UAS Global Airspace Integration
RTCA Special Committee 203

Remotely Piloted Aircraft Systems
RPAS 2012
UVSI

Paris, France
06 June, 2012
A Global Challenge

Unmanned Aircraft System (UAS) Access to Civil Airspace

Managing Expectations
Creating an Environment of Trust
Making Positive Progress
Making Communications and Collaborations Effective
Outreach to Stakeholders
UAS Airspace Integration a Systems Challenge Requiring Systems Solutions
Global Unmanned Aircraft Activities

- European Commission UAS Studies
- Single European Sky ATM Research (SESAR)
- EUROCAE (UAS Standards)
- Eurocontrol / European Safety Agency (EASA)
- Joint Authorities for Rulemaking Unmanned Systems (JARUS) Civil Aviation Authorities
- ASTRAEA (Autonomous Systems Tech) UK
- Israeli UAS Program
- India UAS Program Emerging
- Australian UAS Program Robust with initial civil regulations

- China UAS Program Emerging
- Japanese Agriculture UAS

- Brazilian UAS Program Emerging

- South America ICAO Region - Lima UAS Symposium (& other ICAO Regions)

- UAS Advisory Rulemaking Committee UAS Executive Committee FAA/DoD/NASA/DHS
- sUAS Notice Proposed Rulemaking RTCA/ASTM/SAE (UAS Standards)
- Congressional UAS Test Site Criteria (six sites)
- FAA NextGen Program
- Joint Planning & Development Office

- ICAO UAS Study Team Circular 328
Today Air Traffic Airspace is highly fragmented
Global Initiatives

- RTCA SC 203 / EUROCAE WG 73/93
- ICAO UAS Study Team
- ICAO Regional Seminars
- Joint Authorities for Rulemaking on Unmanned Systems – JARUS
- NATO Flight into Non-Segregated Airspace (FINIS)
- NextGen / SESAR UAS Activities
- South America / Central America / China / India Middle East
- NextGen / SESAR / European Commission
UAS Path Forward

1. **Accommodate**—UAS are considered on a case-by-case basis

2. **Integrate**—All required policy, regulations, procedures, and understanding of systems and operations are in place for routine NAS operations

3. **Evolve**—Specific consideration of UAS operations in the NextGen operational environment
Examining “Manned vs. Unmanned”
Performance Gap between UAS and Manned Aircraft

Unmanned Aircraft
Global Hawk
- FL300 to FL600+
- Cruise 250 to 340 knots

Predator
- FL180 to FL450
- Cruise 140 to 240 knots

Scan Eagle
- 2,000’ to 12,000’
- Cruise 40 to 65 knots

Commercial Aircraft
Cruise FL350 @ 500 knots

General Aviation Aircraft
Cruise FL050 @ 120 kts

How will differences in aircraft performance impact the NAS?
Manned Aircraft Performance

Established performance

- Demonstrated through pilot practical test standards
  - Maintain altitude, assigned heading, standard rate turns
- Airspace requirements (e.g. minimum speeds, speed limits)
- Aircraft performance envelope

Expected performance

- Not quantified. Dependent upon environment and situation
- Interfacing with other aircraft and ATC
- Immediacy/timeliness/accuracy of response
UAS Performance

- Determine acceptable end-to-end UAS performance for operations within the NAS
  - Acceptable performance requirements for UAS representing diverse functionality and capabilities
  - Acceptable performance requirements for various environments and classes of airspace

- Characterize UAS system elements and their individual and collective contribution to performance

- Determination and validation of performance levels through research assures minimal impact on NAS users and ATC
SC-203 MASPS Objectives

- Clearly derive all Operational, Functional, Safety, Interoperability and Performance Requirements from *Anticipated UAS Operations* in the NAS with no gaps or overlap
- Ensure a consistent approach is being used by all SC-203 Work Groups leading to uniform well connected System and Subsystem *Minimum Aviation System Performance Standard* (MASPS)
- Ensure Safety Assessments lead efficiently into Subsystem MASPS development
- Ensure Interoperability Assessments lead efficiently into Subsystem MASPS development
- Document process to defend traceability of Requirements
SC-203 UAS MASPS

Contains the “Aviate”, “Navigate” and “Manage” Functions

Part 1 – OPERATIONAL AND FUNCTIONAL REQUIREMENTS

- Contains all system – level Operational and Functional Requirements for the entire UAS
  - Contains the AV-2 Data Dictionary
  - Reference Standards for manned aircraft will be used as applicable
  - Clear traceability from Operation to Function
- UAS System MASPS – Part 2 - Safety and Interoperability Requirements receives Plenary Final Review and Comment (FRAC)

Part 2 - SAFETY AND INTEROPERABILITY REQUIREMENTS

- Contains all system-level Safety and Interoperability Requirements for the entire UAS
  - Safety and Interoperability Requirements are organized by Function and subFunction
  - Contains the ASOR as an appendix
- UAS System MASPS – Part 1 - Safety and Interoperability Requirements receives Plenary Final Review and Comment (FRAC)
SC-203 CC MASPS

- **Operational Goals, including:**
  - Operational modes and limitations
  - Throughput
  - Latency
  - Availability and continuity
  - Integrity
  - Failure modes, warnings, and flags

- **System Performance Requirements**
  
  **General Requirements**
  - Peak Loading
  - Time-Critical Scenarios

  **System Performance under Standard Conditions**
SC-203 Sense & Avoid MASPS

- Applicability of Right of Way (ROW) Rules
- Concept of Use/Operations
  
  - Operational environment
  
  - Encounters and timelines

  - Collision Avoidance Threshold (CAT) and:
    - Self-Separation Threshold (SST)

- Software and Algorithms
- Hardware and Software Design Assurance
- System Safety Tools and Methods
Challenges & Opportunities

- Increased need to operate UAS in Global Airspace:
  - National/State Security Missions
  - Defense Training & Support
  - Emergency Management
  - Path towards “birthing” Commercial Market

- Routine UAS Airspace Access into Global Airspace currently limited due to lack of:
  - Standards & procedures so UAS are safely separated from other aircraft
  - Robust Command & Control for UAS
  - Certified Ground Control Stations (GCS)
  - Separation Assurance / Sense & Avoid
  - Safety Management System / Mitigation
  - Spectrum

- Technologies, procedures, and regulations for Global Airspace integration:
  - To be Developed, Validated, and Implemented by ICAO/EASA/FAA/etc.
  - Through rulemaking and policy development
SESAR/NextGen Considerations

- Addresses anticipated changes to Global Airspace and its implications and opportunities.
- Provides a high level description of SESAR/NextGen capabilities and technologies.
- Shows where SESAR/NextGen and UAS environments intersect.
- Suggests method for managing SESAR/NextGen changes in the standards development process.
SESAR/NextGen Architecture Goal

Establish UAS Operational Environment

- Describes the environment where UAS will interact with the NAS
  - Airspace classes
  - Air traffic service units / Terminal & Enroute
  - Air traffic management systems

- Defines air traffic characteristics of the current Airspace
  Understanding traffic density estimates and characterization.
- Understand interfaces with NextGen architecture roadmap
Key Points

- Importance of getting spectrum assigned for UAS Control and Communications at the International Telecommunications Union World Radio Communication Conference in 2015.
- Leverage UAS Standards/Airspace Access Integration Work
- Harmonization – Global initiative
- Focus needed on entire UAS system
- Systems Engineering Process / Operations Support
- Industry direction – establish S&A performance requirements - instead of using prescribed, standardized algorithm
- Modeling & Simulation to assess performance and safety – support industry in trade-offs between design elements
UAS Path Forward for Airspace Integration

1. **Accommodation** – Ability to take current UAS and apply special mitigations and procedures to safely facilitate limited access to the NAS.

2. **Integration** – Establishing threshold performance requirements for UAS that would increase access to the NAS.

3. **Evolution** – All required policy, regulations, procedures, technology and training are in place and routinely updated to support UAS operations in the NAS.

4. **Navigation/Surveillance/Communication** - Operating in civil airspace ubiquitously with manned aircraft
Summary

UAS’s Are Transformational and Must be Integrated into Civil Managed Airspace Safely

Technology/Policy/Regulatory Momentum Must be Continued

Civil Airspace Stakeholders Must be Involved to be Successful

Coordinated Domestic and International Action is Imperative to Ensure Fullest UAS Potential and Preserve Safety