

GEORGIA'S AEROSPACE INDUSTRY

ECONOMIC AND FISCAL IMPACT ANALYSIS



2019

PREPARED FOR:



PREPARED BY:



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EXECUTIVE SUMMARY

The economic and fiscal impact analysis¹ of Georgia's aerospace industry quantifies the level of economic activity conducted by all segments of the aerospace industry in 2019 and its ripple effects in the state's economy. It also estimates the industry's fiscal impact and quantifies the industry's contribution to the state's Gross Domestic Product. These estimates are calculated using an input-output economic model and available industry data. The study also estimates the economic impact of aerospace activities in four selected regions of the state and analyzes two small but emerging niches – *unmanned aircraft systems (UAS)* and *space related companies* located in the state of Georgia.

Economic Impact²

The aerospace industry, as defined by the NAICS codes shown on page 5 and tailored to exclude non-aerospace firms, employed 104,863 workers in 2019. This estimate includes civil service employment at Robins AFB, Dobbins ARB and Moody AFB, which together comprise 16 percent of the total direct employment in the aerospace industry. Employees in the aerospace industry were paid \$12 billion in wages and salaries and generated an economic output of \$42.6 billion.

While a large share of the impacts is attributed to direct employment, the total economic impact (direct, indirect and induced) of the aerospace industry is significant. The ongoing operations of aerospace generated ripple impacts throughout the state supporting an additional 159,021 indirect and induced jobs with earnings of \$8.3 billion and economic output of \$25.4 billion. This brings the total economic output to nearly \$68.0 billion. In total, the aerospace industry supported 263,884 jobs, representing 5.8 percent of the state's total employment³, with wages and salaries totaling \$20.3 billion, representing 8.1 percent of the state's total wages and salaries. Table E-1 shows a summary of the direct, indirect, and induced impact.

Table E-1: Georgia's Aerospace Industry Economic Activity: 2019

	Direct	Indirect	Induced	Total
Employment	104,863	64,573	94,448	263,884
Wages & Salaries	\$12.0 B	\$3.8 B	\$4.4 B	\$20.23 B
Output	\$42.6 B	\$11.0 B	\$14.5 B	\$68. B

¹This study is an update of similar economic studies commissioned by Georgia's Center of Innovation for Aerospace (COIA) to assess the industry's contribution to the state's economy.

² The aerospace industry generates additional impacts that are not captured in this study. Due to employment data limitations, the study does not include the impact generated from *single proprietor businesses*, *some employment from emerging sectors (UAS and Space)* and *small airports* operating across the state.

³Source: Quarterly Census of Employment and Wages - Bureau of Labor Statistics: 2019 Annual Averages



104,502

Direct
Aerospace Jobs



\$12.0 B

Aerospace Industry
Wages and Salaries



\$42.5 B

Direct
Output/Business Activity

Study findings show that wages of aerospace employees are higher than Georgia's overall average wages of all industries. The 2019 average wage rate of aerospace workers in Georgia, including benefits, was \$114,274. The annual average wage rate without benefits was \$83,420 or 51 percent higher than the state's overall average wage rate of \$55,263⁴

In addition to the industry's *direct* contribution to state's economy, aerospace activities supported jobs and economic activity of other sectors. The industry's high level of output and high wages, which translates in higher spending and demand for goods and services, has resulted in higher multipliers than the average multipliers of all sectors. The employment multiplier of aerospace industry in Georgia was 2.5 and the income multiplier was 1.7.



Fiscal Impact

The fiscal impact of aerospace industry was calculated by estimating the revenues associated with the industry's total economic activity and subtracting the costs associated with providing state services to Georgia's households and companies associated with that activity. Revenues included individual and corporate income taxes, sales and use taxes, highway taxes,

fees, and miscellaneous revenues. Costs included education; public health, safety, and welfare; highways; administration; and miscellaneous. Table E-2 provides the fiscal impact estimates based on the estimated industry total impacts. The aerospace industry generated \$1.45 billion in revenues for the state budget in calendar year 2019. The net contribution of aerospace industry to the state revenues in 2019 was \$463.8 million.

Table E-2: Aerospace Fiscal Impact Analysis: 2019

Annual State Government Revenues	\$1.45 B
Annual State Government Costs	\$0.98 B
Net Annual Revenues	\$463.8 M

Definition of Aerospace Industry in Georgia

The Georgia Center of Innovation defines "Aerospace" as an inclusive term covering the full range of life cycle activities for vehicles that fly in the air or in space. To measure the economic impact of the broad span of aerospace activities, the industry's

sectors were mapped to a respective six-digit North American Industrial Classification System (NAICS) code (see Table E-3 for a list of core sectors).

⁴ Source: Quarterly Census of Employment and Wages - Bureau of Labor Statistics: 2019 Annual Averages

The aerospace industry is complex and multi-disciplinary and is not easily defined by a single (or even several) NAICS codes. While there are several NAICS codes that contain establishments almost exclusively in the aerospace industry, there are many businesses which provide goods and services that serve a wide range of industries, including aerospace. For example, the 336411 code is for establishments primarily engaged in one or more of the following: manufacturing or assembling complete aircraft, developing, and making aircraft prototypes, and aircraft conversions or major modifications to the system. The companies selecting these NAICS codes are doing business in the aerospace industry.

On the other hand, establishments in the NAICS code 332710 (Machine shops), are engaged in machining metal and plastic parts and parts of other composite materials on a job basis and may or may not perform work that supports the aerospace industry. Some of the establishments in this NAICS

code will partially or fully support the aerospace industry, with other establishments listing in this code support a variety of other industries.

For this report, “core” and “support” NAICS codes have been defined as follows:

- ✓ “Core” codes are those that provide a clear mapping between the establishments listing in that code and the aerospace industry; “support” codes provide goods and services that are essential to aerospace but also serve other industries and therefore contain only a portion of listing establishments in the aerospace industry. It is important to note that many companies in the “support” codes perform work across multiple industries and may have only a fraction of their business in aerospace-related work.
- ✓ For the “support” codes, only establishments known to be performing work in support of the aerospace industry were included in this study.

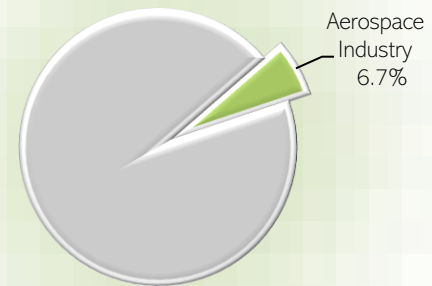
Table E-3: Aerospace Industry Definition Components by NAICS Code – Core Sectors

Sector	NAICS
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	334511
Aircraft Manufacturing	336411
Aircraft Engine and Engine Parts Manufacturing	336412
Other Aircraft Parts and Auxiliary Equipment Manufacturing	336413
Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing	336415
Scheduled Passenger Air Transportation	481111
Scheduled Freight Air Transportation	481112
Nonscheduled Chartered Passenger Air Transportation	481211
Nonscheduled Chartered Freight Air Transportation	481212
Other Nonscheduled Air Transportation	481219
Air Traffic Control	488111
Other Airport Operations	488119
Other Support Activities for Air Transportation	488190
Flight Training	611512
Regulation and Administration of Transportation Programs	926120
<i>Source: North American Industrial Classification System (2017); Georgia Center of Innovation for Aerospace, Georgia Tech's Enterprise Innovation Institute</i>	

Aerospace Industry and the State's GDP

The aerospace industry is an important driver of the state's economic activity. It supports high-paying jobs for Georgia's citizens and generates economic activity beyond the sectors of aerospace industry. In calendar year 2019, aerospace supported 262,975 total jobs or 5.8 percent of the state's total employment⁵, and it contributed \$36.5 billion to the state's GDP or 6.7 percent.

Figure E-1: Contribution of Aerospace Industry to the State of Georgia's GDP (2019)

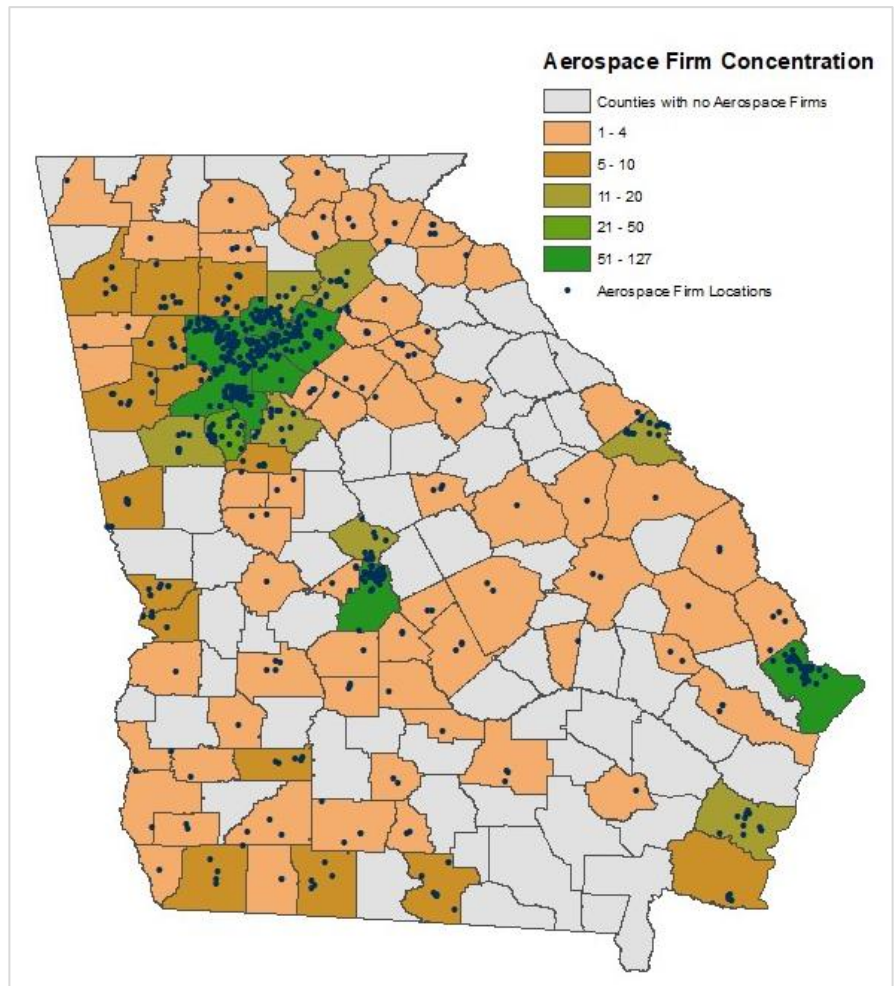


Location of Aerospace Firms in Georgia

Georgia's diverse aerospace industry includes a range of firms that manufacture, operate, service, and repair aircraft, provide air transportation, and operate flight schools. The map below shows the concentration of aerospace firms across the state of Georgia. The map shows only firms that are subject to unemployment insurance (UI) laws. Single proprietor businesses and single owner LLCs are not subject to UI laws therefore are not required to report employment data. In addition, small airports are not included in this map due to limited availability of employment data at that level of detail. Typically, local/regional entities report aggregate employment numbers.

Firms were geocoded and mapped based on their physical address⁶. As the map shows, there is widespread activity throughout the state, with high-activity clusters surrounding the Atlanta Regional Commission, Middle Georgia, River Valley and Coastal Regions.

Figure E-2: Concentration of Aerospace Firms in Georgia - 2019



⁵ Source: Quarterly Census of Employment and Wages - Bureau of Labor Statistics: 2019 Annual Averages, All establishment sizes.

⁶ Incomplete addresses were either not displayed on the map or mapped based on the address information available – e.g., P.O. Box or zip code maps to the center of the 5-digit zip; city name only maps to the center of the city.

Concentrated Aerospace Employment Clusters

As the map clearly shows, there are specific clusters of aerospace activity, which closely correlate to administratively assigned economic development regions in Georgia⁷. As a result, this study's process of economic modeling and analysis was used to create a regional view of economic impact in four concentrated clusters of aerospace activity:

- Region 3 – Atlanta Regional Commission
- Region 6 – Middle Georgia
- Region 8 – River Valley
- Region 12 – Coastal

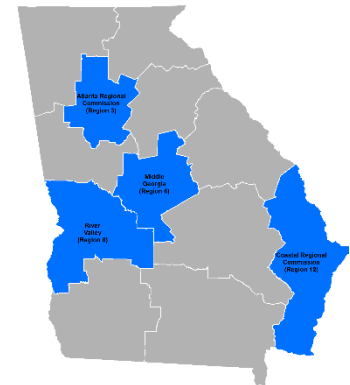


Table E-4 shows a list of these regions and their respective counties.

Table E-4: Regional Commissions

Regions	Counties
ATL Regional Commission (Region 3)	Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, Rockdale
Middle Georgia (Region 6)	Baldwin, Bibb, Crawford, Houston, Jones, Monroe, Peach, Pulaski, Putnam, Twiggs, Wilkinson
River Valley (Region 8)	Chattahoochee, Clay, Crisp, Dooly, Harris, Macon, Marion, Muscogee, Quitman, Randolph, Schley, Stewart, Sumter, Talbot, Taylor, Webster
Coastal (Region 12)	Bryan, Bulloch, Camden, Chatham, Effingham, Glynn, Liberty, Long, McIntosh, Screven

Source: Georgia Department of Community Affairs

The Atlanta Regional Commission (Region 3) is a 10-county area with the largest aerospace activity compared to the other eleven regions. The economic impact that stemmed from aerospace activities in 2019 accounts for 60 percent of the industry's overall economic impact in the state of Georgia. There were 62,833 jobs associated directly with aerospace industry in 2019. These jobs generated \$7 billion in direct wages and salaries and \$25 billion in output. Aerospace activities within Region 3 are estimated to support 151,346 direct, indirect and induced jobs with earnings of nearly \$12 billion, and output of nearly \$40 billion.

The Middle Georgia Region (Region 6) is comprised of eleven counties. Aerospace companies employed 19,582 people in the region, who earned \$2.2 billion in wages and salaries. The regions' direct employment includes 14,821 jobs held by civilians employed at Robins Air Force Base. Companies in this region generated nearly \$4.2 billion in direct output during that year. The total economic impact of aerospace activities in the region totaled to 33,216 jobs, wages and salaries of \$2.5 billion and output of nearly \$6 billion.

⁷ The state's regional commissions (RCs) function as multicounty planning and development agencies. A map of RCs can be found here: <http://www.georgia.org/business-resources/expand-a-business-in-georgia/>

The River Valley Region (Region 8) encompasses 16 counties. In 2019, there were 1,153 direct jobs with wages and salaries of \$0.2 billion related to aerospace activity in the region. Direct output was \$1.2 billion. The overall industry economic impact in the region totals to 3,623 jobs, \$0.3 billion in earnings and \$1.5 billion in output.

The Coastal Region (Region 12) includes 10 counties. This region is the state's third largest in

terms of aerospace activity. There were 11,919 direct jobs connected to aerospace activity in the region in 2019 that injected \$1.7 billion of direct wages and salaries into the region's economy. Direct output was \$9.5 billion. Individual and business spending supported additional regional economic activity bringing the total economic impact to 25,987 jobs, \$2.3 billion in wages and salaries and \$11.7 billion in output.

Unmanned Aircraft Systems (UAS) Companies

Commercial use of unmanned aircraft systems (UAS) has rapidly expanded since its initial authorization in 2015. Given the growing commercial use of UAS in a wide variety of industries such as agriculture, media and construction, this study quantified the economic impact of UAS companies operating in the state of Georgia in 2019.

Many established companies have integrated UAS into their operations, making it difficult to separate UAS operations from their core functions. It is possible that UAS activity and economic impact may be higher as a result, but it is beyond the ability of this study to

quantify the impact of these 'in-house' operations.

Using data provided by the Georgia Department of Labor, it was determined that singularly identifiable UAS companies employed 959⁸ people in year 2019, who earned \$90.2 million in wages and salaries and generated \$268.8 million in economic activity. Spending by these companies and their employees generated additional activity in other sectors of the state's economy. Overall, UAS companies in 2019 supported 1,552 jobs with wages & salaries of \$81 million and generated \$246.6 million of economic activity.

Table E-4: Economic Impact of Unmanned Aircraft Systems Companies in Georgia: 2019

	Direct	Indirect	Induced	Total
Employment	959	753	799	2,511
Wages & Salaries	\$90.2 M	\$43.5 M	\$37.5 M	\$171.2 M
Output	\$268.8 M	\$124.5 M	\$122.1 M	\$515.4 M

Space Companies

An increasing number of companies in Georgia are continuing to actively pursue activities in the space industry. The Center of Innovation for Aerospace has determined that there were 7 companies with some activities in the space sector in 2019. These companies employed 1,153 workers that earned \$131.6 million in direct wages and salaries and

generated \$400.8 million in economic activity. Further spending by space companies and their employees resulted in supporting an additional 2,167 indirect and induced jobs with wages of \$122.5 million that resulted in output of \$371 million. Table E-5 shows the total impact of space companies in the state of Georgia.

⁸ This figure does not include employment of single proprietor businesses and single owner LLCs.

Table E-5: Economic Impact of Space Companies in Georgia: 2019

	Direct	Indirect	Induced	Total
Employment	1,153	981	1,186	3,320
Wages & Salaries	\$131.6 M	\$66.8 M	\$55.7 M	\$254.1 M
Output	\$400.8 M	\$189.8 M	\$181.2 M	\$771.7 M

This impact analysis does not include the economic impact of companies that supplied the National Aeronautics and Space Administration (NASA) with goods and services and reported a NAICS code not associated with aerospace industry as defined in this study. In FY 2019, NASA awarded 314⁹ contracts to Georgia-based companies that provided goods, engineering services, engineering software, training, and education related to NASA's core mission valued at \$24.7 million.

⁹ Source: <https://prod.nais.nasa.gov/cgibin/npdv/usmap01.cgi>. Data was retrieved and analyzed by COIA.

I. INTRODUCTION



The economic impact study of Georgia's aerospace industry measures the industry's contribution to the state's economy in 2019 by quantifying its activity in terms of economic output, employment, and employee compensation. The study also assesses the industry's impact in state government costs and revenues. This report is an update of a series of previous economic studies, the most recent conducted in 2017.

Economic output is typically defined as business revenues, and employee compensation is defined as wages and salaries including benefits, paid by employers. Total activity is generally referred to as

the "multiplier effect." This effect occurs whenever dollars are brought into a state's economy and recirculated before exiting or "leaking out." Section 2 explains the methodology used to estimate total economic activity and provides perspective on how important these activities are in the overall Georgia economy. Section 3 quantifies the industry's impact on state government costs and revenues. Sections 4 and 5 compare the economic activity of aerospace industry to the state's GDP and show the location of aerospace firms in Georgia, respectively. Sections 6 and 7 quantify the economic impact of unmanned aircraft systems and space companies located and operating in the state of Georgia.

Definition of the Aerospace Industry in Georgia



The aerospace industry in Georgia has many diverse functions including research, development, manufacturing, maintenance, repair and overhaul, operations, education and training.

To measure the economic impact of the broad span of aerospace activities, the industry's sectors were mapped to a respective six-digit North American Industrial Classification System (NAICS) code (see Table 1-1 for core sectors and Table 1-2 for supporting sectors). The NAICS codes included in this study were carefully examined by the Georgia Center of Innovation for Aerospace and filtered to exclude any non-aerospace related companies and organizations.

The aerospace industry is complex and multi-disciplinary and is not easily defined by a single (or even several) NAICS codes. While there are several NAICS codes that contain establishments almost exclusively in the aerospace industry, there are many businesses which provide goods and services that serve a wide range of industries, including

aerospace. For example, the 336411 NAICS code is for establishments primarily engaged in one or more of the following: manufacturing or assembling complete aircraft, developing and making aircraft prototypes, and aircraft conversions or major modifications to the system. The companies selecting these NAICS codes are doing business in the aerospace industry. On the other hand, establishments in the NAICS code 332710 (Machine shops), are engaged in machining metal and plastic parts and parts of other composite materials on a job basis and may or may not perform work that supports the aerospace industry. Some of the establishments in this NAICS code will partially or fully support the aerospace industry, with other establishments listing in this code support a variety of other industries.

For this report, "core" and "support" NAICS codes have been defined as follows:

- ✓ "Core" codes are those that provide a clear mapping between the establishments listing in that code and the aerospace industry

- ✓ “Support” codes provide goods and services that are essential to aerospace but also serve other industries and therefore contain only a portion of listing establishments in the aerospace industry. It is important to note that many companies in the “support” codes perform work across multiple industries and may have only a fraction of their business in aerospace-related work. For the “support”

codes, only establishments known to be performing work in support of the aerospace industry were included in this study.

The industry definition used in this study has been updated to include a more extensive list of sectors (compared to previous studies) and make adjustments due to revisions of the NAICS code classification.

Table I-1: Aerospace Industry Definition Components by NAICS Code – Core sectors

Core Sectors	NAICS
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	334511
Aircraft Manufacturing	336411
Aircraft Engine and Engine Parts Manufacturing	336412
Other Aircraft Parts and Auxiliary Equipment Manufacturing	336413
Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing	336415
Scheduled Passenger Air Transportation	481111
Scheduled Freight Air Transportation	481112
Nonscheduled Chartered Passenger Air Transportation	481211
Nonscheduled Chartered Freight Air Transportation	481212
Other Nonscheduled Air Transportation	481219
Air Traffic Control	488111
Other Airport Operations	488119
Other Support Activities for Air Transportation	488190
Flight Training	611512
Regulation and Administration of Transportation Programs	926120
<i>Source: North American Industrial Classification System (2017); Georgia Center of Innovation for Aerospace, Georgia Tech's Enterprise Innovation Institute</i>	

Table I-2: Aerospace Industry Definition Components by NAICS Code - Support Sectors

Support Sectors	NAICS	Support Sectors	NAICS
Soil Preparation, Planting, and Cultivating	115112	Other Clothing Stores	448190
Support Activities for Forestry	115310	Freight Transportation Arrangement	488510
Commercial and Institutional Building Construction	236220	Couriers and Express Delivery Services	492110
Corrugated and Solid Fiber Box Manufacturing	322211	Book Publishers	511130
Artificial and Synthetic Fibers and Filaments Manufacturing	325220	Software Publishers	511210
Tire Manufacturing (except Retreading)	326211	Television Broadcasting	515120
Clay Building Material and Refractories Manufacturing	327120	All Other Nondepository Credit Intermediation	522298
Other Aluminum Rolling, Drawing, and Extruding	331318	Insurance Agencies and Brokerages	524210
Machine Shops	332710	Engineering Services	541330
Ball and Roller Bearing Manufacturing	332991	Testing Laboratories	541380
Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	333924	Interior Design Services	541410

Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	334220	Custom Computer Programming Services	541511
Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	334513	Computer Systems Design Services	541512
Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	334515	Computer Facilities Management Services	541513
Motor Vehicle Electrical and Electronic Equipment Manufacturing	336320	Other Computer Related Services	541519
Metal Service Centers and Other Metal Merchant Wholesale	423510	Administrative Management and General Management Consulting Services	541611
Other Electronic Parts and Equipment Merchant Wholesalers	423690	Process, Physical Distribution, and Logistics Consulting Services	541614
Hardware Merchant Wholesalers	423710	Other Management Consulting Services	541618
Industrial Machinery and Equipment Merchant Wholesalers	423830	R & D in Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	541715
Industrial Supplies Merchant Wholesalers	423840	Photography Studios, Portrait	541921
Transportation Equipment and Supplies (except Motor Vehicle) Wholesalers	423860	All Other Professional, Scientific, and Technical Services	541990
Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers	424310	Corporate, Subsidiary, and Regional Managing Offices	551114
Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	424720	Office Administrative Services	561110
Wholesale Trade Agents and Brokers	425120	Executive Search Services	561312
Motorcycle, ATV, and All Other Motor Vehicle Dealers	441228	Temporary Help Services	561320
Source: North American Industrial Classification System (2017); Georgia Center of Innovation for Aerospace, Georgia Tech's Enterprise Innovation Institute			

Top Aerospace Companies in Georgia

Georgia is home to companies in three major aerospace market sectors: *manufacturing*, *air transportation* and *maintenance, repair and overhaul (MRO)*. With the world's busiest commercial airport, Georgia is home to Delta Air Lines, operations for several large commercial air carriers and air cargo companies.

Georgia is also the home base for four aircraft manufacturers - Gulfstream, Lockheed Martin, Maule Air Inc., Thrush Aircraft and a large number of suppliers. Georgia is the natural home for several large Maintenance, Repair and Overhaul (MRO) enterprises. Delta TechOps is the largest MRO facility in North America, and third largest worldwide¹⁰. Gulfstream Aerospace operates a large service center for their aircraft. In addition, there are 132 aeronautical repair stations.

Table I-2. Top 20 Aerospace Employers in Georgia: 2019

No.	Company Name	No.	Company Name
1.	Delta Air Lines (Delta TechOps)	11.	Endeavor (Delta Connection)
2.	Robins AFB	12.	Honeywell International
3.	Gulfstream Aerospace	13.	Moody AFB
4.	Lockheed Martin	14.	PCC Airfoils Inc.
5.	Southwest Airlines	15.	Dobbins ARB
6.	ABM Aviation	16.	Universal Alloy
7.	FAA	17.	Triumph Aerostructures (now Qarbon)
8.	Pratt & Whitney Group	18.	SITA USA
9.	Georgia Tech Research Institute (GTRI)	19.	American Airlines
10.	Northrop Grumman	20.	Sky West Airlines

Sources: Georgia Center of Innovation for Aerospace, Georgia Tech, Enterprise Innovation Institute.

Georgia is also home for companies and academic centers that do significant amount of research and development for aerospace. Table I-2 displays a list of the top 20 aerospace employers in Georgia.

¹⁰ http://arsa.org/wp-content/uploads/2017/03/ARSA-OW-MROMarketAssessment-20170225_onepager.pdf

II. ECONOMIC IMPACT OF AEROSPACE



Economic impact analysis is a valuable tool used to measure the impact of the economic activity of an industry. Results from an economic impact analysis are typically shown in terms of “direct” and “total” impact, which is a sum of “direct”, “indirect” and “induced” impact. These are defined as:

- *Direct impacts*: employment, income, and business revenue (output) associated with the new economic activity in the region.
- *Indirect impacts*: increases in employment, income and in business revenues (output) of businesses in the study region due to purchases contained in the direct impacts.
- *Induced impacts*: increases in employment, income and in business revenues (output) of businesses in the study region due to employees’ spending of payroll from the direct impacts.

- *Total impacts*: sum of the direct, indirect, and induced impacts. The ratio of “total” to “direct” yields the multiplier.

For each of these impacts three items are measured: 1) employment; 2) wages, salaries, including the benefits accruing to employees, and 3) output¹¹, which is closely related to business revenues. The economic impact analysis in this study was conducted using the nationally recognized IMPLAN¹² model, an input-output economic modelling software that accounts for both the *direct* and *indirect* economic impact of an industry or economic activity. The economic model is customized to reflect the state of Georgia’s economy.

The analytical process of estimating the economic impacts (direct, indirect, and induced) of aerospace in this study involved the following steps:

1

Direct employment for each sector (by NAICS code) was quantified. This study counted the number of employees working for companies whose primary business supports the aerospace industry in Georgia. The best source for employment and wages is the employment data collected and maintained by the Georgia Department of Labor, commonly called ES202 data. It has the drawback, however, of not including single proprietor businesses and single owner LLCs. Employment and Wage data available through this database are derived from reports filed by all employers subject to unemployment insurance laws.

2

Review of employment data was a critical part of this analysis due to the broad definition of NAICS codes for aerospace sectors. Employment was verified by calling individual firms (calls were conducted by Georgia’s Center of Innovation for Aerospace), and changes were made where necessary. During the vetting process, it became apparent that many companies were classified under the wrong code. Every attempt was made to capture all aerospace-related employment as defined by the NAICS codes listed on Section 1. We recognize that there may be many supporting companies that are not included in this study due to their size and structure (such as single owner LLCs) and misclassification of a firm’s NAICS code in unemployment insurance filings.

3

- The third step was to use the I/O model to estimate total impacts, which were divided into three components. The first was the *direct* impacts (the value of resources brought into the state); the second was *indirect* impacts (impacts from recirculation of resources resulting from aerospace industry purchases from other industries); and the third was *induced* impacts, resulting from activities in the household sector. The total impact was the sum of direct, indirect, and induced impacts.

¹¹Output impact estimates the total dollar value of all the goods or services.

¹²IMPLAN Group Inc.

Table II-1 provides estimates of the impacts of aerospace industry sectors contained in the industry's definition. Georgia's aerospace industry employed 104,502 workers in 2019, who earned nearly \$12 billion in wages and salaries and generated an economic output of \$42.5 billion. The direct employment included civilian employment at Robins AFB, Moody AFB and Dobbins ARB, which in 2019 accounted for 16 percent of Georgia's direct employment in aerospace industry. While a large share of the impacts is attributed to direct employment, the total economic impact (direct, indirect and induced) of aerospace industry is significant. The ongoing operations of aerospace companies generated ripple impacts throughout the state supporting an additional 158,473 indirect and

induced jobs with earnings of \$8.3 billion and economic output of \$25.3 billion.

Aerospace industry jobholders in Georgia, were paid an annual average wage of \$83,500, excluding benefits. The average wage rate was 51 percent higher than the state's overall average wage rate of \$55,263¹³ in the same year. The average wage rate, including benefits, of aerospace workers in Georgia was \$114,383. The employment multiplier of the aerospace industry in Georgia was 2.5 and the income multiplier was 1.7. These multipliers were higher than state's average multiplier of all sectors due to the industry's high level of output and high wage rates.

Table II-1: Georgia's Aerospace Industry Economic Activity: 2019

	Direct	Indirect	Induced	Total
Employment	104,502	64,300	94,173	262,975
Wages & Salaries	\$12.0 B	\$3.8 B	\$4.4 B	\$20.2 B
Output	\$42.5 B	\$10.9 B	\$14.4 B	\$67.9 B

Other Impacts not captured in this study

The aerospace industry generates additional impacts that are not captured in this study. Single proprietor businesses are not required to report employee totals, and therefore have not been included in this analysis. There are a number of these types of employers in the aerospace industry in Georgia, particularly in the emerging sector of UAS. There are many small airports operating across the state that have a significant impact on the success of local economies and businesses. Due to data limitations, that impact has not been assessed as part of this report.

Summary of findings: 2011, 2013, 2015, 2017 and 2019 Studies

The Georgia Center of Innovation – Aerospace engaged the Enterprise Innovation Institute (EI2) of Georgia Tech to conduct the economic impact of Aerospace industry in Georgia in 2011. The economic impact study was subsequently updated to show the impact of aerospace industry in 2013, 2015 and 2017. The latest update is based on 2019 industry data. Figures 2-1 through 2-3 show a summary of the studies' findings. It is important to note that aerospace industry definitions (sectors included) evolved in each study. Furthermore, revisions of NAICS code definitions have an impact on the direct effect numbers. Therefore, caution should be exercised in comparing the results of the five studies.

¹³ Source: Quarterly Census of Employment and Wages - Bureau of Labor Statistics: 2019 Annual Averages.

Aerospace direct employment decreased by 4,069 or 4 percent in 2019 compared to direct employment in 2017 (see Figure 2-1).

As shown in Figure 2-2, wages and salaries¹⁴ of direct employment increased to \$12 billion in 2019, an increase of \$560 million or 5 percent from 2017. The total wages and salaries also grew by 5 percent or \$978 million.

The direct output¹⁵ of aerospace industry increased by \$79 billion, or 23 percent, from 2017 to 2019. Total output increased by 18 percent.

Figure 2-1. Aerospace Industry Employment in Georgia
2011; 2013; 2015; 2017; 2019

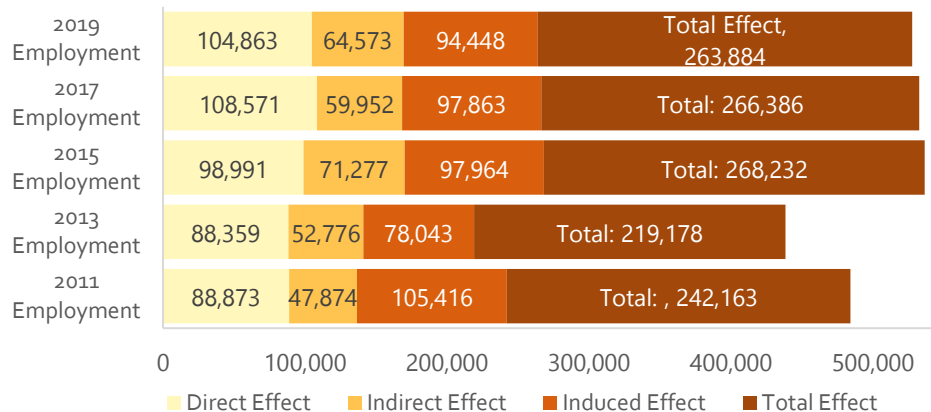


Figure 2-2. Aerospace Industry Wages and Salaries in Georgia
2011; 2013; 2015; 2017; 2019

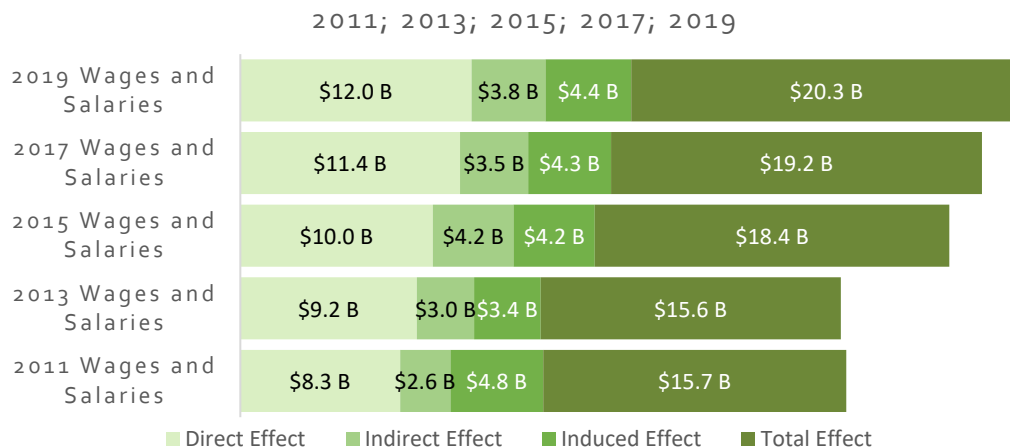
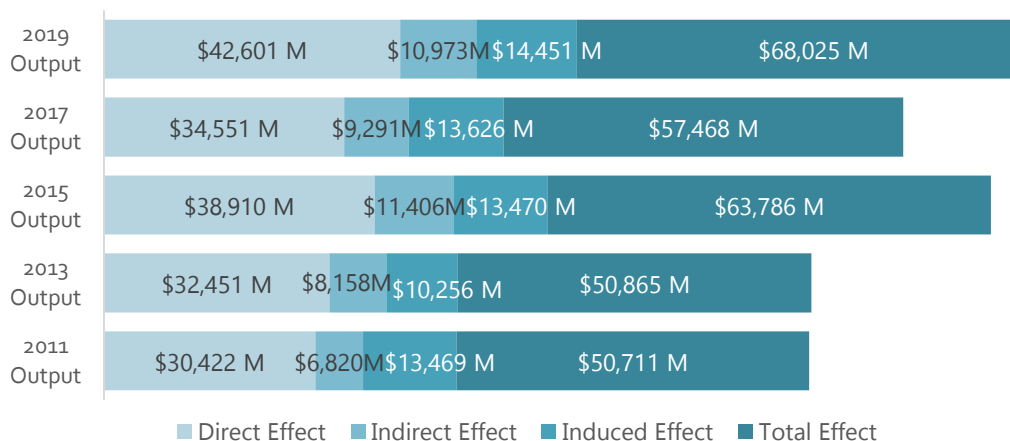


Figure 2-3. Aerospace Industry Output in Georgia
2011; 2013; 2015; 2017; 2019



¹⁴ Wages and salaries presented in Figure 2-2 are not adjusted for inflation.

¹⁵ Output figures shown in Figure 2-3 are not adjusted for inflation.

III. FISCAL IMPACT



The fiscal impact analysis quantifies the impact of aerospace industry activities to state government revenues. These fiscal impacts are in the form of new revenues that accrue to the state government in Georgia as a result of the industry's activity. The net revenues were calculated by estimating the revenues associated with the aerospace industry's total economic activity and subtracting the costs associated with providing state services to Georgia's households and companies associated with that activity. Revenues included individual and corporate income taxes, sales and use taxes, highway taxes, fees, and miscellaneous revenues. Costs included education; public health, safety, and welfare; highways; administration; and miscellaneous¹⁶.

Table 3-1 provides the fiscal impact estimates based on total impacts. The aerospace industry generated \$1.4 billion in revenues for the state budget in calendar year 2019. When the costs of providing services to all aerospace-related employees (direct, indirect and induced) were deducted from these revenues, the net contribution of aerospace industry to the state revenues in 2019 was \$463.8 million.

\$463.8 M

Net State Government
Revenues

\$1.45 B

State Government
Revenues

Table III.2: Aerospace Fiscal Impact Analysis: 2019

Annual State Government Revenues	\$1.45 B
Annual State Government Costs	\$0.98 B
Net Annual Revenues	\$463.8 M

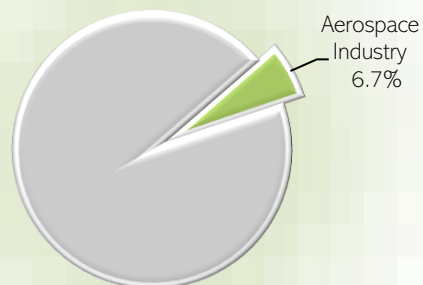
¹⁶ The Georgia Fiscal Impact Model was originally developed in the 1990s by economists at Georgia Tech. Over the years, the econometric equations in the model have undergone revisions based on the State of Georgia's revenue and expenditure data. One such revision was recently completed. Every equation in the model was re-specified and statistically validated. One result of the new model equations is that expenditures in the model tend to be higher than previous model estimates. Many of the reduced form equations in the model are now driven by either the absolute level of the population, or the growth rate of the population. State expenditures are driven by growth in the state's population. As Georgia attracts jobs, it also attracts people and that drives state expenditures. As a result, comparisons between results from previous versions of the Georgia Fiscal Impact Model may show very different net fiscal impact results for similar sized projects.

IV. CONTRIBUTION OF AEROSPACE TO THE STATE'S GDP

The aerospace industry is an important driver of the state's economic activity. In addition to creating and supporting high-paying jobs for Georgia's citizens, it generates considerable economic activity within the state.

In 2019, aerospace supported 263,883 total jobs or 6.7 percent of the state's total employment¹⁷, and it contributed \$36.6 billion to the state's Gross domestic product (GDP)¹⁸ or 6 percent. GDP¹⁹ is the most widely used measure of overall economic output. It measures the total value of goods and services created by an industry.

Figure IV-1: Contribution of Aerospace Industry to the State of Georgia's GDP (2019)



V. LOCATION OF AEROSPACE FIRMS

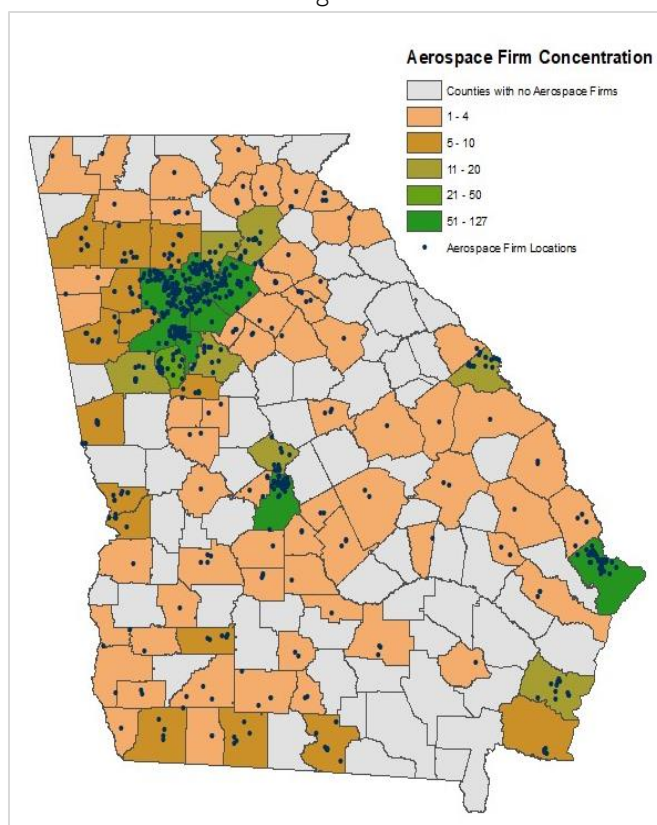
Georgia's diverse aerospace industry includes companies across five main sectors: aerospace manufacturing, air transportation, maintenance repair and overhaul, space, and unmanned aircraft systems.

The following map shows the location of aerospace firms in Georgia. The map shows only firms that are subject to unemployment insurance (UI) laws. Single proprietor businesses and single owner LLCs are not subject to UI laws therefore are not required to report employment data. In addition, small airports are not included in this map due to limited availability of employment data at that level of detail.

Firms were geocoded and mapped based on their physical address. Incomplete addresses were either not displayed on the map or mapped based on the address information available – e.g., P.O. Box or zip code maps to the center of the 5-digit zip; city name only maps to the center of the city.

Note that there is widespread activity throughout the state, with a greater concentration of firms surrounding the Atlanta Regional Commission, Middle Georgia, River Valley and Coastal Regions.

Figure V-1: Concentration of Aerospace Firms in Georgia - 2019



¹⁷ Source: Quarterly Census of Employment and Wages - Bureau of Labor Statistics: 2019 Annual Averages, All establishment sizes.

¹⁸ Source: Bureau of Economic Analysis

¹⁹ State-level GDP data is released by the Bureau of Economic Analysis at the U.S. Department of Commerce

VI. CONCENTRATED AEROSPACE EMPLOYMENT CLUSTERS

As shown in Figure 5-1, the majority of aerospace activity is centered in four economic development regions as defined by the state. This section shows the economic impact of this activity in each of the four selected regions:

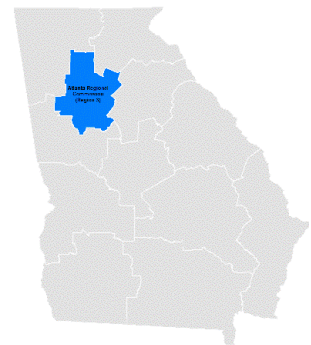
- Region 3 – Atlanta Regional Commission
- Region 6 – Middle Georgia
- Region 8 – River Valley
- Region 12 – Coastal

a. Atlanta Regional Commission- Region 3

The Atlanta Regional Commission (ARC) is the 10-county area of Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, and Rockdale counties, including the city of Atlanta. The region is home to Lockheed Martin Aeronautics, the Hartsfield-Jackson Atlanta International Airport, the Dobbins Air Reserve Base, and several other companies, therefore, it is no surprise that most of the Georgia's aerospace activity occurs within the ARC region. Table VI.a shows the impact of this activity in Region 3.

Table VI.a: Economic Impact of Aerospace Related Activities in the Atlanta Regional Commission (Region 3) in 2019

	Direct	Indirect & Induced	Total
Employment	62,833	88,514	151,347
Wages & Salaries	\$7 B	\$5 B	\$12 B
Output	\$25 B	\$15 B	\$40 B

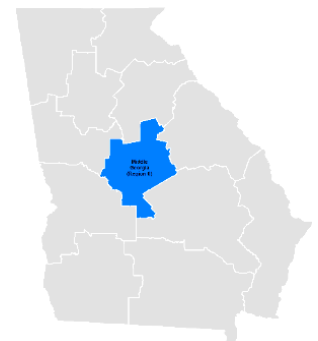


b. Middle Georgia- Region 6

The Middle Georgia Region is comprised of Putnam, Monroe, Jones, Baldwin, Crawford, Bibb, Twiggs, Wilkinson, Peach, Houston, and Pulaski Counties. It also home to the Robins Air Force Base²⁰, the region's largest employer. See table VI.b for a summary of the impact of aerospace activities in region 6.

Table VI.b: Economic Impact of Aerospace Related Activities in the Middle Georgia Regional Commission (Region 6) in 2019

	Direct	Indirect & Induced	Total
Employment	19,582	13,634	33,216
Wages & Salaries	\$2.2 B	\$0.5 B	\$2.5 B
Output	\$4.2 B	\$1.8 B	\$6.0 B



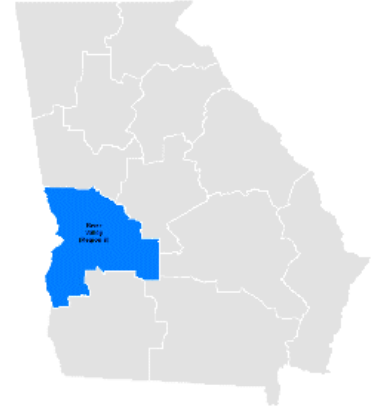
²⁰ This study shows the impact of civilian personnel of the bases. Active-duty military jobs are not included in this study.

c. River Valley Region- Region 8

The River Valley Region includes Chattahoochee, Clay, Crisp, Dooly, Harris, Macon, Marion, Muscogee, Quitman, Randolph, Schley, Stewart, Sumter, Talbot, Taylor, and Webster Counties. Table VI.c summarizes the impact of aerospace industry in Region 8.

Table VI.c: Economic Impact of Aerospace Related Activities in the River Valley Region (Region 3) in 2019

	Direct	Indirect & Induced	Total
Employment	2,183	1,441	3,623
Wages & Salaries	\$0.2 B	\$0.1 B	\$0.3 B
Output	\$1.2 B	\$0.3 B	\$1.5 B

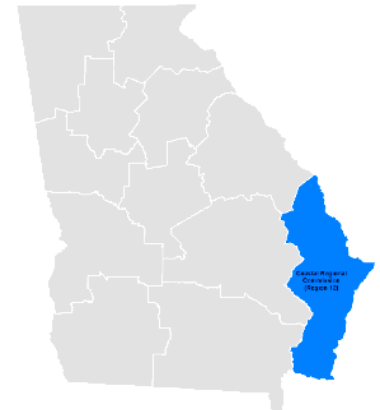


d. Coastal Region- Region 12

The Coastal regions encompasses 10 counties: Bryan, Bulloch, Camden, Chatham, Effingham, Glynn, Liberty, Long, McIntosh and Screven. See Table VI.d for a summary of the impact of aerospace-related activity in Region 12.

Table VI.d: Economic Impact of Aerospace Related Activities in the Coastal Region (Region 12) in 2019

	Direct	Indirect & Induced	Total
Employment	11,919	14,068	25,987
Wages & Salaries	\$1.7 B	\$0.6 B	\$2.3 B
Output	\$9.5 B	\$2.2 B	\$11.7 B



VII. UNMANNED AIRCRAFT SYSTEMS (UAS) COMPANIES

Given the growing use of unmanned aircraft systems (UAS)²¹ in the commercial and civil market, this study quantifies the economic impact of this sector in the state of Georgia. The Georgia Center of Innovation for Aerospace team researched and identified 19 UAS companies active in 2019.

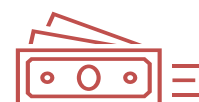
Many established companies have integrated UAS into their operations, making it difficult to separate UAS operations from their core functions. It is possible that UAS activity and economic impact may be higher as a result, but it is beyond the ability of this study to quantify the impact of these 'in-house' operations.

Using data provided by the Georgia Department of Labor,²² it was determined that these companies employed 959 people in year 2019 who earned \$90.2 million in wages and salaries and generated \$268.8 million in economic activity. The spending by UAS companies and their employees generated additional jobs and economic activity in other sectors of the state's economy. In total, UAS companies in the state of Georgia supported 1,552 jobs with wages and salaries of \$81 million and generated \$246.6 million of economic activity in 2019.



959

Direct UAS
Jobs



\$90.2 M

UAS Sector Wages
and Salaries



\$268.8 M

Direct
Output/Business Activity
of UAS Sector

Table VII-1: Economic Impact of Unmanned Aircraft Systems
Companies in Georgia: 2019

	Direct	Indirect	Induced	Total
Employment	959	753	799	2,511
Wages & Salaries	\$90.2 M	\$43.5 M	\$37.5 M	\$171.2 M
Output	\$268.8 M	\$124.5 M	\$122.1 M	\$515.4 M

²¹ Definition of UAS: An unmanned aircraft system (UAS), sometimes called a drone, is an aircraft without a human pilot onboard – instead, the UAS is controlled from an operator on the ground <https://www.faa.gov/uas/>

²² Source: Georgia Department of Labor, ES202 data (Firm level data)

VIII. SPACE COMPANIES



1,153

Direct Jobs in Space-
related sector



\$131.6 M

Space Sector Wages
and Salaries



\$400.8 M

Direct
Output/Business Activity
of Space Sector

Georgia's cluster of companies with space related activities continues to grow. The Center of Innovation for Aerospace has determined that there were 7 companies with some activities in the space sector in 2019²³. These companies had 1,153 employees that earned \$131.6 million in wages and salaries and generated \$400.8 million in economic activity. Further spending by space companies and their employees resulted in supporting an additional 2,167 indirect and induced jobs with wages and salaries of \$122.5 million that resulted in output of \$371 million.

Space companies are an important part of the overall aerospace industry. An increase in commercial space opportunities has resulted in growth of the space companies whose operations have generated an economic impact in the state of Georgia. As Table VIII-1 shows, in 2019, space companies supported 3,320 total jobs that generated \$254.1 million in wages and salaries and \$771.7 million in output.

Table VIII-1: Economic Impact of Space Companies in Georgia: 2019

	Direct	Indirect	Induced	Total
Employment	1,153	981	1,186	3,320
Wages & Salaries	\$131.6 M	\$66.8 M	\$55.7 M	\$254.1 M
Output	\$400.8 M	\$189.8 M	\$181.2 M	\$771.7 M

²³ This study does not include the economic impact of companies that supplied the National Aeronautics and Space Administration (NASA) with goods and services, and reported a NAICS code not associated with aerospace industry as defined in this study. In FY 2019, NASA awarded 314 contracts to Georgia-based companies that provided goods, engineering services, engineering software, training, and education related to NASA's core mission, valued at \$24.7 million.

APPENDIX 1. ECONOMIC IMPACT BY REGIONAL COMMISSION

Study findings show that most aerospace related activities are concentrated in four regions (shown in section 6), the industry has presence in all twelve regions in the state of Georgia. Table A.1-1 shows a breakdown of the economic impact of aerospace industry by region. The aerospace employment by region was calculated based on the physical address of the firms, which were mapped to the respective

region. Note that Wages and Salaries and Output are slightly different (less than one percent) than figures shown in Table 2-1 as result of using regional economic models mirroring each region's economy. These models capture inter-regional interactions of various sectors and therefore, produce slightly different results than the state economic model.

Table A.1-1. Economic Impact of Aerospace Industry by Regions

Region	Employment	Wages and Salaries	Output
Atlanta Regional Commission	62,833	\$7.0 B	\$25.0 B
Middle Georgia	19,582	\$2.2 B	\$4.2 B
Coastal	11,919	\$1.7 B	\$9.5 B
River Valley	2,183	\$0.2 B	\$1.2 B
Southwest Georgia	2,130	\$0.2 B	\$0.6 B
Northwest Georgia	1,861	\$0.2 B	\$0.6 B
Southern Georgia	1,35	\$0.1 B	\$0.5 B
Central Savannah River Area	820	\$0.1 B	\$0.3 B
Three Rivers	738	\$0.1 B	\$0.2 B
Northeast Georgia	610	\$0.1 B	\$0.1 B
Heart of Georgia Altamaha	418	\$0.0 B	\$0.4 B
Georgia Mountains	413	\$0.0 B	\$0.0 B
TOTAL*	104,862	\$12.0 B	\$42.6 B

*Totals may not add up due to rounding

Figures A-1.1 through A-1.3 show each region's output, employment, and wages and salaries.

Figure A-1.1: Aerospace Employment by Region: 2019

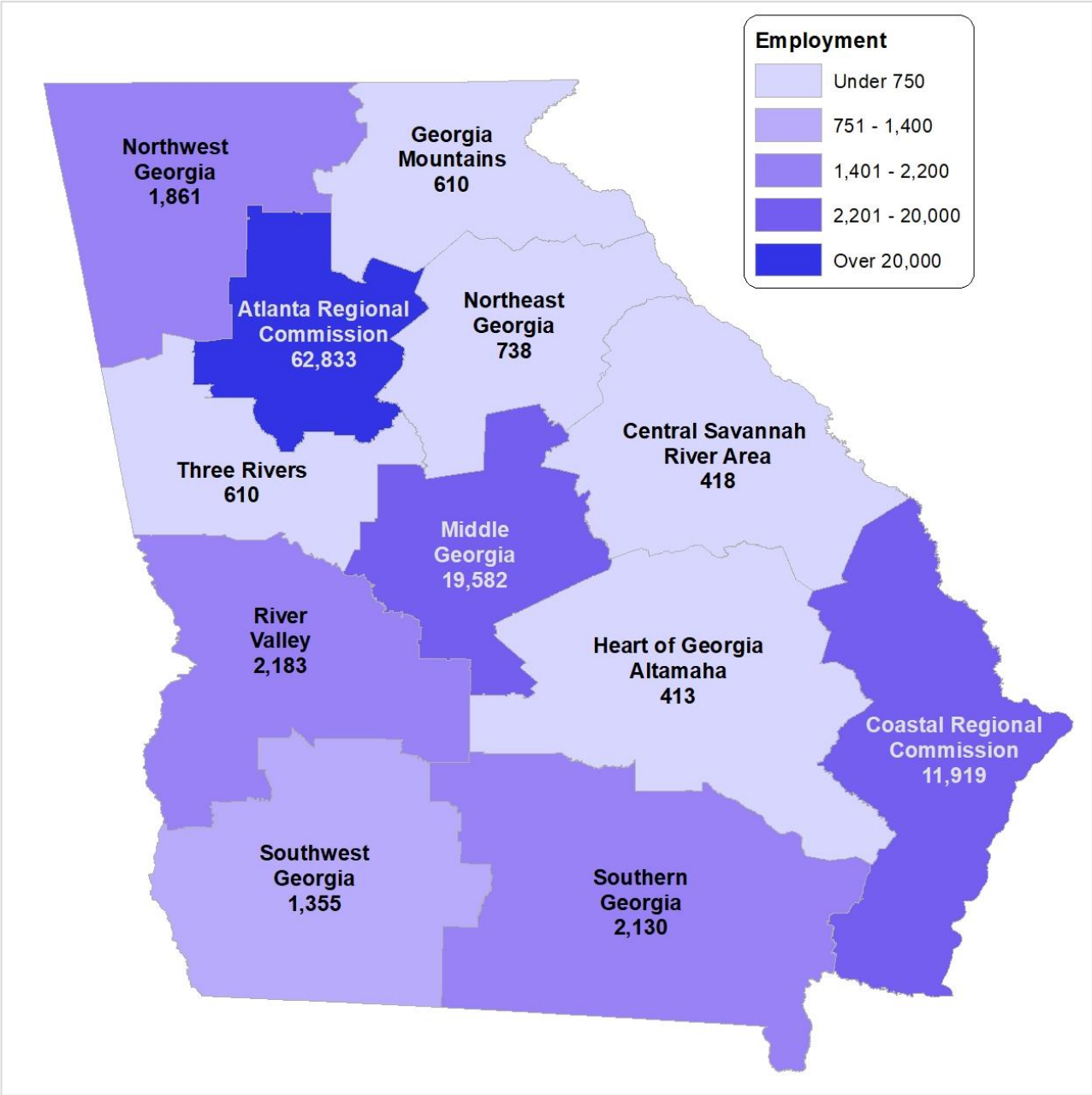


Figure A-1.2: Aerospace Industry Wages and Salaries by Region: 2019

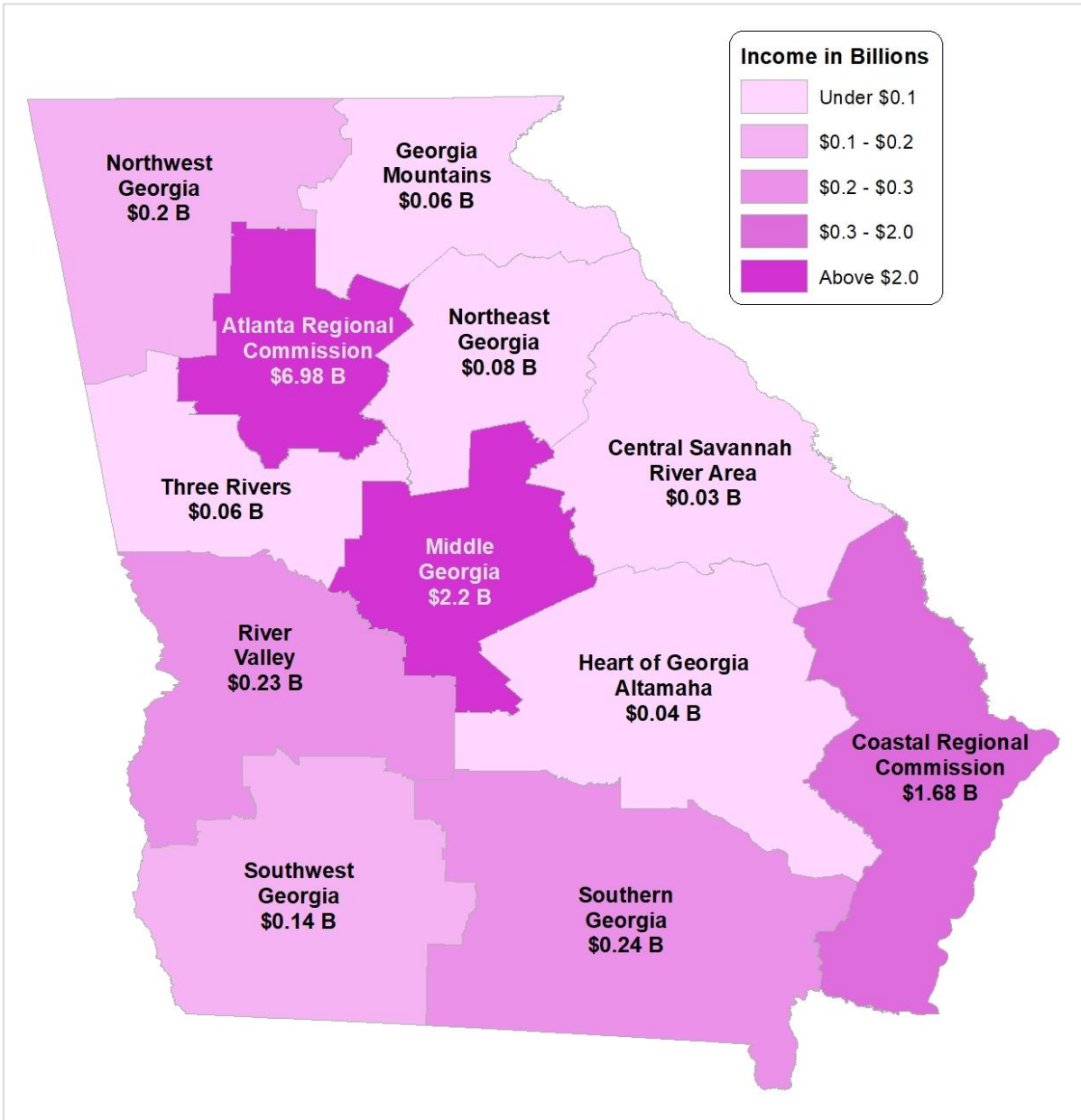
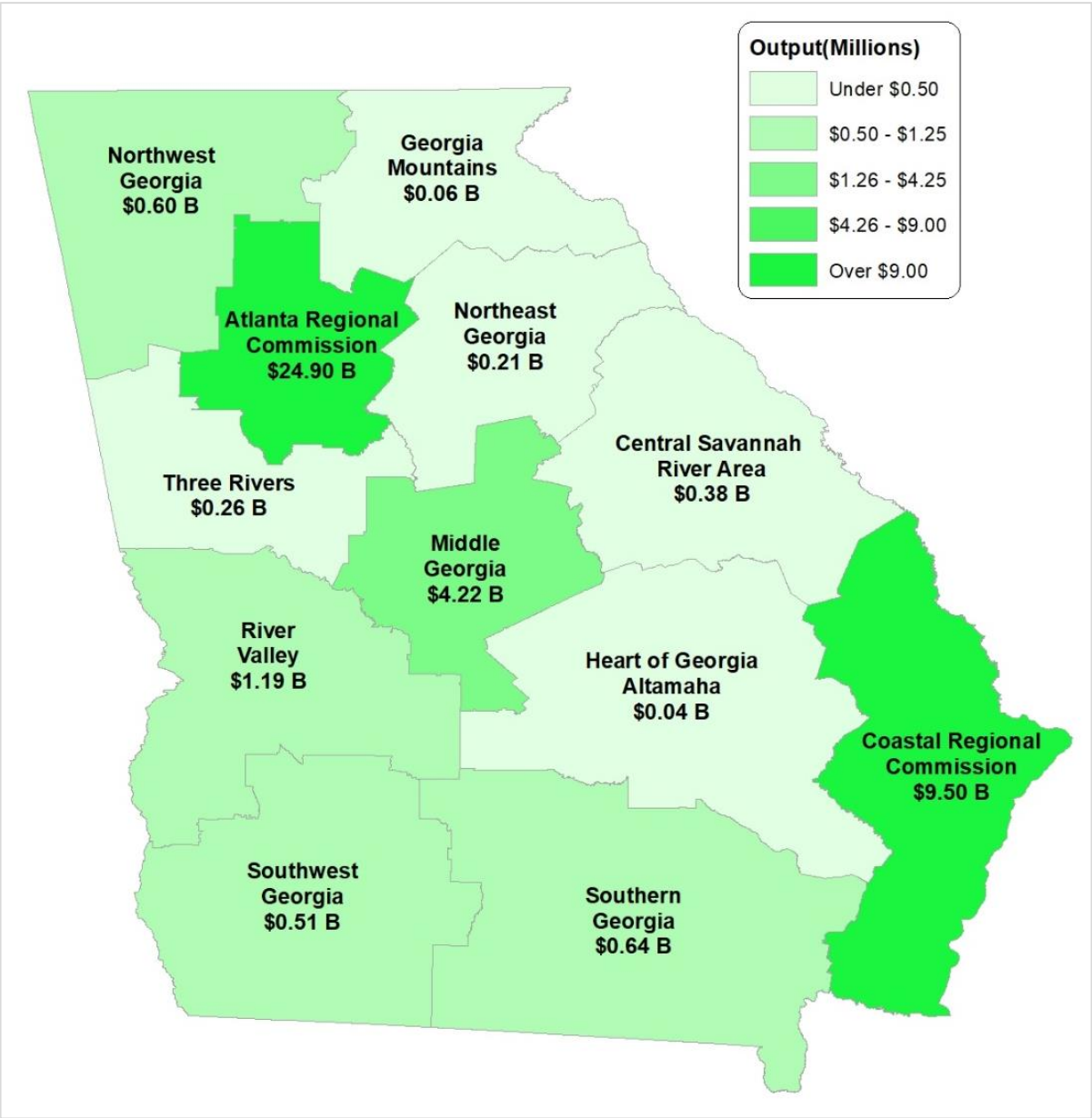


Figure A-1.3: Aerospace Industry Output by Region: 2019



APPENDIX 2. METHODOLOGY, DEFINITIONS, AND REFERENCES

METHODOLOGY AND DEFINITIONS

The economic impact of the aerospace industry was measured using IMPLAN, an economic impact assessment model customized to reflect Georgia's economy. The model estimates the multiplier (indirect and induced) effects of direct economic activity for each sector of the aerospace industry based on linkages across industries in the state of Georgia.

Output: Economic output is defined as the value of a company's or industry's production. Simply, output is total sales revenue minus its cost of goods sold.

Wages and Salaries: Wages and salaries are defined as income paid by employers to local employees, including benefits.

Direct Impacts: Direct impact measures employment, wages and salaries, and expenditures of goods and services attributable to aerospace industry.

Indirect Impacts: Indirect impact results from the purchase of goods and services by suppliers to the aerospace industry.

Induced Impact: Induced impact results from the spending of aerospace employee wages and salaries.

Total impact: Total Impact is generally referred to as the "multiplier effect." This effect occurs whenever dollars are brought into a region's economy and recirculated before exiting or "leaking out."

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Bureau of Economic Analysis Input-Output Sectors as contained in "IMPLAN Pro: Data Guide," Minnesota IMPLAN Group Inc., Stillwater, MN, 2021.

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North American Industrial Classification System (NAICS), <http://www.census.gov/epcd/www/naicstab.htm>