



# EXPLORE FLIGHT

WE'RE WITH YOU WHEN YOU FLY

Air Mobility Data & Reasoning Fabric

TACP/CAS D&R Fabric Team

# MOBILITY CHALLENGE

- Throughout the world, especially in dense urban environments, the quality of life is being negatively impacted by ever growing commute time.
- Travel, beyond commuting, is increasingly driven by door-to-door challenges – not just gate-to-gate considerations.
- Air Mobility may be an approach to address these challenges, as it can effectively convert our 2D mobility system to a 3D mobility system, vastly increasing mobility options.



# AIR MOBILITY CHALLENGES

- Moving from 2D to 3D mobility requires more complex decision, in very short amounts of time, and in safety critical situations.
- Many decisions will need to be made or augmented by machine intelligence.
- Decisions must be made based on accurate, reliable, and current data which must be available to humans, machines, or a combination.



# Air Mobility Data Sources

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**Data will arise from Smart Vehicles operating in Smart Airspace systems, engaged with an instrumented Smart City.**

SMART AIRSPACE



SMART VEHICLES



SMART CITIES

# Air Mobility Data & Reasoning Fabric

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**Data & Reasoning Fabric needs to be an open architecture and a set of data and reasoning services with the following attributes:**

**Data** (Available in-time from disparate sources) – Availability, Quality, Integrity, Correctness, and Authenticity will be driven by standardized requirements.

**Fabric** (Consistent capabilities available as connected nodes across cyber physical entities) – Brings together a choice of nodes across multiple cloud and edge resources that seamlessly work together to tie in data and the reasoning elements for real-time and non-real-time decision-making by *all* users (humans and machines) of the airspace.

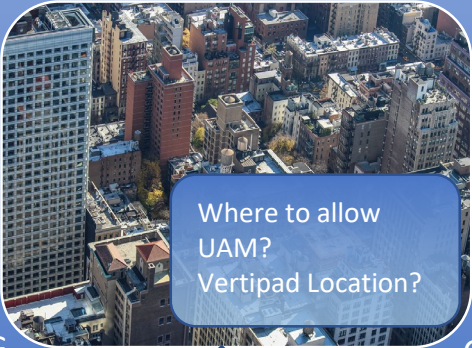
**Reasoning** (Available as services) – At the minimum includes various analytics, AI techniques, Machine learning algorithms, uncertainty quantification methodologies, and a set of Physics engines.

OPPORTUNITY: Retain current levels of safety even with increased air travel density, complexity, and user communities.

# Air Mobility Planning, Operations, and Performance

## APPLICATION ENGINES

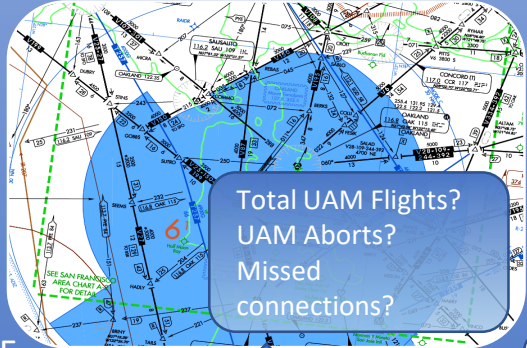
PLANNING



OPERATIONS



PERFORMANCE

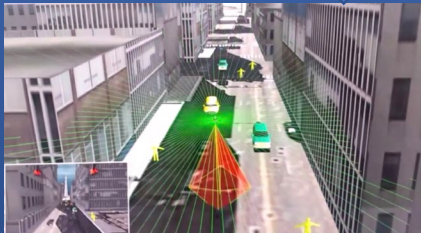


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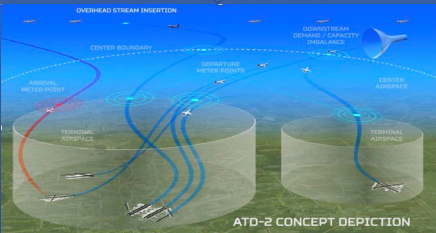
## D&RF



## DATA Producers & Consumers



SMART VEHICLES



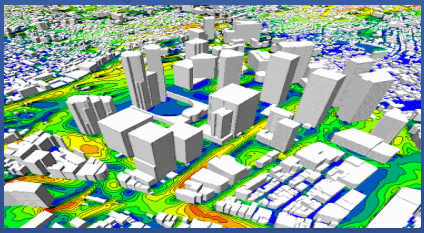
SMART AIRSPACES



SMART CITIES



FAA RULES



MICRO-WEATHER

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# Air Mobility Data & Reasoning Fabric

## Questions:

1. Does an Air Mobility Data & Reasoning Fabric address the data & reasoning challenges that must be resolved to achieve the air mobility vision?
2. Can elements of the Fabric/Mesh/Big Data technology base being developed across the world be re-deployed as the technology base of an Air Mobility Data & Reasoning Fabric?
3. What role should NASA play?
  - a) Prototype application of Fabric technologies to air mobility challenge?
  - b) Identify missing standards/technologies and develop, then re-prototype?
  - c) Other?
4. How do we assess this opportunity, realistically, given the complexity of the technical challenge and the extreme pace of Fabric technology development?





# Data and Reasoning Fabric – The Market Vision

## *Who will use the fabric?*

- The data and reasoning fabric is envisioned to serve multiple market segments.
- Each market segment has different utility functions (or key attributes that are important to that particular segment).
- Beyond the commercial use, the data and reasoning fabric will also serve as a contiguous medium to disseminate and enforce regulatory measures for airspace safety.

## *What will the fabric do for its users?*

- Fabric will enable accessibility of data when it is needed where it is needed, which is critical for data-driven digital systems such as the autonomous vehicles.
- However, fabric is not just about data, rather it is going to embed reasoning inferred from the data to make real-time decision making fast and accurate.
- Users from different market segments will use the fabric to not only boost their internal productivity but also enhance the overall safety and efficacy of the shared airspace usage.



# Image Bibliography

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