

MINI-REPORT 2012

INDUSTRIAL OUTREACH PROGRAM IN MEXICO – QUERETARO WEST VIRGINIA UNIVERSITY in collaboration with Mexican Host Institution and the COUNCIL FOR SCIENCE AND TECHNOLOGY OF QUERETARO (CONCyTEQ)

With Participating Institutions:

- UNIVERSIDAD AUTONOMA DE QUERETARO, (UAQ)
- INSTITUTO TECNOLOGICO DE ESTUDIOS SUPERIORES DE MONTERREY, (ITESM)
- INSTITUTO TECNOLOGICO DE QUERETARO, (ITQ)
- CENTRO DE INVESTIGACION DE CIENCIA Y TECNOLOGIA APLICADA del IPN, (CICATA)
- UNIVERSIDAD POLITECNICA DE QUERETARO(UPQ)
- UNIVERSIDAD TECNOLOGICA DE QUERETARO(UTEQ)
- INSTITUTO TECNOLOGICO DE SAN JUAN DEL RIO(ITSJR)
- UNIVERSIDAD TECNOLOGICA DE SAN JUAN DEL RIO (UTSJR)

Industrial Sponsors:

- TREMEC – Automotive Transmissions
- CIDECE – Technology Development Center for Group CARSO – Electric Cables and Harnesses
- CNH – Case New Holland Agricultural Tractors
- MESSIER SERVICES – Aerospace Landing Gear
- MABE – Domestic Appliances
- CENAM – National Metrology Center



BOMBARDIER



Global Competencies Anyone?.....

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? How much are global competencies sought after by industry?

.....More than ever !!

Introduction

This year, West Virginia University teamed with six universities in Queretaro, Mexico 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.

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 to attain deliverables. 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.

Global Competencies

A definition of a globally competent engineer is one who is capable of working effectively with people who define problems differently. This program complies with this concept by focusing in the following global competencies:

- The ability of working effectively in teams with people of different backgrounds and disciplines.
- The ability of effective communication in spite of language and cultural barriers.
- Cultural adaptability and sensitivity in the work environment.
- The ability to identify and resolve cultural issues that may affect professional work.

Description of Sample Projects of the 2012 cycle

This year a group of 21 students from the USA and Mexico worked on eight industrial sites at CIDECA, MABE, CNH, TREMEC, CENAM and MESSIER. Students engaged with engineers from each company and contributed to the solution or design and analysis of a variety of mechanical and industrial systems.

Eight Mexican Universities teamed up with WVU and CU; IPN-CICATA-Queretaro, University of Queretaro (UAQ), Monterrey Tech-Queretaro Branch (ITESM) the Technological Institute of Queretaro (ITQ), The Technological University of Queretaro (UTEQ), Technological University of San Juan del Rio (UTSJR) and the Technological Institute of San Juan del Rio (ITSJR).

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 makes a final professional 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 rich and total cultural immersion.

Typical day at work

All US students and few Mexican students gather every morning at 7:30 at a designated location within walking distance to their homes. Every morning US faculty advisors greet students in the morning for few minutes to exchange daily news bits in a relaxed friendly manner. A transportation schedule is arranged to deliver the various teams at their industrial sites from 8:00 to 9:00 depending on the site. Students work the full day at the industrial site where the other Mexican students arrive on their own. Faculty advisors carry out a weekly schedule of visitations to each industrial site to guide, monitor and assist each project. These visitations become the

mechanism for faculty-practitioner interaction and exchange. At the end of the day, students are picked up and transported back to their host family home.

Fridays are a little different, after the lunch break, all students are transported to a designated conference room, where each team delivers a brief presentation to the rest of the group to report progress and to solicit suggestions. Faculty members from the US and Mexico take the opportunity to advice, question and assess the progress in each project.

Typical day at home and social scene

The typical day starts with a home-made breakfast prior to the morning “buenos dias” chat at 7:30, at around 5:30 pm, students are back home where dinner is served by the host families. Some students opt to go to the gym or go out for a jog in the neighborhood. After dinner, around 8:00 students have the option to socialize (many times with Mexican students who find time to share with US students). Fridays typically ends up with a friendly soccer game at Monterrey Tech.

At least four of the six weekends are scheduled with cultural sightseeing tours; Teotihuacan Pyramids, Pena de Bernal, San Miguel Allende, Freixenet vineyards and Guanajuato City are typical sites for weekend leisure. Queretaro City also offers plenty of cultural events during the summer, for example “Iberica Contemporanea” (Spanish Festival), Montreal Jazz Festival in Queretaro, Queretaro’s “Gallos Blancos” soccer team games are standard attractions. Finally Queretaro City offers excellent opportunities for very fine and reasonable cuisine and family friendly street cafes, galleries, shopping and the like.

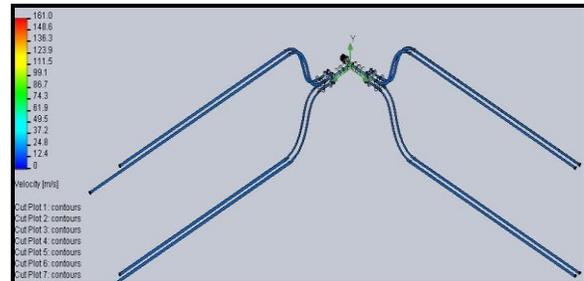
Yet students find time to make sure their projects progress according to schedule.

1. Project at CIDEQ (CONDUMEX)

Two projects were developed in CIDEQ this year.

The title of the first project is “Air Flow Analysis Through a Medical Harness Testing Device”. The objective was to design a new device which will test the medical harnesses more economically than the current one. The design of a high pressure pneumatic entrance system and the analysis of the model in CFD need to be carried out. The students completed the design of the entrance system delivering equal

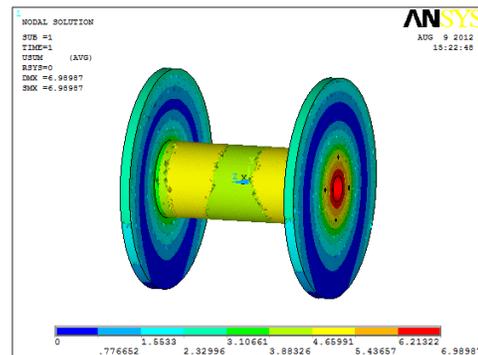
flow characteristics to the system. The CFD simulation was successful and the results were really similar to the experimental results. Finally, the electronic part of the project was also analyzed and tested.



“Air Flow Analysis Through a Medical Harness Testing Device”. Center for Research and Development of Group Carso in Queretaro (CIDEQ)

The student team was comprised by one student from WVU and two Mexican students. They worked under the advice of CIDEQ engineers and faculty advisors.

The title of the second project is “Development of an Algorithm for the design and calculus of a reel with the Finite Element Method”. The objective of the project was to create and analyze a Finite Element Model of a reel.



“Development of an Algorithm for the design and calculus of a reel with the Finite Element Method” Center for Research and Development of Group Carso in Queretaro (CIDEQ)

A finite element analysis was conducted on reels in order to develop an algorithm which aims to optimize the design of reels used in the CONDUMEX factories. Simulation data aims to obtain safety factors for the various components of the reels in order to make sure the loads are within a desired factor of safety. Furthermore, the mechanic properties of the reel were

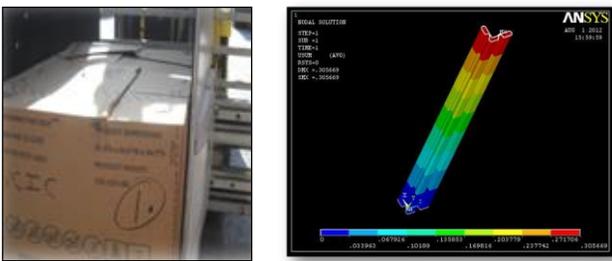
analyzed. The results from the simulation illustrate the behavior of the reels under loading.

The student team was comprised by one student from WVU and two Mexican students. They worked under the advice of CIDEQ engineers and faculty advisors.

2. Project at MABE

Two projects were developed in MABE. This company designs and builds washers, dryers, refrigerators and other appliances. MABE is always developing new technology in its systems because its products are competitive in the international market.

The title of the first project is “Packaging design for home appliances”. The objective of the project was to develop an alternative corner post for the packaging of washers. It must show an equal or better performance under loads than the actual corner post and it needs to be manufactured at a more competitive cost.



“Corner post “
MABE- Domestic Appliances

The title of the second project is “Qualifying for the DOE 2015 Regulations for a Top loading Washer”. The objective of this project was to analyze the vibrations effects in a washer.



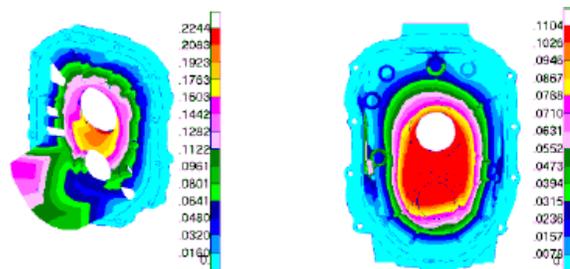
“Prototype of a part of the washer”
MABE - Domestic Appliances

Different vibrations models were developed to understand the behavior of the current model. Experimental test were developed to get important vibration data. Finally, the data was analyzed and considerations of design were suggested to MABE.

The teams were compromised by one student of WVU one from UTEQ and one from UTEQ.

3. Project at TREMEC

TREMEC is a company that provides a full line of transmissions and components for vehicles ranging from high-performance passenger cars and light-duty trucks to medium-duty and commercial vehicles. TREMEC is one of the most important suppliers of transmissions with a worldwide customer base. The team in this company worked in the Finite Element Analysis of a current transmission that will be in the market in next years. In this project the students also learned how to use different commercial software (ANSYS, PATRAN, etc) which are used for running simulations of FEA in the transmissions.



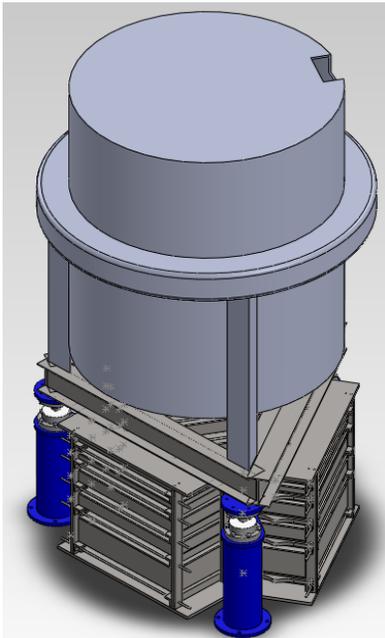
“Main Cases Structural Analyses”
TREMEC

A total structural analysis was completed for the external cases of the transmission to verify that the geometry is strong and stiff enough to support the loads. The finite element models developed provide a useful modal simulation that can be used to take important decisions in the design of the transmissions.

In this project one student from WVU teamed up with one from Queretaro Tech (ITQ) and one from UTEQ.

4. Projects at CENAM

One project was developed at CENAM, The National Center of Metrology in Mexico (equivalent to NIST in the USA). The title of the project is "Automation of the calibration process of the load cells for the reference tanks in the flow and volume division". The objective of this project was to deliver a design of a system which is able to conduct the calibration process of a Coriolis flow meter on a daily basis.



"Final Assembly of the calibration system"

CENAM - The National Center of Metrology in Mexico

The team actually designed a structure with the specifications that were required for the customer. Furthermore, a Finite Element Analysis of the structure was developed. After that, the students selected the materials and finally they delivered the final drawings.

The team was formed by one student from WVU, one from UPN, one from UAQ and one from UTSJR. They worked under the advice of researchers from CENAM and faculty advisors.

5. Projects at Messier

Messier is a global aerospace company with sites in different countries, and a worldwide network of

service centers. Messier manufactures state-of-the-art planes that help people and goods get where they need to go. The title of the project is: "Harness Test Bench Development". The objective of this project was to modify the existing test bench to improve user-friendliness and integrate the Meridian. Aircrafts use electrical harnesses on the landing gear. It is used to guide, isolate, and protect wire during the actuation and operation of the landing gear. These wires connect all component sensors to the cockpit. The testing of these harnesses is extremely important because the operation of aircraft requires zero error. Landing gear malfunctions have caused incidents before, so regular maintenance is a must.



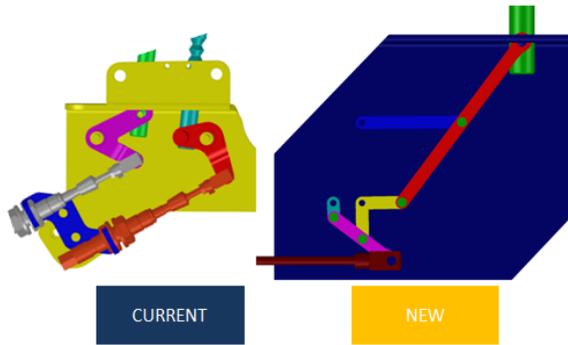
"Harness Test Bench Development"

MESSIER – Aerospace

One student from WVU teamed up with one student from ITESM and one from ITQ.

6. Project at Case New Holland (CNH)

Case New Holland (CNH) designs and manufactures tractors and components. The title of this project is "The hydraulic actuator system of the clutch pedal to avoid the recess problem". The objective of this project was to optimize the current clutch mechanism to ensure that the clutch pedal reaches the initial position and the power shuttle valve reaches the specified pressure. Also, the hysteresis on the mechanism was analyzed to determine the amount of losses in different areas of the mechanism. Finally, a new mechanism was designed and proposed to CNH.



“Straight line” mechanism application for actuation systems in agricultural tractors in Case New Holland - Tractor

The members of this team were two graduate students from West Virginia University: Karen Flores de Jesus and Andres Cavezza.

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.



Architectural touch of colonial San Miguel de Allende

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), and a visit to the Teotihuacan Pyramids archeological site.

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 intense 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 knowledge and 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.

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 and languages in the job place. Under these circumstances, being able to understand, appreciate and moreover yet anticipate cultural differences and communications approaches may well make the difference in order to attain success.....!

Industrial Outreach Program in Mexico: A Professional and Cultural Immersion

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 • UTEQ • Clemson Univ. 	141 (WVU) 10 (UG) 60 (UAQ) 52 (ITQ) 30 (ITESM) 7 (CICATA) 5 (UTEQ) 5 (UPQ) 22 (Clemson)	3 (WVU) 2 (UG) 4 (UAQ) 6 (ITQ) 4 (ITESM) 2 (CICATA) 2 (Clemson) 1 (UPQ)	(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) Case New Holland (1) InMec (4) CENAM (2) ANSYS Mexico (1) Irving de Mexico (1) Crown Mexico (4) Mabe-GE Appliances (2) CIDEC-ConduMex (2) Arvin-Meritor (2) Gabriel (5) CIAT-GE Aircraft E. (3) VRK (Automotive) (2) CIATEQ (4) Bombardier (2) Messier Services	General Motors TREMEC Transmisiones-TSP Micro-Troquelados IMT* LAPEM* ITR (TurboReactores) Terramite Corp.** KOSA Case-New Holland InMec CENAM Group SSC (ANSYS) Irving- Composites Crown Mexico Mabe (CIDEC) ConduMex Arvin Meritor Gabriel CIAT-GE Aircraft E. VRK Automotive CIATEQ (B. Quintana) Bombardier Messier Services * Research Centers ** From West Virginia	(1) GM Mexico (12) TREMEC (4) SPICER-TSP (1) Micro-Troq. (5) IMT (2) LAPEM (2) I. TurboReactores (1) TerramiteCorp.** (3) KOSA (6) Case-New Holland (2) InMec (7) CENAM (1) Irving (1) Crown (12) CIDEC (2) ConduMex (16) Mabe (2) Arvin Meritor (2) Gabriel (6) CIAT (6) VRK Automotive (5) CIATEQ (4) Bombardier ** From West Virginia
11 Institutions	332 Students	24 Faculty	58 Liaisons	24 Companies	103 Projects
Sixteen Year Summary Table Industrial Outreach Program in Mexico					

For further Information Contact

West Virginia University, WV	CONCyTEQ, Queretaro
Dr. Víctor H. Muciño, P.E. Professor and Associate Chair Mechanical and Aerospace Engineering West Virginia University P.O. Box 6106 Morgantown, WV 26506-6106 Tel. (304)293-3150 Fax (304) 293 6689 Email: vhmucino@mail.wvu.edu	Lic. Concepción Bernal CONCYTEQ Luis Pasteur Sur No. 36, Col. Centro 76000 Queretaro, Qro. Mexico Tel. (52-442) 212-7266 Fax (52-442) 212-6156 Email: alcctq@concyteq.mx



Join us in Queretaro, Summer 2013!



Group visiting San Miguel de Allende



After the final presentation at CIDEQ



The Case-New Holland Team with tractor used in project



Poster Session Grand Finale of the Program



New Agreement Signature Ceremony with West Virginia Delegation and the Secretary of Education

The New Agreement...!! Starting in the summer of 2013, eight (8) selected Mexican students from various universities in Queretaro will spend the Spring semester at West Virginia University (January to May), prior to returning to Queretaro in the summer to team up with other WVU students in the new Engineering-Internships Program Abroad. The duration of the internships will be eight (8) weeks and will take place in June and July. WVU students will earn nine (9) credits including six (6) engineering credits for Capstone Design Course and three (3) credits for a GEC Course in Mexican Culture. Both Mexican and WVU students will earn credit towards fulfilling the requirements of their respective academic programs. The focus of this Program is in reaching higher levels of excellence in quality of performance in Queretaro and West Virginia.