

CONFERENCE FOR REMOTE SENSING AND ENVIRONMENTAL MONITORING FOR THE SUSTAINED DEVELOPMENT OF THE AMERICAS

Puerto Rico: Bridge To The Americas

University of Puerto Rico
Center for Hemispheric Cooperation
Center for Advanced Studies in Public Management
and Law
March 21-22, 1995
Condado Beach Hotel, San Juan, Puerto Rico

Repair and Rehabilitation of the Infrastructure of the Americas

29 - 30



Industria,
Gobierno y
Universidad...
por el
Desarrollo
Económico



ENVIRONMENTAL CONSCIOUSNESS



CoHEMIS-JUNE 1994 - JUNE 96
REPORT AND STRATEGIC OUTLOOK

FACILITATING COLLABORATIONS FOR COMPETITIVENESS AND SUSTAINABLE DEVELOPMENT IN THE WESTERN HEMISPHERE

CENTER FOR HEMISPHERICAL COOPERATION
IN RESEARCH AND EDUCATION
IN ENGINEERING AND APPLIED SCIENCE
(CoHEMIS)

5th ANNIVERSARY

LUIS F. PUMARADA-O'NEILL
JORGE I. VELEZ-ARCOHO
WALTER F. SILVA-ARAYA
Co-DIRECTORS

JULY 1996

UNIVERSITY OF PUERTO RICO, MAYAGUEZ CAMPUS

PRECONFERENCE

RESEARCH, ENERGY FOR LATIN AMERICA AND THE CARIBBEAN OPPORTUNITIES AND EMPLOYMENT FOR EXPERTS AND CONSULTANTS

Geo-Environmental Issues Facing the Americas

Symposium on Alternative Energy Sources for Puerto Rico and the Caribbean

Center for Hemispheric Cooperation in Research and Education in Engineering and Applied Science

Sponsors:

- San Juan National Laboratory
- Old Forge National Laboratory
- UPRM Research and Development Center
- UPRM Mechanical Engineering Department
- University of Toronto

City of Puerto Rico, Mayaguez Campus

Conference and Workshop on Geo-Environmental Issues Facing the Americas

Conference 21 IX 94
Workshop 22-23 IX 94
8:00 am - 5:00 pm
Universidad de Puerto Rico

Contents-NSF Conference

TRANSPORTATION RESEARCH IN THE AMERICAS

Presenting Board

Sponsor: National Science Foundation

Co-Sponsors:

- Department of Transportation and Public Works of Puerto Rico
- University of Puerto Rico at Mayaguez
- Research and Development Center
- Old Forge National Laboratory
- UPRM Mechanical Engineering Department
- UPRM Infrastructure Research Center
- Transportation Technology Transfer Center

Organized by:

- Center for Hemispheric Cooperation in Research and Education in Engineering and Applied Science at Mayaguez

Mayaguez, Puerto Rico
July 11-12, 1996

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ACKNOWLEDGMENTS

During its first five years of operations, the Center for Hemispherical Cooperation in Research and Education in Engineering and Applied Science (CoHemis) has benefited from the contributions of many people. The originators of the idea of such a center were Dr. John B. Scalzi, from the National Science Foundation, Dr. Rafael Muñoz-Candelario, nowadays Professor Emeritus of the Mayagüez Campus of the University of Puerto Rico (UPRM), and Dr. Leandro Rodríguez, former Dean of Engineering in the same campus. Dr. Carlos I. Pesquera, currently Puerto Rico's Secretary of Transportation and Public Works, was the founding co-director of CoHemis together with Dr. Luis F. Pumarada. Eng. Gisela González was the coordinator of the conference that initiated the Center in 1991, and remained with CoHemis until December, 1992.

Today, the Center is run most efficiently by coordinator Luz Leyda Vega-Rosado, supported by secretaries Anna I. Álvarez-Castro and Arlene Astacio-Sánchez, with enthusiastic collaboration of the support staff of the UPRM R&D Center. Many UPRM graduate and undergraduate students have worked for the Center during these years, taking care of the anonymous tasks that nobody sees but are nonetheless essential. We want to thank especially Omar Laboy, Carlos Poventud and José C. Lebrón.

We must acknowledge the support, especially in terms of release time and office space, provided throughout the life of the center by UPRM: its Chancellor's Office, Dean of Engineering, and Research and Development Center. We thank NSF for the funding and guidance provided during the first two years of the Center and the Office of the President of the University of Puerto Rico for the operational funds provided since 1993. We also appreciate those who sponsor our collaboration activities, specially NSF, the government of Puerto Rico and its Federal Affairs Officers, and Caterpillar Americas.

A center such as CoHemis depends on the voluntary collaboration of many persons far apart who believe in hemispheric solidarity, embodying our motto, "overcoming through cooperation". These persons are mostly those who serve as delegates in the CoHemis Consortium institutions and our contacts in the various national science and technology organizations who network with us, share and forward information, identify and refer experts, and organize joint activities. Among these all very valuable persons we can not defer mentioning by name Dr. Néstor Ortiz from Sandia National Laboratories, Dr. Emir Macari, from Georgia Tech, Dr. Graciela Sosa, formerly at Venezuela's CONICIT, and Dr. Nuria Capiati, from Argentina.

Many other persons continually contribute to CoHemis' success, including UPRM professors who provide technical expertise and initiatives; alumni who help with translations; Puerto Rico public officials who receive our guests and trust us with their needs, assistance and in kind contributions; Federal and national laboratory personnel who volunteer to participate in our activities with their own funds; visitors who go back and speak well of our performance and capabilities; and those persons who have agreed over the years to lend us their prestige and guidance as individual advisers. Amongst all of these collaborators, we must mention DOE's Gerson Santos-León.

Finally, we also want to acknowledge the efforts of those who made possible the preparation of this report. Specially we want to thank editor Mariluz Gotay and Anna I. Álvarez.

SUMMARY

The CoHemis Center has been networking and facilitating North-South collaborations in science and technology within the Americas for several years before the Summit of the Americas and before the document *Science in the National Interest* converted such collaborations into official US policy. Through its five-year trajectory, CoHemis has demonstrated beyond doubt that it can contribute significantly to the attainment of the objectives of hemispheric integration in ways in which no one else can.

Our Center has been able to get support and collaborations from government, academia and the private sector to organize many activities, both in Puerto Rico and in Latin America. Between June 1994 and June 1996, we have brought 89 presenters from continental US and Latin America and 34 from Puerto Rico together with over 1140 attendees in Puerto Rico and overseas for workshops, conferences, and short courses on such themes as energy, environment, civil infrastructure, and waste disposal. During this period, CoHemis has organized 18 hemispheric conferences, workshops, and seminars in Puerto Rico and a short-course series in six Latin American cities that reached more than 431 persons. This has been achieved through collaboration with universities, private firms and national science and technology organizations in 15 countries in our hemisphere. Our Center has accumulated five years of goodwill, ties and collaborations with most of the national Science and Technology organizations in the hemisphere and is often treated as a Latin American organization in Latin America.

In 1992 CoHemis began to form a hemispheric network which currently embraces 17 institutions in 10 countries, all committed to collaborate in the implementation of the above mission. The CoHemis Consortium is a still-growing, active network that constitutes a comprehensive, unique pool of resources for North-South collaborations in science and technology. It aims to include at least one university teaching science and technology in every country of the Americas that has one.

Thanks to the vision of NSF's Dr. John B. Scalzi, and the support of UPR officials, CoHemis has become the hemispheric cooperation center for science and technology. CoHemis' linkages to most national science and technology organizations in the Americas and its partnerships with key universities in many Latin American and Caribbean countries, complemented by a consistent newsletter and a 5-year record of successful activities and satisfied clients, make it a valuable way to reach the hemispheric science and technology community. Its setting within the University of Puerto Rico provides it with a unique advantage for achieving its objectives.

The University of Puerto Rico is the only institution in the US jurisdiction that teaches mostly in Spanish and has a graduate school which covers engineering, natural, marine, medical, and agricultural sciences, business administration, planning, social sciences, environmental sciences, and public health. Its Mayagüez Campus has a faculty that is 80% Latin in a Land Grant university. In addition, UPR-Mayagüez is fully accredited, fully bilingual, has an international faculty and student body, and is located in a Spanish-speaking Caribbean island within a diverse community that is racially and politically tolerant.

Presently, the mission of CoHemis is to facilitate collaborative applied research, technology assessment, and human resources development programs to serve the needs of the Americas with the participation of engineers and scientists from the different countries of the hemisphere, while working towards the creation of the research center outlined by the 13 country delegates who participated in the



"CoHemis-Caterpillar Short Course Series" opening ceremony in San José. Víctor Ojeda, Costa Rica's Minister of Specific Affairs, welcomes 75 participants from government, academia, and environmental and private sectors.

1991 NSF-sponsored conference that created our Center. These delegates recommended the eventual creation of a multinational applied research center, with headquarters in the University of Puerto Rico's science and engineering campus and coordinating work carried on there and at other collaborating institutions. This organization would bring together Latin American graduate students and researchers for six-month to two-year periods to work with American and Canadian investigators on research funded by member country contributions and by international and North American sponsoring agencies. The part of the research carried on in the University of Puerto Rico will contribute to expand graduate programs in Puerto Rico, thus greatly increasing the number of Hispanic Ph.Ds. in the US and at the same time facilitating the integration of the scientific communities of the Americas.

Puerto Ricans, specially Spanish-speaking island residents, are brothers and sisters to other Latin Americans. Unlike most other members of the US scientific community, Puerto Ricans can discuss issues with Latin Americans with nothing being lost in translations or cultural differences. Teaching, learning and thinking in the same language. Puerto Rican institutions such as the University of Puerto Rico and CoHemis can be very effective collaborators in getting the hemispheric Science and Technology integration goals achieved. CoHemis can participate in US delegations in hemispheric meetings on science and technology, and as a Latin American institution in Latin American organizations. The most significant contribution that UPR, CoHemis, and the CoHemis Consortium can make to hemispheric integration and sustainable and equitable development is the implementation of the applied research center outlined at the 1991 Conference.

The following pages include an overview of the Center since its beginnings and a presentation of CoHemis' achievements during the last two years. This report also features figures of contributions received as well as the Center's expenses. Pending projects, strategic opportunities and future plans are also presented.

INTRODUCTION

THE 1991 PLANNING CONFERENCE

In February, 1991 the National Science Foundation's Large Structures and Building Systems Program (Engineering Division) granted \$99,939 to the University of Puerto Rico's Mayagüez Campus (UPRM) to organize a hemispheric conference for planning a center for promoting joint research activities in the Americas. The original grant to Dr. Luis Pumarada-O'Neill (Principal Investigator) and Dr. Carlos I. Pesquera (Co-PI) through Program Director Dr. John B. Scalzi covered a period of two years. It included follow-up activities such as producing a quarterly bilingual newsletter and writing proposals for funding the conference recommendations. The grant was later extended one year until December 1993, and expanded by \$70,319.

The conference was held in Mayagüez on November, 1991. Most of the existing national research organizations in the Americas sent delegates and/or submitted papers. The US had participants from the academic, government, and private sectors. North American research-sponsoring agencies, such as the National Institute of Standards and Technology (NIST), the Department of Energy (DOE), the Environmental Protection Agency (EPA), as well as the National Science and Engineering Research Center (NSERC-Canada), the US State Department, the American Association for the Advancement of Science (AAAS), and the Scientific Division of the Organization of American States (OAS) also participated. The United Nations' Environmental Program for the Caribbean contributed in covering travel expenses. The participants from Puerto Rico came from UPRM, the UPR Central Administration, and Puerto Rico's Economic Development Administration. The Governor of Puerto Rico and the President of the University addressed the participants and supported the conference objectives. Many key persons and organizations in the science and technology community sent letters backing the conference objectives. These included the United Nations' Science and Technology Division, UNESCO, Hon. George Brown, Chairman of the House Committee for Science, Technology and Space Affairs, and Dr. Allan D. Bromley, Science and Technology Adviser to President Bush. Congressman José Serrano also wrote his solidarity.

The participants' papers described the current situation of research and development activities and of advanced technological education in each country and suggested how a multinational research center could help to increase the frequency and effectiveness of hemispheric cooperation in those fields. The funding agencies presented existing relevant research programs and offered suggestions on how to best use these opportunities. Following the presentations, the participants were divided into groups which discussed different aspects of how a hemispheric research center could be most effective for the countries of the Americas. In addition, each participant was shown those UPRM research and educational facilities which he was interested in.

Creation of the CoHemis Center

In the final session, the delegates unanimously recommended the immediate creation at UPRM of a Center for Hemispheric Cooperation in Research and Education in Engineering and Applied Science (CoHemis). Its mission would be to facilitate, support, and conduct collaborative applied research and human resource development programs to serve the needs of the Americas with the participation of

engineers and scientists from the different countries of the hemisphere. They also created a five-delegate advisory committee (now expanded to six) to assist in this mission. CoHemis received mandates to: promote the participation of the least-developed countries in this center, and to focus on projects that have a potential for short term benefits and development impacts for more than one country.

Current Members of the Advisory Committee

Argentina, Numa Capiati
Brasil, Carlos R. de Faria e Souza
Chile, Mauricio Sarrazin
Colombia, Olga Lucía Turbay
Trinidad & Tobago, Maureen Manchouck
México, Sylvia Ortega Salazar

Our Long-Term Goal: A Multinational Applied Research Center

The format and mission recommended by the conference for the applied research center is a multidisciplinary, world class institution governed and partly supported by member countries, open to all nations and territories in the Western Hemisphere. This center, headquartered in the University of Puerto Rico's Mayagüez Campus, would coordinate work carried on there and at other collaborating institutions. This organization would bring together Latin American graduate students and researchers for six-month to two-year periods to work with American and Canadian researchers on research funded by member country contributions and by international and North American sponsoring agencies. It would have approximately 75 rotating visiting researchers and 25 resident researchers, and provide assistantships to 200 graduate students from different countries of the Americas who would be enrolled at UPRM and other Consortium institutions. These activities will contribute to support graduate programs at the University of Puerto Rico, thus greatly increasing the number of Hispanic Ph.Ds. in the US and thus facilitating the integration of the scientific communities of the Americas.

An advanced science and technology center operating in Puerto Rico linking the most prestigious laboratories and universities in the US with their most important counterparts in the other countries of the hemisphere and promoting technology cooperation with all countries in the Americas with substantial US support will showcase a very favorable image of the US and its scientific establishment. At present, the well-funded and publicized international collaboration programs of the European Community and of individual European countries and Japan are being very well received in the region.

Puerto Rico, due to its unique political, historic and cultural circumstances, can be the most effective vehicle for transferring technology between US and Latin America and to make it work effectively on behalf of the importing countries within the corresponding socioeconomic and sustainability context. The future research center's joint applied projects will allow Puerto Rican researchers to remain on the cutting edge of knowledge in precisely those fields which are of most interest to Latin America and the Caribbean. The creation of such a center and a support and participation network remains as the primary long-term goal of the CoHemis Center. Its implementation looks more promising every year within the context of the CoHemis Consortium and the mechanisms provided by the Summit of the Americas, such as the meetings of science and technology ministers.

THE COHEMIS HEMISPHERIC COOPERATION CENTER

MISSION

Promote human resources development programs, technology assessment, and joint applied research with potential benefits for more than one country in the Western Hemisphere to serve the needs of the Americas with the participation of engineering and science researchers and graduate students from the different countries of the hemisphere.

Bring about the creation of a hemispheric applied research center in the context of the CoHemis Consortium.

OBJECTIVES

- Increase the global competitiveness of Western Hemisphere industry.
- Enhance the technological and human resources capabilities of Latin America and the Caribbean and hence their social, economic and commercial development.
- Foster the protection of the hemisphere's environment and natural resources.
- Bring high priority regional problems to the attention of researchers and sponsoring agencies across the different countries.
- Promote Puerto Rico, its University, and its Mayagüez Campus as ideal for facilitating and conducting effective technology transfer and educational efforts in key areas of sustainable development.
- Increase opportunities available in Puerto Rico for quality graduate study in science and engineering to boost the number and quality of Hispanic-American Engineering and Applied Science Ph.D.'s.
- Promote the creation of a multinational hemispheric education and joint research network centered in the University of Puerto Rico — with the participation of the CoHemis Consortium — which can provide research funds, student assistantships, and high technology services to its member countries according to their priorities.
- Link universities, S&T institutions, and research centers throughout the hemisphere.

THE COHEMIS CONSORTIUM

For the two years following the 1991 Conference, CoHemis worked in proposals and in gaining visibility with the objective of securing funding at the scale needed for its long-term goal, the hemispheric research center outlined by the delegates. CoHemis found other receptive institutions from North and South that adhere to its objectives and were willing to join UPRM in what became known as the CoHemis Consortium. This network, which has grown to 17 institutions in 10 countries, has allowed the center to become a very effective hub for hemispheric collaborations and to organize successful hemispheric meetings,

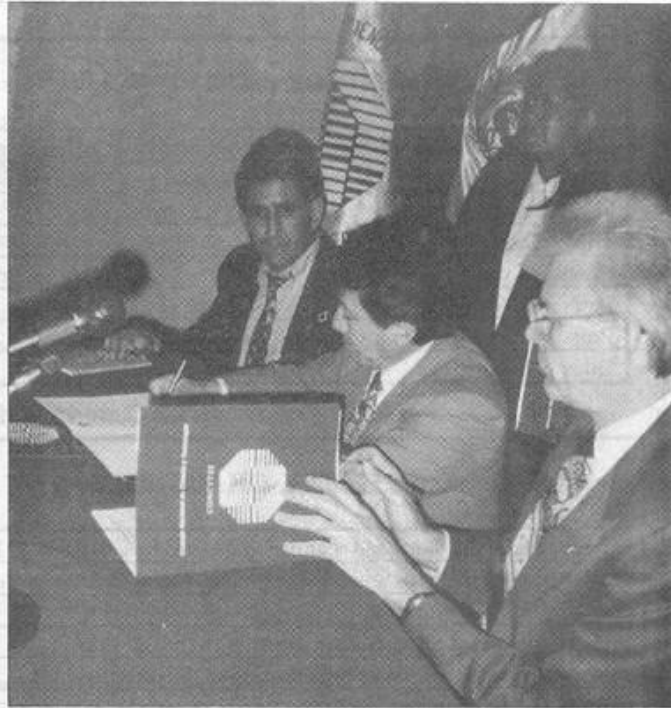
courses, and workshops in Puerto Rico and Latin America. CoHemis has multiplied vastly its capacity of serving the technological development of the hemisphere through the growth of the Consortium.

The member institutions have benefitted through participation in CoHemis activities, either in Puerto Rico with paid invitations, or at their own premises. They also have contributed to and benefitted from networking and information exchanges, and have been exposed to opportunities of presenting short courses. They receive CoHemis publications, notices, and announcements. CoHemis organizes, facilitates, and/or hosts their visits to Puerto Rico and helps to organize interactions with entities in Puerto Rico and the Caribbean.

The mission of the CoHemis Consortium is to enhance the science and technology capabilities of the Americas, foster the integration of its scientific community, and promote its effectiveness in advancing sustainable development. The Consortium uses a set of bilateral agreements of each member with UPRM to facilitate exchanges of faculty and students, assistantships, participation in hemispheric activities, joint research, and sharing research facilities. In the last two years, the following institutions have joined the Consortium: Oak Ridge National Laboratory, Lehigh University, Universidad de Chile, Universidad de Costa Rica, Universidad de la República (Uruguay), Universidad de los Andes (Colombia), Universidad Nacional Autónoma de México, Universidad Nacional de Córdoba (Argentina), Universidad Nacional de Río Cuarto (Argentina), the University of Guyana, and the Instituto Tecnológico de Santo Domingo (Dominican Republic).



Trip to Brazil, 1996. Currently, PUC-Rio is very interested in joining the CoHemis Consortium. From left to right: María Augusta Davidovitch, Vice-Dean in Research Graduate Studies, José A. R. Parise, Academic Vice-Dean, CoHemis Director Luis Pumarada O'Neill, Guiseppe Guimaraes, structures professor, and Roberto Acevedo, professor at PUC-Rio and at the Universidad Federal de Vicosa.



Eng. Pedro Villena-Hidalgo (second from left), Executive Director of Peru's National Council for Science and Technology; recently deceased in a tragic airplane accident, and Dr. Luis Pumarada-O'Neill sign a bilateral agreement to facilitate joint education and research initiatives between Peruvian institutions and the University of Puerto Rico.

Consortium Members and Delegates

- UNIANDES (Colombia), Juan Saldarriaga
- Universidad Simón Bolívar (Venezuela), Juan León Livinalli
- Georgia Tech, Emir José Macari
- Universidad Nacional Autónoma de México, Dorotea Barnés
- Sandia National Laboratories, Néstor Ortiz
- Colorado State University, Jorge Ramírez
- INTEC (Dominican Republic), Daniel Comarazamy
- Oak Ridge National Laboratory, David E. Reichle
- University of Florida, Paul Thompson
- Los Alamos National Laboratory, Alfred Sattelberger
- Universidad Nacional de Río Cuarto (Argentina), Héctor Garrera
- Lehigh University, Louis Martin-Vega
- Universidad Nacional de Córdoba (Argentina), Ricardo Rocca
- University of Guyana, Leslie Lewis
- Universidad de Chile, Luis Ayala Riquelme
- Universidad de Costa Rica, Manuel M. Murillo
- Universidad de la República (Uruguay), Daniel Panario

TABLE 1. ACTIVITIES PROMOTED, 1994-1996

KIND OF ACTIVITY	TOTAL OF ACTIVITIES
Conferences, workshops and seminars organized by CoHemis in PR	20
Conferences, workshops and seminars organized by CoHemis overseas	6
International forums in which CoHemis has participated	5
Trips to other countries	8
Countries visited	12
Proposals submitted	10
Proposals resulting from CoHemis activities	8
Other collaborations	8

TABLE 2. PARTICIPATION AND OUTREACH, 1994-1996

KIND OF ACTIVITY OR PARTICIPANT	TOTAL OF PARTICIPANTS
Conferences, workshops and seminars organized by CoHemis in PR	708 persons
Conferences, workshops and seminars organized by CoHemis overseas	431 persons
Co-sponsoring institutions	19 institutions
International guest resources participating in the activities	89 persons
Puerto Rico guest resources participating in the activities	32 persons
Co-sponsoring countries	10 countries
Host countries	6 countries

In the first meeting of Consortium delegates held in Mayagüez on June 16, 1994, it became clear that there is much to be gained in all directions from collaborations, exchanges, and joint programs. The member institutions comprise a magnificent pool of diversity and expertise in countless fields.

As a result of CoHemis activities and Consortium memorandums of understanding, many UPRM faculty members and students have and will be working at Sandia, Argonne, Los Alamos, and Oak Ridge National Laboratories during the summers. Two research faculty from Universidad de Río Cuarto, Argentina, spent two months working in a UPRM agricultural research facility in 1993 and 1996. A doctoral candidate from Universidad de Córdoba, Argentina, spent two months working for his dissertation with a UPRM civil engineering faculty. Three UPRM faculty belong to dissertation committees of UNC students.

CoHemis activities in Latin America and the Caribbean are carried on preferably with Consortium institutions. This includes inviting Consortium experts for sponsored activities in Puerto Rico, U.S. or elsewhere (e.g., Italy and Venezuela), and the organization of sponsored short courses (most of the Caterpillar-CoHemis short courses were presented by Consortium members). Also, in June 1996, using the CoHemis network, a UPRM professor was able to complete the NSF-funded five-researcher delegation that will represent Latin America in the "International Workshop on Advanced Composites in Construction" to be held in Italy. Two of these researchers belong to Consortium institutions.

INDIVIDUAL ADVISORS

The following persons collaborate with CoHemis as individuals committed to the enhancement of hemispheric collaboration activities.

- Anthony Dvorak, Argonne National Laboratory
- Manuel Gómez, Universidad de Puerto Rico
- Rafael Brás, Massachusetts Institute of Technology
- Carlos I. Pesquera, PR Department of Transportation and Public Works
- Bruce Baner Johnson, University of São Paulo (Brazil)
- Juan F. Facetti, Universidad Nacional de Asunción (Paraguay)

TYPES OF ACTIVITY CONDUCTED

CoHemis conducts activities related to education, research, dissemination, and service (see tables 1 and 2). Its main activities are:

- Organize, promote and/or propose short courses conducted by UPRM resources, or by Consortium resources with UPRM participation, to be presented in Puerto Rico or Latin America.
- Organize, promote and/or propose seminars, workshops, and conferences conducted by UPRM resources, or by Consortium resources with UPRM participation, to be presented in Puerto Rico or Latin America.
- Organize presentations, panels or discussion forums in PR on current topics related to science and technology, with the participation of Consortium and other resources.
- Disseminate general information (on UPR/PR or any other topic of interest to UPR/PR and overseas) by means of the newsletter "CoHemis...update" and the Internet. Promote UPRM activities and programs overseas.
- Answer requests, in Puerto Rico and overseas, for specific information on UPR/PR and other topics within the Center's scope. Offer information on the Center and its activities upon request from different UPR or UPRM programs and divisions.
- Participate in conferences, workshops and forum discussions in PR and overseas.
- Meet key government and academia representatives in US and other countries.
- Receive visitors related to the Center's mission or Consortium members; coordinate their meetings in UPR/UPRM or in PR government agencies.
- Facilitate for entities overseas to send students awarded with external grants to the UPRM Graduate School.
- Stimulate and help UPRM professors to make proposals for joint research projects and to organize activities of hemispheric reach. Facilitate and support those activities once approved.
- Foment and facilitate faculty and student internships and exchanges with institutions overseas, mainly with Consortium members.
- Collaborate with Puerto Ricans and other Hispanics and Latin Americans in the US in matters concerning education and research
- Propose and produce interinstitutional agreements that facilitate UPR/UPRM/CoHemis hemispheric objectives.

CoHEMIS BENEFITS FOR THE US, PUERTO RICO AND THE HEMISPHERE Global Competitiveness and Sustainable Development

CoHemis' activities benefit the Americas in many ways. The meetings and workshops enhance hemispheric human resources to achieve global competitiveness and sustainable development. The Consortium partnerships between institutions in the US and Latin America foster integration and cooperation towards common goals. CoHemis' activities facilitate the region's eventual economic integration and the protection of its environment and natural resources. They work as a training center in cultural diversity, global perspective, and inter-American relations for participants from both North and South.

The CoHemis Consortium provides a vehicle for universities, laboratories, and research centers from the Americas to establish contacts, exchanges, partnerships, and working relationships with each other. It means to provide an opportunity for the institutions to complement their resources and enhance their personnel, and for individual researchers from Latin America and the Caribbean to achieve personal goals without having to resort to permanent migration.

Technology improvements help to break the vicious circle of underdevelopment: this is a statement that most countries in Latin America and the Caribbean believe in and it is the reason why they participate in many regional and international S&T collaborative programs with European countries and Japan. It is the reason why many of them have S&T at a cabinet level.

CoHemis provides an opportunity for US decision-makers to foster economic growth in Latin America and the Caribbean, which is essential to US interests in terms of trade and drug and immigration control, with funds being actually spent in a US territory. The Center's activities reinforce the



Sophisticated equipment for the characterization of inorganic substances. The photograph was taken during CoHemis' visit to the Center of Mineral Technology (CETEM), Rio de Janeiro.

MAIN CoHEMIS ACHIEVEMENTS

- Making CoHemis and UPR into familiar institutions in the hemispheric scientific community and in Washington's science funding establishment.
- Enhancing the interaction between UPR and UPRM with government and industry in Puerto Rico with multinational firms.
- Publication for five years of a quarterly newsletter in Spanish & English that has reached a circulation of 1,000 copies.
- Creation of a home page on INTERNET.
- Creation of a still growing Consortium of collaborating institutions, with UPRM as its hub.
- Publication of four proceedings, one report, and one essay.
- Presentation of several papers at international meetings.
- Presentation of UPRM as an international site for graduate study in sciences and engineering in Spanish within the US system of higher education, especially suited for environmental studies and technologies and remote sensing applications.
- Collaboration with US Hispanic leaders and their communities.

efforts initiated by the government of Puerto Rico to stimulate the export of consulting services to Latin America and the Caribbean. Through the CoHemis Consortium, key US universities and national laboratories participate in these activities.

CoHemis conveys a positive image of Puerto Rico and fulfills the model of the island as a bridge between the Americas. The conferences, research projects, and continued education courses which the CoHemis Center stages in Puerto Rico provide many growth opportunities for the Puerto Rican science and engineering community, as well as to the hemispheric participants.

CoHemis collaborates also with many institutions in Puerto Rico, such as the PR State Department, PR Economic Development Administration, PR Department of Natural Resources, PR Planning Board, PR Telephone Company, PR Electric Power Authority, and the Economic Development Bank for PR. It promotes activities focused on enhancing important sectors of the economy of Puerto Rico, such as manufacturing, conference-tourism, resource management, and sustainable development.

FUNDING

CONTRIBUTIONS RECEIVED 1991-1996

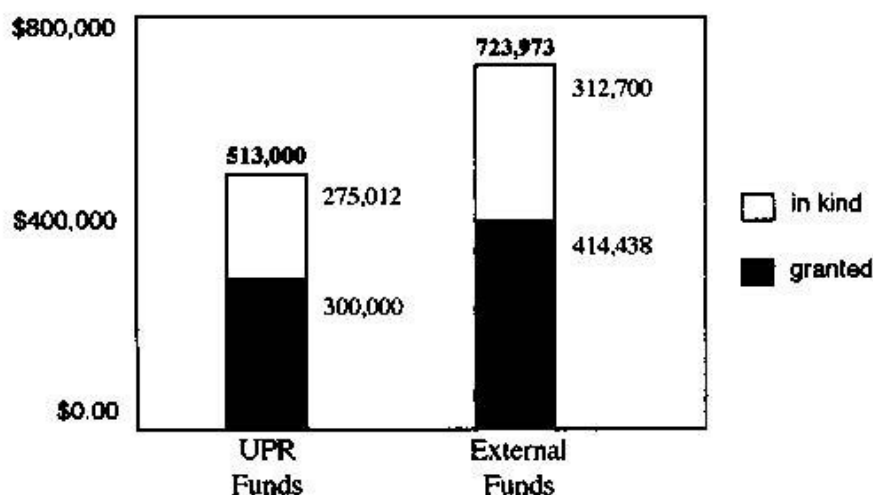


FIGURE 1. CoHEMIS FUNDING BY SOURCE

1993-1996

For the last three years, the Center has received a basic support of \$100,000 per year from the University of Puerto Rico, complemented by in-kind contributions from UPRM and its Research and Development Center, in order to maintain a skeleton organization capable of temporary growth for conducting specific activities, such as the ones sponsored by NSF programs; organizing major events like the "Conference for Remote Sensing and Environmental Monitoring for the Sustainable Development of the Americas," organized for the Raytheon Corporation; and the CoHemis-Caterpillar Short Course Series (see Tables 3 and 4).

That minimal organization cultivates relationships with potential sponsors, writes proposals, publishes the newsletter "CoHemis...update," keeps an electronic bulletin board, disseminates and exchanges information, organizes activities, visits countries in the hemisphere, produces alliances with other institutions of the hemisphere, and conducts hemispheric activities.

CoHemis has been able to get support and collaborations from the government, academia, and the private sector to organize many successful activities in Puerto Rico and Latin America (Figure 1). Between June 1993 and December 1996, the Center brought 89 international presenters and 32 from Puerto Rico together with about 1040 attendees from Latin America and the Caribbean for workshops and short courses on such themes as energy, environment, civil infrastructure, and waste disposal. This has been achieved through collaboration with universities, national laboratories, private firms, and national S&T organizations in 10 countries in our hemisphere (see Tables 2 on page 10).

TABLE 3. EXPENSES BY FUNDING SOURCE

A. UPR CENTRAL ADMINISTRATION FUNDS (from January 1992 to June 1996)			
Category	Total	Average Per Year	Percentage
Compensations for Co-Directors	\$55,079.00	\$15,736.86	18.36%
Management Personnel Salaries	\$64,177.45	\$18,336.41	21.39%
Secretarial Personnel Salaries	\$53,532.98	\$15,295.14	17.84%
Salaries/Wages for Edition/Translation	\$7,845.00	\$2,241.43	2.62%
Student Assistantships/Wages	\$11,796.00	\$3,370.29	3.93%
Fringe Benefits	\$27,869.00	\$7,962.57	9.29%
Trips, Lodging, and Per Diems in PR	\$6,381.00	\$1,823.14	2.13%
Trips, Lodging, and Per Diems Overseas	\$28,806.00	\$8,230.29	9.60%
Guests' and Advisors' Expenses	\$2,563.00	\$732.29	0.85%
Equipment	\$10,591.00	\$3,026.00	3.53%
Materials, Services, Computer Programs	\$17,926.00	\$5,121.71	5.98%
Reproductions and Printing	\$3,916.00	\$1,118.86	1.31%
Mail, FedEx, ect.	\$4,816.00	\$1,376.00	1.61%
Other Expenses	\$4,701.57	\$1,343.31	1.57%
TOTAL	\$300,000.00		

B. EXTERNAL FUNDS (from January 1991 to June 1996)			
Category	Total	Average Per Year	Percentage
Compensations for Researchers (UPR)	\$60,374.00	\$17,249.71	14.68%
Consultant Compensations (Non-UPR)	\$34,625.00	\$9,892.86	8.42%
Management Personnel Salaries	\$23,769.00	\$6,791.14	5.78%
Secretarial Personnel Salaries	\$13,248.93	\$3,785.41	3.22%
Salaries/Wages for Edition/Translation	\$1,762.50	\$503.57	0.43%
Student Assistantships/Wages	\$37,116.00	\$10,604.57	9.02%
Fringe Benefits	\$13,008.56	\$3,716.73	3.16%
Trips, Lodging, and Per Diems in PR	\$60,726.75	\$17,350.50	14.77%
Trips, Lodging, and Per Diems Overseas	\$61,631.00	\$17,608.86	14.99%
Guests' and Consultant Expenses	\$23,778.00	\$6,793.71	5.78%
Equipment	\$8,112.00	\$2,317.71	1.97%
Materials, Services, and Computer Programs	\$23,510.00	\$6,717.14	5.72%
Printing and Reproductions	\$18,944.00	\$5,412.57	4.61%
Mail, FedEx, Ect.	\$2,058.00	\$588.00	0.50%
Indirect Expenses	\$23,954.16	\$6,844.05	5.82%
Other Expenses	\$7,820.10	\$1,330.03	5.82%
TOTAL	\$414,438.00		

TABLE 4. TOTAL EXPENSES BY CATEGORIES AND PERCENTAGES

Category and Expense	Amount	Percentage	Expense Subtotal
Benefits for UPRM Personnel	\$311,058.92	44%	
Compensations for Researchers			\$115,453.00
Management and Secretarial Personnel			\$154,728.36
Fringe Benefits			\$40,877.56
Other UPRM Benefits	\$91,569.16	13%	
UPRM Students' Wages and Assistantships			\$48,912.00
Equipment			\$18,703.00
Indirect Costs			\$23,954.16
Communications and Newsletters	\$39,341.50	6%	
Printing, Mail			\$29,734.00
Edition			\$9,607.50
Activities' Direct Costs	\$218,510.75	31%	
Trips, Lodging, Guests' and Consultant Expenses			\$183,885.75
Consultants			\$34,625.00
Other Operational Costs	\$50,792.67	7%	
Materials, Services, Computer Programs			\$41,436.00
Other Expenses			\$12,521.67
TOTALS	\$711,273.00		\$714,438.00

CATEGORIES AND TOTAL CONTRIBUTIONS RECEIVED, 1991-1996

External funds granted to the Center. (by such entities as: NSF, PR government agencies, Raytheon, Caterpillar) **\$414,438.**

External in kind estimated contributions to CoHemis activities. (Example: Conferences for PR academia, government and/or industry, at no cost to UPR, payed for by collaborating institutions such as Consortium universities and national laboratories, USAID, UNEP, and CONICIT Venezuela) **\$312,700.**

UPR funds granted to the Center (between January, 1992 and June, 1996): **\$300,000**

UPRM release time contributions to CoHemis and its activities (Release time granted to CoHemis Director and activity PIs): **\$275,012.**

SUMMARY OF ACHIEVEMENTS, JUNE 1994 - JUNE 1996

PUBLICATIONS

CoHemis... update: A newsletter which began as an update on conference preparations became a quarterly after the event. Produced in English and Spanish (*CoHemis...al día*), it keeps about 500 key persons and institutions in the Americas informed on the progress of the center. "CoHemis...update" relays information on opportunities for collaborative research and on relevant UPRM events and covers current issues.

INTERNET Home Page. The Center keeps a home page on the Internet with information on CoHemis activities, upcoming events, and links with Consortium Institutions, electronic newsletter, etc.: <http://exodo.npr.ciu.edu/~signal/cohemis>

Luyanda, F., (ed.) *Proceedings of the CoHemis-NSF Conference on Transportation Research in the Americas*, UPRM, 1996. The papers, deliberations and conclusions which resulted from the CoHemis-NSF conferences and workshop within NASTO '95 held in Fajardo, Puerto Rico.

Macari, E.; Frost, D., and Pumarada, L. (eds.), *Proceedings of the Conference-Workshop on Geo-environmental Issues Facing the Americas*, American Society of Civil Engineering (ASCE), 1995.

Toutanji, H. (ed.). *Proceedings of the Conference-Workshop on the Repair and Rehabilitation of the Infrastructure of the Americas*, UPRM, 1995.

Korn, Adolfo, *Institutional Arrangements for the Establishment and Support of Technology Assessment Capacity: the African Context*, CoHemis-UPRM, October, 1994.

McClachlan, C., and Vega-Rosado, L.L. (eds.), *Proceedings of the Hemispheric Cooperation Conference on Engineering and Applied Science Research*: The papers, deliberations and conclusions of the 1991 event which resulted in the creation of CoHemis were produced in Spanish and English in a single volume. It constitutes an important document which describes the needs, deeds and capabilities of science and engineering research and education in most of Latin America: a most valuable resource for policy planning.

TABLE 5. TOTAL EXTERNAL CONTRIBUTIONS RECEIVED FOR SPECIFIC ACTIVITIES, 1994-1996

CATEGORY	TOTAL OF CONTRIBUTIONS
External funds granted to the Center	\$317,018.33
Estimated externally funded contributions to CoHemis' activities	\$165,900.00

CONFERENCES, WORKSHOPS, AND SEMINARS ORGANIZED IN PUERTO RICO, 1994-1996

- June 16, 1994; "First Consortium Meeting", (with Sandía NL, Los Alamos NL, Universidad Simón Bolívar, University of Florida, Georgia Tech, and the Universidad Nacional de México)
- June 29, 1994; "Solar Research in the Caribbean."
Speaker: Dr. Oliver Headley, University of West Indies. Site: UPRM
- August 29-30, 1994; "Conference-Workshop on the Repair and Rehabilitation of the Infrastructure of the Americas." Speakers: US-9; Canada-1; LAC-5; UPRM-3 (Co-sponsors: Georgia Tech and Sandia National Laboratories; NSF granted \$49,553*) Site: UPRM
- September 21-23, 1994; "A Workshop on Geo-Environmental Issues Facing the Americas,"
Speakers: US-8; LAC-6; PR-2 (NSF granted \$27,923; PRIDCO granted \$20,000) Site: UPRM
- December 1, 1994; "Bioconversion of Biomass to Ethanol," Speaker: Gerson Santos,
(Co-sponsor: US DOE) Site: UPRM
- December 12-17, 1994; Oak Ridge National Laboratory meetings with Puerto Rican agencies' representatives, arranged by CoHemis: Economic Development Administration, Science and Technology Board, Planning Board, Tourism Company, Aqueduct and Sewage Authority, Energy Affairs Administration, Natural Resources Department; Sites: PR's Agencies, UPR-Río Piedras, UPRM
- December 15-16, 1994; "Symposium on Alternative Energy Sources for PR and the Caribbean." Speakers: US-7; PR-9 (Co-sponsors: Oak Ridge and Sandia National Laboratories - \$40,000 in kind) Site: UPRM
- March 21-22, 1995; "Conference for Remote Sensing and Environmental Monitoring for the Sustainable Development of the Americas," Speakers: US-25; LAC-13; PR-7 (Co-sponsor: Argonne National Laboratory; Raytheon Corporation - \$100,000 in kind and granted \$24,278)
Site: Condado Beach Hotel, San Juan

* See Table 5 on top of page

- February 9-11, 1995; "Third Annual Conference of the Alliance for Hispanic Engineering Advancement," CoHemis collaborated with the UPRM Mechanical Engineering Department and the Chancellor in the organization of this event at UPRM. Speakers: US-8; UPRM-6; UPR-2
- February 6-10, 1995; "Fourth Meeting of the NIST Caribbean Measurement Assurance Program," CoHemis collaborated with NIST and the PR Consumer Affairs Department in the organization of this event at UPRM.
- June, 1995; "CoHemis / Caterpillar Short Courses on Landfill Waste Systems in Six Latin American Cities," Speakers: 2 (Co-sponsors: Consortium members, UNAM, UNIANDES, University of Costa Rica, National University of Cordoba, plus FUNDACYT-Ecuador and Catholic University of Chile; Caterpillar Corporation granted \$59,477) Sites: Mexico, Costa Rica, Colombia, Ecuador, Chile, and Argentina
- July, 1995; "Hemispheric Workshop on Transportation Research Issues of the Americas," Speakers: US-2; LAC-7; PR-2 (Co-sponsors: UPRM's Sea Grant, R&D, Transportation Technology Transfer, and Civil Infrastructure Research centers; PR Department of Transportation and Public Works - \$6,000 in kind; NSF granted \$29,885.33¹) Site: El Conquistador Hotel, Fajardo, PR
- October, 16, 1995; "Industry, Government and University...for the Economic Development," Speaker: Eng. Arcodaci, PIDCOP/UNS (Argentina) (Co-sponsors: UPRM Chemical Engineering Dept., UPRM R&D Center; PR Department of State) Sites: UPRM and the PR Department of State, San Juan
- November 21, 1995; Panel: "Experiences at National Laboratories: Professors and Students," Speakers: UPRM-6; Site: UPRM
- December 4, 5, 7, 1995; Conference Series: "Engineering, Society and Environment: Challenges to Planning," Speaker: Eng. Mauricio Ramos, CENDES, Venezuela (Co-sponsor: Planning School, UPR-Río Piedras) Sites: UPRM and UPR-Río Piedras
- March 5, 1996; Conference: "The Importance of the International Perspective in a Professional Formation," Speaker: Mr. Angelo Rodríguez, PR Federal Affairs Office at Washington, DC (Co-sponsor: PR Federal Affairs Administration) Site: UPRM
- April 24-25, 1996; Planning and scoping workshop: "Interdisciplinary Research and Training Program in Ethics for Business, Science, and Engineering in the Puerto Rican Context," Speakers: US-5; (NSF - \$10,590) Site: UPRM
- June 27-28, 1996; Seminar: "Daily Operations of a Landfill Waste Site and its Environmental Impacts," (Co-sponsor: BFI Industries) Speakers: PR-2. Site: UPRM and UPR-Bayamón

ACTIVITIES OVERSEAS

Short Course Series

"Caterpillar-CoHemis Consortium Short Course Series on Landfill Waste Disposal," Mexico City, San José, Bogotá and Cartagena, Quito, Santiago, and Córdoba, June 12-30, 1995. (Speakers: US-2) This course series was attended by about 431 participants and received good press coverage by newspapers and TV media, specially in Ecuador, Mexico, and Costa Rica. A second series took place in August 1996 in Lima, Santo Domingo, Bogotá, and Guadalajara which was attended by about 290 persons.

International Conferences

CoHemis has presented papers and represented UPR in:

- Workshop on Environmental Quality, State-of-the-Art Technology, and Sustainable Development in the context of NAFTA, Mexico City, February 7-11, 1996.
- Regional Conference on University-Industry Cooperation in the Caribbean (UNICC '95), St. Augustine, Trinidad & Tobago, September 26-27, 1995.
- Fourth Scientific Conference: Caribbean-Peoples and States-Cooperation and Integration, Santo Domingo, Dominican Republic, November 20-27, 1994
- Third Annual Meeting of Technology Transfer Centers of the Panamerican Institute of Highways, Sao Paulo, Brasil, November 5-10, 1994.
- "International Technical, Business, and Career Conference", Cancun, Mexico, June 2-4, 1994.

Meetings

CoHemis co-directors have visited the following cities since 1994 to meet with S&T, government, and university officials to foster research and educational collaboration on behalf of UPRM and the CoHemis Consortium: México City and Guadalajara, México; Washington and Chicago, USA; Córdoba, Buenos Aires, Bahía Blanca and Río Cuarto, Argentina; Santiago, Chile; Santo Domingo, Dominican Republic; Montevideo, Uruguay; Bogotá and Cartagena, Colombia; San José, Guacimo and Turrialba, Costa Rica; St. Augustine and Port of Spain, Trinidad & Tobago; Asunción, Paraguay; La Paz and Cochabamba, Bolivia; Brasilia, Sao Paulo, San José dos Campos, and Rio de Janeiro, Brazil; Lima, Perú.

In Washington, DC, the following have been visited: the Armed Forces Institute of Pathology (AFIP) and the National Institute of Standards and Technology (NIST); the offices of the following Hispanic Congressmen: José Serrano, Nydia Velázquez, Luis Gutiérrez, Xavier Becerra, and Ed Pastor; the PR Federal Affairs Administration; the UPR Washington Lobby; the PR Resident Commissioner; the White House PR Initiatives Office; the House of Representatives Science Committee; the Department of State USAID Bureau for Latin America and the Caribbean; the House Science Subcommittee on Basic Research; the White House Office of Science and Technology Policy, the National Science

Foundation; the Department of Energy; the Department of Commerce, the Environmental Protection Agency, the Department of Agriculture, and executives from the Topographic Engineering Center of the US Corps of Engineers.

OTHER ACTIVITIES AND ACHIEVEMENTS

CoHemis initiated a collaborative agreement among UPRM, Argonne National Laboratories, and Chicago's Roberto Clemente Community High School to provide information and motivation to those students interested in science and engineering. As a result, CoHemis Director Luis Pumarada O'Neill and other UPRM professors and Argonne researchers have visited Clemente and addressed its students to serve as role models and make presentations on college and research opportunities. CoHemis has also hosted Clemente student visits to UPRM. One Clemente graduate is now studying engineering at UPRM and another has participated in a UPRM pre-engineering summer camp.

The newsletter *CoHemis...update* has provided a Colombian graduate student the possibility of receiving funding for postgraduate studies. In 1995, an interview with Marcela Durán, from UPRM's Civil Engineering Department, was featured in the "UPRM's Latin American Graduate Students" section. This allowed a Georgia Tech faculty to contact and offer her the opportunity to continue doctoral studies in water resources management at Georgia Tech, since this doctorate is not offered at UPRM nor at any Colombian institution.

After a presentation in the Third Annual Meeting of the Technology Transfer Centers of the Pan-American Institute of Highways held in Brazil, CoHemis was asked to provide information so to be considered for the International Road Federation (IRF) Fellowship Program. The information provided on UPRM enabled a Nicaraguan student receive IRF funding to enter UPRM's Civil Engineering Graduate Program. CoHemis helped Eng. José Santana throughout his application process. Santana has now completed his first semester at UPRM.

PROPOSALS SUBMITTED

- "NIST-CoHemis Metrology and Quality Training Center for the Americas." One year and \$127,475 (submitted to NIST -Department of Commerce) 1995. Pending.
- "Ocean/Atmosphere Gas Exchange and Global Change in the Interamerican Region -- A Planning Grant." One year and \$49,500 (NSF - Global Change) 1995. Not funded.
- "Enhancing Education in Ethics and Values for Business, Science and Engineering Students". One year and \$128,361 (NSF) 1993 and resubmitted in 1995. NSF granted \$10,500 for the "Planning and Scoping Workshop." Resubmission on August 1996.
- "International Educational Needs in a Changing Economy." Two years and \$96,000 (Institute for International Public Policy) 1995.
- "Conference on Remote Sensing for Environmental Monitoring and Sustainable Development in the Americas." Six months and \$27,000 (Raytheon Corporation) 1994. Funded; held.
- "Short Course Series on Design and Construction of Landfill Waste Disposal Sites." Eight months and \$60,000 (Caterpillar Co.) 1994. Funded; held.

- "Transportation Research Workshop in the NASTO 95 Meeting in Fajardo, Puerto Rico."
Eight months and \$36,000 (NSF, PR Department of Transportation
and Public Works) 1994. Funded; held.

Proposals Resulting from CoHemis Activities: Submitted or in Preparation:

- "Cooperative Network for Renewable Resource Measurements Project: Puerto Rico Center"
(submitted with the Puerto Rico Energy Affairs Administration to DOE; not funded).
- "Constructed Wetlands for Water Treatment"
(to be submitted to the PR Science and Technology Board with Oak Ridge
National Laboratory).
- "An Industry/Government Partnership to Foster the Use and Development of Renewable Energy
Resources and Energy Efficient Technologies in Puerto Rico and the Caribbean"
(submitted to the PR Energy Affairs Administration and DOE; pending).
- "Tropical Center for Earth and Space Sciences" (UPR; approved by NASA).
- "Durability of Fiber-reinforced Composites Used in Bridge Repairs and Rehabilitation"
(U.S.-P.R.-Canada-Mexico, submitted to NSF; not funded).
- "Radar Measuring Comparing and Analyzing Mesosphere Winds from Puerto Rico
and Colombia" (joint PR-Colombia; in preparation).
- "Dynamic Response Testing of Two Nuclear Reactors in Argentina Using
Underground Explosions" (submitted to University of Cordoba's R&D Secretariat; not funded).

SHORT-TERM PLANS

A symposium commemorating CoHemis' 5th anniversary is being contemplated. The symposium would have the participation of three presidents of Consortium universities who will make presentations on science and technology policies. Vice-President Albert C. Gore has been invited to participate.

Joint research pre-proposals involving researchers from North and South are being evaluated and enhanced prior to being completed and submitted to compete for funding.

Trip to the Dominican Republic with Sandia National Laboratories to present an energy planning scheme.

Coordinating a Caribbean-wide TV campaign for controlling the dumping of garbage by ships. This will be funded by IMO.

"Seminar-Workshop on the State-of-the-art and Future Directions in the Repair and Rehabilitation of Reinforced Concrete Structures." (NSF, CYTED, Universidad del Zulia in Maracaibo, Venezuela). Early 1997.

"Caterpillar-CoHemis Second Short Course Series on Design and Construction of Landfill Waste Disposal Sites" at Guadalajara, Lima, Bogotá, Santo Domingo (Georgia Tech, ENIADES, CONCYTEC, Perú, Universidad de Guadalajara, INTEC). August 1996

A Vital Issues Process event is being conducted in Puerto Rico for Sandia National Laboratories, focusing on PR's water resources management issues.

Articles are being requested from the different countries of Latin America on Environmentally Conscious Manufacturing topics. They will be included in the March, 1997 issue of the *International Journal of Environmentally Conscious Design and Manufacturing*, with CoHemis as invited editor.

The presentation of a \$5M, three-year proposal, jointly with the Puerto Rico Energy Affairs Administration, UPR, and Universidad del Turabo, is being scheduled for the United States Department of Energy in Washington, DC. The proposal seeks to establish a Puerto Rican Center for Renewable Energy and Energy Efficiency to facilitate applied research and technology transfer in Latin America and the Caribbean.

PENDING PROJECTS

A joint proposal to USAID is being planned with Universidad Mayor de San Simón (Cochabamba, Bolivia) for setting up graduate programs in science and engineering in that institution with the collaboration of UPRM.

CoHemis and Georgia Tech are seeking cosponsors to present a Hemispheric Conference on Technology Assessment, Monitoring and Forecasting. The PR Development Bank has committed some funds, Argonne National Labs, CONICYT-Chile and CENDES-Venezuela have expressed interest in cosponsoring and/or fund-raising.

Collaborations in the creation of joint educational and research efforts with a future GIS/Remote Sensing Education and Training Center for the Americas operating at UPRM's LARSIP laboratory are being explored with Colombia's CIAF, Brazil's INPE, and Perú's Geophysical Institute. Joint research and education programs will be considered.

A proposal is being prepared, as requested by INTERTECH (Interamerican Education in Technology and Engineering) to organize their 1998 convention in Puerto Rico.

Symposium on environmental and toxicological effects of Metal Ions is being proposed, jointly with the UPRM Department of Chemistry; Ponce School of Medicine, Armed Forces Institute of Pathology, and the private sector.

A "Hemispheric Workshop on Thermodynamics Research" is being organized and proposed.

A "Hemispheric Workshop on International Practice for Civil Engineering Design and Construction" is being proposed.

CoHemis is collaborating in the organization of PACAM V, the Fifth Meeting of the Panamerican Associations of Applied Mechanics (San Juan, January 1997).

An international short course on Environmental Impacts Assessments is being put together.

STRATEGIC OUTLOOK

TECHNOLOGY ASSESSMENT AND ENVIRONMENTAL EXPERTISE AND EXPERIENCE

Puerto Rico's science and engineering community has many years of experience in dealing with the US' strong environmental laws and regulations within cultural, ecological, and socioeconomic settings which are similar to most of Central America, South America and the Caribbean. This resource, best developed within the UPRM, makes the center ideal to provide Technology Assessment services and environmental training for Latin America and the Caribbean.

EDUCATION AND TRAINING

Puerto Rican and Latin American and Caribbean students and professors who work together with North Americans and Canadians in collaborative projects or participate in workshops will acquire knowledge and contacts which will allow them, and their respective countries, to compete more successfully in a high technology and environmentally conscious global economy. These benefits for the University's Puerto Rican and hemispheric students will mostly be supported by outside sources, such as USAID, the Inter-American Development Bank, and the National Science Foundation.

An active, full-fledged CoHemis Center will be crucial to the development of UPRM doctoral programs and for increasing the number of Puerto Ricans holding Ph.Ds. in science and engineering. The research activity, continued education programs, graduate assistantships, and high hemispheric profile which UPRM will derive from CoHemis will provide a hemispheric scale to its Graduate School. This scale will enable UPRM to sustain doctoral programs which would not be feasible if they were to serve only the demand of Puerto Rico. The interests of the US, Puerto Rico and the other countries of the Americas go hand in hand in enhancing UPRM. This university's activities will boast the quality and size of the pool of human resources which constitute Puerto Rico's and Latin America's scientific and engineering community, so crucial for economic development in this day and age.

COHEMIS HAS IDENTIFIED THE FOLLOWING STRATEGIC OPPORTUNITIES FOR UPRM:

1. Many Puerto Rico and US entities interested in science and technology look forward to entering the Latin American and Caribbean market, and are seeking contacts that allow so. CoHemis has the knowledge and contacts they need, either at or through the Consortium institutions.

2. Demand for science and engineering short courses conducted in English and Spanish is growing in Latin America. This demand will increase as economic integration advances and international licenses for engineering practice are required. CoHemis has access to the resources needed to satisfy this demand and to Consortium members at the countries who may organize the courses.

3. Many US and Canadian universities are interested in opportunities for immersion into Latin American culture and Spanish language that will allow their students and faculty familiarize with the way business is done in Latin American countries.
4. The hemispheric initiative of the Summit of the Americas and their conference series on economic integration, environmental protection, and collaboration in science and technology provide a meeting ground for the development of the multinational research center recommended in the 1991 Conference.
5. The Puerto Rican science and technology community has broad experience in environment fields: measurements, assessments, environmental impact studies, regulations, modeling, and mitigation technologies; all within a tropical, Caribbean and Latin context. This community creates an opportunity to successfully collaborate with Latin American countries who are just starting to study, assess and regulate contamination and find themselves compelled to set and comply with effective control levels.
6. The initiative of the Summit of the Americas provides CoHemis, UPR, and Puerto Rico the opportunity of having a significant role as bridge between the Americas in the three fields mentioned above to the benefit of all parties concerned.

PROPOSED STRATEGIES

To achieve its objectives, the Center management delineated the following strategies:

- Position CoHemis through strategic networking, personal contacts, and consistent follow-up communications to take full advantage of Puerto Rico's and UPR's capabilities to the benefit of Puerto Rico and all the participating countries.
- Develop and implement programs for exchanging faculty, graduate students and information, and for training and research.
- Identify areas in science and technology in which the faculty and facilities of collaborating institutions complement each other to make it feasible to conduct joint research and technology assessment projects.
- Seek financial support for such projects from diverse national and international sources.
- Increase and strengthen the bonds among universities, national science and technology organizations, and other education and research entities in Latin America, Puerto Rico and the US, mainly in those areas where problem solution requires multidisciplinary research and consulting in which Puerto Rico has comparative advantages. Some areas to be considered are: manufacturing, technology assessment, environmental impact studies, metrology and standardization, remote sensing, environmental science and technology, and marine sciences.
- Propose more activities conducted in Spanish language in Latin America within the Consortium framework. Select UPRM experts who are competitive with Consortium resources. Identify Consortium resources willing and able to offer courses conducted in Spanish in Latin America.
- Extend the CoHemis Consortium in order to include all Latin American countries and additional collaboration-minded US universities.

- Increase CoHemis' participation in the initiatives of the Summit of the Americas and within the general S&T relationships between US and Latin America. This would be accomplished highlighting CoHemis' experience as an effective vehicle for North-South collaboration which will complement US resources, funds, and initiatives.
- Disseminate the benefits of making alliances with other countries in the hemisphere. Consolidate joint ventures. Identify organizations willing to develop initiatives in Latin America and propose to be their partners.
- Develop proposals for immersion short courses on relevant aspects of Puerto Rico and Latin America for US and Canadian universities. This could be matched with student and faculty exchanges.
- Extend CoHemis' initiatives to embrace other University of Puerto Rico campuses.
- Improve CoHemis' relationships with federal and national government agencies. This can be done by mechanisms such as inviting observers to participate in our activities.
- Take advantage of CoHemis' potential for improving the quality and quantity of Latin American students who enter UPRM.
- Develop a network of Puerto Rican professionals living in the US with outstanding professional profiles or leaders in S&T areas who may be willing to collaborate with CoHemis' objectives.
- Encourage UPRM faculty to propose initiatives regarding these strategies with CoHemis collaboration.



UPRM's Chancellor, Dr. Stuart J. Ramos, signs in February 1995 an agreement with Roberto Clemente High School and Argonne National Laboratories. On his left is Dr. Margaret Tolbert, Argonne's director of educational programs, and on his right is Mr. Carlos Ortiz, assistant principal of the Chicago high school. Argonne and UPRM collaborate to provide role models, teacher education, educational trips and career orientation to the school's mostly Hispanic students. CoHemis, which promoted the agreement, coordinates these activities. In addition to the activities which have been organized and impacted hundreds of seniors, one Clemente alumnus has been admitted to UPRM's School of Engineering.

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