

MINI-REPORT 2009

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)
CENTRO DE INVESTIGACION DE CIENCIA Y
TECNOLOGIA APLICADA (IPN)



WVU students visiting Teotihuacan Pyramids. Summer 2009

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 at CIDECA working on cryogenic systems design.

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 as well as communication, leadership and human-relations skills.

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

By teaming up with Mexican students, USA 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 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, students make a

professional presentation to the sponsored industries using the Spanish that they learn while working with Mexican students and engineers, while Mexican students deliver their presentation in English as 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 and provides a multi-cultural professional experience. Students live with local families who provide a home away from home environment for a total cultural immersion.

Description of Sample Projects of the 2009 cycle

This year 8 WVU Students and 8 Students from four universities in Queretaro formed four intermixed teams and developed meaningful projects at plants of four industrial sites: CIEDC (ConduMex), MABE (GE-Appliances), GEIQ (GE-Aircraft Engines) and VRK (Automotive). Students engaged with engineers from each industry and contributed to the solution or design of a variety of mechanical and industrial systems. A brief description of these projects follows.

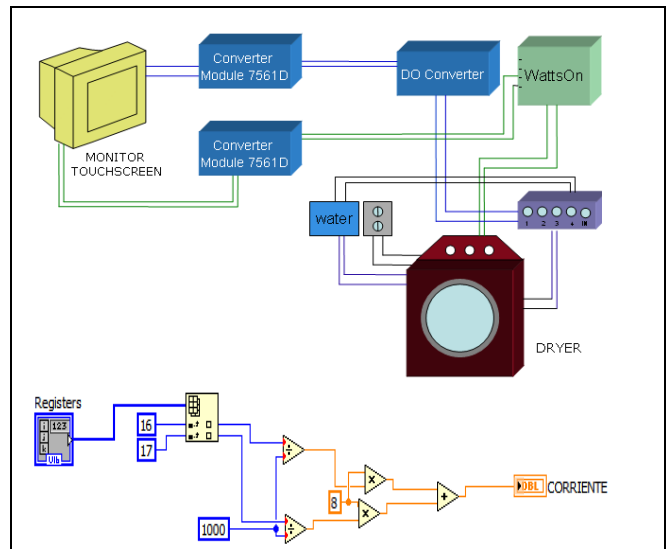
Project at MABE (GE-Appliances)

Two different projects were undertaken at MABE. One of the projects dealt with the aerodynamic design of a dryer fan for enhanced performance and energy efficiency given reduced space within the appliance. In this project several design configurations were modeled and simulated computationally. Several designs were selected to build prototypes and some of the prototypes were tested for verification. Final recommendations based on tests and analytical models were presented to the company.



Students and MABE Engineers working in aerodynamic design of fans for dryer applications.

A second project with MABE involved the development of a testing protocol and design of controllers for lifecycle testing of dryers. In this project, the student team designed a series of test-events to simulate the standard used of a dryer and control system to drive the actuators needed to conduct the physical tests. Data acquisition system was also developed and installed to record data that can be used for quality and reliability assessment of various dryer subsystems. A "working" control based system for testing with data acquisition was delivered and left installed at the company.



Design set up for testing of dryers for lifetime reliability

Project at CIDEA (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. The emphasis was placed on the heat transfer efficiency of connectors and the thermo-elastic response of the vessel. 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.



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. The student team was comprised by two students from WVU, one student from UAQ and one student from CICATA who worked under the advice of CIDEQ engineers and faculty advisors.

Project at VRK

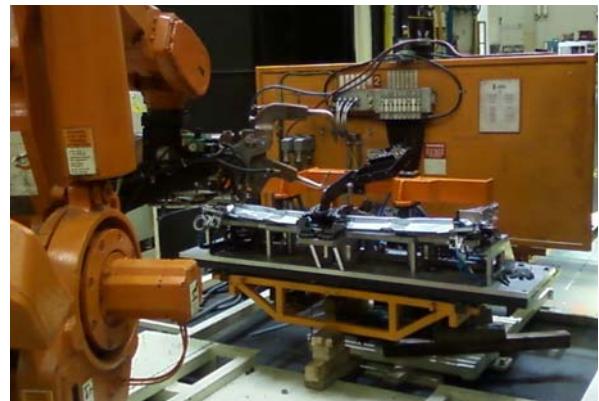
At this company, aluminum and steel structures for automotive applications are manufactured and assembled. High efficiency and quality requirements of various component designs require the use of advanced manufacturing systems including automated welding robot cells.



Welding robot for aluminum automotive structures

In this project a group of students designed and tested a work cell for commercial welding robots. The work included the design of fixtures for the welding

process, the programming of the robots and the simulation of the sequence of operations needed to process the welding of aluminum components. The team delivered the design of a working cell which was actually constructed, installed at the company and tested with simulation programming developed by the students. A working robot system cell was left in operating conditions along with the corresponding documentation for future reference.

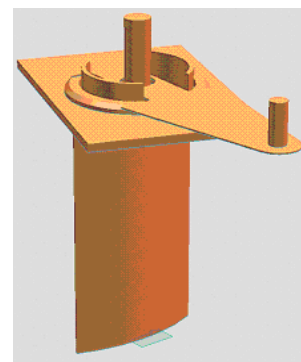


Work cell and fixtures for welding processes of aluminum automotive structures

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

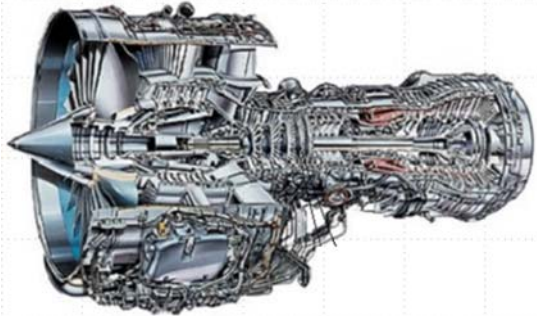
Project at CIAT (GE-Aircraft Engines)

Two projects were also developed at CIAT; the first involved mechanistic modeling of the actuation mechanism for compressor vanes in the stator, to determine the loads that are required to rotate the vanes during the turbine operation. This project required the design of a device to experimentally measure the friction loads that need to be overcome during the actuation of the vanes.



CAD rendition of the stator vane and the lever for actuation

A second project involved development of a program based on simple mechanistic models of deformable bodies to determine the tolerance stack-up on engine components under the presence of gravity, to verify assembly procedures in compliance with performance requirements. In these two projects, two students were assigned in the team advised by GE engineers.



Stator vane model with actuation lever used for finite element modeling of mechanism

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 .



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.

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.



Horseback riding with Mexican students in Tequisquiapan, Queretaro

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.



WVU students with "the catch of the day" at Ixtapa in the Pacific.

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 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"**

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 	115 (WVU) 10 (UG) 48 (UAQ) 44 (ITQ) 18 (ITESM)	3 (WVU) 2 (UG) 4 (UAQ) 6 (ITQ) 4 (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 (4) Mabe-GE Appliances (2) ConduMex (4) CIAT-GE Aircraft E. (2) VRK (Automotive)	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 (CIDE) 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 (8) CIAT (2) ConduMex (8) Mabe (2) Arvin Meritor (2) Gabriel (6) VRK Automotive (1) CIATEQ (1)CIDE
9 Institutions	235 Students	19 Faculty	43 Liaisons	22 Companies	65 Projects

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

Direct inquiries to:

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Join us in Queretaro, Summer 2010!