FINAL ASSESSMENT REPORT

PERIODIC PROGRAM REVIEW (PPR)
Bachelor of Engineering
In Aerospace Engineering
Faculty of Engineering and Architectural Science

In accordance with the Institutional Quality Assurance Process (IQAP)**,** this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the undergraduate **Aerospace Engineering** program. The report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The Implementation Plan identifies who will be responsible for leading the implementation of the recommendations; who will be responsible for providing any resources entailed by those recommendations; and timelines for acting on and monitoring the implementation of the recommendations.

SUMMARY OF THE PERIODIC PROGRAM REVIEW OF THE AEROSPACE ENGINEERING PROGRAM

The Aerospace Engineering program submitted a self-study report to the Vice-Provost Academic on December 3, 2019. The self-study presented the program description and learning outcomes, an analytical assessment of the program, and program data including the data collected from a student survey along with the standard University Planning data tables. Appended were the course outlines for all core required and elective courses in the program and the CVs for all RFA faculty members in the Department of Aerospace Engineering and all other faculty who have recently taught core courses (required and/or elective).

Three arm's-length external reviewers, Dr. Peter Grant, Professor and Aerospace Major Chair, Faculty of Applied Science and Engineering at the University of Toronto, Dr. Regina Lee, Associate Dean of Research and Graduate Studies, Lassonde School of Engineering at York University, and Dr. Alexander Ferworn, Professor in the Department of Computer Science at Ryerson University, were appointed by the Dean of the Faculty of Engineering and Architectural Science from a set of proposed reviewers. They reviewed the self-study documentation and then conducted a site visit at Ryerson University on May 7 and 8, 2019.

The visit included meetings with the Provost and Vice-President Academic; Vice-Provost Academic; Dean, Faculty of Engineering and Architectural Science; Associate Dean FEAS undergraduate; Chair, Aerospace Engineering; and the Associate Chair, Aerospace Engineering. The PRT also met with several members of the Department of Aerospace Engineering including staff, students, and faculty members, as well as with Faculty of Science Chairs from Mathematics, Chemistry, Physics and Computer Science, and the Chief Librarian. A general tour of the campus was provided, including a tour of the program's laboratory facilities and the library.

In their report, dated May 30, 2019, the Peer Review Team (PRT) provided feedback that describes how the Aerospace Engineering program meets the IQAP evaluation criteria and is consistent with the University's mission and academic priorities. The Peer Review Team (PRT) also noted that the Aerospace Engineering program is in high demand by students, and graduates of the program are in demand within the aerospace industry. The curriculum is in line with other aerospace departments within Canada and was recently accredited by the CEAB.

The main areas of strength identified by the PRT include:
- Students engaged in the program and in extracurricular student clubs that the program supports.
- The 'hands on' approach to curriculum, faculty instruction and the RIADI program.
- Well designed and executed laboratories, run by experienced and professional technical staff.
- Alignment with the experiential learning goal in Ryerson's strategic plan.

The PRT also identified areas for improvement, including the large size of first year service courses which negatively affect the learning experience; a lack of appropriate study space for students; incorporation of student feedback; on campus student safety; and the need for improved gender diversity.

The Chair of the Aerospace Engineering program submitted a response to the PRT Report on June 10, 2019. The response to both the PRT Report and the Program's Response was submitted by the Acting Dean of the Faculty of Engineering and Architectural Science on November 26, 2019.

The Academic Standards Committee completed its assessment of the Aerospace Engineering Program Review on February 13, 2020. The Committee indicated that a thorough, analytical and self-critical program review was conducted. The School integrated into the developmental plan feedback from students, alumni, employers and peer reviewers, and outlined a comprehensive plan for program enhancements moving forward.

The Academic Standards Committee recommends that the program continue, as well as provide a one-year follow-up report by June 30, 2021, as follows:

1. Information on the FEAS EDI Task Force mandate, membership, and activities;
2. Report on the status of the initiatives outlined in the Implementation Plan.

Presented to Senate for Approval: April 7, 2020

Start date of next Periodic Program Review: 2024-25

SUMMARY OF THE REVIEWERS' RECOMMENDATIONS WITH THE PROGRAM'S AND DEAN'S RESPONSES

RECOMMENDATION 1. Working closely with the First-year Engineering Office, class sizes for 1st year service courses should be capped at somewhere around 150 students if possible.
Department's Response: Large class sizes are common in the first year of the program. All first year classes, except AER 222, have the potential to be large (more than 150 students). The subjects of these courses are: Mathematics, Chemistry, Physics, Computer Science, and Economics. The program agrees that large classes are detrimental to student learning. However, since these courses are managed by departments outside FEAS, the program must work through the Faculty to address such changes. The program will ask the Associate Dean of Undergraduate studies to work with service departments to lower class sizes.
Dean's Response: not specifically addressed.

RECOMMENDATION 2. The university as a whole should investigate new ways to generate appropriate study space. These spaces should have outlets.
Department's Response: With increasing enrollment in the university, more pressure will be placed on student study space. Ideally, study space dedicated to program students only would alleviate student concerns. The program will make a request through the Dean of FEAS to have more study space made available to program students. This would be a long-term goal since space for any purpose at Ryerson is in very short supply.

Dean's Response: The Faculty recognizes that space issues are one of the biggest threats facing our programs. The Department has developed a significant research facility at Downsview Airport (DAIR), which has helped alleviate some of the space stresses facing the Department. This facility is expected to continue to grow and is already a showpiece for the Department.

RECOMMENDATION 3. IT support for aerospace computing needs to be carefully examined in consultation with the Faculty level support staff. An alternative solution may be required for the suite of specialized software that are available only in the limited space with one technician.

Department's Response: The PRT recognizes that IT support for the program has remained unchanged over the past decade, even though student enrollment in the program has grown 40%. IT support is the one function of the program and the Aerospace Department that is under the most pressure. As artificial intelligence, big data analysis, and integrated engineering software platforms become the norm, pressure on IT capability will only increase. The program will request a new IT position that can support the undergraduate program and research needs of the Department of Aerospace Engineering.

Dean's Response: Needed ongoing investments will be made to ensure continued contribution to the discipline and community. Specific curricular development efforts will be made to improve experiences for greater interdisciplinarity and flexibility for students within the department, across the Faculty and university. Finally, proper staffing will support these goals in a reliable and sustainable manner.

RECOMMENDATION 4. A method should be developed for ensuring the student feedback is taken seriously by all faculty within the department and a clear message to the student is provided in implementing the solution.

Department's Response: The faculty course surveys done at the end of each course do not provide direct feedback on student experience. The program will consider developing its own survey with a free form written section for students to supply feedback. This survey can be developed in conjunction with the efforts currently underway in FEAS. The results of the survey can be compiled at the end of the Winter term and supplied to the Aerospace Curriculum Committee (ACC) along with results from the CEAB GA survey and Industrial Advisory Committee (IAC) review. The recommendations of the ACC involve program curriculum and course content. The ACC recommendations must be approved by the Department Council which has representation from the student body. In this manner, the students will be informed of program changes resulting from student surveys.

Dean's Response: It is a priority for the Faculty to develop a student-centered culture in all Departments. The Faculty has established an "all-in approach" to all Faculty activities which will continue to develop and enhance the student experience.

RECOMMENDATION 5. The department should continue to explore new ways to address gender diversity within the faculty and student body.

Department's Response: Approximately 16% of the undergraduate students are female in 2018-2019. This number has risen from about 9% a decade ago. Progress is being made but it is slow. The point at which student choice can be influenced is while they are considering career options in high school. The female faculty in the program have visited high schools in the past, which may explain the rise in the number of female students. However, more can be done. The program along with FEAS should consider high school student competitions to make student aware of Aerospace as a career option. In the past, the program has run rocketry and radio-controlled aircraft competitions. In terms of the faculty compliment, the Department Hiring Committee (DHC) has been making an effort to actively encourage qualified female candidates to apply for existing faculty positions. It has been working with the Human Resources department to craft appropriate job postings to encourage diverse applicants. The DHC will continue to do so when additional positions become available.

Dean's Response: not specifically addressed.

RECOMMENDATION 6. The program should try to incorporate emerging aerospace fields such as UAVS, autonomous systems, and AI in the curriculum as these fields mature.

Department's Response: This point made by the PRT reflects the rapidly changing engineering environment in aerospace. The program must incorporate these emerging fields to maintain its advantage as a leading edge engineering program. The ACC can create a subcommittee to investigate how these fields can be merged with the program. If these fields can be combined with integrated engineering software platforms and cloud based connectivity, a truly advanced, efficient, state-of-the-art educational experience would be available to students.

Dean's Response: The Department will review its program structure to limit duplication. The Department will also look at ways to include new technologies, such as unmanned aerial vehicles (UAVs) and artificial intelligence (AI). The Department's Developmental Plan includes a full curriculum review, which should address the PRT's recommendations.

RECOMMENDATION 7. The program should explore ways to increase the multi-disciplinary nature of the program perhaps by engaging students and faculty from other programs around the University.

Department's Response: The program has one potential pathway to engage students from other disciplines. The capstone courses could be reconfigured to do projects with large teams that utilize a number of disciplines to provide comprehensive solutions. This would require buy-in from other disciplines and a logistics framework to allow efficient interaction of team members. A competitive format can be used between teams to enhance productivity and innovation.

Dean's Response: refer to Dean's response to recommendation 6.

RECOMMENDATION 8: The program should create opportunities for community outreach which, in turn, would create opportunities for student engagement.

Department's Response: There are several possible pathways to enhance community outreach and student engagement. Mentioned previously in recommendation 5, high school visits and design competitions would create community engagement. Another pathway involves extra-curricular student teams. At present, a number of student teams exist within the aerospace undergraduate cohort that work to enter internationally sponsored design competitions. These teams are open to all willing student participants, and have always been multidisciplinary as a result. Greater support and encouragement by the program would satisfy this recommendation without significantly altering the program. A final pathway would be to create an open elective course focusing the impact of aviation and space exploration. Aerospace has a rich history and has broad community interest which can be used to create a liberal studies course with a wide appeal.

Dean's Response: The Faculty of Engineering and Architectural Science recognizes the value of the program to students, faculty and the public at large. As such, needed ongoing investments will be made to ensure its continued contribution to the discipline and community.

RECOMMENDATION 9: The program should seek higher visibility on campus and engage more members of the Ryerson community.

Department's Response: Greater visibility of artifacts clearly associated with the program will enhance its presence in the University community. One possibility is to use artifacts created by the student competition teams placed around campus to publicize program capability. Such artifacts could include aircraft created to enter the SAE Heavy Lift Competition, or rockets created to enter the Spaceport America Cup, or even the personal flying device in the to Go-Fly competition. Student teams are willing to display their entry after a competition is complete since entries in following years require completely new craft.

Dean's Response: Specific curricular development efforts will be made to improve experiences for greater interdisciplinarity and flexibility for students within the department, across the Faculty and university.

RECOMMENDATION 10: The program should continue to grow the CIP and RIADI programs so that all students have this opportunity for experiential learning.

Department's Response: The Cooperative Internship Program (CIP) and the Ryerson Institute for Aerospace Design and Innovation (RIADI) provide internships to students to enhance experiential learning and career readiness. In fact, the RIADI program is unique in the University and predated the cooperative program. These programs provide a tremendous benefit to student experience and career preparation. The program will make a greater effort to use its existing links with industry to create more internship opportunities.

Dean's Response: refer to Dean's response to recommendation 4 and 6.

IMPLEMENTATION PLAN

Priority Recommendation #1: *Working closely with the First-year Engineering Office to cap class sizes for 1st year at somewhere around 150 students if possible.*
Rationale: *The program agrees that large classes are detrimental to student learning. Reducing class sizes can be helpful in improving the first year students learning.*
Implementation Actions: • *The program will work through the Faculty to reduce class sizes, especially in first year to below 150.*
Timeline: *Department will send the request to the Associate Dean in Fall 2020*
Responsibility for **a) leading initiative:** *Associate Chair Undergraduate* **b) approving recommendation, providing resources, and overall monitoring:** *Faculty Dean*

Priority Recommendation #2: *Working with the Dean of FEAS to investigate new ways to generate appropriate study space for the program students.*
Rationale: Study space dedicated to program students would alleviate student study space concerns*.*
Implementation Actions: • *The program will continue to work through the Dean of FEAS to have more study space made available to program students.*
Timeline: *Long term due to the campus space limitation*
Responsibility for **a) leading initiative:** *Department Chair* **b) approving recommendation, providing resources, and overall monitoring:** *Faculty Dean*

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Priority Recommendation #3: *IT support for aerospace computing needs to be carefully examined in consultation with the Faculty level support staff.*
Rationale: *IT support is the one function of the Department that is under the most pressure. As artificial intelligence, big data analysis, and integrated engineering software platforms become the norm, pressure on IT capability will only increase.*
Implementation Actions: • *The program will request a new IT position that can support the undergraduate program and research needs of the Department of Aerospace Engineering*
Timeline: *Request will go to the Dean in Fall 2020*
Responsibility for **a) leading initiative:** *Chair* **b) approving recommendation, providing resources, and overall monitoring:** *Faculty Dean*

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Priority Recommendation #4: *Developing a method to ensure the student feedback is taken seriously by all faculty within the department.*
Rationale: *The faculty course surveys done at the end of each course do not provide direct feedback on student experience. The program needs to develop its own survey and develop guidelines to improve the program using student surveys.*
Implementation Actions: *e.g.* • *The program will develop its own survey with a free form written section for students to supply feedback.* • *The results of the survey will be compiled at the end of each winter term and supplied to the ACC along with results from the CEAB GA survey and IAC review.* • *ACC recommendations must be approved by the Department Council which has representation from the student body.*
Timeline: *2021-22 academic year*
Responsibility for **a) leading initiative:** *ACC* **b) approving recommendation, providing resources, and overall monitoring:** *Department Council*

Priority Recommendation #5: *Exploring new ways to address gender diversity within the faculty and student body.*
Rationale: *Though the percentage of female students are increased during the past decade, the program still need to do more to attract female students. Progress is being made but it is slow.*
Implementation Actions: • *The program along with FEAS will visit high schools to make student aware of Aerospace as a career option.* • *The program will run competitions such as rocketry and radio-controlled aircraft to attract female students.* • *The Chair and DHC will make every effort to actively encourage qualified female candidates to apply for existing faculty positions for any new faculty position.*
Timeline: *Ongoing*
Responsibility for **a) leading initiative:** *Department Chair, DHC, FEAS* **b) approving recommendation, providing resources, and overall monitoring:** *Faculty Dean*

Priority Recommendation #6: *Incorporating emerging aerospace fields in the curriculum.*
Rationale: *The engineering environment in aerospace is rapidly changing. The program must incorporate the emerging fields to maintain its advantage as a leading edge engineering program.*
Implementation Actions: • *The ACC will create a subcommittee to investigate how the new subjects can be merged with the program.* • *The ACC will prepare the recommendation to the Department Council for approval.* • *The Department gradually implements the approved changes to the program.*
Timeline: *Process will be initiated in 2020-2021 academic year*
Responsibility for **a) leading initiative:** *ACC and Associate Chair* **b) approving recommendation, providing resources, and overall monitoring:** *The Department Council*

Priority Recommendation #7: *Exploring ways to increase the multi-disciplinary nature of the program.*
Rationale: *Improving multi-disciplinary form of education will enhance productivity and innovation.*
Implementation Actions: • *The capstone course coordinators will explore possibility of reconfiguring the projects to utilize students from other disciplines.*
Timeline: *Academic year 2020-2021*
Responsibility for **a) leading initiative:** *Capstone Course Coordinators* **b) approving recommendation, providing resources, and overall monitoring:** *Department Associate Chair*

Priority Recommendation #8: *Creating opportunities for community outreach and student engagement.*
Rationale: *To enhance community engagement and program visibility*
Implementation Actions: • *The program along with FEAS will visit high schools to make student aware of Aerospace as a career option.* • *The program will run competitions such as rocketry and radio-controlled aircraft to attract young students.* • *The Department will give greater attention and support to extra-curricular student teams and encourage them to enter into national and internationally sponsored design competitions.* • *The Department will create a liberal-studies course focusing on the impact of aviation and space exploration.*
Timeline: *Ongoing*
Responsibility for **a) leading initiative:** *Department Chair* **b) approving recommendation, providing resources, and overall monitoring:** *FEAS*

Priority Recommendation #9: *Seeking higher visibility on campus and engaging more members of the Ryerson community.*
Rationale: *This will enhance program visibility on campus and improve the multidisciplinary nature of the program.*
Implementation Actions: • *The program will have higher participation in Ryerson Engineering Day* • *The Department will place around campus artifacts created by the student competition teams to publicize the program capability.*
Timeline: Ongoing
Responsibility for **a) leading initiative:** *Department Associate Chair* **b) approving recommendation, providing resources, and overall monitoring:** *Department Chair*

Priority Recommendation #10: *Growing the CIP and RIADI programs.*
Rationale: *This will enhance students experiential learning through internships.*
Implementation Actions: • *The program will make a greater effort to use its existing links with industry to create more internship opportunities through RIADI and CIP.*
Timeline: Ongoing
Responsibility for **a) leading initiative:** *CIP and RIADI Directors* **b) approving recommendation, providing resources, and overall monitoring:** *FEAS Dean*