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On the Transformative Growth of the UOIT Automotive Centre of Excellence (ACE) from Industry Research to Collaborative Industry/Academic Research and Experiential Learning

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TRANSFORMATION GROWTH OF THE UOIT AUTOMOTIVE CENTRE

On the Transformative Growth of the UOIT Automotive Centre of Excellence (ACE) from
Industry Research to Collaborative Industry/Academic Research and Experiential Learning

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Abstract

The Automotive Centre of Excellence (ACE) at the University of Ontario Institute of Technology is a research and development facility that offers chambers and technology for thermal management and aerodynamics including structural durability and life-cycle testing. Facilities include one of the largest and most sophisticated climatic wind tunnels (CWT) on the planet. ACE is a university-owned and operated research and development facility that commenced operations in 2011. Its original mandate was focused on the research and engineering development of automotive systems with an emphasis on Industry partnerships. Over the years ACE has diversified its market sectors and increased its community involvement and education. This paper will present examples of how ACE has interacted with the community and education sector to help transform the educational experience of not only students but the community at whole. It will discuss how revenue generation has been balanced to support educational and training needs. ACE also promotes research projects with the university and its impact and challenges in this area will be presented in the paper.

Keywords: automotive centre, research facility, technology, wind tunnel, growth, transformation, industry partnerships

On the Transformative Growth of the UOIT Automotive Centre of Excellence (ACE) from Industry Research to Collaborative Industry/Academic Research and Experiential Learning

Introduction

The University of Ontario Institute of Technology (UOIT) was founded in 2003 and as such is a relatively "new" university with respect to other Universities in North America and world-wide. Based on the Strategic Mandate Agreement between the Ministry of Training, Colleges, and Universities and UOIT ("Ontario Ministry of Training Colleges and Universities," 2014), UOIT's vision includes advancing the discovery and application of knowledge to accelerate economic growth, regional development and social innovation, based on a foundation of technology. The Ministry requires that learning institutions define key areas of differentiation from other learning institutions in Ontario. One of these key differentiators is the focus on partnering with industry, business, and governmental and community organizations to engage in problem-focused research activities that contribute to the advancement of society by driving better understanding of social processes, scientific discoveries, and technical innovation. The Automotive Centre of Excellence (ACE) is a "key" facility at UOIT that contributes to this strategic differentiation.

ACE is owned and operated by the University and was specifically focused on fostering collaboration between industry, entrepreneurs, engineers, researchers and students. The beginning anchor tenants were heavily focused on Industry work. Most recently the focus has been to improve the engagement of research and development of academic/industry projects, training, and community outreach. The purpose of this paper is to report on the progress and comment on the challenges faced by the management of ACE in this transformative growth.

The Automotive Centre of Excellence

ACE is a university-owned and operated research and development facility with a working area of approximately 16,300 square metres. The facility's "one of a kind" climatic wind tunnel has extreme weather capabilities along with a large yawing chassis dynamometer that can, for the first time anywhere, test properties in crosswinds. It has a solar array to replicate the effects of the sun, and is also hydrogen-capable, allowing for alternative fuel cell development. There are other chambers which provide additional climatic capabilities and life cycle and durability testing. For example, industry and researchers can test situations such as: starting up a vehicle and driving away in severe arctic climates; the impact of blowing snow, severe ice, rain and humidity; towing a trailer up a steep hill in intense desert heat; and driving on an extremely bumpy road for days, weeks, or years.

ACE was developed in partnership with UOIT, General Motors of Canada, the Government of Ontario, the Government of Canada and the Partners for Advancement of Collaborative Engineering Education (PACE). It officially opened for service in June 2011.

ACE has two principal research, development and evaluation facilities: the Core Research Facility (CRF), and the Integrated Research and Training Facility (IRTF). The CRF constitutes the climatic wind tunnel and core test-bed facilities while the IRTF consists 1950 m² of labs and office space across 3 floors. Currently most of the 4th and 5th floors are focused on projects related to ACE and the 2nd and 3rd floors are university space. The 1st floor is a machine shop for the training of undergraduate students. Since its inception fundamental to ACE's research mandate is the building of research capacity at UOIT and other Ontario universities in automotive science and engineering, since then the focus in automotive has expanded to other areas where the climatic wind tunnel and other testing facilities are required. For example, re-

creation of ice storms, unmanned autonomous vehicles, wind shear effects in solar panels to name a few.

The ACE structure is a lean organization that supports Industry and Academic research, development and testing with a staff of highly qualified engineers, technicians, support staff and academic engagement. Most recently additional support positions have been created to increase outreach activities and academic collaborations with more professors, faculties and other institutions.

Balancing Revenue Generation with Academic Research

Over the years ACE has diversified from predominantly automotive to a more diverse portfolio of market sectors including architectural/civil, aerospace, media production, defense, green energy, human factors, motorsports and expanding further into UAV and sports performance.

In the frontier years, the focus was on running the business. ACE had to learn how to develop the expertise using an anchor tenant, and expand the business to other clients to generate additional revenue to sustain the operations. The early years exceeded forecasts and expectations, however the enterprise under-performed in collaborative and academic research.

Diversifying the Customer Base and Increasing Market Reach

When the business started, the majority of revenue came from its single anchor customer. This presented a major risk to the university in that the institution would face major financial losses if that customer were to reduce their business substantially with ACE. In 2013, ACE had 14 customers in total with the anchor customer representing 79% of the revenue and the business heavily concentrated; 90% of revenue coming from the automotive sector. ACE started on a mission to diversify the customer base, increase the number of customers served, and increase

the market segments served. The expectation was that by increasing the customers and markets served, that ACE would encounter more opportunities to collaborate with industry partners and that this would drive educational and research opportunities. In 2014, the business grew to 20 customers, and by 2016 to 41 customers. By 2016, the business had grown and diversified to a degree such that the anchor customer now represented only 41% of the revenue and automotive just 77%. The sectors served had grown from only a handful at the start to 13 by 2016.

To increase the exposure of ACE and to help win new customers ACE brought on new staff to focus on sales and marketing, including a senior career sales leader, a recent business graduate to work on marketing, and a student to focus on social media. The business launched YouTube, Facebook and LinkedIn channels in 2015 and achieved over a million impressions in the first year. They nurtured relationships with the community and media to increase exposure to the greatest degree possible.

The marketing team operated on the notion that the unusual nature of the facility was sufficiently interesting that by exposing it to the public, and opening it up to faculty, students and the general community, that it would lead to a greater awareness of its existence and bring with it growth in sales and research opportunities.

In the early years there was marginal activity in the core research facility with an estimated \$2.8M grant proposals and activities. Some of the collaborative Industry/Academic projects included in the first two years involved multiple faculties, and institutions:

- Thermal battery development (Faculty of Engineering and Applied Science, FEAS)
- Automotive Aero/Thermal Technique Development (FEAS)
- Firefighter Physiology Trials (Faculty of Health Science Kinesiology)
- Green Energy Solar/Wind Product Development (FEAS)
- Aero Pollution Control (FEAS, Multi-institutional)
- Anechoic Investigation of Outdoor Electronic Signage (FEAS)
- Active Trailer Control (FEAS)

It should be noted, that the values of the projects in the early years were of smaller value and provided some initial foundational work and relationships building. We have seen transformational growth in the last two years. The original \$2.8million of projects has grown to \$15+million in 2014 to \$37+million in 2015 of proposed projects and activities.

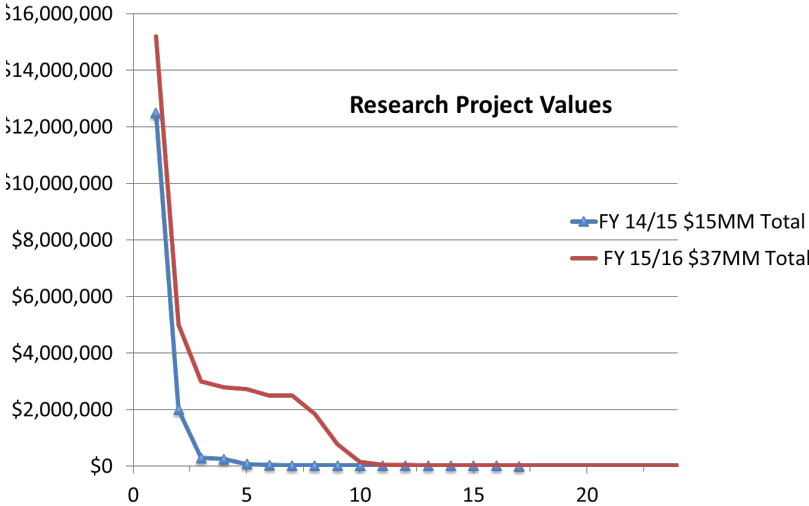


Figure 1. Transformation Growth of Research 2014/15 vs 2015/16

Education and training using ACE had a similar glide path to collaborative research. ACE was always a headline for UOIT and the community. Within the community Ace participated local chamber of commerce events, the automotive journalists electric vehicle rides and the city of Oshawa Autofest car show. The UOIT engagement included, homecoming events, student recruitment during open houses, and school events such as the robotic competition that included tours. ACE also continually hosted a parade of tours for other community and business development reasons.

ACE was initially engaged on a very limited basis to supplement the student curriculum with undergraduate and graduate classes in fluid dynamics and heat transfer. Again we have seen transformational growth in both community and student engagement. This is evidenced in the following events:

Community Events (17 days)

- Homecoming reception
- Faculty of Science Meeting
- FEAS Open House
- Automotive Innovation Symposium
- Health Science Council Event
- Fundraiser for Ontario Shores
- Society of Automotive Engineers (SAE) Race Car Workshop
- Unmanned Aerial Vehicles (UAV) Industry Day
- Human Flight Week
- Student Affairs Mental Health Beach Day

ACE as an Educator (21 days)

- Faculty of Education Lab
- Industry Training on use of Climatic Wind Tunnels
- Firefighter Training with Health Sciences and Durham College
- Health Sciences Labs
- Durham College Fitness and Health Promotion Lab
- Practical Aero of Race Cars for Engineers
- Practical Aero of Race Cars for Professionals
- UAV workshop for Engineers
- Vibrations Classes (undergraduate engineering)
- Fluid Dynamics Classes (undergraduate engineering)



Figure 2. UAV in CWT



Figure 3. Undergraduate Aero Workshop

ACE has always been engaged in UOIT Capstone projects which are two-semester endeavors for undergraduate students. The students pursue independent research on a question or problem of their choice, engage with the scholarly debates in the relevant disciplines, and with the guidance of a faculty mentor, industry mentors, and ACE resources (facility and people) to produce a substantial work that reflects a deep understanding of the topic. Most recently, the ACE sponsored Aerodynamic project was the design and construction of a fully operational wind tunnel for research and instruction. This effort resulted in award winning results, specifically first place in the International Conference for Upcoming Engineers, Ryerson University 2016.



Figure 4. Award Winning ACE Sponsored Capstone Team with Wind Tunnel

Conclusions

The challenge of an enterprise like ACE is to balance research and education with Industrial R&D in the context of achieving financial independence and sustainability. Initially, ACE needed to develop new and specialized expertise and competency. This was initially achieved through an anchor tenant which was quickly expanded to more market sectors and more diversity within those sectors as a hedge against financial volatility. Once competency and expertise grew it allowed for transformational growth in academic and collaborative research as well as expanded community and educational opportunities.

The various workshops and industry days taught us that, as a university, education is the key enabler to meet the needs of students and industry. For example, the initial undergraduate workshop improved and expanded the undergraduate fluid dynamics class, and spawned further opportunities for inter-institutional and industry revenue generating workshops.

Research is expanded by increasing the scope, the number faculties engaged, the number of other institution and industry partners. Expansion of educational and community engagement result in more awareness of potential users which in turn result in more opportunities for research and education.

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