ANNUAL REPORT
Reaching Greener Heights
TABLE OF CONTENT

4 Message from the Chairman of the Board
5 Message from the Executive Director
6 About GARDN
7 GARDN I | Overview of Projects | Research Community and Outreach
8 GARDN II takes flight | First round of Projects
12 Members and Participants
13 Governance
“It is with great pride that I sign this annual report, which not only reflects GARDN I’s significant strides in developing a greener aviation technology, but also gives you a glance at the promising, pioneering projects GARDN II will bring us.

By renewing GARDN, the government has reaffirmed its commitment to developing a more eco-friendly aircraft, reflecting the strategic need for the program in the industry. In addition to consolidating Canada’s green aviation technology expertise, GARDN has a central role to play in driving our industry’s research and development. The program is invaluable for the aerospace world, which should significantly contribute to Canadian innovation, jobs and the economy.

From an even broader perspective, GARDN can also boast about contributing to the expansion of coast to coast collaborative aerospace research. The group has been a key contributor to the establishment of the Consortium for Aerospace Research and Innovation in Canada (CARIC), which plays a key role in providing cohesion and a long-term vision for research programs in Canada. More than ever, our ability to develop new technologies and create highly skilled jobs will be maximized to the fullest extent.

All in all, this is an exciting time for the Canadian aerospace industry. I am proud to be part of a community as great as GARDN.”

“In addition to consolidating Canada’s green aviation technology expertise, GARDN has a central role to play in driving our industry’s research and development.”
“What a year it has been! Indeed, the year 2013-2014 marks the ending of the GARDN I program as well as the launch of its second program, GARDN II. As we embark on this fresh start, our team and our members are looking forward to many opportunities to lift environmental research and development to new heights.

The GARDN renewal was mostly made possible by the solid success of the first program, which was completed in March 2014. This first generation of milestones has laid the foundation for profitable partnerships, including the first flight of a civil jet aircraft powered entirely by pure biofuel and Canada’s first biofuel powered commercial flight.

Rest assured that GARDN II will not be outdone in terms of challenges. Environmental aviation still presents certain critical issues, and we aim to tackle them. This time, three major issues will be identified as priorities to take our leading objectives: silent, clean and sustainable air transportation. We have already announced our initial selection of promising new projects. We plan to initiate a second series in fall 2014.

I would like to conclude by thanking every valuable member and employee who has crossed paths with GARDN. Thanks to them, the continuation of the program has been assured. Your innovative ideas, cooperation and constant support are key to the considerable advances that GARDN projects will bring to the aerospace industry’s environmental challenges.

I hope you will join us for this second installment!”
The Green Aviation Research and Development Network (GARDN) was founded in 2009. Its mandate is to increase the competitiveness of Canada’s aerospace industry by reducing the environmental footprint of the next generation of aircraft, engines and avionics developed in Canada.

GARDN is equally funded by the Business-Led Networks of Centres of Excellence (BL-NCE) and the Canadian aerospace industry.

The BL-NCE program aims to support innovation in the private sector. To this end, the program supports the funding of major collaborative research networks, which are directed by non-profit industrial consortia. These networks boost investment in Canadian private sector research and help foster the transfer of ideas from the laboratory to marketing.

By teaming up Canadian aerospace leaders, BL-NCEs such as GARDN allow the industry to consolidate its resources to address common priorities.

For GARDN, the results in this area are convincing: for its first program, the initial investment of the Network was nearly tripled by industrial and academic members.

**WHAT IS A BL-NCE?**

**AN UNPARALLELED FUNDING LEVERAGE**

**INVESTMENTS IN RESEARCH GARDN I**

2009-2014

Want to know more about GARDN? Watch our corporate video at www.gardn.org!
The Honourable Tony Clement, with representatives from Bombardier Aerospace, Pratt & Whitney Canada, AIAC and GARDN, all collaborators of the first biofuelled commercial flight in Canada.

The Honourable Christian Paradis exchanging with Sylvain Cofsky and Jim Quick at the Farnborough Airshow.
The funding of the second GARDN program was announced on January 22, 2014 by the Honourable Greg Rickford, Minister of State, Science and Technology, at the time.

The new GARDN program will focus on three key words: silent, clean and sustainable. GARDN will also continue to work closely with other national and international research and development initiatives in the aviation and environmental areas.

From left to right: Janet Walden, Chief Operating Officer, Natural Sciences and Engineering Research Council of Canada (NSERC), the Honourable Greg Rickford, Minister of State (Science and Technology) and Sylvain Cofsky, Executive Director, GARDN.

The first round of new GARDN projects was announced in April 2014. With a total value of over $15 million, these projects were chosen from 22 proposals and will act as engines of environmental innovation for the aerospace industry.
NEXT GENERATION COMBUSTOR FOR SMALL GAS TURBINE ENGINES

Objectives
Evolve current low emissions technology developed for large turbofan engines to the next generation turboprops by a new combustor system.

This new combustion system is an enabler for greenhouse gas reduction on the engine and has the potential to deliver significant reductions of NOx and particulate matter while improving component life.

VALIDATION OF POWDER INJECTION TECHNOLOGY FOR THE MANUFACTURING OF AEROSPACE SMALL AND COMPLEX METALLIC COMPONENTS

Objectives
Validate the manufacturing processes of two strategic materials used in aerospace, and apply these processes to components selected by the partners, focusing on understanding the fundamentals of MIM and designing functional components.

This technology could generate significant reduction of the amount of machining and raw material usage resulting in better Buy-to-Fly ratios for complex components.

EXPERIMENTAL VALIDATION OF INNOVATIVE ENVIRONMENTALLY FRIENDLY AIRCRAFT CONFIGURATIONS

Objectives
A continuation of prior work, the GARDN II project involves the development of a novel aircraft concept which is designed to satisfy various performance and stability and control (S&C) requirements.

This aircraft concept will then be tested in a wind tunnel test campaign to validate the S&C characteristics. Various alternative designs will be tested in addition to the baseline configuration.
**FLIGHT MANAGEMENT PERFORMANCE OPTIMIZATION II**

**Objectives**
Optimize the vertical and horizontal path of the aircraft within the Flight Management System by taking into account the Required Time of Arrival, the wind grids and meteorological conditions.

The main motivation of the project is to reduce overall carbon emissions and flight costs.

---

**HYDROFORMED HELICOPTER SKID TYPE LANDING GEAR**

**Objectives**
Reduce weight, components and assembly costs through an enhanced, scaled up methodology of hydroforming aerospace tubular products.

The developed technology will enable the manufacturing of high strength and corrosion, environmental-friendly resistant landing gear components and provide superior quality products at lower life costs values.

---

**NOISE REDUCTION FOR NEXT GENERATION REGIONAL TURBOPROP**

**Objectives**
Leverage new technologies, develop new design methodology, and mature concepts in support of a low-noise large regional turboprop aircraft meeting stringent noise requirements.

The new technology is a feasibility requirement for development of a new large environmentally-friendly turboprop aircraft.
MATERIALS OF CONCERN (MOC) ELIMINATION

Objectives
Reduce environmental impact and personnel exposure during manufacturing and repair by finding greener alternatives to ‘materials of concern’.

The benefits include reducing ozone depleting substances released into the environment and reducing, if not avoiding, worker exposure to hexavalent chromium, cadmium and other ‘materials of concern’.

GREENING THE AEROSPACE SUPPLY CHAIN

Objectives
Define a supply chain management framework to provide industrials with the capacity to prioritize eco-responsible purchasing actions, define technologies’ green specifications and efficiently treat environmental information.

The acquired knowledge will offer a collaboration model fully adapted to the Canadian aerospace sector, facilitating ecodesign across the supply chain.

AIRFRAME NOISE REDUCTION FOR BUSINESS AND COMMERCIAL AIRCRAFT

Objectives
Reduce noise impact of aircraft operations in the vicinity of airports by leveraging new technologies, developing new design methodology and maturing concepts in support of a low-noise large regional turboprop aircraft.

The project will lay groundwork to help reducing the adverse effects of the expected large increase in aircraft traffic volumes in Canada and elsewhere in the next decades.
MEMBERS AND PARTICIPANTS
GARDN I & II

As of September 18, 2014.

ASSOCIATE MEMBERS
GOVERNANCE

BOARD OF DIRECTORS
*Executive Committee  **Observers

PRESIDENT
Jim Quick*
Aerospace Industries Association of Canada

TREASURER
Denis Faubert*
CRIAQ and CARIC

EXECUTIVE DIRECTOR
Sylvain Cofsky* **
GARDN

SECRETARY
Fassi Kafyeke*
Bombardier Aerospace

Don Ball
DB Geoservices

André Bernier**
Industry Canada

Sylvain Cofsky*
Aerospace Industries Association of Canada

Dominique Collin
SNECMA Propulsion Solide/X-NOISE

James Corrigan
Bell Helicopter Textron Canada

Rex Hygate
Esterline CMC Electronics

Farzan Jamarani**
Industry Canada

Jerzy Komorowski*
National Research Council

Renée Leduc**
Networks of Centres of Excellence of Canada

Lucie Boily**
Aerospace Industries Association of Canada

Myrka Manzo
Air Canada

Hayley Ozem
Pratt & Whitney Canada

Benny Pang
Bombardier Aerospace

François Provencher
Pratt & Whitney Canada

Pierre Rioux*
Bell Helicopter Textron Canada

Jacques Roy
HEC Montréal

David W. Zingg*
University of Toronto Institute for Aerospace Studies

PRESIDENT
Benny Pang*
Bombardier Aerospace

David Checkel
University of Alberta

Wajid Ali Chishty
National Research Council

Sylvain Cofsky
GARDN

Stephen Colavincenzo
Bombardier Aerospace

James Corrigan*
Bell Helicopter Textron Canada

Anant Grewal
National Research Council

Mark Huising
Bombardier Aerospace

Rex Hygate*
Esterline CMC Electronics

Ted McDonald
Transport Canada

Sid-Ali Meslioui
Pratt & Whitney Canada

Stéphane Moreau
Université de Sherbrooke

Hayley Ozem*
Pratt & Whitney Canada

Bruce Parry
Bombardier Aerospace

Sam Sampath
University of Toronto Institute for Aerospace Studies

Richard Ullyot
Pratt & Whitney Canada

David W. Zingg
University of Toronto Institute for Aerospace Studies

SCIENTIFIC COMMITTEE
* Scientific Directors

PRESIDENT
Benny Pang*
Bombardier Aerospace

David Checkel
University of Alberta

Wajid Ali Chishty
National Research Council

Sylvain Cofsky
GARDN

Stephen Colavincenzo
Bombardier Aerospace

James Corrigan*
Bell Helicopter Textron Canada

Anant Grewal
National Research Council

Mark Huising
Bombardier Aerospace

Rex Hygate*
Esterline CMC Electronics

Ted McDonald
Transport Canada

Sid-Ali Meslioui
Pratt & Whitney Canada

Stéphane Moreau
Université de Sherbrooke

Hayley Ozem*
Pratt & Whitney Canada

Bruce Parry
Bombardier Aerospace

Sam Sampath
University of Toronto Institute for Aerospace Studies

Richard Ullyot
Pratt & Whitney Canada

David W. Zingg
University of Toronto Institute for Aerospace Studies