




# **The Aeronautical and Aerospace Institute of Puerto Rico Socio-Economic Development Strategic Project**

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# 1. Executive Summary

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Puerto Rico has arrived to and it is facing serious fiscal challenges, which have brought profound changes in its commercial and political dynamics and economic development. The effects and consequences of these challenges have required us to re-examine and re-focus our way to prioritize the use of the resources available to the island. We recognize the need to address with definitive solutions the consequences of past decisions. However, we also recognize that these challenges have provided us an excellent opportunity to find ways to become more creative than ever. Our long-term view of this transitional process have led us to use our wit, abilities to consider multiple models and alternatives to redefine our role in the Americas and reinvent our future as global citizens.

Within our range of our current possibilities, we have decided to become an active member of the global community and its markets. To embrace and fully achieve global competitiveness in all sectors of our economy we are using a strategy of integration, diversification and transformation of our socio-economic landscape. We are preserving our high quality standards and highly regulated bio-pharma and medical devices sector and want to attract more industrial sectors with these characteristics to our manufacturing economy. At the same time we are transforming into a knowledge and creative economy in which we want to attract new businesses and develop local businesses that make a better use of mature technologies in innovative and different ways, develop new paradigms and explore cutting-edge processes, technologies, and products to find solutions for current problems of global impact.

One of the foundations of the dynamic socio-economic reinvention of the island is its growing and promising aerospace industry cluster. For the last ten years Puerto Rico has been the host of aeronautical and aerospace businesses dedicated to multiple activities including among others research and development. The aerospace industry differs from other industrial sectors in its potential for diversification and knowledge applicability across different disciplines and industries. Industry sectors such as Information and Communications Technology, Materials Sciences, Propulsion Technologies, Agriculture and Energy can find niches for expansion within the development of the aerospace industry. Jobs from all kinds of employment groups can be promoted once the aerospace cluster is diversified enough to have the manufacturing, services and research and development components.

In Puerto Rico the Aerospace Cluster is centered in the Island Northwest corridor (Aguadilla, Isabela, Aguada, San Sebastian, Rincon, Moca) encouraged by installations such as the Ramey International Airport host to the biggest runway in the Caribbean, academic institutions such as UPR Aguadilla and the AAIPR with specialized academic programs and industry players such as: Lufthansa Technik, Lockheed Martin, Infosys Inc., Pratt & Whitney, Honeywell Aerospace, Florida Turbines, Phoenix Cables Inc., Axon Puerto Rico, Infotech Aerospace Services, Hamilton Sundstrand, Opti Manufacturing, Essig Research, JetBlue Airways and Seaborne Airlines.

There are three main reasons for this expansion in Puerto Rico: the geographical positioning of the island, which stands it as a midpoint between three continents; the government's commitment and the potential productivity of local workers; and the relation, prestige and commitment of the University of Puerto Rico (UPR) system for establishing a specialized institution in aeronautical and aerospace technology. In order to adapt its academic offer and being a national project, the UPR established an entity to handle all academic projects arising from this initiative, which creates an knowledge ecosystem that supports and helps to grow the aerospace cluster of the island in alliance with public policy and socioeconomic development strategies. **This entity is the Aeronautical and Aerospace Institute of Puerto Rico (AAIPR).**

To support the establishment and expansion of the aerospace cluster in Puerto Rico, the AAIPR is focused on developing three components: innovation by supporting research, development and commercialization of products and intellectual property; infrastructure development; and the growth of an academic ecosystem with diversity of academic degrees, alternatives and certification programs in aerospace and related industries. The development of this knowledge ecosystem and the other components is possible using a co-creation development model. In this model, industry, academia and government create and nurture the growth of solutions together to benefit the socioeconomic environment of the island. This benefit generates value and opportunities in the short, medium and long term for all components of the various initiatives.

The AAIPR initiatives structure is organized to foster creation, dissemination and application of knowledge at the service of the aerospace industry. The currently implemented initiative is the Aeronautical and Aerospace Center for Services and Training (AACST) and the new initiatives projected for year 2017 are the Aeronautical and Aerospace Institute of Multidisciplinary Technologies (AAIMT) and the Aeronautical and Aerospace Institute of Technology Design (AAITD) and the Aeronautical and Aerospace Institute of Creative Integration (AAICI).

The concept presented in this proposal to promote and support the aerospace and the other business sectors stems from the creation of clusters of the targeted industrial sectors. This is being achieved by implementing five concurrent and convergent strategic efforts for organic cluster development.

- The first strategic effort is to integrate and diversify the knowledge ecosystem mainly by the development of a research, development and commercialization initiative.
- The second strategic effort is centered on meeting the needs of potential aerospace industries, by developing a network of local suppliers able to fulfill those needs. If local suppliers cannot serve specific needs, then the focus shifts to attract companies that can meet those needs and settle on the island.
- The third strategic effort is to provide alternatives of quality of life for diverse lifestyles and an infrastructure that provides the development of high-tech companies in a secure, stable, multicultural and diverse environment for its employees.
- The fourth strategic effort is to attract anchor companies and develop local businesses of different areas and disciplines related to the different industry sectors of the targeted cluster.
- The fifth strategic effort is to restructure the financial ecosystem to attract and develop the investment spaces and infrastructure to fund entrepreneur start-ups and activities and

provide an attractive financial environment for entrepreneurs and mature businesses established on the island that wants to create and/or grow their businesses by serving those industries.

**The projected total investment required for the implementation of the proposed plan is \$1,913,041,843.00. Ninety eight percent (98%) of the investment or \$1,883,041,843 is directed toward infrastructure development such as highways, renovation of buildings, telecommunications and energy infrastructure in the Puerto Rico Northwest area.**

**The proposed investment will directly address the grave problem of deterioration in the physical infrastructure at the Ramey Base and Northwest area as described by Section V of the H.R. 5278 known as PROMESA. Additionally it will establish as investment priorities the necessary infrastructure required for promoting Collaborative Regional Innovation, Global Competitiveness and National Strategic Priorities as defined by the Economic Development Administration (EDA).**

**This projected investment will produce approximately 96,000 direct jobs in a 5 to 15 year period with a projected economic impact of \$3,519,996,991.12.**

In summary the proposed project will provide our economically distressed communities and regions with comprehensive, diversified and flexible resources to address a wide variety of economic needs, and is designed to lead and be one of the main drivers for the creation and retention of jobs and increased private investment.

## 2. Foundation

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### 2.1. Scope of this proposal

The geography of Puerto Rico and its political status are both determining factors on its economic prosperity, primarily due to its relatively small size as an island; its lack of natural resources used to produce raw materials, and, consequently, its dependence on imports. During the second half of the 20<sup>th</sup> century and encouraged by duty free access to the U.S. and by tax incentives, U.S. firms have invested heavily in Puerto Rico. As a result, Puerto Rico's export and import has prospered, nearly doubled between fiscal years 1987 and 1997. Puerto Rico's economy depended heavily on the tax incentives given to U.S. mainland companies and on federal transfers; the code went into effect in 1976. In 1993, President Clinton aimed to cut the Section 936 of the U.S. tax code, which exempted the profits earned by American companies from federal taxes. A more modest tax credit linked to wages paid by those companies in Puerto Rico rather than to profits was introduced. It is estimated that 100,000 Puerto Ricans were employed by companies operating under Section 936 (of which 23,000 are in pharmaceuticals) and another 200,000 are indirectly employed. In 1996, Congress opted to phase out Section 936 by the year 2006. As a result, the number of manufacturing jobs on the island dropped by almost half by 2014. At the macroeconomic level Puerto Rico has been experiencing an economic depression for 10 consecutive years, starting in 2006 after a series of negative cash flows and the expiration of the section 936 that applied to Puerto Rico of the U.S. Internal Revenue Code. In comparison to the United States, Puerto Rico has 45% of its population living below the poverty line.

Currently Puerto Rico has been experiencing since 2006 a migration that is due mainly to income inequality and high level of education (Caraballo 2016). Nevertheless the aerospace sector has been steadily growing in the island for the past ten years and with recent business expansion and investments such as the Lufthansa Technik MRO operation and the Infotech and Honeywell expansions. However more work is needed to have a more robust aerospace cluster in the island. A main part of the required work is to change the paradigms that sustained the efforts to attract new businesses to Puerto Rico.

The businesses of the new economy in the member countries of the Organization for Economic Cooperation and Development (OECD) have the following composition; Knowledge intensive manufacturing, innovation on technology and business models, Advances in science, Productivity and cost reduction. They also seek and promote the use of artificial intelligence, Digital evolution and differentiation and a labor market that could provide a stable supply of Engineering, scientific and technical personnel. One of the main paradigms that are needed is the recognition that to attract businesses of the new economy a new set of variables and intangibles come into the equation and incentives only will not guarantee a successful economic development strategy. In fact in some cases is the last variable considered for investment. The

second paradigm shift that Puerto Rico has to embrace is that there should be a deliberate integration and development of the manufacturing, knowledge and creative economies. This integration should be made using as the foundation a knowledge based economy which provide the tools and means for the development of the digital manufacturing environment. It also should the foundation in which a creative economy can be developed and this should be one of the main goals of the strategic economic development centered in the aerospace industry. The work presented in this document establishes a pathway for the integration and development of the necessary socio economic strategy.

## 2.2. A knowledge based economy

For definition purposes we will use the concept provided by the Organization of Economic Cooperation and Development for a knowledge based economy: (OECD, The Knowledge Based Economy, 1996);

“The term “knowledge-based economy” results from a fuller recognition of the role of knowledge and technology in economic growth. Knowledge, as embodied in human beings (as “human capital”) and in technology, has always been central to economic development.”

The concept of knowledge can be divided in four different types;

- Factual knowledge; the knowledge type more related to the concept of information. Subject matter experts should have a vast reservoir of this type of knowledge.
- Why knowledge; it is the scientific knowledge of the principles and laws of nature and systems. Production and reproduction of this type of knowledge are developed in specialized organizations such as research laboratories and universities.
- Capacity knowledge; skills and capacities to do something. Workers that deal with complexity of machines, tools and processes develop and use this type of knowledge.
- Network Knowledge; this is information about who has facts and why knowledge and who has capacity knowledge.

Facts and why knowledge can be acquired through databases, course, books or media. Capacity and Network knowledge has to be acquired by practical experience. Generally capacity knowledge is learned in an apprenticeship environment formal or informal, inside and outside specialized educational facilities. Network knowledge requires primarily the learning and application of social and emotional skills. This kind of knowledge is not easily transferred and has a strong component of the cultural environment in which is formed.

The economic paradigm of the knowledge based economy requires the development of a life long learning of skills, knowledge and competencies. Also it requires the development of capabilities for selecting relevant information; recognize patterns in the information available and learning new skills and discarding old or obsolete skills. For this kind of economy is its fundamental the diffusion and use of knowledge and its creation. Therefore networking tools and capabilities are used to fuel and nurture a non-linear mode of innovation.

The successful implementation of initiatives in the knowledge-based economy requires that several metrics should be developed, correctly measured and maintained. These metrics should measure effectiveness of the key functions that sustain that kind of economy; the development



and provision of new knowledge (knowledge production), the education and development of human resources (knowledge transmission), distribution, dissemination and input for problem solving (knowledge transfer). The principal knowledge indicators, as collected and standardized by the OECD are: i) expenditures on research and development (R&D); ii) employment of engineers and technical personnel; iii) patents; and iv), international balances of payments for technology. Some of these activities are classified by sponsorship or source of funding (government and industry) and by sector of performance (government, industry, academia). However other indicators such as institutional capabilities for knowledge transfer, the knowledge distribution power of the economy and the social and private rate return of investment in knowledge activities should be developed and measured. Equally important is the information technology and communication infrastructure required to sustain the different aspects of the knowledge economy and its level of development, penetration and effective use in our society.

### 2.3. The creative economy

Another layer within a knowledge based economic development is what is called the creative economy. In this economic concept the knowledge infrastructure is developed to nurture and help grow what Richard Florida calls the creative class. The Creative class is defined as “*composed by those who engage in work that create meaningful forms that are easily transferable and widely useful*”. In this class Florida group several professions into what he calls the Super-Creative Core, then the “creative professionals”

According to Florida the Super-Creative Core *includes scientists and engineers, university professors, poets and novelists, artists, entertainers, actors, designers, and architects, as well as the thought leadership of modern society: nonfiction writers, editors, cultural figures, think-tank researchers, analysts, and other opinion makers. The Creative Professionals are the ones who work in a wide range of knowledge-intensive industries, such as high-tech, financial services, the legal and health care professions, and business management. These people engage in creative problem solving, using complex bodies of knowledge to solve specific problems. There is also a third layer within this class as defined by Florida, which comprises technical workers that need to apply complex bodies of knowledge and skills to their work with physical materials.*

There are two main facts about this kind of new class of workers that is necessary to remark before going any further: 1) Normally the two first groups in the creative class require a high degree of formal education but all groups require life long learning to keep in pace with the advances of their respective disciplines. The group of technical workers require more in depth education at the post secondary level even acquiring bachelor degrees in their technical disciplines. 2) These group of workers have an above average wage scale in all their respective groups and according to the Department of labor Statistics for the year 2020 they will be the most growing sector of the economy.

Nevertheless, to provide a fair socio economic development for all components of our society we need to consider what happens to other kind of workers that do not belong to this class as previously defined. That includes jobs related to the normally called blue collar and white collar workers in the traditional definition which are normally regarded as low skilled and routine management, accounting and clerical jobs. Also we need to consider people who are not employable due to different social and economic circumstances. It is important to nurture the growth of the creative class as part of a more comprehensive socio economic development but it is also important to refocus how we provide opportunities for other members of the labor market

to transform their jobs into more creative enterprises to explore their innate capability for creativity.

In summary and using excerpts from the World Bank Institute Book of Building Knowledge Economies: Advance Strategies for Development we need to recognize that:

*“Knowledge is special because it is difficult to obtain, whether through creation or purchase. Unlike information, knowledge involves combinations of facts that interact in intangible ways. Because it is difficult to obtain, it constitutes an entry barrier to growth—and this entry barrier, in turn, helps generate the rent earned from knowledge. There are several types of knowledge rent: technological (control of scarce process or product capabilities), human resources (availability of unique or advanced human skills and know-how), organizational (control of unique or advanced management practices), and marketing and design (both increasingly important in recent years, with a direct correlation to consumer know-how). Knowledge rents such as these are transitory, however, and require continuous renewal.”*

*“Innovation is defined as the diffusion of technologies and practices that are new to a given society. Innovation begins with support for dynamic individuals, firms, and communities. That support should be technical, financial, and regulatory—and it should be delivered locally. Each country’s research and technology infrastructure must be adapted to the society’s needs and capabilities, but it should be managed and funded based on principles of openness and balance between assured (institutional) funding and contingent (contract-based) funding. **Cluster growth depends much more on general incentives and a supportive climate characterized by ample supplies of expertise and knowledge than on the provision of specific subsidies and aids.**”*

*“Information and Communications Technologies are the basic infrastructure of knowledge-based economies. **The development and use of e-applications in government, business, and education sectors should proceed in tandem with efforts to raise the IT literacy of the population.** Comprehensive national programs aimed at attuning citizens to the IT revolution have proven effective even in poor countries.”*

*“Knowledge economies usually require profound changes in education systems. Upgrading education in low- and middle-income countries starts with a rapid reduction of illiteracy, and the cultivation of employability skills and self-learning capabilities. Secondary and vocational students must acquire basic competencies, such as reading, writing, reasoning, and basic mathematics. Universities must adjust their programs to world standards; open themselves to the needs of employers, entrepreneurs, and their communities; and develop public-private partnerships. The labor force should be composed of educated and skilled workers who are able to continuously upgrade and adapt their skills to create and use knowledge efficiently. **Education and training systems encompass primary and secondary education, vocational training, higher education, and lifelong learning.**”*

*“The country’s institutional regime, and the set of economic incentives it creates, should allow for the efficient mobilization and allocation of resources, stimulate entrepreneurship, and induce the creation, dissemination, and efficient use of knowledge. The notion covers a vast array of issues and policy areas, ranging from aspects of the macroeconomic framework, to trade*

*regulations, finance and banking, labor markets, and governance. The latter includes the rule of law and its applications (judicial systems), the quality of the bureaucracy as reflected in measures of government effectiveness, and the level of corruption. **Mediocre governance resulting in a poor business climate is the single greatest hindrance to economic and social development in general, and to knowledge-based development in particular.***”

## 2.4. The Aerospace Economy

### 2.4.1. Global perspective

The Commercial Aviation sector is in the middle of a significant growth phase. The global commercial aerospace market is expected to increase with a compound annual growth rate (CAGR) of 4.6% by 2020, driven primarily by growing air traffic along-with technological evolutions. With steady growth projected for global air traffic & cargo traffic through the mid-2030s complemented perfectly by the introduction of new aircraft programs by almost all key industry original equipment manufacturers (OEMs) such as Boeing and Airbus incorporating cutting-edge technologies along with commercialization of a range of incremental as well as radical innovations. This trend has been a key driver of major fleet renewals underway across airlines globally and provokes burgeoning order backlogs for new aircraft programs.

The aerospace interior sector vessels needs regular maintenance and are required to be replaced in short intervals. This high replacement rate is expected to further drive this market. Airbus interior market is expected to grow at a greater pace than Boeing. Rise in delivery of aircrafts A321 and A380 during forecast period is anticipated to support the expansion of Airbus interior market. Delivery of aircraft A350 is expected by 2015, which will further boost this market.

According to the General Aviation Manufacturers Association (GAMA), in 2010, 42.1% of business jet deliveries were to North American customers, compared with 49% in 2009. Europe accounted for 22.8% of the shipments in 2010, Latin America followed with 14.3%, Asia Pacific at 11.8% and the Middle East and Africa with 9.0%.

Based on a 2014 study performed by the CapGemini Consulting Firm: the worldwide business jets fleet consisted of 14,200 aircraft at the end of 2009 and is forecasted to grow at 3.6% compound annual growth rate (CAGR) to an estimated 29,000 aircraft by 2029. Bombardier forecasted that the business jet shipments would increase to 10,500 by 2019 and to 15,500 by 2029.

The 2015 study from Deloitte and Touche details on page 3 that: “Commercial aerospace subsector sets new records for sales orders, deliveries, order backlogs, and revenues, but the growth rate is expected to edge down. Global commercial aerospace companies achieved the highest levels of the four key growth metrics in the sector in 2014. Sales orders grew from 2,858 in 2013 to record levels of 2,888 sales orders in 2014, while aircraft deliveries increased by 6.1 percent from 1,274 to 1,352 deliveries. However, the sector growth rate is expected to slow down to 3.0 percent, with a 2015 production level expected at 1,393 aircraft and 1,422 aircraft in 2016, for 2.1 percent growth rate. The sector’s 2014 order backlog grew by 14.4 percent and

reached a record high of 12,175 aircraft, compared to 10,639 aircraft in 2013. At the current production rate, this represents a 9.0-year backlog of future production. Revenues grew by 8.2 percent, from US\$291.2 billion in 2013 to US\$314.9 billion in 2014. The Boeing Company and Airbus Group together added US\$6.1 billion in additional revenue in 2014, as a follow up to the US\$11.0 billion of combined incremental growth in 2013. Growth in demand for travel, especially in China, India, and the Middle East, as well as the need for more fuel-efficient aircraft continue to drive demand for new aircraft sales. Because of this continued demand for new commercial aircraft, it is estimated that over 34,000 jets over the next 20 years will be produced, with a value of over US\$1.78 trillion at list prices”

Shipment of 10,500 business jet units is expected to garner revenues worth US\$254 billion until 2019 and US\$407 billion by 2029. Bombardier also predicted delivery to increase to 1,600 business jet units per year. The global airline traffic is expected to grow 4.7% on average every year from 2009 to 2028, with the highest gains in Asia Pacific and the Middle East, according to the Airbus Global Market Forecast. Over the next 20 years, Airbus foresees a demand for around 25,850 passenger and freighter aircraft, worth approximately US\$3.2 trillion and Boeing forecasts demand of 28,980 aircraft at US\$3.5 trillion.

On the other hand the Defense segment of the aeronautical/aerospace industry, continues to face significant challenges with defense budgets across most traditional markets under significant pressure. Nevertheless this segment, has some niche windows of growth opportunities available, created, mostly by technological evolutions and radical innovations being pursued & delivered by the industry value chain driving the generational leap in strategic as well as operational capabilities while providing significant incentive through optimized operating economics for the impending need for replacement of legacy, cold war era systems & hardware.

Within both sectors there is further segmentation based on aircraft parts, components and materials. Classically the aircraft is divided into the fuselage and aircraft systems (mainly composed of aluminum sheet metal and copper wiring) and the engine systems (powerplants; propellers and turbines). However new technological advances in materials, fuel efficiency and digital communication systems, provide the base to new aircraft development and delivery for the next decade. New aircraft technology is based in three main components: the engine system, avionics systems including digital communications and the integration of fiber optics (for aircraft systems) and the combination of sheet metal and composites (for the aircraft fuselage).

In terms of the markets the Aircraft Engines segment consists of companies that primarily specialize in manufacturing jet engines. Three companies dominate this market: General Electric, Rolls- Royce and Pratt & Whitney (with presence in Puerto Rico). Rolls- Royce is the current market leader and is estimated to have about 50% of the new orders in the most lucrative wide-bodied aircraft market, while GE holds about 40% of the new orders.

The Avionics market segment consists of electronic aircraft systems like fly- by-wire (or even fly-by-light) flight controls, system monitoring, anti- collision systems and pilot assistant/ interface systems like communication, flight management systems, navigation and weather

forecast. Key players in this segment include Thales, Honeywell (with presence in Puerto Rico) and L3-Communications.

Composite material generally consists of relatively strong, stiff fibers in a tough resin matrix. Other composite materials that are often used in aerospace include carbon- and glass- fiber-reinforced plastic (CFRP and GFRP, respectively).

Usage of composite materials is lucrative in aircraft because composites help in reducing the overall weight of the airframe enabling better fuel efficiency. Composites are estimated to enable a 20% saving in terms of weight along with lower production time and improved damage tolerance. Usage of composites in aircraft has gradually increased over the years. The A380 has used 20% to 22% composites by weight along with extensive usage of GLARE (glass- fiber-reinforced aluminum alloy). It is expected that the new 757 aircraft from Boeing on schedule for 2015 will be made of 80% composites.

### **The MRO Market**

Demand for MRO services is primarily driven by airline companies, which use in-house maintenance services or outsource these activities to third- party providers such as Lufthansa Technik Puerto Rico. Airline operators are also influencing the dynamics of the market through their growing demand for quick turnaround times in order to keep their planes in the air as long as possible. According to a report presented in the Global MRO Procurement Expo in May 2014 by Richard Brown there are some interesting remarks regarding aircrafts replacements and MRO locations.

- Across all sectors, the MRO industry is valued at \$131B; air transport MRO is ~46% of the total (\$60.7B)
- The strongest driver of growth is expected to be the engine market
- MRO growth is greater than fleet growth – driven primarily by fleet demographics
- Upgrade demand drives high modifications growth
- 46% of the 17,700 new aircraft deliveries in the next decade will be for aircraft replacements, versus the historical norm of ~20 %.
- Air transport MRO spend is expected to grow to \$89B by 2023, at 3.9% per annum
- The cost advantage enjoyed by Asian MRO suppliers will continue to erode due to the shortage of skilled labor and wage inflation.

### **In the Unmanned Aircraft Vehicle’s sector the Teal Group predicts that:**

“The growth of unmanned systems for military and civil use is projected to continue through the next decade. It is estimated that UAS spending will almost double over the next decade, from \$6.6 billion to \$11.4 billion on an annual basis, and the segment is expected to generate \$89 billion in the next 10 years”

## 2.5. The Puerto Rico Perspective

In Puerto Rico the Aerospace Cluster is centered in the Island Northwest corridor (Aguadilla, Isabela, Aguada, San Sebastian, Rincon, Moca) encouraged by installations such as the Ramey International Airport host to the biggest runway in the Caribbean, academic institutions such as UPR Aguadilla and the AAIPR with specialized academic programs and industry players such as: Lufthansa Technik, Lockheed Martin, Infosys Inc., Pratt & Whitney, Honeywell Aerospace, Florida Turbines, Phoenix Cables Inc., Axon Puerto Rico, Infotech Aerospace Services, Hamilton Sundstrand, Opti Manufacturing, Essig Research, JetBlue Airways and Seaborne Airlines. According to several authors:

“Puerto Rico possesses many strategic benefits that make the island an ideal location for R&D, such as U.S. level infrastructure and legal system, geographic location at the center of the Western Hemisphere, a strong academic base and least a strong manufacturing base.” (Misla, 2015)






“The islands has boosted research spending by 3.3% since 2009 and currently spends \$449.3 million in R&D. Furthermore “Puerto Rico’s gross expenditures on R&D are comparable to those of Mexico and Costa Rica” and offers companies a “50% income tax credit of qualified R&D expenses” (Misla, 2015)

“Beyond the current advantages being exploited, Puerto Rico and therefore the AAIPR, have other strategic advantages for future industry developments such as defense and aerospace development. “Puerto Rico falls into the protection of offered by the International Traffic in Arms Regulation (ITAR), which states that all federal defense and military related technologies be produced by U.S. citizens and [under] U.S. exports control” (Negrón, 2015). Also in a recent article by Caribbean Business writer Edison Misla, Chairman of the Executive Committee of the national Space Society, stated, “There is talk of building commercial spaceport in various areas around the country”. Hopkins believes that “Puerto Rico is an advantageous location for a commercial spaceport” (Misla, 2015) since “when rockets are launched from the Equator they get an extra push. The island’s closeness to the Equator and its being a part of the U.S. are huge benefits.” (Hopkins, 2015) In the end, in order to strengthen Puerto Rico’s aeronautical cluster and AAIPR’s global positioning we must “create a more global mentality on the island” (Vidal, 2015) and “achieve competitive advantage through acts of innovation [...] including both new technologies and new ways of doing things” (Porter, 1990).



The growth of this industry sector in Puerto Rico requires the strengthening and expansion of the current ecosystem of suppliers and academic programs to provide and sustain the workforce and economic environment that this type of industry needs.

Job creation potential from this industry as it is reported by various sources including industry representatives forecast a high demand for qualified aviation and aerospace human resources. Direct and indirect job creation forecasts are depicted in Table 1.

**Table 1: Aerospace Industry Direct and Indirect Job Creation**

Direct Job Creation		
Institution	2015	Projected increase by 2017
	250	+200
	1,000	+310
	600	N/A
	250	+300
 Aeronautical & Aerospace Cluster	2,100	+1,000--1,500

Source: CBED from various data sources.

Indirect Job Creation	
Institution	Projected for 2017
	2,000
 Aeronautical & Aerospace Cluster	-3% to -4% decrease in local unemployment rate

Source: CBED from various data sources.

This cluster development represents an opportunity for the establishment of a new technical line of work in Puerto Rico, nurturing from the available academic resources, infrastructure and advisory from the private sector, all in alignment with the Government of the Commonwealth of Puerto Rico's strategic economic development plan of generating jobs, government owned intellectual property, business partnerships and advancement of the academic development of local population.

## 2.5.1. Ramey Base and the Northwest Metropolitan Statistical Area

The Ramey Base facilities infrastructure was built in year 1943 to comply with United States of America military standards. Due to its military use the runway at Ramey had to be built to a length of 11,702 ft. and a width of 200 ft., it has an added 870 ft. Blast Pad at each end and a 50 ft shoulder on each side making it the biggest in the Caribbean. This runway makes the airport fit to receive big and heavy military and commercial type aircraft.

Today Ramey’s runway facilities can provide a platform for satellite launching and unmanned aerial and space vehicle research. Its other building infrastructure provide an ideal place to establish research and development operations that are sensitive to vibrations and require intense weather resistant conditions such as hurricane type winds and earthquake type events. Due to their location at 283 feet above sea level, the facilities are also immune to tsunami type events which also make the facilities suitable to host research activities using high performance computing equipment that sustain major scale simulations and Big Data operations and initiatives.

The Ramey area is host to the Lufthansa Technik Puerto Rico operations and the Northwest Metropolitan area which includes Aguadilla, Aguada, Isabela, Rincon, San Sebastian and Moca municipalities is becoming home for aerospace businesses dedicated to research and development activities such as Honeywell, Infotech and Infosys among others. These businesses along with Lufthansa Technik are creating an ecosystem that requires specialized human resources, products and services to guarantee their global competitiveness.

The northwestern metropolitan area includes the municipalities of Aguadilla, Isabela, Moca, San Sebastian, Aguada and Rincon. Current statistics from the US Department of Labor provide the following profile for the Aguadilla-Isabela-San Sebastian Metropolitan area:

**Table 2: Labor Statistics for the Aguadilla-Isabela-San Sebastian Metropolitan Area**

Year	Civilian Labor Force	Employment	Unemployment	Unemployment Rate %
2012	93,954.2	76,111.0	17,843.2	19.0
2013	91,963.5	73,942.9	18,020.6	19.6
2014	89,991.8	73,523.9	16,467.9	18.3
2015	89,048.1	75,186.8	13,861.3	15.6
2016	89,906.7	76,268.0	13,638.7	15.2
Average	90,972.9	75,006.5	15,966.3	17.5

Up to year 2016 the government sustained the economy of the region with 17% of the employment in the area followed by the trade, transportation, and utilities with a 9.8% and the manufacturing sector with 6% but experimenting a reduction of 3.2% in the 2015-2016 period (see Figure 1 below).



Figure 1: Employment Distribution for the Aguadilla-Isabela-San Sebastian Area

## Aguadilla-Isabela-San Sebastian, PR

### Aguadilla-Isabela, PR

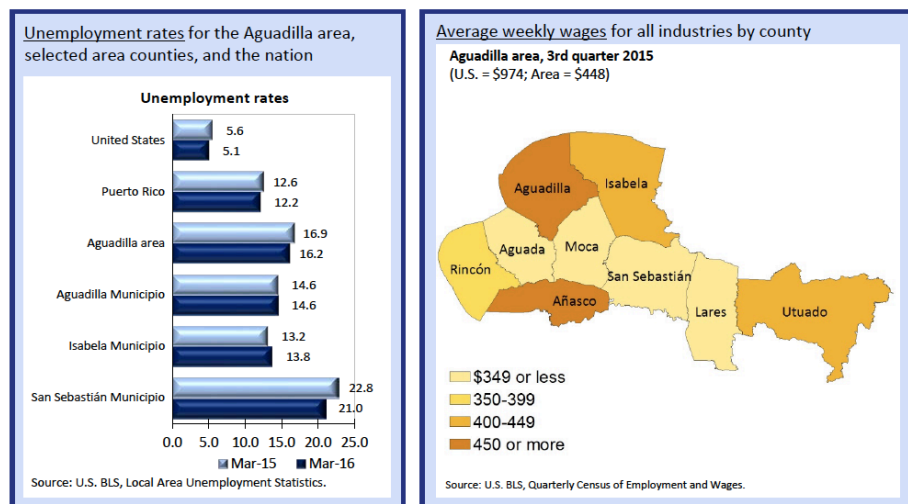
Data Series	Back Data	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016
<b>Labor Force Data</b>							
Civilian Labor Force (1)		(R) 90.3	(R) 91.0	90.7	90.4	(P) 90.3	
Employment (1)		(R) 76.7	(R) 78.9	77.6	76.3	(P) 75.6	
Unemployment (1)		(R) 13.6	(R) 12.1	13.1	14.1	(P) 14.7	
Unemployment Rate (2)		(R) 15.0	(R) 13.3	14.4	15.6	(P) 16.2	
<b>Nonfarm Wage and Salary Employment</b>							
Total Nonfarm (3)		51.5	52.0	51.2	51.2	51.6	(P) 51.5
12-month % change		0.4	-0.8	0.4	0.4	0.8	(P) 0.2
Manufacturing (3)		6.1	6.1	6.0	6.0	6.0	(P) 6.0
12-month % change		-1.6	-4.7	-1.6	-3.2	0.0	(P) -3.2
Trade, Transportation, and Utilities (3)		10.2	10.3	10.0	10.0	9.9	(P) 10.0
12-month % change		0.0	-1.9	0.0	1.0	0.0	(P) 1.0
Financial Activities (3)		1.5	1.5	1.4	1.4	1.4	(P) 1.4
12-month % change		0.0	0.0	0.0	-6.7	-6.7	(P) -6.7
Leisure and Hospitality (3)		4.4	4.4	4.4	4.3	4.3	(P) 4.4
12-month % change		4.8	2.3	4.8	4.9	2.4	(P) 4.8
Government (3)		17.2	17.3	17.1	17.2	17.2	(P) 17.2
12-month % change		1.8	1.8	0.0	0.0	0.0	(P) 0.0
Footnotes							
(1) Number of persons, in thousands, not seasonally adjusted.							
(2) In percent, not seasonally adjusted.							
(3) Number of jobs, in thousands, not seasonally adjusted. See <a href="#">About the data</a> .							
(R) Revised							
(P) Preliminary							

Data extracted on: May 20, 2016

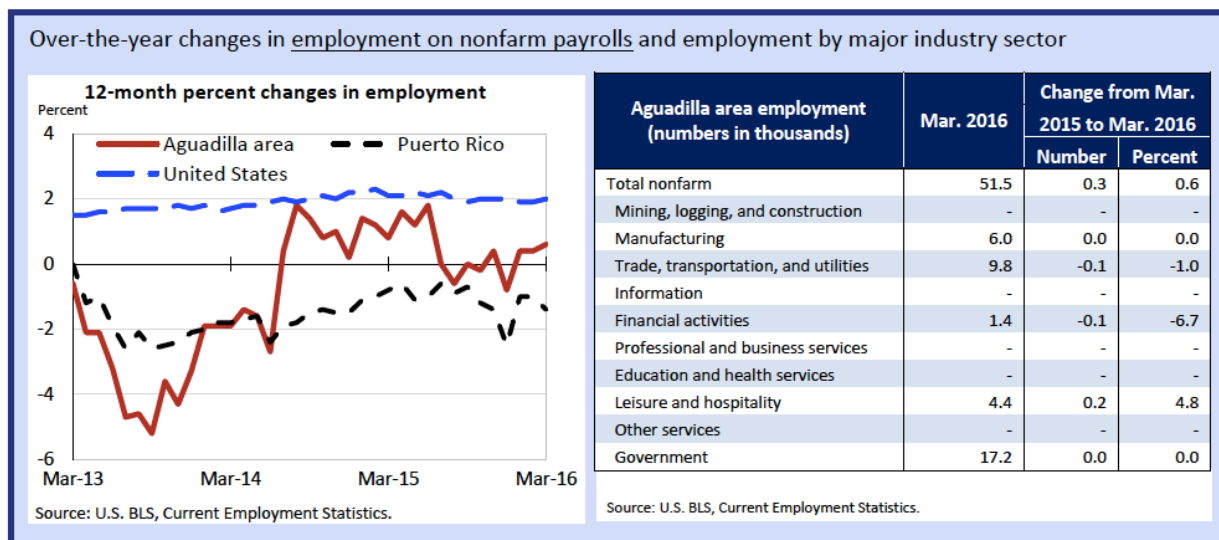
Source: USA Department of Labor

Using Puerto Rico Economy at a Glance and the Aguadilla-Isabela-San Sebastian area data from the US Labor Department from years 2015 to 2016 the average unemployment rate of the Aguadilla-Isabela-San Sebastian metropolitan area was 15.4% in the same period the average for Puerto Rico as a whole was 12%. The Isabela Municipality with the lowest rate of 13.2% and San Sebastian with the highest at 21%. Puerto Rico as a whole has a rate of 12.2% and the US has a 5.1% for the same period. In terms of wages the average wage for the Aguadilla area is \$448 weekly wage while the US has an average of \$974 for the third quarter of 2015 for a 45.9% of the national average weekly rate. Annual mean wage for Puerto Rico was \$28,190 for 2015. See following figures 2 and 3.

**Figure 2: Unemployment rates and Average weekly wages for the Aguadilla area**



**Figure 3: Changes in employment for the Aguadilla area**



The inclusion in the Aguadilla-Isabela-San Sebastian area economy of the strategies proposed in this project will change the composition of the labor market in the area by creating direct jobs related to scientific, engineering and technical disciplines such as university professors, engineers, physicists, software developers, computer system analysts among others which are several of the fastest growing occupations for up to the year 2024 (see Figure 4 below)

**Figure 4: Occupations with most job growth projected to 2024**

## Occupations with the most job growth

Other available formats: [\(XLSX\)](#)

**Table 1.4 Occupations with the most job growth, 2014 and projected 2024 (Numbers in thousands)**

2014 National Employment Matrix title and code	Employment		Change, 2014–24		Median annual wage, 2015 <sup>(1)</sup>
	2014	2024	Number	Percent	
<b>Total, all occupations</b> 00-0000	150,539.9	160,328.8	9,788.9	6.5	\$36,200
Personal care aides 39-9021	1,768.4	2,226.5	458.1	25.9	\$20,980
Registered nurses 29-1141	2,751.0	3,190.3	439.3	16.0	\$67,490
Home health aides 31-1011	913.5	1,261.9	348.4	38.1	\$21,920
Combined food preparation and serving workers, including fast food 35-3021	3,159.7	3,503.2	343.5	10.9	\$18,910
Retail salespersons 41-2031	4,624.9	4,939.1	314.2	6.8	\$21,780
Nursing assistants 31-1014	1,492.1	1,754.1	262.0	17.6	\$25,710
Customer service representatives 43-4051	2,581.8	2,834.8	252.9	9.8	\$31,720
Cooks, restaurant 35-2014	1,109.7	1,268.7	158.9	14.3	\$23,100
General and operations managers 11-1021	2,124.1	2,275.2	151.1	7.1	\$97,730
Construction laborers 47-2061	1,159.1	1,306.5	147.4	12.7	\$31,910
Accountants and auditors 13-2011	1,332.7	1,475.1	142.4	10.7	\$67,190
Medical assistants 31-9092	591.3	730.2	138.9	23.5	\$30,590
Janitors and cleaners, except maids and housekeeping cleaners 37-2011	2,360.6	2,496.9	136.3	5.8	\$23,440
Software developers, applications 15-1132	718.4	853.7	135.3	18.8	\$98,260
Laborers and freight, stock, and material movers, hand 53-7062	2,441.3	2,566.4	125.1	5.1	\$25,010
First-line supervisors of office and administrative support workers 43-1011	1,466.1	1,587.3	121.2	8.3	\$52,630
Computer systems analysts 15-1121	567.8	686.3	118.6	20.9	\$85,800
Licensed practical and licensed vocational nurses 29-2061	719.9	837.2	117.3	16.3	\$43,170
Maids and housekeeping cleaners 37-2012	1,457.7	1,569.4	111.7	7.7	\$20,740
Medical secretaries 43-6013	527.6	635.8	108.2	20.5	\$33,040
Management analysts 13-1111	758.0	861.4	103.4	13.6	\$81,320
Heavy and tractor-trailer truck drivers 53-3032	1,797.7	1,896.4	98.8	5.5	\$40,260
Receptionists and information clerks 43-4171	1,028.6	1,126.3	97.8	9.5	\$27,300
Office clerks, general 43-9061	3,062.5	3,158.2	95.8	3.1	\$29,580
Sales representatives, wholesale and manufacturing, except technical and scientific products 41-4012	1,453.1	1,546.5	93.4	6.4	\$55,730
Stock clerks and order fillers 43-5081	1,878.1	1,971.1	92.9	4.9	\$23,220
Market research analysts and marketing specialists 13-1161	495.5	587.8	92.3	18.6	\$62,150
First-line supervisors of food preparation and serving workers 35-1012	890.1	978.6	88.5	9.9	\$30,340
Electricians 47-2111	628.8	714.7	85.9	13.7	\$51,880
Maintenance and repair workers, general 49-9071	1,374.7	1,458.1	83.5	6.1	\$36,630

**Footnotes:**  
<sup>(1)</sup> Data are from the Occupational Employment Statistics program, U.S. Bureau of Labor Statistics.  
Source: Employment Projections program, U.S. Bureau of Labor Statistics

The proposed project will provide our economically distressed communities and regions with comprehensive, diversified and flexible resources to address a wide variety of economic needs, and is designed to lead and be one of the main drivers for the creation and retention of jobs and increased private investment. In summary this project is for the transformation of the current socio economic environment of the area and the island as a whole.

## 3. The Aeronautical and Aerospace Institute of Puerto Rico

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The Aeronautical and Aerospace Institute of Puerto Rico (AAIPR) is a non-profit subsidiary corporation of the University of Puerto Rico (UPR), which is the main driver to organize and implement the knowledge base ecosystem that promotes the growth and expansion of the aeronautical, and aerospace industry cluster requires. Recognizing that it is of critical importance for any aeronautical/aerospace cluster to foster innovation and strive towards efficiency in order to expand and strengthen, the AAIPR offers current and future cluster businesses a broad range of knowledge products and services which provide Academic, Training and Certification Solutions, Specialized Personnel Development Consultancy Services and Targeted and Problem Specific Research, Development and Commercialization using our specialized facilities and a state of the art research, development and commercialization services platform.

The AAIPR business philosophy is based on a co-creation development model. In this model, industry, academia and government create and nurture the growth of solutions together to benefit the socioeconomic environment of the island. This benefit generates value and opportunities in the short, medium and long term for all components of the various initiatives. In the AAIPR we aim to develop long term relationships based on trust and transparency by means of dedicated personal and organizational assistance, value co-creation and the growth of special interest communities. The set of these relationships make the AAIPR products and services highly customized to exceed customer expectations.

The foundation that sustains the AAIPR strategic framework is the continuous implementation of the paradigm of a knowledge base economy. Our framework recognizes an economy, which is, based on the production, distribution and use of knowledge for the creation and support of innovation. The application of our successful knowledge based economy emphasizes the educational component of the society and its quality, pertinence and capacity to develop integral, ethical and holistic beings and the development of metrics and standards to be measured, sustained and updated within the information infrastructure systems for policy and decision making purposes.

### 3.1.1. History

The AAIPR was incorporated in year 2014 and since that time the AAIPR business concept has been to establish a knowledge ecosystem that supports the start up of new businesses and job creation in the aeronautical and aerospace industry. To further develop the growth and expansion of the aeronautical and aerospace industry cluster in Puerto Rico the AAIPR is focused on developing three components; innovation by supporting research,

development and commercialization, infrastructure development and academic ecosystem. These three components have been organized into different implementation phases; (1) the academic ecosystem (Phase 1 and 2 has been on implementation since 2014), (2) Innovation by Supporting Research, Development and Commercialization and (3) Infrastructure.

Our goal at AAIPR is to become a key player that supports the growth and expansion of businesses as well as academic and research activities within the aeronautical and aerospace industries to ensure that our cluster tenants increase their global presence and competitiveness and guarantee a strong socioeconomic environment that fosters innovation and job creation in alignment with a knowledge based economy.

### 3.1.2. Location

Current AAIPR facilities are located inside the Rafael Hernandez Airport at Hangar Road #576 in the former Ramey Air Force Base in the Aguadilla municipality. The selection for our location was made based on the Ramey Area current physical infrastructure and development potential and it's fit with the AAIPR current target business areas and near future expansion plans.

**Figure 5: AAIPR and UPR Aguadilla facilities location**



### 3.2. AAIPR SWOT Analysis

The situational analysis for the AAIPR current and future programs yielded the following SWOT matrix.

<p><b>Internal Strengths</b></p> <ul style="list-style-type: none"> <li>• AAIMT is the R&amp;D division of a specialized educational facility (AAIPR).</li> <li>• Partnership with the University of Puerto Rico.</li> <li>• Location offers excellent strategic advantages for growth and insertion into local and global aerospace/aeronautical cluster.</li> <li>• Positioned to be the main R&amp;D facility in Puerto Rico specializing in aeronautics and space technology.</li> </ul>	<p><b>Internal Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Critical need of funding</li> <li>• Need for adequate facilities</li> <li>• Further acquisition of equipment</li> </ul>
<p><b>External Opportunities</b></p> <ul style="list-style-type: none"> <li>• Strong ties to the aeronautics cluster in Puerto Rico and alliances with multinational corporations.</li> <li>• No competing agencies.</li> <li>• Law 101 (Scientific Investigator's Income Tax Incentive Act)</li> <li>• Global presence acquired by being an Exhibitor at Hanover Messe part of the Select USA Research and Technology Pavilion</li> </ul>	<p><b>External Threats</b></p> <ul style="list-style-type: none"> <li>• Puerto Rico's fiscal crisis and shrinking economy.</li> </ul>

According to the SWOT and based on market data and the educational and innovation services to be offered the major target markets for the AAIPR have been determined to include segments within the Island and internationally as described below:

- Supply chain and industry players seeking continuous process and technological improvements in their GMOs and equivalent aeronautical operations locally
- Corporate multinational industry players internationally attracted to the Lufthansa MRO and cluster landing site efforts.

Multiple strengths define AAIPR capability to provide customer satisfaction. These strengths are in the following areas:

#### Academic

At the academic and certification level as a subsidiary corporation of the University of Puerto Rico the AAIPR has different strengths that could be described as follows:

- Specialized faculty members and researchers.
- Thematic courses across all the disciplines
- Multiple recognized and accredited programs and certifications

## **Facilities**

AAIPR actual facilities are qualified as the top three in the world making actual workshops and laboratories another strength.

## **Equipment**

All AAIPR equipment has been acquired during years 2014 and 2015 and it is state of the art.

## **Partners**

Currently the AAIPR has as partners different government agencies such as: the Puerto Rico Industrial development Company (PRIDCO), the Puerto Rico Department of Education, the Federal Aviation Administration (FAA). In the private sector the AAIPR has as partners and customers Lufthansa Technik Puerto Rico, Honeywell Aerospace Solutions and is a member of the Aerospace Consortium, which includes Infosys, Infotech, Florida Turbines and other players in the industry in Puerto Rico.

The AAIPR will expand its current market share exploring new markets and new ways to do business. Current opportunities identified are:

- Provide certifications and academic programs to resident students from Latin America and Asia.
- Provide specialized aerospace industry related training to individuals and groups with an engineering background to build Puerto Rico capability in this area.
- Build strategic research capabilities related to the aeronautical and aerospace industry to provide services and commercialize intellectual property.

## 4. Transition year 2016-2017

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### 4.1. Short Term Plan

As established in our SWOT analysis the AAIPR and typical of most non-profits has the following internal weaknesses: Critical need of funding, Need for adequate facilities and Further acquisition of equipment. To address this issues the AAIPR is actively pursuing collaboration and/or cooperation agreements and partnerships with: Academic institutions/universities, global businesses and public and private organizations interested in developing aeronautical/aerospace human resources development initiatives and leading academic institutions/universities, global businesses and organizations interested in developing aeronautical/aerospace research and technology innovation and co-creation initiatives. The AAIPR is also actively exploring other funding and investment alternatives among stakeholders in the industry, the USA and the European Union.

At the same time the AAIPR is leveraging and integrating efforts with current organizations and institutes within the UPR system such as the Molecular Sciences Building, the National Institute for Energy and Sustainability, the Center for Business and Economic Development of UPR Mayaguez and the Interdisciplinary Research Institute of UPR Cayey. All these alliances support the AAIPR efforts to develop a sustainable economic model for the growth of the aerospace cluster. Recognizing the lack of information available in Puerto Rico that complies with global measurement standards the AAIPR is creating during this year a knowledge database that develops and uses multiple indexes to measure the Northwest Metropolitan Area as described in Figure 6 the next page:



**Figure 6: Economic Development Information Criteria**

<b>LOCAL ECONOMIC DEVELOPMENT INFORMATION</b>	
<b>Demographic</b>	<p><b>Population :</b> By size, age, growth rate, projected growth rate, household size, population density:</p> <ul style="list-style-type: none"> <li>▪ This could include a poverty mapping exercise to identify demographic characteristics by sub-districts in the city</li> </ul> <p><b>Employment:</b> Employees by industrial activity - compare regionally and nationally, and note changes over time, if possible:</p> <ul style="list-style-type: none"> <li>▪ Age structure of the employed and occupation breakdown of employed and unemployed</li> <li>▪ Structure of employment (full / part-time / male / female)- nationally and over time</li> <li>▪ Average gross weekly earnings by gender and full / part-time employment</li> <li>▪ Unemployment figures, by numbers, age, duration</li> <li>▪ Numbers and other information on people and activities in the informal sector</li> </ul> <p><b>Education</b> Numbers and types of schools, teachers (full-time equivalent) and class sizes</p> <ul style="list-style-type: none"> <li>▪ Further and higher education establishments by type and numbers attending</li> <li>▪ Educational attainment levels by numbers and types - compare nationally</li> </ul> <p><b>Training :</b></p> <ul style="list-style-type: none"> <li>▪ Numbers and types and age groups of technically qualified individuals and those going through training programs. Assessment of local training providers</li> <li>▪ An assessment of skill / occupational shortages / oversupply</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>▪ Numbers and sizes of firms, broken down by sectors, with numbers of full-time equivalent employees, in time series, if possible</li> <li>▪ Number and type of recent (e.g. last 10 years) firm closures by size, sector and date. Number of inward investments, foreign and domestic (both Greenfield and existing companies) by employee size, sector and date</li> <li>▪ Number of new business start-ups, by size, sector / activity and longevity</li> <li>▪ Number of companies that export / to where / what (by sector) / company size</li> <li>▪ Top 50 (or so) companies by size - employment and / or turnover - by sector and named</li> <li>▪ Business tax income</li> <li>▪ Rental/purchase costs for vacant industrial and service sector units, by time series and size groupings</li> <li>▪ Vacancy rates of industrial and commercial space by size, location, absorption rates</li> <li>▪ Port / airport / rail cargo / passenger statistics</li> <li>▪ Informal businesses: number, sector types, employee number, location etc.</li> </ul>
<b>Business Environment</b>	<ul style="list-style-type: none"> <li>▪ Taxation of businesses</li> <li>▪ Amount of 'red tape' and the ease difficulties of applying red tape</li> <li>▪ Existence of supporting business networks and institutions, such as Chambers of Commerce</li> <li>▪ Municipal government economic development support - services offered or subsidized</li> <li>▪ Assessment of municipal government capacity to carry out local economic development</li> <li>▪ Access to funding (training grants, business incentives)</li> </ul>
<b>Hard Infrastructure</b>	<ul style="list-style-type: none"> <li>▪ Condition of water, electricity and wastewater provision in areas of economic activity</li> <li>▪ Assessment of provision of land, real estate/office space for economic development activities (including markets) and Central Business Districts</li> <li>▪ Availability and quality of road and other transport modalities to nearest/major markets</li> </ul>
<b>Regional and National</b>	<ul style="list-style-type: none"> <li>▪ What neighboring municipalities are doing in terms of their local economic development</li> <li>▪ How neighbors are competing</li> <li>▪ How they are, or could, collaborate</li> <li>▪ What is happening at the national level</li> <li>▪ Opportunities available through the national government</li> <li>▪ Major international / global trends that may impact on the local area</li> <li>▪ Opportunities and threats presented by regional government</li> </ul>

Source: World Bank Economic Development Strategy Learning Module 5

This information provides the AAIPR with the strategic capacity to have a more comprehensive view of the existing gap for a full implementation of an effective knowledge and creative economy. Once the gap is identified a pathway can be developed for provide potential investor

information and an attractive package to establish a presence in the island or an institutional collaboration.

## 4.2. AAIPR Positioning

Using our cultural strength of having a fully bilingual population and environment to conduct business, our US based FAA regulatory and compliance systems, our research capabilities in the engineering sector and an adaptable academic ecosystem with highly ranked engineering schools and technical programs the AAIPR is establishing a comprehensive academic ecosystem that supports the start up of new businesses and job creation in the aeronautical and aerospace industry. **The AAIPR provides a unique opportunity to access the US market within its regulatory provisions and intellectual property protections and infrastructure with a relative lower cost investment.**

*The AAIPR is a strategically located and certified state of the arts installation for delivery of qualified innovation and research services compliant with USA and internationally mandated standards. The AAIPR and its knowledge and creative ecosystem will become the current and new business partner for*

- *Providing the capability to build a relationship with the community and build special interest communities*
- *Providing complementary expertise*
- *Bringing a broader market.*
- *Provide a multidisciplinary research, development and commercialization platform*
- *Provide help in establishing government relations*
- *Help them integrate and enhance their multicultural fit*

## 4.3. Projects and Initiatives

The AAIPR initiatives structure is organized to foster creation, dissemination and application of knowledge at the service of the aerospace industry. The currently implemented initiative is the Aeronautical and Aerospace Center for Services and Training (AACST) and the new initiatives projected for year 2017 are the Aeronautical and Aerospace Institute of Multidisciplinary Technologies (AAIMT) and the Aeronautical and Aerospace Institute of Technology Design (AAITD) and the Aeronautical and Aerospace Institute of Creative Integration (AAICI).

The first and most important current initiative is the AAIMT. This division will focus in providing; research and development services, intellectual property development and a technology transfer and commercialization platform. The AAIMT will have five clusters for research and development that will be developed in phases according to market needs and opportunities, customer requirements from the current and future aerospace industries and businesses established in Puerto Rico and fit with the Commonwealth of Puerto Rico socio economic development strategies. These five research clusters are Materials Science Technologies, Atmospheric Sciences, Navigational and Positional Technologies, Propulsion Technologies and Human Factors Research. These clusters were selected to leverage on

current Puerto Rico research capabilities, the actual aeronautical and aerospace industrial ecosystem and to build capability to sustain available technologies and future industry developments such as Unmanned Aerial, Space Vehicles.

The Aeronautical and Aerospace Institute of Technology Design (AAITD) will provide the integration with the manufacturing branch of the economy. Using 3-D printing and other digital manufacturing capabilities, our natural strength in engineering design, our research and development capabilities and the access to global markets the Institute of Technology Design will provide services to businesses and individuals that require design of processes, materials, biological products and the capability to manufacture them.

The Aeronautical and Aerospace Institute of Creative Integration (AAICI) initiatives will implement the social and environmental responsibility component of the AAIPR. This Institute will provide access to the surrounding communities and municipalities to a state of the art Fab Lab facility, an Entrepreneurship and Incubator Academy and access to the application of developed technology to improve the energy and agricultural sustainability of their communities.

**To host these initiatives the AAIPR is requesting to the Puerto Rico Ports Authority the donation of buildings 507, 508, 512 and 513 currently located in the former Ramey Base at walking distance from current AAIPR facilities. These buildings have been unused by approximately 40 years and require renovations. To obtain the funding for such work the AAIPR submitted a proposal to the Economic Development Administration, which is pending for resubmission until the buildings have been transferred, to the AAIPR.**

## 5. AAIPR Economic Development Plan Proposal 2017-2040

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Developing the Puerto Rico ecosystem for aerospace cluster growth requires also attracting new companies and multinational businesses. The inclusion of the PROMESA law develops in the Island fiscal stability, which is one of the prerequisites to attract foreign investment. Nevertheless we also need to have socio economic stability to attract these kinds of investments and develop our own businesses.

The concept and strategic effort used to support the aeronautical/aerospace business sector stems from the creation of a cluster of industries involved in different focuses of development, which they can and should be made in phasing parallels for the successful implementation of this strategy.

1. The first focus: **Integration and diversification of the knowledge ecosystem.**
2. The second focus: **Supply Chain ecosystem**
3. The third focus: **Quality of Life to support a Multicultural Fit**
4. The fourth focus: **Create an attractor for anchor companies of different areas and disciplines related to the aerospace industry.**
5. The fifth focus: **Financial Infrastructure:**

These five strategic focuses will be implemented following principles that guarantee:

- **The full participation of the Puerto Rican diaspora and underrepresented groups such as women and minorities (as defined within Puerto Rico).**
- **Economic development that is socially responsible and sensible to the needs, lifestyles and culture of special communities (solidary economy).**
- **Will not damage and in all possible scenarios help improve the delicate island natural ecosystem.**

### 5.1. Vision

**To become the aeronautical and aerospace ecumenopolis of the 2040 decade.**

As the projected Aeronautical and Aerospace ecumenopolis (a planet wide city), we will be the thought leader in governance, policymaking and implementation, with the intellectual capital for governments, businesses and academia to access information and knowledge on regional and global trends in the aerospace sector.

## 5.2. Reinvest, Rebuild and Refocus for:

### 5.2.1. The Integration and diversification of the knowledge ecosystem

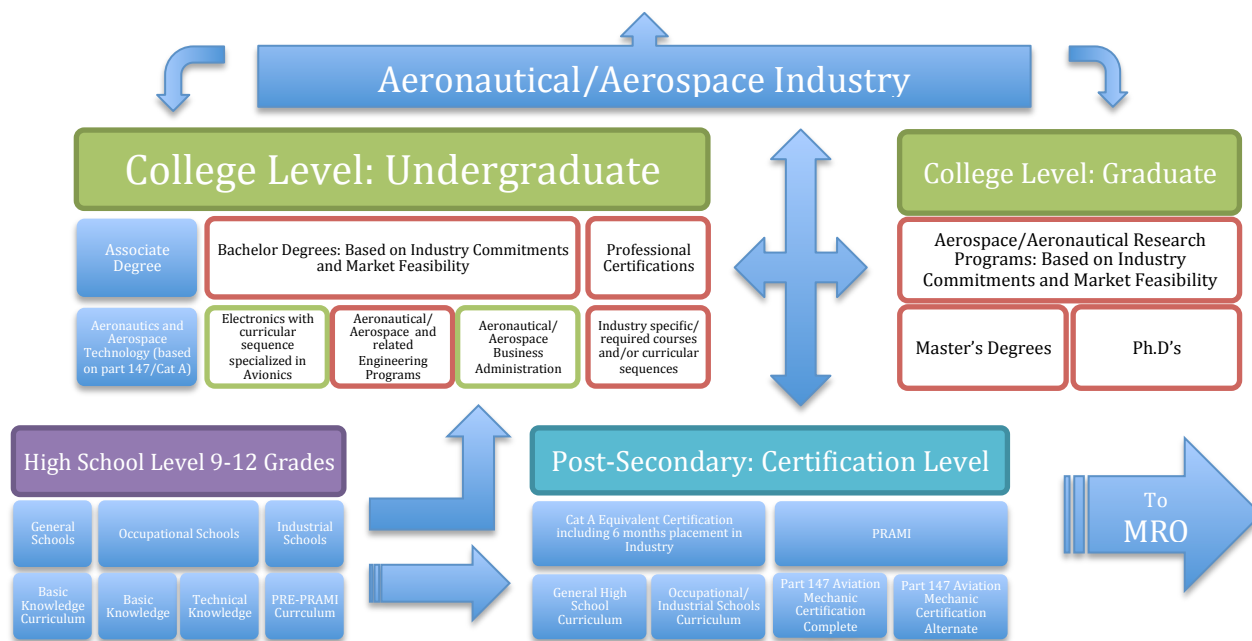
#### The academic ecosystem

The first line of action requires providing the necessary human capital, and meeting the standards and preparation required either by the current and future anchor companies or by the companies in their supply chain. This line of action requires strengthening, redirecting or creating academic and non-academic programs and other educational alternatives in the aerospace/aeronautical industry related topics and lines of development. The main driver in the development of a comprehensive academic cluster that supports the start up of new businesses and job creation is to:

- Create the academic ecosystem that develops the standards, requirements, offerings and deliveries for the training and certification of personnel for the needs of the aeronautical/aerospace cluster.
- Developing and delivering customized training and certification alternatives for business personnel related to the industry.
- Helping in the creation of new academic programs or enhancement of current ones to ensure a pool of skilled workforce.

Currently the AAIPR is developing the following integration of academic programs:

**Figure 7: Actual (Blue) and Projected (Clear) Academic Programs**



Nevertheless these programs targeted to the aeronautical and aerospace industry require the support of other academic programs currently offered in the UPR system.

***Programs that graduate students in technical disciplines at the post secondary level and higher education programs of science and engineering should be completely integrated with AAIPR efforts not only to occupy job positions in their field of expertise but also as educators and entrepreneurs for the next generations of students. Therefore each degree granting academic program should have the educator option and the entrepreneur option as an integral part of the discipline of study.***

**Innovation by Supporting Research, Development and Commercialization:**

It is imperative to support the development of a strong research, development and commercialization platform focused on current and future problem solving in the industry with the capacity to provide disruptive technologies that enhance the island global competitiveness.

It is interesting to note that in terms of R&D Computers, communications, semiconductors, pharmaceuticals and aerospace are among the high-technology and high-growth OECD sectors and are estimated to account for about 20 per cent of manufacturing production but in Puerto Rico we have only isolated efforts in developing these capabilities on our industrial base.

As a natural development of the comprehensive knowledge ecosystem there should be a specialized facility to provide targeted and problem specific research and development for the aeronautical and aerospace industry.

***This research and development and commercialization center should focus in providing; research and development services, intellectual property development and a technology transfer and commercialization platform.***

All these activities are aimed to build Puerto Rico’s capabilities in the aeronautical and aerospace sector for; attracting new businesses for the industry cluster, develop new academic offerings at the graduate and undergraduate level and strengthen current cluster members’ global competitiveness.

This R&D Center guiding principles are targeted to:

- Strengthen the infrastructure and research disciplines of tradition in PR, as foundations of a knowledge-based economy.
- Bridge basic research disciplines with clinical research to foster translational research and technological innovation.
- Develop worldwide-recognized research centers in areas of cutting-edge scientific impact through high level of intra- and inter-institutional collaborations.
- Develop partnerships and collaborations with industry.
- Enhance Puerto Rico intellectual property (IP) portfolio and the commercialization of research inventions.
- Enrich our society with an “open research culture” by exposing research activities, new technology, training opportunities and discoveries.

## Innovation by supporting Design

Puerto Rico has a natural strength in creativity and design. Our artistic class and our architects and engineers have proven this capability. In fact most of the actual output of the aerospace industry in Puerto Rico are design services.

Using this natural talent we can *develop design capabilities in all levels of the workforce by accelerating the introduction of design thinking programs and modules (from post-secondary to post-graduate level), at our educational institutions and in partnership with leading foreign design institutions, as well as targeted industrial attachments. The design capabilities of professionals in different sectors could also be enhanced through broad-based design literacy training.*

Also we can *establish an accreditation system to raise professional design standards and encourage pro-design practices, as well as a ‘Designed by Puerto Rico’ trademark for enterprises to strengthen Puerto Rico’s position as a leading and distinctive design hub.*

### 5.2.2. The strengthening of the Supply Chain ecosystem

Current Puerto Rico capabilities to support the aerospace industry are the following:

- Engineering and Information Systems Services to design, evaluate and support Gas Turbine Engines, Airframe Systems, and other Aerospace Products in the areas of software, drafting, structures analysis, modeling, mechanical design, tool design, electronic design, information technology, and supply chain.
- Maintenance, repair and overhaul (MRO) of narrow body aircrafts of the Airbus A320 family.
- Information technology outsourcing and consulting services.
- Automated Testing and Validation.
- Manufacturing of: Custom Harness Assemblies, RF Assemblies and Over molded Assemblies.
- Contract Manufacturing Services specialized in the manufacture of wiring harness and cable assemblies for aerospace and military applications.

Although we support the current aerospace cluster the supply chain to foster its growth needs to be further developed. The ecosystem to be developed with this project is centered on anticipating and meeting the needs of anchor industries by developing a network of local suppliers able to fulfill those needs. If local suppliers cannot serve specific needs, then the focus shifts to attract companies that can meet those needs and settle on the island. Therefore it is completely necessary as a first step to:

***Correctly identify the number of businesses and their capabilities to fit in the supply chain not to mention to correctly collect tax revenues.***

## **The enhancement of the Puerto Rico entrepreneur class**

There should be a deliberate effort for the development of a local entrepreneurship program for the island student population to encourage the creation of the small businesses critical mass required meeting present and future demands and needs of these industries. There are several programs in the island and private and public initiatives doing some efforts. However its impact is not measured and there is no central comprehensive strategy for developing or synchronizing these programs. As a result the majority of the population does not have real access to these programs.

*Financial and entrepreneurship education should begin early in the life of students therefore should be part of the grade school curriculum.*

*A special group of post-secondary education institutes should be created to develop the supply chain base necessary to attract aerospace businesses to the island.*

*Provide a business-mentoring academy for current small and medium sized business owners that want to grow and diversify their businesses in compliance with global standards.*

### **5.2.3. Create a Quality of Life to support a Multicultural and a Creative Class Fit**

As expressed in our vision to become the To provide alternatives of quality of life for diverse lifestyles and an infrastructure that provides the development of high-tech companies in a secure, stable and diverse environment for its employees. This means implementing the following initiatives:

- **Establish the Northwest as the island most livable and multicultural area.**
- **Develop the Ramey as the hub for aerospace innovation and creative businesses.**
- **Develop the Puerto Rico West End as the best home for talent.**

By means of the following processes:

- *Develop thought and practice leadership in urban planning and solutions by investing in cutting-edge sustainable development strategies, solidary economies, technologies and R&D projects in new trends and growth.*
- *Ensure that all sectors of society have broadband Internet access.*
- *Guarantee and improve access to services and infrastructure.*
- *In Ramey and Aguadilla; enhance current physical infrastructure to increase industry collaboration and design innovation. Collaborative spaces for design innovation by creative and other industries (e.g., interactive and digital media, consumer-centric and urban solutions) could be made affordable to encourage ground-up entrepreneurship and experimentation by individual talents, promising start-ups, SMEs and innovative enterprises. This could be achieved by converting old buildings and industrial zones into low-cost incubators for creative enterprises.*



#### 5.2.4. Create an attractor of anchor companies of different areas and disciplines related to the aerospace industry.

Developing the Puerto Rico ecosystem for aerospace cluster growth requires also attracting new companies and multinational businesses. The inclusion of the PROMESA law develops in the Island fiscal stability, which is one of the prerequisites to attract foreign investment. Nevertheless we also need to have socio economic stability to attract these kinds of investments. To do that we need to do the following:

- ***Have a business intelligence and development unit that is composed of:***
  - ***Professionally trained business development team specialized on targeted industries responsible of developing long-term relationships with these industries.***
  - ***A strategic knowledge development team in charge of providing market analysis and trends for business development and niche identification.***
  - ***A marketing and media design strategic team.***
- ***Identify key businesses and industries that we want to have a presence in our ecosystem.***

#### 5.2.5. Financial Infrastructure:

To provide an attractive financial environment for entrepreneurs and companies established on the island who want to create and/or grow their businesses by serving these industries an adequate financial infrastructure should be in place. Several studies had concluded that the main obstacle in Puerto Rico is the absence of the investor community such as the one that fuels Silicon Valley entrepreneurs in other words risks investors. Efforts should be redirected to:

- i. Attract these kinds of investors and help them establish a continuous presence in the island.***
- ii. Create the community and spaces in which investors and potential entrepreneurs can have a dialogue.***
- iii. Reinvest a percentage of corporate earnings to create a start-up seed fund. For example a start-up initial capital of \$20,000.00 with the requirement to attend and graduate from an entrepreneur and incubator academy.***
- iv. Providing an integrated package of business incentives for investments in design, design-driven IP creation, experimentation and commercialization.***

## 6. Resources, needs and estimated timeframe

The growth of the aeronautics and aerospace industry sector in Puerto Rico requires the strengthening and expansion of the supply chain ecosystem and the knowledge ecosystem to provide and sustain the workforce and economic environment that this type of industry needs. Several key initiatives were given in the preceding section. However to successfully implement them requires to have a comprehensive strategy to provide for the resources needed in a timely manner. The following tables summarizes the resources required according to the strategic implementation:

<b>Table 4: Integration and diversification of the knowledge ecosystem.</b>		
Key initiatives	Objectives	Resources needed
Integration of higher education programs of science and engineering with AAIPR.	Ensure a continuous pool of human resources for sustaining the aerospace industry requirements.	A strategic redesign team of the UPR system and changes to the UPR law. Licensing of the CEPR.
Redesign academic programs at the higher education level to have the educator option and the entrepreneur option as an integral part of the discipline of study.	Refocus and implement certification alternatives at the higher education level.	A curricular design and implementation team.  Specialized and dedicated facilities for implementation of curricular options.
Develop design capabilities in all levels of the workforce.	Accelerate the introduction of design thinking programs and modules (from post-secondary to post-graduate level).  Provide a broad-based design literacy training to develop the design capabilities of professionals.	
Establish an accreditation system to raise professional design standards and encourage pro-design practices,	To build the ‘Designed by Puerto Rico’ trademark for enterprises to strengthen Puerto Rico’s position as a leading and distinctive design hub.	
Establish a research and development and commercialization center. (in development by the AAIPR)	Provide research and development services, intellectual property development and a technology transfer and commercialization platform.	Buildings 507,508,512 and 513 of Ramey Base and permits for construction and use.

<b>Table 5: Strengthening of the Supply Chain ecosystem</b>		
Key initiatives	Objectives	Resources needed
Correctly identify the number of businesses and their capabilities to fit in the supply chain	Develop a knowledge base of Puerto Rico Supply Chain capabilities and gaps.	Implementation of the Business Intelligence Unit
A special group of post-secondary education institutes should be refocused and/or created to develop the supply chain base necessary to attract aerospace businesses to the island.	To have the prepared workforce to implement supply chain sectors	Integration of the current post secondary institutes of the PRDE to the AAIPR knowledge ecosystem.
Provide a business-mentoring academy for current small and medium sized business owners that want to grow and diversify their businesses in compliance with global standards	Develop the global competitiveness of the Puerto Rico local supply chain	A curricular design and implementation team.  Specialized and dedicated facilities for implementation of curricular options.

<b>Table 6: Quality of Life to support a Multicultural Fit</b>		
Key initiatives	Objectives	Resources needed
Develop thought and practice leadership in urban planning and solutions to transform the Northwest area of the island into the aerospace metropolis.	Invest in cutting-edge sustainable development strategies, technologies and R&D projects in new trends and growth on all the Northwestern area municipalities.	Integration of the Northwest municipalities and public and private sectors to identify and align projects for development.
Ensure that all sectors of society have broadband Internet access.	Increase Northwest area capability for knowledge access and diffusion.	
Guarantee and improve access to services and infrastructure.	Improve Northwestern area accessibility to transportation and basic needs.	Expansion of the PR-22  Improve access to the Rafael Hernandez Airport.
In Ramey and Aguadilla; enhance current physical infrastructure to increase industry collaboration and design innovation.	Transform old buildings and industrial zones into low-cost incubators for creative enterprises.  Improve land transportation access to the Ramey area and Airport.	Transfer of all abandoned and sub utilized property to the AAIPR for development. Construction and use permits.

<b>Table 7: Create an attractor for anchor and supply chain companies of different areas and disciplines related to the aerospace industry.</b>		
Key initiatives	Objectives	Resources needed
Have/create a business intelligence and development unit	Develop a knowledge base of Northwestern area Supply Chain capabilities and gaps.  Develop a knowledge base of the Northwestern area amenities and attractions for the investor community and strategic initiatives to improve and/or create them	A professionally trained business development team specialized on targeted industries responsible of developing long-term relationships with these industries.  A strategic knowledge development team in charge of providing market analysis and trends for business development and niche identification.  A marketing and media design strategic team.
Identify key businesses and industries that we want to have a presence in our ecosystem.	Establish presence of the following business sectors: <ul style="list-style-type: none"> <li>• Unmanned Aerial and space vehicles.</li> <li>• Cargo and logistics</li> <li>• Satellite deployment technologies</li> <li>• Software development and Artificial Intelligence</li> <li>• Nano materials</li> <li>• Energy</li> <li>• Propulsion systems and technologies.</li> </ul>	Deployment of the Business Intelligence and Development Unit.

<b>Table 8: Financial Infrastructure:</b>		
Key initiatives	Objectives	Resources needed
Attract these kinds of investors and help them establish a continuous presence in the island.	Create a start-up community and infrastructure	Government Facilitation and commitment
Create the community and spaces in which investors and potential entrepreneurs can have a dialogue.		Government, business organizations and private sector facilitation and commitment.
Reinvest a percentage of corporate earnings to create a start-up seed fund. For example a start-up initial capital of \$20,000.00 with the requirement to attend and graduate from an entrepreneur and incubator academy.		Funding structure availability Changes in funding paradigms.
Providing an integrated package of business incentives for investments in design, design-driven IP creation, experimentation and commercialization.	Establish a creative business friendly environment	Changes in current tax incentives laws.

The successful deployment of these initiatives requires a commitment of several decades to see results in some areas. Changes that involve strategic team formation and changes on methodologies can be implemented in a short time frame producing immediate results. Changes that involve infrastructure project investments may provide results in a medium time frame of three to ten years. Changes in the educational system at all levels are long-term investments that produce visible result in a ten to twenty years scale. It is also important to remark that any foreign investment attraction effort takes on average three years to provide results. The following tables provide an estimated time frame for deployment of the described initiatives.

## 6.1. Timeframe

### 6.1.1. Short term implementation (1-2 years)

<b>Table 9: Integration and diversification of the knowledge ecosystem.</b>		
Key initiatives	Objectives	Resources needed
Integration of higher education programs of science and engineering with AAIPR.	Ensure a continuous pool of human resources for sustaining the aerospace industry requirements.	A strategic redesign team of the UPR system and changes to the UPR law. Licensing of the CEPR.
Redesign academic programs at the higher education level to have the educator option and the entrepreneur option as an integral part of the discipline of study.	Refocus and implement certification alternatives at the higher education level.	A curricular design and implementation team.  Specialized and dedicated facilities for implementation of curricular options.
Establish a research and development and commercialization center and other AAIPR initiatives (in development by the AAIPR).	Provide research and development services, intellectual property development and a technology transfer and commercialization platform.	Buildings 507,508,512 and 513 of Ramey Base and permits for construction and use.
Provide a business-mentoring academy for current small and medium sized business owners that want to grow and diversify their businesses in compliance with global standards	Develop the global competitiveness of the Puerto Rico local supply chain	A curricular design and implementation team.  Specialized and dedicated facilities for implementation of curricular options.

<b>Table 10: Strengthening of the Supply Chain ecosystem</b>		
Key initiatives	Objectives	Resources needed
Correctly identify the number of businesses and their capabilities to fit in the supply chain	Develop a knowledge base of Puerto Rico Supply Chain capabilities and gaps.	Implementation of the Business Intelligence Unit
A special group of post-secondary education institutes should be refocused and/or created to develop the supply chain base necessary to attract aerospace businesses to the island.	To have the prepared workforce to implement supply chain sectors	Integration of the current post secondary institutes of the PRDE to the AAIPR knowledge ecosystem.

<b>Table 11: Quality of Life to support a Multicultural Fit</b>		
Key initiatives	Objectives	Resources needed
In Ramey and Aguadilla; enhance current physical infrastructure to increase industry collaboration and design innovation.	<p>Transform old buildings and industrial zones into low-cost incubators for creative enterprises.</p> <p>Improve land transportation access to the Ramey area and Airport.</p>	Transfer of all abandoned property to the AAIPR for development. Construction and use permits.

<b>Table 12: Create an attractor for anchor and supply chain companies of different areas and disciplines related to the aerospace industry.</b>		
Key initiatives	Objectives	Resources needed (in development by the AAIPR)
Have/create a business intelligence and development unit	<p>Develop a knowledge base of Northwestern area Supply Chain capabilities and gaps.</p> <p>Develop a knowledge base of the Northwestern area amenities and attractions for the investor community and strategic initiatives to improve and/or create them</p>	<p>A professionally trained business development team specialized on targeted industries responsible of developing long-term relationships with these industries.</p> <p>A strategic knowledge development team in charge of providing market analysis and trends for business development and niche identification.</p> <p>A marketing and media design strategic team.</p>
Identify key businesses and industries that we want to have a presence in our ecosystem and their required supply chain.	<p>Establish presence of the following business sectors:</p> <ul style="list-style-type: none"> <li>• Unmanned Aerial and space vehicles.</li> <li>• Cargo and logistics</li> <li>• Satellite deployment technologies</li> <li>• Software development and Artificial Intelligence</li> <li>• Nanomaterials</li> <li>• Energy</li> <li>• Propulsion systems and technologies.</li> </ul>	Deployment of the Business Intelligence and Development Unit.

## 6.1.2. Medium term (3-8 years)

<b>Table 13: Integration and diversification of the knowledge ecosystem.</b>		
Key initiatives	Objectives	Resources needed
Develop design capabilities in all levels of the workforce.	Accelerate the introduction of design thinking programs and modules (from post-secondary to post-graduate level).  Provide a broad-based design literacy training to develop the design capabilities of professionals.	A curricular design and implementation team.  Specialized and dedicated facilities for implementation of curricular options.
Establish an accreditation system to raise professional design standards and encourage pro-design practices,	To build the ‘Designed by Puerto Rico’ trademark for enterprises to strengthen Puerto Rico’s position as a leading and distinctive design hub.	

<b>Table 14: Strengthening of the Supply Chain ecosystem</b>		
Key initiatives	Objectives	Resources needed
A special group of post-secondary education institutes should be refocused and/or created to develop the supply chain base necessary to attract aerospace businesses to the island.	To have the prepared workforce to implement supply chain sectors	Integration of the current post secondary institutes of the PRDE to the AAIPR knowledge ecosystem.

<b>Table 15: Quality of Life to support a Multicultural Fit</b>		
Key initiatives	Objectives	Resources needed
Ensure that all sectors of society have broadband Internet access.	Increase Northwest area capability for knowledge access and diffusion.	Integration of private/public sector initiatives for project development

<b>Table 16: Create an attractor for anchor and supply chain companies of different areas and disciplines related to the aerospace industry.</b>		
Key initiatives	Objectives	Resources needed (in development by the AAIPR)
Attract key businesses and industries that we want to have a presence in our ecosystem	Establish presence of the following business sectors: <ul style="list-style-type: none"> <li>• Unmanned Aerial and space vehicles.</li> <li>• Cargo and logistics</li> <li>• Satellite deployment technologies</li> <li>• Software development and Artificial Intelligence</li> <li>• Nano materials</li> <li>• Energy</li> <li>• Propulsion systems and technologies.</li> <li>• Digital manufacturing</li> </ul>	Deployment of the Business Intelligence and Development Unit.

<b>Table 17: Financial Infrastructure:</b>		
Key initiatives	Objectives	Resources needed
Attract these kinds of investors and help them establish a continuous presence in the island.	Create a start-up community and infrastructure	Government Facilitation and commitment
Create the community and spaces in which investors and potential entrepreneurs can have a dialogue.		Government, business organizations and private sector facilitation and commitment.
Reinvest a percentage of corporate earnings to create a start-up seed fund. For example a start-up initial capital of \$20,000.00 with the requirement to attend and graduate from an entrepreneur and incubator academy.		Funding structure availability  Changes in funding paradigms.
Providing an integrated package of business incentives for investments in design, design-driven IP creation, experimentation and commercialization.	Establish a creative business friendly environment	Changes in current tax incentives and other economic laws.

### 6.1.3. Long term (8-15 years)

<b>Table 18: Quality of Life to support a Multicultural Fit</b>		
Key initiatives	Objectives	Resources needed
Develop thought and practice leadership in urban planning and solutions to transform the Northwest area of the island into the aerospace metropolis.	Invest in cutting-edge sustainable development strategies, technologies and R&D projects in new trends and growth on all the Northwestern area municipalities.	Integration of the Northwest municipalities and public and private sectors to identify and align projects for development.
Guarantee and improve access to services and infrastructure.	Improve Northwestern area accessibility to transportation, energy infrastructure and basic needs facilities.	Expansion of the PR-22 using alternative routes to minimize damage of natural resources and environment  Improve access to the Rafael Hernandez Airport.

## 7. Estimated investment and economic impact analysis

Dr. José Caraballo Cueto, our economic consultant, considering estimated quantities based on economic and employment multipliers made this analysis. These quantities are obtained from an input-output matrix where the interaction between each sector of the economy is measured.

The latest input output matrix of Puerto Rico is a projected matrix of 2013. The methodology is well known as it has more than 60 years (for more details, see Bess and Ambargis, 2011).<sup>1</sup> The employment multiplier gives us the total employment generated in the economy given a dollar invested in a particular sector. For this work, we use this matrix to obtain how many direct, indirect, and induced jobs are created by a given dollar in construction or in services, as shown in the table. The economic multiplier gives us the total economic output generated in the whole economy for a given dollar invested in a particular sector. In doing so, we found that a dollar invested in both construction and services is related to an additional \$1.84 in the rest of the sectors.

Key initiatives	Investment needed	Job created/retained	Economic impact
Integration of higher education programs of science and engineering with AAIPR.	N/A	N/A	N/A
Redesign academic programs at the higher education level to have the educator option and the entrepreneur option as an integral part of the discipline of study.	\$5,000,000.00	75.00	\$9,200,000.00
Develop design capabilities in all levels of the workforce.	\$1,000,000.00	15.00	\$1,840,000.00
Establish an accreditation system to raise professional design standards and encourage pro-design practices.	\$1,000,000.00	15.00	\$1,840,000.00
Establish a research and development and commercialization center and other AAIPR initiatives.	\$100,000,000.00	2500.00	\$184,000,000.00

Key initiatives	Investment needed	Jobs created/retained	Economic impact
Correctly identify the number of businesses and their capabilities to fit in the supply chain	\$200,000.00	3.00	\$368,000.00
A special group of post-secondary education institutes should be	\$10,000,000	150.00	\$18,400,000.00

<sup>1</sup> [http://www.bea.gov/papers/pdf/wp\\_iomia\\_rimsii\\_020612.pdf](http://www.bea.gov/papers/pdf/wp_iomia_rimsii_020612.pdf)



refocused and/or created to develop the supply chain base necessary to attract aerospace businesses to the island.			
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<b>Table 21: Quality of Life to support a Multicultural Fit</b>			
Key initiatives	Investment needed	Jobs created/retained	Economic impact
Develop thought and practice leadership in urban planning and solutions	\$100,000,000.00	2500.00	\$184,000,000.00
Ensure that all sectors of society have broadband Internet access.	\$10,000,000.00	250.00	\$18,400,000.00
Guarantee and improve access to services and infrastructure.	\$1,573,341,843.00	39325.00	\$2,894,948,991.12
In Ramey and Aguadilla; enhance current physical infrastructure to increase industry collaboration and design innovation.	\$100,000,000.00	2500.00	\$184,000,000.00

<b>Table 22: Create an attractor for anchor and supply chain companies of different areas and disciplines related to the aerospace industry.</b>			
Key initiatives	Investment needed	Job created/retained	Economic impact
Have/create a business intelligence and development unit	\$500,000	7.50	\$920,000.00
Identify key businesses and industries that we want to have a presence in our ecosystem	N/A	N/A	N/A

<b>Table 23: Financial Infrastructure:</b>			
Key initiatives	Investment needed	Job created/retained	Economic impact
Attract these kinds of investors and help them establish a continuous presence in the island.	\$1,000,000.00	15.00	\$1,840,000.00
Create the community and spaces in which investors and potential entrepreneurs can have a dialogue.	\$1,000,000.00	15.00	\$1,840,000.00
Reinvest a percentage of corporate earnings to create a start-up seed fund. For example a start-up initial capital of \$20,000.00 with the requirement to attend and graduate from an entrepreneur and incubator academy.	\$10,000,000.00	1500.00*	\$18,400,000.00*
Providing an integrated package of business incentives for investments in design, design-driven IP creation, experimentation and commercialization.	N/A	N/A	N/A

\*It is assumed the creation of 500 startup companies with a minimum of three employees each. The economic impact does not include a blockbuster patent development by any of these companies.

The projected total investment required for the implementation of the proposed plan is \$1,913,041,843.00. Ninety eight percent (98%) of the investment or \$1,883,041,843 is directed toward infrastructure development such as highways, renovation of buildings, telecommunications

and energy infrastructure in the Puerto Rico Northwest area. The remaining two percent (2%) of the proposed investment project will directly serve the following investment priorities as defined by the Economic Development Administration (EDA);

**Collaborative Regional Innovation:** The AAIMT will be a unique facility which will have five clusters for research and development that will be developed in phases according to market needs and opportunities, customer requirements from the current and future aerospace industries and businesses established in Puerto Rico and fit with the Commonwealth of Puerto Rico socio economic development strategies. These five research clusters are Materials Science Technologies, Atmospheric Sciences, Navigational and Positional Technologies, Propulsion Technologies and Human Factors Research. These clusters were selected to leverage on current Puerto Rico research capabilities, the actual aeronautical and aerospace industrial ecosystem and to build capability to sustain available technologies and future industry developments such as Unmanned Aerial and Space Vehicles. The AAIMT is leveraging capabilities with the UPR system Technology Transfer Office and using the proven business model of the Center for Molecular Sciences located in the San Juan Metropolitan Area.

**Global Competitiveness:** The AAIPR initiatives support the growth and development of the new aeronautical and aerospace cluster in the western part of the island specifically on Aguadilla. This cluster formation brings a new industrial sector to Puerto Rico. By the inclusion of the operations of Lufthansa Technik MRO operation and Honeywell Aerospace Research and Development expansion the cluster and the AAIPR has the capacity to grow on a global scale with the credibility and capability of attracting further investment from Germany and other countries of the European Union.

**National Strategic Priorities** – The AAIPR has been part of the Department of Commerce Select USA Program strategic efforts to attract investment to the United States. During the year 2016 the AAIPR participated as an exhibitor in the Hannover Messe 2016 in Germany. At that activity the AAIPR was part of the Select USA delegation on the Research and Technology Pavilion. With the AAIMT initiative the AAIPR encourages job growth and business expansion by providing a comprehensive knowledge and creative platform in the aeronautical and aerospace related scientific disciplines. This effort will provide Puerto Rico and the USA with more capabilities to develop and commercialize and transfer technologic and scientific innovations in alignment with the Select USA strategies.

However the remaining two percent of the investment will have the potential to create high paying jobs for the creative class and entrepreneur class that could have a multiplier effect in the economy not yet calculated. Using regular economic calculations this projected investment will produce approximately 96,000 jobs in a 5 to 15 year period with a projected economic impact of \$3,519,996,991.12 as calculated by Dr. Jose Caraballo Cueto our economic consultant.

## 8. Roles and responsibilities

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### 8.1. AAIPR Role

It has been the role of the AAIPR to assume the leadership that supports the growth and expansion of businesses as well as academic and research activities within the aeronautical and aerospace industries. We need to ensure that our cluster tenants increase their global presence and competitiveness and guarantee a strong socioeconomic environment that fosters innovation and job creation in alignment with knowledge based economy. As a subsidiary corporation of the University of Puerto Rico, the AAIPR can leverage UPR's administrative platform and resources to fulfill the requirements of the proposed Project. Currently there are several phases of this proposed project under implementation but as mentioned earlier funding for the large-scale infrastructure development is required.

To ensure the accountability of this project a set of reliable, pertinent and immediate metrics to measure the economic impact will be done by the AAIPR using current resources and measurements available. To determine the economic impact and return of investment of the knowledge and creative economy a new set of measurements will be developed according to available indexes. New project management, development tools and state of the art software and database platforms will be used to track progress of the different initiatives and to produce the knowledge and information required to strategically managing the completion of this project.

The AAIPR will continue seeking integration to this effort of the public, the private and the third sectors to further enhance the participation of all the components of the Puerto Rican society.

### 8.2. Government role

The Government role in this project should be perceived as a facilitator of all processes tangential to the development of this proposal. As mentioned before we understand that the Oversight Board will bring fiscal stability to the island, which is fundamental to attract foreign investment. But we also remarked that we need to have a long-term view of this transitional process and we need to redefine our role in the Americas and reinvent our future as global citizens. For all this to become a reality and for the successful implementation of any long-term socio economic development plan we need social and economic stability.

## 9. Conclusion

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Among the conclusions of the Puerto Rico Fiscal and Economic Growth Plan Prepared by the Working Group for the Fiscal and Economic Recovery of Puerto Rico Pursuant to Executive Order 2015-022 establish that:

*“Even after the implementation of the FEGP, which is subject to significant political and execution risks, the Working Group’s projections suggest that the Commonwealth cannot meet all of its debt service requirements as currently scheduled and must restructure its liabilities. Further, without significant changes in federal policies, particularly in health care and economic development, the ability of the Commonwealth to meet its debt service costs while providing essential services to its residents will be severely challenged”*

*“While the Working Group recognizes that a restructuring of the Commonwealth’s debt would result in hardship to individual bondholders, the Working Group believes that, unless the persistent stagnation of Puerto Rico’s economy that has helped fuel the increase in Government debt over the past decade can be reversed, the public debt is not sustainable”*

*“Therefore, in order to make the greatest amount of the debt sustainable in the long term, priority has to be given to:*

- *Reigniting Puerto Rico’s economic growth in the short- and medium-term;*
- *Providing essential services, including health, education and safety, to the people of Puerto Rico, the continued deterioration of which will exacerbate the Commonwealth’s negative demographic trends, adversely affect its economic prospects and erode its tax base; ...”*

As stated earlier in this document Puerto Rico has arrived to and it is facing serious fiscal challenges, which have brought profound changes in its commercial and political dynamics and economic development. The effects and consequences of these challenges have required us to re-examine and re-focus our way to prioritize the use of the resources available to the island. We recognize the need to address with definitive solutions the consequences of past decisions. However, we also recognize that these challenges have provided us an excellent opportunity to find ways to become more creative than ever.

We are submitting this proposal with the commitment to make it successful. Nevertheless we need the support of the Government of Puerto Rico, the Task Force and the Oversight Board for the large scale funding required for the project completion.