MINI-REPORT 2013

INDUSTRIAL OUTREACH PROGRAM IN MEXICO – QUERETARO

WEST VIRGINIA UNIVERSITY
And our Mexican Host Institution
COUNCIL FOR SCIENCE AND TECHNOLOGY OF QUERETARO (CONCyTEQ)

With Participating Institutions:

- Universidad Autónoma de Querétaro, (UAQ)
- Inst. Tecnológico de Estudios Sup. de Mtrey. (ITESM)
- Instituto Tecnológico de Querétaro, (ITQ)
- Universidad Nacional Aeronáutica en Qro., (UNAQ)
- Universidad Tecnológica de Querétaro (UTQ)
- Instituto Tecnológico de San Juan del Rio (ITSJR)
- Universidad Tecnológica de San Juan del Rio (UTSJR)

WVU and Querétaro students visiting Teotihuacan

Global Competencies make a difference….!

Global competencies in professionals are not only needed in today's industry; they are expected from college graduates. This is particularly the case for engineering majors….!! Key global competencies include the capacity of effective communication across cultures and languages, capacity for team work with people with different backgrounds, appreciation and sensibility towards different cultures in a professional setting, and the capacity of understanding engineering solutions in a societal context. A globally competent engineer is one who is capable of working effectively with people who define problems differently and approach solutions with different perspectives….

You can make a difference…!!

Introduction

West Virginia University celebrated its 17th year conducting this program. This is a unique program which provides an ideal environment for students to immerse themselves in a different culture while applying and honing engineering and interpersonal 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 barriers. In the process, students learn about themselves as individuals and gain a new perspective on the role of their profession in a global society. This is a program that aims at closing the cultural gaps between academia and industry as well as between the USA and Mexico.

New Format for the Program

In July of 2012, a delegation from WVU visited Queretaro to sign an agreement to expand the Industrial Outreach Program to eight weeks in the summer and to bring eight students from Queretaro to WVU for the spring semester, who would subsequently team up with WVU students participating in the Program in the following summer.

WVU Delegation visiting the Secretary of Education of the State of Queretaro and the leaders of CONCyTEQ, UAQ, ITQ and UNAQ during the Agreement Signature.

This year (2013) for the first time, eight (8) students from Queretaro who were rigorously selected in Mexico were sponsored by the CONCyTEQ and their home institutions to spend the Spring Semester at West Virginia University. These eight students were enrolled full time in regular courses in their respective majors. Their overall performance at WVU was outstanding and several of them received recognition for their achievement. Subsequently these eight students participated in the Industrial Outreach Program in the summer and were part of the various teams designated to the industrial projects. The combination of study abroad experience and the full cultural immersion provided an excellent environment for WVU and Queretaro students during the summer.

Mexican students spending the Spring Semester of 2013 at WVU prior to their participation in the Industrial Outreach Program in Mexico.

For WVU Students, the program also offered something new for the first time. A course in Mexican Culture taught by The School of Philosophy and Letters of the University of Queretaro (UAQ) with credit transferrable to WVU. The combination of engineering experiential learning courses in Mexico and the course in Mexican culture provide students' eligibility for the Certificate of Global Competency described further down.

Objectives of the Program

The objectives of this program are:

1. 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.
2. 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.
3. 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 on the following global competencies:

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

Certificate of Global Competency Eligibility

Students participating in this Program at WVU are eligible to obtain a Certificate of Global Competency, by fulfilling the three requirements listed below:

1. Culture and Language requirement. 9 cr//hr of GEC Coursework dealing with Hispanic culture and Spanish language.
2. International experiential learning. 6 cr/hr of activity such as the activity described in this Program (other similar programs are available).
3. Social Service component. 1 cr/hr of structured volunteer engineering social service work with a professional student society chapter, such as EWB, SAE, ASME, etc.

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. Students are transported to their industrial sites and 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 soccer facility.

At least six of the eight 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 and Queretaro’s “Gallos Blancos” Soccer Club games are typical attractions. Finally Queretaro City offers excellent opportunities for very fine and reasonable cuisine and family friendly street cafes, art galleries, shopping. Yet students manage time to make sure their projects progress according to schedule.

Description of Sample Projects of the 2013 cycle

This year (2013) a group of 23 students from the USA and Mexico worked on five industrial sites at CIDEC, MABE, CNH, CENAM, and MESSIER SERVICES. Students engaged with engineers from each company and contributed to the solution or design and analysis of a variety of mechanical and industrial systems.

Seven Mexican Universities teamed up with WVU; University of Queretaro (UAQ), Monterrey Tech in Qro. (ITESM) the Technological Institute of Queretaro (ITQ), The National Aeronautical University in Qro. (UNAQ), The Technological University of Qro. (UTEQ), the Technological Institute of San Juan del Rio (ITSJR) and the Technological University of San Juan del Rio (TUSJR).

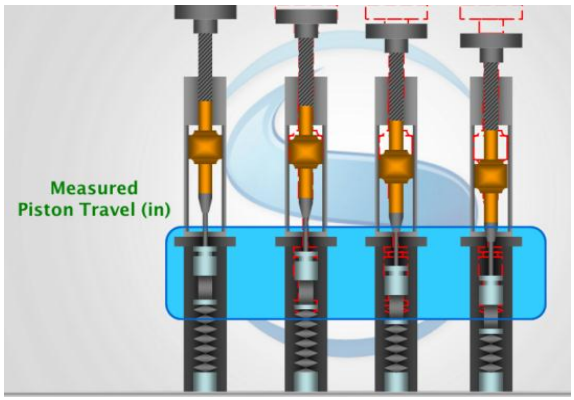
By teaming up with Mexican students, USA students experience a full cultural immersion that is reciprocated to the Mexican students. The mix of professional environment with a different culture provides a framework that brings an added dimension to the engineering experience. Students learn and fine-tune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

skills while they hone their communication and interpersonal skills.

At the end of the eight-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.

Team 1. Messier Services: Landing Gear Hydraulic Valve Calibration

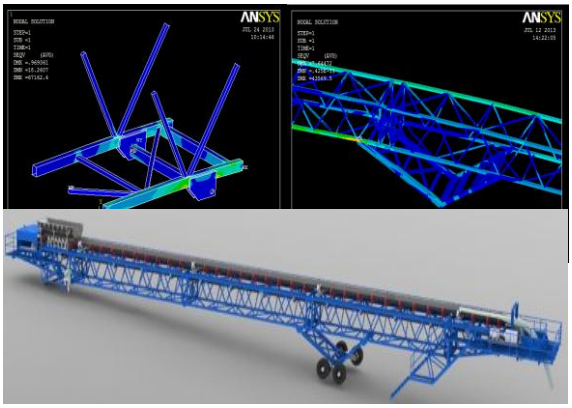
This project by Messier Services involved the use of Emergency Brake Dual Distribution Valve for a commercial airplane. The goal was to the time needed for calibration of the valve. The two main tests are the Mechanical and the Hydraulic tests, in the Mechanical test; the piston displacement versus the reduced (output) pressure is measured. In the Hydraulic test, a control pressure is applied to provide the displacement of the piston and the reduced pressure is measured. A design of experiments was used to relate the output measurable variables to the controllable parameters. A second concept used to reduce the time involved the adaptation of a load cell to the test rig in order to enable simultaneous mechanical and hydraulic tests to be conducted. Finally an automation system for the testing was proposed that would further reduce the overall time for the test.



Design of a hydraulic valve testing device for simultaneous mechanical-hydraulic test.

Team 2. CIDEC: Structural Analysis of a Grasshopper Structure under Tugger Loads

The CIDEC team has been working with a mining conveyor system called Grasshopper which is used to transport mineral from location to location in the mine. The grasshoppers are moved and placed by a tugger, which is attached to the tail section to move the grasshopper radially. The main objective of this project is to conduct a structural analysis of the grasshopper under certain conditions including extra weight on the head section due to back up material, stresses caused by the tugger during movement and oscillations that may have caused resonance. By conducting a structural analysis using a finite element analysis, failures can be prevented in further operations of the grasshopper structure.

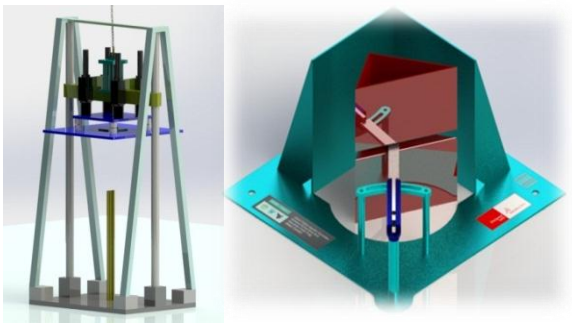


Finite element analysis of a grasshopper structure under tugger lateral loads in mining operations.

Team 3. MABE 1 Testing Device for Packaging Posts.

The objective of this project was to design a testing fixture for corner posts used in the packaging of appliances. Testing of these posts is necessary to assure quality and effective performance. These posts must function under buckling loads and impact lateral loads in order to protect the appliance packaged. The device was designed to fit the equipment at the company in such way that slipping was prevented by the device. A sensor system will also be added to the assembly in order to

streamline the testing process while reducing human error. A proximity sensor was used to prevent parts from being crushed or deformed by moving the top platen down too far. The design developed by this team was developed from scratch as no commercial devices exist for this particular use and application.



Testing fixture device and testing apparatus for packaging posts.

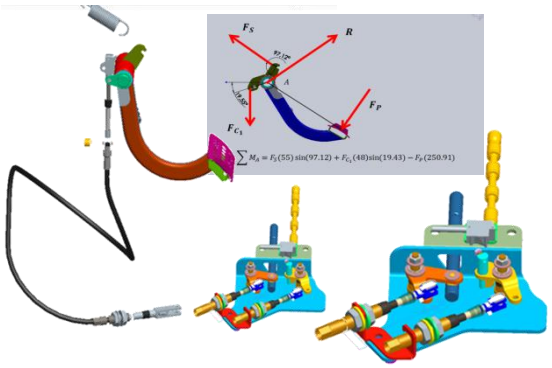
Team 4. CENAM 1: Development of a portable Calibration System for Standard Heavy Weights.

The objective of the project was to design a portable semiautomatic weight calibration system, so the weight (M1 class: 500 kg) can be used to calibrate scales anywhere in the field (as opposed to a laboratory). Calibration is important because it can maintain the quality of products as well as make consistent comparisons between two objects with a standard weight as a reference. Weight calibration is used to determine a how accurate an unknown weight close to a standard, whereas scale calibration is used to figure out the error of an instrument. This project focuses on using scale calibration to determine the error and its certainty. This project is necessary because weights can get damaged during transportation, which means they must be brought back to the lab to be calibrated. This situation is very inefficient if the lab is far away from the client's location. After developing a semiautomatic system with LabVIEW Interface, the instruments will send the data directly to the computer and be organized in proper order. The calibration system is intended to be used outside in the field, perhaps far away from the laboratory.

Data acquisition system, standard weight and load cell used in the calibration process.

Team 5. CNH: Design of a New Mechanism for Clutch Actuation in Agricultural Tractor

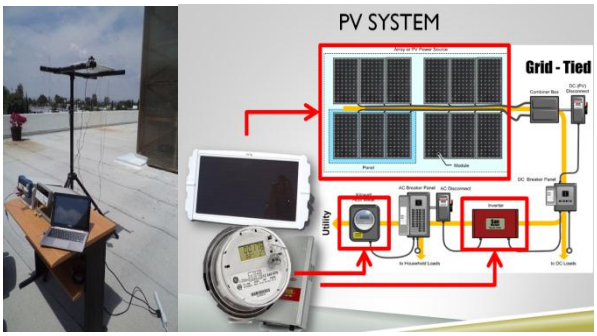
The objective in this project was to design a new clutch mechanism designed to fit in multiple New Holland tractor models. The designed considered spatial restrictions, strength concerns, frictional forces, actuation motion requirements and geometric limitations. The new mechanism used a lever system with improved mechanical advantage and improved efficiency attained by reducing friction. Computer models were developed for design and analysis (both kinematics and strength) to anticipate failures in the system. A prototype was built and tested producing acceptable results. The preliminary design is then used in a more detailed manner to incorporate the actual features of one of the tractors in which it will be used.



Clutch pedal-cable system and valve actuation mechanism.

Team 6. CENAM 2: Design of a Photovoltaic Power Plant for Radiation Measurement.

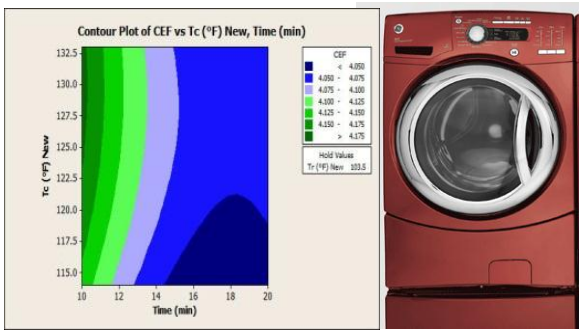
Due to the optimal radiation conditions in México, the implementation of photovoltaic stations has great potential in Mexico. CENAM, The National Center for Advanced Metrology of México, is interested in becoming an active solar energy technologist, specifically in the development of standards for accurately measuring sun radiation. Consequently CENAM is planning to implement a system capable of producing 10% of the total energy consumed at the complex. In order to provide this amount of energy a solar system configuration was developed, which is composed of 3035 panels and 61 inverters. This system will be integrated into a roof like structure located in the parking lot. These structures will not only produce energy to be supplied to the grid but they will also protect and shield automobiles from the sun. Moreover, with the growing popularity of solar generation systems CENAM will be requested to calibrate these components in the future. Therefore a process to measure the efficiencies of some components for this system was researched, developed and tested successfully.



Photovoltaic power plant system with instrumentation for data acquisition.

Team 7. MABE 2: Improvement of Energy Efficiency of a Dryer Appliance.

Home appliances are a major component of today's household; they save time in drying clothes but are not energy efficient. In order to mitigate energy consumption of clothes dryers, the Department of Energy has created a standard called Energy-Star on which to measure energy efficiency as the Combined Energy Factor (CEF). The Objective of this project is to develop a "Heat Modulation" approach to attain Energy-Star rating. The dryer currently has a CEF of 3.79. Energy-Star requirements are to have 4.29. A variable motor is placed in the dryer to increase the airflow, along with a resistance heater. The temperatures are recorded using a thermcouple and thermistors connected by a Wheatstone-Bridge and a data acquisition board. A LabVIEW interface is used to monitor and record temperatures, humidity, and energy consumption. A Design of Experiments procedure yielded a CEF of 4.26. Additional recommendations to increase CEF were presented to the company.



FCLT360 Course: Cultures of Mexico by UAQ

The State University opf Queretaro (UAQ) offered a course on Mexican Cultures equivalent to WVU FCLT360-Cultures of Mexico with 3 cr. This course taugh in Queretaro included a 4 hr. session every Saturday morning followed by guided visits to museums, archeological sites, markets, villages and cities with cultural features. Visits to Pena de Bernal, Guanajuato City, Teotihuacan Pyramids, Tequisquiapan and Queretaro city monuments, churches, museums and cultural events provided an excellent oportunity to showcase, taste, feel and see first-hand the richness of various aspects of Mexican Culture. Students engaged with the Mexican

culture by living with a local family, working with Mexican students and engineers in industry, by participating in popular cultural events in Queretaro including festivals and social events, as well participation in focus groups on cutural and social aspects of the Mexican culture. Essays and on-site assignments provided an opportunity to immerse students in a cultural experience beyond the reach in a classroom setting. This course taught by instructors from UAQ provide yet another dimension of value in this Program.

Acknowledgements:

The companies that made this program possible this year are: MABE, CASE-NEW HOLLAND, CIDEQ, MESSIER SERVICES and CENAM. Thank you.

Cultural Highlights:

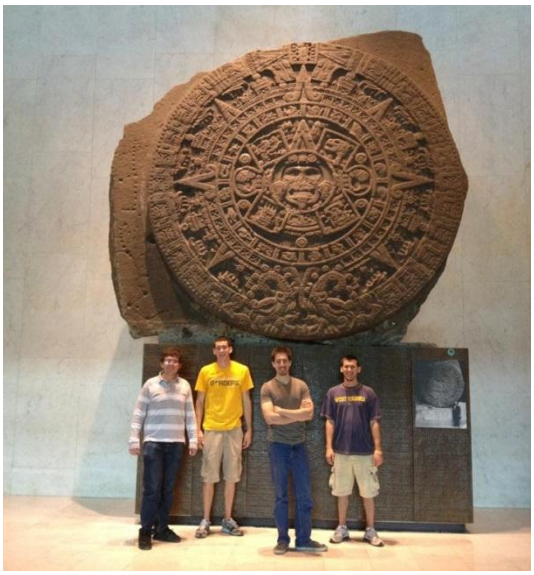
Mexican food in Mexico….!!!

At Pena de Bernal, Queretaro

Visiting the Cathedral of Mexico City

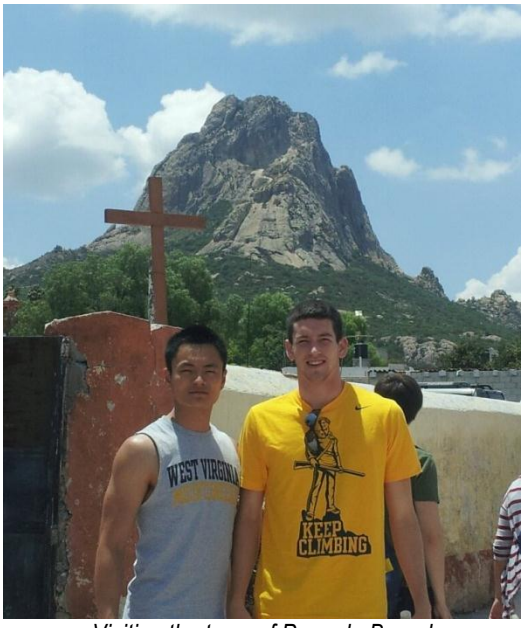
Festival in San Miguel Allende

Posing with Don Quijote and Sancho Panza in Guanajuato



At the National Museum of Anthropology "Piedra del Sol"

At the produce market in San Miguel de Allende

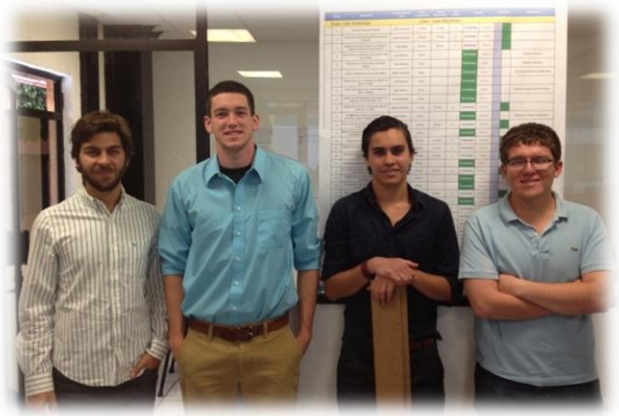


Visiting the town of Pena de Bernal

Ready to "blend in"

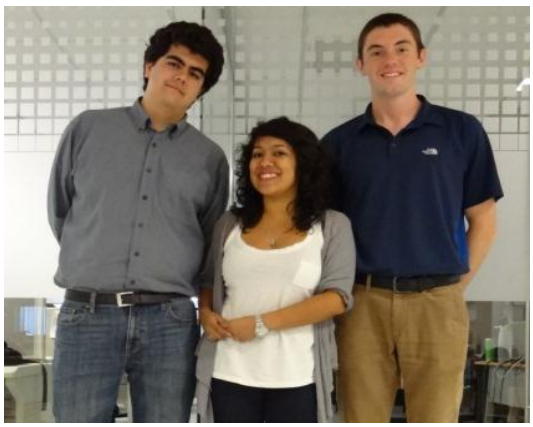
Queretaro City and its Colonial Aqueduct

The Student Teams:



MABE1- Cornet Post: Pablo Aguilar, Dillon Carden, Enrique Echeverria, Educardo Colin.

CENAM2 - Photovoltaic Station: Antonio Colin, Susana Vega, Mark Ladesic.



MABE2-Dryer Efficiency: Rodrigo Estrella, Adriana Camacho, Andrew Rhodes.

MESSIER SERVICES: Javier Rangel, Alonso Rayas, Abhishek Singh,Alejandro Garza.

CASE-NEW HOLLAND: Roberto Gutierrez, Lisbeth Hernandez, Manuel Maldonado

CIDEC: Brian Bacza, Sofia Vega, Andres Perez

CENAM1 - Mass Calibration System: Severiano Jaramillo, Jorge Luis Olvera, Hsin-Li Sun.

Grand Finale poster presentation session, with faculty and industry advisors and educational leaders of Queretaro

	Institutions Involved	Student Participants	Faculty from both countries	Industrial Liaisons	Industries/Research Centers	Projects developed
	• West Virginia University • University of Guanajuato • University of Queretaro (UAQ) • Institute of Technology of Queretaro (ITQ) • CONCyTEQ • ITESM (Tec. De Monterrey) • CICATA (IPN) • Polytechnical Univ. of Queretaro (UPQ) • UNAM • Clemson University USA • Tech. Inst. Of San Juan del RIo • Technological University of Qro (UTEQ) • Tech. University of San Juan del; Rio. • UNAQ	148 (WVU) 10 (UG) 63 (UAQ) 55 (ITQ) 31 (ITESM) 7 (CICATA) 6 (UTEQ) 5 (UPQ) 22 (Clemson) 2 (UTSJR) 2 (ITSJR) 2 (UNAQ)	8 (WVU) 2 (UG) 4 (UAQ) 6 (ITQ) 4 (ITESM) 2 (CICATA) 1 (UTEQ) 1 (UPQ) 2 (Clemson 1 (UTSJR) 1 (ITSJR)	(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 (3) InMec (6) 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 (2) Bombardier (2) Messier Services	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 (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 (7) New Holland (1) InMec (9) CENAM (1) Irving (1) Crown (8) CIAT (14) CIDEC-ConduMex (18) Mabe (2) Arvin Meritor (2) Gabriel (6) VRK Automotive (6) CIATEQ (2) Messier Serv. (4) Bombardier ** From West Virginia
	14 Institutions	**353 Students**	**32 Faculty**	**60 Liaisons**	**24 Companies**	**110 Projects**

Seventeen year summary table for the Industrial Outreach Program in Mexico

Join us in Queretaro, Summer 2014!