

MINI-REPORT 2010

INDUSTRIAL OUTREACH PROGRAM IN MEXICO – QUERETARO



WEST VIRGINIA UNIVERSITY
in collaboration with
CLEMSON UNIVERSITY
and our Mexican Host Institution
COUNCIL FOR SCIENCE AND TECHNOLOGY
OF QUERETARO (CONCyTEQ)

Participating Institutions:

- UNIVERSIDAD AUTONOMA DE QUERETARO, (UAQ)
- INSTITUTO TECNOLÓGICO DE QUERETARO, (ITQ)
- INSTITUTO TECNOLÓGICO DE ESTUDIOS SUPERIORES DE MONTERREY, (ITESM)
- CENTRO DE INVESTIGACION DE CIENCIA Y TECNOLOGIA APLICADA del IPN, (CICATA)

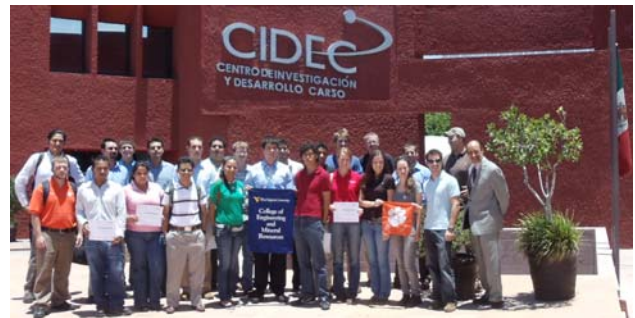


WVU students visiting Teotihuacan Pyramids. Summer 2010

What is the likelihood that engineers have to travel abroad as part of the job? What are the chances that engineers have to deal or negotiate with professionals from different countries, with different cultures and languages? How many job opportunities are there in engineering, which require significant international experience? ...

.....More than ever !!

West Virginia University has now teamed with Clemson University to provide engineering students with the opportunity of gaining international and professional experience through the *Industrial Outreach Program in Mexico*. This is a unique program which provides an ideal environment for students to immerse themselves in a different culture while applying and honing engineering skills in practical industrial projects in a professional international setting. In this Program, students learn the dynamics of teamwork to achieve common goals despite language and cultural differences. In the process, students learn about themselves as individuals and gain a new perspective on the role of their profession in a global society.



WVU, Clemson and Mexican students at CIDEe in Queretaro

Objectives of the Program

The objective of this program is first and foremost, to add value to engineering education and to produce top quality engineering graduates with global competencies, by providing a meaningful industrial experience in a multicultural and multilingual professional environment. The program also seeks to bring value to industry through the projects assigned to the participating students, who apply practical engineering skills, interpersonal and communication skills and ultimately leadership skills. Finally, this program seeks to bring participating faculty members and engineers from industry to share expertise, capacities and experiences in formulating and solving meaningful engineering problems.

Description of Sample Projects of the 2010 cycle

This year a group of 27 students from the USA and Mexico worked on seven industrial sites at CIDEe, VRK, GE, CENAM, BOMBARDIER, CIATEQ and IMT. Students engaged with engineers from each company and contributed to the solution or design and analysis of a variety of mechanical and industrial systems.

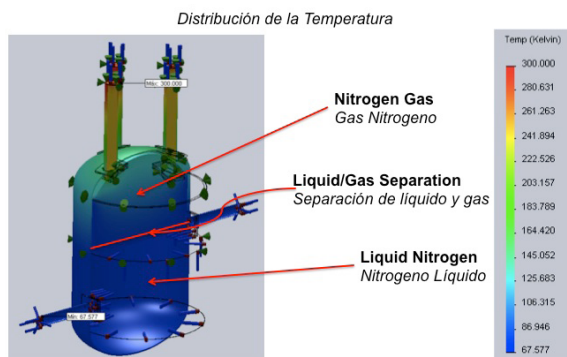
Four Mexican Universities teamed up with WVU and CU; IPN-CICATA-Queretaro, University of Queretaro (UAQ), Monterrey Tech-Queretaro Branch (ITESM) and the Technological Institute of Queretaro (ITQ).

By teaming up with Mexican students, USA students experience a cultural immersion that is reciprocated to the Mexican students. The mix of professional environment with a different culture provides a framework that brings an added dimension to the engineering experience. Students learn and fine-tune their technical skills while they hone their communication and interpersonal skills.

At the end of the six-week exercise each team make a presentation of the sponsor. US students make their presentation in Spanish while Mexican students make their presentation in English. This is a character-building exercise that brings the cultures and personalities to the forefront of the projects and provides a multi-cultural professional experience. Meanwhile US students live with local families who provide a home away from home, for a total cultural immersion. A brief description of these projects follows.

1. Project at CIDEQ (ConduMex)

In this project, students worked on the modeling, design and analysis of a cryogenic pressure vessel for liquid nitrogen to be used in the operation of a superconductor system. The emphasis was placed on the mechanical design of the vessel under thermal and mechanical loads.



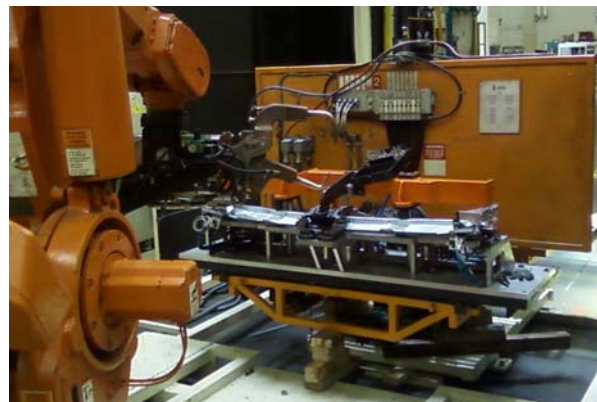
Superconductor development at Center for Research and Development of Group Carso in Queretaro

Cryogenic temperatures and high vacuum pressures pose special design integrity challenges which require both computational modeling as well as experimental

testing to be performed in order to determine realistic conditions of operation for the complete system. This project was in fact a follow up of the previous year's project which is now in construction at an industrial site in Queretaro. The student team was comprised by one student from WVU, one from Clemson one student from CICATA and one from Queretaro Tech. They worked under the advice of CIDEQ engineers and faculty advisors.

2. Project at VRK

In this company, aluminum and steel structures and components for automotive applications are manufactured and assembled. High efficiency and quality requirements of various component designs require the use of advanced manufacturing systems including automated manufacturing cells. For proper quality production, several jigs and fixtures are often needed. The team in this company designed and tested various devices to provide quick and accurate-position fixation devices for a computerized manufacturing cell.



Work cell and fixtures for welding processes of aluminum automotive structures at VRK

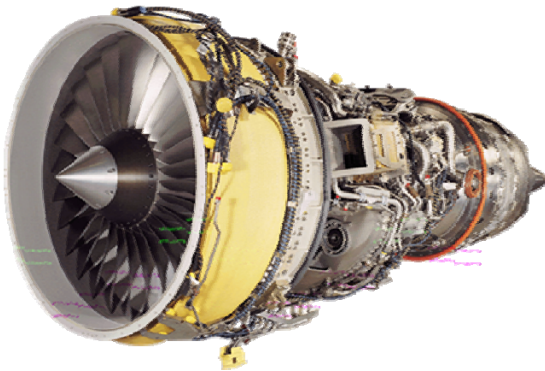
The team also produced the design of a mechanism for a special tool-handling system considering human factors to improve quality of product, reduce stress on the worker and increase the life of the tool.

In this project two students from Clemson University teamed up with one student from ITQ and one student from ITESM under the advice and supervision of VRK Engineers and faculty advisors.

3. Project at CIAT (GE-Aircraft Engines)

One project was developed at GE Aircraft Engines at the Queretaro Site. The problem involved the finite element modeling and vibration analysis of tubing elements used in

turbine engines. The main objectives was to determine the dynamic response of these tubes within the operation range of engines



GE-Turbine engine with tubing around the housing

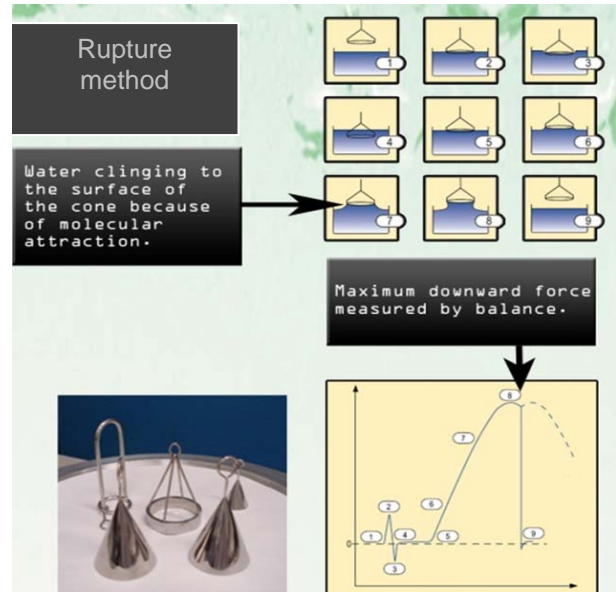


CIAT Team in GE Queretaro Site

The finite element models developed provide a useful simulation of vibration response that can be used for effective fixation and bracketing of tubes and for potential damage analysis. In this project one student from WVU and one from UAQ worked under the advice and supervision of one GE Engineer and faculty advisors.

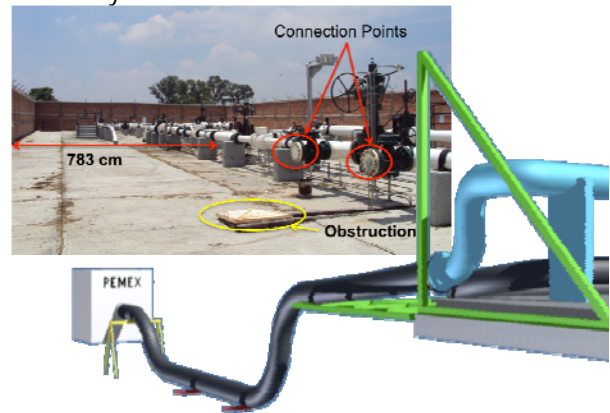
4. Projects at CENAM

Two projects were developed at CENAM, The National Center of Metrology in Mexico (equivalent to NIST in the USA). The challenge in one project was to design a system for measuring the surface tension of fluids with improved accuracy as compared to currently used methods and at a fraction of the cost of commercially available systems. The team actually designed and tested a measuring device and system that substantially improved the accuracy of the measurements at a small fraction of the cost of a commercially available system.



Surface tension experiment set up at CENAM

A second project consisted of designing a flexible and portable lifting system to be used with heavy duty coriolis flow-meters. The resulting system reduced the time for assembly and reduced the stress on operators of these flow meters. This team was formed by one student from WVU, one from ITESM, one from CU and one from UAQ, they worked under the advice of researchers from CENAM and faculty advisors.



Flexible component lifting system for coriolis flow-meters

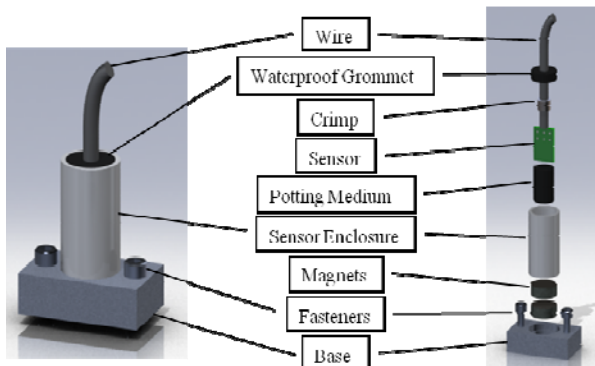
5. Project at CIATEQ

Two projects were developed at the Center for Advanced Engineering and Technology of the State of Queretaro (CIATEQ). Both projects involved the design of robust containers for micro sensors used in harsh environments in such a way that the electronic circuit boards could be protected and prevented from failing under harsh loading conditions. The containers in addition needed to be easy to assemble and cost effective.



CIATEQ team making final presentation

The team produced several containers that were built and successfully tested for the applications provided. In this project two students from CU teamed up with one student from ITQ and one from CICATA working under the advice from engineers from CIATEQ and faculty advisors.

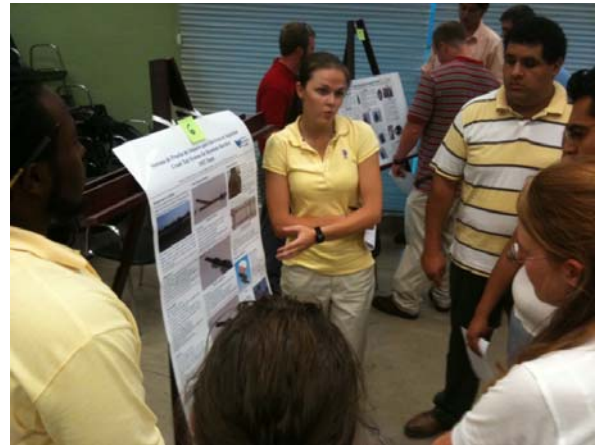


Cylinder sensor enclosure with magnetically attached base

6. Project at ITM

Two projects were developed at the Mexican Institute of Transportation (ITM) both related to the development of a testing protocol for the collision of a light-weight truck and standard highway barriers, currently being tested for effectiveness in protecting people (as opposed to vehicles). The challenge consisted in the design of a system for driving a "test vehicle" without conductor in such a way that the collision occurs at a given speed and at a given target within the barrier. The system in addition had to be safe as to avoid unintended collisions with other objects or outside the target range and should also be cost effective and should not produce damage to the testing track-facility. One team focused on the push-pull propulsion of the bullet vehicle and the second team focused on the steering the vehicle to the target.

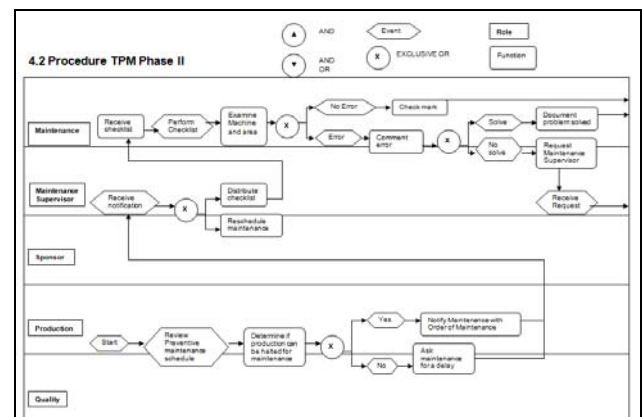
This team consisted of five students, two from CU, one from WVU, one student from UAQ and one from ITESM under the direction of researchers from IMT and faculty advisors.



IMT Team during a Friday poster session

7. Projects at Bombardier

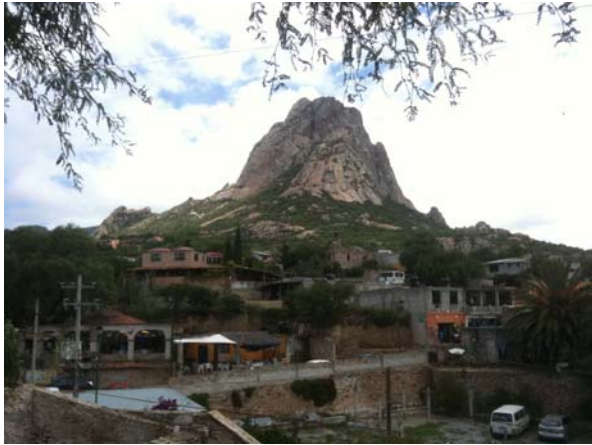
Two projects were developed by a team of four students at Bombardier. One team's project addressed human factors and effectiveness of an andon-light system for summoning the attention of appropriate personnel to reduce idle time in assembly lines through a combination of light, sound and positioning of the andon-lights. The other team's project dealt with the reduction of downtime of wiring machines used for the assembly of wire bunches for airplane electronic harnesses. Machine function and operators interaction were important elements to address and incorporate in producing improved procedures for an efficient industrial wiring operation at the manufacturing cell assigned. This group consisted of one student from WVU, one from CU, one from CICATA and one from ITQ, who worked under close supervision of engineers at Bombardier and faculty advisors.



Partial operations process for wiring bunches at Bombardier

Cultural Highlights

Cultural opportunities are plentiful on a daily basis in the city of Queretaro, with imposing colonial buildings, and a well preserved Spanish style architecture. The city offers many cultural attractions and a vibrant cultural life in the city with excellent and affordable restaurants, bistros and shops in a family-friendly ambiance.



Town of Pena de Bernal

Host families also provide a major cultural opportunity, as they provide a “home away from home” environment, clean and safe environment along with some kind of an “extended family” feeling. Students learn about Mexican food, Spanish, traditions and participate fully on social activities with the friendly local people of Queretaro.

Throughout the six weeks. Visits to archeological sites, hiking rides, and visits to small towns are conducted in the company of local students. Weekend tours included visits to picturesque San Miguel Allende, the magic city of Guanajuato, the traditional town of Tequisquiapan, also a visit and hike to Pena de Bernal (a monolithic rock), a visit to the Teotihuacan Pyramids archeological site and a visit to the Anthropology Museum of Mexico City.

The program culminates with a long weekend at the Ixtapa resort at the golden pacific coast of Mexico....

Conclusion

This Program is unique in the USA and Mexico. It pursues the main objective of adding value to

engineering education through the development of global competencies, acquired through a meaningful engineering project in an international professional setting, providing an exhilarating full cultural immersion.

The program addresses issues that range from communication skills and cultural differences to human relations in the context of a practical project that requires engineering skills. This experience has brought forward not only the practical engineering dimension and technical skills, but also the human dimension that comes with the territory.



Group at San Miguel de Allende

The international dimension in engineering education has acquired an added significance in today's globalized economy. Many major and midsize industries have rapidly expanded their industrial operations beyond borders, and it is more likely than ever, that engineering graduates will have to deal with professionals from different cultures in the job place. Under these circumstances, being able to understand and moreover anticipate cultural differences and communications issues.



Group by the Newton Tree at Mexico's National Metrology Center

Institutions Involved	Participant students	Faculty from both countries	Industrial Liaisons	Industries/Research Centers	Projects developed
<ul style="list-style-type: none"> • West Virginia University • University of Guanajuato • University of Queretaro • Institute of Technology of Queretaro • CONCyTEQ Queretaro • ITESM (Tec. De Monterrey) • CICATA (IPN) • UPQ • UNAM • Clemson University USA 	120 (WVU) 10 (UG) 51 (UAQ) 49 (ITQ) 21 (ITESM) 4 (CICATA) 9 (Clemson)	3 (WVU) 2 (UG) 4 (UAQ) 6 (ITQ) 4 (ITESM) 2 (CICATA) 2(Clemson)	(2) GM (Gto) (4) TREMEC (Qro) (2) Transm-TSP (Qro) (1) Micro-Troq. (Qro) (3) IMT (Qro) (2) LAPEM (Gto) (2) I. Turbo Reactores (1) Terramite (WV) (3) KOSA (3) New Holland (1) InMec (3) CENAM (2) ANSYS Mexico (1) Irving de Mexico (1) Crown Mexico (2) Arvin-Meritor (2) Gabriel (4) Mabe-GE Appliances (2) ConduMex (5) CIAT-GE Aircraft E. (3) VRK (Automotive) (2) Bombardier	GM TREMEC Transmisiones-TSP Micro-Troquelados IMT* LAPEM* ITR (TurboReactores) Terramite Corp.** KOSA New Holland InMec CENAM Group SSC (ANSYS) Irving- Composites Crown Mexico Mabe (CIDEQ) ConduMex Arvin Meritor Gabriel CIAT-GE Aircraft E. VRK Automotive CIATEQ (B. Quintana) Bombardier * Research Centers ** From West Virginia	(1) GM Mexico (8) TREMEC (4) SPICER-TSP (1) Micro-Troq. (5) IMT (2) LAPEM (2) I. TurboReactores (1) TerramiteCorp.** (3) KOSA (3) New Holland (1) InMec (5) CENAM (1) Irving (1) Crown (8) CIAT (2) ConduMex (9) Mabe (2) Arvin Meritor (2) Gabriel (6) CIAT (6) VRK Automotive (2) CIATEQ (2)CIDEQ ** From West Virginia
9 Institutions	264 Students	23 Faculty	51 Liaisons	22 Companies	77 Projects

Fourteen-year summary table of people, companies and projects developed in this Program.

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Join us in Queretaro, Summer 2011!