Commercial Space Transportation (AST)

Commercial Space Transportation RE&D Program

To: REDAC NAS Ops Subcommittee

By: Dr. Michael Romanowski
   Director Commercial Space Integration
   FAA Office of Commercial Space Transportation

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The FAA has a Long History with Commercial Space Transportation Operations

- The Office of Commercial Space Transportation (AST) was formed in 1985 (in the Office of the Secretary); joined FAA as line of business in 1995
- Commercial Space Transportation regulations in place since the 1990s – 2000s
- > 290 authorized launches & reentries
  - No public safety impacts
- Airspace “integration” methods date back to:
  - Space Shuttle (orbital flights)
  - Ansari X-Prize (sub-orbital flights)

* Projection
Current Realities

NASA Commercial Services Programs

Large Satellite Deployment Business

Small Satellite Deployment Business

Suborbital Space Flight Business
Current Realities

NASA Commercial Services Programs

Large Satellite Deployment Business

Small Satellite Deployment Business

Suborbital Space Flight Business
The Industry
US Launch Sites – Significant Investments by States, Local Authorities & Industry

Key
♦ Federal Launch/Landing Site
• FAA-Licensed Launch Site
* Exclusive Use Sites

Potential Future Spaceports
- Texas
- Georgia
- Alabama
- Colorado
- Hawaii
- Florida
- Arizona

- California Spaceport
- Mojave Air and Spaceport
- Edwards AFB
- Vandenberg AFB
- Spaceport America
- Oklahoma Spaceport
- Midland Spaceport
- McGregor
- Houston Spaceport
- Brownsville
- West Texas
- Mid-Atlantic Regional Spaceport
- Wallops Flight Facility
- Cecil Field Spaceport
- Kennedy Space Center
- Cape Canaveral Air Force Station
- Spaceport Florida
- Mahia Peninsula
- New Zealand
- Reagan Test Site
- Kwajalein Atoll, Marshall Islands

Office of Commercial Space Transportation
Federal Aviation Administration
Commercial Space R&D Development

- Research projects within *Safe and Efficient Integration* may include:
  - **Improving integration of launch sites (i.e., spaceports) into the NAS and its system of airports**, including sites in the vicinity of major airports or complex airspace.
  - **Exploring the development of separation standards** for improved airspace management of launch/reentry vehicles during non-explosive phases of flight.
  - **Improving airspace integration planning** for return to land-based sites to decrease the amount of airspace closed to air traffic operations by using higher fidelity input data and models.
  - **Improving real-time monitoring of launch/reentry vehicle operations for airspace integration**, to decrease the amount of airspace closed to regular air traffic operations and expedite response to off-nominal scenarios.
  - **Developing and validating improved noise models for commercial space launch operations at inland launch sites**, including spaceports co-located with airports.
  - **Improving methods for launch and reentry collision avoidance analysis** to produce more efficient launch and reentry planning and NAS integration.
Spaceport Integration

• Spaceports are a critical driver of AST R&D needs
  • Aspects embody a broad spectrum of research questions
• Location and concept of operations of proposed sites have potential implications on:
  • Public safety
  • Air traffic
  • Airports
  • Environment
• Types of operations to be hosted, frequency of operations, timing of operations, etc. all need to be analyzed and addressed
Example: Houston Spaceport
R&D to Assist Spaceport Siting & Integration

Enable applicants to explore trade-space considerations – identifying and quantifying key factors for integrating spaceports in proposed locations

- Exploratory tool proved viability of concept; further work needed to mature
- Factors include:
  - Inland/coastal
  - Proximity to airports/co-location
  - Proximity to critical infrastructure
  - Horizontal/vertical launch
  - Local airspace
  - Neighboring air & ship traffic
  - Local population density
  - Planned launch services
Example Output – Highlights Areas of Program Risk

**Spaceport Categorization Main Matrix**

<table>
<thead>
<tr>
<th>Decision Factors</th>
<th>Part 139 Commercial Service Airports</th>
<th>General Service Airports</th>
<th>Bedside Use Sites</th>
<th>Multiple Launch Site Operations Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
<td>Values below represent the collective score from selected answers in the factor categories.</td>
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</tr>
<tr>
<td>Launch site suitability</td>
<td>1.0</td>
<td>63</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Services Provided</td>
<td>0.9</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Weighted Scores</td>
<td>47.27</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Model Result**

Air and Spaceport: Class 2

**Criteria**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>General attributes of available infrastructure support and the impact launch operations would have on other modes of transportation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services Provided</td>
<td>A list of services that could be offered to enhance the location's ability to host launch activities. To receive credit for the providing a service, it must be able to pass the safety approval process.</td>
</tr>
</tbody>
</table>

**Note on calculation**

The formula for weighted scores uses a Sumproduct formula and has conditional formatting applied. Please check that the formula and conditional formatting includes the correct cell ranges if you add or remove any rows or columns.

**Result Details**

- **License Name**: Air and Spaceport: Class 2
- **Public Safety Risk**: Typical characteristics may include; Located in a more populated area. The trajectory may traverse populated areas and require limitations.
- **Complexity of operations**: Location is co-located at a federally obligated airport. Facility capable of launching less risky vehicles. Operations from this location have some impact on other modes of transportation.
- **Services Provided**: Safety services shall be provided nominal launch operations. Additional services may be need to qualify for this category. Some examples may include: FOD removal, runway inspection, fuel handling and storage, etc.
- **Current Location Examples**: Midland
Leveraging Research: Separation Standards

- Research to define separation standards specific to launch/reentry operations:
  - Separation of aircraft from airspace (aircraft hazard areas)
  - Separation of aircraft from launch/reentry vehicles
    - non-explosive flight phases like captive carry and gliding return
Leveraging Research: Noise

- Modelling & understanding of space vehicle noise, sonic boom, and other effects on environmentally sensitive areas and communities needs further work
  - Gather noise measurements, validate and modify models for rocket noise and sonic boom
Discussion
PPT Portfolio Overview

• The Commercial Space Transportation RE&D portfolio will enable advances in critical areas such as:
  – Safe and efficient integration of increased commercial space launch and reentry activity into the national airspace
  – Advanced safety assessment methods
  – Advanced vehicle safety technologies and methodologies, and
  – Human space flight safety and physiology factors

• Funding enables maturation of concepts for follow-on use in methods, systems, operations and the regulatory framework

• Funding also sustains cooperative, innovative R&D within the FAA’s Commercial Space COE
Licensing Process Overview for Commercial Launch Site

- **Launch Site**
  - Exploratory Discussions
  - Pre-Application Coordination (Site)
  - Application Evaluation (Site)
  - Launch Site Operator License

- **Launch Vehicle Operations**
  - Exploratory Discussions
  - Pre-Application Coordination (Launch License)
  - Application Evaluation (Launch License)
  - Launch License (for operation(s) at commercial launch site)
Licensing & Permitting – *Generic Process Flow*

- **Initial Discussions**
  - Pre-application Consultation
  - Environmental Review
  - Public Safety Review
  - National Airspace System (NAS) Integration

- **Application Acceptance**
  - Evaluation
  - Policy Review
  - Payload Review
  - Financial Responsibility

- **License/Permit Determination**
  - Launch/Reentry Ops
  - Monitoring
  - Safety Inspection