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The Economic Contribution of the Duluth-Superior Aerospace Industry

A REPORT OF THE ECONOMIC IMPACT ANALYSIS PROGRAM

IN PARTNERSHIP WITH: NORTHERN AERO ALLIANCE, THE DEPARTMENT OF EMPLOYMENT AND ECONOMIC DEVELOPMENT, AND APEX. SUPPORTED BY: EDA CENTER UNIVERSITY OF MINNESOTA CROOKSTON

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Economic Contribution of the Duluth-Superior Aerospace Industry: Executive Summary

The following is a summary of the results of a recent University of Minnesota Extension study. The study was conducted in partnership with the Northern Aero Alliance, the Minnesota Department of Employment and Economic Development, and APEX. The research was supported by the EDA Center at the University of Minnesota-Crookston

- In the United States, there are 1.2 million jobs in the core aerospace industry. Nationally, Minnesota is ranked 23rd in the number of aerospace jobs and Wisconsin is ranked 36th.
- After reviewing national and state employment in the aerospace industry, major competitive states for Minnesota and Wisconsin in the aerospace industry include Kansas, Connecticut, Alabama, South Carolina, and Utah.
- Direct Impact: Under an expanded definition of the aerospace industry, there are an estimated 1,400 jobs in the aerospace industry in Duluth-Superior. This includes aerospace product manufacturers employing 430 people in the region, electric component manufacturers employing 371 people and aeronautical systems manufacturers employing 320 people.
- Total Impact: Based on 2012 estimates, the aerospace industry, including the Air National Guard, contributed \$988.0 million to the economy of the Duluth-Superior region. The industry supported 4,630 jobs, including jobs beyond the aerospace sector. Those jobs paid \$268.9 million in wages, salaries, and benefits to residents of the Duluth-Superior region.
- A survey of aerospace businesses indicates an aerospace supply chain exists in Duluth-Superior. Local aerospace businesses are interested in further development of the local supply chain.
- Businesses in the region cite general aviation aircraft sales as the most important industry trend. While local leaders may have little influence over this trend, they can assist with other trends like general business conditions, workforce development, and public perception of the industry.
- Business retention and expansion efforts could concentrate in two areas. First, local leaders may wish to address issues that affect all businesses (i.e. workforce development). Second, local leaders may consider assisting individual businesses (i.e. building and space needs).
- Both opportunities and threats exist for the aerospace industry in the region. Opportunities include building on current strengths such as increasing aviation training and developing the local supply chain. Examples of threats include the national economy and the lack of a strong national reputation as an aerospace hub.
- Businesses find value in current collaborations focused on developing and supporting the industry in the region. Suggestions for future joint efforts include: building on and increasing collaborations; building a national reputation as an aerospace hub; addressing workforce issues including training and education; and retaining individual businesses in the region.

PROJECT BACKGROUND

In February 2012, University of Minnesota Extension staff met with the Northern Aero Alliance to discuss research opportunities based on their application to the EDA Center. The Northern Aero Alliance is a coalition of businesses, government entities, and organizations whose mission is to support and promote the aviation industry in the Duluth-Superior region. The Northern Aero Alliance asked University of Minnesota Extension to conduct a comprehensive analysis of the current status of the aerospace industry in the region, its economic impact, and its potential for the future. This report summarizes the research. The research is supported by the EDA Center at the University of Minnesota-Crookston. Partners in the research include the Minnesota Department of Employment and Economic Development (DEED) and APEX.

Aviation and aviation-related manufacturing have been steady contributors to the economy of northeastern Minnesota and northwestern Wisconsin. Studies have demonstrated the value of the industry to the regional economy (Adiarde 2007, 2010). However, those studies were often hampered by two barriers. First, defining the aerospace industry is a complex and complicated task. A definitive definition of the industry does not exist and federal and state data classification schemes are not designed to fully capture the industry. Second, conducting research that includes both Wisconsin and Minnesota presents challenges. Several analyses of the industry were performed by Minnesota's Department of Employment and Economic Development. Therefore, the analysis was restricted to Minnesota. A more comprehensive study was completed in 2007, but its primary focus was on transportation-related aerospace with a secondary focus on manufacturing-related aerospace.

The research design used in this study was selected in order to address the issues related to quantifying the aerospace industry in Duluth-Superior. The aerospace industry is comprised of both transportation-related sectors (i.e. airports and fixed-based operators) and manufacturing-related sectors (i.e. airplanes and airplane parts). This research attempts to quantify the economic contribution of each sector in the region; however there is a slight emphasis on the manufacturing sector. Activities of the Air National Guard are also included.

The research design allows for a focus on the industry in both Wisconsin and Minnesota. All attempts were made to quantify contributions from businesses on both sides of the border. The region of study for the economic contribution is St. Louis County, Minnesota, and Douglas County, Wisconsin.

Finally, the research design bridges the gap between data available from state and federal government sources and local knowledge. The analysis begins by quantifying the industry using data from publicly-available resources. To supplement that data, 16 individual business surveys were conducted from March to September 2013. These business surveys provided critical insights into the size and scope of the industry, beyond the typical published data.

This report begins with an overview of the aerospace industry in the United States. This provides context for the industry in Minnesota and Wisconsin. The report then highlights public data on the industry for the Duluth-Superior region. Information from the business visits are incorporated into the data, quantifying the industry in the region. From there, the economic contribution of the industry is calculated. Finally, the report details responses from the business visits regarding the future of the industry in the region.

DEFINING AND MEASURING THE AEROSPACE INDUSTRY IN THE UNITED STATES, MINNESOTA, AND WISCONSIN

A definitive definition of the aerospace industry in the United States has not been established. Researchers exploring the role of the industry in the economy have generally taken two broad approaches to defining the industry. One approach is to define the industry based on the federal classification scheme known as the North American Industry Classification System (NAICS) (Drummond, Lann, and Youtie 2008; Chmura 2011). A second approach is to inventory local businesses in order to determine the level of activity related to the aerospace industry (Butler and Stefl 2010). This analysis takes a blended approach to defining the aerospace industry in Duluth - Superior.

Drummond, Lann, and Youtie (2008) argue for the definition of a “core” aerospace industry. Based entirely on the NAICS system, the core definition includes the following industries: aerospace product and parts manufacturing; search, detection, navigation, guidance, aeronautical and nautical systems and instrument manufacturing; air transportation services; and support activities for air transportation. Each of these industries clearly has an aerospace function in the primary definition of the industry (underlined). In this analysis, we consider these industries to be the core aerospace industry.

However, the industries included in the core definition do not represent the full range of businesses that contribute to the aerospace industry. There are other industries whose primary NAICS definition does not specifically relate to aerospace, but who have individual businesses with aerospace customers. To include the entire industry would be to include businesses who do not work in the aerospace industry. Not including the industry would result in critical contributors to the industry not being accounted for in the analysis.

To illustrate, consider research and development. Clearly, there are companies whose primary purpose is to conduct research and development for the aerospace industry. However, they may be classified in the NAICS code which aligns with the type of research and development they conduct. Engineering related to aerospace, as an example, may be classified as engineering services. Including the entire engineering services industry in the core aerospace industry would, however, classify all engineering in the economy as being related to aerospace, which would not accurately reflect the situation. This shortcoming makes the argument for a local survey of businesses to determine all aerospace-related activity.

Core Aerospace Definition

Aerospace products and parts manufacturing

Search, detection, navigation, guidance, aeronautical and nautical instrument manufacturing

Air transportation services

Support activities for air transportation

The Aerospace Industry's Role in the National Economy

In the United States, there are 1.2 million jobs in the core aerospace industry (table 1). The number of jobs in the industry grew moderately (2 percent) from 2010 to 2012. States with the highest number of aerospace jobs include California, Texas, and Washington. Nationally, Minnesota is ranked 23rd in the number of aerospace jobs and Wisconsin is ranked 36th.

In 2012, Minnesota recorded 16,700 jobs in the core aerospace industry. Growth in the industry has been at a pace similar to that of national growth (2.2 percent in Minnesota, 2.0 percent in United States). Wisconsin had 5,160 jobs in the aerospace industry in 2012. Growth was more rapid in that state, where the number of core aerospace industry jobs grew by 21.5 percent from 2010 to 2012.

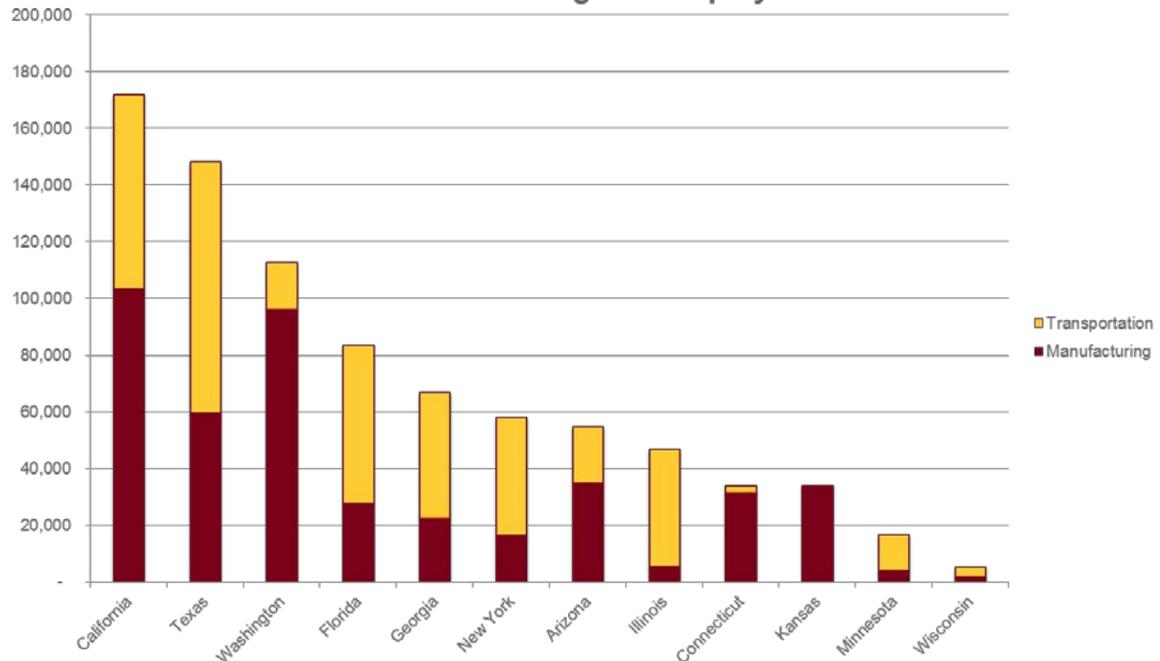
Rank	State	2010	2011	2012	Percent Change 2010-2012
1	California	174,335	172,561	171,846	-1.4%
2	Texas	148,013	148,910	148,206	0.1%
3	Washington	98,325	104,512	112,688	14.6%
4	Florida	78,457	82,058	83,520	6.5%
5	Georgia	64,059	66,457	66,652	4.0%
6	New York	57,594	58,877	58,084	0.9%
7	Arizona	54,886	54,285	54,660	-0.4%
8	Illinois	44,371	45,057	46,704	5.3%
9	Connecticut	34,205	34,219	33,843	-1.1%
10	Kansas	34,349	33,590	33,736	-1.8%
23	Minnesota	16,290	17,116	16,656	2.2%
36	Wisconsin	4,247	5,745	5,160	21.5%
	United States	1,216,216	1,233,376	1,240,800	2.0%

There are two primary components of the core aerospace industry: manufacturing and transportation. Aerospace product and parts manufacturing and search, detection, navigation, guidance and aeronautical and nautical systems and instrument manufacturing constitute the core aerospace manufacturing sector. Air transportation services and support activities for air transportation are the transportation-related codes.

The number of jobs in each of these components can reveal an individual state's strengths in the aerospace industry. Chart 1 shows the distribution of aerospace jobs by core component for the

states with highest levels of core aerospace employment. Although Texas has the second highest level of employment in the industry in the U.S., Washington and California have the largest share of aerospace-related manufacturing. Texas is stronger in the transportation component of the industry. States with larger populations, such as Florida, Georgia, and New York, are home to major international airports and have higher levels of employment in the transportation sector. Small states, such as Kansas and Connecticut, have almost all of their industry in the manufacturing sector. Both Minnesota and Wisconsin have higher shares in the transportation sector versus the manufacturing sector of the aerospace industry.

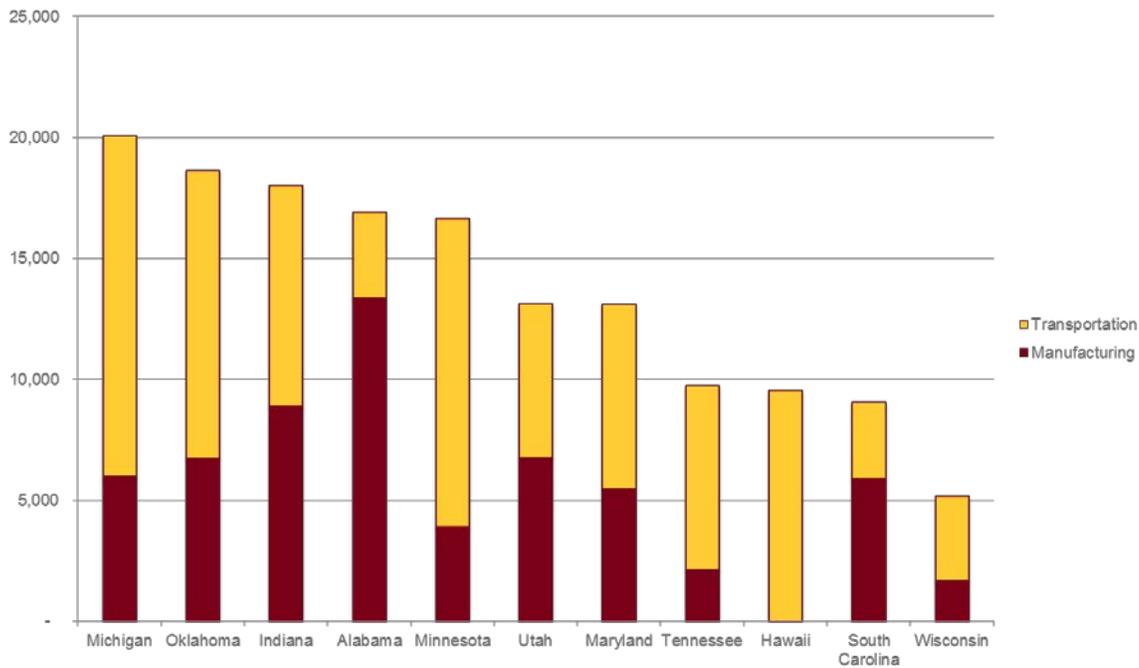
Chart 1: Distribution of Aerospace Jobs by Core Component States with Highest Employment: 2012



As mentioned earlier, Minnesota ranks 23rd and Wisconsin 36th in the nation in terms of aerospace industry employment. Comparing manufacturing versus transportation employment in other states with similar levels of employment in the industry can be instructive (chart 2). Alabama, South Carolina, and Utah are states with similar levels of employment, but a higher share in the manufacturing sector.

After reviewing national and state employment in the aerospace industry, it would appear that states with who Minnesota and Wisconsin might compete in the aerospace industry include Kansas, Connecticut, Alabama, South Carolina, and Utah.

Chart 2: Distribution of Aerospace Jobs by Core Component: States Similar to Minnesota 2012

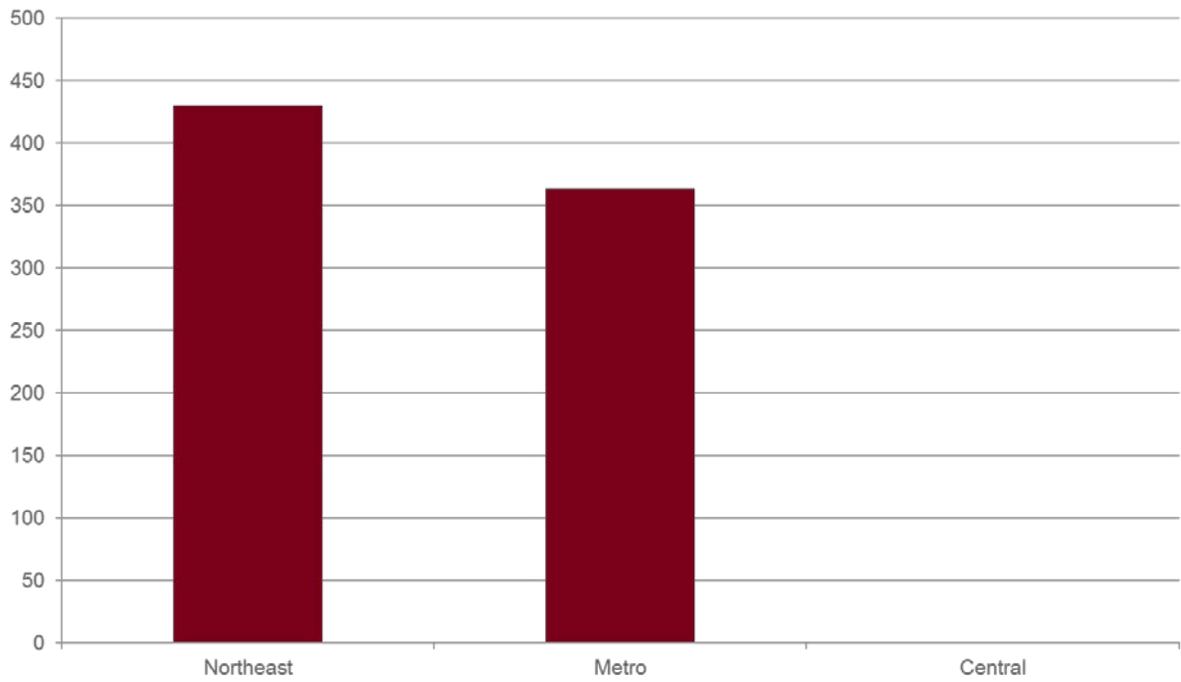


The Aerospace Industry in Minnesota and Wisconsin

Based on 2012 estimates, there were approximately 16,700 and 5,200 jobs in the core aerospace industries in Minnesota and Wisconsin respectively. Each state has its own geographic distribution of the location of those jobs. Approximately 450 of the jobs in Minnesota's aerospace manufacturing industry are located in northeast Minnesota (chart 3). An additional 360 manufacturing jobs are located in the Twin Cities metropolitan area. No other region in Minnesota reported a substantial number of jobs in the industry. Northeast Minnesota, especially in and around Duluth, is considered a hub for the aerospace industry, particularly for aerospace manufacturing.

Data for Wisconsin is limited. Due to data disclosure rules, there is little data available. However, what is available does indicate the industry is based in northwest Wisconsin (near Superior) and in southeast Wisconsin (near Milwaukee).

**Chart 3: Distribution of Aerospace Manufacturing Jobs
Minnesota 2012**

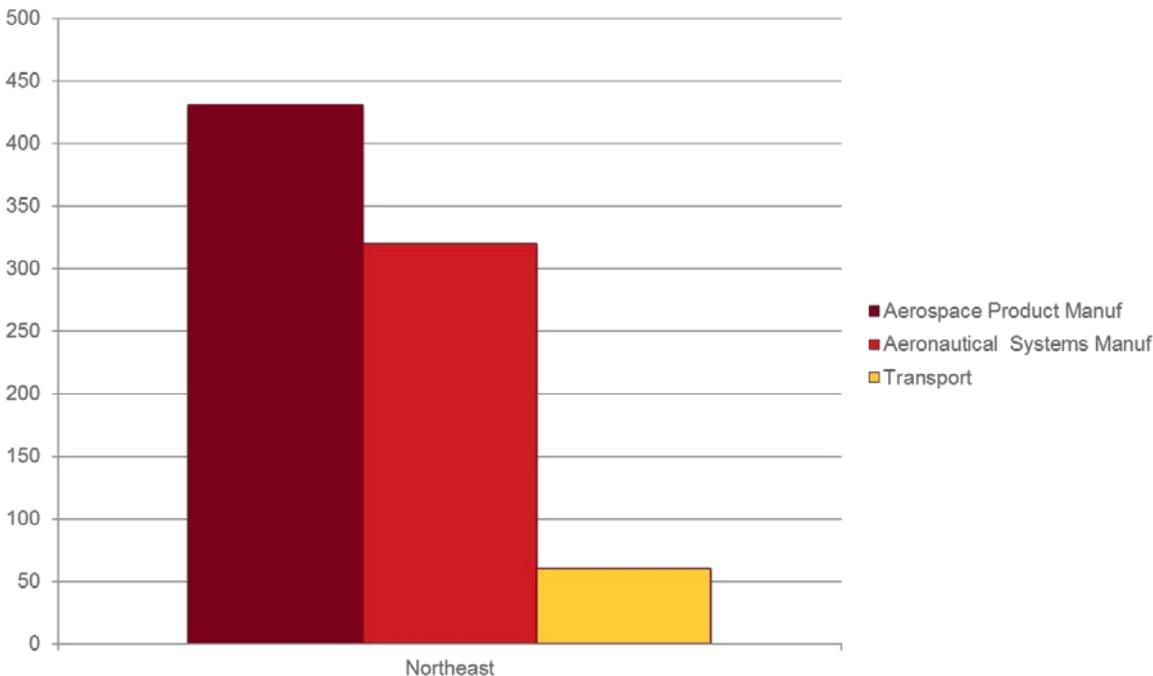


DEFINING AND MEASURING THE AEROSPACE INDUSTRY IN DULUTH-SUPERIOR

Based on the **core** definition of the aerospace industry, there are 810 people in the Duluth-Superior region employed by aerospace-related businesses (chart 4). The core definition does not completely explain the industry in the region, however. Local knowledge indicates there are additional businesses directly providing services and products to aviation manufacturers and to aviation-related transportation providers. These businesses and their employment are not included in the core definition of the aerospace industry.

Public sources are also limited in their release of data. If an industry does not have more than three individual firms reporting employment data, then the data is not published. Therefore, it is possible there is additional employment in Northeast Minnesota that is not disclosed due to privacy concerns.

Chart 4: Distribution of Core Aerospace Jobs
Northeast Minnesota 2012



A location quotient (LQ) is a useful way of measuring an industry's regional concentration; it is the ratio of an industry's regional share of employment as compared to the industry share at the national level. In the third quarter of 2008, the transportation equipment manufacturing sector's pre-recession peak in Duluth, the sector had a location quotient of 1.46 in Duluth. Generally, a location quotient above one means there is a concentration of that particular industry and indicates regional specialization. By 2013, the regional location quotient for the sector had fallen to 0.66, indicating the recession hit the transportation manufacturing sector much harder in Duluth than it did nationally. Aerospace products and parts manufacturing is included within the broader classification of transportation equipment manufacturing, due to data suppression, the LQ was calculated for the broader industry.

While the decreased location quotient is hard to overlook, other indicators are pointing to sector growth in the coming years. For example, DEED conducts a job vacancy survey of state businesses twice a year to gauge the current demand for labor. Survey results for the second quarter of 2013 indicate a high level of vacancies in the production sector. In fact, an estimated 449, or 5.9%, of all production jobs are currently vacant throughout Northeast Minnesota, indicating a relatively high demand for labor. Additionally, every two years DEED releases an employment outlook containing 10-year employment projections for occupations and industry sectors throughout the state. According to the 2010 projections, the aerospace products and parts manufacturing sector in Northeast Minnesota is projected to grow by 40% adding 171 jobs between 2010 and 2020.

Production jobs in the Duluth-Superior MSA typically pay higher than elsewhere in the state and in the nation. The median wage for a production job the MSA is \$19.44 per hour, compared to \$16.34 in the state, and \$15.13 in the nation. Aircraft mechanics and service technicians also do very well in this part of the state, earning a median wage of \$29.39 an hour, \$2.36 higher than the national median (for more on the Duluth economy, see appendix 3).

Business Visits

To fully quantify the employment of the aerospace industry in Duluth-Superior, University of Minnesota Extension engaged in primary data collection. Extension partnered with APEX to conduct individual business visits. Businesses with membership in the Northern Aero Alliance were asked to participate in a short survey. The survey was mailed to the businesses in March of 2013. Businesses could complete the paper questionnaire or take an online questionnaire. Businesses could also opt for an in-person visit with an Extension representative. Concurrently, APEX was conducting business visits under their business retention and expansion program. Businesses targeted for both this research and visits by APEX were visited by APEX and data was shared with Extension. In all, 16 businesses completed the survey. A copy of the survey instrument can be found in appendix 1.

Businesses included in the core aerospace industry completed the survey, including manufacturers and transportation support services. The surveys also uncovered several businesses classified under different industries that primarily serve the aviation industry in the Duluth-Superior region.

The broad survey of the aerospace industry in Duluth-Superior expanded the definition of the aerospace industry to include the core definition plus engineering and construction; electrical

Aerospace Industries in Duluth-Superior

Engineering and construction

Electrical component manufacturing

Aerospace products and parts

Upholstery and flooring repair and maintenance

Commercial and industrial machinery repair and maintenance

Air transportation services

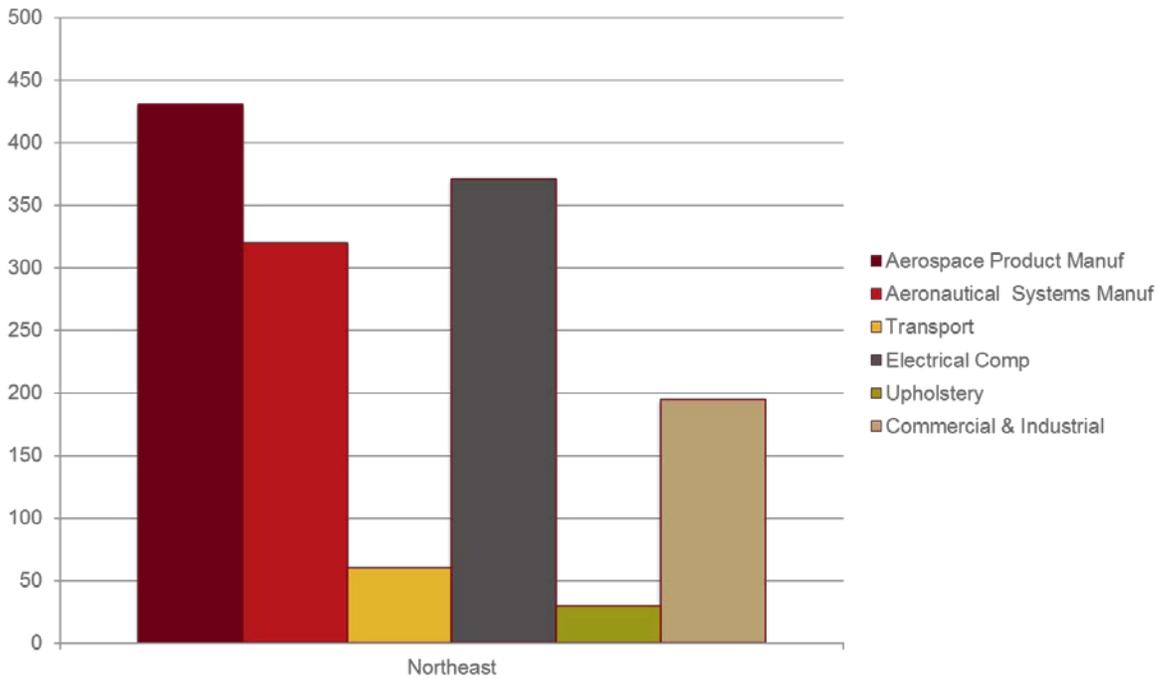
Support activities for transportation

component manufacturing; and upholstery and flooring repair and maintenance. **This is the definition of the aerospace industry in Duluth-Superior used in this study.**

A primary purpose for the business visits was to measure total employment in the industry. The questionnaire asked each respondent to indicate total employment in 2012. The number of employees reported by the individual businesses was then cross-checked with published data on the industry. Estimates of total employment related to aerospace for each industry were then calculated based on the primary data (business visits) and the secondary data (state government) sources.

Under the expanded definition, there are an estimated 1,406 jobs in the aerospace industry in Duluth-Superior. This includes aerospace product manufacturers employing 430 people in the region, electric component manufacturing employing 371, and aeronautical systems manufacturing employing an additional 320 (see chart 5).

**Chart 5: Distribution of Aerospace Jobs
Northeast Minnesota and Douglas County Wisconsin 2012**



ECONOMIC CONTRIBUTION OF THE AEROSPACE INDUSTRY IN DULUTH-SUPERIOR

Measuring the economic contribution of an industry begins by quantifying the direct effect. In this study, the direct effect is the output, employment, and labor income generated by businesses in the aerospace industry in Duluth-Superior. The direct effects can then be entered into an input-output model – IMPLAN was used for this research -- which measures the connections the aerospace businesses have with other industries in the economy. These connections generate indirect and induced effects. Direct, indirect, and induced effects sum to the total effect of the industry.

The study area under consideration is important in any economic contribution analysis. In this analysis, the study area is St. Louis County, Minnesota and Douglas County, Wisconsin.

Direct Effect

Based on 2012 estimates, businesses in the aerospace industry in the Duluth-Superior region employed 1,406 individuals. In addition, the Air National Guard employed 1,044 people in the region. Therefore, total employment related to the aerospace industry was 2,450 in 2012 (table 2).

Table 2: Direct Effect of the Aerospace Industry in Duluth (MN) – Superior (WI) Region, 2012	
Output (sales)	\$719.0 (millions)
Employment	2,450
Labor Income	\$175.6 (millions)

The IMPLAN model can estimate output, or sales, and labor income for each business based on the number of employees. The IMPLAN model estimates that in the Duluth-Superior region, businesses in the aerospace industry realized an estimated \$719.0 million of sales in 2012. The model estimates that these businesses directly paid their 2,450 employees a total of \$175.6 million in wages, salaries, and benefits in 2012.

Indirect and Induced Effects

Now that the estimated direct effects are quantified, the data can be entered into the input-output model. Input-output models trace the flow of goods and services throughout a local economy and can capture the indirect and induced, or ripple effects, of an economic activity.

Indirect effects are those associated with a change in economic activity due to spending for goods and services directly tied to the industry. In this case, these are the changes in the local economy occurring because aerospace businesses and the Air National Guard need to purchase supplies and related services. As the businesses make purchases, this creates an increase in purchases across the supply chain. Indirect effects are the summary of changes across the supply chain.

Induced effects are those associated with a change in economic activity due to spending by the employees of businesses (labor) and households. Primarily, in this study, these are the economic changes related to spending by employees of the aerospace businesses and the Air National Guard. It also includes household spending related to indirect effects. As employees of the aerospace businesses make purchases locally, those businesses make additional purchases and pay their employees, thus triggering an increase in purchases on that supply chain.

More information on direct, indirect, and induced effects is provided in appendix 2.

Total Effect

In 2012, the aerospace industry, including the Air National Guard, contributed an estimated \$988.0 million to the economy of the Duluth-Superior region (table 3). The industry supported an estimated 4,630 jobs. Those jobs paid an estimated \$268.9 million in wages, salaries, and benefits to residents of the Duluth-Superior region.

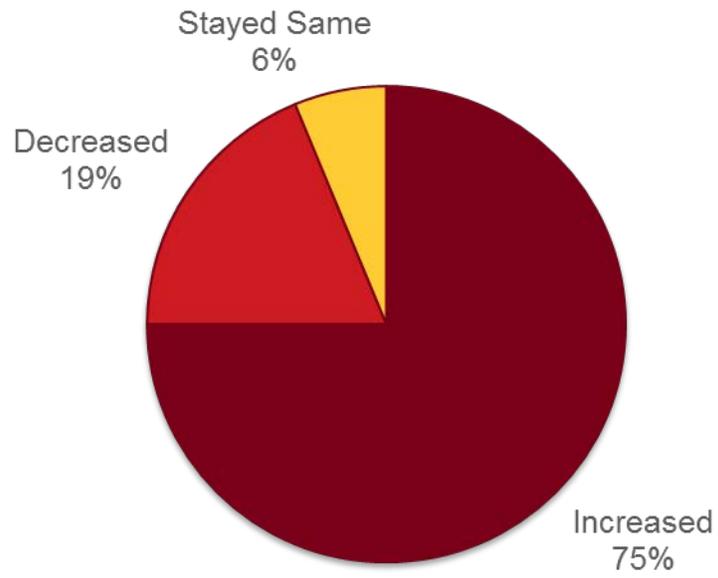
Of note here is the relatively equal distribution of indirect and induced effects. In terms of output, aerospace businesses making purchases from other local businesses accounted for \$122.9 million of the additional economic activity supported by the industry. This indicates aerospace businesses are able to purchase and actually are purchasing some of their supplies locally.

Table 3: Economic Contribution of the Aerospace Industry in Duluth (MN) – Superior (WI) Region, 2012

	Output (millions)	Employment	Labor Income (millions)
Direct	\$719.0	2,450	\$175.6
Indirect	\$122.9	920	\$48.9
Induced	\$146.1	1,260	\$44.4
Total	\$988.0	4,630	\$268.9

The Great Recession affected the aerospace industry in Duluth-Superior. Employment in the manufacturing sector fell by 33 percent between 2000 and 2010 (see appendix 3). The business survey asked businesses to report on how their aviation-related sales had changed between 2008 and 2012. Three-quarters (75 percent) of businesses indicated their sales had increased since 2008 (chart 6). Nearly 20 percent reported a decrease in sales.

Chart 6: Since 2008, Have Your Aviation Related Sales....



SUPPORTING THE AEROSPACE INDUSTRY

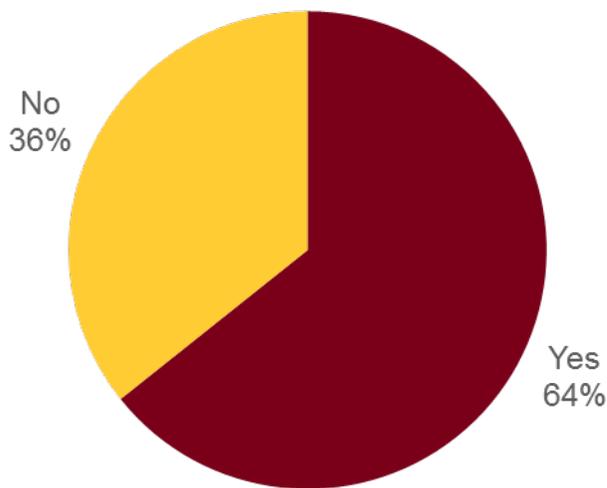
The business surveys asked a series of questions regarding the aerospace industry in general, its future in the region, and potential ways to support the industry. Sixteen businesses completed the surveys, either via in-person visit, a paper questionnaire, or an online questionnaire.

Local Purchasing

The aerospace industry contributes an estimated \$988.0 million to the economy of the Duluth-Superior region. The magnitude of this impact is driven partially by expenditures in the region by aerospace businesses. Increases in the contribution of the industry can be driven by increases in local purchases by those businesses.

Two-thirds of aerospace businesses report they are currently purchasing goods and services within the region (chart 7). When asked to describe those purchases, the majority of businesses listed that they are purchasing from other companies participating in the survey. This shows the supply chain has already developed to an extent in the region.

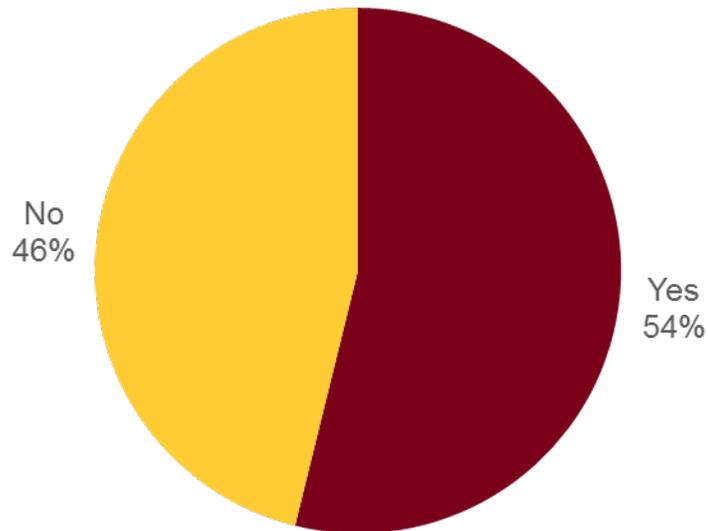
Chart 7: Are Any of Your Inputs Purchased Locally?



Duluth-Superior aerospace businesses are interested in increasing their local purchases. When asked “are there any inputs you would like to buy locally”, 54 percent of businesses responded positively (chart 8). One business responded, “We would rather source locally.” Based on the business responses, it appears there are opportunities to further develop the aerospace supply chain in Duluth-Superior. In particular, businesses indicated aviation grade wire, heat treating, connectors, powder coating, and plating are all products and services of interest.

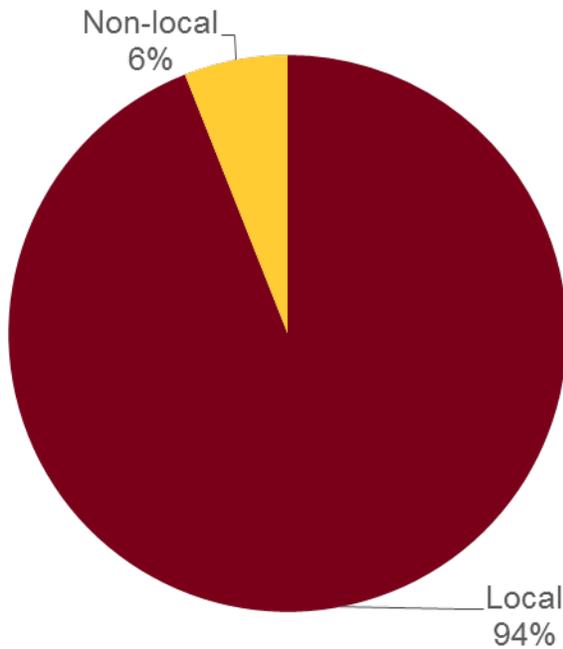
This means identifying the products or services that are currently being provided by businesses outside of the Duluth-Superior area and getting them into the economy either by attracting them to relocate or creating them locally as new start-ups.

Chart 8: Are There Any Inputs You Would Like to Source Locally?



Given the geographical location of Duluth-Superior and Duluth's role as a regional economic hub, it is not surprising the majority of the aerospace businesses' workforce is local. Businesses report 94 percent of their workforce lives locally (chart 9). This is a benefit to the regional economy as the wages, salaries, and benefits paid to local employees are retained in the economy and drive economic contribution. However, this can also be a challenge for aerospace businesses as they need to find qualified employees in the region.

Chart 9: What Percent of Your Workforce Lives Locally?



Aerospace Industry Trends

In the business survey, aerospace businesses were asked “What trends do you see as important for your industry in the next 3-5 years.” This was an open-ended question.

Five survey respondents mentioned sales of general aviation aircraft were vital to the industry moving forward (table 4). The Duluth-Superior region is home to aircraft manufacturers. If demand falls, like it did during the Great Recession, the industry as a whole is affected. Three survey respondents cited general business issues/ taxes as important to the industry. Other industry trends of note by respondents include input costs, workforce, public perception of the industry, federal government changes in regulations, and aerospace business changes.

Table 4: What Trends Do You See As Important for Your Industry in the Next 3-5 Years?

Response	Number of Respondents
Sales of general aviation aircraft	5
General business issues/taxes	3
Input costs/fuel costs	2
Workforce	1
Public perception	1
Federal government changes	1
Aerospace business change	1

These responses include a mix of national and local business concerns. Certainly, general aviation aircraft sales are a national issue over which Duluth-Superior business leaders have little control. However, leaders in the region may be able to address other issues such as local business conditions, workforce development, and public perception of the industry.

Retention and Expansion

For the aerospace industry to continue to flourish in the Duluth-Superior region, local leaders will need to retain existing businesses and encourage expansion. Businesses were asked about barriers to expansion in the Duluth-Superior region and also asked to cite factors that might drive them to move from the region.

Four businesses cited distance from customers as their key barrier to expansion and growth in the region (table 5). Workforce and sales volume/growth were listed by 3 businesses each. The barriers to growth and expansion can generally be divided into individual business concerns and shared business concerns. Distance from customers and sales volume/growth are unique to individual businesses and local leaders may or may not be able to assist those businesses with these issues. Other business issues, like workforce, are shared business issues that local leaders may be suited to address.

Table 5: What is One Key Barrier to Your Growth and Expansion in the Duluth-Superior Area?

Response	Number of Respondents
Distance from customers	4
Workforce	3
Sales volume/growth	3
Finances/credit/cash	2
Local governments/authorities	2
Networks	1
Federal government	1
Building space/needs	1

Five businesses indicated that moving their operation from the Duluth-Superior region was either not an option or not under consideration (table 6). Several businesses indicated they are site specific and could not relocate, even if they would like to relocate. While this commitment to the region is a positive, local leaders should remain vigilant in assisting these businesses with future succession, as those transitions can leave the business susceptible to closing.

Three businesses listed taxes and two businesses listed government incentives/assistance as reasons they might consider moving their operations. Rent costs and availability of building space were also listed by two businesses. Tax policy may be an issue local leaders can address together. Individual business assistance may be helpful for businesses with building and space needs.

Table 6: What Factors Would Make You Consider Moving Your Operations to Another Area?

Response	Number of Respondents
Not an option/consideration	5
Taxes	3
Government assistance/incentives	2
Rent/building availability	2
Sales	1
Workforce/union	1
Regulations	1
Airport access	1

Increasing Competitiveness and Threats to the Industry

Businesses were asked to rate the competitiveness of the aerospace industry in Duluth-Superior in comparison to other regions in the United States. On a scale where 1 equals “not very competitive” and 4 equals “very competitive,” businesses respondents assigned an average rating of 3.0. Therefore, businesses feel the region is fairly competitive. Survey respondents were then asked to list possible ways the industry could be more competitive (table 7).

Four businesses responded that opportunities are one area in which the industry could become more competitive. The opportunities cited varied. One theme was to look at opportunities to build on current strengths, such as increasing aviation training opportunities. Another theme was to look at opportunities to increase sales and volume on the supply chain in the region. A final theme worth mentioning was developing an interest and passion for the industry among youth in the region.

Three businesses cited perception and marketing as a method for increasing competitiveness. To quote one business, we want “to be perceived as the aviation industry powerhouse that we are.”

Response	Number of Respondents
Opportunities	4
Perception/marketing	3
Decrease costs	2
Aviation volume	1
Workforce	1
New airline	1
Networks/collaboration	1

While businesses clearly identified opportunities for the industry in the region, they also noted potential threats to a healthy industry (table 8). Although the Duluth-Superior regional economy is improving, respondents view the economy as a potential threat. Three businesses also cited concerns regarding costs, competition, and customers. The need to maintain a reputation at the national level and the competitive position as a regional hub were also cited as important factors.

In terms of a national reputation, one business underscored the importance of establishing a nationally recognized brand that describes the region as a great place to live, learn, and work.

Table 8: What Are the Biggest Threats to a Healthy Aviation Sector in the Duluth-Superior Region?

Response	Number of Respondents
Economy	3
Costs, competition, and/or customers	3
Decline in Duluth-Superior’s position as a hub	2
Lack of national reputation	2
Health of Cirrus	2
Federal/local government	2
Collaboration (if it were to lack)	1

Moving the Aerospace Industry Forward in Duluth-Superior

The final question asked respondents to provide suggestions for moving the aerospace industry forward and specifically for suggestions for the Northern Aero Alliance (table 9). A common theme among the responses was a level of satisfaction with current efforts. Five businesses cited the need to continue current collaboration and to expand those efforts to include more businesses and organizations in the region. Three businesses indicated they wished the Northern Aero Alliance would continue its current efforts. Also mentioned were building a national reputation, participating in efforts to build the workforce through training and education, helping businesses to build longevity, and being a pipeline for industry news.

Table 9: How Can the Northern Aero Alliance Help the Industry?

Response	Number of Respondents
Collaboration (continue and expand)	5
Continue with current efforts	3
Build a national reputation	2
Education/workforce/work with youth	2
Help businesses build longevity	1
Pipeline for the news	1

SUMMARY AND RECOMMENDATIONS

In 2013, the Northern Aero Alliance requested University of Minnesota Extension research the aerospace industry in the Duluth-Superior region. Specifically, the alliance was interested in the current status of the industry in the region, its economic impact, and its potential for the future.

Defining the aerospace industry in a region is challenging. Current national data collection limits the industry to a core definition which often ignores important supply chain industries. Therefore, to measure the size and scope of the industry in the region, Extension used a dual approach. First, Extension collected available published data on the industry. The Department of Employment and Economic Development assisted with data collection. Second, Extension and APEX conducted individual visits with 16 businesses to incorporate local knowledge into the analysis.

The core definition of the aerospace industry in the United States includes aerospace product and parts manufacturing; search, detection, navigation, guidance, aeronautical, and nautical systems and instrument manufacturing; air transportation services; and support activities for air transportation.

In the United States, there are 1.2 million jobs in the core aerospace industry. Nationally, Minnesota is ranked 23rd in the number of aerospace jobs and Wisconsin is ranked 36th. After reviewing national and state employment in the aerospace industry, it would appear that states competing for industry share with Minnesota and Wisconsin include Kansas, Connecticut, Alabama, South Carolina, and Utah.

Business visits in the Duluth-Superior region expanded the definition of the aerospace industry to include the core industry plus engineering and construction; electrical component manufacturing; and upholstery and flooring and repair and maintenance. This is the definition of the aerospace industry used in this study for Duluth-Superior. The Air National Guard also has a significant presence in Duluth.

In 2012, the aerospace industry, including the Air National Guard, contributed an estimated \$988.0 million to the economy of the Duluth-Superior region. The industry supported an estimated 4,630 jobs. Those jobs paid an estimated \$268.9 million in wages, salaries, and benefits to residents of the Duluth-Superior region.

Of note is the relatively equal distribution of indirect and induced effects. In terms of output, aerospace businesses making purchases from other local businesses accounted for \$122.9 million of the additional economic activity supported by the industry. This indicates aerospace businesses are able to purchase some of their supplies locally. Aerospace businesses are interested in further development of the local supply chain.

Businesses in the region cite general aviation aircraft sales as the most important trend in their industry. While local leaders have little influence over this trend, they can assist with other trends like general business conditions, workforce development, and public perception of the industry.

Business retention and expansion efforts could concentrate in two areas. First, local leaders may wish to address issues (i.e. workforce) that affect all businesses. Second, local leaders may elect to provide individual business assistance (i.e. building and space needs).

Both opportunities and threats exist for the aerospace industry in the region. Opportunities include building on current strengths such as increasing aviation training and developing the local supply chain. Threats include the national economy and the lack of a national reputation as an aerospace hub.

Businesses find value in current collaborations focused on developing and supporting the industry in the region. Suggestions for future joint efforts include: building on and increasing collaborations;

building a national reputation as an aerospace hub; addressing workforce issues including training and education; and retaining individual businesses in the region.

Based on the business visits conducted, University of Minnesota Extension recommends the Northern Aero Alliance consider the following actions as potential steps to assist the aerospace industry in the region.

Recommendation #1: Explore opportunities to develop the supply chain in the Duluth-Superior region.

Current aerospace businesses are already accessing the supply chain available in the region. The businesses indicate a desire to continue to source locally. Developing the supply chain could also contribute to building a national reputation for the region.

Recommendation #2: Continue business retention and expansion efforts.

Aerospace businesses have both individual and collective needs. The surveys identified some collective needs the Northern Aero Alliance might continue to address. However, the survey also identified individual business needs, such as building and land requirements, that direct assistance to the business may be able to address.

Recommendation #3: Continue to build on collaboration efforts.

Members of the Northern Aero Alliance find value in the collaborative. There is an opportunity for the organization to continue to be an advocate for the industry in the region. These collaborative efforts have already resulted in a strong supply chain among locally-based companies. Continuing to expand efforts likely will help develop a national reputation.

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APPENDIX 1: UNIVERSITY OF MINNESOTA BUSINESS SURVEY INSTRUMENT

Section 1: Getting to Know Your Business

1. What are your primary products or services?
2. What is special or unique about your products or services?
3. Which of the following North American Industry Classification (NAICS) categories best describes your business? If you know it, please list your NAICS code _____

1. Administration/Support/Waste Management/Remediation Services	11. Manufacturing
2. Agriculture/Forestry/Fishing/Hunting	12. Mining, Quarrying, and Oil and Gas Extraction
3. Accommodation/Food Services	13. Other Services
4. Arts/Entertainment/Recreation	14. Professional/Scientific/Technical Services
5. Construction	15. Public Administration
6. Educational Services	16. Real Estate/Rental and Leasing
7. Finance/Insurance	17. Retail Trade
8. Health Care Services/Social Assistance	18. Transportation and Warehousing
9. Information	19. Utilities
10. Management of Companies & Enterprises	20. Wholesale Trade

Section 2: The Aviation Industry

1. What types of aviation-related activities are you engaged in?
(Examples: manufacturing of airplane seats, engine coolants, welding of airplane parts, sales of airplane fuel, airplane repair and service, sales of airplane accessories, etc.)
2. Using your best estimate, what percent of your business is related to aviation? _____
3. Since 2008, have your aviation-related sales, as a whole...
 - a. Increased
 - b. Decreased
 - c. Stayed About the Same
4. If the Duluth airport did not exist, would your sales be affected? Yes No
 - a. If yes, what percent of sales?
 - b. Why?

Section 3: Business Operations

1. What was your total employment in 2012? _____
(include full-time, part-time and seasonal as one job each)
2. Did you make any capital investments in 2012? Yes No
 - a. Yes, please describe
 - b. How much did you invest? _____
3. Are any of your inputs (raw materials used in your production process) purchased locally (within 50-miles of your location)? Yes No
 - a. Yes, what do you buy?

4. Are there any inputs you could like to buy locally, but cannot? Yes No
 - a. Yes, please describe.
5. What percent of your workforce lives within 50-miles of your location? _____%

Section 4: The Future

1. What trends do you see as important for your industry in the next 3-5 years?
(Examples: Changing sales of general aviation aircraft, changing cost of aviation fuels, changes in the number of aircraft mechanics, changes in the number of general aviation, changes in commercial aviation, etc). Industry changes may or may not be related to aviation.
2. What is one key barrier to your growth and expansion in the Duluth area?
3. What factors would make you consider moving your operations to another area?
4. In your opinion, on a scale where 4=very competitive, 1=not very competitive, how competitive with other regions is the aviation sector in Duluth? _____
5. If you answered, 1,2 or 3, what could be done to make the industry more competitive with other regions in the United States?
6. What are the biggest threats to a healthy aviation sector in the Duluth area?
7. The Northern Aero Alliance wants to help aviation-related business grow and thrive in the Duluth-area. What suggestions do you have for them?
8. Who else should we interview if we want to get a true sense of the aviation industry in the region?

APPENDIX 2: ECONOMIC CONTRIBUTION METHODOLOGY AND TERMS

Special models, called input-output models, exist to conduct economic impact analysis. There are several input-output models available. IMPLAN (Impact Analysis for PLANning, Minnesota IMPLAN Group)¹ is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations will help ensure the best results from the model.

One of the most critical aspects of understanding economic impact analysis is the distinction between the “local” and “non-local” economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the study area (the local economy) is a county or a group of counties that share economic linkages. In this study, the study area considered was St. Louis County Minnesota and Douglas County Wisconsin.

A few definitions are essential in order to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant “double counting.” Think of corn as an example. The value of the corn is counted when it is sold to the mill, again when it is sold to the dairy farmer, again as part of the price of fluid milk, and yet again when it is sold as cheese. The value of the corn is built into the price of each of these items and then the sales of each of these items are added up to get total sales (or output).

Employment

Employment includes full- and part-time workers and is measured in annual average jobs, not full-time equivalents (FTE’s). IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the corn example when the corn is sold to the mill, a certain percentage of the sale goes to the farmer for his/her labor. Then when the mill sells the corn as feed to dairy farmers, it includes some markup for its labor costs in the price. When dairy farmers sell the milk to the cheese manufacturer, they include a value for their labor. These individual value increments for labor can be measured, which amounts to labor income. Labor income does *not* include double counting.

Direct Impact

Direct impact is equivalent to the initial activity in the economy. In this study, the direct impact is the impact created by businesses in the aerospace industry in Duluth-Superior.

¹ IMPLAN Version 3.0 was used in this analysis. The trade flows model with social accounting matrix multipliers was implemented.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to **spending for inputs** (goods and services) by the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel, and equipment. As the plant increases purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts. In this study, indirect impacts are those associated with spending by aerospace businesses for operating items and for capital outlays.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to **spending by labor**. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to spend to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. Induced impacts also include spending by labor generated by indirect impacts. So, if an aerospace business purchases services from a local tax preparer, spending of the tax preparer's wages would also create induced impacts. Primarily, in this study, the induced impacts are those economic changes related to spending by aerospace industry employees.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

Input-Output, Supply and Demand, and Size of Market

Care must be taken when using regional input-output models to ensure they are being used in the appropriate type of analysis. If input-output models are used to examine the impact or the contribution of an industry that is so large that its expansion or contraction results in such major shifts in supply and demand that prices of inputs and labor change, input-output can overstate the impacts or contributions. While the Duluth-Superior aerospace industry is a major component of the Minnesota economy, it is not likely that its existence has an impact on national prices. Hence, the model should estimate the contributions reliably.



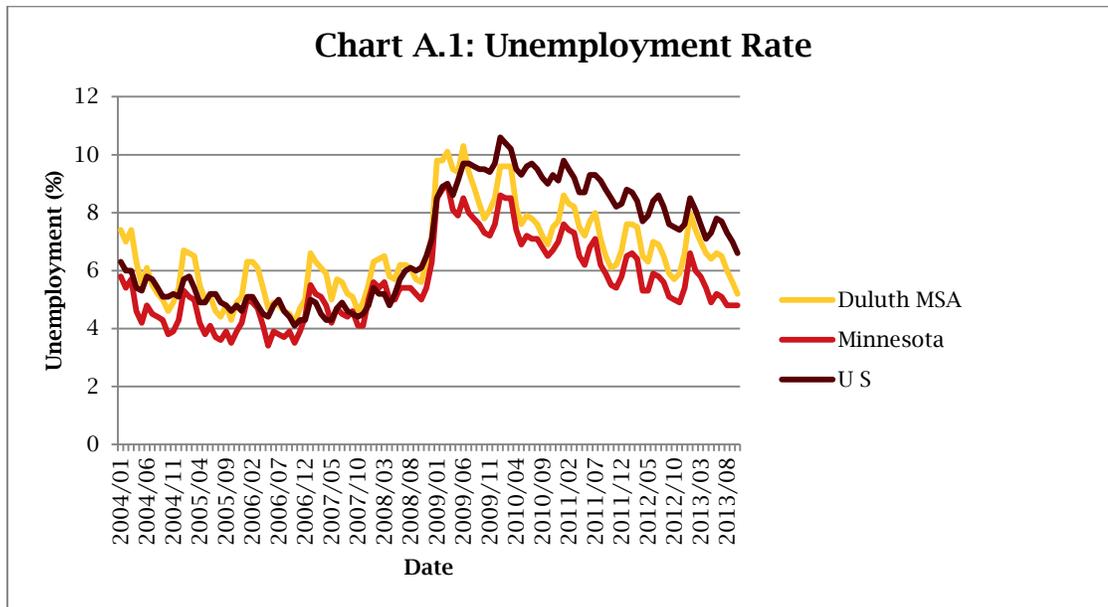
APPENDIX 3: THE DULUTH-SUPERIOR MN-WI METROPOLITAN STATISTICAL AREA

The cities of Duluth and Superior are located in Northeastern Minnesota and Northwestern Wisconsin, respectively, on the western tip of Lake Superior. The two cities form the population center of the Duluth-Superior MN-WI Metropolitan Statistical Area (MSA), an area that includes all of St. Louis and Carlton counties in Minnesota, and Douglas County in Wisconsin. Other key cities located within the MSA include Hermantown, Virginia, and Hibbing in St. Louis County; and Cloquet in Carlton County. The MSA is home to a diverse economy built upon mining, timber, tourism, healthcare, manufacturing, and transportation.

As of the 2010 U.S. Census, the Duluth-Superior MSA had a population of 279,771, up slightly from the 2000 census population of 275,486. Slightly over half of the population lives in and around Duluth, an area that includes the cities of Cloquet, Hermantown, Esko, Proctor, and Superior. At 86,265 people, the City of Duluth is the most populous city in the MSA, and the fourth most populous city in the state of Minnesota.

Employment

According to the Minnesota Department of Employment and Economic Development's (DEED) Local Area Unemployment Statistics (LAUS), the Duluth-Superior MN-WI MSA had a total 2012 annual average labor force size of 144,804. Of that 144,804, 134,144 were classified as employed, and 9,660 were unemployed, for an unemployment rate of 6.7%. As of October of 2013, the total labor force was a non-seasonally adjusted 142,740, 135,314 of whom were employed, and 7,426 were unemployed, for an unemployment rate of 5.2%. Chart 1 shows unemployment rates over time for the MSA, the state, and the nation.



At the end of the recession in 2009, the MSA had an annual average labor force size of 147,208, a number that had grown every year since 2006. An increase in the number of discouraged workers and increasing retirements has resulted in declining labor force numbers every year since. While labor force numbers have declined, so has unemployment. During the low point of the recession in

2009, unemployment in the MSA stood at 13,507. As mentioned above, by October of 2013 unemployment had fallen to a non-seasonally adjusted 7,426. While declining unemployment rates in the MSA can no doubt be attributed to decreasing levels of unemployed persons, declines in total labor force size are also a major factor.

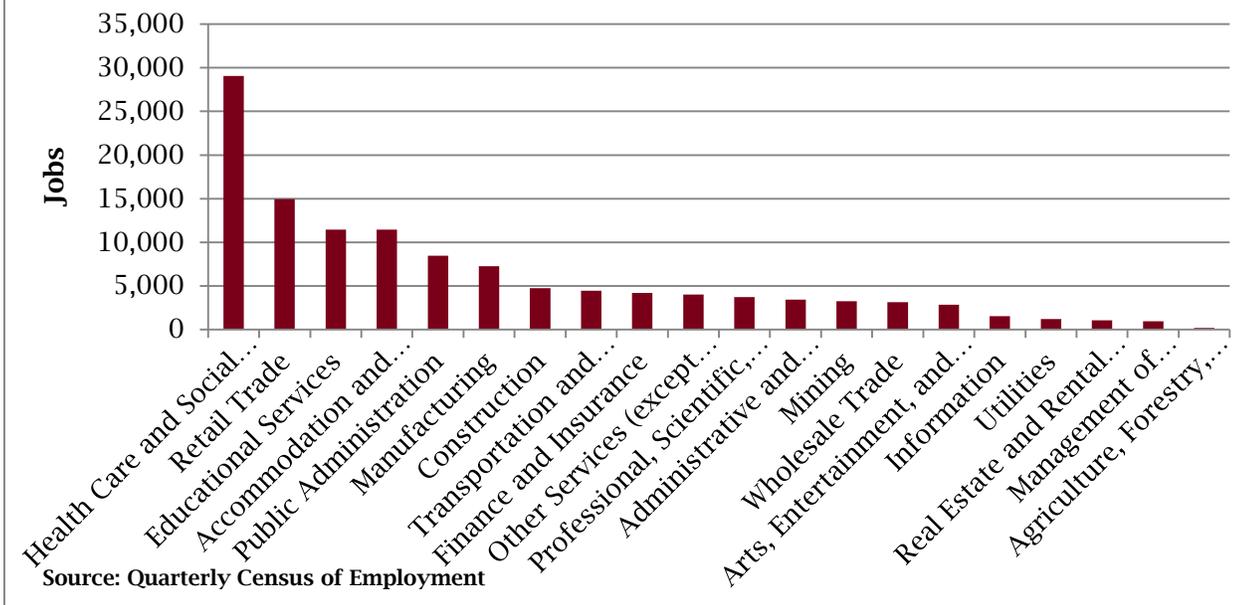
High levels of unemployment on the Iron Range have tended to skew unemployment rates for the MSA upward as the region slowly recovers from the Great Recession. The unemployment rate for the MSA peaked in June of 2009 at non-seasonally adjusted 10.3%, but by October of 2013 it had fallen to 5.2%, higher than Minnesota's unemployment rate of 4.8%, but considerably lower than the national rate of 7%. On the Iron Range, cities such as Hibbing and Virginia saw unemployment rates climb upwards of 17% as a result of drastically decreased production in the mining sector during the recession. Conversely, the city of Duluth has been able to maintain relatively healthy levels of unemployment throughout the recession, peaking at 8.9% in January of 2009, but falling to 4.7% by October of 2013.

Jobs

According to DEED's Current Employment Statistics (CES), as of October 2013 there were 132,710 nonfarm jobs in the Duluth-Superior MSA, up 0.3% from October of 2012. Prior to the recession the region was going through a period of relative growth, adding jobs every year between 2004 and 2008. The recession caused a 3.7% dip as employment declined from the 2008 peak of 133,229 jobs to 128,291 jobs in 2009. Since then the MSA has once again begun to add jobs, with employment rising to an annual average 130,063 in 2012, and 132,710 jobs as of October, 2013. While the state as a whole has regained all the jobs lost as a result of the recession, the Duluth-Superior MSA still has yet to reach that milestone.

According to the Quarterly Census of Employment and Wages, as of the first quarter of 2013, the Healthcare and Social Assistance sector was the largest employer in the region with 29,080 jobs, followed by Retail Trade with 14,944 jobs, Educational Services with 11,465 jobs, and Accommodation and Food Services with 11,449 jobs. Manufacturing employed 7,268 people throughout the three-county area. Chart 2 shows the distribution of jobs by industry.

Chart A.2: Employment by Industry: Duluth-Superior MN-WI MSA



According to DEED’s Occupational Employment and Wages data, there were 122,940 employed persons in the MSA as of the second quarter of 2013. 10,810, or 8.7%, of those people were working in the goods producing sector (manufacturing, mining, timber, and construction), while the remainder worked in the service providing sector. One in three, or 41,580 people, work in Office and Administrative Support, Food Preparation and Serving, and Sales related occupations.

Commute and Labor Sheds

Because it is the population center of the MSA, many people commute into Duluth from elsewhere for work. Because of that, there are more jobs in Duluth than inhabitants, so the city is a net importer of labor. The city imports 33,488 workers or 59.6% of the total labor force from outside the city limits. 22,680 residents, or 40.4% of the of the cities labor force, live and work in Duluth, while 9,806, or 30.2%, live in Duluth and work elsewhere. Duluth’s labor shed includes greater St. Louis County, Carlton County, and Douglas County in Wisconsin.

Wages and Income

Wages in the Duluth-Superior MSA are typically lower than statewide median rates, but higher than most other regions outside of the Twin Cities metro area. According to DEED’s Occupational Employment Statistics wage data, in the second quarter of 2013, the median hourly wage for all jobs in the MSA was \$16.45 per hour, compared to \$18.08 in the state, and \$17.03 in the nation. Of the nine MSAs located throughout the state, the \$16.45 hourly wage in the Duluth-Superior MSA ranked third behind only Minneapolis-St. Paul and Rochester MSAs. Additionally, Duluth-Superior MSA production occupations pay a median wage of \$19.44 per hour, considerably higher than the state wide median wage of \$16.34.

Median household incomes in Northeast Minnesota and Northwest Wisconsin are lower than state and national incomes. The median household income in St. Louis County in 2011 was \$44,475; Carlton County was \$49,257; and Douglas County (WI) was \$45,935. The median household incomes

for Minnesota and the nation were \$56,944, and \$50,502 respectively. Over the past decade, median household incomes have grown 18% in St. Louis County, 22% in Carlton County, and 29% in Douglas County.

Manufacturing Sector Job Loss

Historically, manufacturing has been an important industry sector in the region, and that continues to the present day. That being said, the recession hit the manufacturing sector in the Duluth-Superior MSA disproportionately hard compared to the nation as a whole. In 2000, the MSA's manufacturing sector had 10,222 jobs. That number dropped to 8,479 during the early 2000's recession, and by 2010, as a result of the Great Recession, total jobs in the sector dropped to 6,844 – 33% below 2000 numbers.

Shift share analysis is a method for analyzing differences between regional and national economic growth trends. Shift share analysis conducted for the Duluth-Superior MSA indicates that regional factors were the cause behind the majority of the 2,235 manufacturing jobs lost during the Great Recession. According to shift share analysis, the number of manufacturing jobs lost due to national economic conditions was 47, jobs lost due to national industry trends was 855, and jobs lost due to regional conditions was 1,333.

Aerospace Industry

With two prominent aircraft manufacturers, several aircraft components manufacturers, a large aircraft maintenance company, an international airport, and an Air Force fighter wing, the MSA is home to an emerging aerospace cluster. Aerospace Products and Parts Manufacturing (NAICS 3364) falls under the Transportation Equipment Manufacturing (NAICS 336) subsector. As previously stated, the manufacturing sector took a hard hit during the recession, and transportation equipment manufacturing was no exception as employment dropped by 59% from 1,044 jobs in the third quarter of 2008 to 425 jobs in the first quarter of 2013.

A location quotient (LQ) is a useful way of measuring an industry's regional concentration; it is the ratio of an industry's regional share of employment as compared to the industry share at the national level. In the third quarter of 2008, the transportation equipment manufacturing sector's pre-recession peak in Duluth, the sector had a location quotient of 1.46. Generally, a location quotient above one means there is a concentration of that particular industry and indicates regional specialization. By 2013, the regional location quotient for the sector had fallen to .66, indicating the recession hit the transportation manufacturing sector much harder in Duluth than it did nationally.

While the decreased location quotient is hard to overlook, other indicators are pointing to sector growth in the coming years. For one, DEED conducts a job vacancy survey of state businesses twice a year to gauge the current demand for labor. Survey results for the second quarter of 2013 indicate a high level of vacancies in the production sector. In fact, an estimated 449, or 5.9%, of all production jobs are currently vacant throughout Northeast Minnesota, indicating a relatively high demand for labor. Additionally, every two years DEED releases an employment outlook containing 10-year employment projections for occupations and industry sectors throughout the state. According to the 2010 projections, the Aerospace Products and Parts Manufacturing sector in Northeast Minnesota is projected to grow by 40% adding 171 jobs between 2010 and 2020.

Growth in this sector is a positive sign for the regional economy, as these jobs typically pay wages much higher than the median. As stated above, production jobs in the Duluth-Superior MSA typically pay higher than elsewhere in the state in nation. The median wage for a production job the MSA is

\$19.44 per hour, compared to \$16.34 in the state and \$15.13 in the nation. Aircraft mechanics and service technicians also do very well in this part of the state, earning a median wage of \$29.39 an hour, \$2.36 higher than the national median.

The goods producing sectors, including aviation manufacturing, were hit especially hard during the recession, and for a multitude of reasons these sectors were hit disproportionately hard in Northeast Minnesota. As the regional economy slowly recovers, and employers in all sectors once again begin hiring workers, the aviation sector should rebound nicely, and continue to evolve into a cornerstone of the Duluth-Superior MN-WI MSA economy.