

MINI-REPORT 2007

INDUSTRIAL OUTREACH PROGRAM IN MEXICO – QUERETARO



WEST VIRGINIA UNIVERSITY
and the
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)
UNIV. NACIONAL AUTONOMA DE MÉXICO (UNAM)



WVU students and Mexican students pose for a picture before a friendly soccer game, Summer 2007

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 some sort of international experience? ...

.....**More than ever !!**

WVU's engineering students have now the opportunity of gaining international and professional experience through the *Industrial Outreach Program in Mexico*, which provides an ideal environment for students to immerse themselves in a different culture while using and honing engineering skills in practical industrial projects abroad. In this Program, students learn the dynamics of teamwork to achieve a common goal 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 and Mexican students team up with ConduMex Engineers

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, by providing a meaningful industrial exposure 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 develop practical engineering skills as well as communication, leadership and human-relations skills.

Finally, this program seeks to bring faculty and engineers from industry to share expertise in formulating and solving engineering problems.

By teaming up with Mexican students, WVU students acquire a cultural exposure 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 whole experience. Students learn and fine-tune their engineering skills while they hone their communication and interpersonal skills. At the end of the six-week exercise, students give a professional

presentation to the sponsored industries using the Spanish that they learn while working with Mexican professionals, while Mexican students deliver their presentation in English they learn with the help of our students. This is a character-building exercise that brings the cultures and personalities to the forefront of the projects. Students live with local families who provide a home away from home environment for a total cultural immersion.

Description of Sample Projects

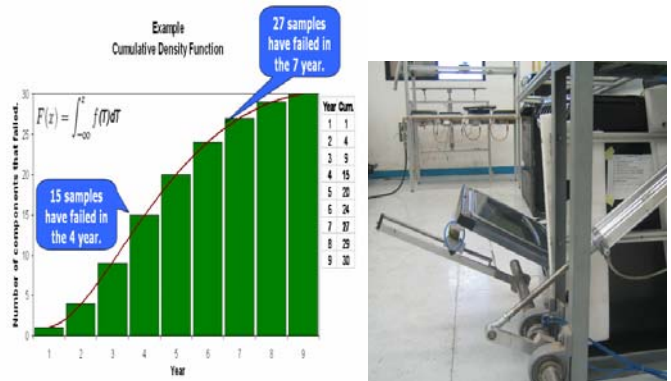
This year 9 WVU Students and 12 Students from 3 Universities of Queretaro; Queretaro Tech (ITQ), University of Queretaro (UAQ) and Monterrey Tech (ITESM), to form six intermixed teams. The industrial sites included Case-New Holland, ConduMex, MABE (Appliances), CIATEQ, GE (Aircraft Engines) and VRK (Automotive). Students engaged with engineers from industry and contributed to the solution or design of a variety of mechanical and industrial systems. A brief description of these projects follows.

Project at MABE (GE-Appliances)

Two different projects were undertaken at MABE. The first involved the design, analysis and testing of components for domestic appliances. These systems consist of mechanisms designed to simulate repetitive use of appliance movable parts, including opening and closing of valves, doors, drawers. These systems are instrumented to trace the deterioration of the appliance (top range, refrigerators, washing machines etc). The second project involved a Weibull reliability analysis was conducted to determine the useful life of the components as a quality metric. Students produced and collected statistical data on accelerated tests of several appliances, used simulation tools (LabView)



MABE Team: Juan Carlos(UAQ), Rafael (MABE), Colin (WVU), Ariadna (MABE), Mariano (ITESM) and Carlos(ITESM)



Appliance testing machine conducting test cycles in the laboratory

Project at CONDUMEX

The student team working at ConduMex had two projects to tackle; first was the problem of eolic vibrations of cables and testing standards to comply with quality certification requirements. Students actually conducted testing and produced an assessment of current testing methods with improvements for quality compliance. A second project involved the manufacturing procedure to produce magneto wire and selection of industrial oven type needed for producing high quality magneto wire. Students visited manufacturing plants to observe the process and conducted testing and analysis of magneto wire to determine its quality characteristics.



Magneto wire industrial oven in a Plant of the group ConduMex.

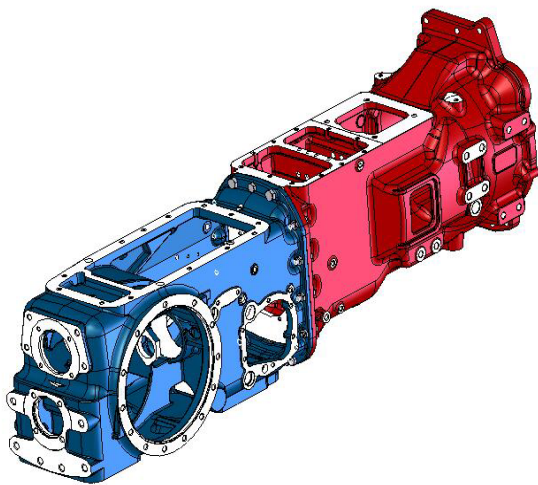
Project at Case-New Holland

Two projects were addressed by the Case-New Holland group. The first one dealt with strength characterization of agricultural tractor components in response to field reports. Finite element modeling and analysis was conducted for the company on actual systems under review.



CNH Team: Mario Ortiz (CNH), Luis (ITQ), Candice (WVU), Mario Rojas (CNH), Aldo (ITESM) and Richard (WVU)

The second project at Case-New Holland involved the assessment of flange design and sealing properties for the connection between the transmission and the differential casing of an agricultural tractor. Finite element analysis of the flange, and experimental procedures were applied to the joint design in order to assess the sealing effectiveness for quality assurance of the system.



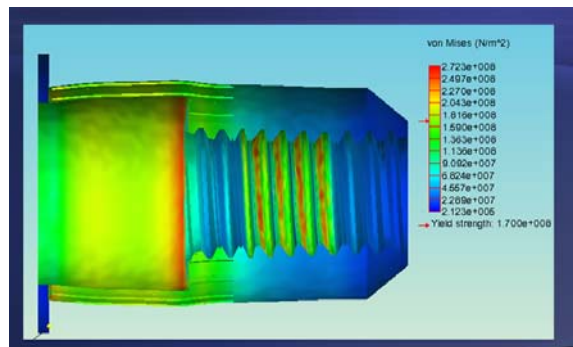
Housings of transmission and differential systems with a bolted flange for an agricultural tractor

Project at VRK

Two projects were developed for VRK Automotive. The first involved the performance of a rivnut (a combination between a rivet and a nut) used to fasten aluminum components while providing a tapped site for bolted assemblies. The rivnut is made of aluminum and at some point is subjected to buckling (riveting) through a pull action of the threaded element. A finite element analysis was conducted to assess the loading required for the process.



Rivnut and mandrel used to produce the rivet joint by direct pull through the threaded element.



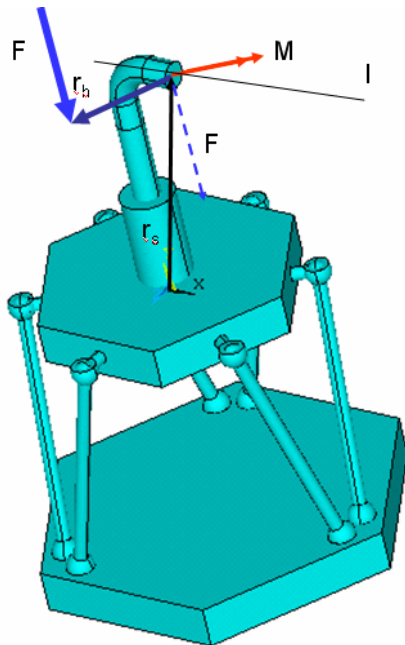
Model of the new machine designed for welding struts

The second project involved the design of a die for bending aluminum square tubing with specific geometry requirements. These aluminum elements are used for automotive structures used by several automakers.

Project at CIAT (GE-Aircraft Engines)

Two projects were also developed at CIAT; the first involved the use of time series and statistical data management of service data to forecast service requirements based on actual vibration signatures of engines. A second project involved the assessment of assembly procedures for accessories of turbine engines and the 3D measurement of forces during installation of various harnesses. A design was proposed for an

instrument aimed at measuring actual human forces applied to assembly tools



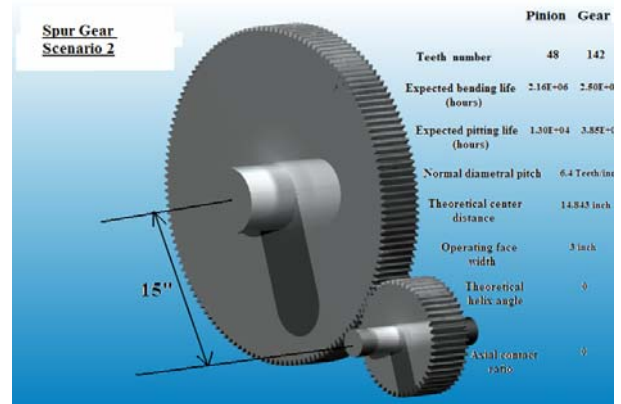
Model of an 3D-force measuring device for human assembly loads on harnesses

Project CIATEQ

The project conducted at CIATEQ related to the development of case studies for the application of gear train design software developed by the company. This software can be used for teaching engineering students as well as for training engineers in industry involved with gear design applications. The student team worked with the source code to implement graphics of gear systems for industrial applications. Specific design scenarios were developed to illustrate functionality of the software for actual industrial cases.



Eward (ITESM), Tonho (ITQ), Daniel (WVU), Dr. Isaias Regalado (CIATEQ)



Gear system designed with software developed by CIATE, with graphics developed by student team.

Cultural Highlights

Cultural opportunities are plentiful throughout the six weeks. Visits to archeological sites, horse back rides, and visits to small towns and villages are conducted in the company of local students during weekends, to culminate with a long weekend at the golden pacific coast .



WVU Students enjoying the archeological site of Teotihuacan



Volleyball at the beach in Ixtapa during the last weekend.

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.



Host families and students during a "family social function"

Conclusion

Our Program is unique. It pursues the main objective of adding value to engineering education through a meaningful engineering exercise in an international professional setting. 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.

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



Luis (ITQ) and Richard (WVU) conducting torque tests with a technician at CNH

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 may well be the key to success in a professional situation. The question is how can students best prepare themselves for the challenges that the engineering profession faces in a globalized present and... future? ...Think... "Industrial Outreach Program in Mexico"



American and Mexican students take a break during a hike at Pena de Bernal



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) • UNAM 	105 (WVU) 10 (UG) 44 (UAQ) 39 (ITQ) 14 (ITESM)	3 (WVU) 2 (UG) 4 (UAQ) 5 (ITQ) 2 (ITESM)	(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 (1) CENAM (2) ANSYS Mexico (1) Irving de Mexico (1) Crown Mexico (2) Arvin-Meritor (2) Gabriel (3) Mabe-GE Appliances (2) ConduMex (4) CIAT-GE Aircraft E.	GM TREMEC Transm-TSP Micro-Troquelados IMT* LAPEM* I. TurboReactores Terramite Corp.** KOSA New Holland InMec CENAM Grupo SSC (ANSYS) Irving- Composites Crown Mexico Mabe ConduMex Arvin Meritor CIAT-GE Aircraft E. Gabriel VRK Automotive CIATEQ (B. Quintana)	(1) GM Mexico (8) TREMEC (4) SPICER-TSP (1) Micro-Troq. (4) IMT (2) LAPEM (2) I. TurboReactores (1) TerramiteCorp.** (3) KOSA (3) New Holland (1) InMec (3) CENAM (1) Irving (1) Crown (4) CIAT (2) ConduMex (4) Mabe (2) Arvin Meritor (2) Gabriel (2) VRK Automotive CIATEQ (B. Quintana) ** From West Virginia
7 Institutions	190 Students	16 Faculty	42 Liaisons	22 Companies	51 Projects

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

Direct inquiries to:

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Join us in Queretaro this Summer 2008!