serve to further increase CVG's already incredible shipping and receiving capabilities. CVG has a daily flight to France that flies whether or not there is even one passenger on board. The reason for this is the value of the aerospace products shipped in the cargo hold. Kentucky proves time and time again that in a world where the ability to reach customers globally is key to success, it can truly deliver.

Aerospace & Aviation Industry Overview

Global logistics infrastructure is a big reason why many companies are looking to do more business with our Commonwealth. This advantage is not just a positive for the larger companies, but also for the small to medium size businesses in aviation and aerospace cluster. These Kentucky based companies make an incredible array of parts for both military and civilian aircraft. Phoenix Products makes parts for the Blackhawk Helicopter, C-130 and the F-16. Foam Design supplies for the MV-22 Osprey. Meggitt has parts on the E-3A as well as braking systems on many other various aircraft. A.C.E. Compressor builds remanufactured air compressors. Highlands Diversified Services makes armrests and seat parts for commercial airliners. In addition, over 30 Kentucky companies supply Boeing in Charleston, South Carolina. The list of companies in our state contributing to America's aircraft and airpower goes on and on.

Many of these companies are making an impact on the space side of the equation as well. Space Tango, in Lexington, Kentucky, is one of only a handful of companies in the world that has their very own lab on the International Space Station (ISS). They have the capability to deliver to their clients the ability to conduct tests and experiments in micro-gravity. Their lab completes all experiments autonomously, without continuous interaction from ISS astronauts. They can, however, communicate directly with astronauts through a live feed from their Lexington office as they install experiments into the lab on the ISS. Space Tango is pushing into a new frontier in micro-gravity by taking a new approach when looking at space research. Most money spent in space is on looking outward to what is beyond Earth. Space Tango looks at space and micro-gravity and seeks to find how they can use these exotic environments to positively impact our lives on earth. They are completing this mission by finding new ways to use micro-gravity to manufacture products that cannot be built within Earth's gravity, and conducting bio-medical testing through their affiliate, Exomedicine. Until a few years ago the term exomedicine, which seeks to understand better ways to treat illnesses or diseases, did not exist. Now individuals worldwide are making calls to one of Exomedicine's founders, Kris Kimel, to see where they can pursue a Ph.D. on the subject.

Discussing aerospace in Kentucky would not be complete without talking about how our education opportunities are also breaking new ground, and influencing the aviation and aerospace industries worldwide. For many years, we have held the standard for aviation based stem high school education. With 38 schools involved in this program in the past that provided four different pathways for students, Kentucky changed the way our young minds viewed aviation and aerospace. Kentucky officials are continuing to re-work this program so that all schools have the ability to expose their students to possibilities available in aviation and aerospace.

Kentucky universities are also making a huge difference, and each in their own unique way. The University of Louisville (UofL) supports research in micro and nanotechnology, advanced materials, biotechnology, and advanced manufacturing at their Micro/Nano Technology Center. UofL, along with Western Kentucky University are also conducting International Space Station (ISS) experiments to understand colloid material behavior to enhance solar cell performance. In partnership with NASA Kentucky, the University of Kentucky (UK), and Kentucky State University led the development of Next-Generation Entry Thermal Protection. This will be beneficial to both small and large satellites. UK also conducts Unmanned Aerial Systems research in their Mechanical Engineering Department. Eastern Kentucky University is making waves in their aviation department as one of the top pilot training programs in the nation.

Some of the most incredible work in aerospace, however, happens at Morehead State University (MSU) in eastern Kentucky led by Dr. Benjamin Malphrus. MSU not only is one of the leaders in cubesat and other



small satellite technologies, but is also now part of the NASA Deep Space Network (DSN). This makes MSU the only non-NASA asset to have that honor. To date, MSU has launched five satellites into space, and will have their sixth released from the ISS in June 2017. One of their most incredible endeavors comes in 2018, where they will release a satellite mission called “Lunar Ice Cube” from the first launch of the new NASA Space Launch System. The NASA Space Launch System will be the largest rocket ever created. MSU’s Lunar Ice Cube mission will be to travel to the moon to look for potential ice formations, a critical building block for future NASA moon missions.

So what is next? As you can see, Kentucky is participating at the forefront of new frontiers, and is pushing the boundaries of technology. The innovation and participation of companies, universities, and individuals will continue to propel our state to the top of the aerospace industry in exports and other categories. The Commonwealth’s biggest battle moving forward is perception. Most people in state and out of state are completely unaware of the impact we are having on aerospace. We need to act now to unite, promote, and grow this industry in order to solidify itself as a focal point in a growing aerospace region throughout the Midwest and South. Companies in aerospace continue to relocate in these areas for their business friendly policies, lower taxes, lower energy costs, and lower costs of living. Promotion of the industry will help grow businesses currently in Kentucky, but will also help attract new businesses to relocate. It will also increase awareness of the career opportunities in these thriving industries for our citizens.

As you can see, Kentucky is having a vast impact on the aerospace industry. This, however, is only a small portion of what is happening throughout the Commonwealth. To continue this momentum, state officials need to ensure they make the right steps to continue to strengthen this industry. Great strides have been made in the promotion and unification of the aerospace industry through the creation of the Kentucky Aerospace Industry Consortium by Governor Matt Bevin, and Lt. Governor Jenean Hampton. This organization will be key moving forward to grow the aerospace industry and create a brand for Kentucky Aerospace. The Commonwealth has also shown its commitment to the industry through the recruitment of Braidy Industries to relocate to Kentucky and invest \$1.3 billion to build an aluminum mill in Greenup County. Some of the aluminum produced at this facility will be aerospace grade material suitable for many manufacturers and suppliers in the aerospace industries. This proves that our state is serious about aerospace and is poised to continue to make a huge impact.

Fifty years ago, most technological innovations were accomplished by governments, large companies, or major universities. However, we currently live in a world of rapidly growing technological capability. As that capability grows, it also shrinks in physical size. This has allowed smaller companies and individuals to create disruptive technologies or to have an impact on any industry globally. Want proof? Look no further than Kentucky with its robust and growing aerospace industry.

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Project Manager

Kentucky Commission on Military Affairs

Project Overview

Aerospace and Aviation are two industries rising to new prominence in Kentucky. Because of Kentucky's strong military identity with installations such as Ft. Knox, Ft. Campbell, and Bluegrass Army Depot, opportunities for Kentucky to benefit from defense contracting are coming into focus. The nature of national defense and its ties to aerospace and aviation means opportunities in each sector must be considered as well as understanding where they overlap.

In a move to assure Kentucky realizes its full potential to leverage these opportunities, the Kentucky General Assembly passed House Joint Resolution 100 (HJR100) in 2015. The resolution directed the Kentucky Commission on Military Affairs (KCMA), the Kentucky Transportation Cabinet (KyTC), and the Cabinet for Economic Development (CED) to study the economic impact of the overall aerospace/aviation industry in the commonwealth and to report the findings to the Governor and the Legislative Research Commission (LRC).

Following a competitive bidding process, a consulting team led by Thomas P. Miller and Associates (TPMA) was selected to provide the partner agencies listed in the resolution with a study analyzing the Aerospace, Aviation, and Defense industry sectors. TPMA was charged with determining the annual economic impact, potential growth areas, education and workforce development issues, developing recommendations for sustained growth, and creating an online, interactive, data-driven mapping tool. The study and subsequent mapping tool will enable Kentucky companies to understand and participate in the aerospace, aviation, and defense industries. Civic leaders and policy-makers will benefit from an effective, updated source to inform the legislative process and drive increased employment in this sector.

To better understand the aerospace and aviation industries in Kentucky, TPMA utilized several sources of quantitative and qualitative data over the year-long project. In addition to the myriad of data sources accessed for quantitative review, representatives with TPMA hosted several topic-specific focus groups with industry leaders across Kentucky. Targeted interviews further refined the qualitative feedback, ultimately providing a more rich and in-depth analysis of the aerospace, aviation, and defense industries in the state.

In addition, representatives of the TPMA team attended marketing and other public presentation opportunities to provide progress updates and gather additional viewpoints from across the state. Reports and presentations were provided to the project steering committee, legislators, Kentucky's Aviation Day Conference, and the Kentuckians for Better Transportation Conference.

In 2016, Kentucky's total aerospace and aviation exports surpassed those of all but one state. The companies that make up these industries provide good-paying, high-skilled jobs for Kentuckians across the commonwealth and immense state and local economic impact. Leading edge research and development and the resulting innovations is pushing the sector to new heights.



Several common themes, synergies, and obstacles exist in both the civilian aerospace and aviation industries and the defense industry in Kentucky. Each sector also has its own set of dynamic characteristics. In order to provide the most comprehensive analysis at each of the two areas, TPMA and the project team present this report into two distinct sections:

- The Kentucky Aerospace and Aviation Industry Study
- The Kentucky Defense Industry Study

The Kentucky Aerospace & Aviation Industry Study Team

Prime Consultant –



THOMAS P. MILLER & ASSOCIATES

Consulting Team –



Lieutenant General
(Ret.) Benjamin
Freakley



Fourth Economy
Consulting



R.A. Wiedemann &
Associates



Business
Development Zone

Web and Mobile Visualization –



Heartland Communications
Consultants

Executive Summary

Key Findings

The following represent the most high-level findings from the analysis of Kentucky's Aerospace and Aviation industry. Additional and more detailed findings on specific topics are highlighted in the chapters that follow.

- With more than \$10.85 billion in goods exported internationally, Kentucky ranks second nationally in aerospace-related exports.
- Kentucky is home to more than 630 businesses in the Aerospace & Aviation cluster.
- There are 1,500 more companies related to this cluster in some way with more than 150 unique industry classifications represented.
- Supply chain potential is significant with Kentucky firms in the Aerospace Products industry spending \$316 million annually purchasing products outside Kentucky. Firms in the Aviation Services group spend an estimated \$344 to import products from outside the state.
- Among the commonwealth's unique Aerospace & Aviation assets are facilities like the Morehead State Science Center, the Micro/Nano Technology Center at the University of Louisville, research on thermal re-entry systems at the University of Kentucky, organizations such as Space Tango, manufacturers such as Safran Landing systems, and initiatives like the constellation satellites developed in Kentucky.
- Kentucky's Aerospace & Aviation cluster accounts for over 17,500 jobs and around \$1 billion in earnings.
- Aerospace and Aviation contribute \$3.4 billion in economic activity or 0.8% of the state's annual economic output.
- Of the 53 General Aviation (GA) airports in Kentucky, 28 have runways of 5,000 feet or more. This length is necessary to serve larger civilian aircraft and cargo planes.
- Kentucky is home to three major private-sector logistics hubs: DHL and Amazon in Northern Kentucky and UPS in Louisville.
- Six general aviation airports serve the Aerospace industry with 93 companies located in a close proximity to those facilities.
- To measure Kentucky's progress in realizing opportunities in the Aerospace and Aviation cluster, six states serve as benchmarks for their rankings in employment, research and development, or both. Those are: Alabama, Arizona, Indiana, Kansas, Ohio, and Washington.
- Of the top 15 occupations in Aerospace Products, about 30 percent are in Architecture and Engineering, and almost one-fourth are in the Production occupational group.
- The top three occupations in Kentucky's Aerospace industry are Industrial Engineers, Aircraft Mechanics & Service Technicians, and Team Assemblers.
- The occupations with the most potential for growth in Aerospace are Industrial Engineers and Aircraft Structure, Surfaces, Rigging, & Systems Assemblers.
- Of the top 15 occupations in Aviation Services, more than 60 percent are in the Installation, Maintenance, and Repair occupational group, with more than 20 percent in the Transportation and Material Moving group.



- The top three occupations in Kentucky’s Aviation Services sector are Aircraft Mechanics & Service Technicians, Commercial Pilots, and Airfield Operations Specialists.
- The occupations with the greatest potential for growth in Aviation Services are Commercial Pilots, Aircraft Mechanics & Service Technicians, and General & Operations Managers.
- Kentucky’s high school and postsecondary programs appear to offer an ample potential talent supply to meet the needs of the talent demand in Aerospace & Aviation key occupations.

Key Recommendations

The following is a preview of the recommendations for maximizing the economic potential of Kentucky’s Aerospace and Aviation industries. These recommendations are described in detail in the following chapters.

Capitalizing on Military Installations

- Utilize Airspace for Public-Private Partnerships
- Develop Mission Tracking Capabilities
- Include Military Human Resources and Recruiting Personnel in Aerospace & Aviation Sector Consortium
- Create and Promote Apprenticeships and Related Programs, Focusing on Military Installations in the State
- Explore the Creation of a Research and Technological Hub at Fort Knox
- Explore a Communications and Contracting Framework to Facilitate Defense Contracting
- Explore Becoming a Leader in Crash Investigation and Search and Rescue
- Explore Becoming a National/Regional Maintenance Hub for Military Fixed Wing and Rotary Aircraft

Leveraging Opportunities for Development

- Create an Aerospace and Aviation Consortium
- Establish a “Blue Ribbon Panel” for UAS
- Invest in University R&D
- Stimulate Connections with the Private Sector
- Conduct Efficiency Audits and Training
- Explore Preferred Vendor Certifications
- Create an Innovation Center
- Build a Culture of Commercialization
- Extend the Manufacturing Region Designation
- Create an Embedded Lab

Enhancing Workforce

- Establish Sector Partnerships
- Expand Apprenticeships
- Partner with Community Colleges

Promoting Policy

- Re-align Tax Policies and Incentives
- Expand and Target Advertising Capacity
- Leverage Appropriate Legislation
- Explore Human Capital Centered Incentives
- Develop an Advanced Manufacturing Tax Credit