



Canadian Aeronautics Innovation an Overview

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National Research
Council Canada

Conseil national
de recherches Canada

Canada

Quick overview for today

- The aerospace industry in Canada
- Who we are
- What we do
- How we succeed
- Some of our recent successes



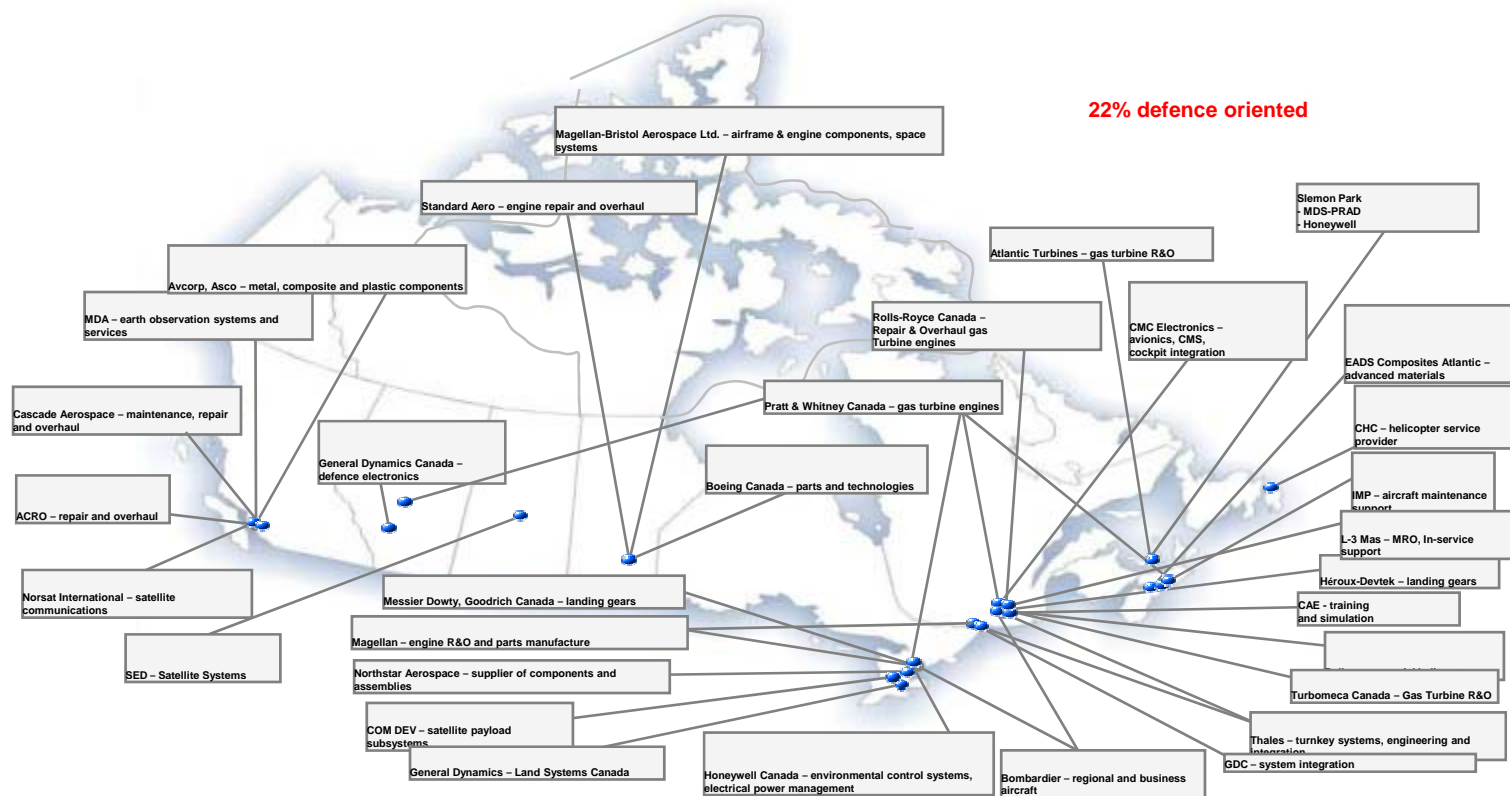
Aerospace in Canada: The Facts

- A **dynamic sector** of Canadian industry
- Currently **5th largest aerospace industry** in the world, after the US, UK, France and Germany
- Contribution to **GDP: \$9.2B**
- Revenues: **\$23.6B**
- Exports: **\$18.6B**
- Aerospace firms: **400+**
- Direct employees: **80,000+**
- Industry **leading in advanced technology exports** with more than 80% of output



Aerospace in Canada – A national industry

Canadian Aerospace Industry - A Presence in all Regions



Aerospace in Canada: Challenges

- **Canadian content** in the global aerospace industry is **declining**
- New and **emerging competitors** in China, Japan and Russia
- **R&TD responsibility shifting** to lower-tier suppliers who lack the necessary resources to compete
- Canada **not well represented in new aircraft** programs
- Demand increasing for aerospace **environmental technologies**



Important Aerospace Innovation Organizations

- Aerospace Industries Association Canada
- AeroMontreal (cluster organization)
- Canadian Aeronautics & Space Institute
- Composites Innovation Centre (Manitoba)
- Canadian Composites Manufacturing Research and Development
- EnviroTREC



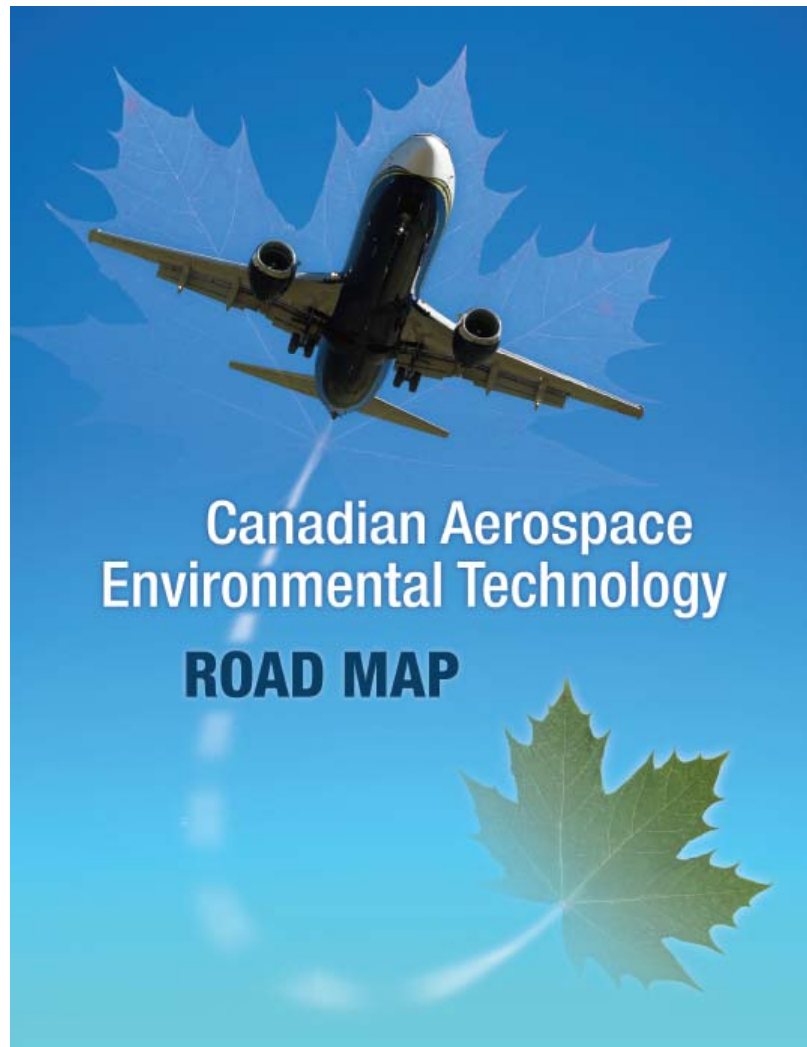


Aeronautics Innovation in Canada





Canadian Aerospace Environmental Technology Road Map (CAETRM)



VISION

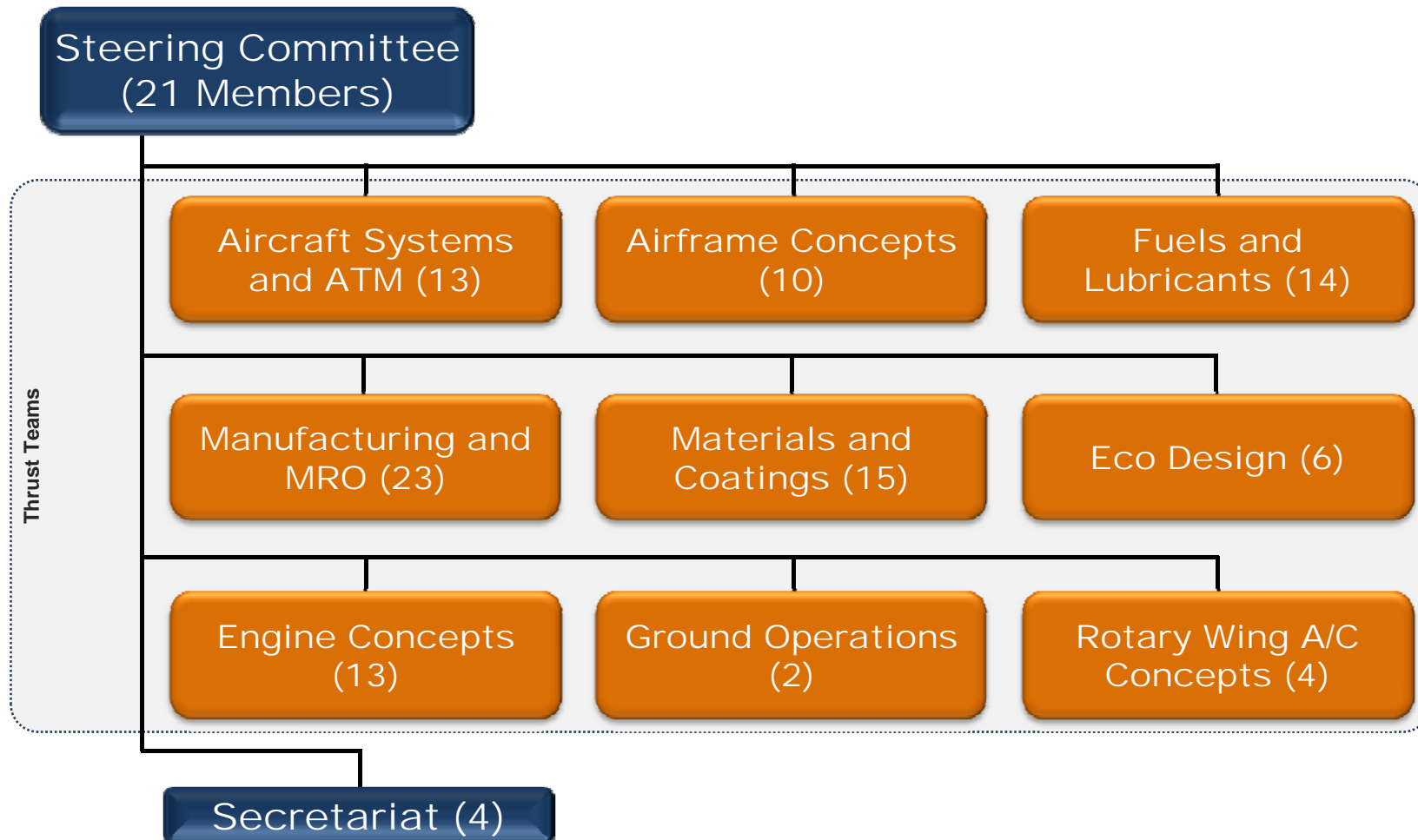
Through critical and timely technology advances, ensure that Canada's aerospace industry grows and prospers by becoming a world leader in environmental management and therefore increases the global competitiveness of its products and services.

PURPOSE

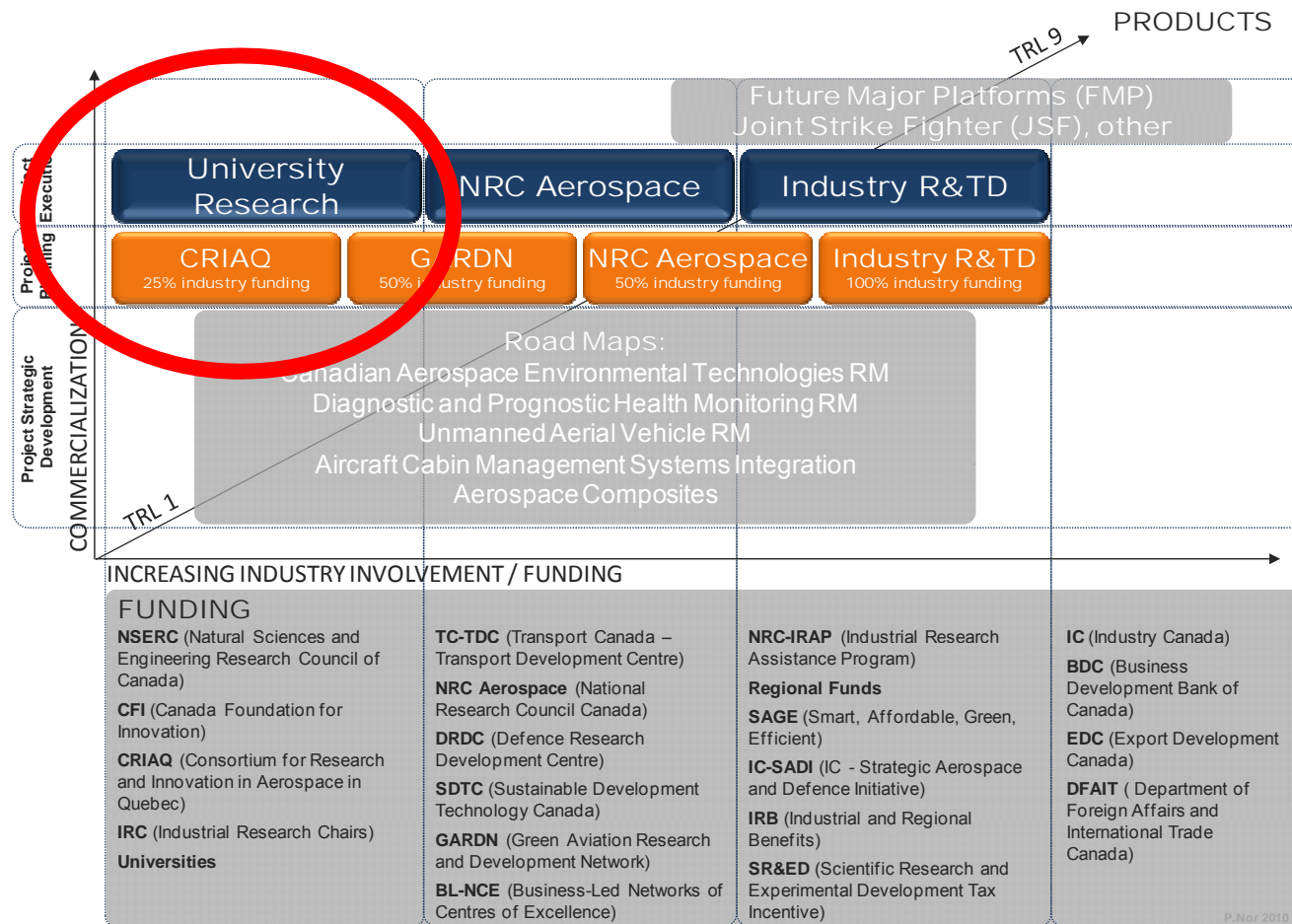
To identify those critical, enabling technologies and infrastructure which the Canadian aerospace industry will require to meet environmental and sustainability requirements over the next ten to fifteen years.



CAETRM Structure



Aeronautics Innovation in Canada



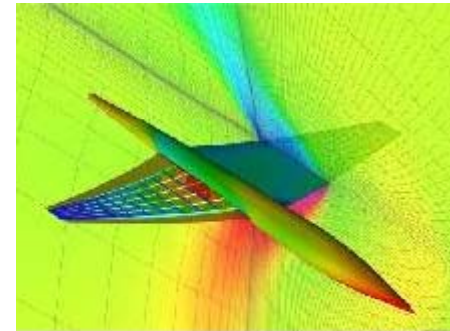
Universities



The University of
Western Ontario



McGill



UNIVERSITY OF
TORONTO



uOttawa



UNIVERSITY OF
CALGARY



ÉCOLE
POLYTECHNIQUE
MONTREAL



Major granting agency: **Natural Sciences and Engineering Research Council (NSERC)**



***CRIAQ - a unique model for collaborative,
industry led research, involving Industry,
universities and research centres***



Consortium de recherche et d'innovation en aérospatiale au Québec
Consortium for Research and Innovation in Aerospace in Québec



Clément Fortin, President and CEO



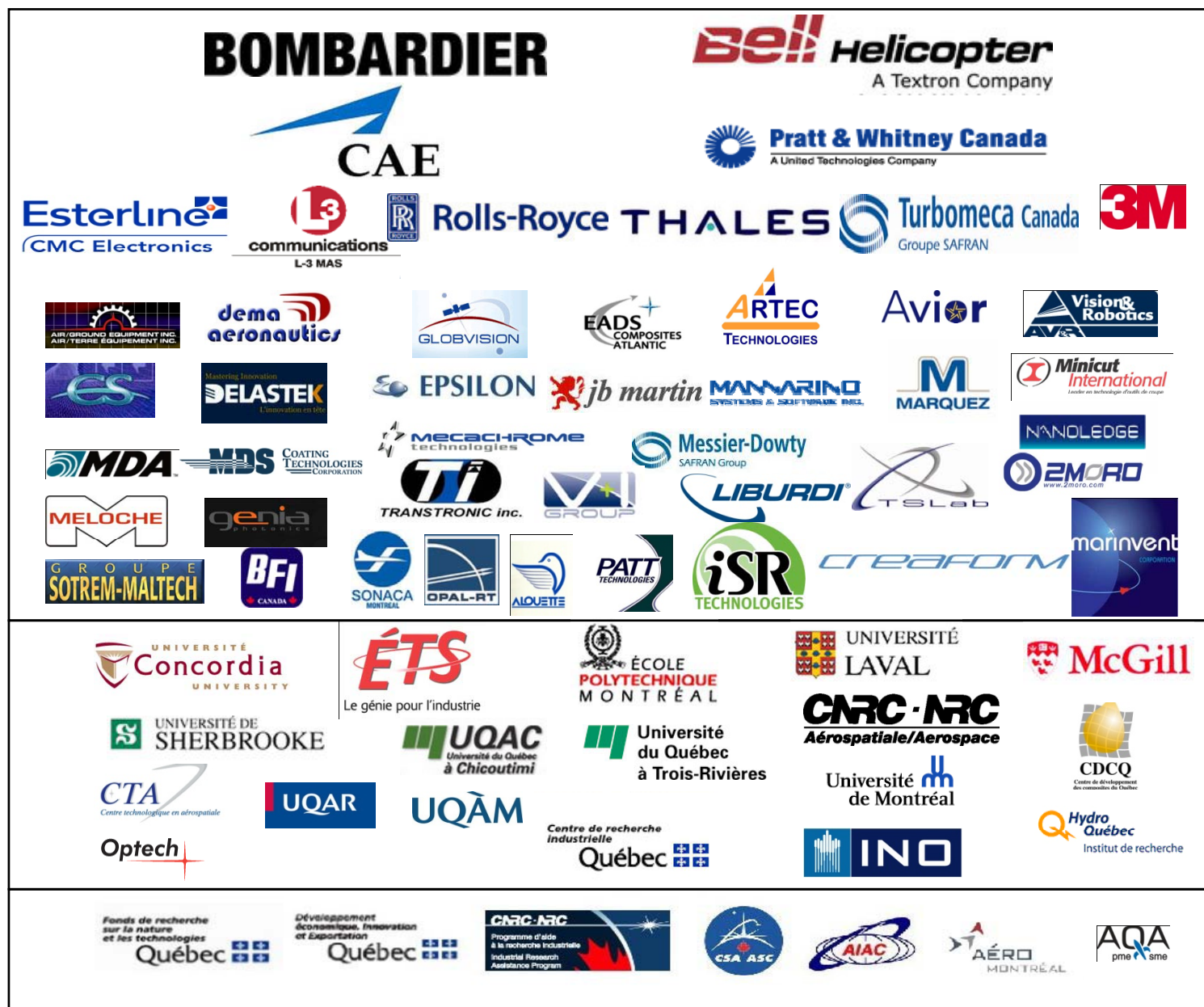
Photos : courtoisie de Bell Helicopter Textron Inc., Bombardier Inc.,
CAE Inc., Pratt&Whitney Canada Corp.

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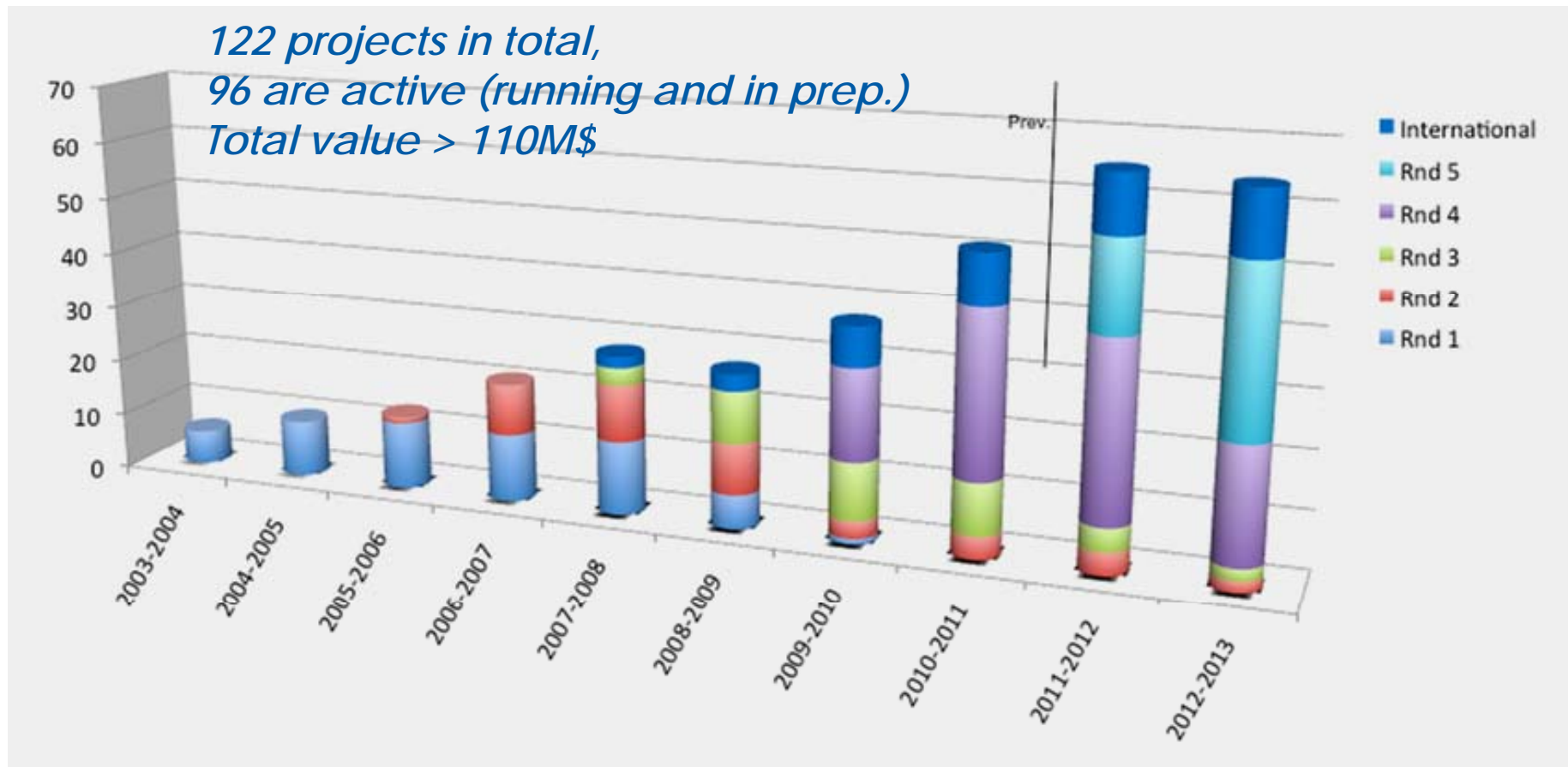
Mission

- Increase competitiveness of Aerospace Industry and enhance collective knowledge base through a better training of students
- **OBJECTIVES**
 - Collaborative Research Projects (distinct projects, industry driven, multiple partners)
 - Innovation (Full IP coverage)
 - Training (Students in every project)
 - Promotion (support student forums and competitions)
 - National Collaborations (non-Québec Universities, GARDN, Ecological Airplane) international (missions, exchanges, projects)

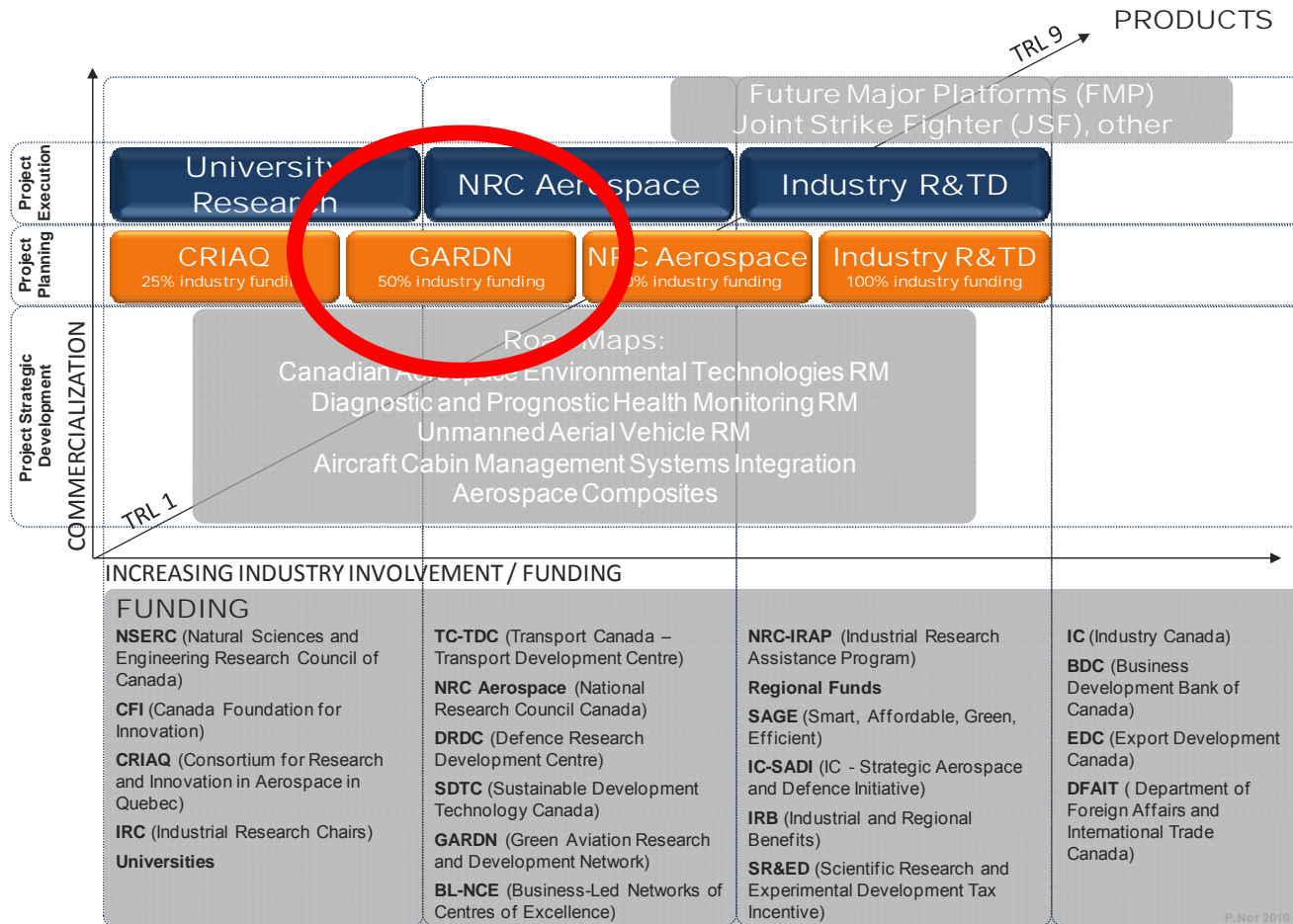
MEMBERSHIP



Running Projects by Year

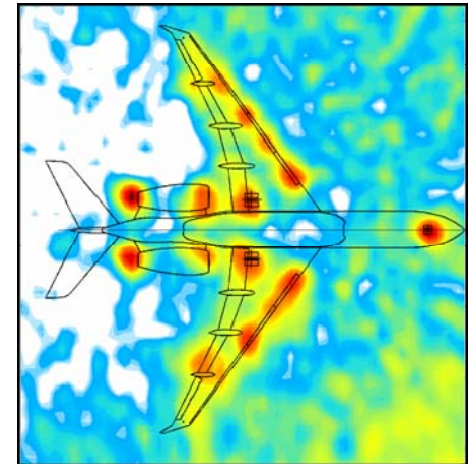


Aeronautics Innovation in Canada



What is GARDN?

- GARDN = **Green Aviation R&D Network** - is a Business-Led Network of Centres of Excellence (BL-NCE)
 - created in 2009
 - established to address the environmental challenges
- GARDN is funding the development of aviation
 - reduction of the environmental impact
- GARDN brings together:
 - government
 - academic
 - industrial partners

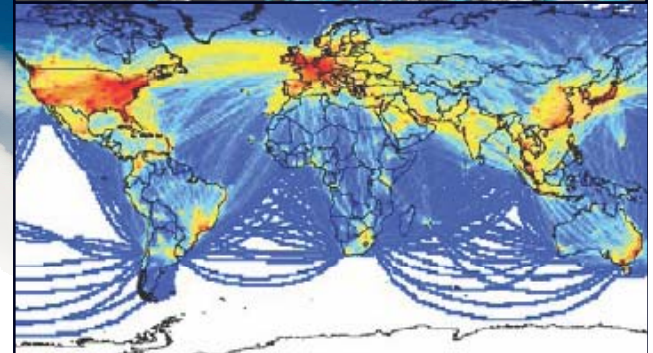


Green Aviation
Research & Development
Network



GARDN 7 Research Themes

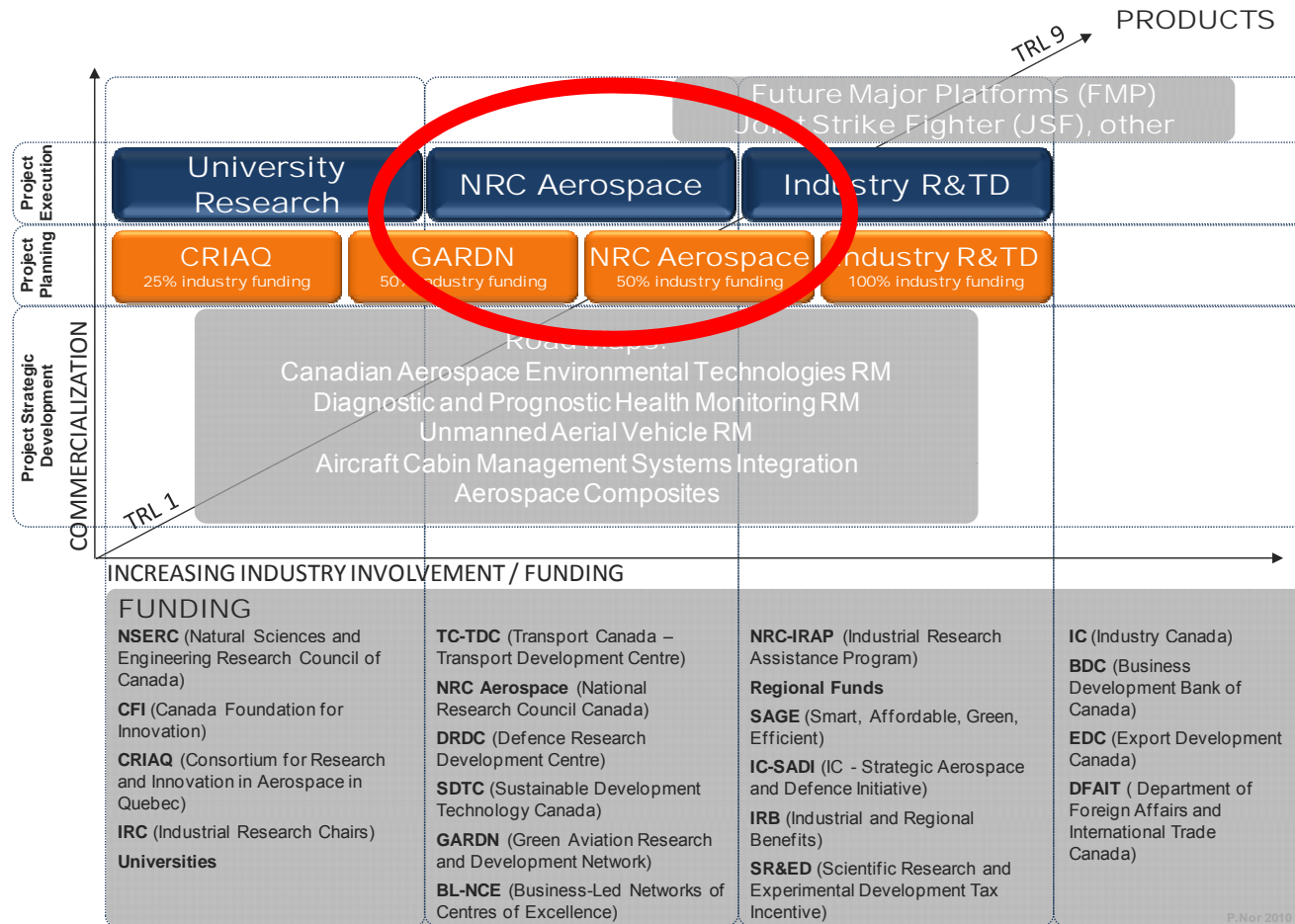
- Source Emissions Reduction
- Source Noise Reduction
- Aircraft Operations
- Alternative Fuels
- Materials / Manufacturing
- Lifecycle Management
- Icing



Green Aviation
Research & Development
Network

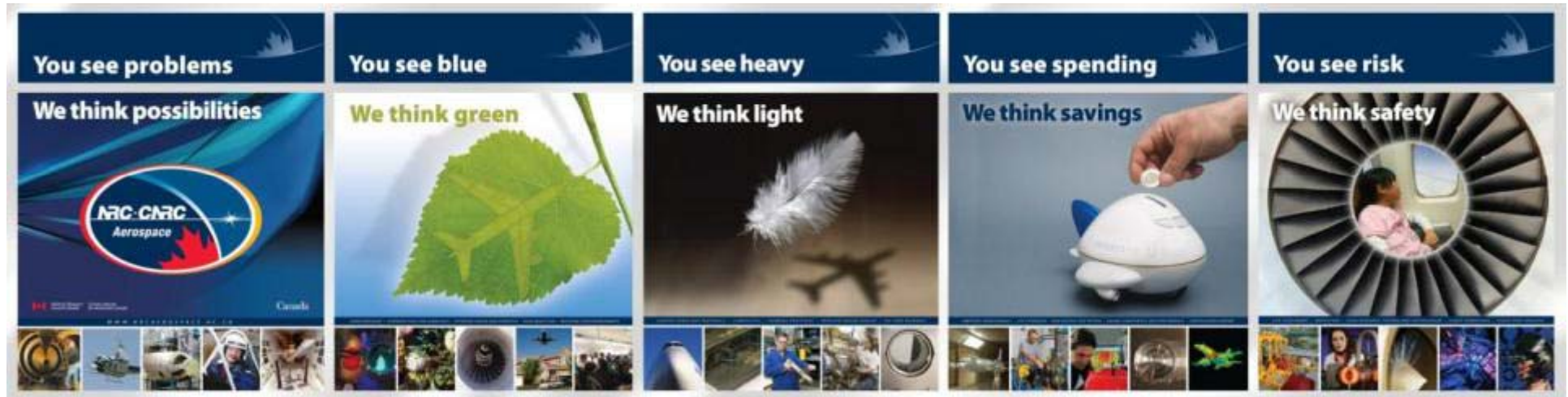


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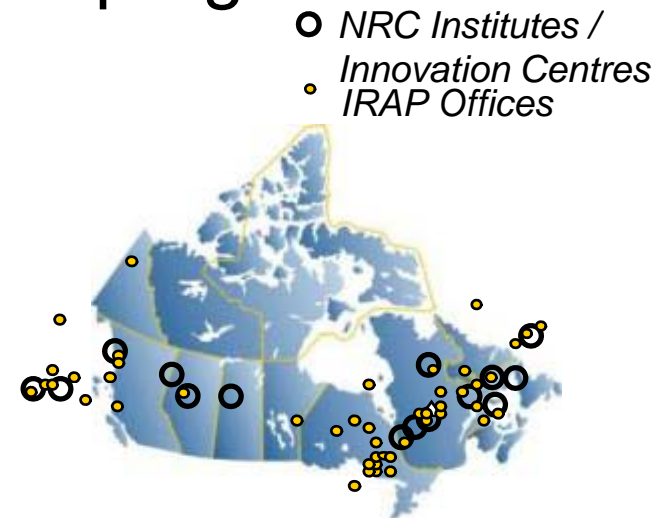
NRC Aerospace - Who we are

- Canada's national aerospace laboratory, conducting research that affects **safety**, **weight**, **cost** and **environment**



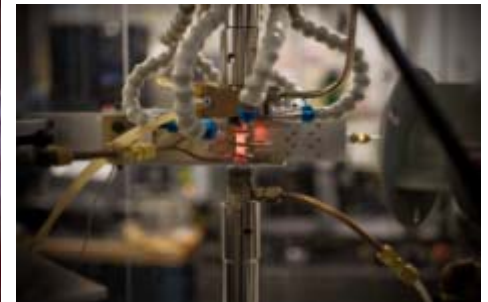
NRC Aerospace – Who we are

- Part of **NRC**, the National Research Council of Canada
- Over **5,000 employees** (approximately 4000 full-time employees, 1200 guest workers)
- Over **20 institutes** and national programs
- Total **expenditures \$850M**
- Total **revenues: \$170M**
- Home to **IRAP** and **CISTI**
- Labs & facilities **across the country**



NRC Aerospace – How we deliver

- Maintain expertise in five main areas of aerospace research: **aerodynamics**, aerospace **manufacturing**, **flight research**, gas turbine **engines**, and **structures and materials** performance



Research result – High-altitude Atmospheric Research Capability

- Pressurized, temperature-controlled canisters under each wing have been integrated with the NRC T-33 vintage military jet trainer
- Will allow NRC researchers and collaborators to study turbulence and aircraft emissions at altitudes up to 40,000 feet and to sample air quality at different altitudes to determine altitude's effect on emissions
- An area of increasing interest as the aerospace industry works to '*green*' its operations



Research success – Engine Icing Breakthroughs

- Developed an isokinetic probe that can measure total water content when flying at altitude through clouds with ice crystals, the only fully functioning device of its kind in the world
- A significant step forward in the effort to understand the total water content present in clouds with ice crystal conditions
- Further demonstration that air data probes can accumulate ice under certain conditions builds on NRC's capability to create significant ice accretion in a simulated aircraft engine test rig with frozen ice crystals in air temperatures above 0°C

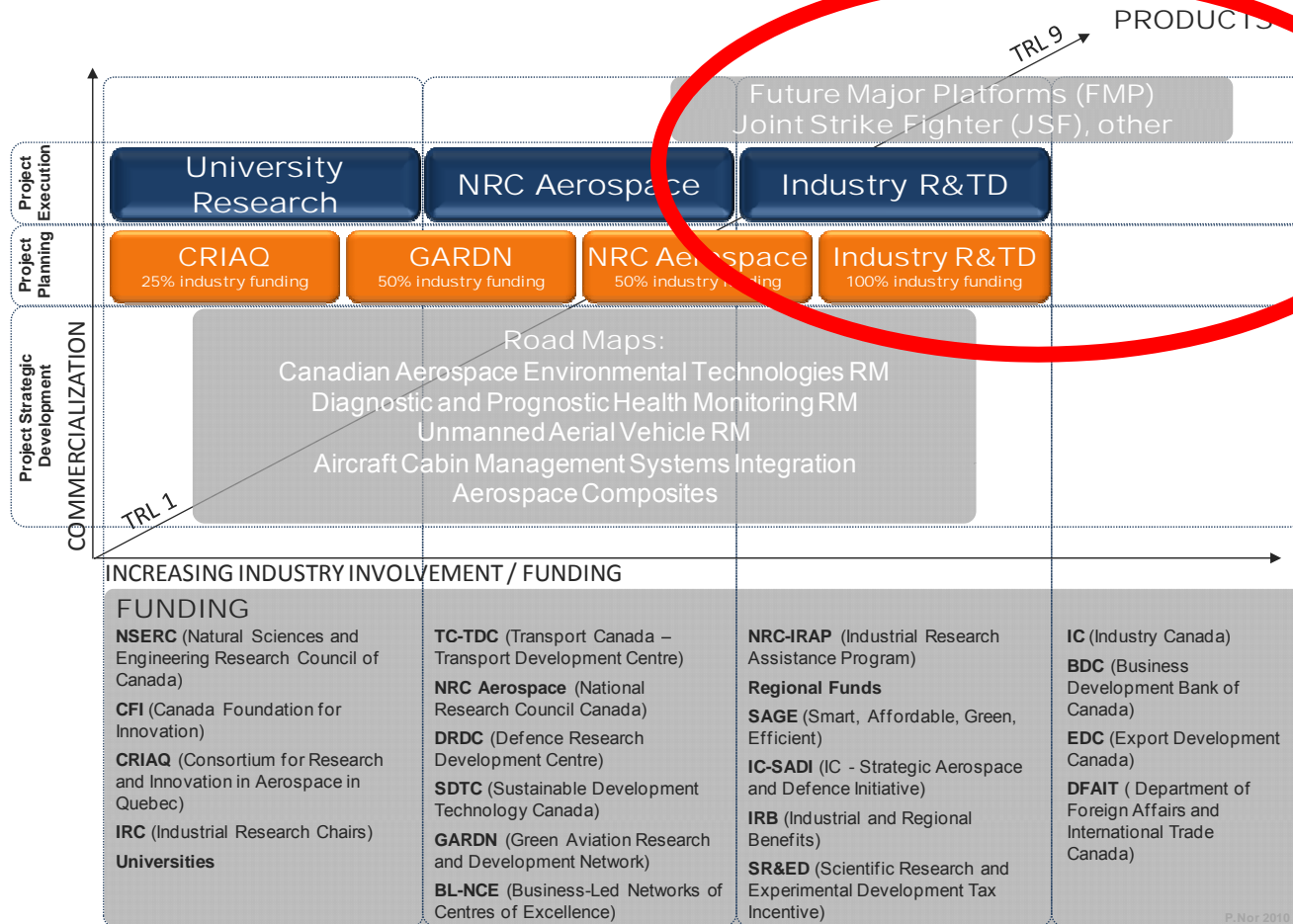


Research result – Control System for Fly-by-Wire Rotary-Wing Aircraft

- A major breakthrough in the development of advanced aircraft control systems, allowing pilots to operate their aircraft to its maximum capabilities, more safely
- Blends rotorcraft control response types so that the frequency of the pilot's input determines the control response type applied
- Gives pilots stability when they need it and agility when they request it



Aeronautics Innovation in Canada



Research result – Composites Technology Demonstrator

- Completed a \$40M, 3-year automated fibre placement composite fuselage collaboration project on with partners Bombardier, Bell Helicopters, NRC and Composites Atlantic
- Completed an elevated-temperature full-scale fatigue and residual strength test to certify Canada's first all-composite helicopter tail boom
- Next steps for helicopter project are ballistic impact test and flight test



Future Major Platforms TDP

- Platforms: Bombardier, Airbus, Boeing, Embraer
- Technology Matrix (needs/opportunities)
- Technology Demonstrator Programs:
 - Airframes
 - Engines
 - Airborne Systems
- AIAC led initiative



L'avion écologique (SAGE*) Demonstrator Projects



SAGE 1

Composite aircraft fuselage structure



SAGE 2

*Next Generation Green
Compressor Demonstrator*



SAGE 3

*Integrated modular avionics for
cockpit applications*



SAGE 4

Integrated avionics for critical systems



SAGE 5

Future Landing gear



* Smart, Affordable, Green, Efficient



Certification - GLACIER

- The Global Aerospace Centre for Icing and Environmental Research (GLACIER) opened in October 2010 in Thompson, Manitoba
- To be used for icing certification of the world's largest aircraft turbines
- RR PLC, PW(A&C), Fed. and Manitoba Governments
- NRC developed and will maintain and update the icing system of this \$42 million facility
- NRC will also use the facility to advance engine icing research
- EnviroTREC



Canadian Industry some examples





Questions?

Thank-you



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Canada