AAM Ecosystem Working Groups (AEWG):

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

Vehicle Breakout

June 26th, 2020

1:30pm-3:00pm EDT

Image Source: NASA UAM Grand Challenge Industry Day

Agenda

June 26th, 2020

1:30pm-3:00pm

Topic	Content	Presenters	Timing	Duration
Welcome **Introductions** **Overview**	Rules for the Road Meeting Speakers Vehicle Pillars Overview	Carl Russell Dwight DeCarme	1:30-1:45	0:15
Concept Deep Dive(s) **Interactive Polling**	Individual Vehicle Management & Operations Vehicle Development & Production	Brian Hill	1:45-2:45	0:60
Next Steps **Questions**	Next Steps Questions	Dwight DeCarme	2:45-3:00	0:15

Image Source: NASA UAM Grand Challenge Industry Day

Speakers

Carl Russell, National Aeronautical and Space Administration (NASA)
RVLT Partnerships Lead, Aircraft/Vehicle AEWG Lead, NASA Ames

Brian Hill, Deloitte
Specialist Master, Systems Engineering for Government & Public Sector Practice

Dwight DeCarme, Deloitte
Senior Consultant, Systems Engineering for Government & Public Sector Practice

Objectives & Logistics

Objectives

Engage the community of the detailed UAM concept in the Vehicle pillars

Elicit input regarding industry perceptions, near-term trends, and hurdles pertaining to the Vehicle pillars

Respond to questions regarding detailed Vehicle pillar concepts resident in the ConOps

Logistics

Polling & Questions: Polling will be part of the presentation questions. Use the **Conferences IO link** (https://arc.cnf.io/sessions/akh3/#!/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 those that could not attend today.

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

Scope

This **ConOps "Vehicle" Breakout session** is designed such that **detailed, pillar related content will be covered.** This session will be **more interactive** than the overview session with **additional polling, real-time questions, and a wrap-up questions/answer session.** This is the first breakout in this series and subsequent breakout meetings will address additional UAM pillars and barriers

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

Poll

Conferences I/O

Polling is anonymous

Were you able to successfully join the Conferences I/O?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Please keep Conferences I/O open throughout the duration of this presentation

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Stakeholder Classification

Polling is anonymous

In which stakeholder group do you classify yourself?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

ConOps Overview Attendance

Polling is anonymous

Did you attend the UAM ConOps Overview on June 25th?

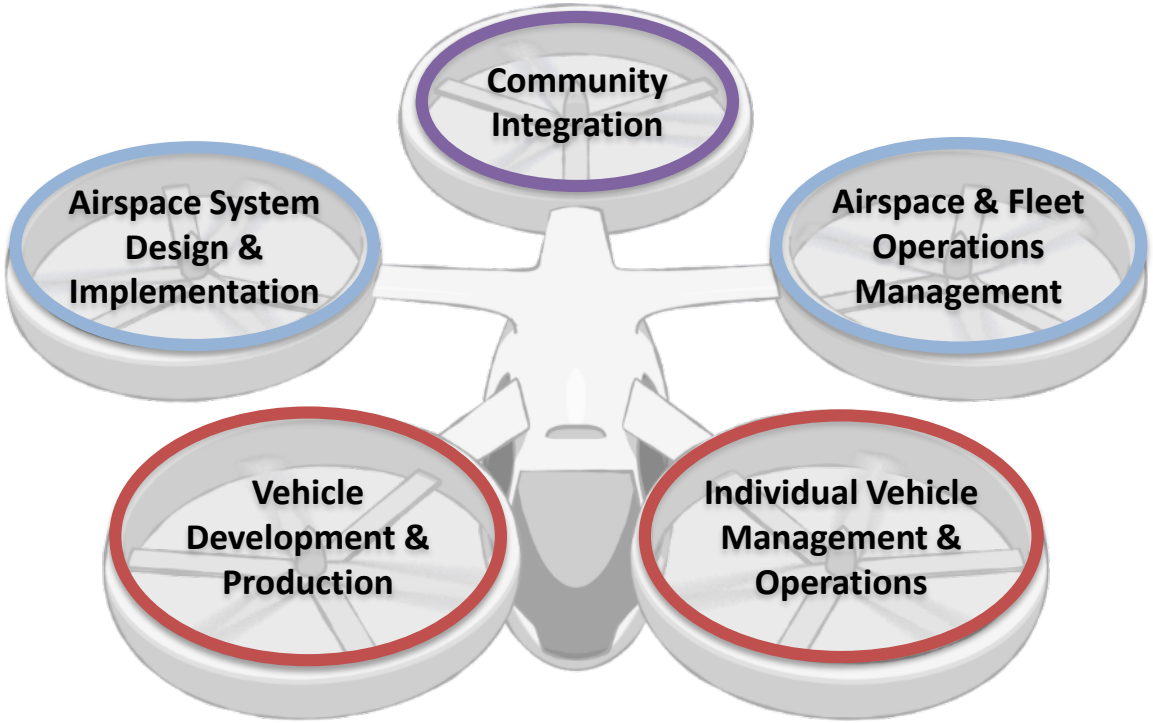
https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Urban Air Mobility Community Concept of Operations

Vision ConOps

(Structure Based on NASA UAM Framework)



UAM Vision

Revolutionize mobility around metropolitan areas by enabling a safe, efficient, convenient, affordable, and accessible air transportation system

"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)

UAM Maturity Levels (UML)

UAM Framework and Barriers

Vehicles | Airspace | Community

INITIAL STATE

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

INTERMEDIATE STATE

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

MATURE STATE

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

Concept Decomposition – UAM Pillars & Barriers

UAM concept development relied on input from a diverse set of stakeholders across different mediums

Subject Matter Expert Input from
- NASA ARMD
- FAA
- Deloitte Ecosystem Advisory Group

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**

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

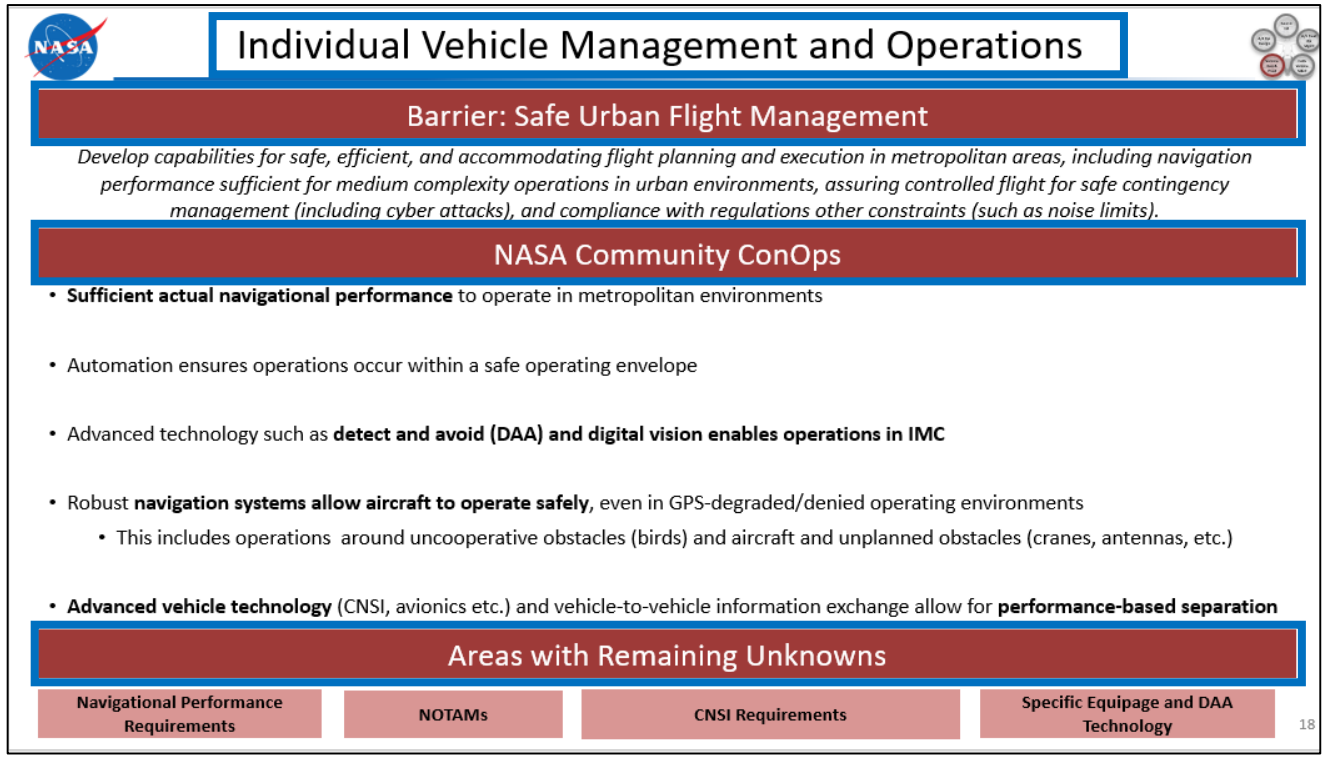
A barrier to realizing the UAM concept. These barriers break out the next level of detail within each pillar. The UAM concept is defined through the details associated with each barrier.

UAM ConOps Content

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

Remaining Unknowns

The unknowns are the areas that require more detail and future research. These unknowns will require further investigation as the UAM concept matures.



Individual Vehicle Management and Operations

Barrier: Safe Urban Flight Management

Develop capabilities for safe, efficient, and accommodating flight planning and execution in metropolitan areas, including navigation performance sufficient for medium complexity operations in urban environments, assuring controlled flight for safe contingency management (including cyber attacks), and compliance with regulations other constraints (such as noise limits).

NASA Community ConOps

- **Sufficient actual navigational performance** to operate in metropolitan environments
- Automation ensures operations occur within a safe operating envelope
- Advanced technology such as **detect and avoid (DAA) and digital vision enables operations in IMC**
- Robust **navigation systems allow aircraft to operate safely**, even in GPS-degraded/denied operating environments
  - This includes operations around uncooperative obstacles (birds) and aircraft and unplanned obstacles (cranes, antennas, etc.)
- **Advanced vehicle technology** (CNSI, avionics etc.) and vehicle-to-vehicle information exchange allow for **performance-based separation**

Areas with Remaining Unknowns

Navigational Performance Requirements | NOTAMs | CNSI Requirements | Specific Equipage and DAA Technology

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This "vision" ConOps is a **living document** and will continue to be revised as concepts mature through research, development, and UMLs 1-3.

Key UAM Elements of Vehicles at UML-4

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

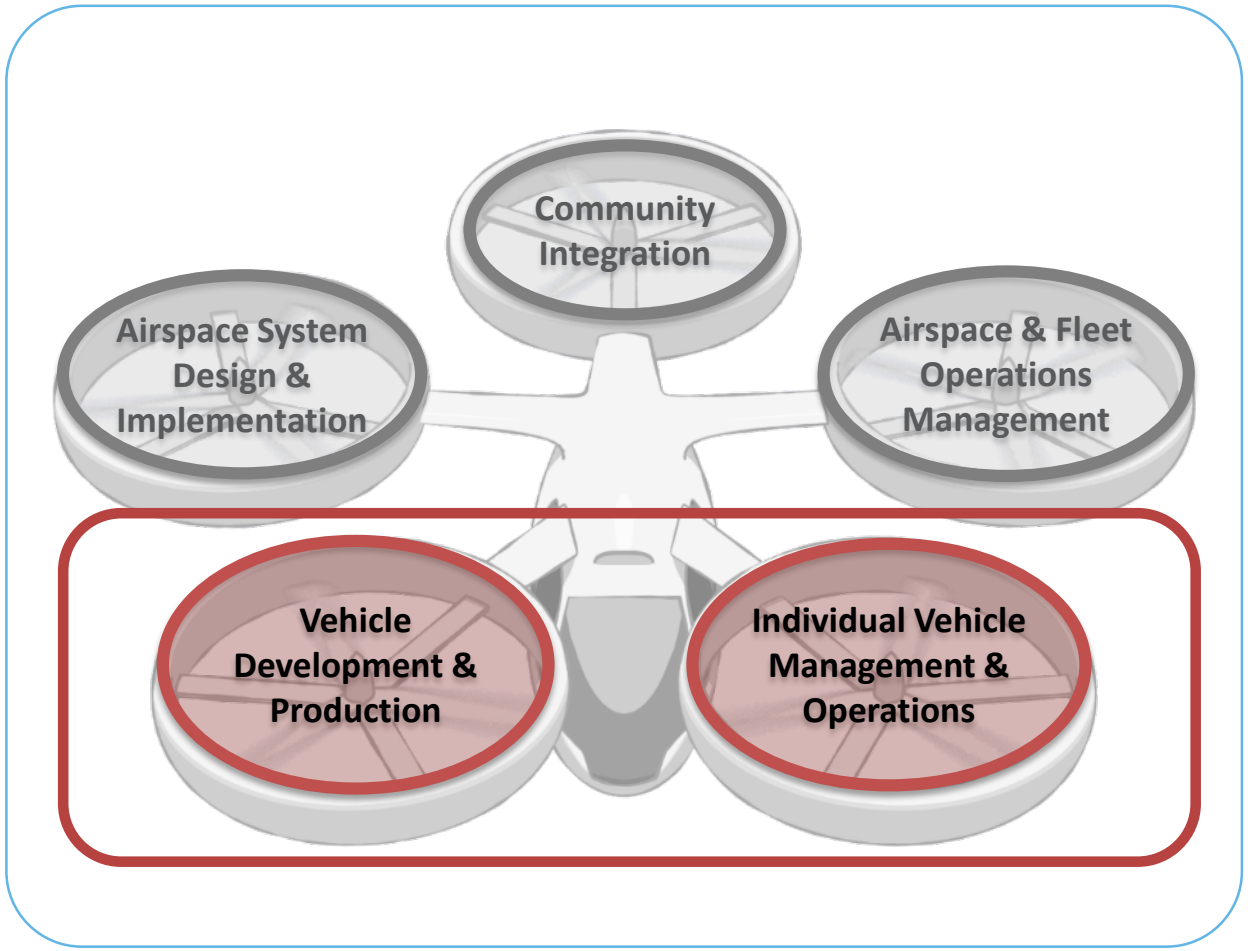
Certification process are adapted for new technologies, materials, vehicles and manufacturing process building on the regulatory frameworks in place and enable more rapid incorporation of safety improvements

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**

For the purposes of this presentation Vehicle = Aircraft

UAM ConOps – Vehicle Pillars

Scope and Focus



Individual Vehicle Management & Operations Barriers

- Safe Urban Flight Management
- Increasingly Automated Vehicle Operations
- Certification & Ops Approval
- Ground Ops & Maintenance

Vehicle Development & Production Barriers

- Vehicle Design & Integration
- Airworthiness Standards & Certification
- Vehicle Noise
- Weather-Tolerant Vehicles
- Cabin Acceptability
- Manufacturing & Supply Chain

Concept Insights & Questions

As the concepts are presented through the course of this presentation, we would like you to keep the following in mind:

Which of the Vehicle unknowns are the highest priority?

What are your ideas on addressing the highest priority Vehicle Management & Operations unknowns?

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

What are the near-term next steps for each Vehicle pillar early adoption

Specific questions associated with the concepts within the Vehicle pillars and barriers

Please think about and populate the conferences I/O tool with your individual thoughts, industry perspectives, and up-vote those concepts you agree with

Poll

ConOps Familiarity

Polling is anonymous

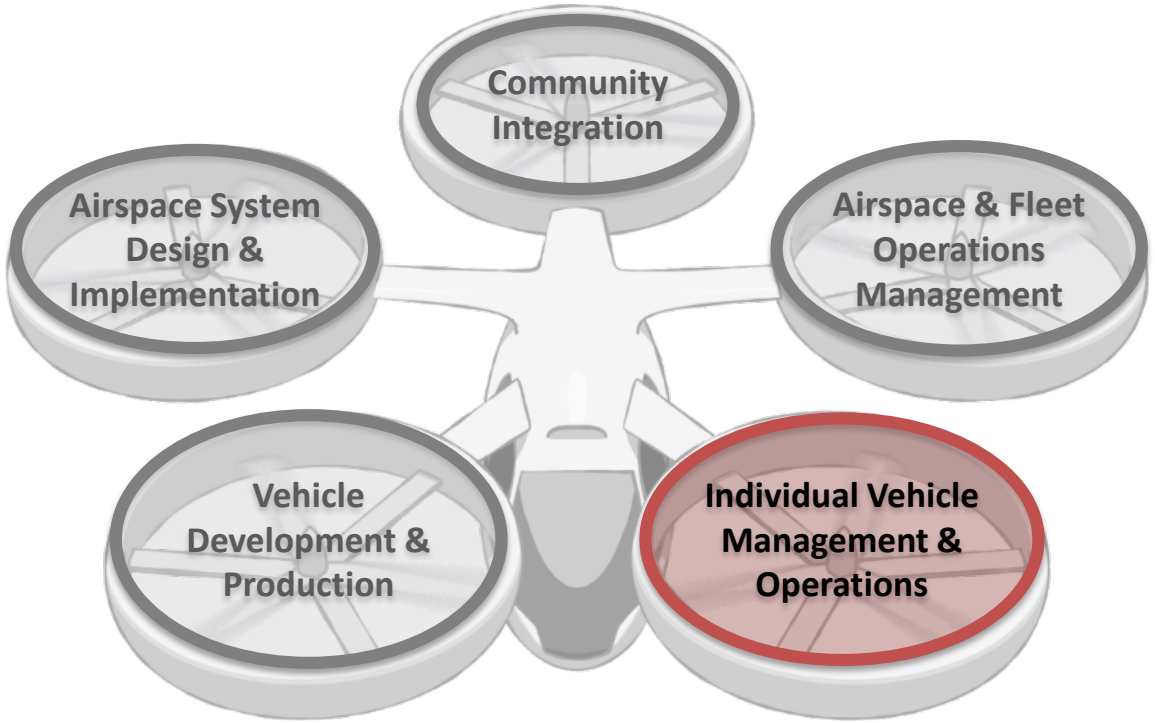
Please rate your familiarity with the UAM ConOps

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Individual Vehicle Management & Operations

Scope and Focus



Safely operate UAM vehicles in and around metropolitan areas while maintaining compliance with all required operational rules and procedures.

Barriers

- Safe Urban Flight Management
- Increasingly Automated Vehicle Operations
- Certification & Ops Approval
- Ground Ops & Maintenance

Individual Vehicle Management and Operations

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Develop capabilities for safe, efficient, and accommodating flight planning and execution in metropolitan areas, including navigation performance sufficient for medium complexity operations in urban environments, assuring controlled flight for safe contingency management (including cyber attacks), and compliance with regulations other constraints (such as noise limits).

NASA Community ConOps

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- **Advanced vehicle technology** (CNSI, avionics etc.) and information exchange allow for **performance-based operation**

Areas with Remaining Unknowns

Navigational Performance Requirements	**NOTAMs**	**CNSI Requirements**	**Off-Nominals & Contingency Operations**	**Specific Equipage and DAA Technology**

Individual Vehicle Management and Operations

Barrier: Increasingly Autonomous Vehicle Operations

Develop highly automated capabilities and associated operational procedures to enable cost-effective scalability by increasing the ratio of vehicle operations to human operators and support staff.

NASA Community ConOps

- **Highly automated vehicles** capable of performing most operations with minimal human interaction
- **Increasingly automated capabilities** of vehicles **reduce cost for flight crew training and vehicle operations** while maintaining an **equivalent level of safety**
- **Advanced automation** compared to what is currently available **will enable the vehicle to identify the lowest risk emergency landing alternative.**

Areas with Remaining Unknowns

DAA Technology

Certification of Automated Systems

Training for Flight Crew & Operator

Human Interaction Roles & Responsibilities

Individual Vehicle Management and Operations

Barrier: Certification and Operations Approval

Develop a framework and corresponding methods of compliance for the holistic certification of advanced automation, humans, and operations of a UAM aircraft, as well as regulations and approval processes for commercial urban operations.

NASA Community ConOps

- **Certification likely occurs under the existing framework** regulations (14 C.F.R. 121, 135, et al.)
- **Advanced methods to test and certify high-levels of automation** approaching Artificial Intelligence will likely be developed
- **Certificated Maintenance processes have been developed** to ensure vehicles are properly maintained
- **Flight Crew and maintenance professional training** will include a curriculum that **covers areas unique to UAM**
- The **flight crew will have sufficient training** to meet their allocated requirement of identifying possible maintenance actions

Areas with Remaining Unknowns

Certification of Vehicle	**Certification of Flight Crew**	**Certification of Operator**	**Certification of Maintenance Facilities & Personnel**	**Certification of Parts & Supply Chain**

Individual Vehicle Management and Operations

Barrier: Ground Operations and Maintenance

Develop guidance and requirements to ensure safe and efficient maintenance and routine vehicle handling between flights, including considerations for Vertiport design and operations.

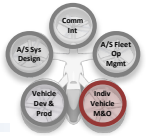
NASA Community ConOps

- **Ground operations at the vertiport will be the responsibility of the vertiport operator** who may contract with vehicle operators and ground services to provide routine vehicle maintenance at the vertiport, and maintenance, repair, and overhaul (MRO) providers
- **Ground operations include an efficient way to recharge/refuel aircraft** in a manner that ensures **safe operation and ensures the safety of flight crew, ground crew, and passengers**
  - May include an automated or flight crew safety briefing
  - Passengers are guided safely through the vertiport environment and around safety hazards
- **MRO facilities will provide both minor and major maintenance** supplied by secure certificated supply chains
  - The types of services provided at vertiports may be constrained by the location of the vertiport and the level of traffic at the vertiport

Areas with Remaining Unknowns

Ground Services Training	**Minimum Level of Maintenance Needed at Vertiports**	**Supply Chain Certification**	**Non-Maintenance Services at vertiports**

Individual Vehicle Management & Operations



Unknowns	Key Issues for Further Exploration
Off-Nominals & Contingency Operations	How will off-nominal situations be managed and what is the role of the flight crew? How does this differ if there is no crewmember onboard the vehicle?
Human Interaction Roles & Responsibilities	What is the flight crew capability? How is automation envisioned to enable this? Does it rely on there being someone onboard the vehicle?
Certification	How will vehicles, operators, flight crews, supply chains, and maintenance professionals/facilities be certified? Can occur using the existing framework or are new regulations needed? How will automation be certified?
Training	What amount of flight hours and educational training requirements will there be for flight crews, operators, and maintenance professionals? How does the training compare to that of a traditional pilot? How does it differ?
Supply Chain Certification	How can the integrity of the supply chain be ensured?
DAA Technology	What are the key outstanding research questions that remain for detect and avoid? What will be the requirements for these systems in the UAM context?

Poll

Vehicle Management/Ops Unknowns

Polling is anonymous

Which of the Individual Vehicle Management & Operations unknowns are the highest priority?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Addressing the Unknowns

Polling is anonymous

What are your ideas on addressing the highest priority Vehicle Management & Operations unknowns?

https://arc.cnf.io/sessions/akh3/#!/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 Individual Vehicle Management & Operations in the next 2-3 years?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Early Adoption

Polling is anonymous

What are the near-term next steps for Individual Vehicle Management & Operations early adoption?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

QUESTIONS

Use Conferences I/O

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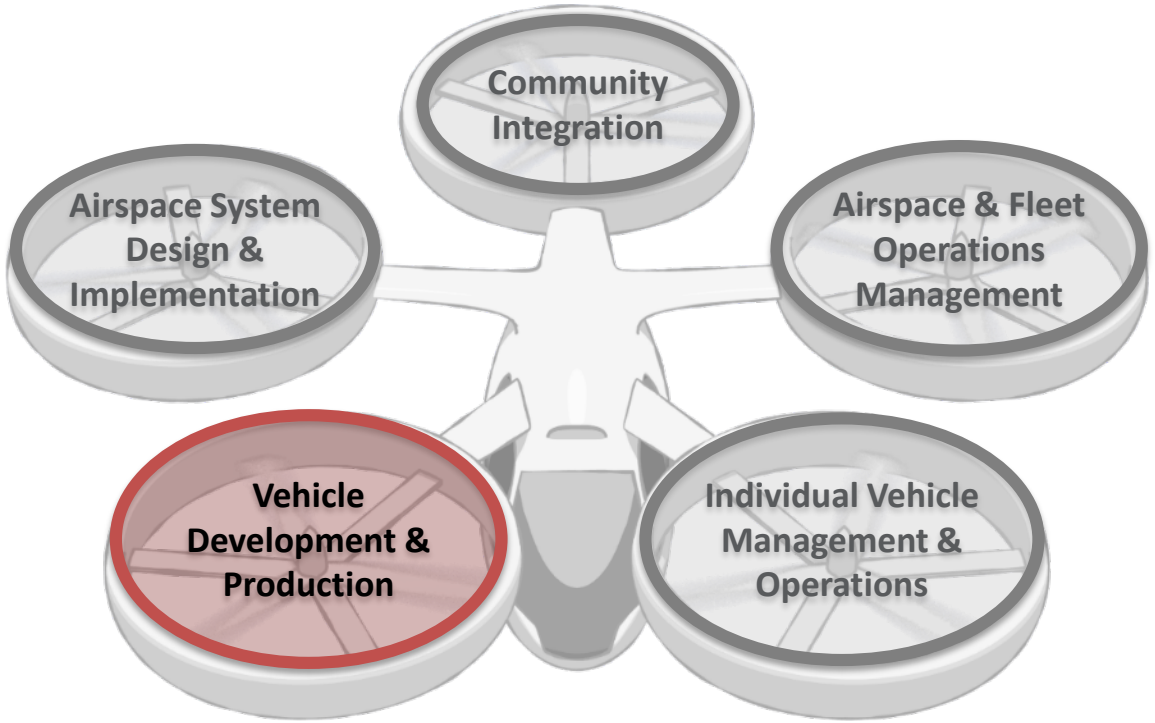
Image Source: NASA UAM Grand Challenge Industry Day

Vehicle Development & Production

Scope and Focus

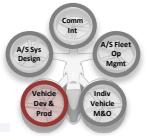


Design, certify and produce airworthy, mission-capable, integrated vehicles that operate safely in all weather conditions required by the mission, with adequate passenger comfort and sufficiently low levels of noise.

Barriers

- Vehicle Design & Integration
- Airworthiness Standards & Certification
- Vehicle Noise
- Weather-Tolerant Vehicles
- Cabin Acceptability
- Manufacturing & Supply Chain

Vehicle Development & Production



Barrier: Vehicle Design and Integration

Develop "mission-capable," integrated vehicles with automated flight critical systems that are compatible with Vertiports and meet all required attributes simultaneously to be safe; operationally and economically competitive with competing transportation modes; environmentally responsible; and secure from digital attack.

NASA Community ConOps

- **Electric propulsion systems and lightweight structures** enable vehicle configurations tailored to UAM missions, with **lower manufacturing and operational cost** and **lower noise signatures** (compared to vehicles in the 2010s).
- **Fly-by-wire control systems** enable new smaller UAM vehicle configurations to take advantage of electric propulsion.
- Current vehicle **fuel reserve requirements will be modified** to account for the short distance of UAM flights.
- **High-speed computing** and **advanced automation** accelerate **development cycles** to efficiently bring promising concepts to market.
- Vehicle design eliminate **electromagnetic interference (EMI)/radio frequency interference (RFI)** between onboard systems, offboard systems, and other radio frequency-emitting devices in urban areas.

Areas with Remaining Unknowns

Resiliency to EMI/RFI

New Testing and Verification Approaches

Fuel Reserve Requirements

Vehicle Development & Production

Barrier: Airworthiness Standards & Certification

Develop a means of initially certifying and allowing for continuing certification of novel and/or rapidly evolving vehicles in a cost- and time-effective manner, including developing certification requirements and means of compliance for vehicles and propulsion systems as well as ensuring harmonious international regulations and standards.

NASA Community ConOps

- **Enhance existing regulatory framework**, where appropriate, for the certification of UAM vehicles.
- Some **certification requirements may be updated**. For example, rather than **freeze the configuration**, there may be ways for the process to be more adaptable so that manufacturers can **certify as they build**.
- Standards for UAM vehicles incorporate **unique elements of UAM operations** such as **automation/artificial intelligence**, **distributed electric propulsion**, and **interoperability with the U4-UOE.**
- Approaches for **vehicle and component certification** for UAM will keep pace with **accelerating technology development.**
- **Surveillance** standards, standards for **detect-and-avoid**, and **maintenance/inspection** standards will be developed.
- New testing and certification standards and are **harmonized internationally** so that flight operations are **not cost-prohibitive.**

Areas with Remaining Unknowns

Standards for New Technology

Certification of Automation

DAA Standards

Vehicle Development & Production

Barrier: Vehicle Noise

Develop vehicle designs and technologies to reduce vehicle noise during all phases of flight; including taxi, take-off/departure, approach/landing, and cruise.

NASA Community ConOps

- Vehicles designed to meet **noise levels that are acceptable to the communities in which they operate**.
- Noise level only slightly above the level of **ambient noise**.
- Vehicle noise reduced through **advanced design** and incorporation of **noise reduction technologies** enables quiet vehicle operations including **distributed electric propulsion** and **low-noise rotors.**
- Community noise **measured in the context of a fleet** in addition to measuring noise from a single vehicle.
- Noise standards at UML-4 are reduced compared to UMLs 1 through 3 and will continue to **evolve**.

Areas with Remaining Unknowns

Noise Standards

Vehicle Development & Production

Barrier: Weather-Tolerant Vehicles

Develop vehicles that are capable of safely flying into and maintaining control in poor, yet frequently experienced, weather conditions, including moderately high winds, low visibility, and high density altitudes.

NASA Community ConOps

- UAM vehicles operate safely in weather and climate conditions experienced in the **urban environment**, such as **turbulence** due to thermal heating/cooling or **wind shear** due to obstacles.
- Designed for the characteristics of the **local markets** in which they operate, such as Denver's altitude, Phoenix's temperature, and Chicago's wind.
- Vehicles designed with performance consummate with the **weather** expected in the location in which they operate.

Areas with Remaining Unknowns

Weather Monitoring

Vehicle Development & Production

Barrier: Cabin Acceptability

Develop vehicles that provide an acceptable level of passenger comfort and payload protection including ride quality, cabin noise, interior climate control, and vibrations.

NASA Community ConOps

- Cabins **safe for passengers and cargo** in both **nominal and off-nominal** events.
- **Seat belts** that are effective and simple to use and **ergonomically designed spaces** reduce injuries in an accident.
- **Crashworthiness principles** and safety technologies such as **energy absorbing seats** support occupant survivability in crash landings.
- Cabin design will **minimize vibration and noise during turbulence, provide climate control,** and **assure passenger safety and comfort.**
- Cabins designed so that necessary maneuvers **do not provide significant adverse impact to passenger comfort**.
- Use of **consumer research** and testing will promote strong understanding of **metrics for passenger acceptance.**
- Factors considered in cabin design include **ambient noise**, **illumination**, **vibration**, **temperature**, and **seating configuration.**
- Safe and efficient access to the cabin provided for passengers – including **children and persons with disabilities**.
- Support for **communication between passengers** by active or passive noise cancellation, personal mobile phones for convenience.

Areas with Remaining Unknowns

Minimum Cabin Design Requirements

Metrics for Cabin Acceptability

Cabin Monitoring

Vehicle Development & Production

Barrier: Manufacturing & Supply Chain

Develop safe, certifiable, high-volume, affordable, secure and rapid manufacturing capabilities as well as a supporting supply chain ecosystem that is robust and scalable.

NASA Community ConOps

Manufacturing

- Use of **advanced manufacturing techniques** combine practices and processes developed across the **automotive**, **aerospace,** and **other industries**.
- Manufacturing processes supported by **integrated design, modular configurations, and advanced materials, and new techniques** (e.g., 3D printing).
- **Supply scaled** to the number of vehicles anticipated, flexible **vehicle configurations.**
- **Strict quality and authenticity standards verified by electronic processes** for tracking, providence, and authentication of safety-critical components (i.e., block chain, digital authentication) and to protect against **cyber and physical security threats**.

Supply Chain

- Approaches for **supply chain qualification** keep pace with levels of production for manufacturing high volumes of vehicles.
- **Less vertical integration** and dependency on single suppliers in supply chains; **greater diversity of manufacturers** and **distributors** of parts and materials.
- **Close integration** between the OEMs, operators, and manufacturers to **optimize supply chain management and control costs.**

Areas with Remaining Unknowns

Advanced Manufacturing processes

Production Rates

Secure Supply Chain

Supply Chain Diversity

Vehicle Development & Production

Unknowns	Key Issues for Further Exploration
Resiliency to EMI/RFI	How can vehicles be designed to be resilient from EMI/RFI, both of which are prevalent in urban environments?
Fuel Reserve Requirements	How will fuel requirements be determined for different UAM vehicles
New Testing & Verification Approaches	Will new testing methods be employed for UAM vehicles or will testing occur using existing methodologies?
Certification	Will there be UAM-specific regulation for certification or will certification occur within the existing framework?
Noise Standards	How will noise standards be determined? Will these standards be stricter than they are for traditional manned aircraft? Will local communities have a role (or be consulted) in determining noise standards?
Weather Monitoring	Will vehicles be designed to include weather sensors? Will weather sensors be mandatory? What type(s)?
Metrics for Cabin Acceptability	What metrics or factors will be used to determine cabin acceptability? Will cabin acceptability differ for passengers on UAM vehicles than for passengers flying on traditional commercial aircraft?
Secure Supply Chain	What are the security risks associated with vehicle production? How will parts be authenticated?

Poll

Vehicle Development/Production Unknowns

Polling is anonymous

Which of the Vehicle Development & Production unknowns are the highest priority?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Addressing the Unknowns

Polling is anonymous

What are your ideas on addressing the highest priority Vehicle Development & Production unknowns?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Near-Term Needs

Polling is anonymous

What are the areas of greatest focus for UAM Vehicle Development & Production in the next 2-3 years?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Early Adoption

Polling is anonymous

What are the near-term next steps for Vehicle Development & Production early adoption?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

UAM Concept Maturation & Next Steps

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.

Baseline ConOps Release

- The UAM Community ConOps **Version 1.0 release is targeted for July of 2020**
- This document will be **released into the public domain** and serve as the **"Vision" ConOps for UAM at UML-4**

AAM Ecosystem Working Groups

- Each **AEWG will address domain specific UAM concepts**
- The AEWGs will serve as the **main forum for concept discussion, feedback, and forward work**

UAM Concept Maturation

- **UAM concepts will mature as government, academia, industry, & community coalesce**
- As various **UAM activities are realized,** such as research & test, **the UAM concepts will be updated**

Poll

Future Sessions

Polling is anonymous

For the Vehicle technologies, what year will UML-4 be realized

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

Poll

Future Sessions - Format

Polling is anonymous

For future sessions, should the format and audience size be adjusted to accommodated greater interaction?

https://arc.cnf.io/sessions/akh3/#!/dashboard

Image Source: NASA UAM Grand Challenge Industry Day

QUESTIONS

Image Source: NASA UAM Grand Challenge Industry Day

THANK YOU

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

Image Source: NASA UAM Grand Challenge Industry Day