



**FINAL ASSESSMENT REPORT**  
**September 2021**  
**Bachelor of Engineering in Automotive Engineering**  
**Program Review**  
**Dean: Dr. Hossam Kishawy**

Under Ontario Tech University's Quality Assurance Framework, all degree programs are subject to a comprehensive review every eight years to ensure that they continue to meet provincial quality assurance requirements and to support their ongoing rigour and coherence. Program reviews involve several stages, including:

1. A comprehensive and analytical self-study brief developed by members of the program under review.
2. A site visit by academic experts who are external to and arm's length from the program who prepare a report and recommendations on ways that it may be improved based on a review of the program's self-study and supporting material, and a two-day site visit involving discussions with faculty, staff and students and a tour of the facilities.
3. Development of a plan for improvement by the program and proposed timelines for implementation.

On the completion of the program review, the self-study brief together with the reviewers' report and the assessment team's response are reviewed by the Resource committee, the appropriate standing committee of Academic Council (USC/GSC), and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In academic years 2019-2021a program review was scheduled for the Bachelor of Engineering in Automotive Engineering.

This is the second program review for this program and the internal assessment team is to be commended for undertaking this assignment in addition to an already challenging workload and within a very tight timeline. The following pages provide a summary of the outcomes and action plans resulting from the review, identifying the strengths of the program as well as the opportunities for program improvement and enhancement. A report from the program outlining the progress that has been made in implementing the recommendations will also be put forward in eighteen months' time.

**External Reviewers:**

Dr. Xianguo Li, University of Waterloo

Dr. Bruce Minaker, University of Windsor

**Site Visit:** June 7<sup>th</sup> – 9<sup>th</sup>, 2021

**Program Overview**

The Bachelor of Engineering in Automotive Engineering focuses on the design and manufacturing of automobiles, relevant components, and assemblies. This includes a wide array of products, including passenger cars, military multi-wheeled vehicles, devices for intelligent transportation systems as well as innovative technologies, such as autonomous vehicles. It is the only Canadian Engineering Accreditation Board (CEAB) accredited undergraduate program in automotive engineering in Canada.

The program has a strong foundation in mechanical engineering, and also includes elements of manufacturing and electrical engineering. Students graduate from the Automotive Engineering program with the knowledge and skills required for engineering in all areas of the automotive sector and its related industries.

Developed in consultation with industry and experts at other universities, the Automotive Engineering curriculum provides a solid grounding in fundamentals, with significant content in engineering sciences and engineering design. The program features a common first year with all engineering programs in the Faculty of Engineering and Applied Science (FEAS). In the first year, students study mathematics, sciences, computing and technical communications — courses that represent the foundation building blocks of most engineering programs. In the second year, students cover basic engineering courses like thermodynamics, fluid mechanics, materials properties, electrical circuits, and the mechanics of solids.

In third and fourth years, students study a range of applied and advanced automotive engineering courses including vehicle dynamics and control, introduction to automotive engineering, powertrain design, automotive structural design, chassis systems design, electric and hybrid vehicles, and combustion and engines. In addition, the upper two years cover important courses in mechanical, electrical and manufacturing engineering including computer-aided design, dynamics of machines, mechatronics, and control systems.

Through all four years of study, students complete core design courses, which culminate in the fourth year with a two-semester capstone project focusing on real-world automotive engineering design problems. Similarly, co-op and internship options are available to students completing third year, and provide an excellent opportunity to apply classroom and lab concepts to real-world situations. Students in

Automotive Engineering may also elect to have the Engineering and Management option, where they take two semesters of business and management courses for 30 credit hours after successfully completing third year. The regular fourth year of the engineering program is then taken in Year 5 of the program. Students gain critical management skills in key areas of business including accounting, finance, operations, human resources and marketing.

### **Significant Strengths of the Program**

- 1) The Automotive Engineering program at Ontario Tech is the only one in Canada.
- 2) Strong research background. All the faculty members in Automotive Engineering have NSERC funding and/or industrial funding.
- 3) The faculty members in Automotive Engineering are well recognized in their field of research and all of them are registered professional engineers.
- 4) Most of the faculty members in Automotive Engineering have practical industrial experience which is an important asset in both teaching and research.
- 5) Interactive learning environment through the use of laptops in lectures.
- 6) The laboratories and the available equipment for undergraduate students are state-of-the-art.
- 7) World class facilities (such as ACE) with customers from the automotive industry are available.
- 8) Motorsports teams are available for extra curriculum activities with genuine participation/advising from the faculty members.

### **Opportunities for Program Improvement and Enhancement**

- 1) The job market is recovering, but still not as strong as it once was in Canada.
- 2) Some faculty members have to teach courses for other programs at the same time. More resources are required to address this issue.
- 3) The program has to share some of the lab resources with other programs.
- 4) Class sizes in some courses are relatively large.
- 5) Facilities such as the Automotive Centre of Excellence (ACE) cannot be fully utilized by the program.
- 6) Limited number of faculty members specifically in the area of automotive engineering.
- 7) List of available electives for Automotive Engineering students is limited. Very few of the engineering elective options are geared specifically to Automotive students.

### **The External Review**

The site visit took place on June 7<sup>th</sup> to 9<sup>th</sup>, 2021. Drs. Li and Minaker met with members of the Faculty as well as key stakeholders at the University, including Dr. Lori Livingston, Provost, Dr. Hossam Kishawy, Dean of the Faculty of Engineering and Applied Science, Dr. Scott Nokleby, Program Chair, and members of the internal assessment team and a number of faculty, staff, and students.

The Faculty was grateful for the thoughtful and thorough review provided. The external reviewers recognized the high quality of the faculty, the rigorousness of the program, and the innovation in the content and delivery of the programs.

The reviewers identified thirteen recommendations, some of which have multiple components. The Faculty values the recommendations and have been very thoughtful in their responses.

## **Summary of Reviewer Recommendations and Faculty Responses**

### **Recommendation 1**

Expand upon the Thermofluids content within the program curriculum. This could be accomplished by expanding the core content, or through electives, or some combination. Specifically, courses in Aerodynamics of Road Vehicles and Computational Fluid Dynamics would be appropriate.

### **Program's Response**

The Program will look at developing and adding an elective course in Automotive Aerodynamics. Similarly, the Program will look at adding Computational Fluid Dynamics as an elective using the idea of Recommendation #5.

### **Dean's Response**

The Dean agrees with the Program's response. It is also suggested that the emphasis of electives should not be limited to the traditional Automotive courses but should also gradually add courses to cover new emerging topics in automotive engineering.

### **Recommendation 2**

Expand upon the Automotive Engineering specific elective course options available to students. Develop/revise Automotive specific content within the program to bring it up-to-date with recent industry directions, including investigating making the course Electric and Hybrid Vehicles core to the program and developing elective courses related to Autonomous Vehicles.

### **Program's Response**

The Program will replace MECE 3390U: Mechatronics with a new course on Automotive Sensors and Instrumentation. This course, combined with the new course on Autonomous Vehicles, which has already been approved, will increase the autonomous vehicles content in the program and better reflect current automotive trends. The Program will also make AUTE 4080: Electric and Hybrid Vehicles a core course and remove MECE 4210U: Advanced Solid Mechanics and Stress Analysis as a core course and make it an elective. A complete review of the program map will be undertaken to optimize the delivery of the program and address Recommendations #2, 3, and 4.

**Dean's Response**

The Dean agrees with the response from Program.

**Recommendation 3**

Review program curriculum to ensure consistency and fluidity of content between existing Automotive specific courses, with an eye to elimination of unnecessary overlap in content.

**Program's Response**

A thorough review of the core automotive engineering courses will be undertaken to eliminate any unnecessary overlap in content. A complete review of the program map will be undertaken to optimize the delivery of the program and address Recommendations #2, 3, and 4.

**Dean's Response**

This is related to the first two comments and the Dean agrees with the Program's response.

**Recommendation 4**

Introduce students to Automotive Engineering specific content earlier in the program (e.g. move AUTE 3010U – Introduction to Automotive Engineering earlier in program than Year 3-1, or include examples of automotive engineering in ENGR 1015U – Introduction to Engineering if possible, etc.).

**Program's Response**

The Program will rename AUTE 3010U: Introduction to Automotive Engineering to AUTE 3010U: Automotive Fundamentals and review the program map to determine if it can be moved to the second year of the program. In addition, the Program will ensure that the content is better aligned with the other courses in the program as per Recommendation #3.

**Dean's Response**

The Intro. to Engineering is a general course and part of the common first year. It does introduce students to all the engineering fields covered in the Faculty. Any program specific topics are expected to be covered starting the first term of the second year. The Dean supports the Program's suggested approach.

**Recommendation 5**

Examine the option of allowing some overlap of graduate course and senior undergraduate technical electives, to improve upon selection of senior-level course options, and implement as required.

**Program's Response**

The Program agrees with the idea of cross-listing some senior undergraduate electives with master's level courses to increase the elective opportunities available to students. The Program will work with the Faculty on implementing this structure for some elective courses, such as Computational Fluid Dynamics as per Recommendation #1.

**Dean's Response**

This requires a thorough discussion at the Program Curriculum Committee (PCC) and department levels. Another point to consider here is offering an accelerated master degree.

**Recommendation 6**

Clearly define the relationship between the ACE and the Faculty of Engineering and Applied Science, particularly the facility's role within the Automotive Engineering Program (is it available to students or not?), and ensure it is reflected in the messaging that is sent to prospective students. Look for ways to improve student access/involvement with the ACE Facility at undergraduate level.

**Program's Response**

This is an ongoing issue that has also been identified by a number of students. In fact, Automotive students do not get to use the facilities of ACE as part of their studies. The Program would like a formal agreement put in place where specific labs for different automotive engineering courses will be scheduled on a yearly basis in ACE. This would be a wonderful addition to the program and will aid in attracting and retaining students in the program.

**Dean's Response**

The Dean will follow up with the Provost and VP research on this issue. The ACE can play an excellent role in promoting not only automotive engineering but also all engineering at Ontario tech. Engineering program does not necessarily need full access to commercial large-sized laboratory equipment, but the effort can be made to better utilize existing small equipment that is not necessarily part of ACE facilities but belongs to Ontario tech faculty.

**Recommendation 7**

Explore the possibility of combining the Reverse Career Fair with the Capstone Design presentations, as well as expanding the Capstone Oral Presentation to include a Poster Presentation to aid in this interaction.

**Program's Response**

The annual capstone exhibition is already an extremely busy event so it will not be feasible to hold a Reverse Career Fair at the same time. Industry and community

members are already invited to this event allowing them the opportunity to interact with the students. Also, there is already a poster presentation as part of the annual capstone exhibition.

### **Dean's Response**

The Dean agrees with the Program.

### **Recommendation 8**

Review faculty compliment to ensure there is sufficient regular (TTT) faculty to comfortably meet the program's needs, now and going forward. The Dept of Automotive and Mechatronics Engineering is very small, with only five regular faculty members and one teaching-only faculty member dedicated to the Automotive Engineering program. This requires the program to rely on the Mechatronics, Mechanical, and Manufacturing Engineering programs for delivery of several courses. The small number of faculty in both the Automotive and Mechatronics programs places limits on how much the Automotive Engineering program can be distinct from e.g. Mechanical Engineering.

### **Program's Response**

The Program agrees that the faculty compliment is insufficient. A minimum of two to three additional TTT positions must be allocated to the program.

### **Dean's Response**

This term, the department hired a new faculty member to serve the mechatronics engineering. The Dean, in consultation with the provost, will continue to monitor the needs of the department and will ensure the programs are well served with the needed expertise in not only Automotive but also Mechatronics engineering.

### **Recommendation 9**

Review Program Learning Outcomes to ensure that they are clearly defined and easily understood by prospective students and the general public.

### **Program's Response**

The Program Learning Outcomes were reviewed and completely updated as part of this cyclical review. The reviewers' made note about the outcome: ""Understand and apply the principles and key provisions of the Canadian automotive engineering framework." This outcome was one of the old learning outcomes and is no longer listed.

### **Dean's Response**

The Dean supports the Program's response.

### **Recommendation 10**

Review the organizational structure of the Academic Advising unit and its relationship to the Faculty, including the distribution of tasks between Academic Advising and Student Life. Explore the possibility of reducing the distinction between seeking academic counselling and mental health counselling.

### **Program's Response**

The Program agrees that the new advising structure needs to be updated. Advisors should be reporting directly to the Faculty as per the old model.

### **Dean's Response**

This is a new advising structure that is currently evolving. The Faculty will continue to provide the necessary feedback and work with the advising team to ensure the students are well served and the program integrity is preserved to meet the CEAB requirements and standards.

### **Recommendation 11**

Investigate raising the admission requirements/standard for the program, as a method of improving retention rates within the program, particularly between 1st and 2nd year. In particular, a review of the academic performance in high school, and the particular high school or district of the students who withdraw from the program may prove helpful in informing the admission standards.

### **Program's Response**

The Program supports the idea of raising admission requirements, but this will need to be investigated carefully to ensure no negative budgetary impacts. As noted, more data about incoming students would be useful prior to making any changes.

### **Dean's Response**

There is continuing effort across the university and within the Faculty to improve students' retention. The retention issues that are related to the students' readiness are closely monitored by the Faculty. The common first year is designed to enhance the retention and students' engagement. The efforts made in the past 7 years by creating a common first year and designating a first-year engineering advisor have shown great success. The variations among different school districts will continue to be a challenge, and data will be needed before making any new suggestions of changes.

### **Recommendation 12**

Investigate the program's student retention, particularly students choosing to switch into another program. A questionnaire or survey to those students who have switched programs on their reasons for switching would provide useful information.

#### **Program's Response**

The Program will ask the Faculty to survey all students who either leave the program completely or switch to another engineering program to determine their reason for leaving. This information will be useful in understanding issues around student retention and developing ideas to improve student retention.

#### **Dean's Response**

The Dean supports the Program's suggestion. The Associate Dean will follow up with the advising team and collect all the relevant data.

### **Recommendation 13**

Develop supports to assist student performance and retention. Consider establishing a program-specific scholarship that can be offered to the first-year quality-selected students, and to continuing students with both quality-based and need-based selections, and/or some expanded peer mentoring or opportunities for assistance from teaching assistants.

#### **Program's Response**

In the last number of years, the Faculty has implemented a number of initiatives to improve student retention, most notably having dedicated first-year academic advisors. Using the information gathered from Recommendation #12 will also allow us to better understand the issues surrounding student retention and propose additional initiatives for student retention. The Program will explore the possibility of implementing a mentoring program for new students, matching first year students with senior level students. Regarding dedicated scholarships for automotive engineering students, the University already has some dedicated scholarships for automotive engineering students but we will work with the Advancement Office to attempt to get further scholarship support.

#### **Dean's Response**

The Dean agrees with the Program's response.

## Plan of Action

The table below presents a timeline of the actions planned to address the recommendations from the external report.

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow Up*	Timeline	Resources/Support Needed
<p><b>Recommendations 1-4</b></p> <ul style="list-style-type: none"> <li>• Expand upon the Thermofluids content within the program curriculum.</li> <li>• Expand upon the Automotive Engineering specific elective course options available to students. Develop/revise Automotive specific content within the program to bring it up-to-date with recent industry directions.</li> <li>• Review program curriculum to ensure consistency and fluidity of content between existing Automotive specific courses, with an eye to elimination of unnecessary overlap in content.</li> <li>• Introduce students to Automotive Engineering specific content earlier in the program.</li> </ul>	<p>Curriculum Committee will review and provide recommendations.</p>	<p>Program Curriculum Committee and Department Chair</p>	<p>2023</p>	<p>None</p>

<p><b>Recommendation 6</b></p> <ul style="list-style-type: none"> <li>Clearly define the relationship between the ACE and the Faculty of Engineering and Applied Science, particularly the facility's role within the Automotive Engineering Program, and ensure it is reflected in the messaging that is sent to prospective students. Look for ways to improve student access/involvement with the ACE Facility at undergraduate level.</li> </ul>	<p>Follow up with Provost and VP-Research.</p>	<p>Dean</p>	<p>2023</p>	<p>None</p>
<p><b>Recommendation 8</b></p> <ul style="list-style-type: none"> <li>Review faculty compliment to ensure there is sufficient regular (TTT) faculty to comfortably meet the program's needs, now and going forward.</li> </ul>	<p>Ask to hire 2 to 3 more faculty members to support Automotive/Mechatronics. These are large programs and we don't have proper coverage for all expertise.</p>	<p>Dean/Provost</p>	<p>2023</p>	<p>Yes</p>
<p><b>Recommendation 12-13</b></p> <ul style="list-style-type: none"> <li>Investigate the program's student retention, particularly students choosing to switch into another program.</li> <li>Develop supports to assist student performance and retention. Consider establishing a program-</li> </ul>	<p>Associate Dean will follow up with the advising team and collect all the relevant data.</p>	<p>Associate Dean</p>	<p>2022</p>	<p>None</p>

<p>specific scholarship that can be offered to the first-year quality-selected students, and to continuing students with both quality-based and need-based selections, and/or some expanded peer mentoring or opportunities for assistance from teaching assistants.</p>				
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\*The Dean of the Faculty, in consultation with the Program Review Chair shall be responsible for monitoring the Implementation Plan. The details of progress made will be presented to the Academic Resource Committee, Academic Council and the Board of Governors and filed in the Office of the Provost and Vice-President (Academic).

## Recommendations not Addressed

Recommendations not addressed and rationale from the Decanal response.

<b>Recommendation not Addressed</b>	<b>Rationale</b>
<p><b>Recommendation 5</b> Examine the option of allowing some overlap of graduate course and senior undergraduate technical electives, to improve upon selection of senior-level course options, and implement as required.</p>	<p>It does not have a direct impact on the program quality. May be a good option to retain our undergraduate students for graduate studies.</p>
<p><b>Recommendation 7</b> Explore the possibility of combining the Reverse Career Fair with the Capstone Design presentations, as well as expanding the Capstone Oral Presentation to include a Poster Presentation to aid in this interaction.</p>	<p>The Faculty does not feel this is essential and they are too big to hold together.</p>
<p><b>Recommendation 9</b> Review Program Learning Outcomes to ensure that they are clearly defined and easily understood by prospective students and the general public.</p>	<p>The Program Learning Outcomes were reviewed and completely updated as part of this cyclical review. The reviewers' made note about the outcome: "Understand and apply the principles and key provisions of the Canadian automotive engineering framework." This outcome was one of the old learning outcomes and is no longer listed.</p>
<p><b>Recommendation 10</b> Review the organizational structure of the Academic Advising unit and its relationship to the Faculty, including the distribution of tasks between Academic Advising and Student Life.</p>	<p>This is a new advising structure that is currently evolving. The Faculty will continue to provide the necessary feedback and work with the advising team to ensure the students are well served and the program integrity is preserved to meet the CEAB requirements and standards.</p>
<p><b>Recommendation 11</b> Investigate raising the admission requirements/standard for the program, as a method of improving retention rates</p>	<p>There is continuing effort across the university and within the Faculty to improve students' retention. The retention issues that are related to the</p>

<p>within the program, particularly between 1st and 2nd year. In particular, a review of the academic performance in high school, and the particular high school or district of the students who withdraw from the program may prove helpful in informing the admission standards.</p>	<p>students' readiness are closely monitored by the Faculty. The common first year is designed to enhance the retention and students' engagement. The efforts made in the past 7 years by creating a common first year and designating a first-year engineering advisor have shown great success. The variations among different school districts will continue to be a challenge, and data will be needed before making any new suggestions of changes.</p>
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**Due Date for 18-Month Follow-up on Plan of Action: February 2023**  
**Date of Next Cyclical Review: 2027-2029**