RTCA-SC 203

By John Walker, Co-Chairman

The rapid increase in the number of operations by Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) and the growing demand that future UAS operations be integrated into the NAS is widely acknowledged and understood as a key challenge confronting the aviation community. RTCA Special Committee 203 was established in October 2004 to assist in addressing that challenge. RTCA SC-203 is completing a rigorous work program to develop recommended UAS Minimum Aviation System Performance Standards (MASPS) that are one of the essential elements successfully integrating UAS into the U.S. National Aerospace System.

The SC-203 Terms of Reference were recently adjusted to reflect the changing needs associated with the delivery of a UAS System Level MASPS, a UAS Control and Communications MASPS, and a UAS Sense and Avoid MASPS. Changes to the Terms of Reference reflect that UAS have the potential to allow government agencies and commercial enterprises to increase efficiency, save resources, enhance safety and protect life itself. It is recognized that global interest is accelerating in a broad range of UAS uses, from aerial photography to agriculture applications to protecting boarders and ports against intruders. Another factor in adjusting the Terms of Reference change was to enhance the close working relationship between the UAS community, through SC 203, and the Federal Aviation Administration's UAS Program Office. Also, adjustments to the committees Terms of Reference provide achievable due dates for completion, with associated description (as described in table 1).

Product	Description	Due Date
Guidance Material for Unmanned Aircraft System (UAS)	Provides key definitions and assumptions - Published as DO-304	March 2007
Operational Services & Environment Definition (OSED)	Provides baseline descriptions of UAS operational functions and performance charachteristics, ATC services, NAS environment and procedures. This information is used to support safely, interoperability and performance assessments.	March 2010
UAS MASPS	Provides quantitative performance standards for overall UAS system. Allocates fonctions to subsystem	Dec 2012
Sense and Avoid MASPS	Provided quantitative performance standards for SA subsystem	Dec 2013
Control & Communication MASPS	Provides quantitative performance standards for CC subsystem	Dec 2013

Table 1

Under the revised Terms of Reference the initial scope of the committee will develop MASPS for operations in the NAS that include airspace classes E and G; MASPS development for UAS operations in other NAS airspace will be established in a future timeframe. There are a few areas that are not within the scope of SC 203's work plan, including:

- Issues concerning near term access for publically operated UAS
- UAS that are tethered and those not intended for recovery or reuse (e.g., weather balloons, model rockets or missiles)
- UAS operated strictly within visual line of sight of the pilot or qualified observer (e.g., small UAS operations and systems being addressed by FAA rulemaking)
- Aircraft and airworthiness certification
- Operational procedures to accommodate UAS

Envisioned Use of Deliverables

While these deliverables can be used by the UAS industry, the primary intent of these deliverables is for FAA use. The work efforts leading to these products are being informally coordinated with EUROCAE Work Group 73 to facilitate harmonization. Use of the deliverables include (not limited to):

Guidance Material and Considerations for Unmanned Aircraft Systems
The Guidance Material and Considerations UAS document will be used by both the FAA and industry as an informational baseline document. This document may be used to develop FAA Orders and Advisory Circulars.

Operational Services and Environment Definition (OSED) for Unmanned Aircraft Systems
The OSED document may be used by the FAA to develop Advisory Circulars and other guidance material that require a baseline set of definitions/descriptions used for assessing and establishing UAS system-level operational, safety, performance and interoperability requirements for operations in the NAS.

Minimum Aviation System Performance Standards for Unmanned Aircraft Systems
Minimum Aviation System Performance Standards for Control & Communication Systems
Minimum Aviation System Performance Standards for Sense & Avoid Systems
These MASPS will be considered by the FAA in development of policy and guidance such as TSO and Advisory Circulars

Specific Guidance Regarding Use of Terms of Reference

All SC 203 recommendations will be based on the premise that UAS and their operations will not have a negative impact on existing NAS users. Products from the special committee will be developed considering the methodology described in "*Guidelines For Approval Of The Provision And Use Of Air Traffic Services Supported By Data Communications, DO-304*", which provides a means to establish the operation, safety, performance and interoperability requirements for aviation systems. Also, SC 203 will conduct studies and analyses of current and planned capabilities of the NAS to evaluate and present various alternatives for use in development of future products.

The following information provides an update of current

committee activities.

Operational Services & Environment Definition - OSED

In addition to the revised Terms of Reference, SC 203 received final approval to the Operational Services & Environmental Definition (OSED) document at the committee's Plenary meeting in February, 2010. The OSED document provides a necessary baseline of information that characterizes UAS attributes, market projections and likely operations in the NAS. The OSED includes all UAS types, except those intended to operate in visual line of sight. It includes all operating environments in the NAS.

In 2009, the OSED was finalized with the inclusion of representative UAS operational scenarios and estimates of UAS utilization of airspace classes and aggregate density distributions by altitudes. In October 2009, the OSED underwent formal review and comment and was, as previously mentioned, approved by committee members during the February 2010 Plenary. The OSED, along with the operational architecture products and high-level requirements, provide the technical baseline input for conducting the operational safety, performance and interoperability assessments.

A Safety Product Team was formed in February 2010. Its initial focus is to define the scope, methodology and definitions needed to enable development of a safety case for UAS operations in the NAS. The safety process will identify, classify and assess hazards and define system-level safety objectives that can be further decomposed and allocated to lower-level safety requirements. In order to accelerate development of Sense and Avoid and Command & Control MASP, the initial concentration will be on airborne operational functions relating to collision avoidance and communications in airspace classes A, E and G. The first iteration of the Operational Safety Assessment (OSA) is expected in 2011. Concurrent with the safety assessment work, the committee anticipates forming teams to conduct the Operational Performance Assessment (OPA) and Interoperability Assessment (IA). Combined, the OSA, OPA, and IA will result in the Operational Safety, Performance and Interoperability Requirements (OSPIR) that define requirements of the UAS system-level MASP. Expected delivery of the UAS MASP is 2012.

Command & Control

The Control and Communications Work Group (WG2) is currently focused on two areas of activity both of which are necessary precursors to development of the UAS Control and Communications MASPS. These two areas are the identification of spectrum for UAS Control and Communicators links and the assessment of the anticipated performance of all possible Control and Communications Architectures.

Currently no spectrum is assigned to civil UAS Control and Communications links so the CC WG has been actively supporting the National Telecommunications and Information Administration (NTIA) with technical information papers and subject matter expertise to facilitate ongoing discussions at the International Telecommunications Union. These contributions have enabled an agreement to be reached on the amount of spectrum required and are currently helping make progress towards consensus on what frequencies will be recommended for adoption at the ITU's World Radio Conference in 2012.

RTCA DO-264 Required Communications Performance parameters such as latency and availability will be some of the key parameters that will be covered by the UAS Control and Communications MASPS. Other parameters are being derived from the Systems Engineering process being undertaken in the Systems WG. The CC WG is assessing each of these performance parameters and developing papers for them that describe what performance can be realistically achieved by the top ten candidate Control and Communications architectures that they have previously defined. These ten architectures cover all of the possible ways of configuring a UAS Control and Communications system. Feedback from safety assessments and modeling and simulation will refine these performance levels and validate their inclusion in the UAS Control and Communications MASPS due to be released in 2013.

Sense & Avoid Product Team

The Sense & Avoid (S&A) Product Team has drawn interest from a broad spectrum of industry, academia and government. The efforts to date have concentrated on the avoidance of airborne traffic. Future work also is likely to extend to the avoidance of terrain and obstacles, surface traffic and obstacles, and hazardous weather.

The team is actively engaged in refining operational and performance requirements for the S&A function. We are drawing from the results of the FAA/DoD S&A Workshops, which identified some essential, top-level functionality. At this point, the requirements work is taking care not to restrict the choices of architecture or technologies. Future work will expand the functional requirements to develop quantitative performance requirements. That step will require results from safety analysis and architecture, and will include allocation of performance among functional blocks to facilitate practical implementation.

The team previously conducted surveys of sensor technologies and algorithms that could be suitable for S&A. While many sensors have been developed to varying degrees, those exploiting cooperative equipment onboard other aircraft would not acquire all targets; and other, "non-cooperative" sensors have different strengths and weaknesses. The use of diverse sensor types may be needed. It is envisioned that the ultimate standard will be performance-based, and would not specify technology except where required for interoperability.

Considerable research has been undertaken to investigate various approaches to algorithms, either for early conflict detection or last-minute collision avoidance. None of these is mature or widely available except the TCAS standardized for air carriers. Using the TCAS algorithm is problematic due to various mismatches with most UAS aircraft and architectures.

Since very limited amounts of data could be collected by flight testing, a comprehensive program of modeling and simulation would be required to support the development and then validate performance requirements. Some of the modeling needs include sensor characterization, aircraft encounter statistics, candidate algorithms, human decisions in detecting and resolving conflicts, communication links, and aircraft maneuverability.

For additional information:
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please reference SC 203.

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