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RPAS Traffic Management Advisory Committee - General

Canadian RTM Airspace Concept Working Paper

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Summary

The proliferation of RPAS available to the public and to commercial operators has been a major driver of innovation which continue to bring great benefit to society. To support further expansion of the sector by integrating more complex operations, additional rules and requirements must be developed to maintain aviation and public safety.

RPAS Traffic Management (RTM) services will facilitate airspace access for RPAs and integration of higher risk RPAS operations in the Canadian air navigation system. RTM airspace is a concept that is intended to support the implementation of the RTM ecosystem that will enable the delivery of RTM services by ANSPs and/or third-party RTM service providers (RSPs).

As such, this paper introduces the concept of RTM airspace in Canada. It builds on previous work by Transport Canada, NAV CANADA, the RTMAT/AC and others to propose a framework that covers the necessary components to develop this model. The following are included for consideration:

- RTM airspace definition.
- Location criteria.
- Mandatory and optional services.
- RSP requirements.
- Aircraft and pilot/operator requirements.
- Operational requirements

The development of RTM airspace will require extensive effort to arrive at a framework suited for Canada's unique environment. Therefore, it is recommended that the RTMAC members review and comment on the content of the document and propose a methodology to define the concept. It is also recommended that an Ad Hoc industry group be formed to produce a white paper on their view for RTM airspace.

1. Preface

1.1. In this paper, the concept of Canadian RTM airspace is introduced for consultation with the RTMAC.

1.2. This paper goes over the many aspects that need to be studied for the development and implementation of new airspace requirements.

1.3. This initial look draws on the work from the RTMAT/AC and concept developed by other jurisdictions.

2. Introduction

2.1. The proliferation of RPAS available to the public and to commercial operators, has been a major driver of innovation which continue to bring great benefit to society. Also, these "drones" must share the airspace they fly in with many existing users, namely: general aviation (GA), helicopters, military exercises, gliders and paragliders, etc. Canada has implemented regulations to ensure that the integration of these new aircraft into the airspace takes place safely, both for other aircraft and for people and infrastructure on the ground. Previously existing regulations have also been leveraged to ensure people's privacy is maintained and that environmental impact is minimised for example. To support further expansion of the sector by integrating more complex operations, additional rules and requirements must be developed to maintain aviation safety.

2.2. Such complexity emerges when considering the effects of rising air traffic density, BVLOS operations, airspace integration in proximity to traditional aviation and aerodromes, increasing levels of automation/autonomy, and potential passenger- carrying capabilities, among others.

2.3. *RPAS Traffic Management* (RTM) services will facilitate airspace access for RPAs and integration of higher risk RPAS operations in the Canadian air navigation system. However, an RTM system that meets safety and security objectives must be accompanied by a suitable airspace construct.

2.4. RTM airspace is not intended to change current classifications or structure, but to add a set of requirements that will enable safe and efficient airspace integration of RPAs with conventional aviation through the delivery of RTM services by ANSPs and/or third-party service providers (RSPs).

2.5. This paper introduces the discussion on designation of RTM airspace in Canada. The list of topics and considerations included in the narrative are not final but serve as a starting point, or initial thoughts about each item and are expected to be revised significantly over time. It is anticipated that each section will be added to following the discussion and comments received from the RTMAC. The result will feed into several elements of RTM: the system, regulation, concept of operations, etc.

2.6. This paper builds on previous work by Transport Canada, NAV CANADA, the RTMAT/AC and others to propose a framework that covers the necessary components to develop this model. The following are included for consideration by the RTMAC:

- RTM airspace definition.
- Location criteria.
- Mandatory and optional services.
- RSP requirements.
- Aircraft and pilot/operator requirements.
- Operational requirements
- Safety assessment.
- ANSP expectations.

3. Defining RTM Airspace

3.1. To guide the development of supporting concepts, it is important to define the nature of RTM airspace. Although it is expected that this may evolve over time, the following elements should be included.

3.1.1. Volume. RTM Airspace Volumes will define geographic areas in which complex RPAS operations can be performed through the provision of RTM Services and definition of requirements, including equipage. RTM airspace volumes overlay existing airspace classifications. Different types of RTM Airspace Volumes could be used to enable RPAS operations or limit RPAS use in defined geographic areas.

3.1.2. Low Risk Airspace. RTM Airspace Volumes are not required in atypical and low airspace use areas for complex operations including BVLOS. Regulations and Performance standards will be defined for this low-risk airspace. Geographically a large percent of Canada, outside controlled airspace and urban areas, will be considered low risk airspace.

3.1.3. Altitude. The initial altitude for RTM airspace should remain at very low-level (VLL) at around 500 feet above ground (AGL). Topography may require that portions of designated section of RTM airspace be higher than 500’ AGL, but it should always remain below 1000’ AGL.

3.1.4. Impact to Traditional Aviation. RTM airspace volume should account for the operational needs and contingencies, but not infringe on VLL airspace currently used for aerodrome operations, such as IFR arrival and departure, and other established procedures.

3.1.5. Risk to be addressed. RTM airspace is mainly concerned with addressing air risk in more complex environments. As such, the level of risk that RTM airspace should address needs to be well defined. It is anticipated that controlled airspace will require RTM airspace designation to enable routine BVLOS operations in that environment, but conditions may exist elsewhere that will necessitate RTM airspace to mitigate risk.

3.1.6. Level of integration. The level of integration with current airspace needs to be defined. From complete segregation to full integration, there may be room to have a starting point closer to a compromise between the two. Conditions and mechanism to allow conventional aircraft access to the airspace in routine or contingency operations should be listed.

3.1.7. Services offered. It will be important to clearly identify which services are mandatory for the initial phase of RTM airspace. Discussions between Transport Canada and NAV CANADA have proposed that mandatory services should be: flight planning, network ID, conflict advisory, conformance monitoring and geo-awareness. Others might be considered as well as a list of optional services.

3.1.8. RPA weight/class. As RTM airspace is introduced, there may be a need to limit the size and weight of RPAs and perhaps more importantly, clearly identify minimum aircraft performance.

3.1.9. Roles and responsibilities. What are the roles and responsibilities of actors in defining RTM airspace (ex. Regulator, ANSP, operators, municipalities, airport authorities, etc.)

3.1.10. Commercial sustainability/feasibility. In some locations, it may be important to ensure services are commercially viable. Due to the effort and resources required to integrate an RSP, RTM airspace may be limited to where cost recovery for services can be reasonably expected.

3.1.11. Dynamic configuration. Should dynamic configuration of the airspace be considered for the initial implementation? If so, the means to communicate the configuration to airspace users should be identified. RTM Airspace description should include to what extent airspace requirements may be dynamic, if at all.

3.1.12. Types of airspace. The intent is not for new classes of airspace, but add an overlay to existing airspace classes. On the other hand, different types of RTM airspace have been proposed, which would drive which services are mandated/offered. If RTM airspace is to be divided in several category factors like density, risk or others may drive the categorisation.

3.1.13. CNS availability. Available infrastructure, such as cellular networks or other comms solutions, surveillance equipment and navigation availability (ex. GNSS augmentation), will be critical for many services. As such, minimum CNS availability may be listed for RTM airspace.

3.1.14. Other. Any other component that should be included when describing RTM airspace.

4. Location Selection Criteria

4.1. Where RTM airspace is implemented should be determined based on several factors, which are as follows.

4.1.1. User demand. RTM airspace designation, both inside and outside controlled airspace, should be driven by demand for necessary RTM services, especially where CNS technical requirements are required to deliver services.

4.1.2. Social Acceptance. In some areas, such as high occupancy locations (public parks, events, tourism sites, etc.), that do not meet other criteria it may be necessary to manage RPAS traffic to avoid public criticism on the use of drones. This would require close coordination with public authorities and groups.

4.1.3. Environmental. Other areas with environmental considerations (wildlife, farms, national and provincial parks, etc.), may require traffic management based on various requirements from interested stakeholders.

4.1.4. Airspace. Airspace conditions that may not fall within the current classification or categorisation, such as high RPA traffic volume, may support the use of RTM airspace designation. Also, RTM airspace may have an impact on conventional aviation traffic. A streamlined process to identify the impact should be developed as a tool to minimise or mitigate any disruption to traditional air traffic.

4.1.5. Privacy. There are also factors not related to aviation safety or traffic management that could warrant the use of RTM airspace to be better manage privacy concerns.

4.1.6. Security. Security around some sensitive and critical sites might be better served by implementing RTM airspace which could provide the level of assurance required for RPA operations around those locations.

4.1.7. Cross-border. Flying operations that requires crossing international border may be better facilitated through operations in RTM airspace where services would provide the information required for those flights.

4.1.8. Other. Other factors, such as noise impact, may influence where RTM airspace is used.

5. Mandatory and optional services (Initial implementation)

5.1. Several services will be required to support RTM airspace operations. It is anticipated that the number of services offered is going to evolve as system capabilities are developed and demand for more complex operations increase. However, the following services are proposed for the initial implementation of RTM airspace. (refer to the latest services document for a definition of each service)

5.1.1. Flight planning. To initiate the flight in the system (rFIMS) and for the pilot to receive proper authorisations this service should be mandatory.

5.1.2. Network ID. Digital identification and real-time position, tracking , operational volume of aircraft provides the foundation of the RTM surveillance system and a N-ID service is anticipated to be mandatory in RTM airspace.

5.1.3. Conformance monitoring. In higher risk environments it will be essential that any deviation be reported to the RTM system. As such, in RTM airspace, conformance monitoring is anticipated to be a mandatory service.

5.1.4. Traffic information. To enhance conflict resolution a traffic information service about RPA and other aircraft traffic should be mandatory.

5.1.5. Geo-awareness. To ensure all RPA have the information about the latest airspace conditions and defined geographical zone. This service is anticipated to be mandatory.

5.1.6. Weather. This service can support the operational success of RPA flights, it should be available as an optional service within RTM airspace.

5.1.7. Capacity management. This service ensures that the system is able to manage the airspace demands to an acceptable level of safety.

5.1.8. Incident/accident reporting. Essential for oversight responsibilities as a simple means to track reports of RPAS involved incidents/accidents, and to ensure the preservations of data and records

5.1.9. Others. Other service, such as emergency declaration or vertical conversion service, could be included in the initial roll-out of RTM airspace, either as optional or mandatory, to facilitate the implementation of this concept.

6. RTM Service Providers (RSP) Requirements (RPAS Traffic Services – RTS)

6.1. The current RTM notional architecture identifies RTM Service Providers as the means by which pilots and operators will interact with the RTM system. Allowing industry to provide that interface is new to the provision of air navigation services. The integration of RSPs within the ecosystem will require that they meet some parameters before being able to provide RTS.

6.1.1. Technical. Technical requirements to connect to the centralised system (rFIMS) will require validation by the ANSP who will manage that system. However, to ensure the integrity and robustness of services, RSPs will be required to meet a level of safety assurance. Other requirements such as connectivity, cybersecurity, availability, and so on will ensure the robustness of the ecosystem.

6.1.2. Record-keeping. RSPs will be required to maintain historical records about key elements of services provided. Specific requirements are to be developed.

6.1.3. RTS Operations Certificate**.** Similar to the current construct of *Canadian Aviation Regulation* (CAR) Part VIII Subpart 1 for Air Traffic Services, RSPs would be required to obtain an operations certificate to provide RTM services.

6.1.4. SMS. RSPs will be required to maintain a safety management system similar to what is described in the CARs.

6.1.5. Other. Other requirements such as manual and instructions to end-user may be put in place to approve RSP operations.

7. Aircraft Requirements

7.1. To operate within the RTM ecosystem, RPAS will need to meet some performance objectives. This is to ensure that RPAS can respond properly to system inputs and that they maintain the appropriate level of safety assurance.

7.1.1. Navigation Performance. The aircraft is expected to meet some performance criteria related to navigation accuracy, responsiveness, required link performance and so on. Those will need to be identified to ensure that services can be provided effectively.

7.1.2. Endurance. Should the RTM system require additional endurance requirements?

7.1.3. Surveillance/Remote ID. Technical network identification requirements will include tracking, altitude reporting and other data items required to support surveillance within the RTM ecosystem.

7.1.4. Connectivity. To operate within the RTM ecosystem, the RPAS may be required to maintain digital connectivity to enable real-time services and the required data exchange.

7.1.5. Safety Assurance. RPAS safety assurance requirements will need to meet associated operational risk. The minimum expected for RTM Airspace is third-party review, in according with the current SA concept being developed, and certification for many future operations.

7.1.6. Other. Any other aircraft requirements necessary for operations with the RTM system. There may also be a requirement to identify RPA classes with known flight characteristics to enable more efficient separation.

8. Operational Requirements

8.1. In addition to the mandatory use of services to conduct operations within an RTM environment, the pilot/operator will need to meet some conditions. These minimum requirements should ensure efficiency of the ecosystem and seamless integration of multiple operation types. The following is an initial list of requisites.

8.1.1. Flight planning. As a mandatory service for RTM, pilots will be required to submit flight plans to initiate their operations within RTM airspace. This will validate the information required for safe operations such as, pilot certification, aircraft registration and identification, operational intent, contingency measures and so on. Operators will also be required to access mandatory services through an RTM service supplier to monitor changes to the airspace conditions.

8.1.2. VLOS operations. Within RTM airspace there is likely going to be a need for VLOS operations to interact with the RTM system. Requirements may be less than for BVLOS flights, but at a minimum authorisation will still be needed. This will also provide access to services, such as traffic information, that should be used for overall situational awareness.

8.1.3. Aircraft Monitoring. Operators will be required to ensure their aircraft maintains their tracking and altitude reporting capability throughout the flight and the aircraft operates in accordance with their N-ID tracking performance required for the RTM airspace and airworthiness approval. It must also conduct contingency operations IAW their operating manual and procedures for the RTM airspace.

8.1.4. RPAS Operator Certificate. An operator's ROC should include the ability to operate in RTM airspace and operations should be conducted IAW the conditions contained within it.

8.1.5. Pilot licensing. The need for additional licensing requirements (knowledges, training, experience, etc.) may be needed for flights in RTM airspace.

8.1.6. Risk Assessment. In an RTM environment the operator is still required to conduct a proper operational risk assessment. Further work is needed to evaluate how RTM services can provide risk mitigations.

8.1.7. Other. Other operational requirements, such as seasonal may be added as necessary. There may also be additional inputs to the safety assurance process of RPAS to meet minimum requirements for the RTM ecosystem.

9. Air Navigation Service Provider (ANSP) Expectations

9.1. The provision of air navigation in Canada is governed by the Civil Air Navigation Services Commercialization Act (CANSCA) which grants sole responsibility to manage Canada's civil airspace to NAV CANADA. As such, NAV CANADA is assuming the role of centralised actor for the provision of RPAS traffic services. There is NAV CANADA's interaction with other actors is identified in the RTM system notional architecture. The following will require more clarification as the RTM concept is defined.

9.1.1. Roles and responsibility. Beyond the technical interaction between actors as identified in the notional RTM system architecture, operational roles and responsibility between the ANSP and other actors need to be defined. These are Items such as safety management, data interchange, infrastructure maintenance, collaboration, business relationship, client interaction and so on. Some elements of RTM airspace may also impact the overall architecture of the ecosystem.

9.1.2. Agreements. The current legislative framework requires an agreement with NAV CANADA for third party delivery of air navigation services in civil airspace.

9.1.3. Implementation. Implementation of RTM airspace needs to be well planned and coordinated between all actors. It is also expected that some regulatory changes and additions will be required. Elements such as network identification, separation and others identified in this document will be the focus of Transport Canada to enable the provision of RTS.

9.1.4. Other. There are likely other ANSP expectations in the development of the Canadian RTM airspace concept, including some for DND airspace, which will be expanded on during consultation and other works.

10. Conclusions

10.1. Developing RTM airspace will require extensive effort by all concerned. Although this concept has some similarity with work done by other jurisdictions, it will differ in some key areas to come up with a framework suited for Canada's unique environment. There are numerous areas that need thorough exploration to arrive at a concept that will facilitate the integration of RPAS within the current air navigation system while looking forward to modernisation of the aviation sector. The initial implementation of RTM airspace will require a solid definition and set of criteria to decide where it should be designated.

10.2. It is also vital to identify clear expectations in other areas such as for services, aircraft, service providers, operational requirements, ANSP, regulations and possibly more. As we work through a collaborative process the concept is expected to change and evolve in response to technological developments and industry demands. The successful development and implementation of this concept will rest on the effort of all RTM stakeholders.

11. Recommended Action

11.1. It is recommended that the RTMAC membership review and comment on the content of the document and propose a methodology to address the concept. It is also recommended that an Ad Hoc industry group be formed to produce a white paper on their view for RTM airspace.