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Growing the Space Ecosystem

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Abstract

In 2010, the Canadian Space Agency decided to ease the entrance of recent engineering graduates into the space domain. The Engineer Development Program was created. It welcomes early career engineer, trains them for 2 years, gives them the required tools to become bilingual, a requirement for many positions at the Canadian Space Agency, and trains them for their future position, either as an operation engineer, a system engineer, a specialty engineer, or a project manager. Moreover, during the 2 years of the Engineer Development Program, trainees do 2 internships in sectors of the Canadian Space Agency different from the one of their future position, ensuring they have a wide knowledge of the Canadian Space Agency. This paper presents the program, and how an early career engineer or a student in engineering or physics can prepare themselves for such positions and gain experience in the space domain. Canada relies on the academic community to prepare students to a career in space. The Canadian Space Agency took note that a large part of the academic space domain ecosystem was constituted of well established academia members. Many academic researchers outside the space domain work in fields that are interesting to the space industry and could lead to innovation in the space domain, but it is difficult for these academic researchers to obtain funding for a space project, given their lack of space experience. The Ad Astra program was instituted. Teams that are formed mostly of academic researchers with no previous space experience can be mentored by Canadian Space Agency specialists in order to build their network and train themselves on space specificities. Within a year, those teams are in a position to obtain funding for their space initiative. As they do so, they train students who become the next wave of early career engineers in the space domain. This presentation will also present the Ad Astra program and how to form a team.

Keywords: space sector, space research

1. Introduction

Space is an endeavour requiring excellence. The Canadian space sector relies on its academic community to train engineers able to excel in the space sector. Those involved are doing extremely well, but as the space sector grows, more academics are required to train more engineers in a wide array of research fields link to space. This paper describes how the Engineer Develop Program allows recent graduates to join the Canadian Space Agency and, in the space of 2 years, become highly proficient engineers able to handle complex space project. It also presents the Ad Astra program that was designed to grow the academic ecosystem in the space domain. As the space sector grows, more professors are needed to join the space domain and train the future generation.

2. The Engineer Development Program

In the early 2000, there was a realisation that most engineers joined the Canadian Space Agency at mid-career. Steve MacLean, the President of the Canadian Space Agency at the time, had many conversations with recent graduates in engineering and science that expressed the difficulty they had in going from a degree related to space to a position in the space industry. For Canada, this meant a loss of talent, as these recent graduates would either go work abroad or switch industry. Steve MacLean mandated his staff to create a program to allow recent graduates to join the Canadian Space Agency. Under the leadership of Tuan Huynh, director of what is now called the Engineering and Capacity Demonstration Department, the Engineer Development Program was created. Three main objectives were expected from the program: firstly, break silos by training engineers that would be knowledgeable in several aspects of the Canadian Space Agency, and ensure these engineers could be easily redeployed within the Canadian Space Agency if a need arose; secondly, ensure these engineers would possess good interpersonal skills to take on leadership roles; and lastly, provide the necessary training to ensure these engineers would gain good corporate skills, allowing them to work in the context of government.

2.1 Program Design

A survey of existing training programs convinced the management team that simple rotations from one sector to the other did not allow for the development of interpersonal skills or corporate skills. Some form of coaching would be better suited to reach that goal. Moreover, it was recognized that a strong sense of belonging leads to a more motivated workforce, and therefore, it was important that the program becomes one that would induce pride in its members.

The model chosen implied a manager that would be very active in the life of the team, while the team members would be assigned to different projects and departments to become proficient in several aspects of the Canadian Space Agency over a period of two years. The design of the program evolved over time, but in its current form, the new member of the team is told when offered the job who is the future manager and team in which this new member will work two years later. The first month, the new member works 2 days per week for the future manager, getting acquainted with the future team and the projects of that team. The new member works also 1 day per week for a different project in a different department in order to get acquainted with another aspect of the Canadian Space Agency. That second task is chosen to balance the training of the team member and ensure a good mix of specialty tasks, system engineering tasks, project management tasks, and operational work. The last 2 days of the week are reserved to training to get familiar with the way government works. Starting the second month and for the next 6 months, the member of the team works 2 days a week for the future manager, 2 days a week on the second assignment, and 1 day a week on activities aiming at developing corporate knowledge, but also leadership skills. The members of the team learn to evaluate bids, write statements of work, and lead teams of undergraduate students in the design of space systems.

The second 6 months, the member will still work 2 days a week for the future manager, but will chose the second assignment, in order to explore an aspect of engineering or the Canadian Space Agency of special interest to the career of that team member. For the second year of the program, the team member will work 4 days a week for the future manager, but the team members will still be highly involved in the life of the program by assisting newer members and developing new activities to teach undergraduate students the complexity and specificity of space systems.

2.2 The Recruitment Process

Recruitment campaigns are launched when the need arise to obtain a pool of qualified candidates on certain topics. Nominally, recruitment campaigns are held every 2 years, but they can be held yearly if required. The specialty topics will vary from recruitment campaign to recruitment campaign. Usually, a recruitment campaign will regroup between 5 and 15 specialty topics, such as, optics, structure, thermal analysis, radars, embedded systems, etc. The recruitment campaigns are advertised on jobs.gc.ca and candidates are typically given 2 weeks to complete their application. Applicants answer questions detailing their experience on their chosen specialty topics. Applications will be screened based on these answers and the strongest applicants will be invited to technical oral exams to evaluate their understanding of the topic and their ability to reflect on the topic and form solutions or relevant observations when presented with a technical problem. The applicants who do well on the technical exams are then invited to an interview that is dedicated to interpersonal skills. Candidates will be asked to recount some events they went through in their academic or professional life and will demonstrate their interpersonal skills in the process. Candidates who do well in the interviews are then placed in a pool of qualified candidates. When a manager asks for potential candidates with a specific specialty, all the relevant files are presented to that manager, who will in turn select a candidate based on the complete file of that candidate.

2.3 Preparing Oneself for the Recruitment Process of the Engineer Development Program

Some candidates are evidently well prepared for the recruitment process. First, these candidates read their emails carefully and prepare each step of the recruitment process with great care. They tend to be motivated and resourceful, making themselves available for each step of the recruitment campaign. They read on the specialty topic they are applying to and come to the technical tests and interview with knowledge on the specificity of their specialty topics when it comes the space sector.

Candidates who do well on the interview tend to be candidates who are involved in the community and therefore, have gained more life experience and are able to share insights with the interviewers. Candidates who read a lot also have an advantage as they express themselves more easily when it comes to recounting some events they lived through. The competencies being evaluated during the interview are spelled out when the position is announced, for example, 'Working effectively with others'. Well prepared candidates review the events they went through that are relevant to this competency and they come to the interview with several events fresh in their minds for which they are able to give details.

While the program is geared towards engineers, physics students can obtain a qualification from a bureau of engineers. Often, only a few topics must be studied to obtain that qualification. However, it must be already obtained

at the time of the application to the recruitment campaign. It is advised for physics students to explore the required topics to gain expertise in to be considered as an engineer.

3. The Ad Astra Program

While several activities allow to train more undergraduate students in space topics, such as Cubesat clubs or Capstone projects related to space, it was noticed that it was mostly a group of well established academics that trained many of the students entering the space domain. To enlarge the ecosystem of academics doing research in the space sector, the Ad Astra program was instituted. This program is aimed at researchers with interesting technologies for the space sector, but who do not have yet the required specific knowledge of the space sector to write a proposal that will lead to grant. With the Ad Astra program, no funds are offered, but Canadian Space Agency specialists will accompany teams of academics and participate on discussions on the specificities of the space environment or the space sector. Typically, the Canadian Space Agency specialist meets its team at least on a monthly basis to discuss with the students and offer perspective on what is required in space.

The team must be composed of at least 2 professors who are not space experts, from 2 different departments or institutions. Their project must not be a simple application of existing work to space, but it must be a unique product or project specifically designed for space. The teams contact the author of this paper, and if there is availability, a specialist is assigned to their team.

As there is no fund associated to this initiative, the teams must accept to start small, relying on Capstone teams or non-thesis master students to try out ideas and build the necessary knowledge to then be able to apply independently to a granting agency. If the team chooses to apply to a grant of the Canadian Space Agency, then the Canadian Space Agency specialist puts an end to its collaboration with the team.

The Ad Astra program is still in its pilot phase, but 2 of the original teams formed under Ad Astra are thriving with several graduate students attached to the team.

4. Conclusions

During the years 2000, a difficulty for recent graduates to access the space sector was noticed. The Engineer Development Program was created and has trained over 55 engineers from all over Canada in the last 15 years. Candidates wishing to apply must prepare themselves carefully to distinguish themselves among all the applicants.

Capstones related to space, Cubesats clubs and similar space oriented clubs are an excellent manner to increase space proficiency in undergraduate students, but a body of academics versed in the space domain is required for these activities to thrive. To increase the number of professors doing research in the space sector, the Ad Astra program was created which accompanies teams of professors new to space to establish their own research program in that field. The Ad Astra program doesn't carry any funds, but it provides a Canadian Space Agency specialist that meets regularly with the team to discuss the space environments and its specificities. Early results are encouraging with some teams growing their number of graduate students involved and gaining in space knowledge.