

# DAIR and NRC: Webinar on Green Aviation

**NRC Aerospace Research Centre (ARC)**

*Mike Benner, Director R&D, Aerodynamics*





# Present-Day NRC at a Glance

The NRC is Canada's **largest federal R&D organization.**

**4,100**

Scientists,  
engineers,  
technicians and  
support staff

**1,500**

Companies  
with R&D  
collaborations

**\$1.4B**

Annual  
budget

**8,000**

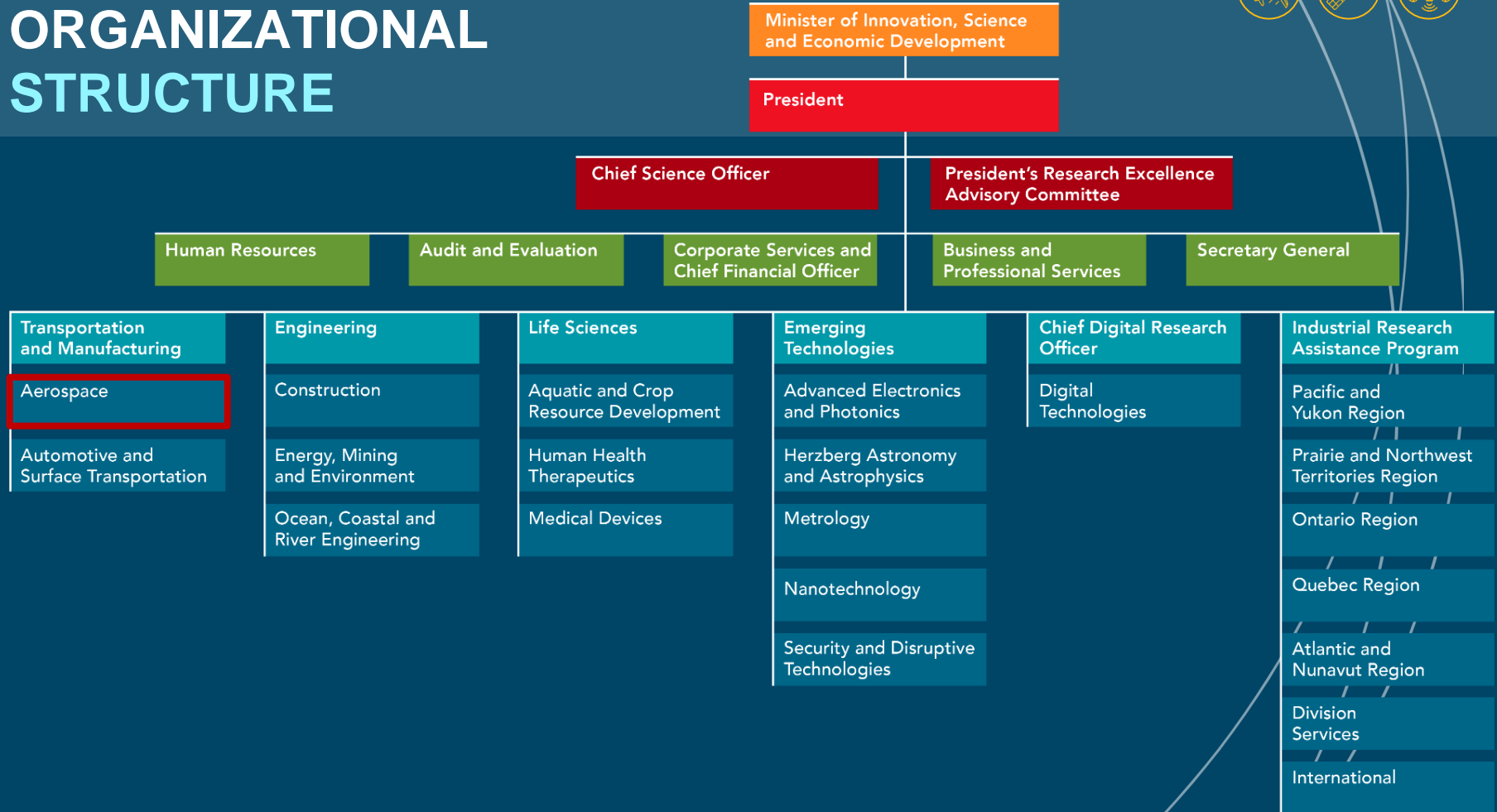
SME  
clients

**100s**

of national and international partners



# ORGANIZATIONAL STRUCTURE



Transportation and Manufacturing

**Aerospace**

Automotive and Surface Transportation

Engineering

Construction

Energy, Mining and Environment

Ocean, Coastal and River Engineering

Life Sciences

Aquatic and Crop Resource Development

Human Health Therapeutics

Medical Devices

Emerging Technologies

Advanced Electronics and Photonics

Herzberg Astronomy and Astrophysics

Metrology

Nanotechnology

Security and Disruptive Technologies

Chief Digital Research Officer

Digital Technologies

Industrial Research Assistance Program

Pacific and Yukon Region

Prairie and Northwest Territories Region

Ontario Region

Quebec Region

Atlantic and Nunavut Region

Division Services

International



# AEROSPACE RESEARCH CENTRE





# Canadian's Centre for Aerospace Innovation

3

GOALS

1. Support business innovation
2. Advance scientific and technical knowledge
3. Deliver policy solutions for government





# Aerospace Research Center at a Glance



- **400** - Technical experts
- **~\$1B** - Physical facility assets
- **\$60M** - Annual expenditures
- **\$32M** - External funding

# Priority Areas

Autonomous  
Aerial  
Mobility



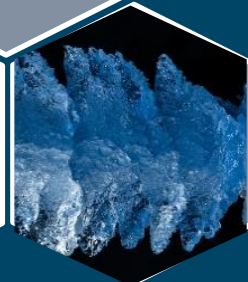
Digital twins /  
Virtual testing



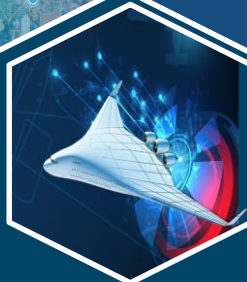
Cabin  
technologies



Atmospheric  
& Aircraft  
Icing



Sustainable  
aviation



Intelligent /  
Digital  
manufacturing



Defence  
technologies

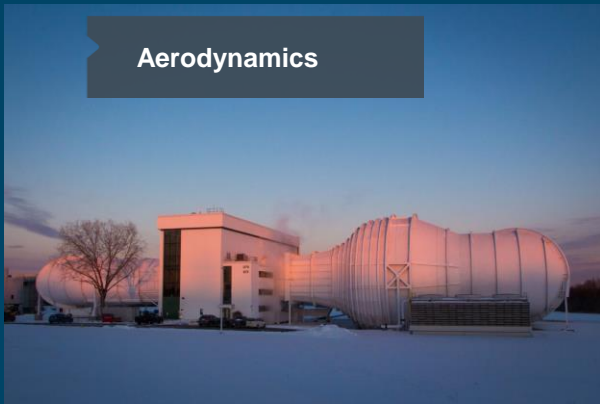






# Six Areas of Specialization

**Aerodynamics**



**Aerospace Manufacturing**



**Propulsion Systems**



**Flight Research**



**Structures and Materials Performance**



**Air Travel Research**







# Aerodynamics

## Expertise in aviation and bluff-body aerodynamics

RESOURCES & CAPABILITIES	RESEARCH AREAS
<ul style="list-style-type: none"><li>• 64 research and technical staff</li><li>• 7 wind tunnels (subsonic to supersonic) including 2 icing simulation test facilities</li></ul>	<ul style="list-style-type: none"><li>• Air vehicle performance, stability &amp; control</li><li>• Aerodynamics of non-conventional aircraft</li><li>• Ground vehicle aerodynamics</li><li>• Ship/helicopter interaction</li><li>• Stores separation safety analysis</li><li>• Airframe &amp; air data probe icing</li><li>• Weather-induced cable vibration</li><li>• Sports aerodynamics</li><li>• Acoustics</li></ul>



# Aerospace Manufacturing

Expertise in **metallic, ceramic and composite materials** and **advanced manufacturing techniques**

RESOURCES & CAPABILITIES	RESEARCH AREAS
<ul style="list-style-type: none"><li>• 50 research and technical staff</li><li>• 47 pieces of unique equipment</li><li>• 3 sites: Montreal, Mirabel, Ottawa</li></ul>	<ul style="list-style-type: none"><li>• Forming and joining of metallic and composite products</li><li>• Material removal technologies</li><li>• Automation, robotics and intelligent manufacturing systems</li><li>• Additive/subtractive manufacturing</li></ul>



# Flight and Air Travel Research

Expertise in **aircraft flight dynamics, human factors** and the use of aircraft as **sensor-based research platforms**

## RESOURCES & CAPABILITIES

- 80 research and technical staff
- Authority from Transport Canada to modify NRC aircraft *and* assess their airworthiness
- 9 research aircraft
- 3 helicopters
- 6 fixed-wing aircraft
- Centre for Air Travel Research

## RESEARCH AREAS

- Atmospheric science & icing
- Airborne systems integration & testing
- Autonomous mobility
- Virtual flight testing (digital twins)
- Low-carbon fuels
- Hybrid-electric/electric flight
- Hyperspectral, electro-optic & electromagnetic remote sensing
- Human factors, air travel research
- Flight dynamics modelling and control



# Aerospace Structures and Materials

Expertise in **holistic, full-lifecycle research** from design and development to operation

RESOURCES & CAPABILITIES	RESEARCH AREAS
<ul style="list-style-type: none"><li>• 50 research and technical staff</li><li>• Facilities for characterizing materials and structures, including full-scale testing, high-temperature material, structural integrity, non-destructive inspection</li></ul>	<ul style="list-style-type: none"><li>• <b>Developing and certifying high-temperature materials</b></li><li>• <b>Component &amp; full-scale structural testing</b></li><li>• Non-destructive evaluation</li><li>• Structural virtual testing (digital twin)</li><li>• Engine/airframe structural risk assessment, life extension</li><li>• Structural health monitoring &amp; prognostics</li></ul>



# Propulsion

Expertise in **combustion and fuels, hybrid and electric propulsion, icing and performance assessment**

RESOURCES & CAPABILITIES	RESEARCH AREAS
<ul style="list-style-type: none"><li>• 70 research and technical staff</li><li>• 7 test cells: 2 for turboshafts, 2 for turbofans, and 3 for high-pressure combustion testing</li><li>• Altitude test facility</li><li>• Syngas combustion lab</li><li>• Low-speed wind tunnels</li><li>• Planar cascades (transonic/subsonic)</li></ul>	<ul style="list-style-type: none"><li>• Gas turbine combustion</li><li>• Hybrid &amp; electric propulsion</li><li>• Low-carbon fuels</li><li>• Performance &amp; interoperability</li><li>• Engine icing and icing probe development</li><li>• Engine diagnostics, prognostics, &amp; health monitoring</li><li>• Internal aerodynamics</li></ul>



# Partnership is Paramount



# NRC IRAP: SME Support for Technological Innovation



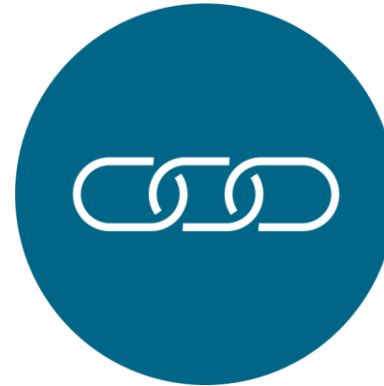
# Industrial Research Assistance Program • NRC IRAP



**PROVIDE ADVICE,  
CONNECTIONS,  
AND FUNDING**



**SERVE OVER 8,000  
CLIENTS ANNUALLY**



**LINK INNOVATIVE  
CANADIAN SMES TO  
GLOBAL VALUE CHAINS**



**SUPPORT YOUTH**

# NRC IRAP Services

## Advisory services and support

- Help with idea validation
- Technical and business advice
- Networking and connections
- Strategic intelligence
- Intellectual property (patent precedence)
- etc.



## Financial contributions (non-refundable)

### Innovation support

- Up to 80% of salaries
- Up to 50% of subcontracting
- No equipment with residual value



### Hiring (youth employment strategy)

- % of salary for 6-12 months
- Post-secondary diploma
- Between the ages of 15-30



# SME Funding Availability: Working with the Aerospace Research Centre

- The **NRC IRAP Certificate Program** focuses on establishing relationships between SMEs and the Research Centre.
  - Certificate funding is applied as a **discount** against the total value of the service.
    - **Discount amount:** 50% of total service value up to a max of \$100K.
    - **Funding duration:** Projects can span multiple years.
    - **Client eligibility:** Any SME that is eligible for IRAP
- The Research Centre also offers a discount of 40% specific to its labour costs.



# THANK YOU

**Mike Benner**

**Director R&D, Aerodynamics**

**Michael.benner@nrc-cnrc.gc.ca**

**IRAP:**

**<https://nrc.canada.ca/en/support-technology-innovation>**

**IRAP PHONE: 1-877-994-4727**

