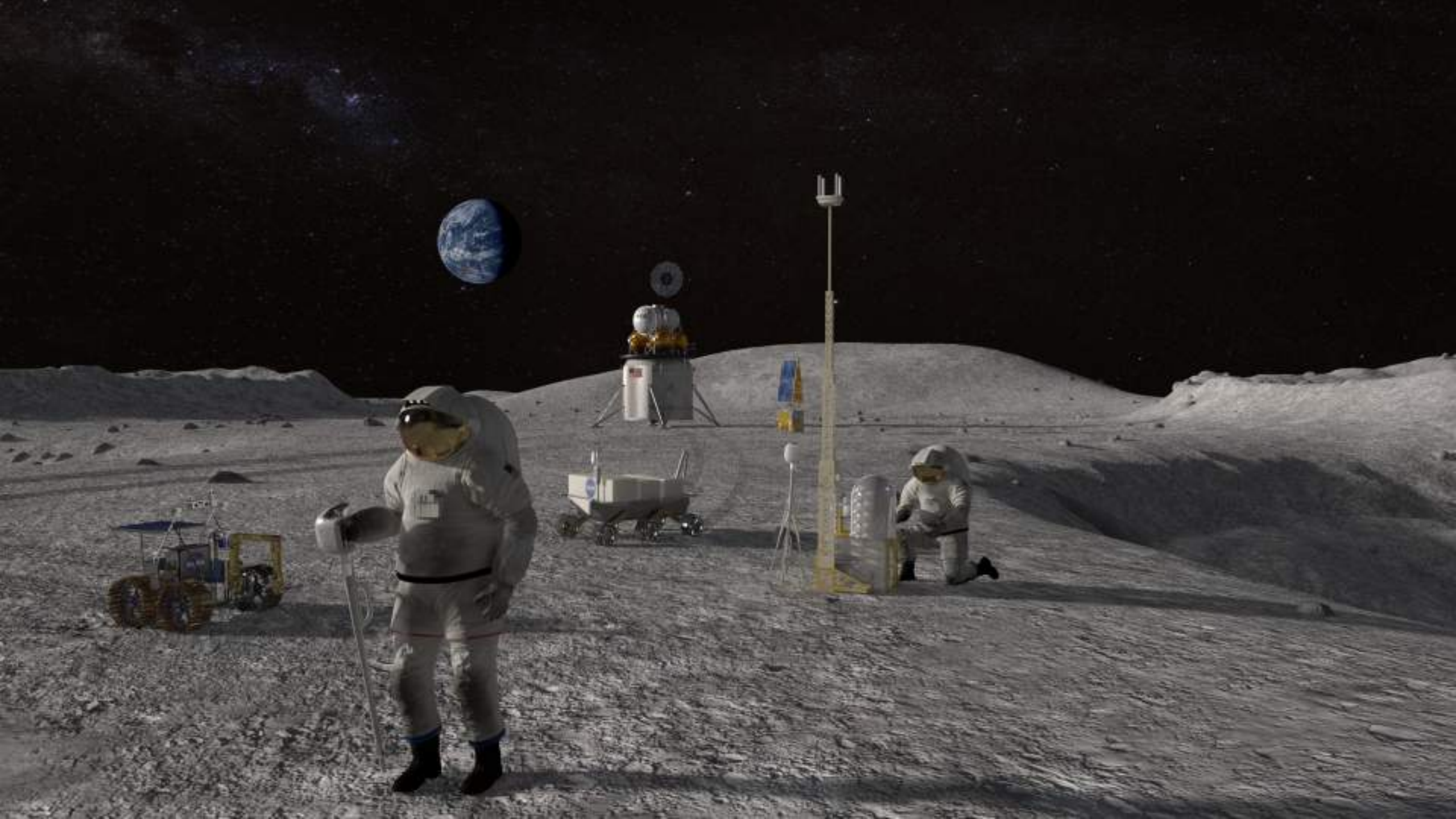
PR-SPRInT Meeting

NASA MIRO: Puerto Rico Space Partnership for Research, Innovation and Training to Engage the Next Generation of Explorers: (PR-SPRInT)

FEBRUARY 7, 2020

Security Notice



PR-SPRInT

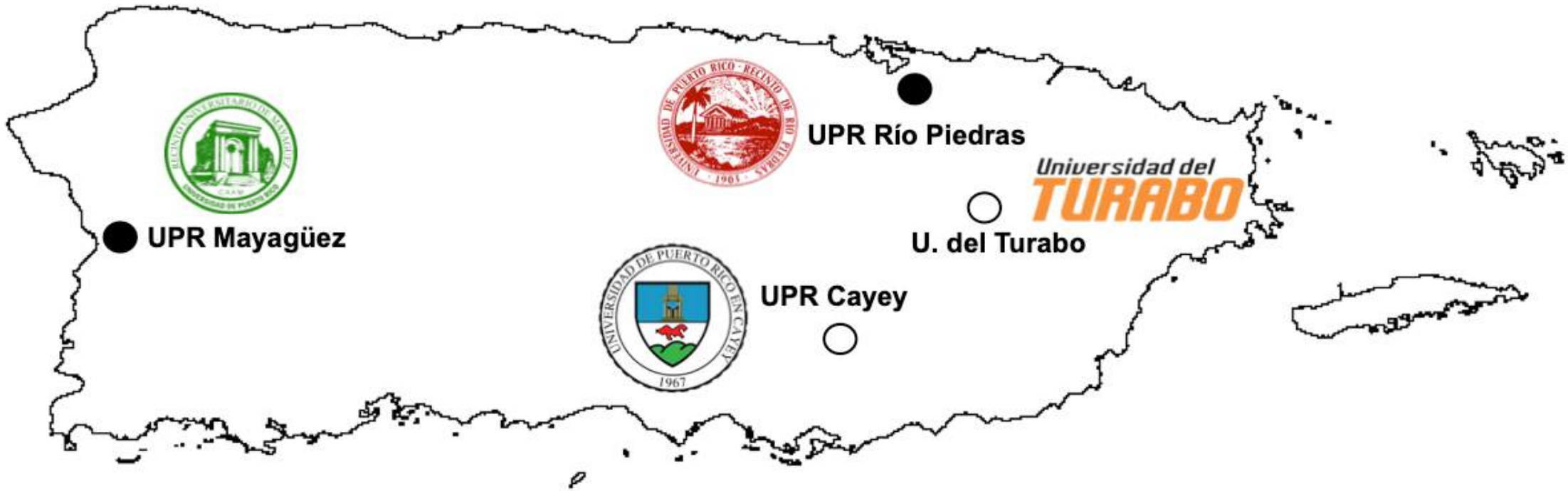
ca. 2019

UPR Río Piedras and UPR-Mayaguez (R2)

UPR-Cayey (4 year programs BS)

Universidad del Turabo (private, 2 year programs AD)

Access/contact to: 13,408 STEM students per year
(2014-2018)



Full geography of the island, different socioeconomic backgrounds and contexts.

PR-SPRInT Team…

Water Reclamation

Dr. Eduardo Nicolau
PI, UPR-RP

Dr. Liz Díaz
Co-PD, UPR-RP

CO2 Removal and Conversion

Dr. Yomaira Pagán
UPR-M

Dr. Arturo Hernández
UPR-M

Renewable Energy Robotics

Dr. Miguel Goenaga
SUAGM-Gurabo

Energy Storage: Batteries

Dr. Brad Weiner
UPR-RP

Dr. Gerardo Morell
UPR-RP

Dr. Ram Katiyar
UPR-RP

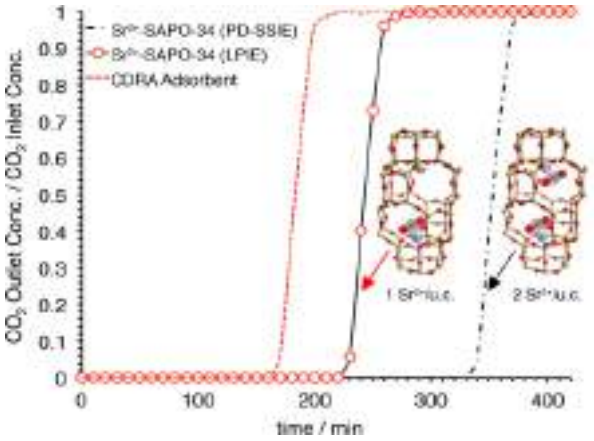
Computational Studies

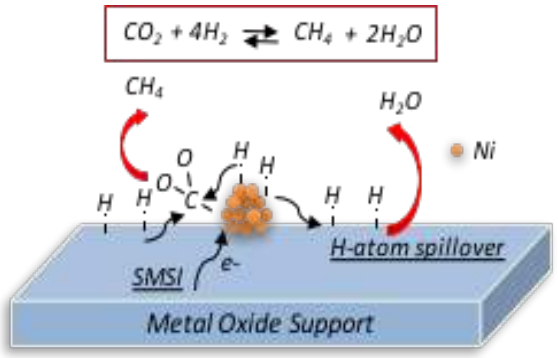
Dr. Zhongfang Chen
UPR-RP

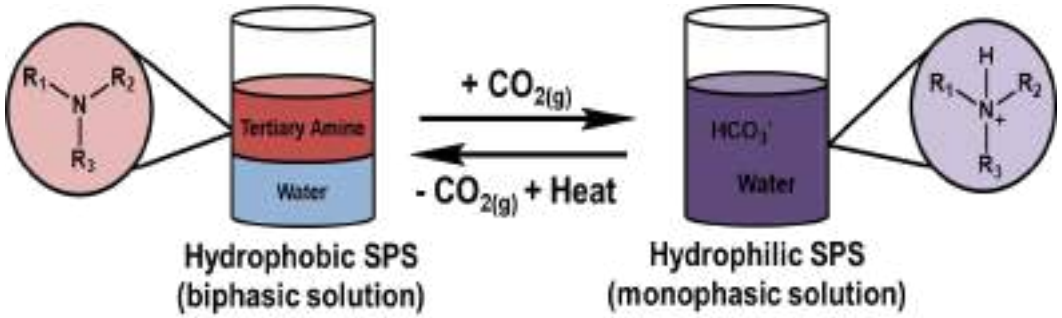
Dr. J. López-Encarnación
UPR-Cayey

+ 10 graduate students, 13 undergraduate students!!

Research



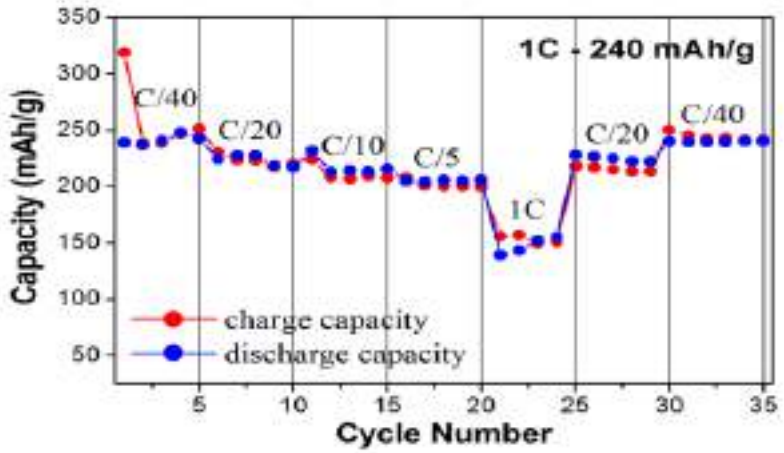




Life support systems

- Sub-Theme 1A: CO_2 Removal and Conversion in Life Support Systems.
  - Sub-Theme 1A.1: Robust and Efficient CO_2 Adsorbents for Spacecraft Air Ultrapurification.
  - Sub-Theme 1A.2: Supported Ni and Ni-alloy Catalysts for CO2 Methanation.
- Sub-Theme 1B: Synthesis of amine-based switchable polarity solvents (SPS) to enable a combined technology for the removal of CO2 and water purification in space applications

- **Lithium Batteries**
  - Sub-Theme 2A: LIB cathodes to achieve stable high power and long cycling performance
  - Sub-Theme 2B: LIB anodes to achieve stable high power and long cycling performance
  - Sub-Theme 2C: Cathodes for Li-S batteries



National Aeronautics and Space Administration

2020 NASA Technology Taxonomy

IRG 1: Human Health, Life Support, and Habitation Systems

"**NASA is addressing key challenges within the habitat for maintaining the physical and mental health of astronauts and detecting and diagnosing illness, cognitive/performance degradation, or trauma**. NASA is developing tools to model, understand, and predict radiation risk and develop countermeasures and protection systems. NASA develops technologies that ensure crew health and safety by protecting against spacecraft hazards and by providing for an effective response should an accident occur. Specifically, NASA enhances sensors to monitor air, water, and microbial environments; provides for fire detection, suppression, and recovery**; and enables remediation by providing the crew with the ability to clean the habitable environment of the spacecraft in the event of an off-nominal situation "**.

IRG 2: Solid state batteries for energy storage

"**NASA seeks to qualify high specific energy, high energy density batteries for the space environment. Batteries are needed that are tolerant to electrical, thermal, and mechanical abuse with no fire or thermal runaway.** Batteries that can safely store very large amounts of energy in small, low-mass packages enable the next generation of deep space EVA suits that require advanced life support, communications, and computing equipment. All other missions are enhanced by having additional electrical power available without a mass penalty".

TX03

Aerospace Power and Energy Storage

Overview

Many state of the art power systems are too heavy, bulky, or inefficient to meet future mission requirements, and some cannot operate in extreme environments. The different components of a power system—power generation, energy storage, and power management and distribution (PMAD)—each require technological improvements to enable or enhance the missions currently in NASA's plans.

TX06

Human Health, Life Support, and Habitation Systems

Overview

This section covers technologies that are specific to the human element and directly affect crew needs for survival and wellbeing, including the environment to which the crew is exposed and interfaces that crewmembers encounter.

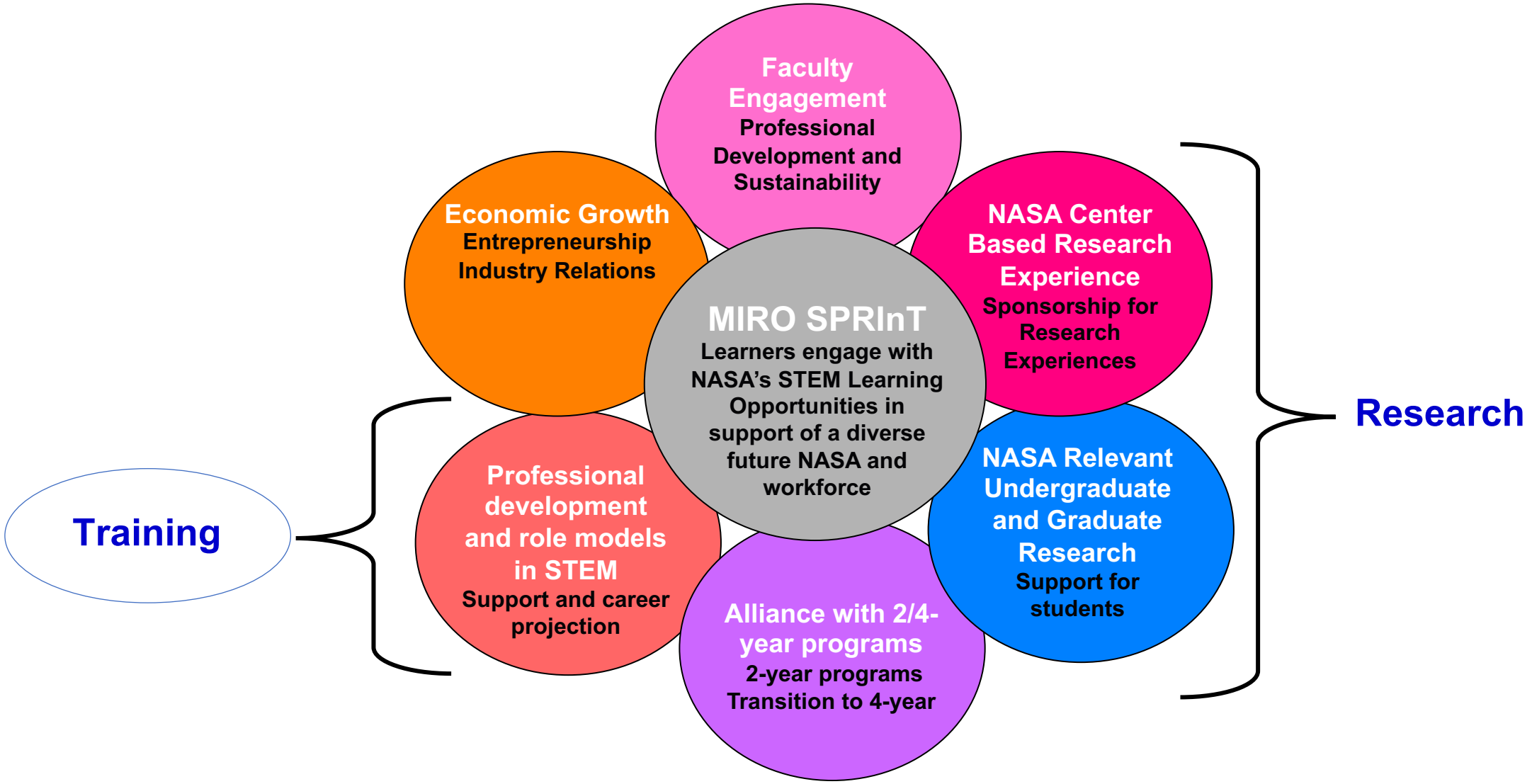
IRG 1: Human Health, Life Support, and Habitation Systems

1. **Water reclamation:** Membrane based water reclamation systems, water sensors.. (mass, reliable)
2. **Air revitalization:** data from the ISS reveals that the combination of the microgravity environment and CO_2 concentrations elevated to about 10 times that experienced on Earth has detrimental effects on astronaut physiology. In particular, chronic headaches appear to occur in greater frequency at CO_2 concentrations above 4780 mg/m^3 (2630 ppm). In order to avoid such high concentrations of CO_2 in the cabin, an alternative system for carbon dioxide removal must be employed in order to: 1) avoid leakage or dusting of the material into the cabin, 2) reduce CO_2 concentrations below 2630 ppm, and 3) while allowing integration into the ECLSS without compromising power and volume.

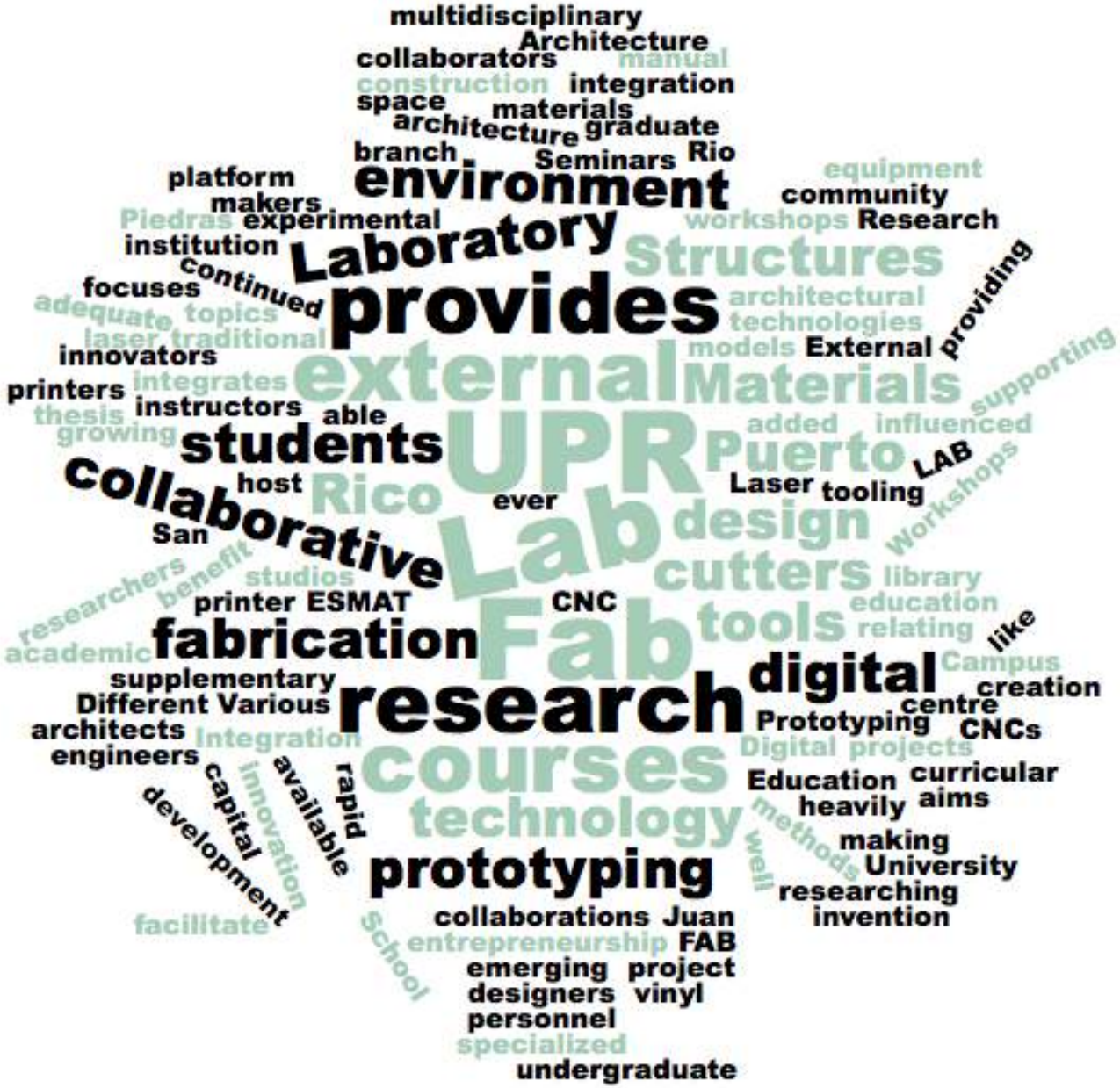
IRG 2: Solid state batteries for energy storage

1. high specific energy (~250 Wh/kg) and long life (50,000 cycles and 15 years) rechargeable batteries required for future orbital missions concepts.
2. high specific energy rechargeable batteries (>250 Wh/kg @ RT) with low temperature operational capability (150 Wh/kg @ <–40° C) required for future planetary surface mission concepts
3. high specific energy primary batteries and/or primary fuel cells (>500 Wh/kg) required for outer planetary probes and Ocean World landers.
4. high specific energy primary batteries (>500 Wh/kg @ RT) with low temperature operational capability (300 Wh/kg @ <–60° C) required for future planetary outer planetary probes and Ocean World landers.
5. high temperature (460° C) primary and rechargeable batteries required for Venus surface mission concepts.

MIRO SPRInT Main Activities



unique collaborations


multidisciplinary
Architecture
collaborators
manual
construction
integration
space
materials
architecture
graduate
branch
Seminars
Rio
platform
environment
equipment
community
makers
Piedras
experimental
workshops
Research
institution
Laboratory
Structures
continued
focuses
provides
architectural
providing
adequate
topics
technologies
laser
traditional
models
External
innovators
external
Materials
supporting
printers
integrates
instructors
able
thesis
growing
students
UPR
added
influenced
Puerto
LAB
host
Rico
Laser
tooling
Collaborative
ever
Lab
design
Workshops
San
researchers
benefit
studios
cutters
library
printer
ESMAT
CNC
education
Fab
tools
relating
like
academic
fabrication
Campus
digital
supplementary
creation
research
Different
Various
centre
Prototyping
CNCs
architects
Integration
engineers
courses
Digital
projects
Education
curricular
capital
innovation
available
rapid
heavily
aims
development
technology
methods
making
prototyping
well
University
researching
facilitate
collaborations
Juan
invention
School
entrepreneurship
FAB
emerging
project
designers
vinyl
personnel
specialized
undergraduate

FABLAB
UPR

FABLAB & DIGITAL PROTOTYPING

1 FABLAB & MAKER SPACES

2 DIGITAL 2D DRAWINGS / 3D MODELING

3 DIGITAL FABRICATION

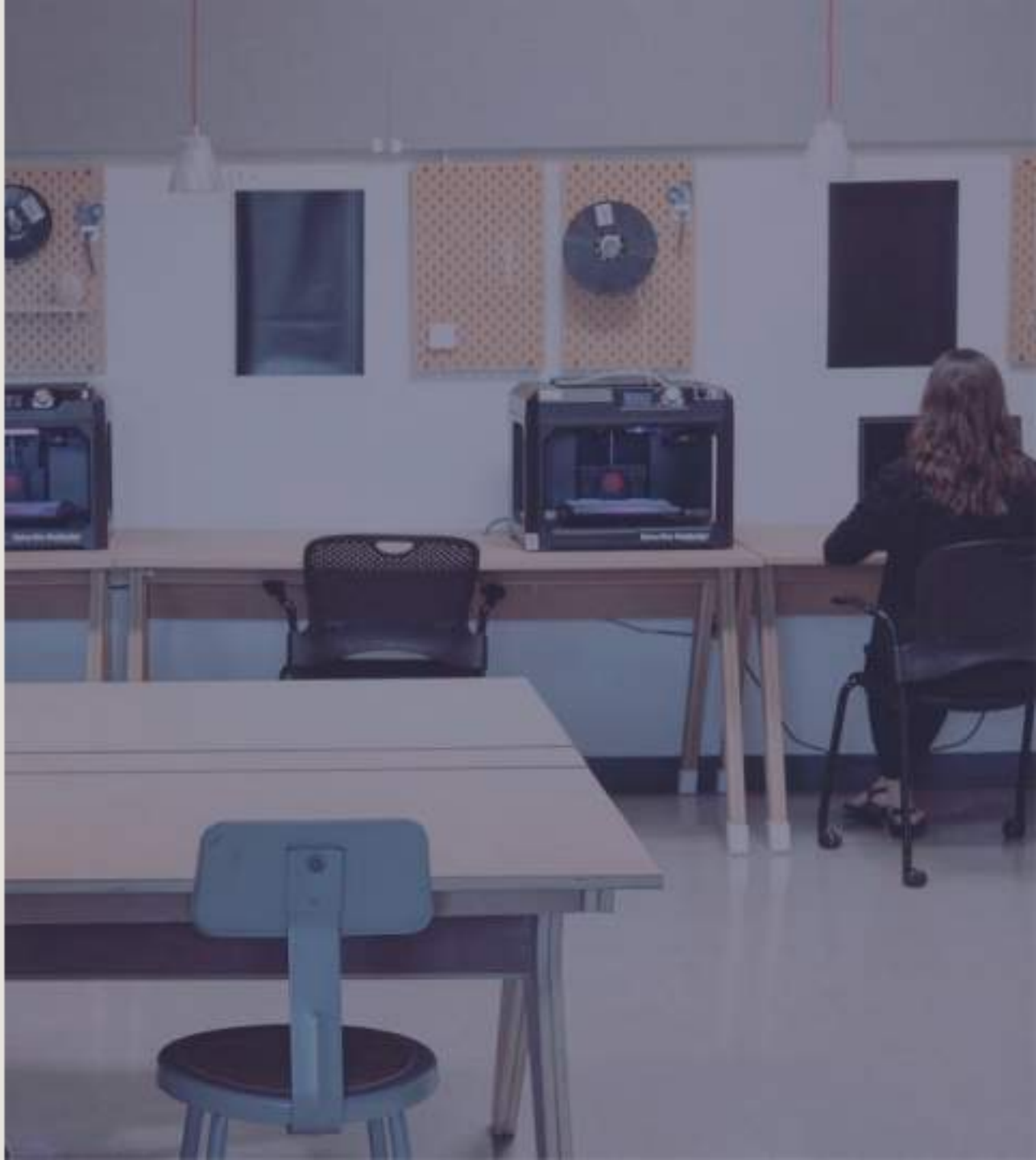
RAFAEL VARGAS
rafael.vargas2@upr.edu

FABLAB
UNIVERSIDAD DE PUERTO RICO

1 FABLAB & MAKER SPACES

WORKSHOP

Seminar that introduces the theory and practice of digital fabrication and the maker movement. Students will learn how the different types of numerically controlled technologies operate and will gather basic knowledge about subtractive and additive technologies, their possibilities and their limits.



2 DIGITAL 2D DRAWINGS / 3D MODELING

WORKSHOP

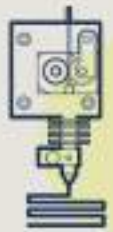
Digital Fabrication tools such as: 3d printers, laser cutters and CNC machines operate using digital design language; therefore, it is imperative for students to learn the techniques and benefits of CAD (Computer Aided Design). In this seminar students will learn how to use software to create two dimensional and three dimensional design. This seminar will teach:

2d CAD with Autodesk Software 3d design with Sketchup and/or Rhinoceros 3d G code

3 DIGITAL FABRICATION

WORKSHOP

This seminar combines the lessons learned in the previous seminars in a project based teamwork course. Students will be presented with a design challenge and will be required to incorporate several of the digital prototyping methods to solve it. Students will present their projects to a panel that will return guided comments and recommendations.



IMPRESIÓN 3D | 3D PRINTING

CORTE LÁSER | LASER CUTTING

ROUTER CNC | CNC ROUTER

TERMOFORMADO | VACUUM FORMING

HERRAMIENTAS | HAND TOOLS

HERRAMIENTAS ELÉCTRICAS | POWERTOOLS

CUARTO DE PINTURA | PAINT ROOM

MESAS DE TRABAJO | WORK TABLES

EXPERTOS | FABRICATION EXPERTS

MORE INFO

INSTAGRAM **@fablabupr**

FACEBOOK **@FabLab UPR**

FABLAB.ARQUITECTURA@UPR.EDU

FABLAB

UNIVERSIDAD DE PUERTO RICO

upr i+c

Centro de Apoyo a la Innovación y Comercialización

El Centro de Apoyo a la Innovación y Comercialización es un espacio de apoyo a proyectos e iniciativas en favor de una cultura de innovación y una economía más sustentable

upr i+c

Centro de Apoyo a la Innovación y Comercialización

UPR Universidad de Puerto Rico

DEGI

Puerto Rico Science, Technology & Research Trust

Servicios de apoyo a proyectos de innovación

Análisis de mercado y proyecciones financieras

Mentoría en competencias

VENTUREWELL

NASA

MITTIC

INNOVACIÓN EMPRESARIAL

I-CORPS PUERTO RICO by GRUPO GUAYACÁN

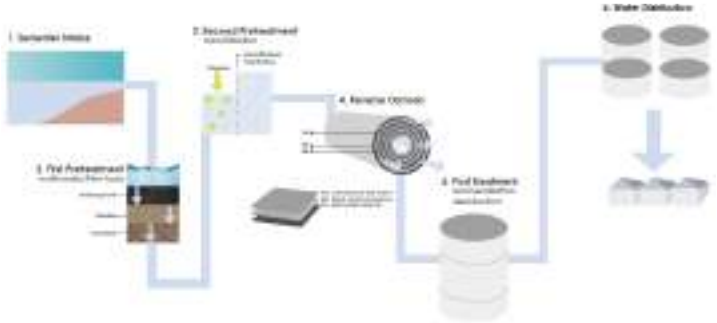
P 1 8

Biblioteca José M. Lázaro

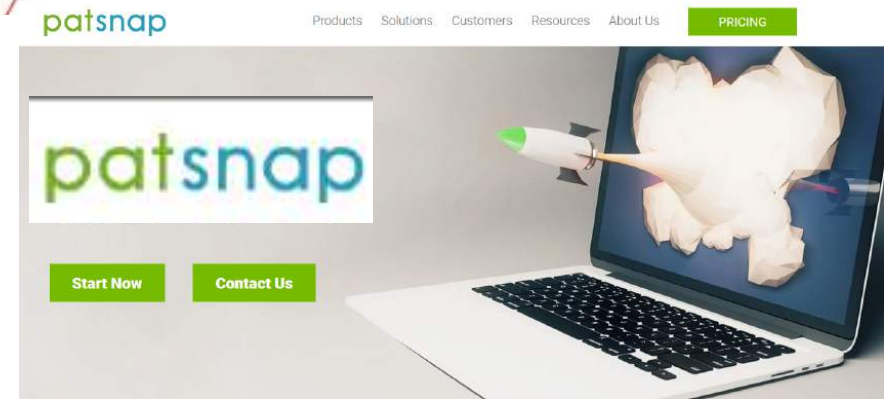
UPR i+c

Centro Universitario

Diseño industrial y prototipos



Análisis de *prior art*



Website

787-764-0000 Ext. 86742 prexplorers@upr.edu Decanato de Estudios Graduados e Investigación 18 Avenida Universidad #1801 San Juan PR 00925-2512

PR-SPRInT
to engage the next generation of explorers

HOME RESEARCH ABOUT US PUBLICATIONS & PAPERS NEWS RESOURCES EDUCATION & OUTREACH EVENTS MY ACCOUNT CONTACT US

PUERTO RICO SPACE PARTNERSHIP FOR RESEARCH INNOVATION AND TRAINING

PR-SPRInT aims to be spearheading in the development of training programs related to NASA's goals.

READ ARTICLE

We are PR-SPRInT

PR-SPRInT was born in 2019 from the need to forge professionals interested in aerospace and the basic sciences related to NASA missions. With this in mind, a group of Professors from different disciplines and led by Dr. Eduardo Nicolau, took on the task of devising a project in this direction. The project was designed with students in mind, and as such the program seeks to support them to persist in their academic degrees to eventually graduate. One of the peculiarities of this project is that it provides professional development opportunities, workshops in scientific entrepreneurship and in the development of prototypes and 3D printing. Participating students and professors have the unique opportunity to collaborate and carry out work in conjunction with NASA scientists.

Save the Date!

August 21, 2020
External Advisory Board

Sept-Dec 2020
Technical Review Committee

PR-SPRINT Grant Number: 80NSSC19M0236

to engage the next generation of explorers

PR-SPRInT

Photo Session

Lunch

Education & Outreach

PR-SPRInT

ca. October 2019

- ✓ Curiosity
- ✓ Team oriented
- ✓ Excellence
- ✓ Passion for Exploration
- ✓ Agility
- ✓ Resilience

Le A's STEM
Le support of
a workforce

NASA-MIRO-PR-SPRInT

Main activities

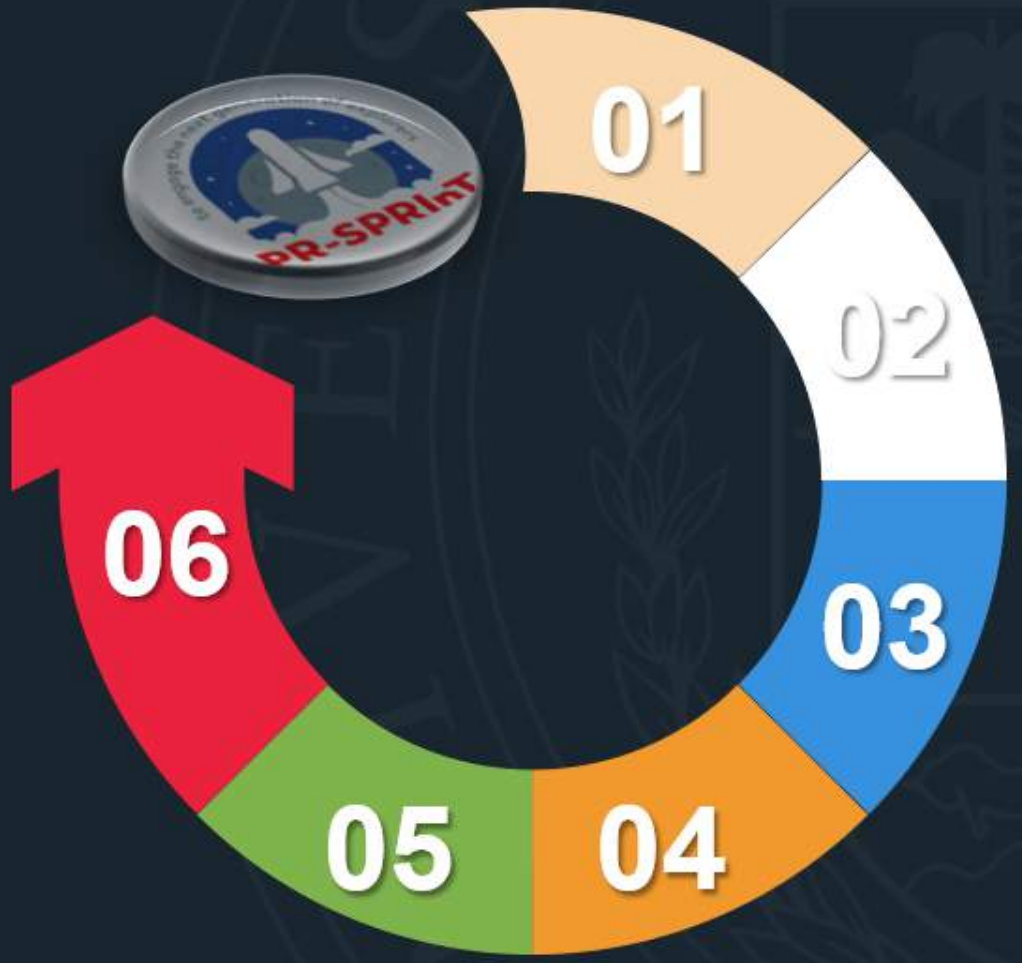
Economic Growth
Entrepreneurship
Industry Relations

Professional development and Role models in STEM

Support and career projection

Faculty Engagement

Professional Development and Sustainability



NASA Center Based Research Experiences

Sponsorship for Research Experiences

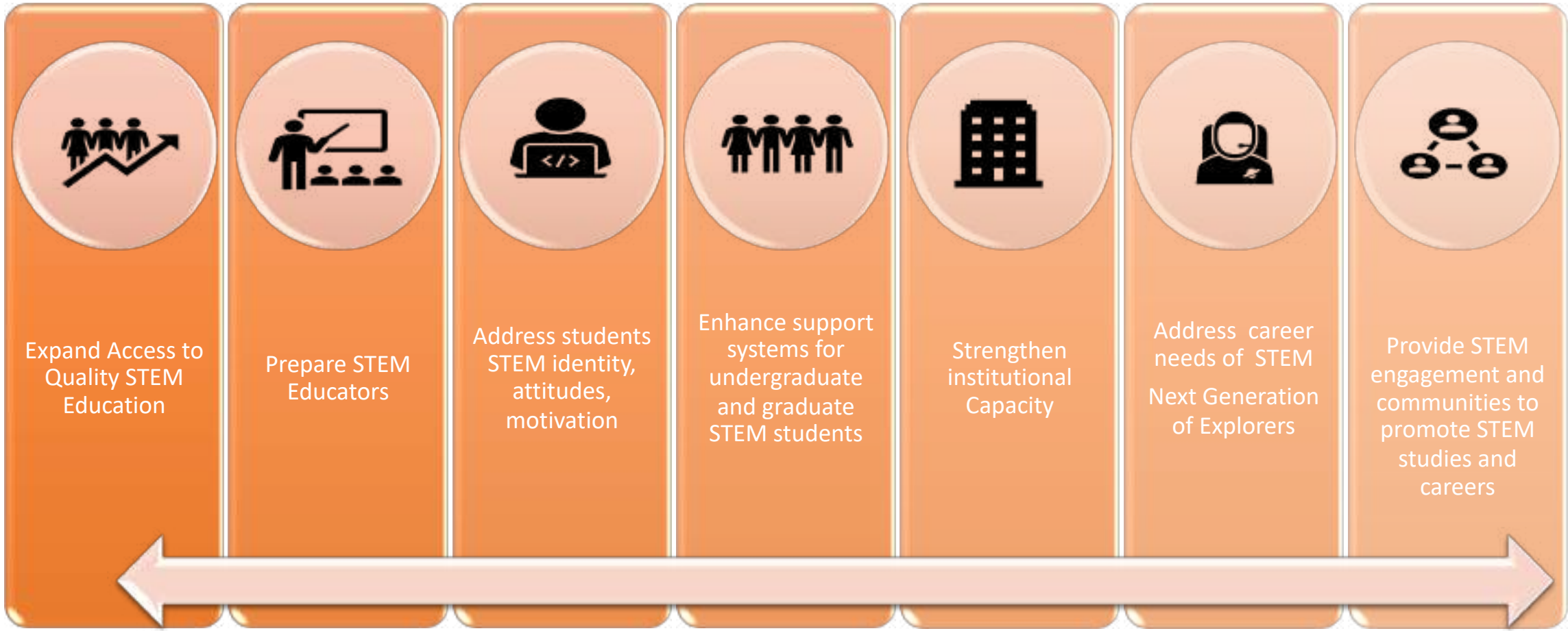
NASA Relevant Undergraduate and Graduate Research

Support for students

Alliance with 2/4-year programs

2-year programs Transition to 4-year

NASA-MIRO Education and Outreach Vision



Graduate and Undergraduate Education

Research Experience (Semester and Summer Internships)

New courses and laboratory experiences

Science Communication Training/ Outreach and Education Experiences

Professional Development Workshops, and Mentoring Program

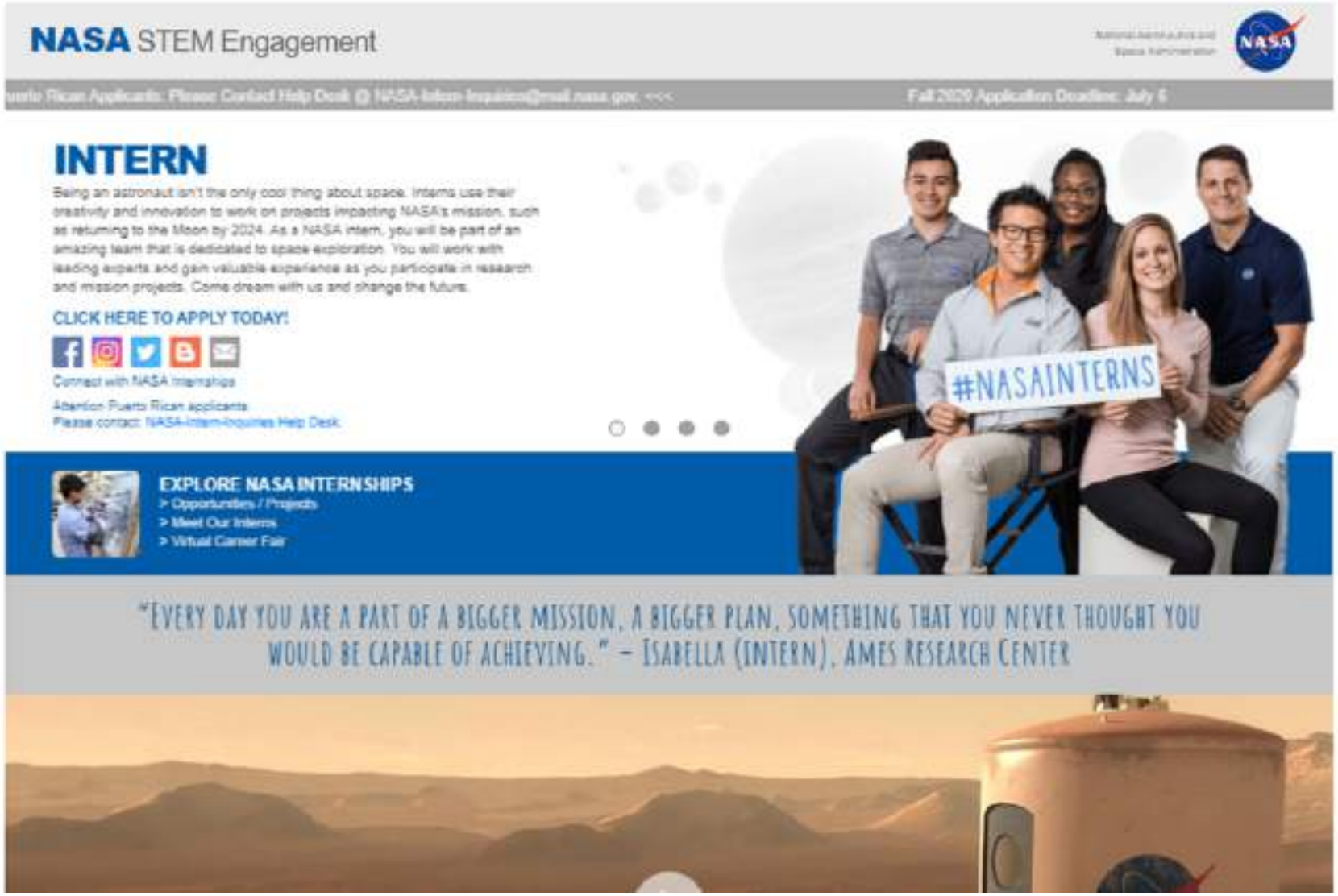
Mentoring/
Professional Development Plan

Expected Outcome: PDPs will be developed in year 1 and used as a biannual roadmap by both mentee and mentors

PROVIDE OPPORTUNITIES FOR POSTDOCS, GRADUATE FELLOWS AND YOUNG FACULTY IN EXCHANGE PROGRAMS AT STRATEGIC PARTNER INSTITUTIONS

Sorkness et al. BMC Proceedings 2017, 11(Suppl 12):22 DOI 10.1186/s12919-017-0083-8

- **Student must apply to NASA summer research experiences (Deadline March 6)**



https://intern.nasa.gov/

Teachers and K-12 students Training

- ❑Master Teacher- Help in the Training of other teacher and Students
- ❑NASA Monthly Activities
- ❑Summer Training Series for Teachers and High School Students
- ❑NASA Challenges and Proposals
- ❑Explorando – Science Education Magazine

Team:

Regina Magomedova, Ph Candidate in Science Education

Shirley Martinez- Science Teacher




Role Model Program

School activities

CIENCIA PUERTO RICO

Bienvenidos a CienciaPR, una red de recursos para todos los interesados en las ciencias y en Puerto Rico.

PROYECTO CIENCIA AL SERVICIO

Ciencia al Servicio de Puerto Rico

Es un proyecto educativo que busca democratizar y transformar la educación científica al poner la ciencia al servicio de la sociedad y la educación (Ciencia al Servicio). El programa une a expertos en las áreas STEM, educadores y estudiantes para implementar durante el año académico, lecciones de ciencia que:

- Son desarrolladas por maestros(as) y profesionales STEM durante un taller de verano
- Integran aprendizaje basado en proyectos (PBL por sus siglas en Inglés) y estándares educativos de ciencia de 6to-8vo grado
- Proporcionan ejemplos a seguir a través de visitas de científicos a las escuelas
- Proporcionan experiencias educativas cultural y socialmente relevantes y promueven la integración ciudadana y el servicio por parte de los estudiantes
- Fomentan el pensamiento crítico y el desarrollo de actitudes positivas hacia la ciencia

Ciencia al Servicio
cienciapr.org

Target first-generation-in-college and low-income students

- Expected Outcome: Target first generation, low SES students and offer workshops and outreach activities at: public schools and The Boys & Girls Club of PR, which offers afterschool programs to low income students in high risk areas.
  - Impact at least 30 schools and 6 nonprofit organization participants during the project period (Boys and Girls, CARAS, Make a Wish).

Responsible parties: IRG Leaders, faculty, graduate and undergraduate students, Outreach and Education coordinator Dr. Diaz Collaborating Non-Profit organization

caras con causa

YS & GIRLS CLU
OF PUERTO RICO

Summary of Activities

February-May, 2020

Outreach

- Informal communication best practices (How to approach students at a lower level?) ONLINE
- School visits (1 per year minimum)
- Scientific journalism

Professional Development

- How to write a manuscript and a proposal
- Scientific seminars
- How to apply to major scholarships and fellowships? Dr. Michael Westrate, Univ. of Villanova

Skills development

- 3D design and prototyping
- Entrepreneurship

NASA-MIRO SPRINT

Training the Next Generation of Explorers

Itinerary of Activities January- May 2020

ACTIVITY	Type of Activity	DURATION	Day	Participants	Modality
Individual Development Plan	Workshop	6hrs	February-May	Graduate Students	Online / Onsite
Science communication for Broader Audiencies	Workshop	4hrs	21-Feb-20	Graduate and Undergaduate Students	Onsite UPRRP
Symposium: El poder de la mujer en las ciencias	Seminar	1 day	6-Mar-20	Graduate and Undergaduate Students, Faculty	Onsite UPRRP
3D Design and Printing Workshop	Workshop	3 days	March 21,2020, March 28, 2020 May 9, 2020	Graduate and Undergaduate Students	Onsite UPRRP
NASA Day for communities	Outreach activity	1 day	3-Apr-20	Graduate and Undergaduate Students, Faculty	On site- Bahia Viva Cataño, (9:00 am - 2:00pm)
ACS Junior Technical Meeting/ PRLASMP Scientific Meeting	Symposium	1 day	18-Apr-20	Graduate and Undergaduate Students, Faculty	Onsite UPRRP
Scientific Writing Workshop	Workshop	1 day	May	Graduate and Undergaduate Students	Onsite
Scientific Journalism Workshop	Workshop	6hrs	February-May	Graduate and Undergaduate Students	Online
Visit to schools / Non profit organizations	Practice	2 days	February-May	Graduate Students	Onsite -Designated School

Univerty of Puerto Rico

THE POWER OF WOMEN IN SCIENCE

MARCH 6, 2020

Amphitheather [illegible] Studies UPRRP

to engage the next generation of explorers

PR-SPRInT

Puerto Rico Space Grant Consortium

NASA

PUERTO RICO LOUIS STOKES

AMP

ALLIANCE FOR MINORITY PARTICIPATION

CIRE²N

CENTER FOR THE ADVANCEMENT OF WEARABLE TECHNOLOGIES

DEGI

DECANATO DE ESTUDIOS GRADUADOS E INVESTIGACION

CN

Partner

THE POWER OF WOMEN IN SCIENCE

A Symposium to Empower the Next Generation of Women in Steam Careers

University of Puerto Rico,
Rio Piedras Campus
Faculty of General Studies
Amphitheater #1

March 6, 2020
7:00am – 4:00pm

7:00am -7:45am	Registration
8:00am - 8:30am	Welcoming Remarks

8:30am- 12:00 pm Scientist Presentations: How to become the Scientist you Dream of?

8:30am - 8:45am	Dr. Yajaira Sierra
8:45am- 9:00 am	Dr. Azlin Biggali
9:00am - 9:15am	Dr. Dionne Hernández
9:15 am -9:30 am	Dr. Vilmali López (CAWT)
9:30am- 9:45 am	Ada Monzon
9:45am - 10:00 am	Dr. Greetchen Diaz
10:00am-10:15 am	Coffee Break
10:15am-10:30 am	Isatis Cintrón
10:30am- 10:45am	Dr. Madeline Torres
10:45am-11:00 am	Dr. Carmen Maldonado
11:00am -11:15am	Dr. Ingrid Montes
11:15am-11:30 am	Dr. Giovanna Guerrero
11:30am - 12:00 am	Questions & Answers Secction

12:00pm- 1:45pm Lunch: Meet and Greet the Scientist

Working lunch: participants interact with invited scientists and interview them. The interviews will be compiled in a procedure booklet.

2:00pm- 2:30pm Orientation about Research and Education opportunities for students and educators at UPRRP

Sponsors: NASA-MIRO SPRINT, Puerto Rico NASA Space Grant, NSF-CREST CIREN, NSF-EPSCoR CAWT describe the opportunities offered by their programs,

2:30pm- 3:30pm UPR Natural Science Faculty Departments and Programs Orientation

3:30pm-4:00pm Workshop: How to prepare a Successful application (Ms. Andrea Guzman PhD Candidate)

4:00pm -4:15pm Closing Remarks

CoopSEI External Evaluation

Administrative Details

Who Qualifies?

- Graduate and undergraduate students working in one of the PR-SPRInT Mentor's Research Laboratory
- Undergraduate students must be sophomores and above
- Graduate students in their second year of graduate studies

Benefits

The PR-SPRInT Fellowship offers the following benefits, subject to successful academic performance:

Graduate students

$16,800 stipend per year

Up to $3,000 per year for tuition, institutional fees, and health coverage

$1,500 per year for travel expenses (subject to availability of funds)

$2,000 per year for research and educational materials

Undergraduate students

Up to $4,800 stipend per year

$1,500 per year for travel expenses (subject to availability of funds)

$1,000 per year for research and educational materials

Application Requirements:

- Applicant is a participating student in one of the PR-SPRInT Labs.
- Applicant intends to pursue a PhD degree in a STEM field
- An undergraduate or graduate GPA of 3.10 or higher
- Meet each semester all the requirements established by their respective programs
- Complete nine credits per semester (graduate), or twelve credits (undergraduate) per semester
- Participate in all PR-SPRInT activities, as established in the program's calendar for each semester
- Serve as role model to high school students
- Perform NASA related research
- **Student must apply to NASA summer research experiences (Deadline March 6)**

Required Application Documents

Personal Relevant Background and Future Goals Statement.

- Applicant must follow the guidelines of the NSF-GRFP when preparing this document. (Provided)
- 2 pages, single space, margins at 1”, times new roman or arial.

Research Plan

- Applicant must follow the provided guidelines to align the proposal to the NASA mission and goals. (Provided)
- 3 pages (undergraduates) 5 pages (graduates), single space, margins at 1”, times new roman or arial.

Two (2) Reference Letters (one must be from research mentor)

- The applicant must submit a minimum of 2 reference letters from Faculty members with knowledge about the student’s potential to become a successful student. One of the reference letters shall be from the student’s research mentor as an undergraduate or as a graduate student.
- The letters must be sent to the NASA PR-SPRInT Administrator at: **nilsa.aponte@upr.edu**, with the subject line: PR-SPRInT_LastName_First Name

Official Academic Transcripts (or student copy)

Deadline February 28, 2020

Duties and responsibilities

- Dedication
- Compromise
- Assistance

Follow the norms…

- Compliance
  - Norms and internal regulations at UPR
  - Deadlines

Other details

- Compliance
  - Purchasing of materials
  - Travel

Partners

NASA Partners

Ames Research Center

JPL Jet Propulsion Laboratory California Institute of Technology

non-NASA Partners

Puerto Rico Science, Technology & Research Trust

BROOKHAVEN NATIONAL LABORATORY

University Partners

UNIVERSIDAD DE PUERTO RICO · RECINTO DE RIO PIEDRAS · 1903 ·

RECINTO UNIVERSITARIO DE MAYAGUEZ · CAAM · UNIVERSIDAD DE PUERTO RICO

UNIVERSIDAD DE PUERTO RICO EN CAYEY · 1967

Puerto Rico Space Grant Consortium · NASA

upr i+c Centro de Apoyo a la Innovación y Comercialización

EPSCoR RESEARCH IN PUERTO RICO

Universidad del TURABO

FABLAB UPR

PR-SPRINT Grant Number: 80NSSC19M0236

PR-SPRInT

NASA MIRO Goals and Objectives

- **MIRO Program goals:**
- 1) Expand the nation's base for aerospace research and development by fostering new aerospace research and technology development concepts aligned with NASA research priorities as defined by NASA Mission Directorates.

  - *Objective 1.1 Develop significant scientific, engineering, and/or technology research centers at the MSI that align and engage one or more programs of the NASA Mission Directorates.*
  - *Objective 1.2 Increase the lead institution's capacity to contribute to the priorities of NASA's Mission Directorates (Aeronautics Research, Human Exploration & Operations, Science, and Space Technology) and NASA's ten Centers.*

- 2) Promote institutional advancement and enhanced research capacity through partnerships among MSIs, other academic institutions, NASA research assets, and industry.

  - *Objective 2.1 Increase the lead institution's ability to sustain research efforts through development of strategic partnerships.*
  - *Objective 2.2 Increase the lead institution's pursuit of additional funding opportunities offered by NASA, industry, and other agencies.*
  - *Objective 2.3 Increase the ability of research leadership at the lead institution to leverage resources to enhance its research capacity at the project, program, department, college, and/or university levels.*

NASA MIRO Goals and Objectives

- **MIRO Program goals:**

- 3) Strengthen participation of faculty, researchers, and students at MSIs in the research programs of NASA's Mission Directorates.

  - *Objective 3.1 Develop faculty and researcher knowledge and skills in NASA-related research through professional development and NASA research opportunities.*
  - *Objective 3.2 Increase capacity to develop student knowledge and skills in NASA-related research through curriculum enhancement, redesign, and development at the course, degree, and/or department levels*
  - *Objective 3.3: Increase capacity to develop student knowledge and skills in NASA-related research through NASA internships and opportunities.*

- 4) Facilitate mechanisms to insure the diversity of workers at NASA and in undergraduate and graduate degrees awarded to students from MSIs in NASA-related fields reflects the diversity of our nation.

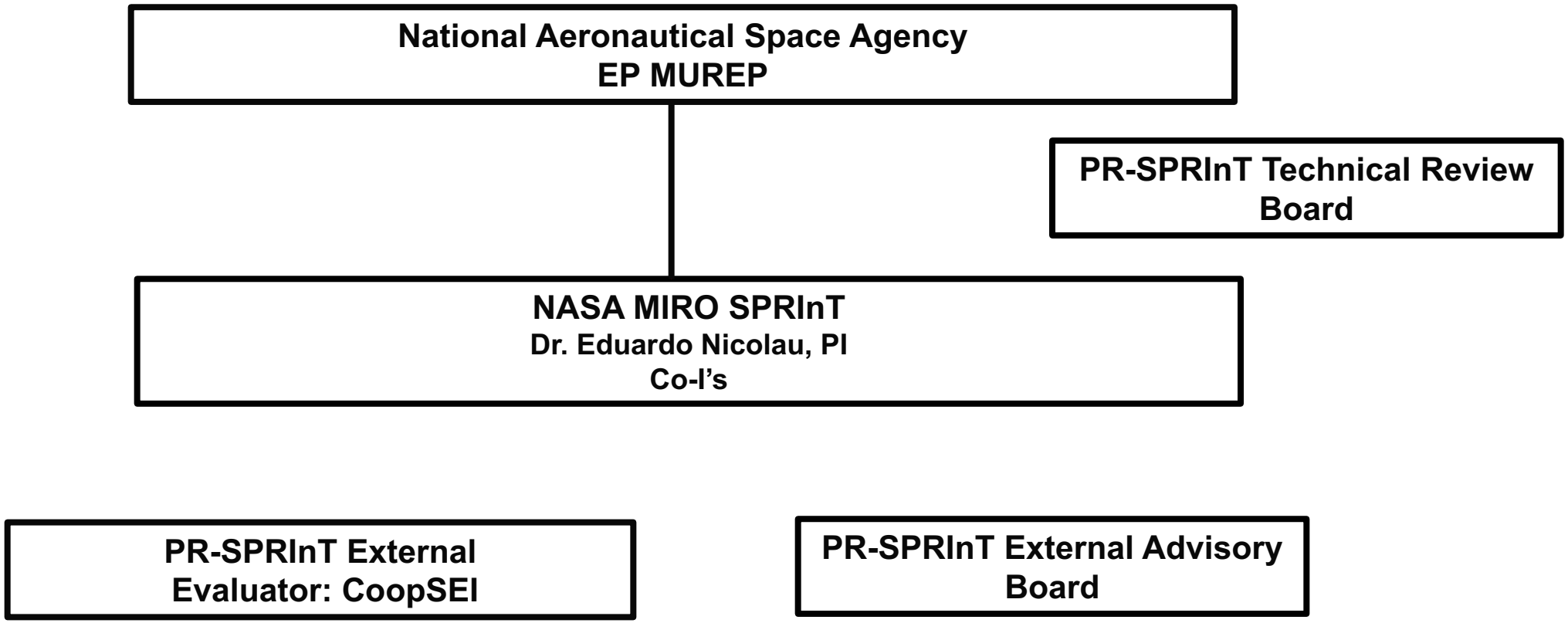
  - *Objective 4.1 Increase the number of undergraduate and graduate degrees awarded to students from MSIs in NASA-related fields.*

NASA MIRO SPRInT: Relevance to NASA

- **Primary Mission Directorate(ARC, KSC, JSC):**
- Human Exploration Operations Mission Directorate
  - Human Research Program: health risks (monitoring, countermeasures etc.)
  - Space Biology: effects of lack of gravity in living systems
  - Physical Science Research: Biomaterials, materials science
  - Engineering Research: Life support, water recovery, air revitalization, waste processing

- **Other Mission Directorate:**
- Space Technology Mission Directorate
  - Manufacturing methods for space and in space
  - Ultra-light weight materials for space applications
  - Materials for extreme environments
  - Robotics
  - Power generation, storage and transfer
  - In situ resource utilization (fuels, water, pharmaceuticals, polymers, chemicals etc.)
  - Bio approaches to ECLSS

NASA MIRO PR-SPRInT Organizational Chart



NASA MIRO SPRInT: IRG's

- IRG 1: Human Health, Life Support, and Habitation Systems to Enable Long term Duration Missions. (A. Hernández, Y. Pagán, E. Nicolau, Liz Diaz and J. López-Encarnación)
  - UPR-RP, Cayey and SUAGM (life support); UPR-M (air revitalization)

- IRG 2: Solid state batteries for energy storage (R. Katiyar, B. Weiner, G. Morell and Zhongfang Chen)
  - Solid state batteries

- IEG: Outreach, Student/Faculty Development and Entrepreneurship/Industry (L. Díaz)
  - Puerto Rico Science Trust
  - C3TeC
  - Honeywell, Eli Lilly, Amgen etc.
  - Center for Innovation UPR-RP (Workshops)
  - Arecibo Observatory
  - CEA, DEGI, Cottrell Scholars and ACS Faculty Development
  - FabLab Prototyping and Habitation Concepts (School of Architecture, Workshops)
  - Computer Science/Machine learning (Workshops)