Caltrans Planning Horizons Forum
May 7, 2019

- UTM is an "air traffic management" ecosystem for small UAS in low altitude airspace

- UTM utilizes industry's ability to supply services under FAA's regulatory authority where these services do not exist.

- UTM development will ultimately identify services, roles/responsibilities, information architecture, data exchange protocols, software functions, infrastructure, and performance requirements to enable the management of low-altitude UAS operations.

Transparency   **Security**   **Safety**   **Commerce**   **Scalability**
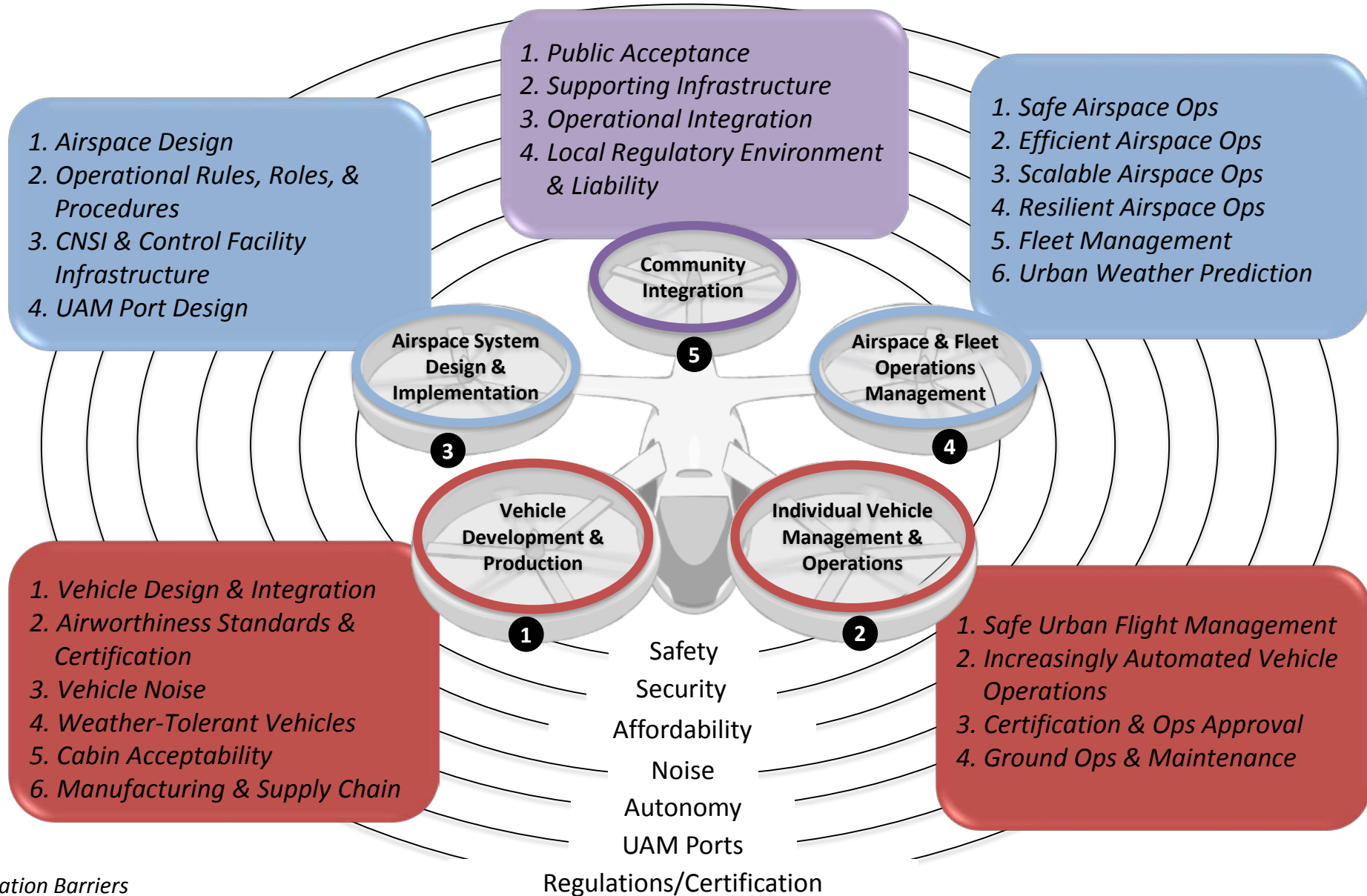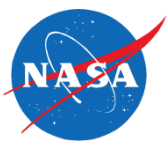
UAM Framework and Barriers

1. Public Acceptance
2. Supporting Infrastructure
3. Operational Integration
4. Local Regulatory Environment & Liability

1. Airspace Design
2. Operational Rules, Roles, & Procedures
3. CNSI & Control Facility Infrastructure
4. UAM Port Design

1. Safe Airspace Ops
2. Efficient Airspace Ops
3. Scalable Airspace Ops
4. Resilient Airspace Ops
5. Fleet Management
6. Urban Weather Prediction

1. Vehicle Design & Integration
2. Airworthiness Standards & Certification
3. Vehicle Noise
4. Weather-Tolerant Vehicles
5. Cabin Acceptability
6. Manufacturing & Supply Chain

1. Safe Urban Flight Management
2. Increasingly Automated Vehicle Operations
3. Certification & Ops Approval
4. Ground Ops & Maintenance

Community Integration — 5

Airspace System Design & Implementation — 3

Airspace & Fleet Operations Management — 4

Vehicle Development & Production — 1

Individual Vehicle Management & Operations — 2

Safety
Security
Affordability
Noise
Autonomy
UAM Ports
Regulations/Certification

Vehicle Barriers
Airspace Barriers
Community Integration Barriers
Pillar number
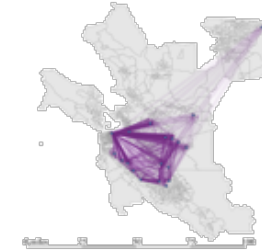
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Grand Challenge (GC) Series Overview

Vehicles
functional UAM vehicles with threshold level of demonstrated airworthiness

Airspace Management
airspace and air traffic management technologies and services built and simulated to a threshold level of UAM ATM requirements

Safety and Integration Scenarios
airworthiness processes and scalable scenarios designed in concert with the FAA, with range(s) and Testbeds as a UAM proving ground
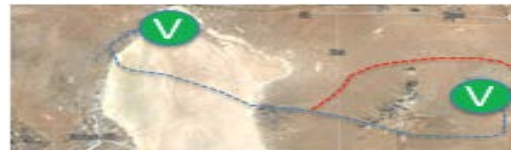
Stakeholder Integration
societal integration and acceptance of UAM Operations including public acceptance, supporting infrastructure, operational integration, standards organizations, the local regulatory environment, etc.

Industry Provided   NASA Provided   Ecosystem Wide Support

Initial Grand Challenge Objectives

Goal

Support requirements and system development for UAM through integrated Demonstrations of vehicle and operational scenarios critical to scalable UAM commercialization

Objectives

- **Accelerate Certification and Approval.** Develop and assess an integrated approach to vehicle certification and operational approval

- **Develop Flight Procedure Guidelines.** Develop preliminary guidelines for flight procedures and related airspace design criteria

- **Evaluate the CNS Trade-Space.** Explore and evaluate communication, navigation, and surveillance requirements, options, and trade-offs

- **Demonstrate an Airspace Management Architecture.** Demonstrate and document an airspace system architecture, based on the UTM construct, capable of safely managing scalable UAM operations without burdening the current ATM system

- **Develop Autonomy Methods of Compliance.** Create and evaluate standardized flight test scenarios and candidate methods of compliance supporting certification of autonomous flight and airspace systems

- **Characterize Community Considerations.** Conduct initial characterization of passenger and community considerations through vehicle ground noise, cabin noise, and on-board ride quality measurements
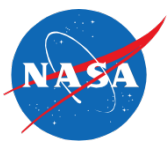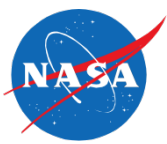
Acronyms

AAM	Advanced Air Mobility
AC	Aircraft
AIA	Aerospace Industries Association
ARMD	Aeronautics Research Mission Directorate
ARTR	Aeronautics Research and Technology Roundtable
ASTM	ASTM International, formerly known as American Society for Testing and Materials
ATC	Air Traffic Control
ATM	Air Traffic Management
ATM-X	Air Traffic Management-eXploration
C^2	Command and Control
CC	Critical Commitment
Cert	Certification
CNS	Communication, Navigation and Surveillance
CNSI	Communication, Navigation, Surveillance, and Information
Comm	Communication
CONOPS	Concept of Operations
DAC	Drone Advisory Council
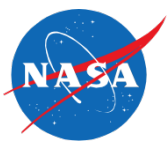
Acronyms

DFW	Dallas/Fort Worth International Airport
DOT	Department of Transportation
eVTOL	Electric Vertical Takeoff and Landing
ExComm	Executive Committee
FAA	Federal Aviation Administration
FDC	Flight Demonstrations and Capabilities
GAMA	General Aviation Manufacturers Association
GC	Grand Challenge
IPP	Integration Pilot Program
LA	Los Angeles
M&S	Modeling and Simulation
MOC	Means of Compliance
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
OAA	Office of Associate Administrator
OEM	Original Equipment Manufacturer
OGA	Other Government Agency

Acronyms

Ops	Operations
Pax	Passenger
PM	Project Manager
Qual	Qualification
R&D	Research and Development
RFI	Request for Information
RVLT	Revolutionary Vertical Lift Technologies
sUAS	Small Unmanned Aircraft Systems
SWS	System Wide Safety
TBD	To Be Determined
TC	Type Certificate
TRB	Transportation Research Board
UAM	Urban Air Mobility
UAM TM	Urban Air Mobility Traffic Management
UAS	Unmanned Aircraft System
UAST	Unmanned Aircraft Safety Team

Acronyms

UCAT	UAM Coordination and Assessment Team
SE	Systems Engineering
SME	Subject Matter Expert
SPMR	Strategic Portfolio Management Review
TTT	Transformative Tools & Technologies
UML	UAM Maturity Level
UPP	UTM Pilot Program
US	United States
UTM	Unmanned Aircraft System Traffic Management
V&V	Verification and Validation