Undergraduate Research at the UPRM ECE Department

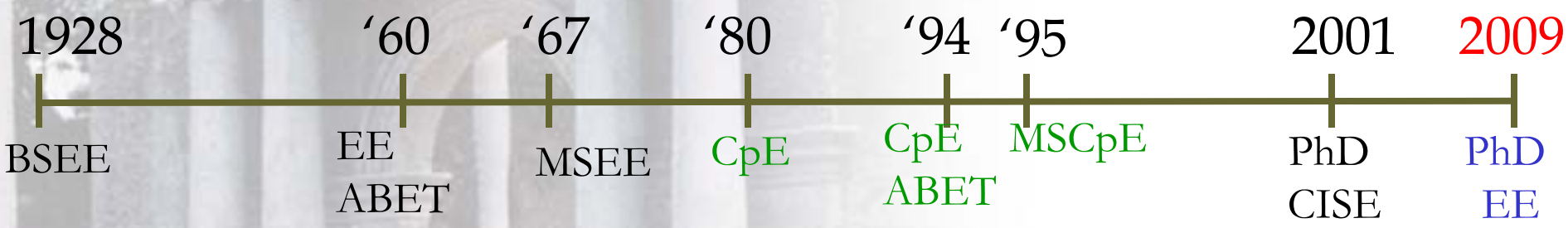
A Short Historical Personal Perspective

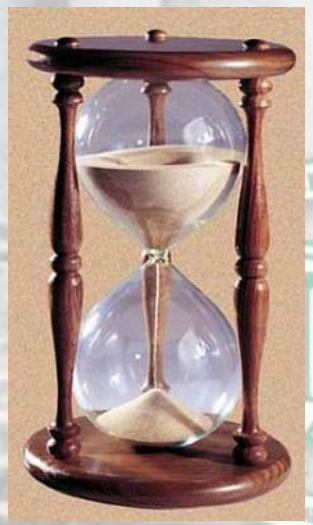
Miguel Velez-Reyes
January 8, 2009

Outline

- Background
- History
- Some Examples
- Final Remarks

ECE Timeline



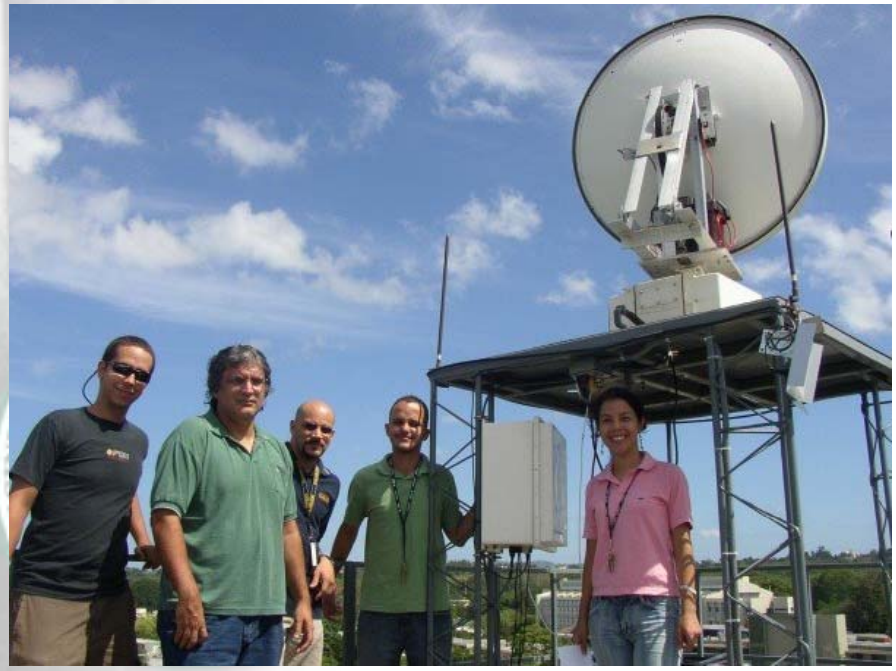


ECE Faculty

- 60 Faculty members
  - 34 Professors
  - 11 Associate Professors
  - 12 Assistant Professors
  - 3 Instructors
- 54 members of the faculty have a PhD
  - 39 professors involved in the graduate program and research

ECE Research

- Approximately $4-5M/year in sponsored research (ECE accounts for 4.2% of faculty members at UPRM and generates 24% of external funds)
- Among the top 2 departments in external funding.
  - NSF
  - NASA
  - DoD
  - DoE
  - PR Government
  - Industry



Location of ECE Research Laboratories

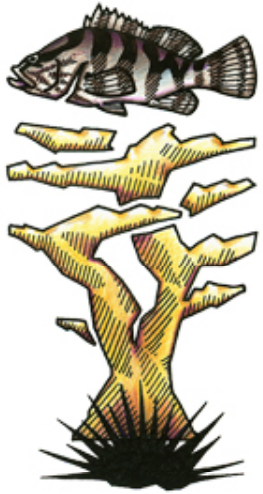
R&D Center

LARSIP
EEPSyL
ICIS
IRISE
Power Quality
PDC
ADM
AIP

Stefani Bldg

Climmate
Radiation
ICDL
HPC
Biomedical
RaSP
CRL

Examples of Industry and Government Sponsors and Collaborators



Graduate Programs @ ECE

- Electrical Engineering: MSEE & MEEE (Ph.D. in 2009)
- Computer Engineering: MSCpE & MECpE
- Computing and Information Sciences and Engineering: Ph.D. (joint with Mathematics Department)
  - administered outside ECE: Program director Dr. Néstor Rodríguez

UG Research a Key Component of our Research Programs

- Just in the numbers
  - ~1,300 undergraduate students
  - ~140 graduate students
  - $3-4M/yr in research
- Many benefits
  - Best students
  - Pipeline
  - Enhance our students educational experience

Before 1990

- Limited research infrastructure.
- Limited research funding
- Small graduate program
  - only MS in EE (est. in 1967)
- Development of critical mass of research oriented faculty
  - Ramon Vásquez, Domingo Rodriguez, Rogelio Palomera, Tom Noack, K. Venkatesan, B. Ray and others

Key Enablers

- Industrial Affiliates Program (IAP) 1988

- NSF CISE Research Infrastructure Seed Funding, 1988
  - Development of a Five Year Plan for the Enhancement of the Computer Engineering Program at UPRM, Ramon Vasquez, PI

- Laboratory for Applied Remote Sensing and Image Processing established in1989
  - UPRM Puerto Rico Center of Excellence in Tropical and Caribbean Research sponsored by NSF MRCE, 1988

1990-2000

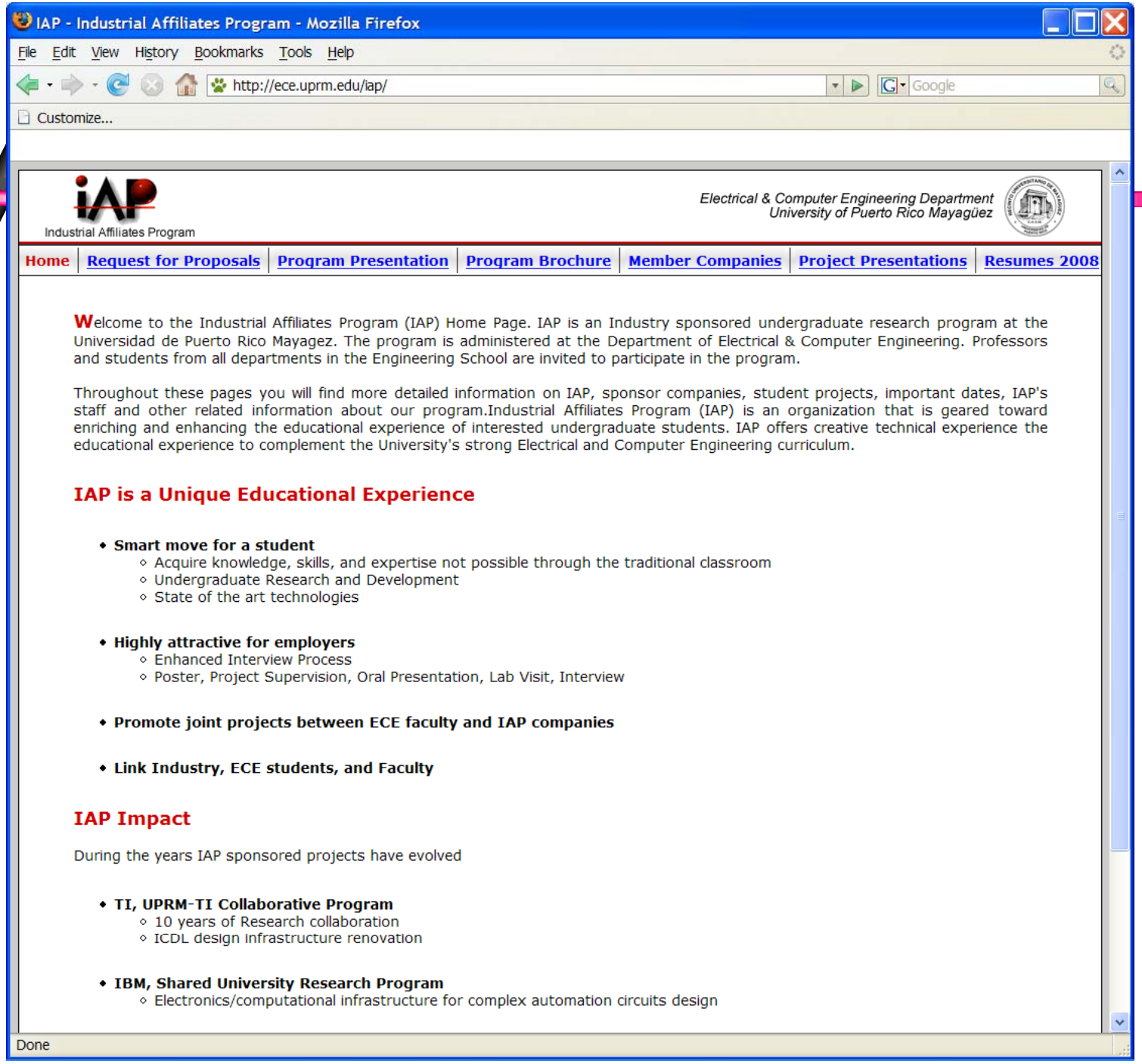
- CISE Research Infrastructure →CECORD
  - Enhancement of the Computer Engineering Academic and Research Program at UPRM, Ramon Vasquez, PI
- Establishment in 1994 of the Tropical Center for Earth and Space Studies
  - NASA University Research Centers Program
- The ERC era begins
  - CPES - 1998

2000-Current

- Two new ERCs
  - CenSSIS, 2000
  - CASA, 2003
- DHS CoE (2008)
  - CIMES, ALERT
- CISE Research Infrastructure
  - MII: A Program for Research in Computing and Information Sciences and Engineering (PRECISE), Domingo Rodriguez, PI
- Many individual grants and other types

Two Examples: IAP & TCESS

Industrial


IAP - Industrial Affiliates Program - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://ece.uprm.edu/iap/
Google
Customize...
Industrial Affiliates Program
Electrical & Computer Engineering Department
University of Puerto Rico Mayagüez
Home
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Program Brochure
Member Companies
Project Presentations
Resumes 2008
Welcome to the Industrial Affiliates Program (IAP) Home Page. IAP is an Industry sponsored undergraduate research program at the Universidad de Puerto Rico Mayagez. The program is administered at the Department of Electrical & Computer Engineering. Professors and students from all departments in the Engineering School are invited to participate in the program.
Throughout these pages you will find more detailed information on IAP, sponsor companies, student projects, important dates, IAP's staff and other related information about our program.Industrial Affiliates Program (IAP) is an organization that is geared toward enriching and enhancing the educational experience of interested undergraduate students. IAP offers creative technical experience the educational experience to complement the University's strong Electrical and Computer Engineering curriculum.
IAP is a Unique Educational Experience
Smart move for a student
Acquire knowledge, skills, and expertise not possible through the traditional classroom
Undergraduate Research and Development
State of the art technologies
Highly attractive for employers
Enhanced Interview Process
Poster, Project Supervision, Oral Presentation, Lab Visit, Interview
Promote joint projects between ECE faculty and IAP companies
Link Industry, ECE students, and Faculty
IAP Impact
During the years IAP sponsored projects have evolved
TI, UPRM-TI Collaborative Program
10 years of Research collaboration
ICDL design infrastructure renovation
IBM, Shared University Research Program
Electronics/computational infrastructure for complex automation circuits design
Done

Industrial Affiliates Program

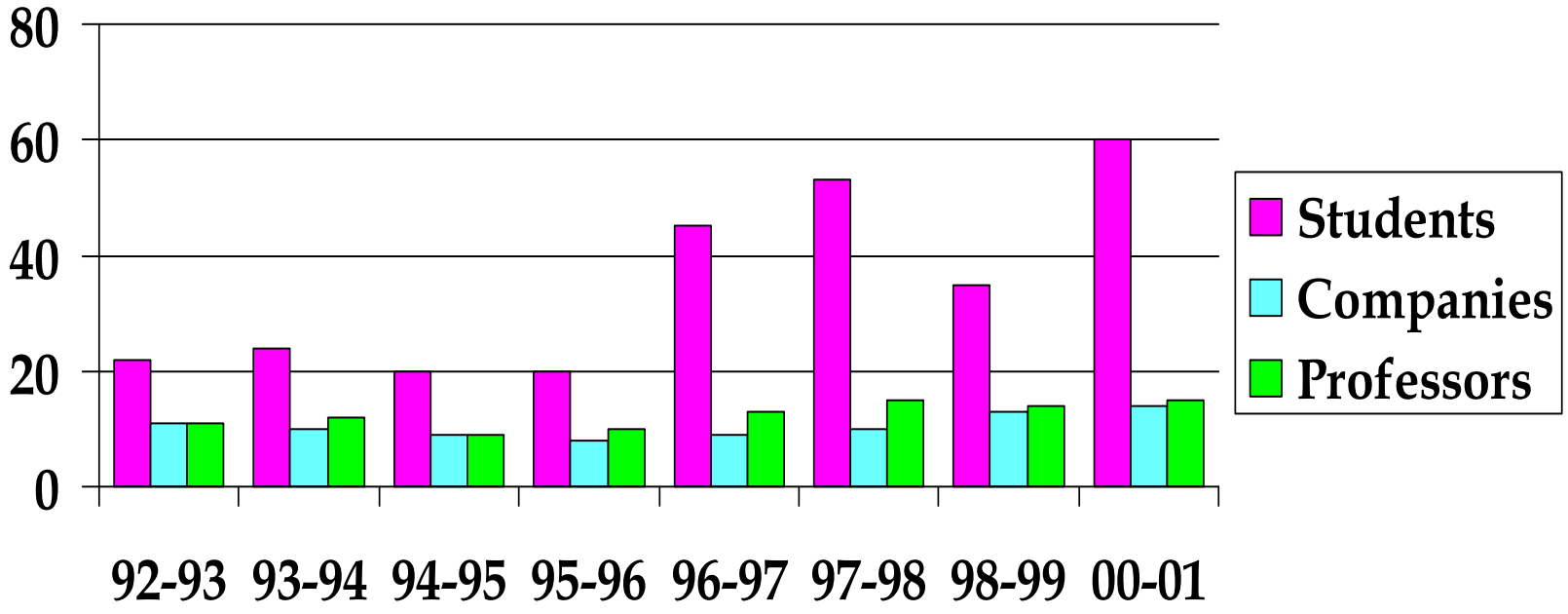
IAP Objectives

- Unique educational experience for students
- Acquire knowledge, skills, and expertise not possible through the traditional classroom
  - State of the art technologies
- Highly attractive for employment
- Link Industry, ECE students, and Faculty
- Enhance ECE Department Infrastructure

Industrial Affiliates Program

Student/Faculty/ Company Participation

Participation in IAP



Industrial Affiliates Program

IAP through Time

1988 — 2008

IAP is born
6 projects,
15 students,
8 professors
3 companies
(Kodak, Bellcore, Raytheon)

- In Summary
- Over 600 undergraduate students have participated
- Over $600,000 in cash donations
- Over $100,000 in equipment donation for projects

15 projects
48 students
14 professors
5 companies

Industrial Affiliates Program

Session 13c5

The Industrial Affiliates Program at the University of Puerto Rico Mayagüez

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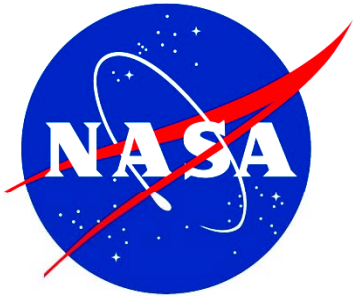
Abstract - The Industrial Affiliates Program (IAP) is an Industry sponsored undergraduate research program at the University of Puerto Rico Mayagüez. The program is currently on its 10th year and has the support of more than 12 companies, many of them internationally recognized companies. IAP is administered by the Department of Electrical & Computer Engineering and has student and professor participation from all departments in the School of Engineering. The program seeks to provide undergraduate students with research experience, to work

organization that is geared towards enriching and enhancing the educational experience of interested undergraduate students. IAP offers a creative technical educational experience to complement the University's strong Engineering curriculum.

The importance of undergraduate research has been widely documented in the engineering education literature [1-11]. IAP differs from many of these programs providing research experiences for undergraduate (REU) students in several respects. Some REU programs take place during the



Tropical Center for Earth and Space Studies

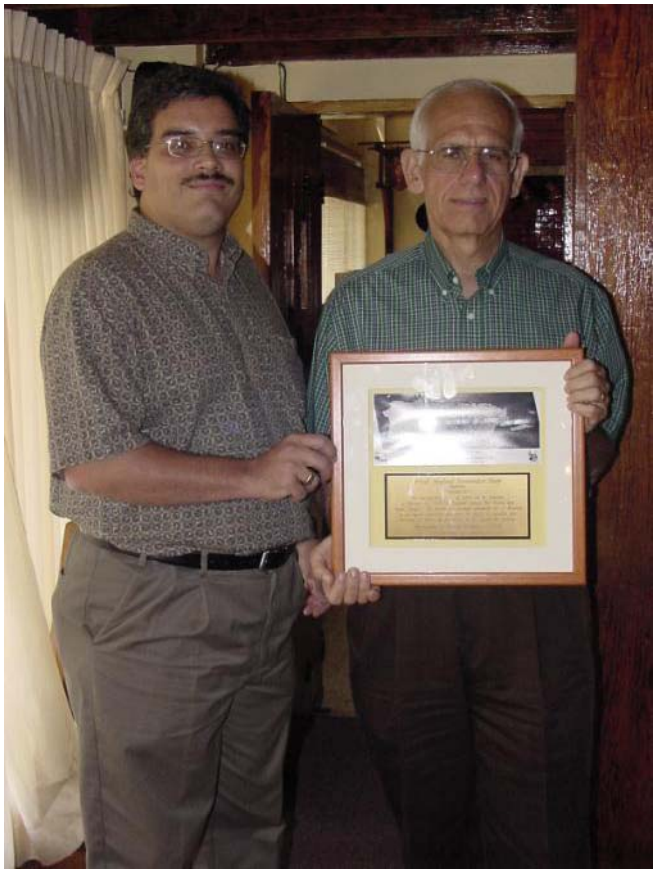
A NASA University Research Center

Dr. Miguel Vélez-Reyes

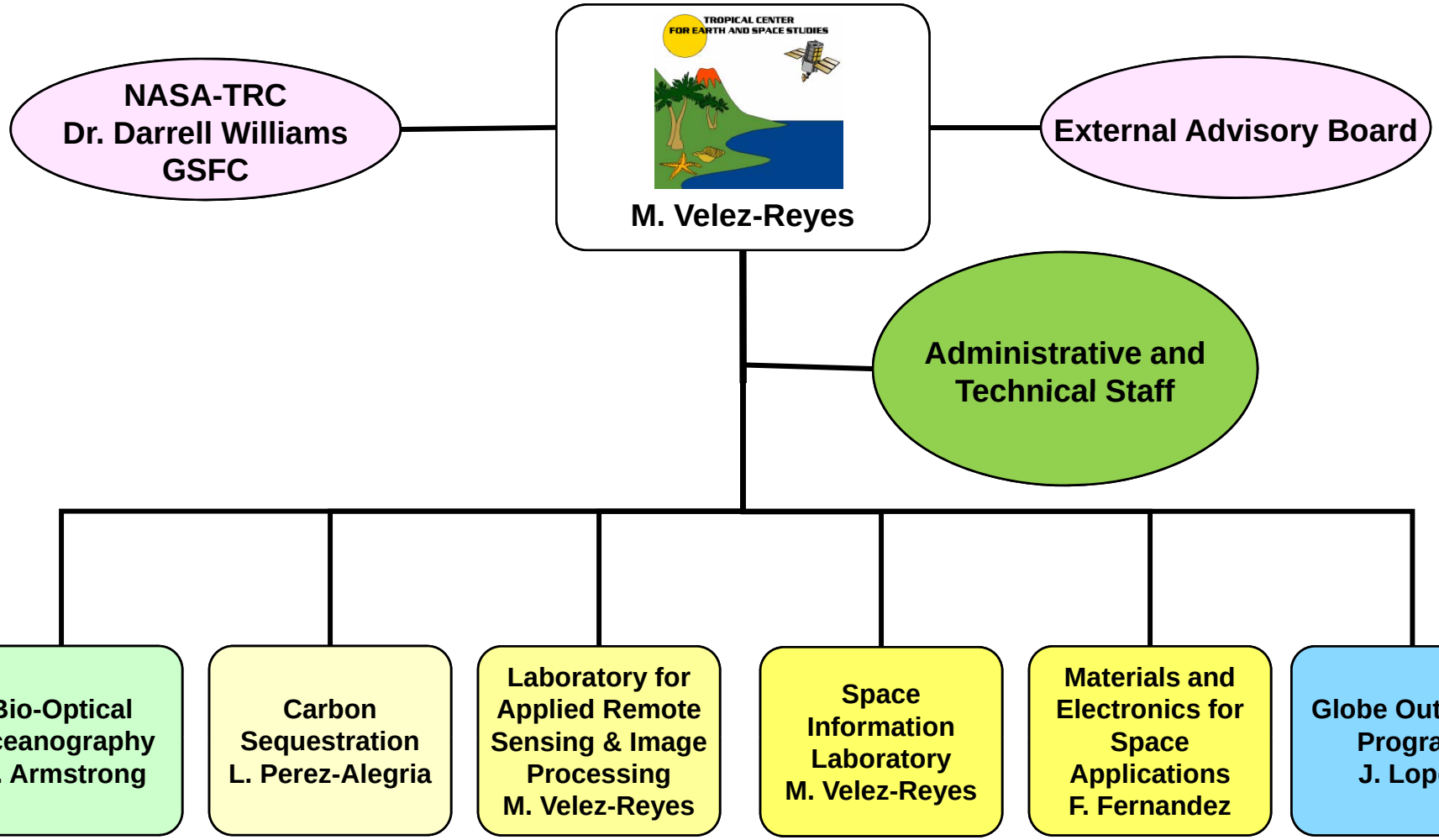
Director

Background

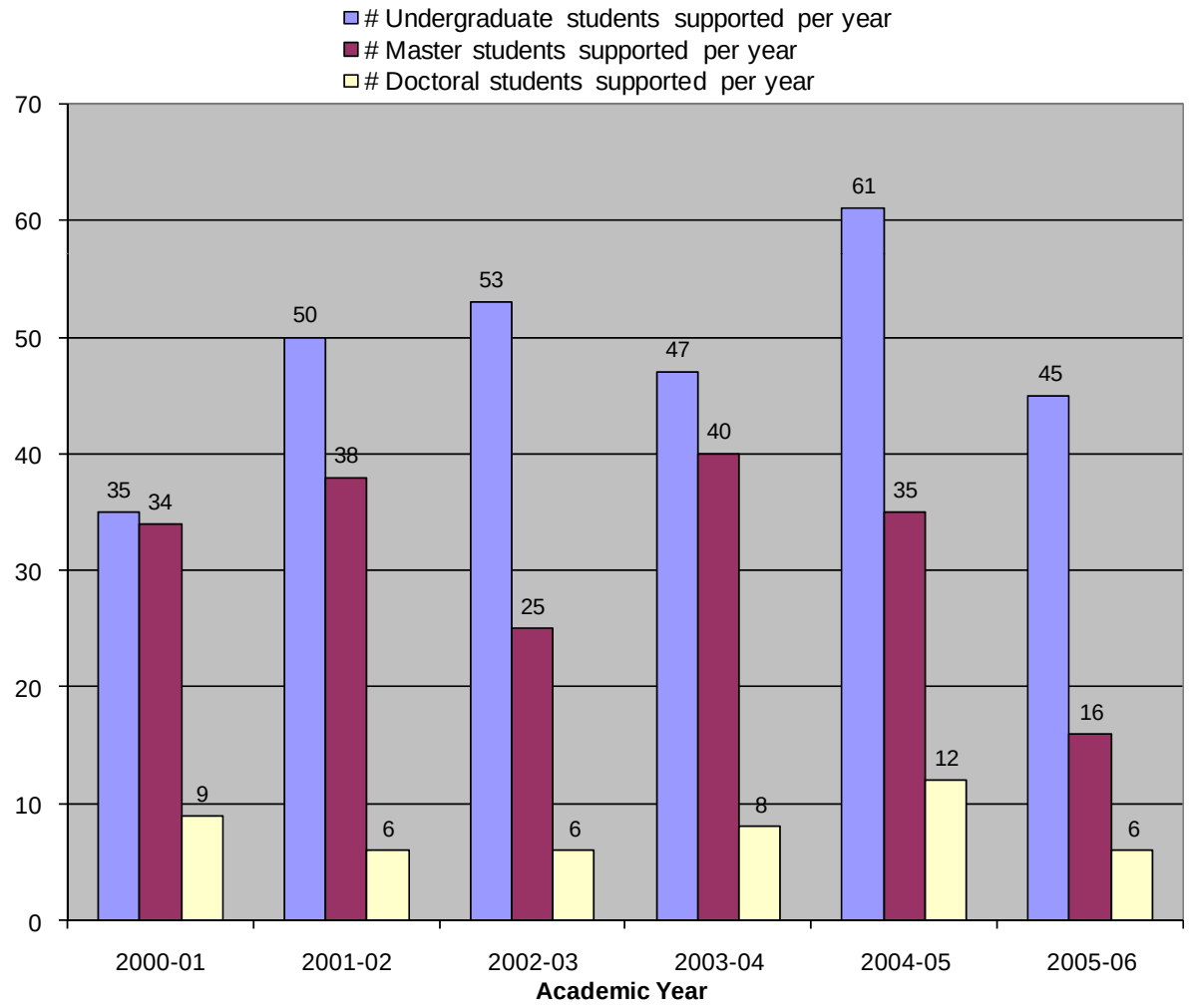
- TCESS was a Group 2 NASA URC established in 1995.
  - 10 yrs of NASA support $10.8M
- Prof. Rafael Fernández-Sein was the project director until August 2003.
  - Continued his participation in TCESS as director of the Space Information Laboratory until June 2005.
- TCESS was the largest NASA project at UPRM.



TCESS: Program



Student Participation



1st PhD in the UPRM Computer and Information Science and Engineering Program Graduated in 2004!

3 TCESS Female Students now Faculty/Researchers at UPRM
-V. Manian (F)
-Y. Detres (R)
-G.O. Ducoudray (F)

127 Degrees Awarded

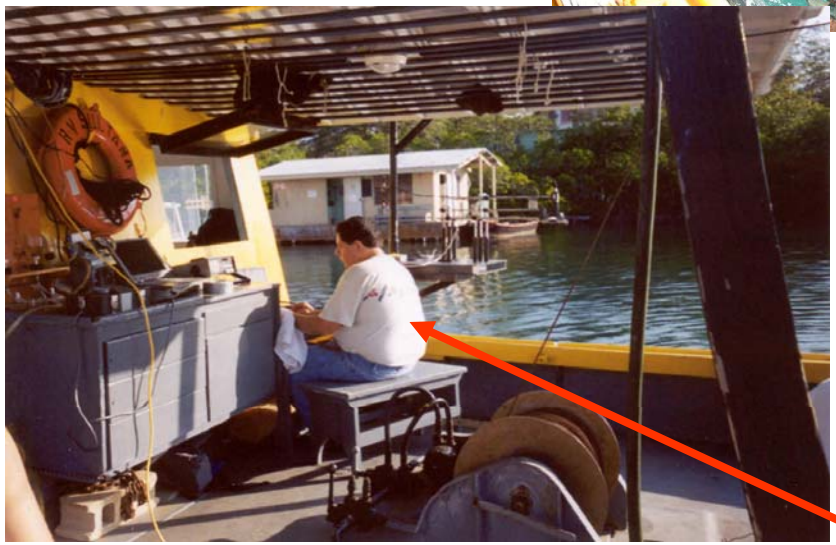
- 81 Undergraduate Degrees
- 43 Master Degrees
- 4 Ph.D.
- Infrastructure and student support made UPRM a competitive option for graduate studies
  - 17 continued MS or PhD studies at UPRM

TROPICAL CENTER
FOR EARTH AND SPACE STUDIES

Multidisciplinary Research

Jeannette Arce
Geology

Jose Torres
Marine Sciences



Eladio Rodriguez
Electrical Engineering

Elias Beauchamp
Computer Engineering

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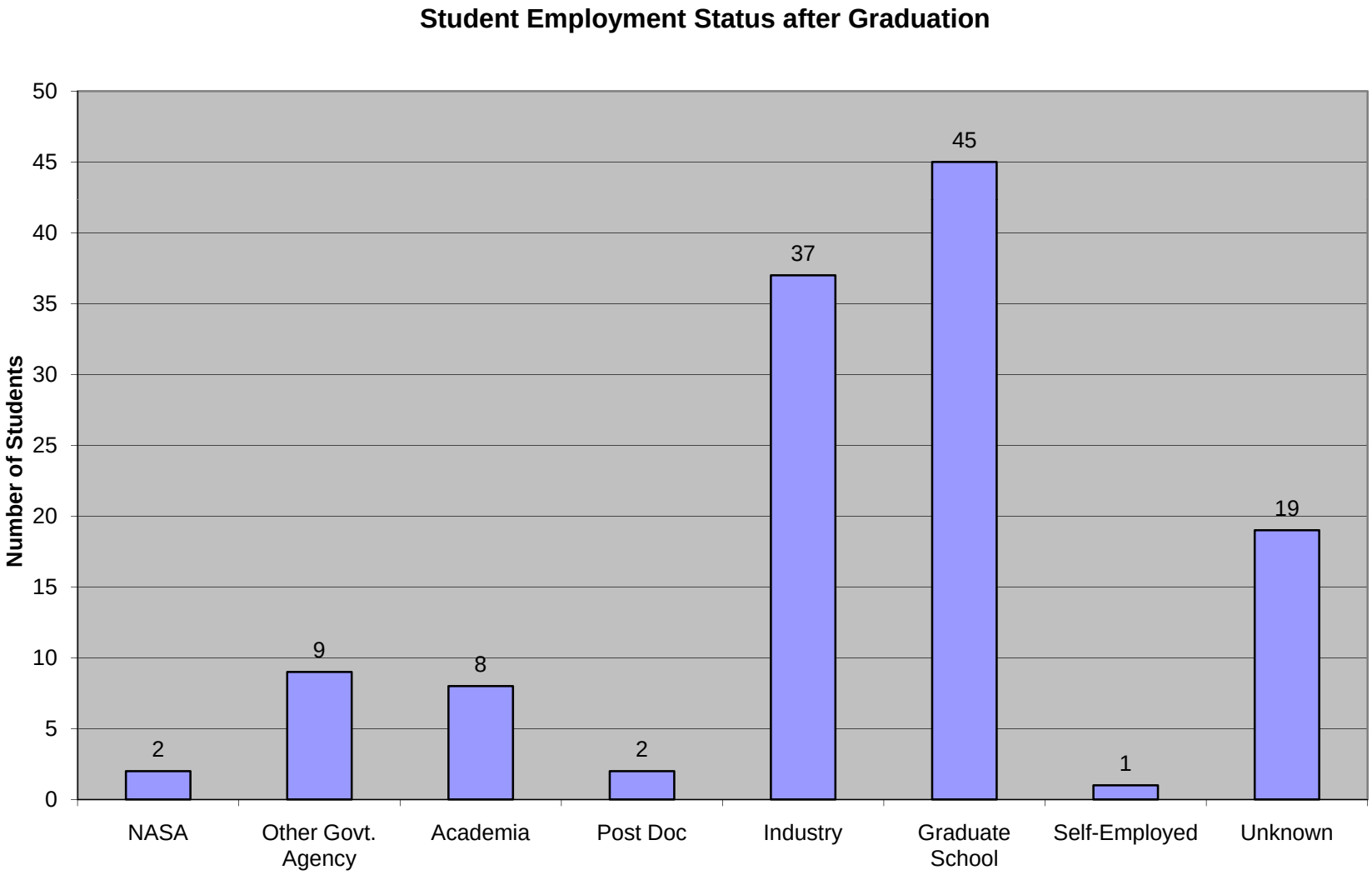
Student Follow Up



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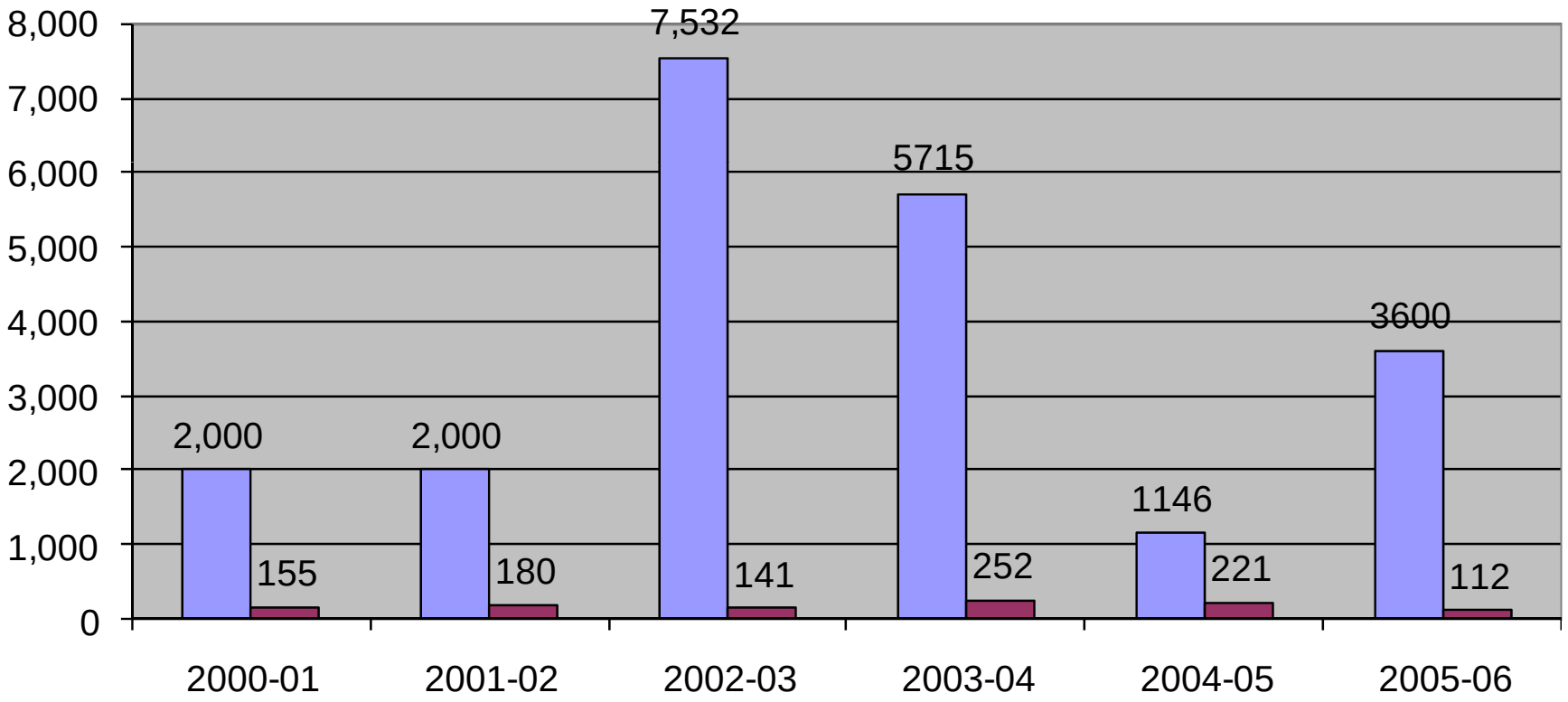
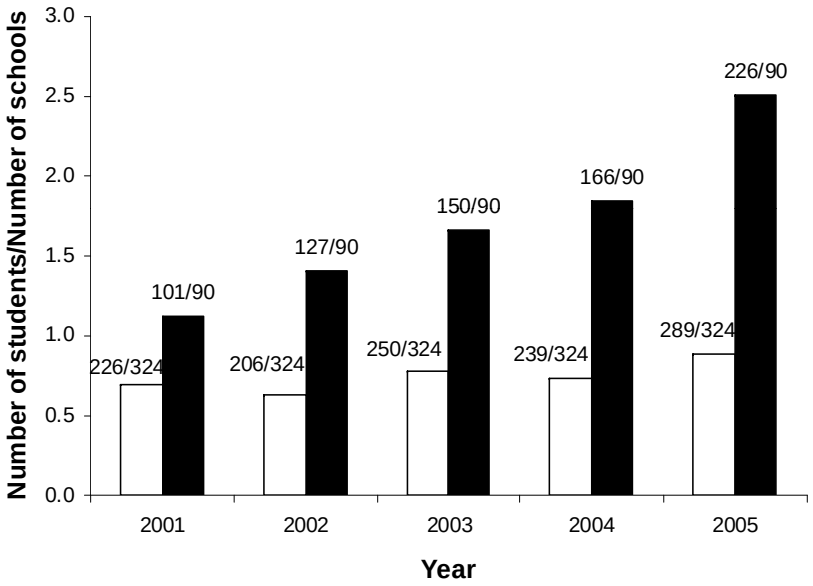
K-12 Students & Teachers

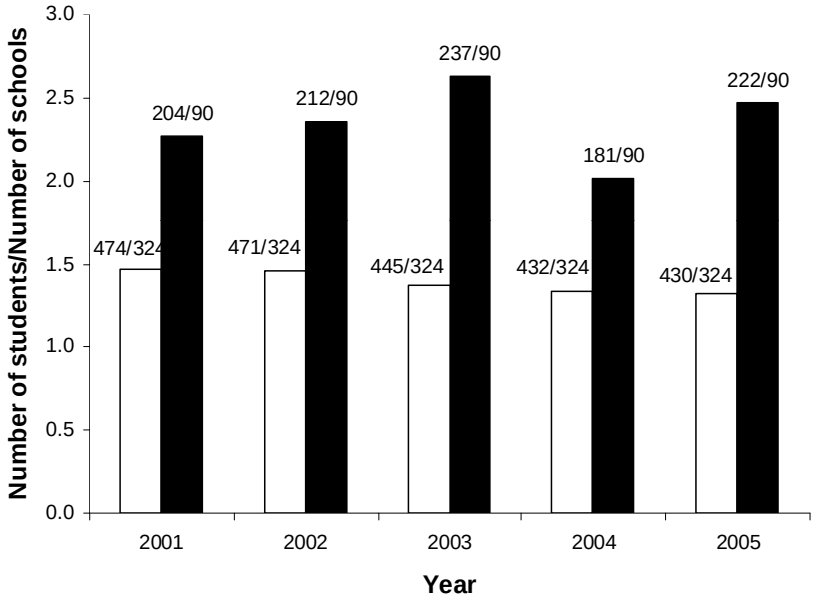


Over 20,000 school students and 1000 school teachers

Impact on Attracting Students to UPRM Sci & Eng Programs



Comparison between number of students which entered UPRM to study science from 324 and 90 non-visited and visited school, respectively by SOW.



Comparison between number of students which entered UPRM to study engineering from 324 and 90 non-visited and visited school, respectively by SOW.

Final Remarks

- UG is an important component in our research/education work
- Different models are used by researchers
- Collaboration in developing soft skills
  - Workshops and seminars
- Publications with UG students as authors are important
- Models that facilitate interaction are needed as ECE graduate programs grow

Sample Publications with UG Co-Authors

A Computer-Based System for Validation of Thermal Models for Multichip Power Modules[1]

Zharadeen Parrilla*, Jose J. Rodríguez*, Allen Hefner**, Miguel Veléz-Reyes*, and Dave Berning**

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Abstract— **This paper presents a computer-based system for experimental validation and calibration of thermal models for multi-chip power electronic modules. The thermal models under study are based on the thermal component network. The paper describes the basic system features and experimental set up as well as experimental results. Calibration results show good performance for the proposed models.**

component network is built in a similar fashion as a circuit as the interconnection of basic elements where each element represents an indivisible building block (power module, heat sink, etc…) used by the designer to form the thermal network. The modular structure of the models allows the designer to interchange different thermal components and examine different configurations of the thermal network easily and allows

Abundance Estimation Algorithms using NVIDIA® CUDA™ Technology

David González, Christian Sánchez, Ricardo Veguilla, Nayda G. Santiago,
Samuel Rosario-Torres, Miguel Vélez-Reyes

Center for Subsurface Sensing and Imaging Systems
Electrical and Computer Engineering Department, University of Puerto Rico, Mayaguez Campus
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ABSTRACT

Spectral unmixing of hyperspectral images is a process by which the constituent's members of a pixel scene are determined and the fraction of the abundance of the elements is estimated. Several algorithms have been developed in the past in order to obtain abundance estimation from hyperspectral data, however, most of them are characterized by being highly computational and time consuming due to the magnitude of the data

Self-Reconfigurable Electric Power Distribution System using Multi-Agent Systems

Janeth G. Gómez-Gualdrón, *Graduate Student Member, IEEE,* Miguel Vélez-Reyes, *Senior Member, IEEE,*
and Luis J. Collazo, *Student Member, IEEE*

Abstract–**Electric power distribution systems (EPDS) can be found almost everywhere, from ship power systems to data centers. In many critical applications, there is needed to maintain minimal operating capability under fault conditions. Therefore, it is necessary to develop energy distribution control techniques, which allow the implementation of a self-reconfigurable EPDS. This research project focuses on the application of MultiAgent Systems (MAS) to develop a self-reconfigurable EPDS. MAS are composed of multiple interacting software elements, known as**

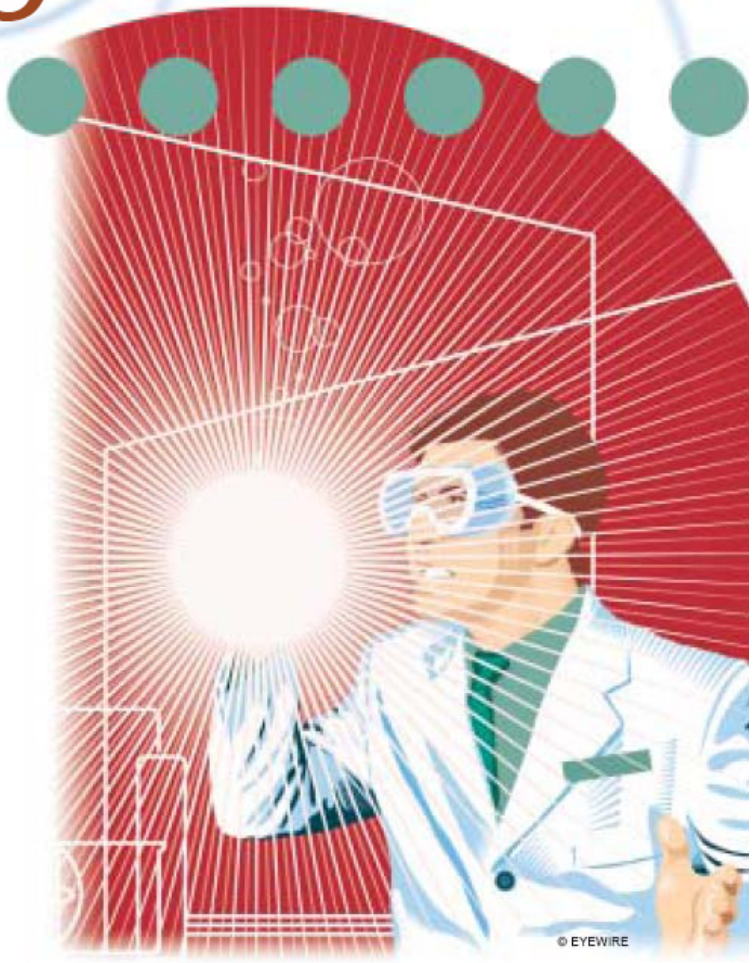
- A new functional network topology is chosen.
- The EPDS has to be reconfigured.

All these decisions must be made by a self-reconfigurable control system that incorporates not only simple regulatory loops and the supervisory control logic, but also a set of components that detect, isolate, and manage faults, in coordination with the control functions. The goal is to increase survivability, eliminate human mistakes, make intelligent reconfiguration decisions more quickly, reduce the manpower

Efraín O'Neill-Carrillo, Miguel Vélez-Reyes, Agustín Irizarry-Rivera, and Eddie Marrero

The Power of Undergraduate Research

Implementing an undergraduate research program to help ensure availability of qualified professionals to face today's energy challenges



Questions?

- Suggestions, Advice, …

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