A Concept for Launch and Reentry Collaborative Decision Making (CDM)

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Presentation to the Space Traffic Management Conference
26-27 February 2019

This work was funded by the Federal Aviation Administration through the Federally-Funded Research and Development Center’s (FFRDC’s) Mission-Oriented Investigation and Experimentation Program
CDM Opportunity: Make Better-Informed Decisions On Shared Resource Use

- Typical airspace request is 10-15 days in advance
- Impacts will be harder to absorb as operations grow
- Through CDM practices, Launch and Reentry (L/R) operators can have a voice in building the future

Source: MITRE
CDM Background: Flight Operator and FAA Perspectives

Problem: Early 1990’s ↑Flights ↑Congestion ↑Delays

Context: FAA made decisions based on flight operator schedules but had little additional information to support planning

Solution: A new concept for collaboration and increased data exchange

Approach: Pilot program to validate the concept and benefits

Result: CDM was officially created in 1995 as a joint FAA/Industry activity to:

- Work together to create new technology to improve TFM
- Exchange information
- Collaborate to identify and resolve issues
Comparison of Commercial Space and Air Transportation Industries

<table>
<thead>
<tr>
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<th>Commercial Space 2018</th>
<th>Air Transportation 1993</th>
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<tbody>
<tr>
<td><strong>Numbers of operations</strong></td>
<td>33 licensed launches, 3 licensed reentries*</td>
<td>Over 10 million air carrier and air taxi flights** per year</td>
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<td><strong>FAA’s knowledge of operations and business models</strong></td>
<td>Limited experience in emerging operations or business models</td>
<td>Well-understood operations, but limited knowledge of business models</td>
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<td><strong>Industry maturity and diversity</strong></td>
<td>Evolving, diverse vehicle and mission types</td>
<td>Relatively stable, similar missions and performance across aircraft</td>
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<tr>
<td><strong>CDM motivation</strong></td>
<td>Effects of airspace demand and congestion an emerging problem</td>
<td>Delays and airspace congestion an acknowledged problem</td>
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** Based on an OPSNET 1993 data query, which indicates approximately 20 million air carrier and air taxi operations. A flight departure or an arrival each count as a single operation. The operations count was divided by two to obtain the approximation for the number of flights.
Space CDM Involves Space Operators as Members of the National Airspace System (NAS) User Community

1. **Improve airspace efficiency during mission planning** through timely exchange and informed use of airspace schedule information

2. **Improve airspace efficiency during mission operation** through timely information sharing to enable improved air traffic management procedures

3. **Improve operations over time** through feedback exchange and identification of new capabilities and procedures

Operators exchange perspectives and data to improve situation awareness and to make better decisions about the shared resource
Some Factors and Perspectives in Launch and Reentry Decision-Making

- FAA Air Traffic
- Airspace Availability
- Weather
- Safety
- Site Availability
- Mission Constraints
- Payload Customer
- FAA Commercial Space and FAA Air Traffic
- L/R Operator
- Site Operator

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Space CDM Scope

Environment of increasing and diverse space operations and of evolving airspace management operations
Strategic Collaboration: the Foundation of the Operational Process and Stakeholder Engagement

- Identification and prioritization of challenges
- Development of processes and procedures
- Identification and development of supporting data and tools
- Agreement on standards and rules of the road
Planning Concept Elements (CEs)

CE1. Exploring Airspace for L/R Use

CE2. Scheduling and Sharing L/R Mission Information

CE3. Strategic Collaboration on L/R
Operation Concept Elements

CE4. Managing NAS Airspace for L/R

CE5. Tactical Collaboration Preceding and During L/R
Post-Analysis Concept Elements

CE6. Post-operation Analysis

- Mission-specific
- Baselines and Trends

Post-Analysis
Performance Measurement and Feedback

Recommendations for Improvements

KEY
FAA ATO & AST  L/R Vehicle & Site Operators  Aircraft Operators
Space CDM Capabilities (1 - 9) and Information Flows Supporting the Operational Process

1. Options
2. L/R Data
3. Updates
4. Decisions
5. L/R Status & Events
6. Airspace Needs
7. Vehicle Position
8. Data & Perspectives
9. Improvements

1. Planning
2. Operation
3. Post-Ops Analysis

Airspace Usage Analysis
Mission Collaboration and Scheduling
AMP Development and Update
Real-time Operation Processing
Vehicle Information Processing
L/R Performance Analysis

Airspace Usage Repository
Scheduled Mission
Scheduled Mission Airspace Information
AMP Info
L/R Operations Repository
Information Sharing
Planning Capabilities and Scenario Summary

1. Options exploration
2. Options submission/collaboration
3. Option/backup selection
4. Dynamic airspace management plan update
5. Data capture and storing
6. Sharing with authorized users
Operation Capabilities and Scenario Summary

1. Continuous processing and update of L/R operator and FAA data
2. Coordination of changes
3. Dynamic airspace management
4. Data capture and storing
5. Sharing with authorized users
1. Event analysis
2. L/R metrics analysis
3. Airspace management metrics analysis
4. Data reporting
5. L/R operations review and improvement
6. Acceptance of updates
7. Data capture and storing
8. Sharing with authorized users
Some Topics To Be Addressed Through Strategic Collaboration

- **Information and Information Exchange**
  - Visibility of shared information for different users
  - Data exchange formats

- **Planning**
  - Criteria for airspace congestion/demand levels and the likelihood that a L/R option would require coordination based on those levels
  - Number of L/R airspace schedule options that may be submitted

- **Operations**
  - Conditions and timing for requesting mission adjustments, and parameters within which the adjustments need to fall
  - Information exchanged between the L/R operator and FAA at specific points in time or as specific events occur, and what actions are expected to be taken based on the information

- **Post-Analysis**
  - Performance metrics – airspace management, L/R operations
Space CDM Outcomes

- For all NAS operations and users
  - Enhanced common situation awareness and informed decision making
  - NAS operation is more stable with consistent processes and improved schedule predictability
  - Improved use of available airspace
  - More efficient airspace management

- For space operations: Voice of L/R operator
  - In NAS decision making for airspace management
  - In determining engagement, processes, and tools for airspace use optimization
Thank You!
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