

A look into the Canadian aerospace innovation ecosystem

Posted on April 6, 2016 by [Nitin Dahad](#) |



Innovation clusters and hubs often grow around specific industries. In *The Next Silicon Valley*, we frequently explore what makes particular locations strong in specific industry sectors. In this article we take a look at the innovation ecosystem in Canada's aerospace sector, since this is one of the most important contributors to its economy, delivering CAD\$29 billion in GDP and CAD\$27.7 billion in annual revenues, and with CAD\$1.8 billion in annual R&D spending across five clusters.

Innovation in aerospace, space and defence is a major focus of various research institutes and organizations in Canada, including the [University of Toronto Institute for Aerospace Studies](#), [Carleton Aerospace](#), the [National Research Council](#) and [Centre for Aerospace Technology and Training](#), and the Consortium for Aerospace Research and Innovation in Canada ([CARIC](#)). In terms of technology and innovation programs, there are projects like the [Coalition for Greener Aircraft](#), which is funding research and projects looking at [aircraft composite fuselage structures](#), [landing gear of the future](#), and [integrated avionics for the cockpit](#).

The aerospace industry is becoming important both globally and in Canada, and will rely on significant technology and innovation. The industry is changing, with six percent annual growth in air traffic worldwide, fleet sizes more than doubling to over 43,000 aircraft, and it is expected to be a CAD\$5.6 trillion market over the next 20 years.

Total sector revenues in the global aerospace and defense industry is estimated to grow at three percent in 2016, according to the Deloitte Touche Tohmatsu Limited (Deloitte Global) Consumer & Industrial Products Industry group's 2016 [Global aerospace and defense sector outlook](#). The report says this growth will continue as governments equip their armed forces with modern defense weapons platforms

and next-generation technologies, including cyber, intelligence gathering, defense electronics, and precision strike capabilities.

It also says the commercial aerospace subsector is expected to continue its decade-long trend of above-average growth rates, driven by growth in passenger travel demand and an accelerated equipment replacement cycle. Strong increases year on year of global revenue passenger kilometers are leading to an unprecedented level of aircraft production rates, which in 2015 were about twice the levels experienced 10 years ago.

This all points to an important role for Canada's aerospace and defense innovation clusters. According to the [Globe and Mail](#), "Aerospace is one of the most important sources of innovation activity in Canada." The industry ploughs back more than 20 per cent of its total gross domestic product into new research and development spending. Aerospace exports have grown faster than any other major category of Canadian exports, a record CAD\$25 billion last year. In fact, aerospace is the only non-resource industry where Canada enjoys a trade surplus. "That helps offset the enormous trade deficits we incur every year in every other high-tech sector, including machinery, automotive products and electronics," says the article.

We recently obtained a glimpse of the aerospace clusters in Toronto, Montreal, Ottawa and Winnipeg. It was clear that all have very closely linked relationships, interdependencies and networks between academic research, innovation, industry and government. The 'invest-in' agencies in all these locations made a particular play on the strength of the entire aerospace ecosystems, not just one element.

As an example, Toronto's aerospace cluster is supported by industry-led initiatives/organizations such as the Ontario Aerospace Council, as well as Canadian government departments and agencies, the Canadian Space Agency, National Research Council, and Canadian Commercial Corporation. As mentioned already, several leading academic institutions, including the University of Toronto's Institute for Aerospace Studies and Ryerson Institute for Aerospace Design and Innovation provide leading-edge aerospace education and training, as well as facilities for advanced research and development.

In particular, the recently formed [Downsview Aerospace Innovation and Research \(DAIR\) hub](#), a collaborative venture between academia and industry supported by all three levels of government, is a key focus of R&D and innovation in the Toronto region aerospace cluster.

Each hub in Canada has a specific strength or research focus – evident in Toronto for example, where a significant amount of research and industry activity is taking place in the area of UAVs (uninhabited aerial vehicles). To illustrate this, at UTIAS, which is ranked among top five public aerospace departments in North America, there is a good level of research into unmanned aerial systems at its [Centre for Aerial Robotics Research & Education \(CARRE\)](#), and partnerships with numerous Canadian UAV companies. CARRE is a Natural Sciences and Engineering Research Council of Canada (NSERC) sponsored program over six years for collaborative research and training experience in UAVs.

One interesting area of research at CARRE is into applications for UAVs or drones travelling in networks for carrying out, for example, co-operative wildfire monitoring. We've seen demos of multiple drones managed in an autonomous network formation flight, which can be used to detect and estimate fire front lines in forest fires or wildfires. The research into enabling safe, high performance flight looks at motion planning, control, and learning for single and multiple systems/robots, in changing and unknown conditions.

The links to private companies delivering solutions based on research from such institutes is also evident – for example, in the area of UAVs, [Brican Flight Systems](#) and [ING Robotic Aviation](#) have some fairly advanced solutions in areas like agriculture and oil and gas, as well as emergency or critical situations.

The aerospace innovation ecosystem is not just limited to traditional aerospace manufacturing technology. While you have locations that are strong with hubs for manufacturing aviation systems and simulation systems, there are also areas like Winnipeg, the aerospace industry's largest industry's largest centre for repair, overhaul, modification and service of rotary and fixed-wing aircraft, aircraft engines and

accessories, the development and production of sounding rockets, rocket propellants and exotic structural composite components for commercial and military applications, microcomputers and integrated processing systems, and the production of space satellite components.

In addition, it also looks into research and testing for special processes in specialty coatings as well as training simulation and commercial jet engine testing. Winnipeg's aerospace ecosystem is home to the world's largest privately owned facility for the repair and overhaul of turbine engines as well as Canada's only solid rocket propellant manufacturing plant.



Image: At GE Aviation's testing facility in Winnipeg, GE engineers submit the GENx engine to cold weather tests that ensures the engine's performance in the harshest winter conditions.

What is evident is that over the years, with strong industry and government alliances and support with relevant incentives (such as the [scientific and experimental development tax incentive program](#)), the research institutes are well networked in to industry. This ranges from component and landing gear manufacturing (such as Mitsubishi Heavy Industries), to aircraft manufacturers (like [Bombardier](#), [Magellan Aerospace](#)), to simulation (for example CAE), to repair and testing (such as [Standard Aero](#) and [General Electric](#)), and even digital technologies and apps for the aerospace industry (such as [Lixar IT](#)). The linkages certainly help to enable a co-ordinated and collaborative approach to solving industry challenges, addressing the global growth in aerospace and defense, and creating innovative solutions across the entire ecosystem.