

University of Puerto Rico and Aeronautical and Aerospace Institute of Puerto Rico Capability Statement

Institution: **University of Puerto/Aeronautical and Aerospace Institute of
Puerto Rico**

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Certificates, Registrations, Accreditations:

MSCHE, CAEP, ABET, ACS, IACS y ACRL, CPR, ACBSP

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OVERVIEW

The University of Puerto Rico System, created on 1903 is the oldest and largest university system in Puerto Rico. As today it is composed of 11 campuses distributed among the island serving a total of approximately 60,000 students. At present, the UPR System offers a total of 463 different academic degrees in Arts, Sciences, Business, Engineering and Technology and an average of 9,240 degrees have been conferred annually since 2012. The UPR System has 450 Ph.Ds conferred in the past five years, half have been in Science and Technology.

To support and continue enabling research and development within an academic environment, as a strategic effort for socio economic development in a knowledge based economy, and to ensure more targeted efforts in areas with growth and economic potential the UPR has developed specialized centers across the island within its campuses and as subsidiary corporations. These centers and initiatives focus on: the bio-pharma industry, materials characterization, nanoparticles and materials, medical, energy issues its sustainability and community impact, and its latest addition currently under development aeronautics and aerospace.

AAIPR complex

The Aeronautical and Aerospace Institute of Puerto Rico (AAIPR) is a non-profit subsidiary corporation of the University of Puerto Rico (UPR) forming with the Aguadilla Campus, what is called in this document, the **UPR Aguadilla-AAIPR complex**. The AAIPR with its academic counterpart, the UPR Aguadilla, 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. It serves approx. 4,000 students.

The UPR Aguadilla side implements the academic programs level of the UPR Aguadilla-AAIPR complex. Current academic programs and development with the AAIPR and centered in the aerospace industry includes; the Associate Degree in Aeronautics and Aerospace Technology that will be expanded into a Bachelor's degree program by January 2019 and has under development for starting on August 2018 a minor on Aerospace Business Management part of the Business Administration Bachelor Degree. The Natural Sciences Department is currently developing two certification options within the bachelor's degree in biology; one in Astrobiology and one in Aerospace Physiology.

The AAIPR side implements the private sector and government agencies co-creation partnerships. 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. At the government and business level the AAIPR has as partners' different government agencies such as: the Puerto Rico Economic Development and Commerce Department, the Industrial development Company (PRIDCO), the Puerto Rico Department of State, the Federal Aviation Administration (FAA), the US Department of State, the National Aeronautics and Space Agency (NASA) and the Select USA Program of the US Department of Commerce. In the private sector the AAIPR has as co-creation partners Lufthansa Technik Puerto Rico and Honeywell Aerospace Solutions and is a member of the Aerospace Consortium, which includes Infosys, Lockheed Martin, UTC Aerospace and Pratt and Whitney among other players in the aerospace industry in Puerto Rico.

CURRENT RESEARCH CAPABILITIES

Bio-Pharma and materials:

Bio Molecular Sciences Center: HIV/AIDS, Bio informatics, Sequencing and Genotyping, Proteomics.

Material Characterization Laboratory: characterization, identification of unknown materials and analysis to industrial partners under (cGMP's, GLP's) conditions.

Nanotechnology Center for Biomedical and Environmental and Sustainability Applications: nanoscaled materials for cancer therapy assisted by the application of magnetic fields and specialized light sources, composites for removal of emerging contaminants from water sources, including pharmaceuticals and personal care products, and selected pathogens, nanostructured composite materials using polymers as the main component, intended for the next generation of fuel cells applications, nanocatalysts for the conversion of renewable resources.

Center for Biomedical Engineering and Nanomedicine: Biological Applications and Characterization of Nanomaterials.

Medical:

Institute of Neurobiology: oscillating neuronal circuits in lobster ganglia, the interactions between neurons and glial cells in amphibians, gene expression in individual identified pyloric neurons in lobsters, calcium signaling in muscle, and the activity, synthesis and turnover of the sodium pump in vertebrates and invertebrates.

Caribbean Primate Research Center: collaborative studies on the entire life cycle of rhesus monkeys as a biological model for humans.

Comprehensive Cancer Center: research and provision of clinical services and treatment related to cancer.

Energy:

Center for Renewable Energy: Algal Biomass Production, Conversion of Algal Biomass into Biogas by Anaerobic Digestion, Thermochemical Conversion of Algal Biomass into a Liquid Fuel.

Multidisciplinary

NASA-MIRO Center for Innovation, Research, and Education in Nanotechnology (CIREN): Advanced High Energy Materials, sensing devices that remain operational in harsh conditions in collaboration with NASA, Microgravity Research Technology.

National Institute of Energy and Island Sustainability: provides industry, government, communities, and non-profit organizations with integrated, innovative and sustainable approaches to the solution of energy issues and problems. Consulting in energy policy and energy governance processes, Design of public participation processes, community capacity building, and futures visualization, Identification of areas of needs/services and knowledge gaps, Technology testing and evaluation.

Cayey Institute of Interdisciplinary Research: responsible for disseminating Census information to communities and conduct demographic and economic research.

CubeSat Specific: At the University of Puerto Rico's we have several units that have capabilities both current and in development related to the CubeSat initiatives. These units are the UPR Mayaguez, UPR Bayamon and UPR Humacao campuses and the Aeronautical and Aerospace Institute of Puerto Rico (AAIPR) complex.

UPR Mayaguez

At the UPR Mayaguez Campus the UPR system has the main Engineering school in the island and it serves approx. 12,000 students. Currently it is classified as a research institution within the system and it ranks 1st in graduating Hispanic engineers, 2nd in graduating women engineers, 1st in the number of graduated chemical engineers and 11th in granting chemical engineering master's degrees among U.S. institutions. The UPRM has programs at the bachelor and master's Degree in Electrical, Computer, Mechanical, Chemical and Industrial engineering. At the PhD level UPRM has the Electrical, Computer and Chemical Engineering.

Expertise areas:

- **Mechanical Engineering:** aerospace engineering; mechatronics; aerodynamics; structural analysis; materials testing; sensor development; gas turbine thermodynamics and propulsion; aircraft performance; aircraft structural analysis and design
- **Industrial Engineering:** lean methods, processes & management; inventory management, supply chain and logistics; process improvement; production flow; facilities design; human factors & ergonomics; industrial safety; quality engineering
- **Electrical Engineering:** automated navigation systems; power electronics; wireless communications and applied electromagnetics; semiconductors & chip design.

- **Engineering Sci. & Materials:** materials processing; materials testing & characterization; Al-based alloys
- **Computer & Software Eng.:** cloud computing; embedded systems; high-performance computing; networking; data base management; operating systems; computer architecture & organization; cyber security
- **Chemical Eng.:** polymeric materials; gas-purification systems; sensor development

UPR Humacao

The Physics applied to Electronics in Humacao is a science concepts-oriented program where circuits and systems electronics are applied to science investigation and testing. These science related areas where study and testing of concepts are done include: physics, astronomy, relativity, materials science, information systems and electrical/electronic technology.

Expertise areas:

- Nanotechnology, moon transportation technology, nano-materials (including nano-fibers applied to electronics and ferroelectric materials) are current investigation areas done in Humacao laboratories with several external sponsorships (NACK Center and PENN University).

On Development Research Capabilities

Aeronautical and Aerospace Institute for Multidisciplinary Technologies: On September 2017 the AAIPR obtained a grant from the Economic Development Administration to renovate two builds in the Former Ramey Base to host the AAIMT. This division of the AAIPR 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. These five research clusters are Materials Science Technologies, Atmospheric Sciences, Navigational and Positional Technologies, Propulsion Technologies and Human Factors Research.

FACILITIES (Dedicated current and projected)

Bio molecular Sciences Center- DNA Microarray, global gene expression, cellular/ biological imaging & analysis, Quantitative Gene Express, Microarray Verification, Quality control and Assay Validation, Pathogen Detect, SNP Genotyping, MicroRNA Analysis, Viral Quantification through both Real Time PCR and Thermal Cycle PCR. a state-of-the-art ultra high resolution(HR) Cs probe corrected TEM (JEOL JEM-2200FS), a HR TEM (JEOL JEM-2100F), a conventional energy filtered TEM (Zeiss LEO 922), a HR field emission SEM (JEOL JSM-7500F), and a focused ion beam system (JEOL JEM-9310).

Aeronautical and Aerospace Institute for Multidisciplinary Technologies(AAIMT)- Forty nine (49,000) thousand square feet space dedicated for development of five specialized laboratories for research and development activities on propulsion technologies, material sciences, navigational technologies, atmospheric sciences and human factors, a high performance computing facility, six classrooms and meeting spaces, one auditorium and administrative offices.

Major& Specialized Instrumentation- Scanning Electron Microscopy, florescence, Infrared, NMR, UV/Vis. High speed centrifugation, Fluorescence Microscopy, Real time PCR, Particle Size Analyzer, Vector Network Analyzer, 3- D Printing, Real time PCR, flow cytometer, Atomic absorption Spectroscopy, GC-Mass Spectroscopy.

PAST PERFORMANCE

The UPR System for several years has had grants with NASA, NSF and NIH. Specifically with NASA the UPR has an SBIR Phase 1 and 2 in joint venture with Faraday Technology. Current business partners such as Honeywell are using the UPR thru the AAIPR to increase their human capital skills and knowledge to attract new business and initiatives in "IoT" and Microsatellites to their facilities in the island. Honeywell also is a main stakeholder in the AAIMT project.

National and Global Outreach

With the AAIPR the UPR System has become part of the Select USA strategic efforts to attract foreign direct investment to the United States. During the years 2016 and 2017 the AAIPR participated as an exhibitor in the Hannover Messe in Germany. During 2017 the AAIPR also has been part of the Select USA Investment Summit Exhibitor as an Economic Development Organization. During this year the AAIPR will be participating again in both activities.

With the AAIMT initiative the University of Puerto Rico and the USA have with more capabilities to develop and commercialize and transfer technological and scientific innovations in alignment with the strategic efforts of the USA Department of Commerce, the USA Department of Labor, NASA and in the near future other federal agencies strategies.

The AAIMT Research Division supports 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. With the inclusion of the operations of Lufthansa Technik MRO operation and Honeywell Aerospace Research and Development expansion the cluster and the AAIMT 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.