



Puerto Rico
Aerospace and Defense

Industry Report - March 2023

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Industry History

The **Puerto Rico Aerospace and Defense (A+D) Industry**¹ began in the early 1990s with the acquisition by **Hamilton Sundstrand (HS)** of the operations of an aerospace power system manufacturer owned by General Electric in the Municipality of Santa Isabel, PR. HS was eventually acquired by **United Technology Corporation (UTC)**. A few years later, UTC completed another company merger, and the company began operating under the brand name of **Collins Aerospace**.

Ten years after the establishment of HS, other companies began establishing in Puerto Rico. In 2003, Infotech Aerospace Service entered the Island as a joint venture between Infotech (India) and **Pratt & Whitney**. Currently, Pratt & Whitney and Collins Aerospace became subsidiaries of **Raytheon Technologies**.

Just over 12 years ago, the Government of Puerto Rico established “AEROSPACE” as one of the emerging and strategic industrial sectors. Since then and continuing today, the **Department of Economic Development and Commerce** (DDEC, in Spanish acronym) has dedicated great efforts to the development of the aerospace sector in Puerto Rico from the perspective of aeronautics, defense, and space. The Puerto Rico government established a public policy: To diversify the island’s industrial mix and attract subsectors such as research and development, engineering, design and testing, software development, cyber security, manufacturing, space, and aircraft maintenance.

It wasn’t until 2007 that the Puerto Rico A+D industry took off. An article published on September 25, 2008, for the Caribbean Business titled Aerospace Investment Takes Off (2008)² the journalist expresses “the investments by two of the largest aerospace companies in the world have kicked the local aerospace industry into high gear.” The facts that lead to this article are the establishment of **Honeywell Aerospace and Lockheed Martin** in Puerto Rico recruiting local talent in the field of engineering and information-systems. **Honeywell Aerospace** began by establishing a pilot program in the Municipality of Aguadilla, PR under a Job Corps Program. Several years later the company grew exponentially in both the number of employees and building space with the construction in 2014 of their World-Class, Electromagnetic and Environmental Laboratory (EMC) in the Municipality of Moca, PR.

In March 2010, the Governor of Puerto Rico inaugurated AXON Puerto Rico, today known as **DXC Technologies** and several hundred employees were hired. Followed by the arrival of companies such as **Lufthansa Technik** in April 2014. This was an historical agreement signed with a German company establishing the first maintenance, repair, and overhaul facility of the company in the Americas. One year later, **Avenger Aerospace Solutions** started operations in April 2015 to provide testing and engineering services to Lufthansa Technik.

¹ This report was written by José Castro-Segarra, Senior Business Development Office with the collaboration of Ivan Roche Morales, Senior Economist and Yasmin García Martínez, Senior Economist for the Department of Economic Development and Commerce. March 2023.

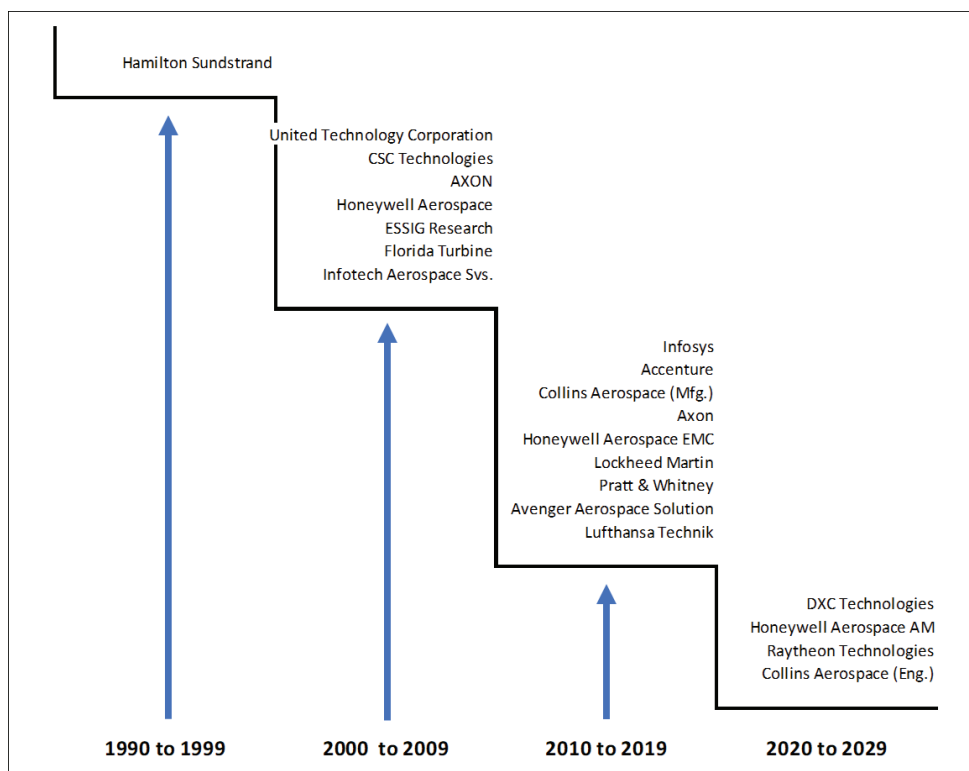
² Thurston, Lawson D. (2008) Aerospace Investment Takes Off. Edition: September 25, 2008. Volume: 36, No: 38.

Lufthansa Technik and Avenger Aerospace Solutions joined the A+D local industry at the historic moment when Infotech, UTC, Lockheed Martin, Honeywell Aerospace, Florida Turbine, Essig Research and AXON were operating. Today, some of the later brand names are no longer operating in Puerto Rico or are operating under a different brand name. Please refer to Table 1 to learn the ones currently operating.

In November 2022, **Honeywell Aerospace, After Market Division** relocated its HQs from Phoenix, AZ to San Juan, PR. On the same year, **Raytheon Technologies** and **Collins Aerospace** established their Global Engineering Centers in the Municipality of Aguadilla, PR to serve both, commercial and defense contracts.

An A+D Historical Timeline was developed to depict the time slot that each company or division of a company entered the Puerto Rico economic sector.

Diagram 1 – A+D Historical Timeline



Besides the Puerto Rico’s industrial incentives program under the DDEC, and access to federal grants programs which are excellent tools for company attraction, the success and rapid growth of the A+D industry can be mainly attributed to the island offering of a highly educated workforce. These companies also value the ability to provide goods and services in a U.S. jurisdiction with a competitive wage rate and in compliance with the International Traffic in Arms Regulation (ITAR) and Overseas Outsourcing Suitability.³

³ ITAR means that only U.S. citizens are able to access defense and military-related technologies, eliminating outsourcing to foreign countries with low operating costs. Puerto Rico also meets all the criteria from the defense segment of the aerospace market for U.S.-made products based on the Overseas Outsourcing Suitability.

Industry Composition

The composition of the A+D industry in Puerto Rico is different from that of the mainland United States.

In the mainland, the A+D industry are mostly companies producing end-use goods and services including aircraft, space systems, land vehicles, ships, armaments and cyber, and are responsible for 52 percent of the total A+D output. The remaining 48 percent was attributable to the industry's supply chain, which includes 35 percent from goods-producing companies and 13 percent from companies that provide services such as engineering, testing, logistics, and information technology.⁴

The total sales estimated of the A+D operations in Puerto Rico is \$625 million (as of December 2022)⁵. The companies that are established on the Island are positioned in the supply chain category. Tangible goods are only 30 percent of the total estimated sales and the other 70 percent are shared & outsourced services including but not limited to sales, engineering, testing, logistics, and information technology.

As of June 2022, and surveyed under the Quarterly Census of Employment and Wages (QCEW) Data Base under custody of the Department of Labor and Human Resources (DTRH its acronym in Spanish), the A+D sector in Puerto Rico have grown nearly 6,000 employees (5,983 to be exact). This sector has a business multiplier effect⁶ (as per FY 2020-21) estimated in 1.113 for indirect employment, and 0.832 for induced employment, in other words 6,678 and 4,992 employees respectively, for a total effect of 17,670 employees in economic activity.

An informal industry-survey⁷ shows that more than 95% of the employees are local talent, mostly engineers at an annual average salary of \$59,000 (49% over the island average industrial salary of \$29,440). About half of the companies conduct research and development activities locally and have plans to create new job opportunities within the next 12 months. As much as 20% of them would create over 100 jobs each. This is validated by the fact that an average of 785 employees were added between FY 2019 and 2020, right in the middle of the Covid-19 Pandemic.

Puerto Rico's A+D firms may provide one or more type(s) of goods and services:

- Aerospace and Defense: providing aerospace solutions and services to military and government customers from design, parts manufacturing, and supply chain.
- Commercial Aviation: Design, parts manufacturing, and service commercial aircraft, business jets, helicopters, personal aircraft, unmanned aerial vehicles, subsystems, components, and maintenance.
- Technology-based: High tech services for wearables, additive manufacturing, specialized imaging, battery technology, cloud computing/cybersecurity, artificial intelligence (AI), augmented reality (AR), and Internet-of-Things (IoT).
- Aerospace Contractors: Small to medium-sized contractors providing tools and die, CNC, harnesses, electromechanical assembly among others.

⁴<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-eri-2023-outlook-aerospace-and-defense.pdf>

⁵Data aggregated from companies' financial statements, annual tax reports, and DDEC's incentives applications and estimates.

⁶DDEC, Industry Profile, Aerospace, Sept 2022, Table 3 – Business Multiplier Effect in the Aerospace Sector.

⁷PR Aerospace Technology Consortium, 2022 Industry Survey

- Suppliers: raw materials, services, and sources of information, evaluate potential new products, track competitor’s actions, and identify opportunities.

A list of A+D firms that comprise the economic sector is in Table 1.⁸ In general terms, there are 11 US-based, and 15 PR-based companies established in Puerto Rico as per the PR State Department incorporation register. See also Exhibit B -- Aerospace and Defense Companies -- Brief Description which provides additional information. The Puerto Rico A+D industry conglomerate is not complete unless we mention the support and partnerships of major engineering, research centers and technical schools, and other non-profits (see Table 2).

Table 1 – List of Companies by Location and by Type of Goods and Services⁹

		Engineering	BPO	IT and Software	Manufacturing	MRO	FBO	CNC / Metal Fabrication	Cyber Monitoring	Artificial Intelligence	Encryption	After Market Sales	Satellite Imaging
7Eagle Group Caribe	San Juan								X				
Accenture	Santa Isabel		X										
Airport Aviation Services	Carolina					X	X						
AKM Manufacturing	San Juan				X								
American Tools	San Juan							X					
Aptima	San Juan									X			
Arlet Aviation	Ceiba					X	X						
CNC 2000	Caguas							X					
Collins Aerospace	Aguadilla	X											
Collins Aerospace	Santa Isabel				X								
DXC Technologies	Isabela		X										
EcoLift	San Juan					X							
EL-COM Systems	Caguas				X								
EngiWorks	Caguas							X					
ESSIG Research	Rincon	X											
Global-Tek Manufacturing	Ceiba							X					
Honeywell Aerospace	Aguadilla	X	X										
Honeywell Aerospace EMC Lab	Moca	X											
Honeywell Aerospace, After Mkt	San Juan											X	
Infosys	Aguadilla		X										
Lockheed Martin	Aguadilla			X									
Lufthansa Technik	Aguadilla					X							
OPTI Manufacturing	Luquillo				X								
Phoenix Cables	Aguadilla				X								
Pratt & Whitney	Aguadilla	X											
Precision Worx	Yabucoa							X					
Raytheon Technologies	Aguadilla	X											
Rubidex	San Juan										X		
Western Aviation Services	Aguadilla					X	X						
Wovenware	San Juan												X

Puerto Rico has always stood out as a talent bank and source of continuous recruitment of professionals in the field of engineering thanks to the graduates of its Minority Serving Institutions (MSIs).

⁸ For a Location Map and a Brief Narrative on each Company please referred to Exhibit A and B, respectively.

⁹ BPO Business Process Outsourcing, MRO Maintenance Repair & Overhaul, FBO Fixed-based Operator.

University of Puerto Rico ranks at number 4 in Table 10 of the Top 50 Institutions by Total Bachelor’s Degrees awarded to Underrepresented Minorities.¹⁰ After the establishment of the A+D conglomerate in 2007, aerospace engineering field of study began to be formed and offered on the island.¹¹ The programs that stand out are:

1. The master’s degree in mechanical engineering with a certification in Aerospace Engineering at the Interamerican University, Bayamón Campus.
2. The master’s degree in mechanical engineering with a certification in Aerospace Engineering at the Polytechnic University of Puerto Rico; and
3. The bachelor’s degree in mechanical engineering with a certification in Aerospace Engineering at the University of Puerto Rico, Mayagüez Campus.

Table 2 – List of Engineering Schools, Research Centers, and Other Entities

Entity	City	Type of Support
Aeronautic & Aerospace Institute of PR	Aguadilla	Talent Development
University of Puerto Rico	Aguadilla	Academic
Arecibo Observatory	Arecibo	Research
Inter American University	Bayamon	Academic
University of Puerto Rico	Bayamon	Academic
INTECO	Caguas	Regional Economic Dev
Mech Tech School	Caguas	Talent Development
Puerto Rico 5G Zone	Carolina	Research
Ana G Mendez University	Gurabo	Academic
Universidad de Puerto Rico Nanotech Lab	Humacao	Research
PR Photonic Institute	Manati	Research
CAUSE	Mayaguez	Research
PR Technoeconomic Corridor	Mayaguez	Regional Economic Dev
Turbo/Lab	Mayaguez	Research
University of Puerto Rico	Mayaguez	Academic
LIFT Puerto Rico	San Juan	Technology & Talent Development
Polytechnic University of Puerto Rico	San Juan	Academic
PR NASA Space Grant Consortium	San Juan	Research
PR NASA ESPCoR Program	San Juan	Research
PRIMEX	San Juan	Technical Assistance

¹⁰(2021) American Society for Engineering Education (ASEE). Engineering & Engineering Technology By the Numbers. ASEE 2020 Edition. Profile of Engineering and Engineering Technology. Washington, DC.
 Top 50 Institutions by Total bachelor’s Degrees awarded to Underrepresented Minorities. Table 10. Document available accessing <https://ira.asee.org/wp-content/uploads/2021/11/Total-by-the-Number-2020.pdf>.

¹¹The MSIs are institutions of higher education that serve minority populations. Through Presidential Executive Orders and special legislation enacted over the past 20 years, MSIs have accessed Department funds and leveraged other Departmental resources on behalf of their students and communities.

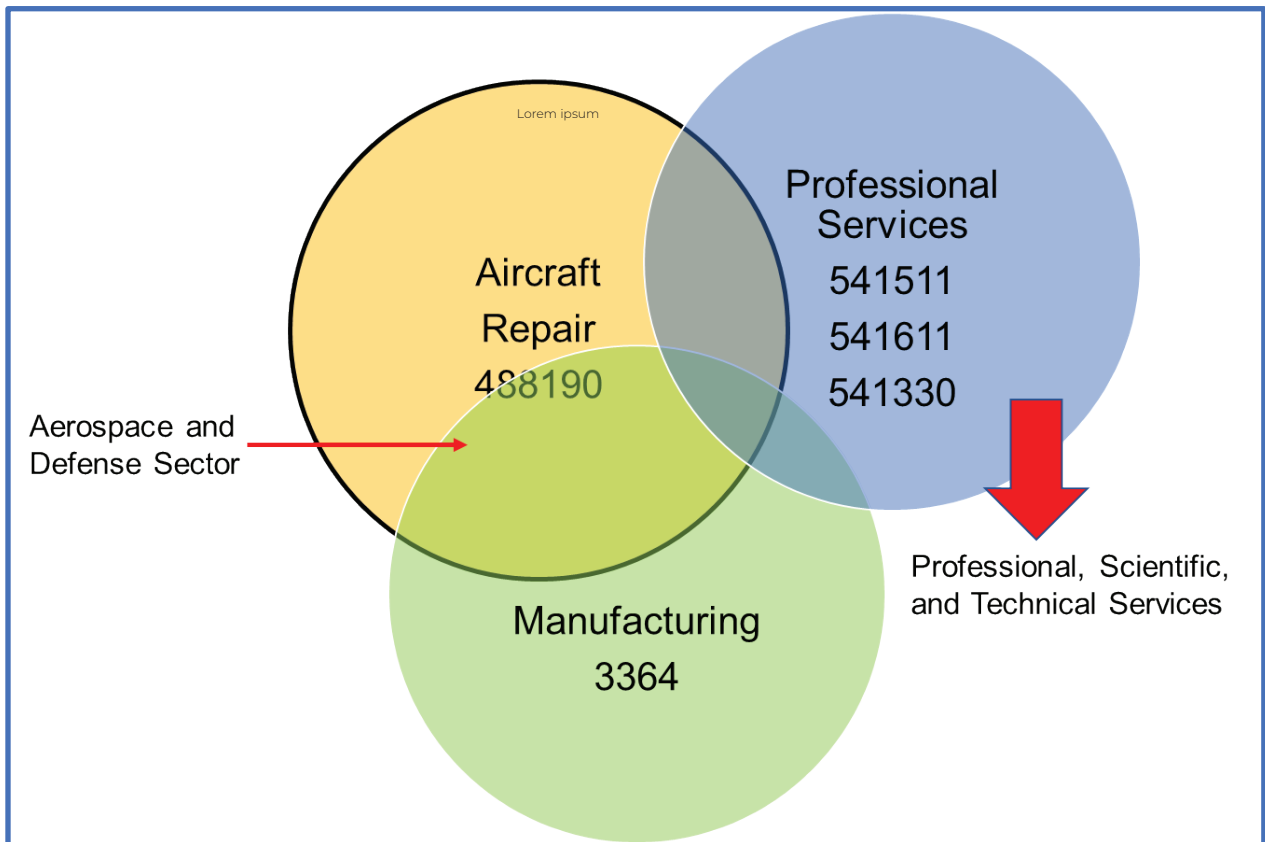
Universities in Puerto Rico are also part of the U.S. Department of Education's list of postsecondary institutions enrolling populations with significant undergraduate minority students and of the Hispanic-Serving Institutions (HSIs).¹² In 2020, 5,218 students graduated from an engineering-related major, which represents an increase of 2.1% or 105 students when compared to the previous year (5,113 students in 2019).¹³

Industry Employment and Wages

Another way to look at the industrial composition of the A+D sector in Puerto Rico is by aggregating business establishments by type of economic activity under the North American Industry Classification System (NAICS) and depicting where several industrial sectors and subsectors meet (see Diagram 2). The sectors are:

- Aerospace product and parts manufacturing (NAICS 3364),
- Other support activities for air transportation, aircraft maintenance and repair services (NAICS 488190) and
- Professional, scientific, and technical services sector which aggregates custom computer programming services (NAICS 541511),
- Administrative management and general management consulting services (NAICS 541611), and
- Engineering consulting services (NAICS 541330)

Diagram 2 – The Aerospace and Defense Sector



¹²HSIs is an institution of higher education that is an eligible institution and has an enrollment of undergraduate full-time equivalent students that is at least 25 percent Hispanic students at the end of the award year immediately preceding the date of application.

¹³Department of Economic Development and Commerce, September 2022, Industry Profile – Aerospace

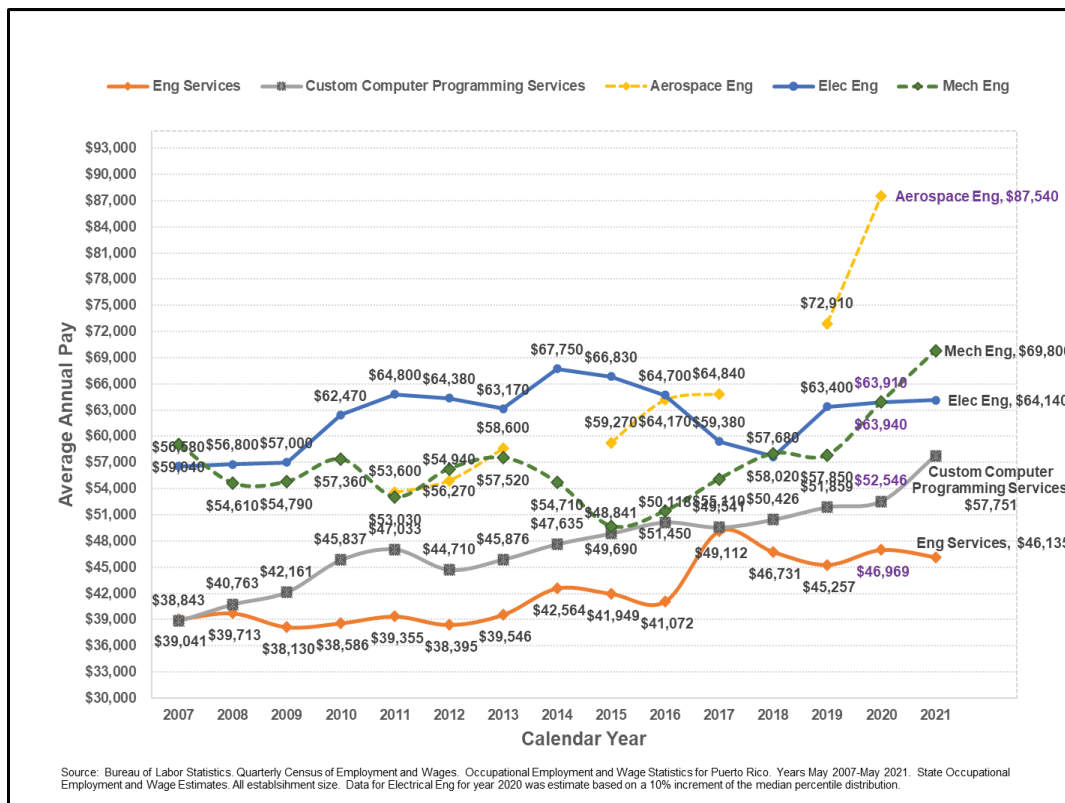
Of particular interest is the subsector of the professional, scientific, and technical services, which is engaged in business processes where human capital is the major input. These firms make available the knowledge and skills of their employees, often on an assignment basis, where an individual or team is responsible for the delivery of services to the client. Each company’s mission is based on their expertise and training in the services provided. The A+D conglomerate’s employees design, develop, and conduct engineering work and testing services for software and hardware components.

It is notable that the workforce has become in the past decade a competitive advantage for established companies. This advantage was published in July 2016: *The aerospace promise grows on the Island*¹⁴ and in the Business section interview by El Nuevo Día “Luis Ramos: talento local aeroespacial”.¹⁵

Selected engineering occupations (related to A+D) are depicted in Graph 1. In 2020, the highest average paying job was aerospace engineer with \$87,540, followed by mechanical and electrical engineer with \$69,800 and \$64,140, respectively, and custom computer programming with \$57,751.

Under engineering services occupations (which include both related and non-related A+D occupations), it reflects a lower average salary. It means that A+D firms are paying higher wage rates than general engineering firms. The average wage for engineering services occupation in 2020 was \$46,969.

Graph 1 - Average Annual Wage per Selected Aerospace Related Occupations



¹⁴El Nuevo Día. Published on July 26, 2016.

¹⁵Gómez, Antonio R. (2017) Luis Ramos: talento local aeroespacial. Business section. El Nuevo Día. December 10, 2017. Document available accessing to <https://www.elnuevodia.com/negocios/empresas-comercios/notas/luis-ramos-talento-local-aeroespacial>.

To benchmark the competitive position of our employees' occupations versus other occupations jurisdiction, we use the Location Quotient (LQ).¹⁶ It is a measure of the concentration of employees on one occupational category and where 1.0 is comparable to the national average. The selected occupations which are related to A+D Industry show that Puerto Rico still needs to catch up with jurisdiction that are strong in hiring A+D employees.

The jurisdiction with the concentration of employees most alike to Puerto Rico is the State of Florida, still it shows that there is room for improvements in all engineering occupations (see Table 3). One of the features of Florida is the government-run spaceport and the cluster around it. Puerto Rico will move to the next level with the establishment of its spaceport which will help improve its LQ standing. Currently, PR Ports Authority issued a Request for Proposal (RFP) to secure a spaceport managing company to attract space-related companies (see details in the Industry Perspective section). The table also shows that the State of Alabama engineers LQs are off the chart because it is a State where defense commands and agencies have a stronghold, and many companies strive around them and unlike Puerto Rico which has no comparable activities.

Table 3 – Location Quotient

Occupational Title	Location Quotient (LQ)				
	PR	AL	TX	CA	FL
Aerospace Engineers	0.51	4.98	1.12	1.18	1.34
Computer Hardware Engineers	0.45	0.85	0.79	N.D.	0.72
Electrical Engineers	0.52	1.62	0.94	1.29	0.60
Mechanical Engineers	0.39	1.40	0.86	0.87	0.44
Aerospace Eng. and Ops. Technologist	**	5.19	1.43	0.88	3.74

Source: Bureau of Labor Statistics. May 2021. Selected occupational categories related to the aerospace and defense cluster in Puerto Rico. Note: ** Estimates not released. Data for Aerospace Engineers is for Year 2020.

While the academia sector may be doing a good job in developing engineering talent, they still need to make best effort in creating new aerospace courses and technical short programs. The aerospace engineering and operations technologists and technicians will be needed by the industry. These technicians usually work in manufacturing plants, offices or laboratories and usually run and maintain equipment used to develop, test, produce, and sustain aircraft and spacecraft. Industry outlook expects a 6 percent grow in this occupation in the upcoming decade (from 2021 to 2031) as indicated by the Bureau of Labor Statistics, Occupational Outlook Handbook¹⁷.

¹⁶ Location Quotient (LQ). The location quotient (LQ) is a valuable way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group (or other chosen characteristic) is on a region as compared to the total aggregate of a country, state, or a major geographic or political subdivision. It can reveal what makes a particular area or region unique in comparison with the aggregates selected. Thus, location quotients are a valuable tool for public policy decisions.

¹⁷ Bureau of Labor Statistics. Occupational Outlook Handbook for Aerospace Engineering and Operations Technologists and Technicians. <https://www.bls.gov/ooh/architecture-and-engineering/aerospace-engineering-and-operations-technicians.htm#:~:text=Aerospace%20engineering%20and%20operations%20technologists%20and%20technicians%20install%2C%20run%2C%20and,of%20these%20vehicles%20and%20systems.>

A criterion of great significance, and a key competitiveness factor for the Puerto Rico A+D sector is the occupations wages (or salary) when they are compared with U.S. jurisdictions. This advantage, which translates into the payroll, is a positive reinforcement for companies that analyze the opportunity to establish themselves in a newer jurisdiction. Puerto Rico outperforms most U.S. jurisdictions, and in some cases, it could represent a competitively lower wages up to 50% depending on the skill set of the occupation analyzed. The annual salary depicted in the wage distribution Table 4 shows the wages difference for a selection of occupations of jobs associated with the A+D sector. The higher the skill set of the occupation, the wider the difference in salary for the benefit of companies established in Puerto Rico.

Table 4 -- Wages Comparison for Aerospace Related Occupations as of May 2021

<u>Standard Occupational Classification Number</u>	<u>Selected Occupational Category</u>	<u>PR</u>	<u>AL</u>	<u>AZ</u>	<u>CA</u>	<u>FL</u>
17-2011	Aerospace Engineers*	\$87,540	\$123,200	\$126,850	\$126,650	\$109,540
17-2061	Computer Hardware Engineers	\$87,840	121,780	\$121,900	\$169,970	\$114,720
17-2071	Electrical Engineers	\$64,140	109,090	\$99,830	\$126,640	\$94,270
17-2072	Electronics Engineers, Except Computer	\$65,410	115,800	\$120,750	\$130,330	\$104,630
17-2112	Industrial Engineers	\$72,300	93,640	\$100,800	\$109,460	\$93,320
17-2141	Mechanical Engineers	\$69,800	96,930	\$100,010	\$113,130	\$90,060
17-2199	Engineers, All Other	\$58,600	126,070	\$117,480	\$117,990	\$103,980
17-3012	Electrical and Electronics Drafters	\$32,640	58,260	\$70,250	\$73,150	\$61,400
17-3021	Aerospace Engineering and Operations Technologists and Technicians	\$53,700	64,820	\$58,910	\$82,420	\$77,860
17-3022	Civil Engineering Technologists and Technicians	\$33,240	48,410	\$55,040	\$74,020	\$54,510
17-3023	Electrical and Electronic Engineering Technologists and Technicians	\$44,440	65,550	\$68,570	\$73,910	\$61,010
17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians	\$40,350	**	\$67,530	\$63,530	\$58,170
17-3026	Industrial Engineering Technologists and Technicians	\$46,370	58,960	\$68,180	\$69,420	\$58,490
17-3027	Mechanical Engineering Technologists and Technicians	\$31,160	53,670	\$61,970	\$69,870	\$61,420
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	\$42,640	61,080	\$61,480	\$68,460	\$64,720

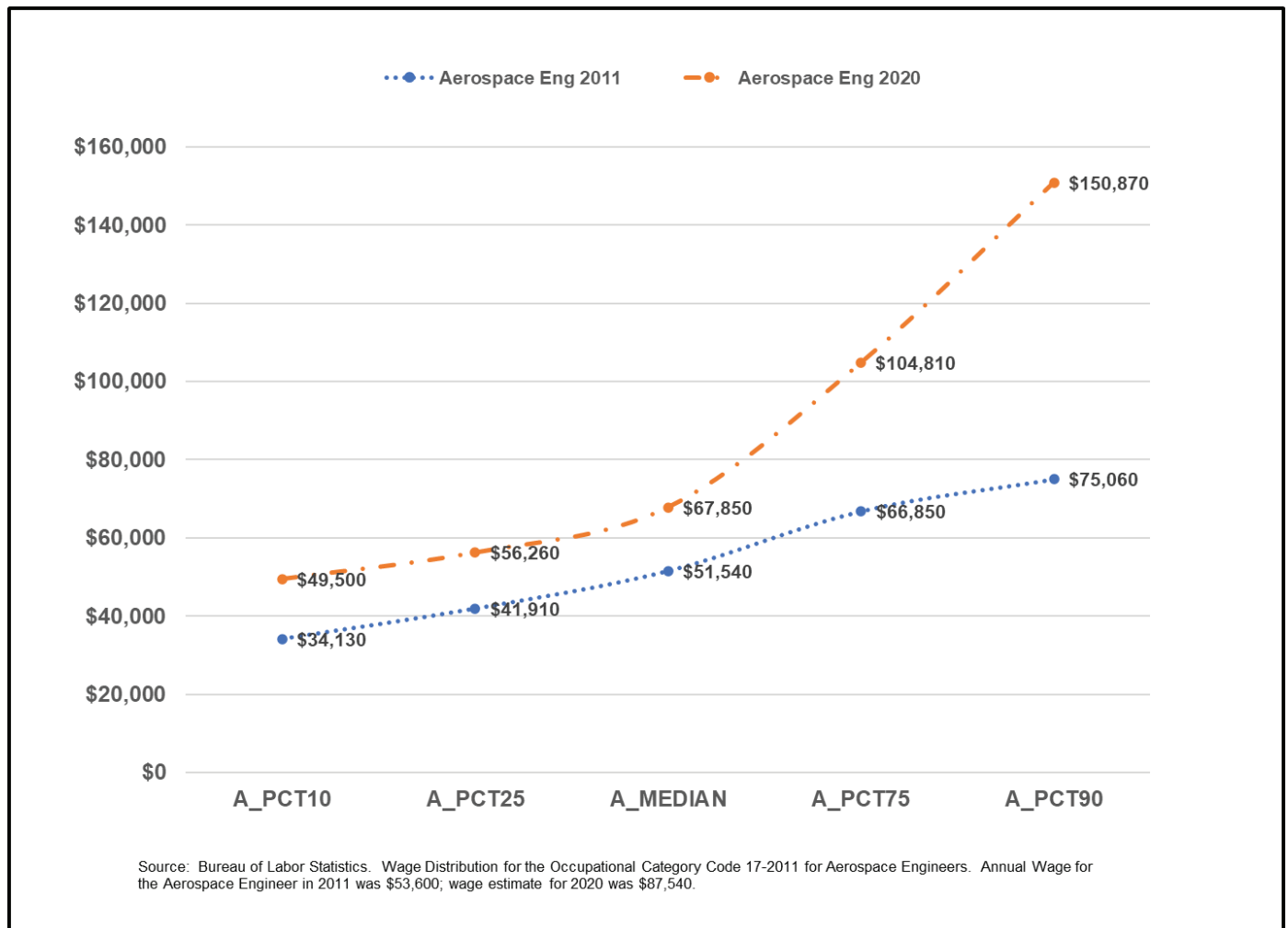
Source: Bureau of Labor Statistics. May 2021. Selected Occupational categories related to the Aerospace and Defense cluster in Puerto Rico. Data for the Aerospace Engineers Wage, category code 17-2011 for Puerto Rico belongs to year 2020. Wage data not available for year 2021. Wage data for comparison purposes with the AL, AZ, CA & FL jurisdictions were used for year 2020. All other wage data is for May 2021. Notes: Estimates for detailed occupations do not sum to the totals because the totals include occupations not shown separately. Estimates do not include self-employed workers. Annual wages have been calculated by multiplying the hourly mean wage by a "year-round, full-time" hours figure of 2,080 hours; for those occupations where there is not an hourly wage published, the annual wage has been directly calculated from the reported survey data. If table show the relative standard error (RSE) is a measure of the reliability of a survey statistic. The smaller the relative standard error, the more precise the estimate. The location quotient (LQ) is the ratio of the area concentration of occupational employment to the national average concentration. A location quotient greater than one indicates the occupation has a higher share of employment than average, and a location quotient less than one indicates the occupation is less prevalent in the area than average. Note: Asterics denotes (**) data not released.

The occupation of an aerospace engineer was first recorded in Puerto Rico after 2011 when the survey began collecting this data in the US Bureau of Labor Statistics (BLS) publications. Based on the results of the survey conducted by the BLS, an aerospace engineer started with an average salary of \$53,600 and reached \$87,540 in 2020. U.S. national estimates reported for that same year (2020) shows the average salary of an Aerospace Engineer at \$121,110 (38% higher than Puerto Rico). This salary represents 29% less than its counterpart in Alabama (\$123,200); 31% less than its counterpart in Arizona (\$126,850) or California (\$126,650) and 20% less than its counterpart in Florida (\$109,540).

Other examples of occupational categories related to the Aerospace and Defense cluster in Puerto Rico, electrical, mechanical, and software engineering are shown in the Wages Comparison (Table 4) with numbers updated as of May 2021. Further data research has shown that the occupation with the highest demand in the local A+D sector is engineering followed by the services offered by computer systems specialists such as systems engineers, and application engineers.

Compensations may also vary by industry, region, and employee's experience. Graph 2 shows the Wage Percentile Distribution of aerospace engineers in Puerto Rico. It depicts the wage compensation for the year 2011, about four (4) years after the conglomerate was established and it is compared to the latest data collected for the year 2020.

Graph 2 -- Wage Percentile Distribution for Aerospace Engineers



The annual percentile distribution can be an indicator of experience in the industry. Where employees below the 10 percentiles can be referred to as the entry-level salary of an engineer just out of college with \$34,130 in 2011 and rose to \$49,500 in 2020 (an increase of 45%). Anyone above the 90 percentiles may have over 5-year experience in the industry got a \$75,060 salary in 2011 and commanded a salary of up to \$150,870 in 2020 (an increase of 100%).

The Aerospace Engineer’s total wage compensation based on hourly rate plus fringe benefits is depicted in Table 5. The total wage compensation represents an hourly rate of \$42.09 plus fringe benefits of \$8.30 (almost 20% of hourly earnings) totaling \$50.39 per hour.

Table 5 -- Compensation Cost Puerto Rico Jurisdiction

AEROSPACE ENGINEERS (Year 2020)	
Employment in the Industry¹	180
Earnings, Compensation and Fringe Benefits	Dollars
Annual Average Earnings (= \$87,540 X 2,080)	87,540.00
Average Hourly Earnings (US Bureau of Labor Statistics) ²	42.09
Weekly Compensation Per employee (= 87,540/52)	1,683.46
Total Mandatory Fringe Benefits Per Worker Per Year	10,734.17
Social Security (7.65% up to \$61,200 per year)	6,696.81
Unemployment Insurance (6.2% up to \$7,000)	434.00
Workmen's Compensation (\$3.25 per \$100)	2,976.36
Disability Insurance (0.3% up to \$9,000)	27.00
Christmas Bonus (6% up to \$10,000)	600.00
Average Mandatory Fringe Benefits Per Worker Per Worker Per Hour	5.16
Other Mandatory Benefits Included in Worker's Compensation Per Worker Per Year	6,531.24
Vacation leave (up to 6 days per year)	2,020.15
Sick leave (up to 12 days per year)	4,040.31
Maternity leave (8.5 weeks for female employees at half pay) (32.9% of manufacturing work force for which 10% received the benefit)	470.78
Average Other Mandatory Fringe Benefits Per Worker Per Hour	3.14
Total Mandatory Fringe and Other Mandatory Fringe Benefits Per Worker Per Hour	8.30
Average Total Compensation Per Worker Per Hour	50.39
Fringe Benefits as a Percent of Earnings and Compensation	Percent
Total Fringe Benefits as a Percent of Hourly Earnings	19.72%
Total Fringe Benefits as a Percent of Total Compensation Per worker Per Hour	16.47%
<p>1. Actual employment for the PR Industrial Sector is 4,624 for Engineering Service industrial sector.</p> <p>2. This amount count employees at the Engineering Service Sector for the May 2021 National Industry-Specific Occupational Employment and Wage Estimates. NAICS 541330.</p> <p>Source: US Bureau of Labor Statistics May 2021. Avg Hourly Earning for the Aerospace Engineers occupational code 17-2011. Data modified for March 2023.</p>	

Industry Perspective

The economic sector identified as the Puerto Rico A+D Industry is part of the Global A+D industry which was impacted by the COVID-19 pandemic. After years of steady growth, civil aviation was grounded in 2020 as the world contended with COVID. The A+D supply chain, comprising thousands of small and medium-sized companies located here and abroad, were faced with huge financial and logistical challenges to support existing defense contracts and replace losses in civil aviation sales. On February 24, 2022, Russia's invasion of Ukraine would profoundly complicate the global A+D industry scenario and further stress the supply chain.

The global A+D Industry is still navigating uncertain times, as shown from the PwC analysis, where industry revenue was 6% below the 2019 record of \$754 billion and operating profit was 24% below the 2018 record of \$82 billion.¹⁸ This year (2023) is an opportune time for the industry to capitalize on the changes and trends. A Deloitte's outlook survey shows that 88% of surveyed senior executives believe the general business outlook for the A+D industry is **"somewhat to very positive."**¹⁹ There are several reasons for this optimistic outlook including growth in new technologies and segments such as Advanced Air Mobility (AAM), evolving business models in areas such as Space, and the use of digitalization and automation. For that reason, Puerto Rico's A+D conglomerate are positioning themselves to capitalize on these trends.

1. Supply chain: Focusing on supply chain visibility and resilience to mitigate a broader set of risks.

Puerto Rico's A+D companies are focusing on creating visibility deep into their supply chains to improve supply control and coordination and to better manage third-party risk. Companies like **Honeywell Aerospace** and **Collins Aerospace** are managing the risks of their supply chain internally, and through Business Process Outsourcing (BPO) providers such as **Infosys** and **Accenture**. Moreover, three industry players, **Lockheed Martin Corporation**, **7 Eagle Group Caribe**, and **Rubidex** are reinforcing their needs for cybersecurity, cloud privacy, and the resilience of the systems and automation to avoid risks in core operations and with key suppliers.

2. Digital transformation: Accelerating digitalization and conversion to automation to drive improved efficiencies.

"Digitization is one of the most ubiquitous buzzwords in the aerospace industry for a reason. With new capabilities that quickly capture incredible amounts of data and thoroughly analyze it, digitization technologies enable the industry to predict and identify what needs to be repaired or replaced, often before a part breaks or fails, and then pinpoint the best time and employees to do the work."²⁰

¹⁸<https://www.pwc.com/us/en/industrial-products/publications/assets/pwc-aerospace-defense-annual-industry-performance-outlook-2022.pdf>

¹⁹<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-eri-2023-outlook-aerospace-and-defense.pdf>

²⁰<https://www.asme.org/topics-resources/content/5-aerospace-technologies-and-trends>

Lufthansa Technik is quickly moving to provide airlines customers with the ability to track and monitor aircraft parts that need repairs or replacement. Already, Collins Aerospace is hard at work in the automation transformation of its manufacturing operation in the Municipality of Santa Isabel, PR. And LIFT Puerto Rico, a new stakeholder (managed by the American Lightweight Material Manufacturing and Innovation Institute of Detroit, MI), brings world-class advanced manufacturing technology development capabilities to the Puerto Rico's A+D and the Medical Devices conglomerates, thus providing a significant economic asset that will expand competitiveness, manufacturing readiness, economic, and workforce growth (<http://www.lift.technology>).

3. **Talent:** Reversing the post-Covid challenges of attracting, retaining, and developing top talent (in engineering and manufacturing).

The **PR Aerospace Technology Consortium** (the official A+D conglomerate organization, <https://www.aerospace.pr>) and its members are focused on branding the A+D industry as a talent destination. This means leaning into the strength of A+D as a mission-driven industry, which has a unique appeal that many other industries can't match. The A+D sector is building talent pipelines, reaching deep into communities and schools through partnerships, internships, co-investment; and close, sustained collaboration between industry and education on specific workforce skills and capacity needs. Also, the A+D companies are incorporating greater flexibility into workforce schedules, environment, and career paths to meet workforce expectations.

Three major announcements broke early this year (2023) for developing top talent.

The first announcement, **Pratt & Whitney**, dedicated to the design and manufacture of aircraft engines, and the **University of Puerto Rico, Mayagüez Campus** opened **Turbo/Lab**, its first aerospace center of excellence in Puerto Rico and the Caribbean. This initiative seeks to train students and faculty in concepts relevant in aerospace engineering (gas turbines, controls, embedded systems, and computer-aided design). According to its director, Eng. Sheilla Torres, PhD, "it is a space for cross training where students can be exposed to other areas of specialty and achieve multidisciplinary competence [i.e., in mechanical, electrical, and software engineering]."

The second announcement, the U.S. Congress approved an allocation of \$7.5 million for the construction of the **Aerospace Research Institute (AIR)** at the **University of Puerto Rico, Mayagüez Campus (UPRM)**. This project is a concerted effort of many public and private stakeholders to strengthen the aerospace sector and help in the development of the local industry. This facility is the next level to better train students to become future engineers, and to continue undergraduate and graduate research on topics of interest for the industry.

The third announcement, **LIFT Puerto Rico** began operations in the last quarter of 2022 with the cooperation of the Department of Economic Development and Commerce, and it is geared to prepare local workforce with advanced manufacturing skills enabling local industry to commercialize innovative technologies and manufacture tomorrow's products thereby creating a more diverse, equitable and inclusive national manufacturing ecosystem which will attract additional high-tech assets to the region, and to promote and assist with the local development of advanced manufacturing technologies.

4. **Decarbonization:** Lowering emissions in aircraft and implementing sustainable manufacturing and services operations remain business priorities.

As the industry strives for lighter, stronger components in aircraft bodies, fuselages, and engines, it has steadily replaced aluminum (as much as 50 percent) with new composites and alloys, including titanium, graphite, fiberglass, reinforced epoxy, and ceramics. Besides being stronger and stiffer than aluminum, the materials are corrosion and chemical resistant, and maintain their qualities in extreme conditions.²¹

In October 2021, members of the International Air Transport Association (IATA) released a target to achieve net-zero greenhouse gas emissions by 2050. Emissions reductions are expected to be attained through the shift to sustainable aviation fuel, new electric and hydrogen technologies, industry efficiencies, carbon capture technology and carbon offsets.²²

The trajectory of the sustainable aviation fuel sector is evolving quickly, especially for small craft, carrying 10 to 40 passengers for flights up to 500 miles, powered by lithium-ion or hydrogen batteries (including fuel hybrids). Experts agreed that electric aircraft could cross the threshold to mainstream acceptance in as little as three years. Sustainable aviation can revolutionize PR's short-haul flight in the Caribbean by connecting the network of small, regional airports, and decentralizing the existing hub (like the SJU airport).

University of Puerto Rico, Bayamon Campus (UPRB) presented its vision of the proposed Center of Excellence for Climate Change at the U.S. Department of Commerce, Round Table Event on February 7, 2023, focused on Training & Mentoring, Innovation, and Sustainability, the proposal is currently under review by the National Science Foundation.

Also, UPRB presented a collaborative Applied Research Laboratory around the topics of sustainable aviation and AAM. The lab can potentially be an economic engine and major driver of STEM workforce development for the Caribbean and Minority Serving Institutions in the mainland U.S., and thus positioning Puerto Rico as a major aerospace and defense development site for NASA and DoD.

²¹ <https://www.asme.org/topics-resources/content/5-aerospace-technologies-and-trends>

²² <https://www.iata.org/en/programs/environment/flynetzero/>

5. Emerging markets: Investing in innovation and applied research accelerates growth in emerging areas like space and hypersonic. The space sector is utilizing emerging technologies including 5G, advanced satellite systems, 3D printing, big data, and quantum technology to upgrade and scale activity and operations in space. Puerto Rico 5G Zone, a non-profit organization with a Zero Trust Architecture (ZTA), is making a difference with enabled research lab for development, testing, training, and research on next generation (5G) communications applications in an open innovation platform, publicly owned, and connected to resident interface of foreign/domestic, terrestrial/non-terrestrial, and cooperative/non-cooperative networks.

Moreover, new space tech trends such as smart propulsion, space robotics and space traffic management are gaining traction in the emerging space industry. Several global startups are developing technologies that will ease movement, operations, and communications between Earth and space.

What space economy entails? Wikipedia defines commercial use of space as:

“The provision of goods or services of commercial value by using equipment sent into Earth orbit or outer space. This phenomenon – aka Space Economy – is accelerating cross-sector innovation processes combining the most advanced space and digital technologies to develop a broad portfolio of space-based services. The use of space technologies and of the data they collect, combined with the most advanced enabling digital technologies is generating a multitude of business opportunities that include the development of new products and services all the way to the creation of new business models, and their configuration of value networks and relationships between companies. If well leveraged such technology and business opportunities can contribute to the creation of tangible and intangible value, through new forms and sources of revenue, operating efficiency and the start of new projects leading to multidimensional (e.g., society, environment) positive impact.”²³

Due to the importance of the space sector, the Governor of Puerto Rico issue an Executive Order 2022-026 to create the Aerospace and Aeronautics Council for Puerto Rico. The council will develop an integrated plan for the development and implementation of a commercial spaceport in coordination with the pertinent state and Federal agencies. The council prepared a report titled: Space Hub Borinquén / Why Puerto Rico is the Ideal Location for the Space Industry.²⁴

1. The space industry is big. It is growing rapidly and will become one of the largest industries in the world. Today, the space economy is \$469 billion, bigger than Singapore’s GDP. Bank of America predicts the industry will grow to \$1.4 trillion by 2030 and \$4 trillion by 2040.

²³ https://en.wikipedia.org/wiki/Commercial_use_of_space

²⁴ Puerto Rico Aeronautical and Aerospace Council, September 2022, Space Hub Borinquen, Why Puerto Rico is the Ideal Location for the Space Industry

2. Puerto Rico already has all the elements needed for a successful and competitive Space Hub. Puerto Rico has top quality STEM talent, world-class researchers, modern infrastructure, advanced manufacturing capabilities, excellent tax and economic incentives, dominance in the life sciences, excellent deepwater ports, proximity to mainland U.S. where most rockets are being developed, strong presence of aerospace companies, and one of the best geographies in the US for space activities (located in Parallel 18, near the Equator) along with a strategic location for national security.
3. The upside economic benefit to Puerto Rico is too large to ignore. Benchmarking Space Hubs located in Scotland and Australia, the island could see close to \$0.5 to \$1.2 billion in salaries alone, creating over 8,000 – 20,000 jobs over the next 10 to 15 years. This is in addition to the significant infrastructure investment and ongoing economic activity that Space Hub will generate. A Space Hub would also have positive impact on the local economy with increase in commercial and industrial tax revenue, and a wider base of high-skill and high-income workforce.

In conclusion, Puerto Rico is well-positioned to capture a large share of activity in A+D-related research, innovation, engineering, service, and production. Also, the A+D industry is ready to take on space economy opportunities. Experts agreed that the Space sector has the potential to double the size of the A+D employment and increase sales and taxable base exponentially within the next 5 years in Puerto Rico.

Exhibit A

Aerospace and Defense Cluster Map

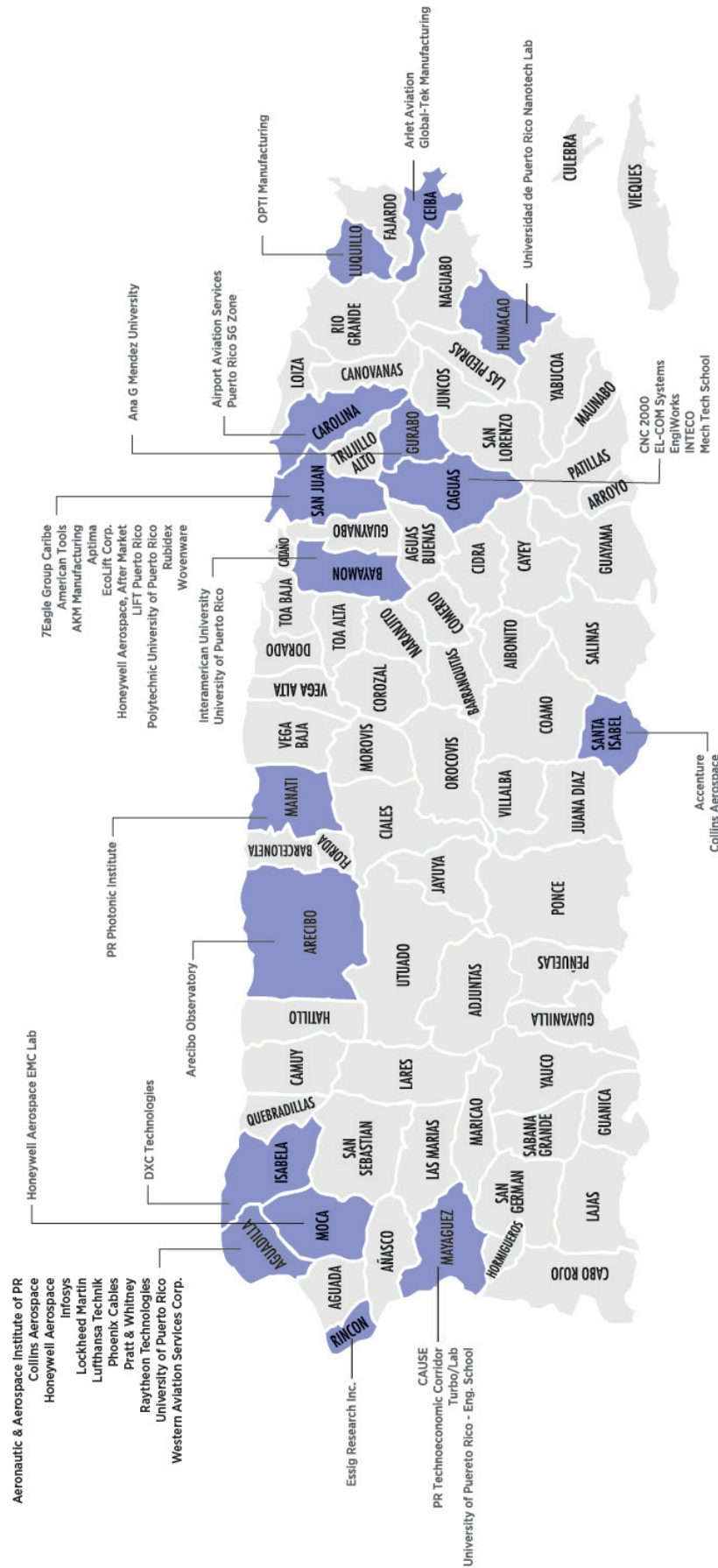


Exhibit B – Aerospace and Defense Companies -- Brief Description

Collins Aerospace - Specializes in aerostructures, avionics, interiors, mechanical systems, mission systems, and power and control systems that serve customers across the commercial, regional, business aviation and military sectors. In Puerto Rico, Collins Aerospace manufactures electrical power systems to manage several critical aircrafts' systems.

Pratt & Whitney - Designs, manufactures, and services the world's most advanced aircraft engines and auxiliary power systems for commercial, military and business aircraft. In Puerto Rico, P&W designs turbines for commercial and military aircraft.

Raytheon Intelligence & Space - Specializes in developing advanced sensors, training, and cyber and software solutions —delivering the disruptive technologies its customers need to succeed in any domain, against any challenge. In Puerto Rico, RIS designs and develops military systems.

Raytheon Missiles & Defense - Provides the industry's most advanced end-to-end solutions to detect, track and engage threats. In Puerto Rico, RMS designs and develops military systems.

Honeywell Aerospace - Innovates and integrates thousands of products and services to advance and deliver safe, efficient, productive experiences and comfortable on every aircraft commercial, defense, and space worldwide. Also, they have a world-class laboratory for conducting electromagnetic and environmental testing of their products.

Lockheed Martin is a global security and aerospace company principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products, and services. In Puerto Rico they have an IT Center and software development for advanced systems.

DXC Technologies is a trusted IT service provider for the world's leading private and public sector aerospace and defense organizations. DXC's solutions modernize mission-critical systems for these organizations to shorten time to market, gain insight from data and accelerate innovation across digital manufacturing operations and value networks.

Infosys A+D practice offers digital commerce solutions to augment quote-to-fulfillment processes. Automated order generation enables aircraft manufacturers to initiate engineering activities, including new product development whenever required.

Accenture optimizing and running supply chains, designing, and implementing technology, and building resilient operating models and cultures for the A+D customers.

Wovenware is an artificial intelligence (AI) and software development company conducting work for the Defense. The company has Secret Clearance from DoD. Recently, it became one of the success stories when Maxar Company bought the company and retained staff and management. Maxar is a satellite imagery company.

7Eagle Group Caribe is a cyber security monitoring agency. Its business model is to train and hire retiring veterans.

EngiWorks is an engineering, CNC and metal fabricator conducting work for the Life Sciences and Aerospace sectors. Is a small-owned and operated company with several Federal designations.

PrecisionWorx is a contract manufacturing supplier to the Puerto Rico Global Aerospace, Life Sciences, and Industrial sectors. It is a small company whose owner has 44 years of experience in manufacturing complex components and assemblies in Puerto Rico.

RUBIDEX is a startup, technology-based company with a patent pending process that employs a proprietary tunnel encryption method that makes proprietary file system secured outside of a database.

OPTI Manufacturing manufactures and services Aircraft Cable Tensiometers under the highest quality standards. It is a small company conducting work with the department of Defense and is a Mentor Protégé of other small businesses.

Phoenix Cable is a subsidiary of a small U.S. company that is certified ISO9001 for harnesses.

Global-Tek Manufacturing is a CNC shop that two years ago was bought by Crawford United Corporation. Another success story of a small company with great products and people.

Lufthansa Technik is a leading provider of aircraft maintenance, repair, overhaul, and modification services for civil aircraft, from commercial to VIP and special mission aircraft.

Aptima develops software to measure, analyze, understand, and optimize human performance in space or military conditions using Artificial Intelligence (AI), Augmented Reality (AR), and Machine Learning (ML) technologies.

EL-COM Systems is a leader in electronic interconnect manufacturing and solutions. They specialize in custom wire harnesses and cable assemblies for high-reliability products for the aerospace and defense industry.

AKM Manufacturing has served a broad spectrum of industries concentrating on the design, implementation and manufacturing of sheet metal products and electrical projects.

Arlet Aviation provides aircraft MRO and FBO services, like airplane annual inspection, propeller overhaul, aircraft avionics service, and aircraft paint job.

CNC 2000 is a production machining and contract manufacturing for medical, electronics, aerospace and defense, and pharmaceutical industries.

American Tools is a versatile, fully equipped machining facility providing quality machined components. They work with a variety of materials including (but not limited to!) Carbon Steel, Alloy Steel, Brass, Nickel Alloys, Stainless Steel, Castings, Aluminum and Plastics.

ECOLIFT Aeroespacial is the authorized Service Center for MD Helicopters in the Caribbean. It is the premier center for rebuilding, refurbishing, accessorizing, and installing the latest avionics systems for helicopters.

Airport Aviation Services is a fixed-based Operator (FBO) for corporate aircraft services as well as pilot and passenger care.

Western Aviation Service Corp. is a fixed-base operator (FBO) providing fuel, aircraft maintenance and other quality services for all types of aircraft, commercial and private.

ESSIG Research is a leading provider of high-tech engineering (in both OH and PR), manufacturing and product lifecycle management (PLM) services and solutions.

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