

AN UNDERGRADUATE/GRADUATE RESEARCH COLLABORATION BETWEEN UMASS AND UPRM

Authors:

José G. Colom, University of Puerto Rico Mayaguez, Electrical Engineering Dept., Mayaguez PR 00681-9042, Phone: 787-832-4040 x2448, Fax: 787-831-7564, Colom@ece.uprm.edu

Sandra Cruz-Pol, University of Puerto Rico Mayaguez, Electrical Engineering Dept., Mayaguez PR 00681-9042, Phone: 787-832-4040 x2444, Fax: 787-831-7564, SandraCruzPol@ece.uprm.edu

Steve Sekelsky, University of Massachusetts, Microwave Remote Sensing Laboratory, Dept. of Electrical & Comp. Eng. Knowles Rm. 209CU, Amherst, MA 01003, Phone: (413) 545-4217, Sekelsky@ecs.umass.edu

Abstract — *A direct collaboration between the University of Massachusetts – Amherst and UPR-Mayaguez in the area of Applied Electromagnetics has been steadily growing for the past five years. More than 12 UPRM students have participated in research activities sponsored by the Summer Undergraduate Research Experience Program (NSF-SPUR) at UMass and other UMass/UPRM funding sources. The students have specifically participated in research projects involving microwave and mm-wave radar system design, deployment, operation, and data analysis using the Microwave Remote Sensing Lab (MIRSL) facilities located in UMass-Amherst. MIRSL is one of the leading US research laboratories in the design and fabrication of microwave remote sensing instruments. The program has served to increase the interest of underrepresented students to continue graduate studies in a Research I Institutions by providing UPRM undergraduate students the opportunity to participate in summer research projects at UMass. As a result, four graduate students have participated in research activities through Summer Internships at UMass, and they are currently pursuing their MSEE with research projects under UPRM advisors and in collaboration with UMass. In addition, one full time PhD students and one full time MSEE student, both graduated from UPRM, are now pursuing their respective degrees at UMass. These are the first UPRM students in more than ten years to continue graduate studies in Electrical Engineering at UMass. In order to increase this collaboration at different levels, a Memorandum of Understanding has been signed between both institutions. This MOU will allow UPRM students to perform research activities at the UPRM campus while pursuing a PhD degree from UMass. This MOU will allow UPRM to have PhD level students to work in high-level collaborative projects between the two institutions.*

Index Terms — *Collaborative PhD degree, Educational Model, Multi-campus collaboration, underrepresented student*

INTRODUCTION

The University of Massachusetts at Amherst (UMass-Amherst) and the University of Puerto Rico at Mayaguez (UPRM) have implemented a novel educational/research program to train a new generation of radar/atmospheric remote sensing specialists. This is accomplished by promoting minority undergraduate and graduate research through a collaborative educational program between Electrical and Computer Engineering Departments at UMass and UPRM. This collaboration was initiated five years ago and it was originally intended for undergraduate students, but it was quickly extended to MS level graduate students, and most recently to PhD students for the Fall of 2003. The program encourages minority undergraduate and graduate students (from UPRM) to pursue graduate studies (MS and PhD) by exposing them to the research environment of a Research I Institution (UMass) and participation in field work experiments not possible at UPRM. To support this initiative a newly collaborative Ph.D. program between Electrical and Computer Engineering Departments between UMass and UPRM has just been established. The Ph.D. program is a culmination of prior collaborative environmental remote sensing educational activities between UMass and UPRM (UPRM currently does not offer a Ph.D. degree in Electrical Engineering). However, this program provides opportunities for UPRM students to earn a Ph.D. from UMass while simultaneously working with faculty advisors from UMass and UPRM. It is anticipated that research will be conducted primarily on the UPRM campus, thus, providing the institution with access to Ph.D. students to stimulate high-level geosciences research at UPRM. Ultimately, the collaborative Ph.D. program should lead to the establishment of a Ph.D. program in Electrical and Computer Engineering at UPRM.

Based on prior experience we feel strongly that a significant percentage of undergraduate students recruited into this program will follow through at least the master's level. In just a few years we have managed to successfully see two UPRM MS

students through graduation in 2002 with two additional MSEE students anticipated to graduate in 2003. In addition, one PhD student and another MS student with BSEE degrees from UPRM are currently full time graduate students at UMass.

The successful demonstration of this program is currently encouraging interest and duplication at other partners' institutions such as University of Oklahoma and Colorado State University. These two institutions, together with UPRM and UMass, are core partners in an NSF Engineering Research Center that will provide new research opportunities among the different campuses.

Since 1999, nine undergraduate students have participated at UMass in the NSF SPUR summer program (and two more to participate in 2003). The students have worked under the supervision of Dr. Steve Sekelsky and his colleagues in different areas of microwave remote sensing. There has also been four UPRM MS students working in collaborative research projects with UMass, and three of those four have participated in Graduate Summer Internships at MIRSL/UMASS. It is worth to note that three from those four students are interested in continuing their PhD degree through the MOU. There are also at least two additional students interested in pursuing the PhD at UMass through the MOU. In addition, with 39% female, UPRM has one of the highest percentages of women in engineering in the U.S. allowing us to increase the diversity of the students benefiting in the program. Figure 1 illustrates a block diagram of the UMass/UPRM Educational Model. Statistics of student participation are included in the figure.

UMASS/UPRM COLLABORATION MODEL

The success of the program is mainly due to a combination of efforts from both institutions through the years, for example Dr. Colom and Cruz-Pol were UPRM visiting faculty at UMass during the summer of 2001 and several research initiatives were developed during that time. Specifically, Dr. Cruz Pol efforts during that summer resulted in a NASA Faculty Award for Research (FAR) that had provided funding for undergraduate and graduate students to continue research initiatives at UPRM which were originated during summer internships at UMass.. Other initiatives include Dr. Steve Sekelsky teaching a 1 credit short-course at UPRM in the area of Atmospheric Radars. Most recently UPRM and UMass have partner in an NSF-ERC proposal and a NSF-GeoEd program proposal, should these proposals be approved the number of research activities and students exchange will significantly increase. In addition, there have been several undergraduate research projects at the UPRM campus that have been tied to the collaborative MS projects, or are continuation of undergraduate summer internships that started at UMass. Using this approach, students that did not have the opportunity to participate in summer internships at UMass are directly involved in collaborative research during the academic year at UPRM under the supervision of Dr. Cruz Pol and Colom. Some of the most recent undergraduate projects where UPRM students participated at UMass are:

- Development of UHF Receiver for Turbulence Radar using Surface Mount Components
- Effects of MM-Waves propagating through wet soil
- Modification of Marine Radar into Atmospheric Radar
- EMI of Power Supply in mm-wave radar performance

Some of the projects above were extended through the academic year at UPRM by using different undergraduate funding opportunities available at the institution such as the Industrial Affiliates Program [1]. In this manner, students that participated in summer internships will share their experiences and knowledge with other undergraduate students at UPRM. As a result of the different collaborations, seven UPRM/UMass co-authored papers have been published in International Conferences. The MS research projects already completed or currently under way are:

- Stratus Cloud: Parameter Retrieval Using Dual-Wavelength [Ka and W band] Millimeter Doppler Radar [2], [3].
- Atmospheric Attenuation Performance for Scanning Millimeter-Wave Radar in a Tropical Environment for the Maritime Continent Thunderstorm Experiment [MCTEX], in Australia– studies the scanning performance of MMW radar, scanning effect on atmospheric attenuation [4].
- Cirrus Clouds: Ice Crystals: development of models for bullets and bullet rosettes as measured by airborne instruments for comparison with radar measurements [5].
- Precipitation: Applying active rain-gauge concept with W-band and S-band Doppler radars [6].
- Geological Survey for location of nodes in a radar network to sense the lower atmosphere.

As part of these experiences, graduate and undergraduate students have had to interact with scientists with expertise in these areas such as Andrew Heymsfield from NCAR [National Center for Atmospheric Research], who works with cirrus ice crystal models.

The recruitment of these MS students was due to the combination of SPUR experiences and increasing the interest of undergraduate students in microwave remote sensing applications through modules presented at UPRM senior level courses. Figure 2 and Figure 3 shows pictures of students participating in field work experiments at Oklahoma and California, respectively. This type of experience is unique for UPRM undergraduate students and it has been observed that such experiences increases interest in pursuing graduate degrees in this particular area.

CONCLUSIONS

In conclusion, the exposure of undergraduate and graduate students to the environment of a research I institution increases the interest of students to pursue a higher degree. In five years, four students are pursuing MSEE degrees at UPRM in research projects in collaboration with UMass. One PhD students and one MS student have become full-time students at UMass and it is expected that 2 PhD students and six more MS students will start working in collaborative research at either UMass or UPRM during the fall of 2003. Even though the sample of students is small, the program has clearly shown a trend of students from UPRM to continue graduate school when opportunities for unique experiences are provided.

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FIGURES AND TABLES

FIGURE. 1

BLOCK DIAGRAM OF UPRM/UMASS EDUCATIONAL MODEL

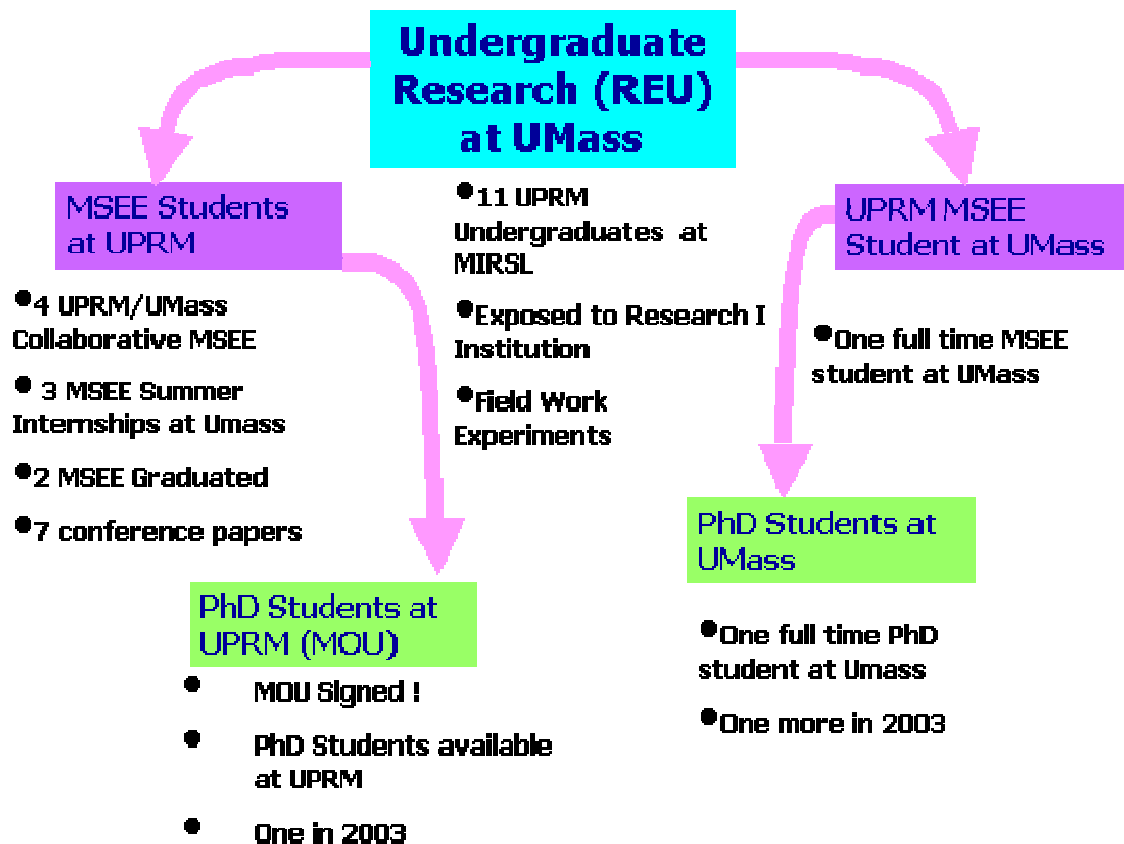


FIGURE. 2

UPRM GRADUATE STUDENT LEYDA LEON OPERATING MM-WAVE PRECIPITATION RADAR AT THE CLOUD AND RADIATION TESTBEN (CART) IN OKLAHOMA, DURING THE FALL OF 2001. SHE LATER CONTROLLED AND OPERATED THE RADAR FROM PUERTO RICO VIA COMPUTER.



FIGURE. 3
UPRM STUDENT RAFAEL RAMIREZ PREPARING MM-WAVE RADAR FOR FLIGHT TEST, 1999

