

Aerospace future is green and lean

Concordia is conducting research to help Canadian sector stay competitive

Aerospace researchers at Concordia University in Montreal envision a day when Canadian aircraft will be lighter, greener and more efficient to design and manufacture.

But first, says Nadia Bhuiyan, a professor in Concordia University's department of mechanical and industrial engineering, Canadian firms need to maintain and improve their position at the cutting edge of a highly competitive industry.

Ten years ago, Canada's aerospace sector – which employs more than 170,000 people in upwards of 700 companies – was ranked No. 1 in the world for cost competitiveness.

But in recent years, emerging rivals – among them China and India – have threatened this.

"We are moving into an era of increasingly heightened competition," says Dr. Bhuiyan, who is also the associate director of the Concordia Institute of Aerospace Design and Innovation (CIADI). "We face significant challenges to maintain a leadership stance in the global arena."

This increasing pressure from international forces is pushing aerospace companies to lower their costs and reduce development and manufacturing lead times, while at the same time improving quality.

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Dr. Nadia Bhuiyan
Associate Director
Concordia Institute
of Aerospace Design
and Innovation

That's where a \$1.3-million grant comes in, awarded to Dr. Bhuiyan by the Natural Sciences and Engineering Research Council of Canada (NSERC) and collaborating companies Bombardier Aerospace and Bell Helicopter.

Dr. Bhuiyan and her team are carrying out research to trim waste – by being lean.

Lean is a manufacturing method that can be applied throughout the life cycle of a product – from concept to delivery, aftermarket and disposal – to create more value for customers by using fewer resources but not compromising quality.

Lean has been successfully applied to many industries, including aerospace. However, most efforts are still in their infancy in Canada and more research is needed to find the best way forward.

"In practice, lean means that companies are able to focus on what value means to the customer, and then look for ways in which anything that is non-required, non-value-added

can be removed or minimized," explains Dr. Bhuiyan. "To increase their competitiveness in the marketplace, Bombardier Aerospace and Bell Helicopter, both leading global manufacturers of aircraft, are looking to implement lean principles across various parts of their organization."

It's no surprise then, that more and more companies are interested in lean to ensure a heightened level of success and profitability.

By applying lean initiatives, companies such as Boeing and Lockheed Martin, among countless others, have realized improvements in resource productivity, quality, lead times, and even significant environmental benefits due to the reduced use of resources such

as energy and materials. Ultimately, these positively affect a company's bottom line and reputation.

At CIADI, educating undergraduate students will be enhanced and complemented through this collaborative, industry-driven research project. NSERC president Dr. B. Mario Pinto lauds the initiative, saying it not only has a high level of quality research behind it, but it will also help train the next generation of engineers in lean.

"Students will be spending time with companies and gaining real world experience," he says. "They will then be hired and can help apply lean principles within the sector."

The NSERC chief says the collab-

oration is a great example of what can be achieved when academia links with business to find solutions to a common problem. NSERC, which invested \$23-million in aerospace research in 2013-14, acts as the connector between the two.

"All our grants are peer-reviewed by experts, so when we are involved it's a validation," he says. "Businesses can be assured it's a quality-approved venture."

Dr. Pinto believes bringing lean to the aerospace industry is a worthy and ambitious undertaking. "Developing lean processes will be very significant and this will set a precedent to eliminate waste in an important sector in which Canada is already very strong."



Dr. B. Mario Pinto,
NSERC president

He adds that the country is building from a position of strength and has learned a lot from countries like China and India. "We should not set this up as adversarial, India prides itself on frugal innovation and specializes in that, so we cannot sit back and rest on our laurels," Canada, he believes, must also become experts in that, "but we also have to admit our strengths and weaknesses and look to bridge the gaps with the help of others."

Dr. Pinto also believes competition should be collaborative and friendly. "We are going global in the collaborative sense, and the result is a better end product."

For her part, Dr. Bhuiyan is particularly interested in how lean principles can be applied to the design process. "Engineers formulate ideas, which become concepts that are designed, prototype(s) built and tested, and then eventually manufactured," she says, "and it typically takes many years to get the final product or service to market."

A lot of waste is generated during this process, including engineers' time, and she wants to remove such waste and speed up the process while still delivering the best possible product to the customer.

Lean, though, is not about eliminating workers. "Improving processes are meant to improve competitiveness and, in a sense, that can be done by creating more jobs leading to a thriving industry that will in time create more jobs," says the Concordia professor.

"A lean sensei once said that it is order to make planes, one must make and develop people. Lean strives to help workers do the right thing at the right time and, in doing so, workers tend to be much more satisfied with their jobs."

ONLINE

For more information on the Concordia Institute of Aerospace Design and Innovation, visit concordia.ca/encs/aerospace.html

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JUST TALKING

Stellar role

Launching aerospace career is exciting and rewarding, says Concordia University Professor

Q What got you interested in the aerospace sector? Was it something you always wanted to do?

Dr. Nadia Bhuiyan: I've always had an interest in airplanes. I come from a family where almost everyone has worked in the aerospace and aviation business, so I've had a lot of exposure. However, my research was not in this industry initially for that reason. Dr. Hany Moustapha, the director and brains behind behind CIADI [and also a senior fellow and manager...at the time], asked me to be a part of CIADI, and once I became involved, I was lucky to have many opportunities open up to me. So I would say that my involvement in aerospace is thanks to Dr. Moustapha, and it has been very fruitful and fulfilling so far.

Q Explain the role of CIADI.

One of CIADI's main goals is to advance knowledge through innovative research in aerospace in Canada while enriching the learning experience of highly qualified personnel, and assisting industry in implementing research results.

It forms a critical mass of aeronautics and space researchers who collaborate with industry and other institutions to satisfy industry-driven research needs. It also facilitates collaborative aerospace research between government and industry.

Q How is Canada faring in global competition?

In terms of total revenues, in 2010, Canada stood fifth after the USA,

France, Germany and the U.K.

According to experts, in the next 10 years, Asia-Pacific is expected to be the largest market for air transport aircraft.

So the countries within this region pose a threat to the big players and Canada needs to be prepared.

Such intense global competition and changing market dynamics are forcing companies to operate more effectively and efficiently. This is especially the case in the aerospace industry, where increasingly complex systems require time-consuming, expensive and risky product-development cycles and, as such, enterprises must strive to be lean, both within and across organizations.

Q Where do you see the Canadian aerospace industry in 10 or 20 years?

With major challenges ahead, much research is required to quickly find effective solutions to maintain and improve Canada's position in the world of aerospace. The increasing pressure from global competition is forcing aerospace companies to lower their costs and reduce their manufacturing lead times while improving their quality. The future of the aerospace industry lies in part in developing and manufacturing innovative technologies, and governments, the industry and universities are fostering innovation through collaborative research and development.

The future will include creating lighter and greener aircraft, with the goal of reducing environmental impacts. A focus on fuel-efficient

aircraft and noise-pollution reduction are among some of the priorities for the industry. Furthermore, with the increase in fuel prices, which represent a major portion of an airline's operating expenses, aircraft manufacturers are being forced to reduce costs more than ever. By adapting lean techniques to the aerospace industry, Canadian companies can compete better in the global market by reducing their costs and shortening lead times.

Q What would you say to a young person considering a career in aerospace?

There is no doubt that aerospace is an exciting industry. While it faces its share of challenges, it also offers so many opportunities since aviation plays a significant role in our economy. Anyone who is passionate about aircraft and spacecraft should consider a career in aerospace, which involves designing, building and maintenance of aircraft or spacecraft. Among the skills you will need to work in aerospace are technical skills [math and science], problem-solving skills and interpersonal skills, since you will be working in a team-based environment and will have to communicate your ideas and solutions with others in writing or orally. You will also need project management skills and you will always be working on the forefront of technology. Most of the graduates I speak to, who are working in the field, rise quickly in the ranks especially when they have a good cross-sectional knowledge of the business, and they are very stimulated by the industry.