

Update on AAM implementation in Canada



**Charles Vidal, Program Leader
Integrated Aerial Mobility Program
National Research Council of Canada**

Creating the Future Together



Source: <https://canadianaam.com/>

Expanding Advanced Air Mobility Ecosystem

**Near-Term
Micro**





Drones/RPAS

◆ — ◆

- Remotely Piloted
- Autonomy

Mid-Term

Urban **Regional**



VTOLs **Fixed Wing**

◆ — ◆

- Sustainability Focused - Zero Emission
- Piloted & Autonomy

**Long-Term
Intercontinental**



Commercial Aviation

◆ — ◆

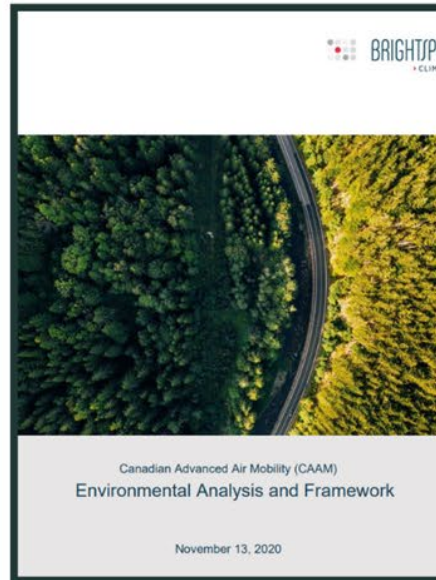
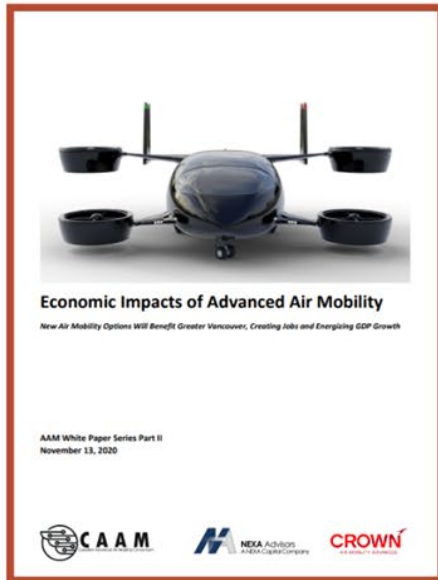
- AAM Infrastructure at Airports



Aerial Evolution
Association of Canada
Association pour l'Évolution
Aérienne du Canada



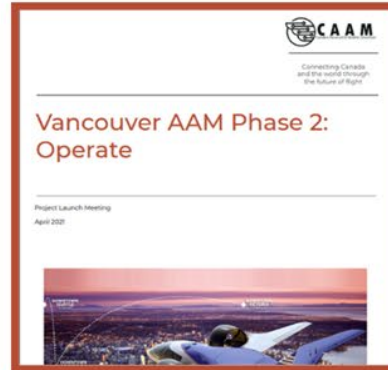
▶ Triple Bottom Line Feasibility



Liftoff Projects



Assess the feasibility of AAM in the GTA by completing a white paper and triple bottom line analysis.



Launch a revenue generating proof of concept flight.



Assess the potential of advanced manufacturing in the AAM industry.



Develop a 20 year AAM master plan with regional implementation strategies.

Recently in the press

Organ transport



Source: Unither.aero

AAM corridor announced



VPorts, a Quebec-based world leader in the design, construction and operation of Advanced Air Mobility (AAM) infrastructure, will create Quebec's first regional electric AAM vertiport network. By 2030, the network will extend to all major Quebec regions. (CNW Group/VPorts)



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Source: vports.com

Medicine delivery



Source: indrorobotics.ca

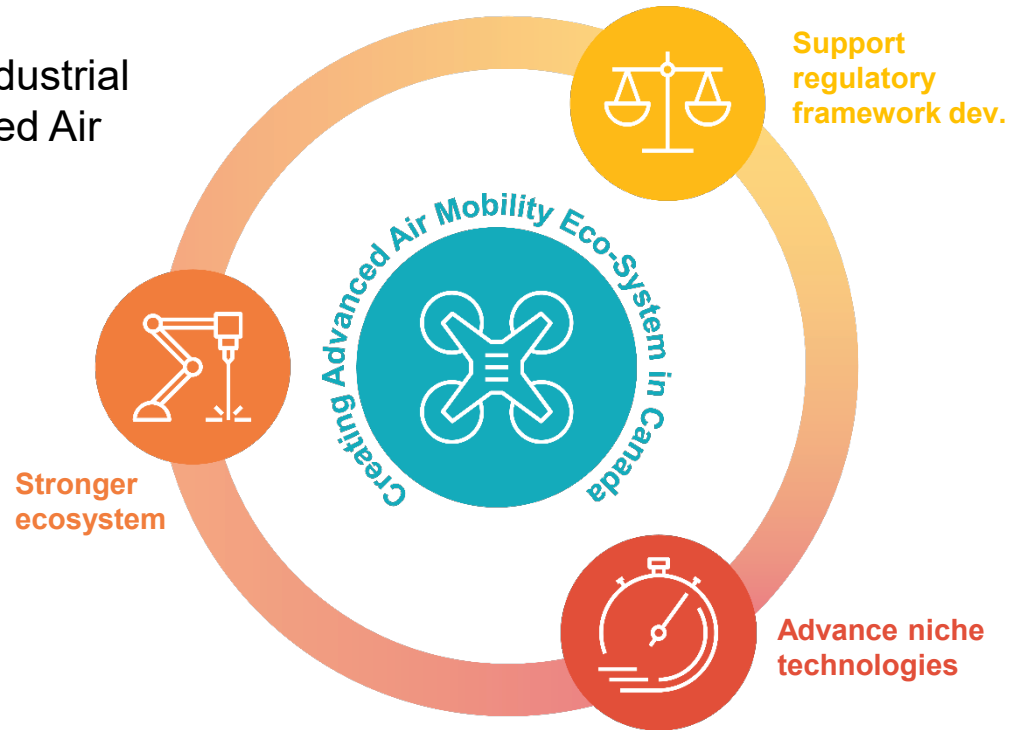
NRC's Integrated Aerial Mobility Program Objectives

Goal and Objectives

Support the ecosystem and grow Canada's industrial capabilities in the strategic and global Advanced Air Mobility market.

NRC Mandate:

- Support business innovation
- Advance scientific and technical knowledge
- Deliver policy solutions for government

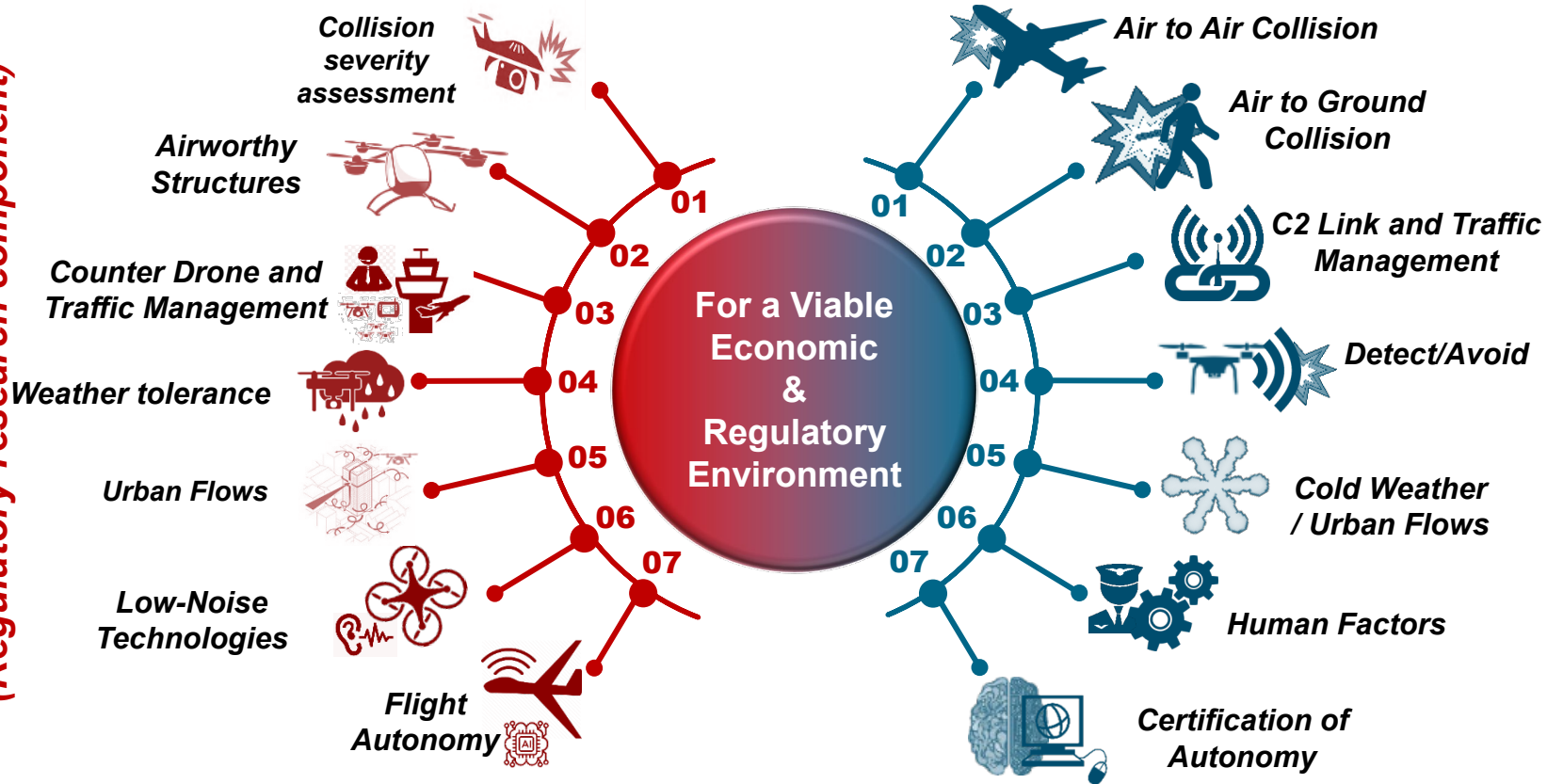




Federal RPAS R&TD Portfolio

NRC's IAM Program
(Regulatory research component)

TC's RPAS-TF R&D Program

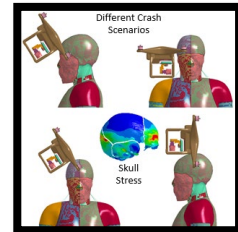
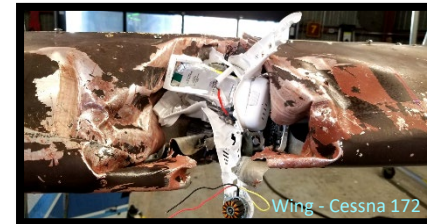
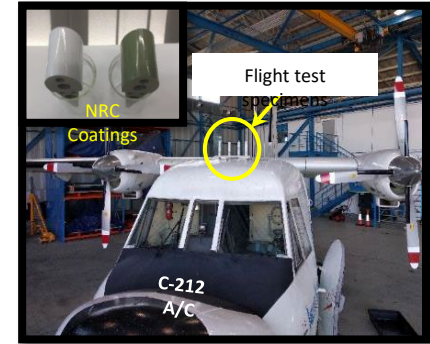


Integrated Aerial Mobility Operating Environment



Multi-year goals

- Develop experimental and computational Modelling and simulation capabilities and tools for AAM
- Characterize RPAS icing and develop effective ice detection and ice protection technologies
- Evaluate extreme airflows within Canadian cities and investigate stability limits and suitability of novel control systems
- Determine small RPAS air-to-air and air-to-ground collision impact for safe operations in civilian airspace and populated areas



Outdoor testing facility



Integrated Aerial Mobility Flight Autonomy

Multi-year goals

- Develop and publically demonstrate safe & efficient autonomous flight algorithms
- Develop Validation & Test/Benchmarking Techniques for different levels of automated systems
- Provide expert understanding of autonomy to enable regulation development



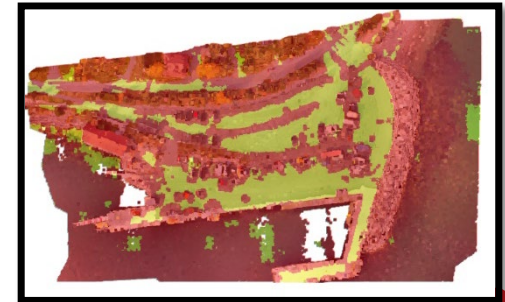
Mission Management & Trajectory Planning



Autonomy Displays



**Trajectory Command Integration
into Flight Controls**



ML Based Landing Zone Identification



Canadian Vertical Lift Autonomy Demonstration - Project Objectives

Demonstrate kit based, advanced autonomous flight technology on the Bell 412 and CH147 Chinook

- Reduce crew workload
- Provide Improvements to operational capability
- Vehicle life extension through envelope protection
- Research & Technology Development to TRL 7

Link the demonstration to a viable production path

Create a Strategic Autonomy capability within Canada



Detect and Avoid

Airborne DAA Sensor Performance Eval (TC):

1. Echodyne EchoFlight Radar
2. Fortem R20i Radar
3. Iris Casia X Optical

Flight Test:

- 2 Campaigns (Bell 206 & Harvard)
- 35 Intercepts Flown To Date



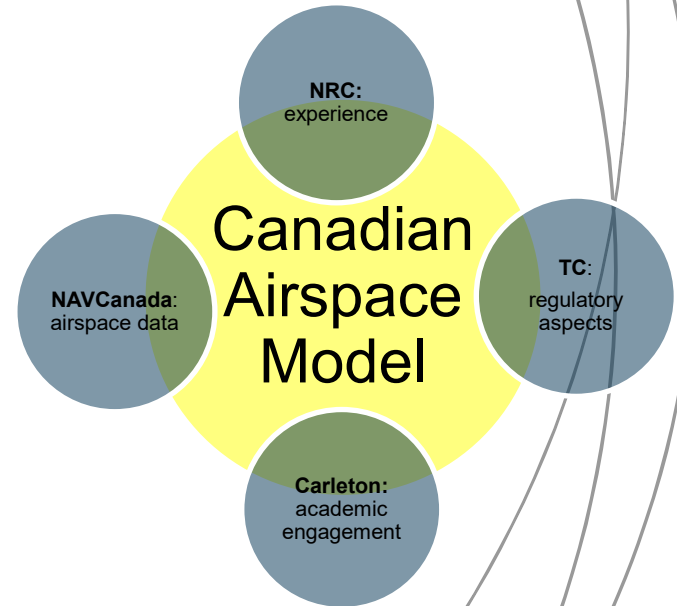
Figure 2. Detect and Avoid Sensors on Bell 205



Figure 3. Engineering Workstation power switches

Canadian Airspace Modeling

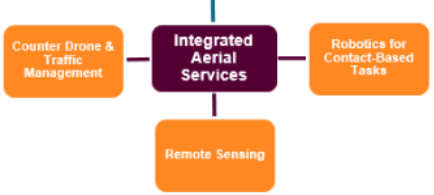
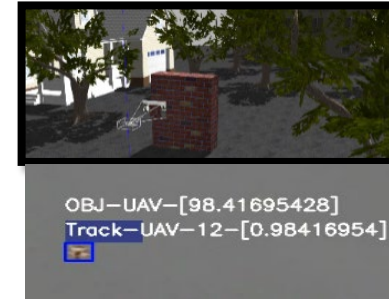
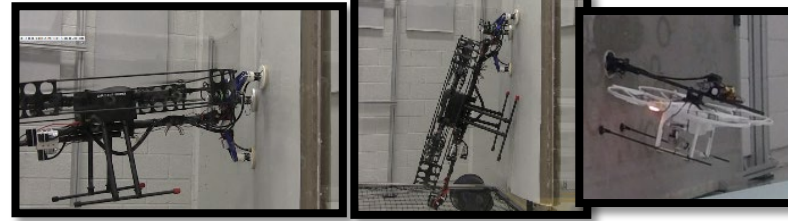
- Objectives:
 - Aid the introduction of RPAS in Non-segregated airspace by developing a Canadian specific tool to assess collision risk between RPAS and intruder aircraft
 - Develop models and methods to allow risk assessment for RPAS with specific performance envelopes in various airspaces in Canada



Integrated Aerial Mobility Integrated Aerial Services

Multi-year goals

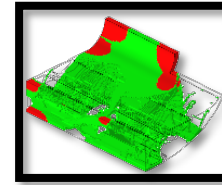
- **Aerial Robotics:** Develop aerial robotics technologies for inspection and maintenance of elevated structures and security applications.
- **Counter Drone and RPAS Traffic Management (RTM)** Develop and validate advanced AI-enabled Counter drone technologies, and develop-implement new capabilities to enable RTM in Canada and support regulation developments
- **Advanced Remote Sensing** Utilize an integrated system of sensors (e.g. hyperspectral, LiDAR, aeromagnetics and thermal-IR) to develop BVLOS applications. Implement advance analytics (e.g. data fusion) for different applications for natural and man-made.



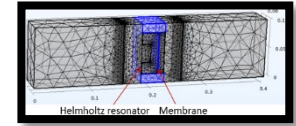
Integrated Aerial Mobility Integrated Design

Multi-year goals

- **Integrated UAM Cabin Project** Multi-objective optimization and prototype manufacturing of a subfloor and side floor cabin structure.

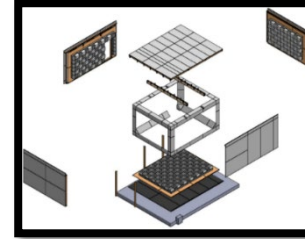


Example MTO results

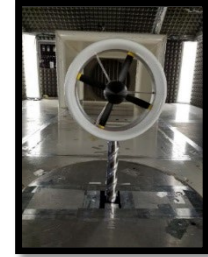


Acoustic meta-materials

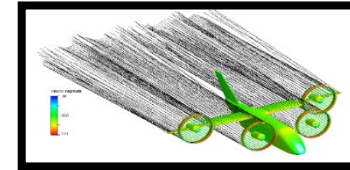
- **Noise reduction and Urban Air Mobility Propulsor Aeroacoustics** Develop and demonstrate low-noise UAM propulsion.



Drone acoustic test facility

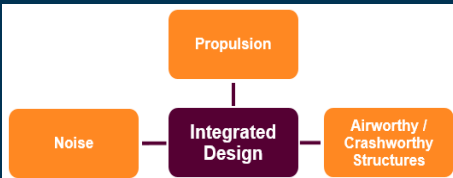


- **Low-order simulations of flying taxi solutions** Prediction of aerodynamic performance of UAM configurations and rotors.



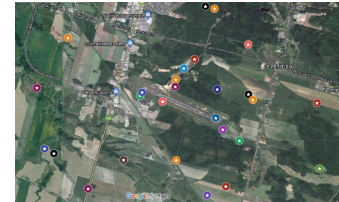
Nexus configuration in cruise

- Specialized Propulsion Facilities



Student UAM / UAS Competition

- 2022: New scaled Air taxi competition scenario
- Objective: To promote and develop Canadian expertise and experience in AAM technologies at the university level
- Approximately 15 universities - 150 students onsite/year.
- 14th edition in 2022-2023



THANK YOU

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<https://nrc.canada.ca/en/research-development/research-collaboration/programs/integrated-aerial-mobility-program>

