AAM Ecosystem Working Groups (AEWG):

Urban Air Mobility (UAM) Concept of Operations (ConOps) Overview

June 25th, 2020
1:30pm-3:00pm EDT

The UAM vision will only be achievable if everyone benefits

Image Source: NASA UAM Grand Challenge Industry Day
### Agenda

**June 25th, 2020**

1:30pm-3:00pm

<table>
<thead>
<tr>
<th>Topic</th>
<th>Content</th>
<th>Presenters</th>
<th>Timing</th>
<th>Duration</th>
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<tbody>
<tr>
<td><strong>Welcome</strong></td>
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<tr>
<td><strong>UAM ConOps in AAM</strong></td>
<td>Introductions, AAM vs. UAM, UAM at NASA &amp; FAA, Path to Today</td>
<td>Davis Hackenberg, Jim Herrera, Fran Greaney</td>
<td>1:30-1:45</td>
<td>0:15</td>
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<tr>
<td><strong>Path to Today</strong></td>
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<tr>
<td><strong>UAM Vision, Framework, &amp; Maturity Levels</strong></td>
<td>What is a “Vision” ConOps? UAM Framework: Pillars &amp; Barriers, UAM Maturity Levels</td>
<td>Nancy Mendonca, Michael Patterson, Ken Goodrich</td>
<td>1:45-2:15</td>
<td>0:30</td>
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<tr>
<td><strong>The UAM Concept at UML-4</strong></td>
<td>ConOps at-a-glance, Key Concepts, Roles &amp; Responsibilities, Operations at UML-4</td>
<td>Matt Metcalfe</td>
<td>2:15-2:45</td>
<td>0:30</td>
</tr>
<tr>
<td><strong>ConOps Breakouts Preview</strong></td>
<td>Schedule, Format &amp; Objectives</td>
<td>Fran Greaney</td>
<td>2:45-2:50</td>
<td>0:05</td>
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<tr>
<td><strong>Concept Maturation Next Steps</strong></td>
<td>UAM ConOps Maturation, Next Steps</td>
<td>Nancy Mendonca</td>
<td>2:50-3:00</td>
<td>0:10</td>
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</table>

Image Source: NASA UAM Grand Challenge Industry Day
Objectives & Logistics

**Objectives**

*Engage* the community on the UAM ConOps, framework, and concepts

*Elicit* input regarding industry perceptions & trends

*Respond* to questions regarding ConOps release, concept feedback, and maturation

**Logistics**

Polling & Questions: Polling will be part of the presentation questions. Use the Conferences IO link ([https://arc.cnf.io/sessions/xsa9/#!/dashboard](https://arc.cnf.io/sessions/xsa9/#!/dashboard)). Facilitators will answer questions real-time and presenters will answer the most popular questions.

Recording: This meeting is being recorded so it can be accessed at any time for watch back and for those who could not attend today.

Materials: These meeting materials (slides & recording) will be uploaded to the NARI website.

**Meeting Scope**

This ConOps Overview session is intended to educate the community on the 5 pillars in the UAM framework, UML-4, and give high-level insight into the UAM concepts. It is the first in the series. Subsequent breakout meetings will provide detailed, pillar related content that will be covered in the specific UAM ConOps breakout sessions.

Feedback received during the AEWG ConOps sessions will *NOT* be incorporated into Version 1.0 of the UAM Community ConOps
Speakers

**Davis Hackenberg, National Aeronautical and Space Administration (NASA)**
Advanced Air Mobility Mission Manager, Aeronautics Research Mission Directorate

**Jim Herrera, Federal Aviation Administration (FAA)**
UAM/AAM Program Manager, FAA Co-Lead AAM National Campaign

**Nancy Mendonca, National Aeronautical and Space Administration (NASA)**
Deputy, AAM Mission Office, NASA COR

**Dr. Michael Patterson, National Aeronautical and Space Administration (NASA)**
AAM Mission Office, NASA Langley

**Ken Goodrich, National Aeronautical and Space Administration (NASA)**
Deputy Project Manager for Technology, AAM Project, NASA Langley

**Fran Greaney, Deloitte**
Principal, Strategy & Analytics for Government & Public Sector Practice

**Matt Metcalfe, Deloitte**
Managing Director, Future of Aviation
Advanced Air Mobility (AAM) Mission

Image Source: NASA AAM Ecosystem Working Group Kickoff

Develop validated AAM System Architectures that define a safe, certifiable, and scalable system
FAA-NASA UAM Conops
Building the UAM Regulatory Framework

James “Jim” Herrera – AUS-430
New and innovative industries are also competing for regulatory attention: UAS, Supersonic, Commercial Space, and Additive Manufacturing.

UAM Specific Regulatory Challenges:

- Airspace Integration/Airspace Design
- Aircraft Certification
- Pilot minimum standards
- Operations Certification
- Environmental (loudness vs noise, visual noise)
- Spectrum Management
- Security: Physical and Cyber

UAM Crosses All LOBs and Supporting Offices within the FAA
UAS Integration Strategy – 2019

Airspace Management

- Low Altitude Authorization & Notification Capability (LAANC)
- ATM – NAS System Integration
- ATM – ACAS-Xu based DAA
- Aeronautical Information Infrastructure for sUAS
- Remote ID Network
- USS-USS Communication
- ATC Order – No ATC Services below 400 Ft AGL
- UAS Registration

Low-risk, Isolated

Building the Foundation

Regulatory Activities

- Full UAS Integration
- Automated Flight Deck for Transport
- Urban Air Mobility
- Cargo Operations
- Interpretive Rule Update
- Consistent Airspace Rule Applicability
- Part 135 Certifications
- Part 137 Certifications
- Partnership for Safety Plan Operations
- UAS Operations Over People
- UAS Flight Restrictions & Remote ID
- Section 333 Operations
- Part 107 Operations
- Remote ID Network
- Urban Air Mobility
The Implementation Plan lays out the structure and timing that will be used to work toward identifying the activities necessary for implementing.

- Research and Data Analysis
- Operational Concepts and Operational Requirements
- Risk Management
- Streamlining and Stewardship
- Airspace
- Systems/ System Reliability
- Standards
- Procedures
- Policies & Rulemaking
- Security
- Outreach/ Collaboration/ Partnerships
- Human Resource Management and Training
- Performance/ Oversight Processes

Aimed at organizing activities in a manner that support incremental implementation – crawl, walk, run.

UMLs are established to provide a picture of the operational states of readiness for which we can anticipate planned activities.
The FAA Urban Air Mobility (UAM) Implementation Plan Analysis summarizes the actions, office(s) of primary responsibility, and notional completion dates (contingent on funding and resource availability) for the major actions that will be performed across the FAA to address UAM challenges, identify gaps and UAM operational objectives.

- Composed of Functional Categories and sub-categories with nested task elements
- Functional categories are finite and defined by the office or offices within the FAA that engage in these activities.
- The UAS Integration Office defines the functional categories based on the agency Offices of Primary Responsibility (OPRs) roles and responsibilities.

**UAM implementation plan highlights UAM as a cross cutting effort and touches all LOBs and many Supporting Offices within the FAA.**
Traceability and linkage between activities is key to ensuring a useful Framework for Focals to use.

The Framework Will Show the Building Blocks for Unlocking UML-1

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<tbody>
<tr>
<td>Standards</td>
<td>Air Traffic Policy</td>
<td>Facility Maps</td>
<td>Waivers &amp; Exemptions</td>
<td>Air Traffic Policy</td>
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<tr>
<td>Systems</td>
<td>Air Traffic System/Oper Capabilities</td>
<td>Support Systems</td>
<td>FAA Detection and Tracking</td>
<td>宝贵 Traffic System/Oper Capabilities</td>
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<td>Policies</td>
<td>Physical Security</td>
<td>Incident Reporting</td>
<td>Physical Security</td>
<td>Physical Security</td>
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<tr>
<td>Security</td>
<td>Cyber Security</td>
<td>Accident/Incident Investigation &amp; Reporting</td>
<td>Cyber Security</td>
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<tr>
<td>Oversight Processes</td>
<td>Air Traffic System/Oper Capabilities</td>
<td>Fight Standards Training</td>
<td>Fight Standards Training</td>
<td>Fight Standards Training</td>
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<tr>
<td>HR Mgmt &amp; Trng</td>
<td>Air Traffic System/Oper Capabilities</td>
<td>General Public Outreach</td>
<td>General Public Outreach</td>
<td>General Public Outreach</td>
<td></td>
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<tr>
<td>Outreach/Communi cation</td>
<td>Air Traffic System/Oper Capabilities</td>
<td>Int’l Outreach &amp; Engagement</td>
<td>Int’l Outreach &amp; Engagement</td>
<td>Int’l Outreach &amp; Engagement</td>
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The front “page” of the Framework is intended to display the functional areas and the and the categories of activities needed to unlock UMLs.
The Framework is Traceability, Linkage, and Validation Between Activities

The in-depth “pages” will display all critical information about an activity: Functional Category; Line of Business, Planned or Underway; pertinent dates; a short description, points of contact; and the Targeted maturity level up to UML-4.

While the focus of the Framework is unlocking UML-1 we will track beyond. Ideally creating a critical line path to a more mature level of UAM.

<table>
<thead>
<tr>
<th>Functional Categories Needed to Enable UAM Passenger Operations</th>
<th>LOG</th>
<th>Planned/Underway</th>
<th>Critical Activity Description</th>
<th>UML 1</th>
<th>UML 2</th>
<th>UML 3</th>
<th>UML 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Certification Research</td>
<td>AERB</td>
<td>Planned/Underway</td>
<td>Certification policies are changing, and as a result, regulations and standards for the type certification of all-electric VTOL aircraft are researched.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Flight Characterization</td>
<td>AVS</td>
<td>Need</td>
<td>The characterization of UAM aircraft performance during various phases of flight, under different operating criteria, and in various meteorological phenomena. Research on all-weather performance in urban conditions and mechanical turbulence. Research capable of conducting operations in all-weather conditions up to normal aviation thresholds for wind, visibility, temperature, and precipitation.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Cabin Design</td>
<td>AVS</td>
<td>Need</td>
<td>The design of UAM aircraft cabin that provides adequate passenger comfort and safety.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Automated flight contingency_mgmt</td>
<td>AVS</td>
<td>Need</td>
<td>Research the development and integration of systems that manage and conduct high-level aircraft operations, e.g., route planning, fuel management, etc., including contingency management.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Having each activity aligned in a structured way will create a traceable structure to unlocking MULs.
Questions?

James Herrera
UAM Program Manager and AAM NC Co-Lead
Federal Aviation Administration
Office of Unmanned Aircraft Systems Integration (AUS)
Safety and Operations Branch (AUS-430)
Email: James.herrera@faa.gov
Phone: (202) 267-9332
Deloitte and NASA have been working on the UAM ConOps at UML-4 since March, 2019. The ConOps is organized around the UAM framework established by NASA and focuses on passenger carrying operations at UML-4. The UAM ConOps is developed through research, lessons learned and is heavily reliant on broad UAM community expertise, elicitation, and comment.
Poll

Stakeholder Classification

Polling is anonymous

In which stakeholder group do you classify yourself?

https://arc.cnf.io/sessions/xsa9/#!/dashboard
Poll
ConOps Familiarity
Polling is anonymous

Please rate your familiarity with the UAM ConOps
https://arc.cnf.io/sessions/xsa9/#!/dashboard
Urban Air Mobility Community Concept of Operations

“Vision ConOps”
• High-level – Providing a vision of key concepts in the future
• Broad, covering all pillars

Scope
• Passenger-carrying operations
• Vision at the Intermediate state (UML-4)
• Placing air mobility within reach of the general public (i.e., realistic / cost effective transportation choice for general public)
Urban Air Mobility (UAM) Vision: Revolutionize mobility around metropolitan areas by enabling a safe, efficient, convenient, affordable, and accessible air transportation system for passengers and cargo.
UAM Maturity Levels (UML)

**UML-1**  
**Late-Stage Certification Testing and Operational Demonstrations in Limited Environments**  
Aircraft certification testing and operational evaluations with conforming prototypes; procedural and technology innovation supporting future airspace operations (e.g. UTM-inspired); community/market demonstrations and data collection

**UML-2**  
**Low Density and Complexity Commercial Operations with Assistive Automation**  
Type certified aircraft; initial Part 135 operation approvals; limited markets with favorable weather and regulation; small UAM network serving urban periphery; UTM Construct and UAM routes supporting self-managed operations through controlled airspace

**UML-3**  
**Low Density, Medium Complexity Operations with Comprehensive Safety Assurance Automation**  
Operations include urban core; operational validation of advanced airspace operations and management including UTM inspired ATM, CNSI, C^2, and automation for scalable, weather-tolerant operations; few high-capacity vertiports; noise compatible with urban soundscape; model-local regulations

**UML-4**  
**Medium Density and Complexity Operations with Collaborative and Responsible Automated Systems**  
100s of simultaneous operations; expanded networks including closely-spaced high throughput vertiports; many UTM inspired ATM services available, simplified vehicle operations for credit; low-visibility operations

**UML-5**  
**High Density and Complexity Operations with Highly-Integrated Automated Networks**  
1,000s of simultaneous operations; large-scale, highly-distributed networks; high-density UTM inspired ATM; autonomous aircraft and remote, M:N fleet management; high-weather tolerance including icing; high-volume manufacturing

**UML-6**  
**Ubiquitous UAM Operations with System-Wide Automated Optimization**  
10,000s of simultaneous operations (capacity limited by physical infrastructure); ad hoc landing sites; noise compatible with suburban/rural operations; private ownership & operation models enabled; societal expectation
QUESTIONS

UAM Framework & UML Questions

Use Conferences I/O

https://arc.cnf.io/sessions/xsa9/#!/dashboard
The UAM ConOps

**ConOps Inputs & Release**

*Subject Matter Expert Input* from
- NASA ARMD
- FAA
- Deloitte Ecosystem Advisory Group (EAG)

Active, detailed *engagement of 100+ organizations* through a series of two-day community workshops

Review of *160+ sources of UAM and UAM applicable literature* (e.g., UAM, AAM, UAS, UTM, etc.)

Community-wide information sharing generating *1000+ comments* and *800+* were incorporated

Version 1.0 UAM Community ConOps release targeted for *July 2020*

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The UAM Concept

The ConOps focuses on the UAM concepts and includes:
- Preface
- Introduction
- Description of the U4-UOE
- The UAM Framework
- The UAM Pillars
- The UAM Cross-Cutting Barriers

Appendices

The ConOps appendices are intended to provide more detail and context around the UAM concepts and include:
- Roles & Responsibilities
- Gate-to-Gate Operations
- Use Cases
- Acronyms List & Glossary
- Contributing Stakeholders
- Bibliography

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**Concept Decomposition**

**Pillar**

The 5 UAM Pillars divide the UAM concepts into various high-level categories. These pillars define the major areas of focus for the UAM concept.

**Barrier**

A “barrier to entry” in realizing the UAM concept. These barriers break out the next level of detail within each pillar. The UAM concept is defined through the details associated with each barrier.

**ConOps Content**

These bullets are the detailed, decomposed concepts as they pertain to each barrier. They represent the body of the ConOps and the concept at UML-4.

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This “vision” ConOps is a *living document* and will continue to be revised as concepts mature through research, development, test, and realization of UMLs 1-3.
**Key UAM Elements of Airspace at UML-4**

**UAM Maturity Level (UML)-Level 4: Medium Density and Complexity Operations with Collaborative and Responsible Automated Systems**

- **UML-4 UAM Operations Environment (U4-UOE) –** Dynamic airspace volumes with high UAM activity
- **UML-4 Provider of Services to UAM (U4-PSU) –** Federated, 3rd party suppliers of services including air traffic management

**Other Characteristics**

- Advanced automation (vehicles and air traffic management) largely human-over-the-loop
- High performance vehicles (e.g., EVTOL) capable of detect and avoid and performance based separation
- All vehicles operating in U4-UOE are appropriately equipped and actively participate in U4-UOE
- U4-UAM is characterized by medium density operations between closely-spaced, high throughput vertiports
- Higher throughput combined with lower operating costs reduce per passenger price & place air travel within reach of the general public as a practical mode of transportation
Advanced technologies enable:
• New vehicle configurations
• High performance aircraft
• Efficient propulsion systems
• Greater weather tolerance
• Greater design and production agility

Advanced design and engineering methods (model-based, digital engineering, etc.) along with advanced rapid testing enable more rapid commercialization

Certification process are adapted for new technologies, materials, vehicles and manufacturing process building on the regulatory frameworks in place and enable more rapid incorporation of safety improvements

Mature manufacturing and supply chains, including secure digital processes to track parts and ensure authenticity and traceability, will enable rapid ordering and receipt of parts
Key UAM Elements of Community Integration at UML-4

U4-UAM is a value added, integrated component of a city/region’s multi-modal transportation system and is part of local/regional transportation plans.

Cohesive federal, state, and local roles and authorities support design and development of air and ground UAM infrastructure.

Effective processes established to engage and consider community integration concerns (e.g., Safety / Noise Visual / Privacy).

Infrastructure meets industry standards, local ordinances and other regulations.

Infrastructure integrates advanced technologies to support UAM operations (e.g., grid/power capacity, security, ground transportation, weather sensing, and navigational infrastructure).
UAM Ecosystem Key Roles

This list of key UAM roles is NOT an exhaustive list of UAM stakeholders. The below roles are some of the major roles in the UAM ecosystem and play a large role in UAM operations and the regulatory landscape. The stakeholders are listed alphabetically and does NOT imply importance of any given role.

- Federal Aviation Administration (FAA)
- Fleet Operators
- Flight Information Management System (FIMS)
- Provider of Services for UAM (PSU)
- Public Safety
- State and Local Government
- Supplementary Data Service Provider (SDSP)
- UAM Flight Crew
- UAM Operations Environment (UOE)
- Vehicle
- Vertiport Operators

This list of key roles is not an exhaustive list of all roles in UAM
# UAM Nominal Gate-to-Gate Operations Overview

UAM operations are highly collaborative & rely on constant information exchange between stakeholders.

<table>
<thead>
<tr>
<th>Pre-Flight</th>
<th>Fleet Operator</th>
<th>U4-PSU</th>
<th>FAA</th>
<th>Vertiport Operator</th>
<th>Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request performance authorization</td>
<td>• Conduct strategic deconfliction and negotiate resolution(s)</td>
<td>Automated Operations Plan approval (through data exchange)</td>
<td>Screen passengers &amp; cargo</td>
<td>Screen passengers &amp; cargo</td>
<td>Perform systems check</td>
</tr>
<tr>
<td>File operations plan</td>
<td></td>
<td></td>
<td>Perform vehicle boarding</td>
<td></td>
<td>Confirm ready for departure</td>
</tr>
<tr>
<td>Confirm vehicle ready for departure</td>
<td></td>
<td></td>
<td>Confirm all clear for departure</td>
<td></td>
<td>Confirm all clear for departure</td>
</tr>
</tbody>
</table>

**Fleet Operator**
- Request performance authorization
- File operations plan
- Confirm vehicle ready for departure

**U4-PSU**
- Conduct strategic deconfliction and negotiate resolution(s)

**FAA**
- Automated Operations Plan approval (through data exchange)

**Vertiport Operator**
- Screen passengers & cargo
- Perform vehicle boarding
- Confirm all clear for departure

**Vehicle**
- Perform systems check
- Confirm ready for departure
# UAM Nominal Gate-to-Gate Operations Overview

<table>
<thead>
<tr>
<th>Pre-Flight</th>
<th>Take-off</th>
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<tbody>
<tr>
<td><strong>Fleet Operator</strong></td>
<td><strong>U4-PSU</strong></td>
</tr>
<tr>
<td>- Request performance authorization</td>
<td>- Conduct strategic deconfliction and negotiate resolution(s)</td>
</tr>
<tr>
<td>- File operations plan</td>
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<tr>
<td>- Confirm vehicle ready for departure</td>
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UAM operations are highly collaborative & rely on constant information exchange between stakeholders
# UAM Nominal Gate-to-Gate Operations Overview

## UAM Operations

UAM operations are highly collaborative & rely on constant information exchange between stakeholders.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Flight</th>
<th>Take-off</th>
<th>Climb &amp; Cruise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fleet Operator</strong></td>
<td>Request performance authorization</td>
<td>Approves taxi/takeoff authorization and execute take-off</td>
<td>Conformance monitoring</td>
</tr>
<tr>
<td></td>
<td>File operations plan</td>
<td></td>
<td>Vehicle monitoring</td>
</tr>
<tr>
<td></td>
<td>Confirm vehicle ready for departure</td>
<td></td>
<td>Maintain open data exchange with U4-PSU and vehicle</td>
</tr>
<tr>
<td><strong>U4-PSU</strong></td>
<td>Conduct strategic deconfliction and negotiate resolution(s)</td>
<td>Transmit taxi/takeoff authorization and departure sequencing command</td>
<td>Conformance monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Communicate updated operations plan - perform tactical deconfliction</td>
</tr>
<tr>
<td><strong>FAA</strong></td>
<td>Automated Operations Plan approval (through data exchange)</td>
<td>No active participation but maintain authority over airspace. Modify airspace volume if required</td>
<td>Maintain open data exchange</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Vertiport Operator</strong></td>
<td>Screen passengers &amp; cargo</td>
<td>Confirm all clear for vehicle departure</td>
<td>N/A</td>
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<tr>
<td></td>
<td>Perform vehicle boarding</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Confirm all clear for departure</td>
<td></td>
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<tr>
<td><strong>Vehicle</strong></td>
<td>Perform systems check</td>
<td>Execute take-off procedure and sequencing</td>
<td>Execute climb &amp; cruise procedures</td>
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<td></td>
<td>Confirm ready for departure</td>
<td></td>
<td>Maintain vehicle-to-vehicle performance-based separation</td>
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<td>Monitor systems &amp; push vehicle health and status to operator</td>
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</tbody>
</table>
## UAM Nominal Gate-to-Gate Operations Overview

<table>
<thead>
<tr>
<th>Pre-Flight</th>
<th>Take-off</th>
<th>Climb &amp; Cruise</th>
<th>Descend</th>
</tr>
</thead>
</table>
| **Fleet Operator** | • Request performance authorization  
• File operations plan  
• Confirm vehicle ready for departure | • Approves taxi/takeoff authorization and execute take-off | • Conformance monitoring  
• Vehicle monitoring  
• Maintain open data exchange with U4-PSU and vehicle  
• Conformance monitoring  
• Vehicle monitoring  
• Maintain open data exchange with U4-PSU and vehicle  
• Conformance monitoring  
• Vehicle monitoring  
• Maintain open data exchange with U4-PSU and vehicle | |
| **U4-PSU** | • Conduct strategic deconfliction and negotiate resolution(s) | • Transmit taxi/takeoff authorization and departure sequencing command | • Conformance monitoring  
• Communicate updated operations plan - perform tactical deconfliction  
• Maintain open data exchange | • Conformance monitoring  
• Communicate and sequencing of route changes, issues landing clearance, sequence vehicles into vertiport | |
| **FAA** | • Automated Operations Plan approval (through data exchange) | No active participation but maintain authority over airspace | | |
| **Vertiport Operator** | • Screen passengers & cargo  
• Perform vehicle boarding  
• Confirm all clear for departure | • Confirm all clear for vehicle departure | • N/A  
• Confirm vertiport clear for vehicle landing  
• Allocate landing pad and debark area | |
| **Vehicle** | • Perform systems check  
• Confirm ready for departure | • Execute take-off procedure and sequencing | • Execute descent procedure and sequencing  
• Maintain vehicle-to-vehicle performance-based separation  
• Monitor systems & push vehicle health and status to operator | |

UAM operations are highly collaborative & rely on constant information exchange between stakeholders.
### UAM Nominal Gate-to-Gate Operations Overview

<table>
<thead>
<tr>
<th></th>
<th>Pre-Flight</th>
<th>Take-off</th>
<th>Climb &amp; Cruise</th>
<th>Descend</th>
<th>Land/De-Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fleet Operator</strong></td>
<td>• Request performance authorization</td>
<td>• Approves taxi/takeoff authorization and execute take-off</td>
<td>• Conformance monitoring</td>
<td>• Conformance monitoring</td>
<td>• Conformance monitoring</td>
</tr>
<tr>
<td></td>
<td>• File operations plan</td>
<td></td>
<td>• Vehicle monitoring</td>
<td>• Vehicle monitoring</td>
<td>• Ready for turnaround</td>
</tr>
<tr>
<td></td>
<td>• Confirm vehicle ready for departure</td>
<td></td>
<td>• Maintain open data exchange with U4-PSU and vehicle</td>
<td>• Maintain open data exchange with U4-PSU and vehicle</td>
<td></td>
</tr>
<tr>
<td><strong>U4-PSU</strong></td>
<td>• Conduct strategic deconfliction and negotiate resolution(s)</td>
<td>• Transmit taxi/takeoff authorization and departure sequencing command</td>
<td>• Conformance monitoring</td>
<td>• Conformance monitoring</td>
<td>• Confirm all clear for vehicle landing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Communicate updated operations plan - perform tactical deconfliction</td>
<td>• Communicate and sequencing of route changes, issues landing clearance, sequence vehicles into vertiport</td>
<td>• Close operations plan</td>
</tr>
<tr>
<td><strong>FAA</strong></td>
<td>• Automated Operations Plan approval (through data exchange)</td>
<td></td>
<td>• Maintain open data exchange</td>
<td>• Maintain open data exchange</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vertiport Operator</strong></td>
<td>• Screen passengers &amp; cargo</td>
<td>• Confirm all clear for vehicle departure</td>
<td>• N/A</td>
<td>• Confirm vertiport clear for vehicle landing</td>
<td>• Approve/move vehicle to deplane area</td>
</tr>
<tr>
<td></td>
<td>• Perform vehicle boarding</td>
<td></td>
<td></td>
<td>• Allocate landing pad and debark area</td>
<td>• Deplane vehicle</td>
</tr>
<tr>
<td></td>
<td>• Confirm all clear for departure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle</strong></td>
<td>• Perform systems check</td>
<td>• Execute take-off procedure and sequencing</td>
<td>• Execute climb &amp; cruise procedures</td>
<td>• Execute descent procedure and sequencing</td>
<td>• Scan and confirm all clear for landing</td>
</tr>
<tr>
<td></td>
<td>• Confirm ready for departure</td>
<td></td>
<td>• Maintain vehicle-to-vehicle performance-based separation</td>
<td>• Maintain vehicle-to-vehicle performance-based separation</td>
<td>• Execute landing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Monitor systems &amp; push vehicle health and status to operator</td>
<td></td>
<td>• Identify needed maintenance/turnaround requirements</td>
</tr>
</tbody>
</table>

**UAM operations are highly collaborative & rely on constant information exchange between stakeholders**
In 1 word, what is the biggest benefit of UAM?

https://arc.cnf.io/sessions/xsa9/#!/dashboard
Poll

UML-4 Realization

Polling is anonymous

What year do you think UML-4 will be realized?

https://arc.cnf.io/sessions/xsa9/#!/dashboard
ConOps Breakouts
All Breakouts are 90 minutes

<table>
<thead>
<tr>
<th>Topic</th>
<th>Content</th>
<th>Dates</th>
</tr>
</thead>
</table>
| Vehicle             | Vehicle Development & Production Individual Vehicle Management & Operations | Friday
                       |                                                               | June 26th, 2020
                       |                                                               | 1:30pm-3:00pm         |
| Community Integration | Community Integration                                       | Friday
                                                                 | July 10th, 2020       |
                                                                 | 1:00pm-2:30pm         |
| Airspace            | Airspace Design & Implementation Airspace & Fleet Operations Management | Thursday
                                                                 | July 16th, 2020       |
                                                                 | 3:00pm-4:30pm         |
Breakout Format

**Meeting Format:** Webinar with interactive polling & questions (similar to this overview)

**Objectives:** *Engage, Elicit, Respond*

**Takeaways:** Insight into the UAM domain specific concepts and near term direction of the ConOps

These sessions are designed to be more interactive than the ConOps Overview with additional domain specific polling and providing a forum for detailed questions.

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Topic</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00-0:15</td>
<td>0:15</td>
<td>Introduction Overview</td>
<td>- Rules for the road &amp; meeting speakers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Pillar(s) overview</td>
</tr>
<tr>
<td>0:15-0:75</td>
<td>0:60</td>
<td>Pillar(s) &amp; Barrier(s)</td>
<td>- Detailed overview of the content for each specific pillar(s) &amp; barrier(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactive Polling</td>
<td>- Technical and domain information beyond the ConOps overview</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Interactive polling and elicitation are strategically placed throughout the breakouts</td>
</tr>
<tr>
<td>0:75-0:90</td>
<td>0:15</td>
<td>Questions</td>
<td>- Answer any questions and discuss next steps</td>
</tr>
</tbody>
</table>

Feedback received during the AEWG ConOps sessions will **NOT** be incorporated into Version 1.0 of the UAM Community ConOps
Poll
UAM Barriers to Entry

Polling is anonymous

What do you (or your organization) see as the biggest hurdles to achieving UML-4?

https://arc.cnf.io/sessions/xsa9/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day
Poll
Near-Term Needs

Polling is anonymous

What should be the areas of greatest focus for UAM in the next 2-3 years?

https://arc.cnf.io/sessions/xsa9/#!dashboard
Poll

Early Adoption

Polling is anonymous

What are the near-term next steps for UAM early adoption?

https://arc.cnf.io/sessions/xsa9/#!/dashboard
Poll

Areas of Interest

Polling is anonymous

Which ConOps breakout session(s) are you planning on attending?

https://arc.cnf.io/sessions/xsa9/#!/dashboard
The UAM ConOps is a living document that coincides with the maturation of the UAM concept. These concepts and associated documentation will be updated at appropriate intervals. Updates could also align with results from research, test, industry trends, federal/city/state/local policy and regulations, and community input.

### UAM Concept Maturation & Next Steps

<table>
<thead>
<tr>
<th>Baseline ConOps Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0 of the UAM Community ConOps targeted for July of 2020</td>
</tr>
<tr>
<td>This document will be released into the public domain and serve as the “Vision” ConOps for UAM at UML-4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AAM Ecosystem Working Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each AEWG will address domain specific UAM concepts</td>
</tr>
<tr>
<td>The AEWGs will serve as the main forum for concept discussion, feedback, and forward work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UAM Concept Maturation</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAM concepts will mature as government, academia, industry, &amp; community coalesce</td>
</tr>
<tr>
<td>As various UAM activities are realized, such as research &amp; test, the UAM concepts will be updated</td>
</tr>
</tbody>
</table>
THANK YOU

This recording and materials can be found on the NARI website in the next few days

https://nari.arc.nasa.gov/aamecosystem