Transport Canada Transports Canada

Canada RPAS Integration Overview

R&D program summary

Presented by Carlos Ruella / March-2021

Canada

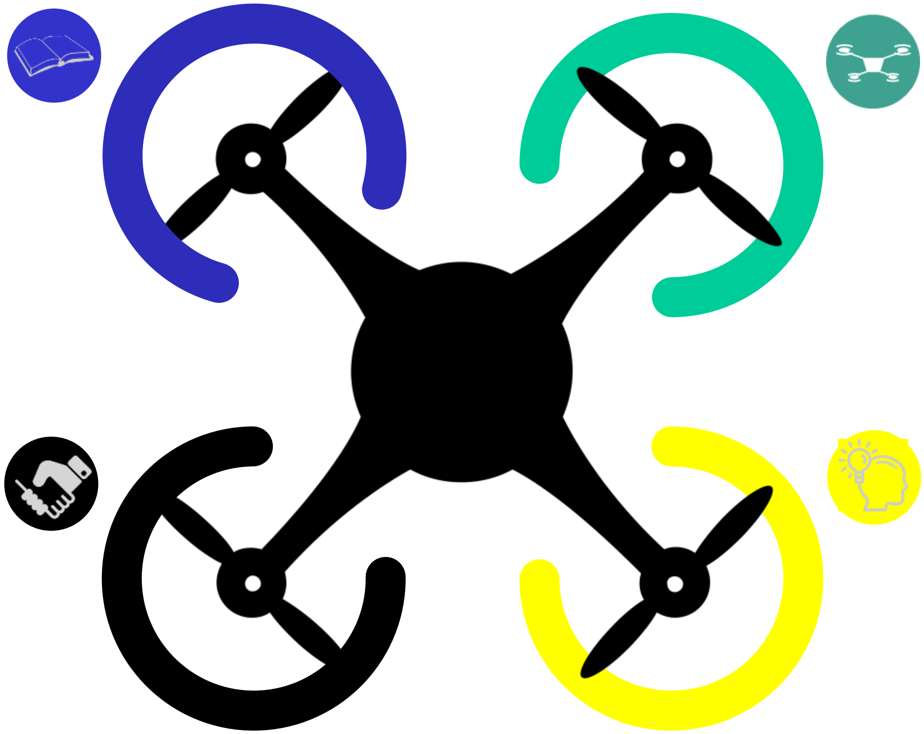
Transport Canada RPAS Integration:

Regulations

- Implementing Part IX visual line-of-sight (VLOS) Regulations
- Advancing lower risk BVLOS regulations
- Creating guidance material
- Identifying efficiencies for the Drone Management Portal

Operations

- Supporting Beyond Visual Line-of-Sight (BVLOS) and RPAS Traffic Management (RTM) pilot projects
- Enabling routine operations by way of Special Flight Operations Certificates (SFOCs)
- Providing guidance, oversight, and enforcement activities for safe operations.



Engagement

- Supporting safety awareness activities
- Soliciting stakeholder views through the BVLOS Notice of Proposed Amendment (NPA).
- Working with international partners to align standards and rules

R&D

- Developing research priorities to guide industry innovation
- Establishing relations with other regulators to share information
- Providing an evidence-base for policies and regulations

Regulatory Update: Implementing Part IX

- Since implementing new rules for VLOS operations in 2019, TC has observed increasing industry adoption and compliance with the new rules*:

82,000
active user accounts

57,000
RPAS registered

105,000
pilot exams taken

57,000
pilot certificates issued

679
flight reviewer exams taken

13
law enforcement agency partnerships

- Currently we are working on the next set of regulations that aim at low risk BVLOS operations, and VLOS operations of larger RPAS.

** Information valid as of March 2021*

Operations Update: BVLOS

- TC began authorizing lower risk BVLOS operations in August 2019
- The Specific Operations Risk Assessment model is the foundation to allow BVLOS operations, and TC's focus is on enabling operations in lower risk categories.
- Since August 2019, TC has issued more than **<u>89 SFOCs</u>** for lower BVLOS risk operations, with more to come. Also many more SFOCs were issued for pilot projects, test range operations, lower risk BVLOS operations.

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Engagement: Safety Awareness

To foster safety awareness, information sharing, and user compliance, TC continues to advance activities via an annual **#DroneSafetyDay**:

Webinar Series: A guide on how to fly safely, and showcasing unique Canadian use-cases.

Twitter Chat (Planned): Connecting with Canadians to answer questions on drone safety. **#DroneSafetyDay**

Stakeholder Outreach: Encouraging industry to share safety successes and stories through social media.

Advertisement Campaign: Enhancing our web messaging with additional graphics, videos, and advertisements.

International Engagement

- Working with global partners underpins our regulatory work. TC engages through multiple forums to align rulemaking and advance Canadian leadership:

International Civil Aviation Organization (ICAO)

Radio Technical Commission for Aeronautics (RTCA)

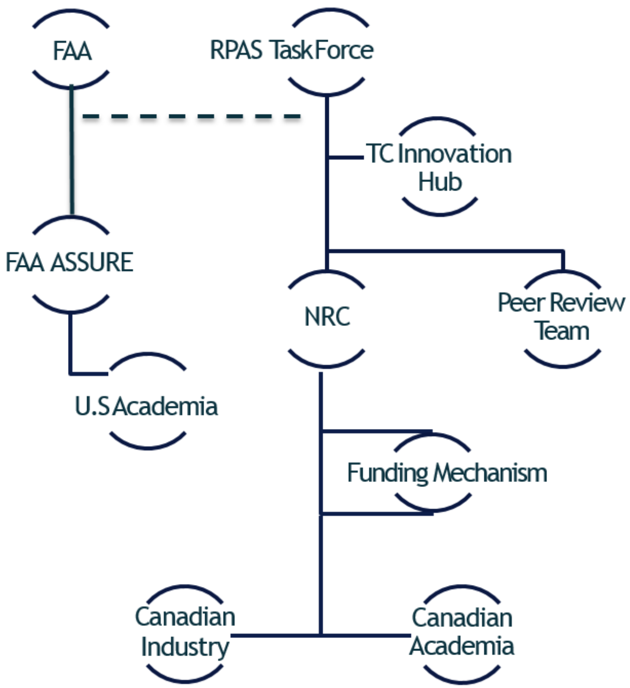
ASTM International

Joint Authority for Rulemaking of Unmanned Systems (JARUS)

International Transport Forum

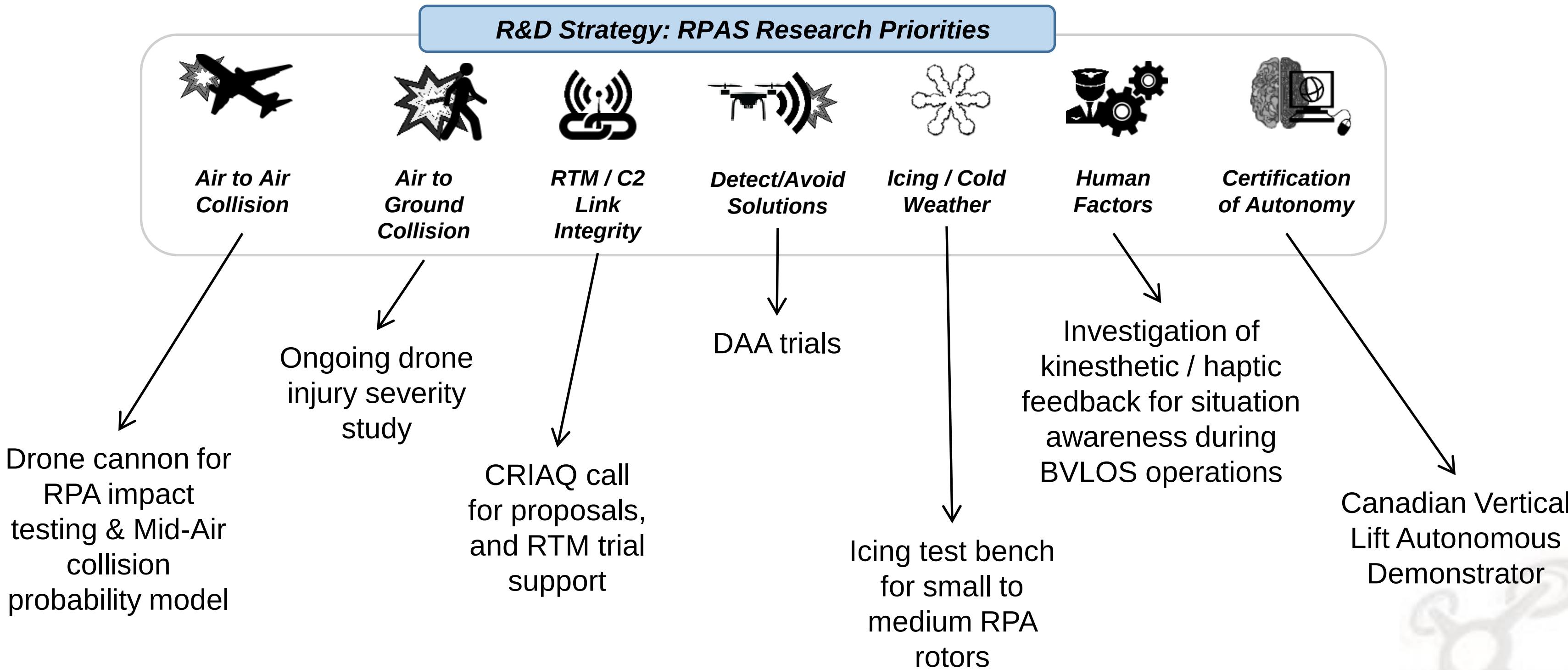
R&D Mandate and Partners

- Provide R&D data that supports regulatory and policy framework development.
- TC is collaborating with the FAA and FAA Assure to share R&D data and reduce duplication of research.
- TC have engaged with the 'National Research Council Canada' (NRC) to execute R&D to support the regulatory development for RPAS operations.



Current RPAS Research Areas

TC and the NRC have identified these 7 areas as the R&D Short term priorities, in order to fill the existing gaps to create BVLOS regulations:



Ground Impact Injury Severity

- **General Description:**

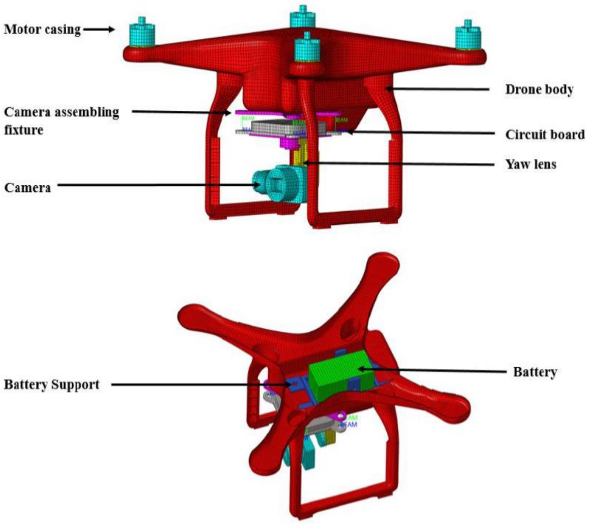
To expand the currently used injury severity metrics to include the effects on more vulnerable populations. Also to determine what level of injury is considered "acceptable" from a brain response perspective.

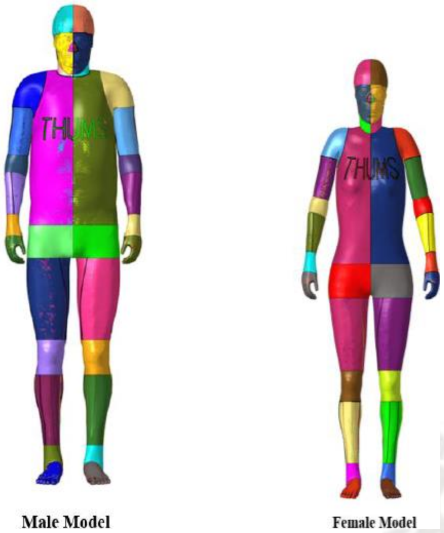
- **Organizations Involved**

TC RPAS Task Force – Research coordinator

NRC – Research coordinator

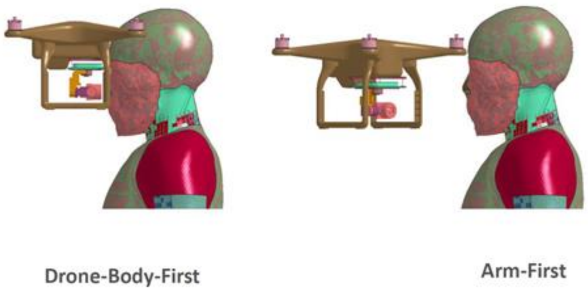
Western University – Project Execution

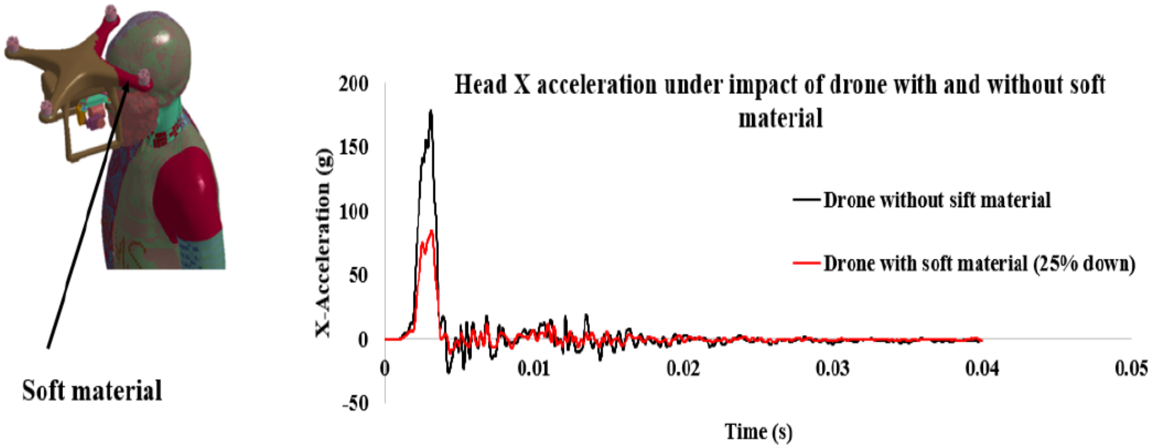




Ground Impact Injury Severity

- **Testing executed:**
  - Simulated representative model head impacts from drones at various angles for 50% male and 5% female
  - FAA ASSURE previously conducted 50% male cadaver and ATD tests

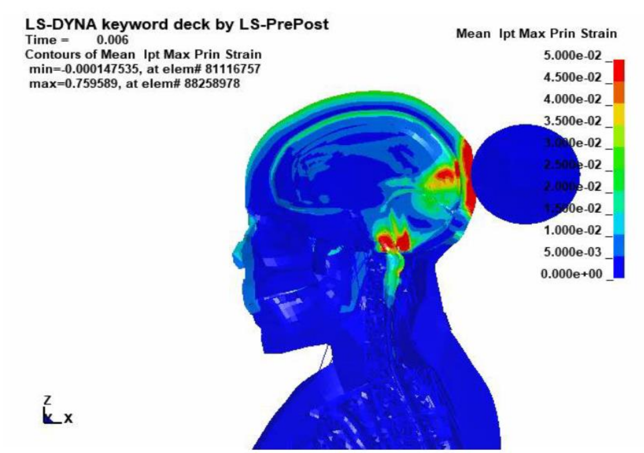




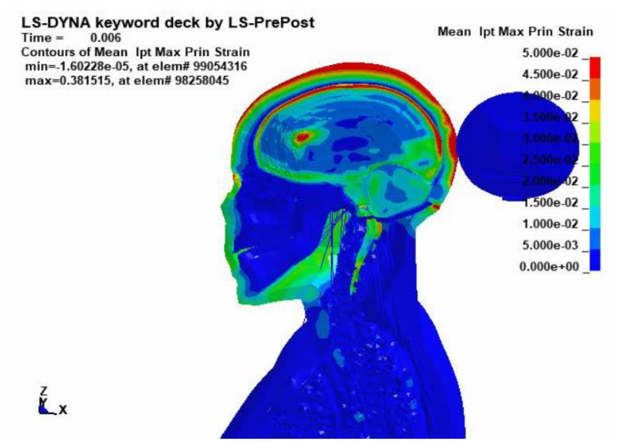
Ground Impact Injury Severity

- **Relevant results :**
  - Female head experienced 42% more linear acceleration
  - Female head experienced a 138% higher HIC
  - Drone arm to head is more dangerous than body to head impact
  - For light drones, softer body materials may reduce injury

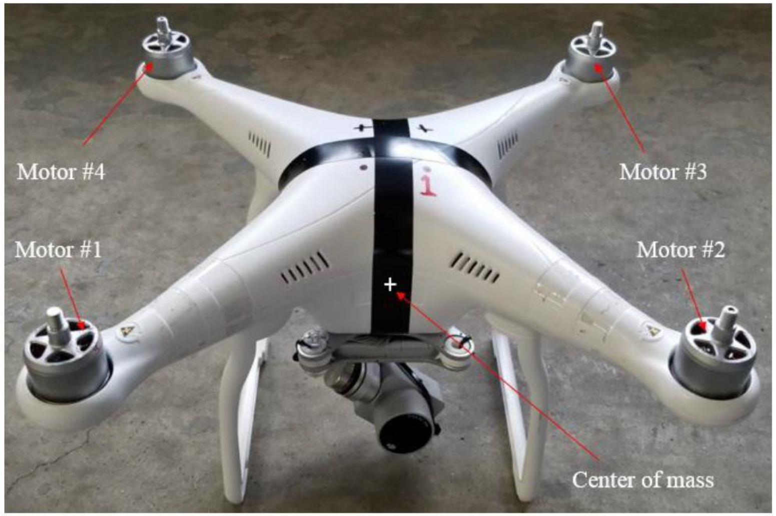
Male



Female



Drone Impact Severity Assessment



- **General Description:**

Impact severity assessment of a quadcopter shot from drone cannon against windshield & wing leading-edge of Part 25 representative aircraft.

- **Organizations Involved**

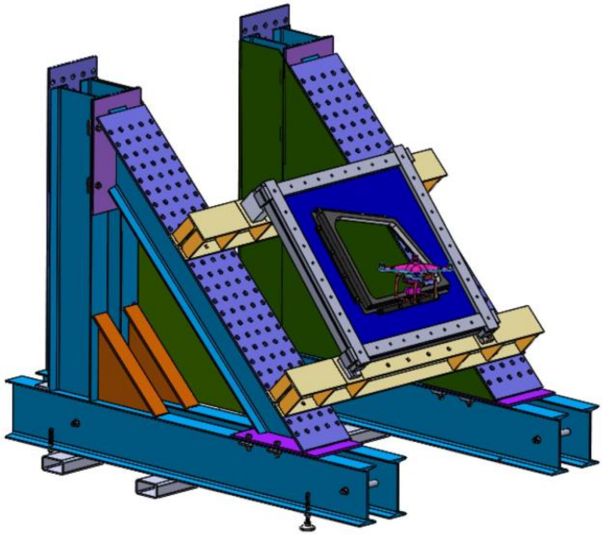
TC RPAS Task Force – Coordinator

TC NAC – SMEs

DRDC – Funding and Technical Support

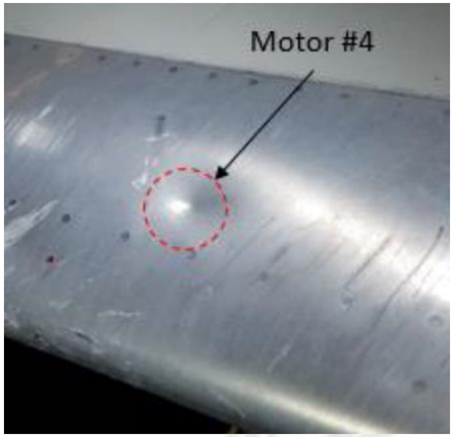
NRC – Project Execution

FAA ASSURE – Testing and Support



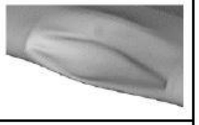
Drone Impact Severity Assessment

- **Testing executed:**
  - 1.2Kg popular drones shot at windshield and leading edge of slat
  - Impacts speeds of 140kts and 250kts
  - Cameras used to measure speed and orientation
  - Conditions meant to simulate typical approach and cruising speeds under 10,000ft



Drone Impact Severity Assessment

- **Relevant results :**
  - Battery cells regardless of charge level do not pose fire risk
  - Windshield tests received a **fail** with loss of vision and glass in cockpit
  - Impacts do not cause *immediate* harm to aircraft
    - Technical damage such as lack of flap deployment or retraction may occur
    - Emergency may need to be declared

Severity	Description	Example
Level 1	• Airframe undamaged. • Small deformations.	
Level 2	• Extensive permanent deformation on external surfaces. • Some deformation in internal structure. • No failure of skin.	
Level 3	• Skin fracture. • Penetration of at least one component into the airframe.	
Level 4	• Penetration of UAS into airframe. • Failure of parts of the primary structure.	

	AWM 525 (Part 25) Aircraft							
	Leading edge slat						Windshield	
	Deployed (140 kn)				Retracted (250 kn)		140 kn	250 kn
Case	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 1	Test 2
Severity	Level 1	Level 2	Level 2	Level 2	Level 2	Level 3	Fail	Fail
Fire risk	No	No	No	No	No	No	No	No

Drone Impact Probability Assessment

- A Canadian air-space model does not currently exist, hence is difficult to asses the probability of an RPAS colliding with a manned aviation platform.
  - A 3 year project has started with the NRC and Carleton University to create such model
  - To developed this model radar data from NAV Canada as well as other sources of data will be used

- Once this model will be completed, we will be able to combine the air to air collision severity data with the probability of such types of collisions to properly asses the risk of this types of operations in the Canadian air space.

Impact Severity + Impact Probability = Full Risk Assessment

RPAS R&D Past, Present and Future

Green= Completed,
Blue = Active,
Yellow = Planning Stage

	FY18-19	FY19-20	FY2020-2021	FY2021-2022
Air to Air Collision	Drone Impact Assessment Part 25	Drone Impact Assessment Part 25	Drone impact Assessment on Part 23	
			Air space model - Phase 1 of 3	Air space model - Phase 2 of 3
Air to Ground Collision		Human injury severity Phase 1	Human injury severity Phase 1	Human injury severity Phase 2
RTM C2 Link Integrity			RTM Trials support	RTM 2nd Trials support
Detect/Avoid Solutions			DAA Performance Evaluation Trials	Onboard DAA Systems Perf. Eval.
Icing / Severe Weather		Icing of Small Rotors	Icing of larger Rotors	Icing testing guidance
			Urban Wind flow – Operator guidance	Urban Wind flow - Wind resistance
Human Factors	Situation Awareness			
Certification of Autonomy		Certification of Autonomous Flight Systems	Certification of Autonomous Flight Systems	Certification of Autonomous Flight Systems
Others	R&D Planning and Coordination	R&D Planning and Coordination	R&D Planning and Coordination	R&D Planning and Coordination
	Drone Site Selection Tool	Drone Site Selection Tool	Drone Site Selection Tool	Drone Site Selection Tool Update

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RPAS TASK FORCE