Develop validated AAM System Architectures that define safe, certifiable, and scalable AAM operations.
NASA Sponsored: Vertiport Automation System Task
Vertiport Automation System

The intent of this task is to accelerate concept development, technology development, and standardization around vertiport infrastructure and automation.

This task forms the basis for research that will inform policy decisions and system design decisions.

Scope of Work

- Perform a trade study and analysis of existing technologies that would support high density vertiport operations using automation.
  - Vertiports serving UAS cargo delivery and small passenger-carrying aircraft (< 10 passengers) are of interest.
  - Particular focus on vertiport infrastructure, vehicle, and airspace services sensors and automation technologies that would enable large volumes of traffic in and out of a vertiport
- Scope the use cases for all tasks to align with vertiport and operations requirements associated with heavy lift UAS cargo delivery eVTOL operations and passenger carrying eVTOL operations.
- Develop a concept of operations for a specific location(s) to develop relevant requirements, considerations, barriers, and enabling technologies to best inform operationalization of vertiports and maturation of vertiport automation technologies.
- Develop a vertiport automation system architecture and software specification to incorporate infrastructure, vehicle, and airspace technologies to enable proposed eVTOL business models for passenger carrying and heavy-lift UAS cargo delivery operations.
NYUAST Vertiport Automation Task

Vertiport Automation Trade Study

High-Density Automated Vertiport CONOPS

Vertiport Automation SDSP Architecture

Completed

Completed

In Work – Contractor Development

In Consideration

• Public Release
• FAA-NASA Community Integration Working Group (FAA ARP, AFS)
• NASA AAM HDV Technical Scope

• Public Release
• ASTM F38.02 Vertiport Automation SDSP
• FAA-NASA Conops Working Group – UAM CONOPS v2.0
• FAA-NASA Community Integration Working Group – Vertiport AC
• NASA AAM Concept Development
• NASA AAM HDV – Partnership Engagement

• Public Release
• ASTM F38.02 Vertiport Automation SDSP
• FAA-NASA Conops Working Group
• NASA AMIO System Architecture
• NASA AAM HDV and ATM-X Technology Development

MBSE Model (Magic Draw)
Advance Air Mobility Project:
High Density Vertiplex (HDV) Subproject
AAM Project Organization

Integrated Aviation Systems Program (IASP)

Advanced Air Mobility (AAM) Project Office

- National Campaign Subproject
- Automated Flight and Contingency Management
- High Density Vertiplex
Industry Need for Vertiport Technology

HDV is developing technologies and requirements to support industry infrastructure and automation needs and FAA vertiport design guidance development.

<table>
<thead>
<tr>
<th>Heliports</th>
<th>Vertiports</th>
<th>Airports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low throughput operations</td>
<td>• Moderate-High throughput operations</td>
<td>• High throughput operations</td>
</tr>
<tr>
<td>• Limited infrastructure needed</td>
<td>• Infrastructure and Automation Needed</td>
<td>• Infrastructure and automation</td>
</tr>
<tr>
<td>• FAA Guidance and State/Local Government Oversight</td>
<td>• FAA Guidance and State/Local Government Oversight</td>
<td>• FAA Regulations and Oversight</td>
</tr>
<tr>
<td>• Operations managed mostly by aircraft Operators</td>
<td>• Operations intended to be managed by vertiport Operators, PSUs, aircraft/fleet operators aided by automation</td>
<td>• Operations managed by airport operator, ATC, procedures, and aided by automation</td>
</tr>
<tr>
<td></td>
<td>• Interoperability with UAM, UTM, and ATM</td>
<td>• Interoperability with ATM</td>
</tr>
</tbody>
</table>
HDV technologies addressing key UML-4 challenges will enable NC-3 vehicle-airspace-vertiport automation.
# HDV Research Flow to National Campaign

<table>
<thead>
<tr>
<th>CY2021</th>
<th>CY2022</th>
<th>CY2023</th>
<th>CY2024</th>
<th>CY2025</th>
<th>CY2027</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advanced Onboard Autonomy</strong></td>
<td><strong>Scalable Autonomous Operations</strong></td>
<td><strong>Vertiplex Operations</strong></td>
<td></td>
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<tr>
<td>Small UAS</td>
<td>Small UAS</td>
<td>Small UAS</td>
<td>Representative eVTOL</td>
<td></td>
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</tr>
</tbody>
</table>

**Operations**

- Automated Aircraft
  - Small UAS: x3
  - Small UAS: x5
  - Small UAS: x7

- Merging and Spacing
  - Simulations and Multi-Aircraft VLOS Flight Test
  - Simulation and Limited Multi-Aircraft BVLOS

- Contingency Decision Making
  - Simulation and Expanded Operations (BVLOS & m:N aircraft control)

- Operational Environment (e.g. Test Range for NC)

**Infrastructure**

- Vertiport Terminal Procedures Design
- Instrumented and Connected Vertiport
- Automated Services for Vertiplex

**Scenarios and Use Cases**

- UAS Automation Reference Architecture
- Vertiport Automation Reference Architecture
- BVLOS Safety Case
Vertiport Automation System Design Review
### NASA’s Objectives

**Tell Us:** NASA highly encourages industry participation, feedback, and thoughts on the proposed Vertiport Automation Concepts and Architecture

- Tell us what works for your business cases
- Tell us what doesn’t work for your business cases
- Tell us what we are missing
- Tell us what your priorities are
- Tell if certain decisions (e.g. technology, policy/regulation, etc.) have big impacts on your development, business case, etc.
- Tell us where you see challenges ahead
- Tell us if we need to speed up (and yet at the same time slow down)

**Join Us:** NASA sees this as the start of many discussions to mature and accelerate vertiport development and automation

- **Concepts:** Advanced Air Mobility Ecosystem Community Integration Working Group Meetings
- **Standards:** ASTM Vertiport Standard (WK59317, Ballot F38 21-02), ASTM Vertiport Automation Supplemental Data Service Provider (WK75981)
- **Research and Development:** NASA Announcement for Collaborative Opportunities (ACO-2 released, ACO-3 to be released soon)

**Share with Us:** Discussions on Vertiport Automation should not end today, NASA encourages participants to continue the discussions with us.

- Existing or planned research and development activities that you have that could inform the vertiport automation requirements and standards
- Feedback on the CONOPS, Vertiport Automation Architecture, the workshop, or future directions NASA should be considering for vertiport research