



CONCYTEQ



UNAQ
Universidad
Aerodútica en Querétaro



UT SAN JUAN DEL RIO
UNIVERSIDAD TECNOLÓGICA



CICATA
QUERÉTARO

Universidad Politécnica de Santa Rosa Jáuregui

UPQ

UNIVERSIDAD POLITÉCNICA DE QUERÉTARO

West Virginia University Statler College of Engineering and Mineral Resources



Industrial Outreach Program in Mexico

Mini-Report 2017

21 years building bridges and bridging the
gap between academia and industry in
Mexico and the USA...!!



This Program aims at graduating highly competitive engineering graduates from Mexico and the USA, capable of working with professionals from different backgrounds, and cultures, in realistic industrial scenarios abroad. USA students team up with Mexican students and conduct

an experiential learning activity under the supervision and guidance of engineers from industry and faculty members from Mexico and USA universities. This is a full professional and cultural immersion that focuses on “global competencies” and practical industrial experience.

Participating Institutions, 2017

Host Mexican Agency:

- Consejo de Ciencia y Tecnología del Estado de Queretaro (CONCyTEQ)

USA Institutions:

- West Virginia University (WVU), Lead Institution
- University of Nevada Reno (UNR)
- University of Wisconsin-Milwaukee (UWM)

Mexican Institutions:

- Autonomous University of Queretaro (UAQ)
- Technology Institute of Queretaro (ITQ)
- Aeronautic University in Queretaro (UNAQ)
- Technological University of Queretaro (UTEQ)
- Technological Institute of San Juan del Rio (ITSJR)
- Technological University of San Juan del Rio (UTSJR)
- Technological University of Santa Rosa de Jauregui (UTSRJ)
- Polytechnic University of Queretaro (UPQ)
- Advanced Science and Technology Research Center- (CICATA-IPN)

Industrial Sites, 2017

Industrial Technology Development Centers:

- CIDECE – ConduMex – Wire and cables R&D
- CIDECE – Delphi – Automotive electronics R&D
- MABE – Domestic Appliances R&D Center
- GRUPO MESS – Industrial Metrology Lab



CONDUMEX

National Technology Development Centers:

- CIDESI – Industrial National R&D Center
- CIATEQ – Technology National R&D Center
- CENAM – Metrology Center, R&D Standards Tech.
- IMT- Transportation Research Center



Industries in Queretaro:

- BROSE – Automotive implements
- CASE NEW HOLLAND – Agricultural machinery
- SAFRAN MESSIER SERVICES – Landing gear systems
- CONSTRULITA – Lighting Systems



Welcome by the Lead Institutions



Mtro. Raul Iturralde Olvera, Director of CONCyTEQ welcomes WVU students to participate in the Industrial Outreach Program in Mexico, also known as “Programa Bicultural de Alcance Industrial.” CONCyTEQ is committed to promote and support the interaction between universities, industries and research centers in Queretaro. CONCyTEQ also supports and coordinates the selection of the best students from Queretaro to spend the spring semester at WVU as part of the IOPM Program.



Dr. Victor H. Mucino is a Professor of Mechanical and Aerospace Engineering at WVU. He is also the director and founder of the IOPM at WVU. He leads the day-to-day operations of the Program in Queretaro, acting as advisor and supervisor of all students and projects and provides the overall stewardship of the Program.

Program Description and Activities



Full group of students from Mexico and WVU, summer 2017

Senior students in good standing in the Statler College of Engineering and Mineral Resources at WVU have the opportunity to participate in the Industrial Outreach Program in Mexico (IOPM) during the summer of each year (June and July), to earn a total of 9 credits (described below) toward their BS degree requirements. This program is open to students in various areas of engineering in which practical projects in industry can be established; typically, mechanical, aerospace, electrical, civil, and industrial engineering.

In this program, students are teamed up with Mexican students from local universities and conduct meaningful engineering projects in industrial sites, where they work full time for 8 weeks, under the supervision of practicing industrial engineers. Faculty members from the USA and Mexico provide further guidance and oversight to all student teams and projects.

Practical engineering problems from well-established companies in Mexico are presented to each team, with specific objectives and technical deliverables to be attained during the 8 week duration (June and July) of the program. Students are required to report on a weekly basis and produce a final report and a presentation, which are delivered to the company at the conclusion of the 8 weeks. A poster session is conducted for all participants at the closing of the program, which is open to the public.

Objectives Program

1. To add value to student's education through international experiential learning.
2. To solve meaningful engineering problems of value to industry.
3. To bridge the gap between academia and industry in the USA and Mexico.



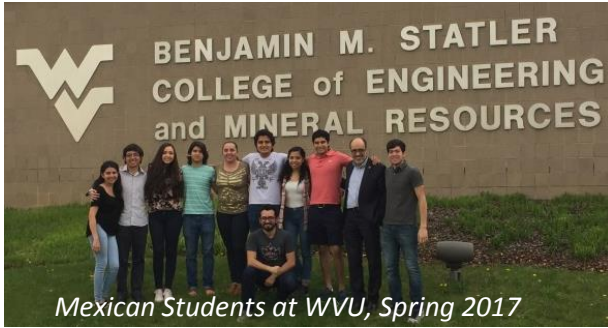
Housing and Logistics of Program

Students are placed in home-stay with local families in a well-established residential area of Queretaro (Col. Alamos 2a. Sec.) The families provide safe, healthy, comfortable and friendly family environment for the students, who are in close proximity to each other all the time. Homes are conveniently located near shopping areas, recreational parks, convenience stores, and just a few minutes from the colonial downtown area of Queretaro. Room and board includes meals and cleaning service for the duration of the stay.

Students are also provided with daily transportation to and from their home to the workplace (typically a 15 to 30 minute commute) using vehicles provided by the host institution, CONCyTEQ, and a local university, UNAQ. A typical weekday starts at 7:30 outside their homes in order to be at the industrial site by 8:00 am. The return commute starts at 5:00 pm. On Saturdays a culture class is offered by the University of Queretaro followed by a field trip to parks, museums, towns and villages nearby. On Sundays we rest.



Mexican Students at WVU in the Spring 2017



Just like in the previous five years, a very selected group of ten Mexican students from the 4 major universities in Queretaro (UAQ, ITQ, UNAQ and UPQ) spent the spring semester of 2017 at WVU, conducting a one semester study-abroad. These students carried a full academic load of 4 regular courses of the Junior/Senior Year (3rd/4th year) plus the involvement in an undergraduate research student project. Students were highly motivated to deliver

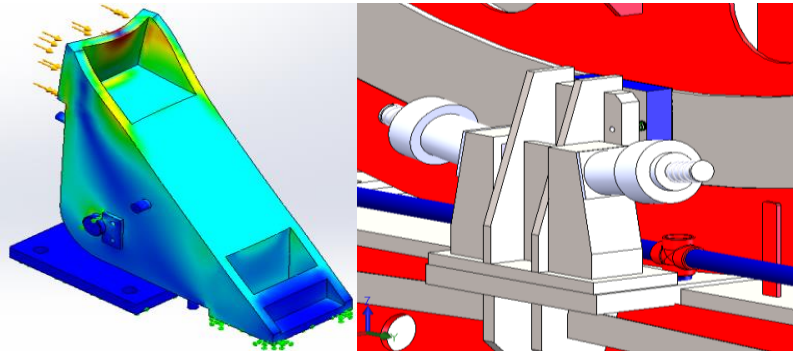
top performance in all their classes and were encouraged to contribute significantly to each research project they were assigned. This cohort of Mexican students traveled back to Mexico to join the group of 21 students from WVU, who participated in the summer program in Queretaro. Ten additional students from local universities joined the summer activity producing 12 intermixed teams of 3 to 4 students per team, who worked on 12 industrial sites. The 12 projects are briefly described next.

Project Descriptions, IOPM Summer 2017

1. Team CIDEC-ConduMex. A high voltage cable is a complex system consisting of a composite structure of copper core, semiconductor materials and an aluminum shield. Production of this type of cable requires the determination of mechanical bending properties for both manufacturing, and for coiling the cable on the wooden reels. The bending properties of cables can be determined both experimentally and analytically to fine-tune the manufacturing process parameters required to render a quality product. The Student group developed a finite element model to predict the key bending properties of this type of cable.



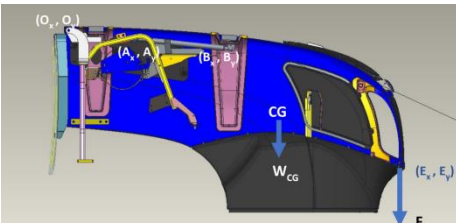
2. Team CIDESI. Worked on a collaborative project with various centers focused on developing the preliminary design for the new San Martir, Optical Telescope, scheduled to be operational in 2023 in Baja California. Specifically, the team was tasked with designing, analyzing, and proposing a retractable mirror cover system, safety locking pins, brakes and additional components for the telescope. The student team conceptualized, modeled and analyzed these components for design feasibility purposes and produced simulations of their performance.



3. Team BROSE. The Brose team worked on a new training machine for incoming employees to become familiar with a hose pressing machine. This machine will be used in a new location in Mexico to ensure the proper procedure is followed to assemble the part. This involves sensors placed on the press to account for rating alignment of the press, placement of the hose to be pressed, and whether the employee can judge a correctly manufactured part. This project involves CAD design models, fabrication of prototype, and experience with electronics. The machine was designed, built and successfully tested.



4. Team CASE NEW HOLLAND. The Case New Holland team worked on a new hood hinge for a tractor. This hinge replaces a four-bar mechanism in order to reduce the cost of manufacturing for the company. The analysis of this new mechanism has incorporated the replacement of struts with human factors considered. The new hinge design is simpler than the original mechanism and just as effective.



5. Team CIDEC. The Cidec team worked on an autonomous aerial vehicle project. This vehicle is an investigation into another field of study for the company and it requires a multidisciplinary team to focus on a systems approach to the design and integration of the overall configuration of the particular application. Hardware selection, programming and simulation of system's performance were attained for the company.

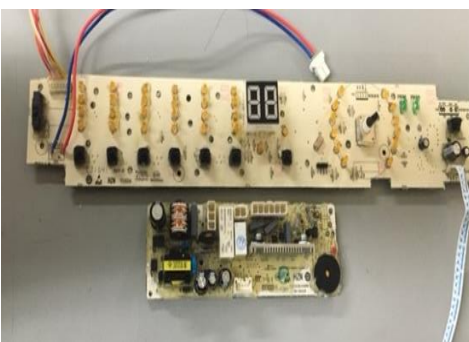


Figure 11 Frame to house the system



Figure 12 One of four brushless dc motors

6. Team MABE. The Mabe team worked on cataloguing failure modes of domestic appliance machines and some of the electric components. A data-base was created listing all known failures, with characterization of specific features, in order to prevent and anticipate failures in the field. This team developed an approach to address the demands in the market that can make Mabe products highly competitive.



7. Team CENAM-Dynamometer. The CENAM team is worked in de design of a transportable dynamometer. The team conceptualized a new deployable design to satisfy requirements of portability and ease of assembly. A deployable mechanism was designed and analyzed for fabrication purposes. The system also includes a mechanism for lifting a vehicle safely and placing it on the dynamometer.



Figure 3.2 –Small Dyno.

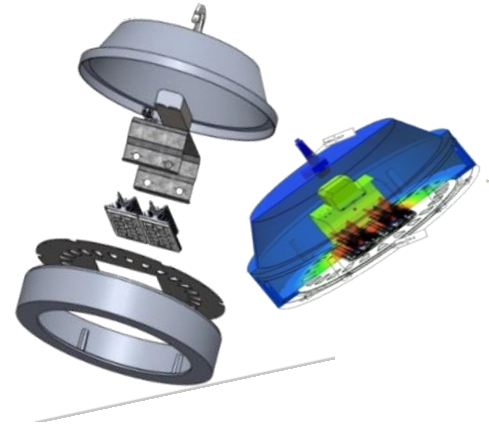


Figure 3.3 – Big Roller Dyno.

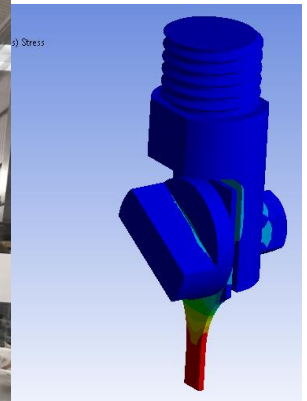
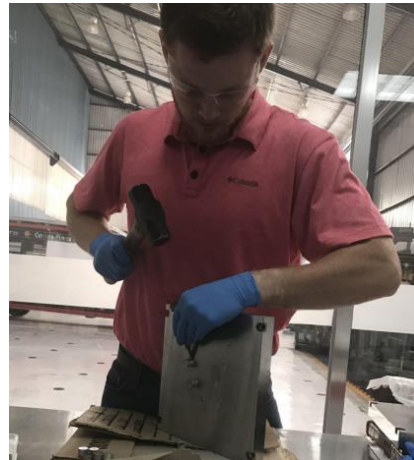


Figure 3.4 – Multiple Roller Dyno.

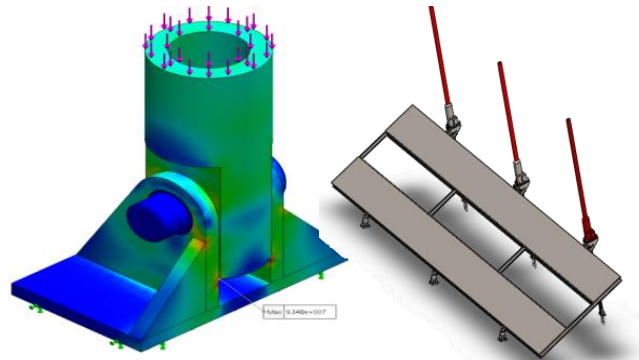
8. Team Cnstrulita. This team used CAD/FEM software for thermal analysis to simulate the heat transfer response of an industrial LED lamp heat sink. Based on current designs, a new geometry for the heat sink was developed with more capacity to dissipate heat while keeping the working temperature below 100°C for the 100 Watt model. With the results obtained an organized methodology for designing new heat sinks was developed including the approach to conduct thermal analyses on the proposed designs. One new product and an improved product were developed, based on the results obtained by this team.



9. Team CIATEQ- CIATEQ team worked on the design of a testing fixture for special materials using CAD software and a DMLS machine to design and manufacture components. Use of a 3D printer to test plastic components for a tensile strength test for a client. The team worked on additive manufacturing techniques to determine whether a DMLS machine can be used to fabricate/repair components made out of Inconel alloy. The fixture design for the tests was simulated and a prototype was fabricated.



10. Team IMT. This team worked on the preliminary design of a tilt-table to be used for rollover threshold testing for small commercial vehicles in the Transportation Research Institute. The design had to consider the most effective and economical actuators to provide the lift in a reliable way. The tilt table will produce the roll-over ratio for large vehicles by simulating varying road conditions with specific g-loads. The proposed design was used to ascertain the feasibility of manufacturing at a reasonable cost.



11. Team Grupo Mess. The Grupo Mess team was assigned the task of improving a gear testing system. This system is used to test the amount of chatter that occurs on gear shafts. The team is attempting to reduce the chatter by constructing a mechanism that better clamps down onto the gear. The team was also concerned with the time tests typically take, in order to reduce it in future testing. This was accomplished through the design of a testing fixture.

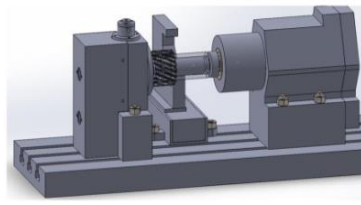


Figure 2 piston position



12. Team Safran-Aerospace. This team was asked to identify the possible causes of crack formation on a landing gear components during a routine maintenance and inspection performed at the company. In the process, this team focused on the tools used in the service process to ensure that components are not damaged during the repair process. Finite element models and experimental tests were conducted to identify improvements in the tools used.



Culture Class, Mexican Cultures, Summer 2017



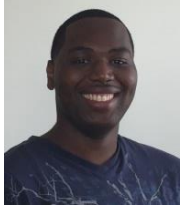
FCLT 260 Cultures of Mexico Class.

An equivalent of this 3 credit course is taught by the Autonomous University of Queretaro with Prof. Shaila Alvarez who has developed an outstanding course for this program with oversight by Dr. Angel Tuninetti of WVU. The course is offered on Saturdays from 9:00 to 12:00 at the UAQ Downtown Campus, and is followed by field trips to archeological sites, museums, parks, villages and markets. In this course students learn about language, traditions, history and culture, including gastronomy, folklore

and cultural sightseeing. The City of Queretaro also offers outstanding cultural opportunities during the summer. The International Jazz Festival in the Summer is a tradition, free of charge in the he main plazas of colonial downtown. The festival “Iberica Contemporanea” is another summer cultural event free of charge. The journey ends with a long weekend in Cancun and the Maya Riviera.



Distinguished visitors to the Summer, 2017



Stephen Birt. A graduate student from the MAE Department. Stephen provided logistic support and assistance with the book-keeping and documentation of the overall activity, with all the teams and all the projects. Stephen organized all reports and presentations in google-drive setting a lasting structure to preserve full documentation of the program.



Alejandro Mejia Giraldo. A graduate student from the MAE Department. Provided essential monitoring and assistance with all the projects, facilitating effective team work oversight and advice. His expertise in programming and his overall engineering experience was essential to guide all the teams to the timely completion of each project.



This year we had the visit of Ms. Alexis Robertson from the University of Nevada-Reno, who is our liaison to expand the IOPM Program and to integrate UNR in the near future. Alexis is very familiar with the program as a former participant and also as supervisor. She provides valuable input in the organization and planning of this program.

Dr. Angel Tuninetti, Chair of the World Languages, Literature and Linguistics at WVU also visited the Program to provide support and oversight to the Mexican Cultures class taught by Prof. Shaila Alvarez of University of Queretaro. Dr. Tuninetti also offers advice and valuable suggestions based on his professional international experience and expertise.



This year we also had the visit of Mr. Dave Solley, Undergraduate Program Coordinator and Advisor, and Dr. Edward Sabolsky, Professor and Coordinator of the Materials Science and Engineering Graduate Programs, both from the Department of Mechanical and Aerospace Engineering. They participated as observers and advisors to the whole group. They attended all the final presentations of the 12 groups, and conducted to UNAQ, CENAM, and CIDECC-ConduMex. During their visit, WVU and Mexican students had the opportunity to share their experiences, providing feedback to our visitors who in turn offer advice and constructive suggestions.



Visit our webpage at <https://industrialoutreachmexico.wvu.edu/>

21 Year Summary IOPM - 2017

Institutions Involved	Student Participants	Faculty	Industrial Liaisons	Industries/Research Centers	Projects developed
Local Institutions: <ul style="list-style-type: none"> • CONCyTEQ • University of Guanajuato • University of Queretaro (UAQ) • Institute of Technology of Queretaro (ITQ) • Tech. University of San Juan del Rio. • ITESM (Tec. De Monterrey) • CICATA (IPN) • Aeronautical University in Queretaro (UNAQ) • Polytechnical Univ. of Queretaro (UPQ) • UNAM • Tech. Inst. Of San Juan del Rio • Technological University of Qro (UTEQ) • Universidad Politecnica de Santa Rosa de Jauregui 	167 (WVU) 10 (UG) 73 (UAQ) 64 (ITQ) 31 (ITESM) 7 (CICATA) 11 (UTEQ) 8 (UPQ) 22 (Clemson) 8 (UTSJR) 8 (ITSJR) 14 (UNAQ) 1 (UNR) 3 (UPSRJ)	9 (WVU) 2 (UG) 5 (UAQ) 6 (ITQ) 4 (ITESM) 2 (CICATA) 2 (UTEQ) 1 (UPQ) 2 (Clemson) 2 (UTSJR) 2 (ITSJR) 2 (UNAQ) 1 (UPSRJ)	(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 (4) Case- New Holland (3) InMec (8) CENAM (2) ANSYS Mexico (1) Irving de Mexico (1) Crown Mexico (10) 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 (3) Brose (3) CIDEC-Delphi (2) CIDESI	GM Mexico 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 CIDEC-Delphi Arvin Meritor Gabriel CIAT-GE Aircraft E. VRK Automotive CIATEQ*(B. Quintana) Bombardier Messier Services CIDEC-Delphi BROSE CIDESI Construlita Grupo Mess	(1) GM Mexico (13) TREMEC (4) SPICER-TSP (1) Micro-Troq. (6) IMT (2) LAPEM (2) ITR TurboReactores (1) TerramiteCorp.** (3) KOSA (11) Case-New Holland (1) InMec (14) CENAM (1) Irving- Composites (1) Crown Mexico (8) CIAT-GE (19) CIDEC-ConduMex (23) Mabe (2) Arvin Meritor (2) Gabriel (6) VRK Automotive (8) CIATEQ (4) Messier Serv. (4) Bombardier (4) CIDEC-Delphi (4) Brose (3) CIDESI (1) Construlita (1) Grupo Mess ** From West Virginia
17 Institutions	427 Students	40 Faculty	77 Liaisons	30 Companies	176 Projects

Join us in Queretaro, Summer 2018!

<https://industrialoutreachmexico.wvu.edu/>





IOPM, an intense 8 week journey of learning, practicing, engaging, sharing and growing...!