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Africa Conference 2018

3-5 September, Mombasa, Kenya



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A tall, white, cylindrical air traffic control tower with a glass-enclosed observation deck at the top, set against a blue sky with scattered white clouds.

September 6-7, 2018

RPAS/UAVs

ANSP PERSPECTIVE

CANSO Safety Workshop

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WORKSHOP PHILOSOPHY ...

› Periodic table

- **Cso → Ssi**

- **H²O**

- **Sso → Csi**

FUTURE INTEGRATION CHALLENGES...

› Space Aircraft



ANSPs current traffic



› UAVs/Drones





Context – Growth of the UAS Sector in Canada

- Year-over-year, TC has observed exponential demand for SFOC authorizations:

2010: **66**

2011: **159**

2012: **353**

2013: **945**

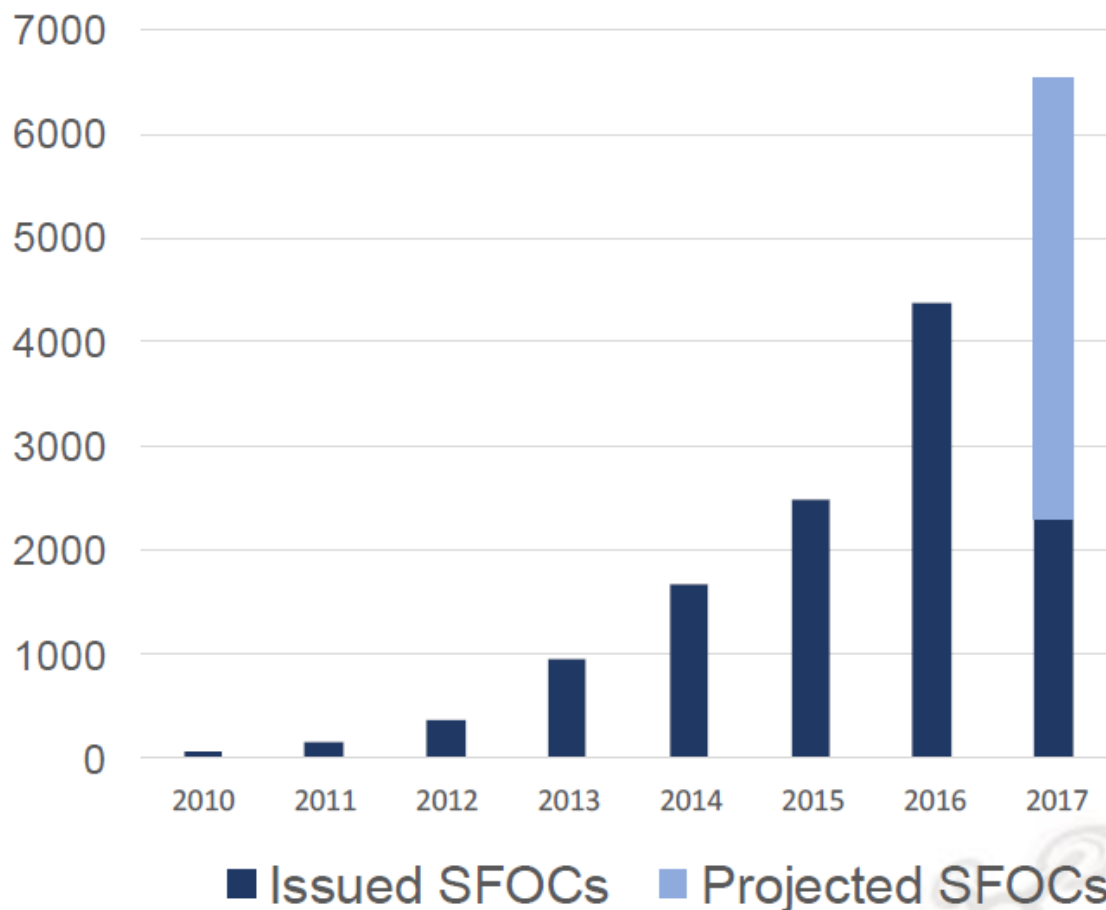
2014: **1672**

2015: **2480**

2016: **4381**

2017: **2229** (to date)

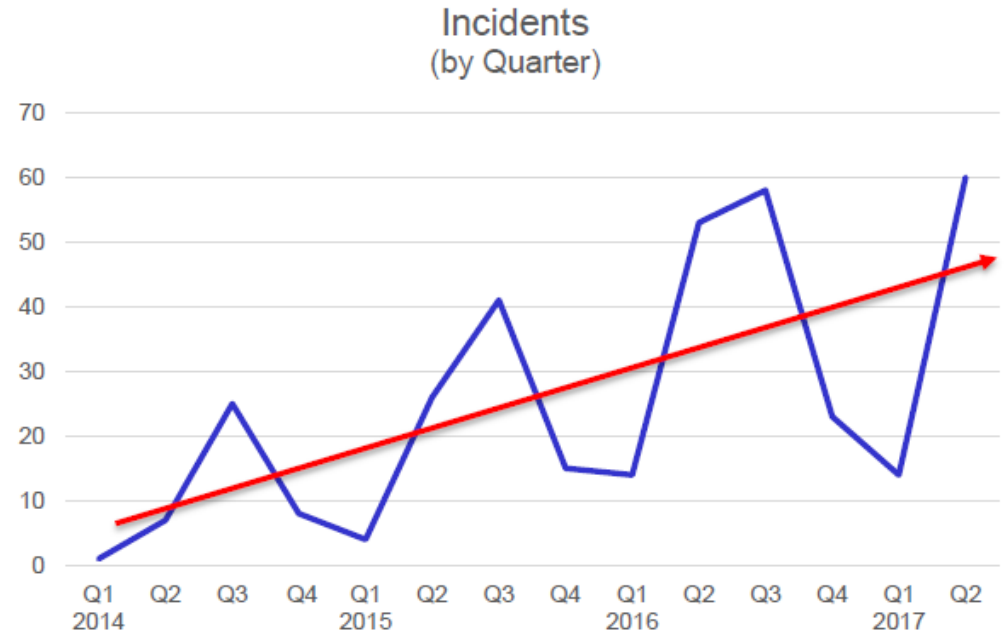
Projected 2017: **6539**





Context – Risk to Aviation

- Since 2014, the number of reported unmanned aircraft incidents has risen over 200%.
- Incidents have included UAS near flight paths, airports and other aircraft
- Reports from law enforcement agencies, provinces, territories, and municipalities with respect to privacy issues or risks to public safety have also been on the rise.



2014: **41** incidents

2015: **86** incidents

2016: **148** incidents

2017: **74** incidents (to date)



WHAT IS AN UNMANNED AIR VEHICLE (UAV) SYSTEM?

- **Unmanned Air Vehicle** - means a power-driven aircraft, other than a model aircraft, that is designed to fly without a human operator on board.
- **Model Aircraft** - means an aircraft, the total weight of which does not exceed 35 kg (77.2 pounds), that is mechanically driven or launched into flight for ***recreational purposes*** and that is not designed to carry persons or other living creatures.
- A UAV System (UAS) is a set of configurable elements consisting of the aircraft, the control station, the command and control links and any other elements as may be required during the flight operation.

WHAT IS AN UNMANNED AIR VEHICLE (UAV) SYSTEM? CONT'D

- Also known as Unmanned Aircraft System (UAS) or Remotely-Piloted Aircraft System (RPAS).
- The term “drone” is misleading, as there is always a person in the loop.
- UAVs may be automated, but not autonomous.
- Introduction of new terms, acronyms and definitions for UAV operations required e.g. C2 links, VLOS, BVLOS, Visual Observer.

QUESTIONS PERIOD...

- › Own a drone/UAV?
- › Have seen a drone/UAV in action?
- › Have in place Regulations?
- › Have data gathering processes?
- › Have experienced ATS – drone/UAV situation?

RPAS – AN ANSP PERSPECTIVE

Outline

- › Current Canadian RPAS/UAS Operations
 - Impact on ATS Services
- › Current Safety Risks and ATS Concerns
- › Implementation of New RPAS Regulations
 - Impact upon ATC
- › New Supporting Technology
- › Strategies Going Forward
 - Situational Awareness Tools
 - UAS Registration/Identification/Detection/Enforcement
 - UAS Traffic Management (UTM) Systems

CANADA'S AIRSPACE

Information on Airspace Classification and Structure

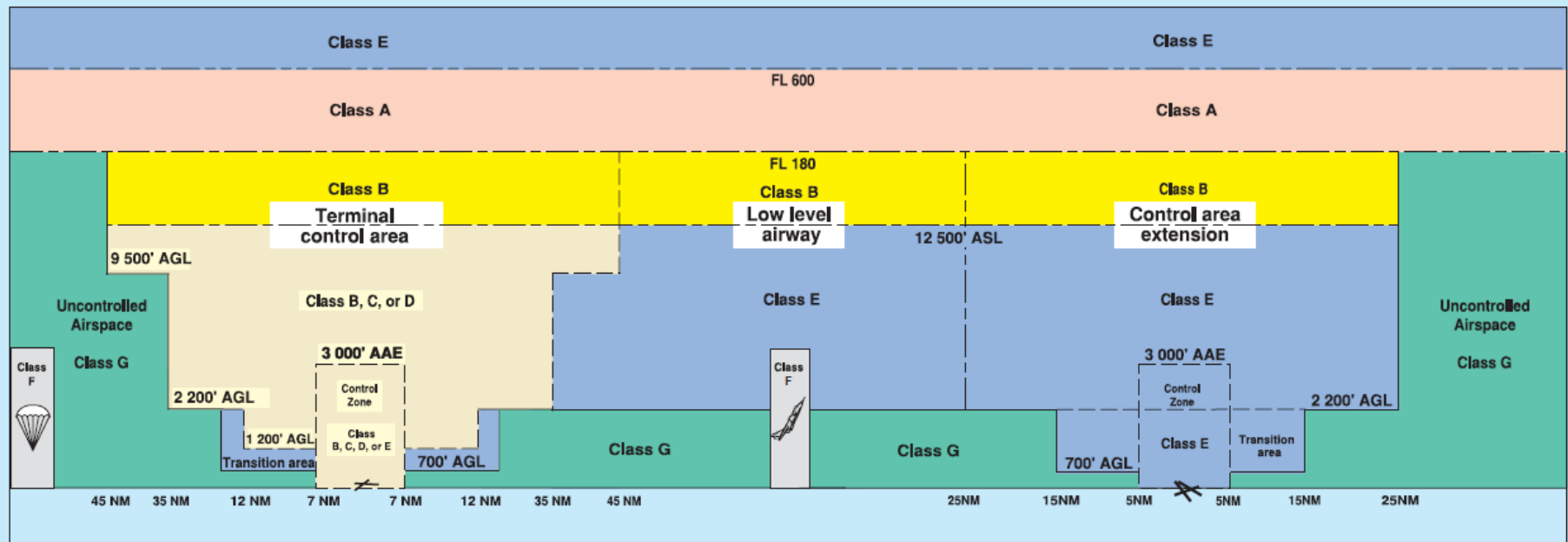
This information has been produced by Civil Aviation to provide a better understanding of the airspace classification system in Canada. For more details on the airspace structure and classification, please refer to Division I of Subpart 601 of the *Canadian Aviation Regulations* (CARs), Airspace Structure, Classification and Use, and the *Designated Airspace Handbook* (DAH), TP 1820.

I F R	CONFLICT RESOLUTION:	N/A	N/A	Provided between IFR and VFR	Equipment and workload-permitting	No	<u>Special-use Airspace</u> <u>Rules</u> As specified in the DAH (TP 1820), If not specified, or when the area is not active, the appropriate rules for the surrounding airspace apply.	Uncontrolled airspace 250 kt below 10 000' MSL 200 kt below 3 000' AGL within 10 NM of a controlled airport ATS provides flight information and alerting service.	
	TRAFFIC INFORMATION:	N/A	N/A	Yes	Yes	Workload-permitting			
	SEPARATION:	All aircraft	All aircraft	IFR from IFR	IFR from IFR	IFR from IFR			
	SPEED LIMITATION:	Nil	250 kt below 10 000' MSL 200 kt below 3 000' AGL within 10 NM of a controlled airport						
	RADIO:	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory			
	TRANSPONDER:	Yes	Yes	Yes	Yes, in designated areas	Yes, in designated areas			
	CLEARANCE:	- ATC -	- ATC -	- ATC -	- ATC -	- ATC -			
V F R	CONFLICT RESOLUTION:		N/A	Upon request	Upon request-equipment and workload-permitting	No	<u>Restricted</u> Traffic not authorized without the approval of the user/controller agency <u>Advisory</u> Non-participant traffic should avoid flight within the area	 250 kt below 10 000' MSL 200 kt below 3 000' AGL within 10 NM of a controlled airport ATS provides flight information and alerting service.	
	TRAFFIC INFORMATION:		N/A	Yes	Yes	Workload-permitting			
	SEPARATION:		All aircraft						
	VMC MINIMA:								
	SVFR:		Yes	Yes	Yes	Yes			
	SPEED LIMITATION:								
	RADIO:		Mandatory	Mandatory	Mandatory	Not required			
TRANSPONDER:	Yes	Yes	Yes, in designated areas	Yes, in designated areas					
CLEARANCE:	- ATC -	- ATC -	Establish radio contact	Not required					

Canada's Airspace (continued)

CLASSIFICATION: Canadian Domestic Airspace (CDA) has seven classifications. The application of any classification to an airspace structure determines the operating rules, the level of ATC service provided within the structure and, in some instances, communications and equipment requirements.

STRUCTURE: The airspace structure defines the physical dimensions of the elements into which the airspace is divided, such as control zones (CZ), terminal control areas (TCA), control area extensions (CAE) and airways.



CANADIAN RPAS REGULATIONS & CURRENT OPERATIONS

- › Majority of ops focused on small RPAS in VLOS, however...



Setting up to fly an aggregate site in western Canada

CANADIAN UAV REGULATIONS & CURRENT OPERATIONS

BVLOS Operations (cont'd)

- Global Hawks (under MND authority) regularly use Canadian airspace (FL550-FL600) on great circle routes for international deployment



CANADIAN UAV REGULATIONS & CURRENT OPERATIONS

BVLOS Operations (cont'd)

- Guardian MQ-9B (under TC-issued SFOC) deployed to the UK July 2018
 - › Domestic and International Oceanic airspace transit FL270



WHALES MONITORING UAV



WHALES MONITORING UAV



WHALES MONITORING UAV CONTROLS



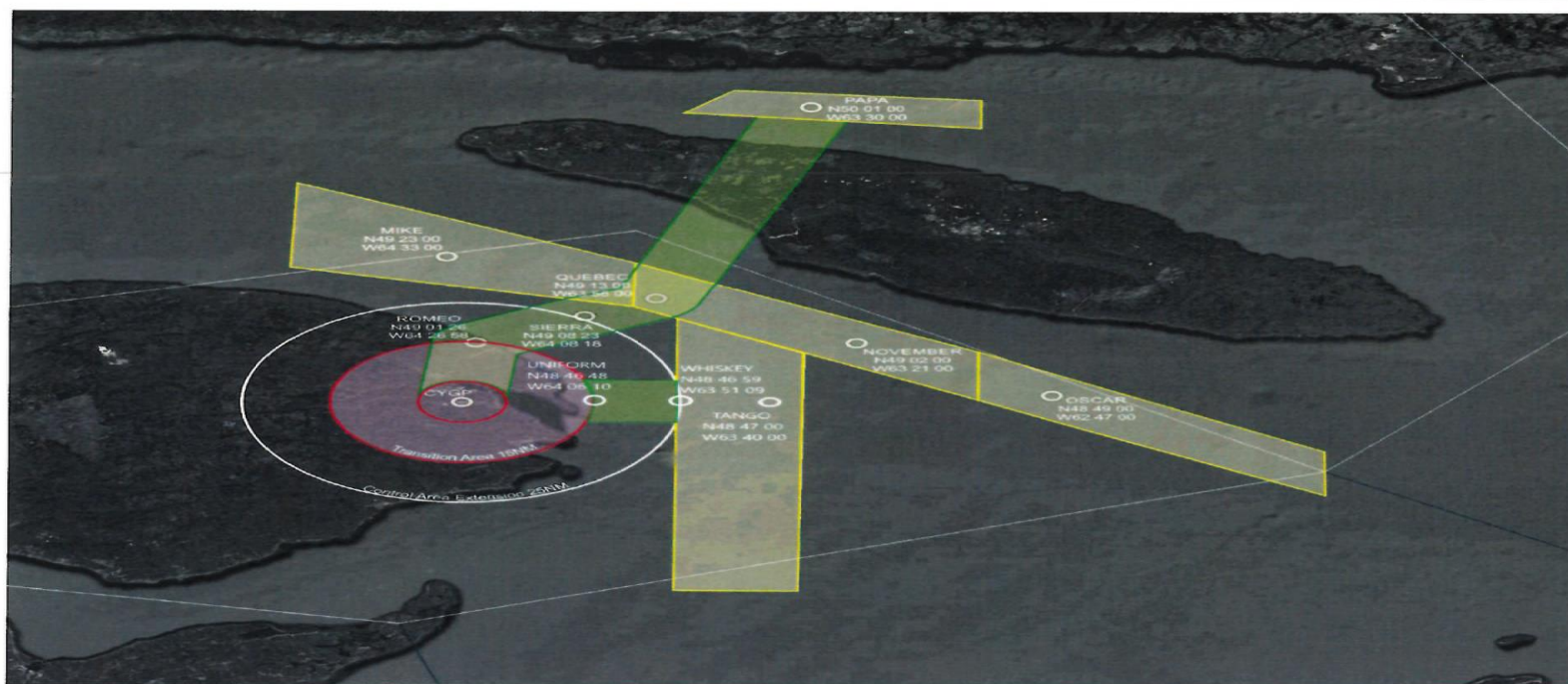
WHALES MONITORING AREA

ANNEXE A

APPENDIX A

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Airspace



CURRENT UAV OPERATIONS

Commercial

- Limited to Visual Line of Sight (VLOS) ... Except for Global Hawk or Flight Tests in segregated/restricted airspace
- Transports Canada (TC) - approved Special Flight Operating Certificate (SFOC)
 - › Exceptions for < 2kg and <1 kg in uncontrolled airspace
- Coordination required with NAV CANADA for access to controlled airspace
 - › UAV Operator negotiation with UPS/AOS
 - › Time-consuming (lack of operator aviation knowledge/experience)
- Standing SFOCs (1 year approvals vs individual flight approval)

Recreational

- Interim Order addresses restrictions for hobbyists
 - › 3NM radius around all aerodromes
 - › Below 300ft

BVLOS Operations

OTHER CHALLENGES...

Exercise:

What are the main challenges and limiting factors for conducting safe BVLOS UAV operations?

CHALLENGES...

- Sense and avoid capability (aircraft, weather, terrain, obstacles, people).
- Air Navigation Service Provider standards and coordination:
 - separation standards
 - levels and provision of services
 - required navigation performance
 - communication requirements and communication failures
 - wake turbulence
 - flight plans
 - call signs
- Predictable lost command and control (C2) link (e.g. 7400 transponder code) and flight termination procedures (divert/contingency points) and behavior.

CHALLENGES...

- Reliability of flight critical systems and system (aircraft, control station) certification requirements.
- Reliability, continuity, integrity, availability and communication transaction (latency) time of C2 link.
- Sufficient and /protected spectrum for C2 links and sense and avoid systems.
- Aerodrome operations.
- All-weather capability (icing detection/protection).
- Interception Orders.
- Pilot and Operator knowledge and training.
- International harmonization.

FLIGHT SAFETY ISSUES

- › Airspace structure and air traffic service were based on manned aviation – not remotely piloted (read “unequipped”) aircraft
 - VLOS operations are neither VFR nor IFR, yet RPAs are operating in airspace designed for those rules
- › Lack of situational awareness
 - “What you can’t see, can hurt you!”
 - Mitigation: SA tools available on PEDs (personal electronic devices)
- › Risk to aviation is primarily due to non-compliant or uninformed operators, not commercial operations that are coordinated with and approved by Regulator/ANSP
- › Cyber security and terrorism risks to aviation extend to RPAs

QUEBEC DRONE ACCIDENT

› Exercise

- Read the report and collectively discuss what information you have retained to assist you in the future and what from an ANSP's perspective would you need in similar event from the pilots and/or the investigators, to enhance your procedures and reporting processes.
- So 2 things, what in the report, was sufficient to help you and what else would you need.....

IMPLEMENTATION OF NEW REGULATIONS

- › November 2018 target date
- › Will eliminate need for SFOC if compliant with new regulations
- › SFOC will be required for non compliant ops (e.g. >25Kg,
- › Major issue: how to address industry's demand for greater access to controlled airspace

- › However...
 - TC electronic registration system to be introduced
 - Compulsory UAV Identification on aircraft
 - Introduction of airspace awareness tools... including interface to ATS units for either automatic airspace access authorization, or a means to negotiate access where required

ANSP ISSUES & CONCERNS

- › Operator lack of aviation/airspace knowledge, communication/terminology, coordination procedures...
 - Difficulty in distinguishing piloting capabilities without some form of recognized training standard/national licensing requirement, etc.
 - Critical need to establish common baseline – certified ground schools, Remote Pilot Licenses
 - Need to facilitate interaction between Remote Pilots and ATS units

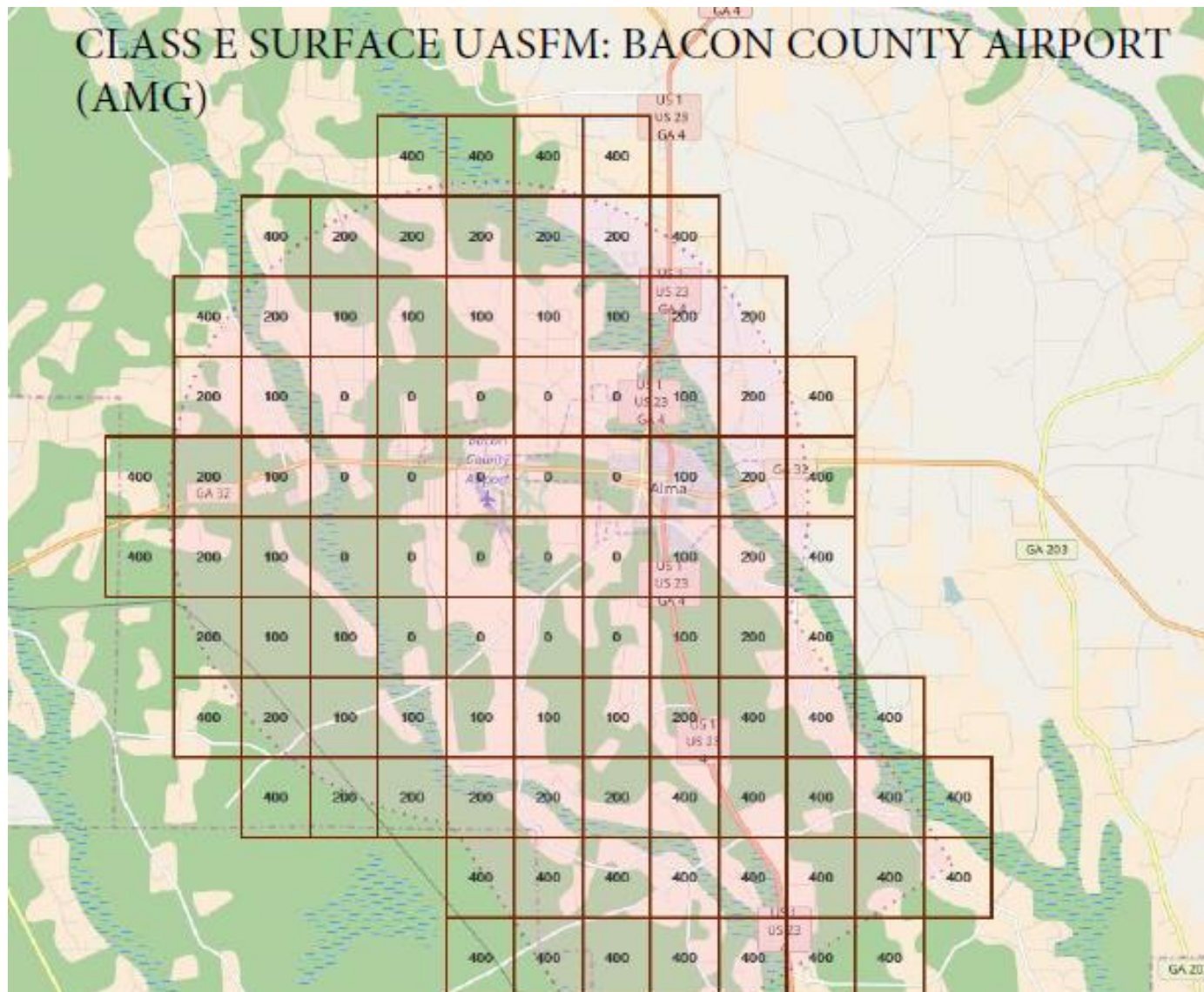
NEW DEVELOPMENTS

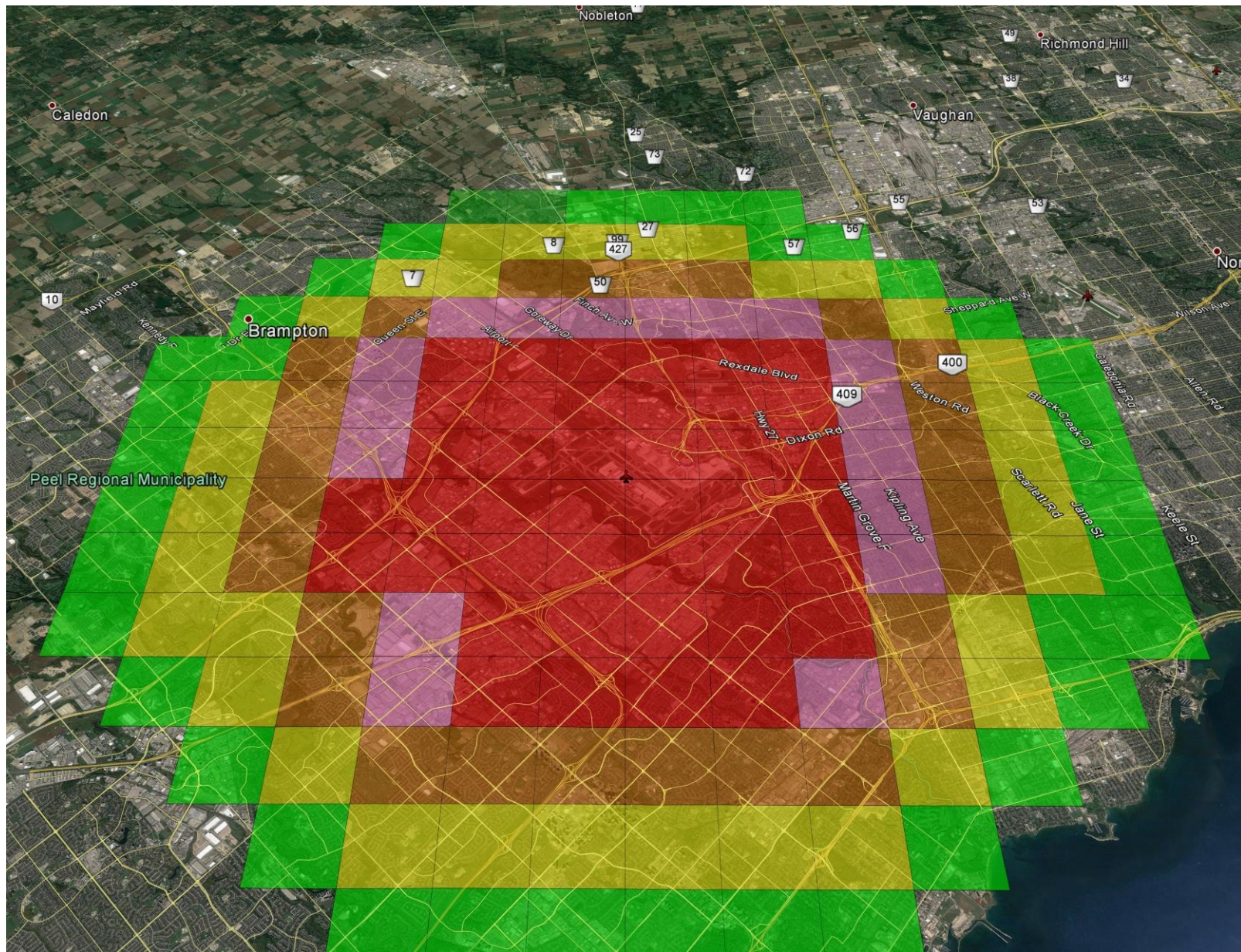
- Situational Awareness Tools
 - Personal Electronic Device (tablet/cell phone) Applications
 - Airspace structure/rules, restrictions, authorization
- RPA Registration/Identification/Detection/Enforcement
- UAS Traffic Management (UTM) System

NEW DEVELOPMENTS

- › Situational Awareness Applications (using laptop / personal phone / tablet)
 - Registration/Identification
 - Mission planning
 - › NOTAMs
 - › Weather
 - › Airspace structure and temporary restrictions
 - › Coordination with ATS Unit
 - Flight conformance monitoring (insurance/regulator use)
 - Surveillance (radar, ADS-B, RPA GPS) data
 - e.g. Air Market, AirMap, Unifly

FAA LAANC 1NM GRID MAP





- › **Situational Awareness APPs (examples)**

- ›

- ›

- › <https://www.airmap.com/airspace-authorization/>

- ›

- ›

- › <https://www.unifly.aero/>

- ›

- ›

- › <http://hologarde.com/>

- ›

- ›

- › <https://airmarket.io/>

- ›

NEW DEVELOPMENTS

- › Drone detection/interdiction
 - Under trial at airports, special security events
 - Hybrid of radar, radio frequency and electro-optics sensors

- › UAS Traffic Management System
 - Package delivery system (Amazon, UPS, etc.)
 - Low altitudes (below 500ft and controlled airspace)
 - Computer-controlled system
 - › Uses on-board GPS position sent via cell network

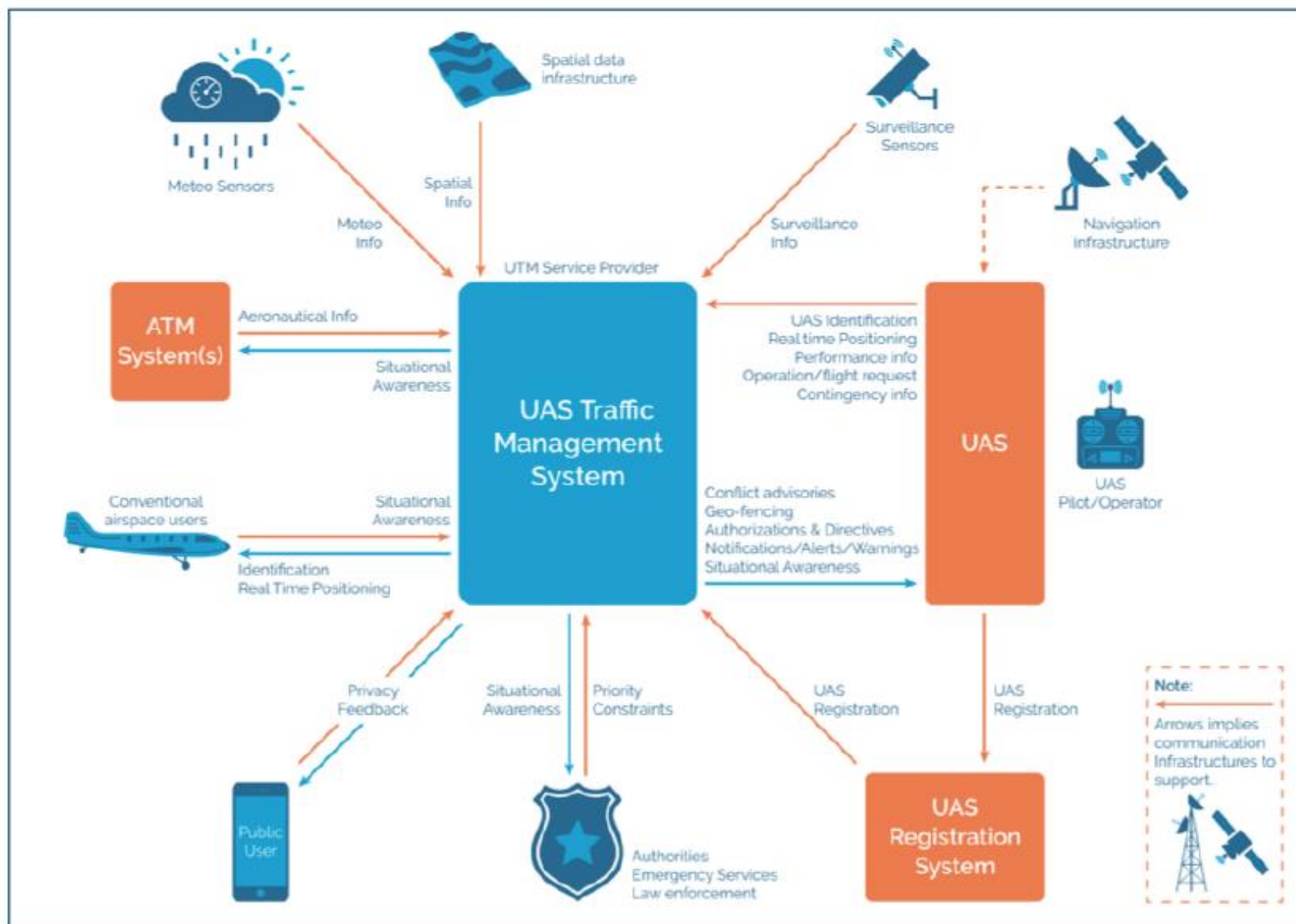


Fig. 1 – Architecture of a UTM system (GUTMA, 2017)

› ***Rules for recreational drones:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html#flying>

› ***When you need a permission to fly a drone:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html#permission>

› ***About the Special Flight Operating Certificate:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/getting-permission-fly-drone.html#sfoc>

› ***Legal requirements when flying a drone:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html#legal>

› ***Getting permission to fly your drone:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/getting-permission-fly-drone.html>

› ***No drone zones:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/where-fly-drone.html>

› ***Report a drone incident:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/report-drone-incident.html>

› ***New regulations for drones:***

- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/flying-drone-safely-legally.html#regulations>
- › <https://www.tc.gc.ca/en/services/aviation/drone-safety/proposed-rules-drones-canada.html>

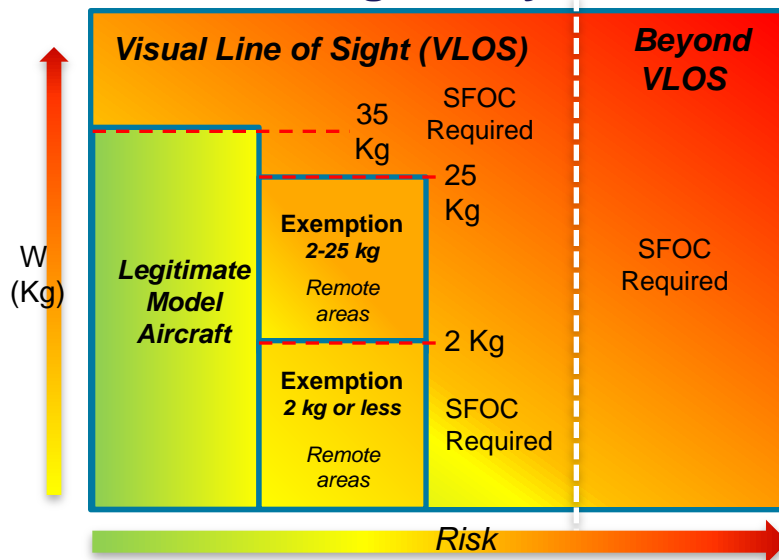
A tall, white, cylindrical air traffic control tower with a glass-enclosed observation deck at the top, set against a bright blue sky with scattered white clouds. The tower has a dark horizontal band around its middle section.

QUESTIONS?

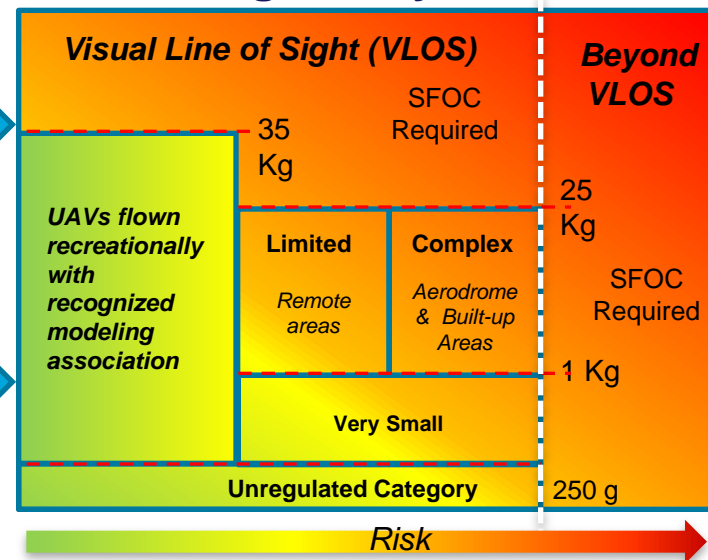
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Current Regulatory Structure



New Regulatory Structure



- Recreational users currently operate in a grey area as model aircraft under the regulations and operate in higher risk areas.
- Legitimate model users currently respect strict safety guidelines.
- Academic and Commercial operations require a Special Flight Operating Certificate (SFOC).
- SFOCs consist of a risk review by TC inspectors and risk mitigation measures.
- Two exemptions from the SFOC process for lower risk operations, with prescriptive operating conditions.
 - 2 kg or less
 - 2 – 25 kg

- Dedicated provision for legitimate model aircraft organizations.
- Three categories of operations:
 - **Complex operations** - pilot permit, registration, and a design standard.
 - **Limited operations** - knowledge tests but no pilot permit, identification requirements (name, contact).
 - **Very Small** – basic knowledge (self-study) and identification requirements (name, contact).
- Preservation of the SFOC process for Beyond VLOS operations.
- Tethered UAVs would be treated as obstacles – lit and marked over 50 feet.
- Indoor operations would not be regulated under this proposal.



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