



EXPLORE FLIGHT

WE'RE WITH YOU WHEN YOU FLY

Data and Reasoning Fabric (DRF)

NASA Aeronautics Research Mission Directorate (ARMD)

Transformative Aeronautics Concepts Program (TACP)

Convergent Aeronautics Solutions (CAS) Project

Data and Reasoning Fabric Team



Current Barrier

Are you frustrated by traffic and growing travel times in dense urban areas?

Do you want more control in your quality of life?

Increased access to mobility options in rural areas?



DRF is the Solution

DRF is developing a trusted service discovery and exchange backbone to enable the transportation of people and cargo to places previously not served or underserved by aviation.

This technology aims to increase awareness of EVERYTHING affecting air transportation to maintain safety in a new ecosystem.

NASA DATA & REASONING FABRIC (DRF)

seamlessly connects information and decision making to enable the full potential of future air mobility to advance human society



DRF is a groundbreaking technology which seamlessly connects data to decision-making:

- Sends air vehicles any information critical for safe flight and obtains their data to inform others
- Intelligently processes and decides what data is of most importance for safe flight, much as humans do today

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DRF is a groundbreaking technology which seamlessly connects data to decision-making:

- Access to timely data created with intelligent reasoning allows for high tempo operations, enabling more vehicles to safely use the same airspace

DRF seamlessly connects information and decision making to enable the full potential of future air mobility to advance human society

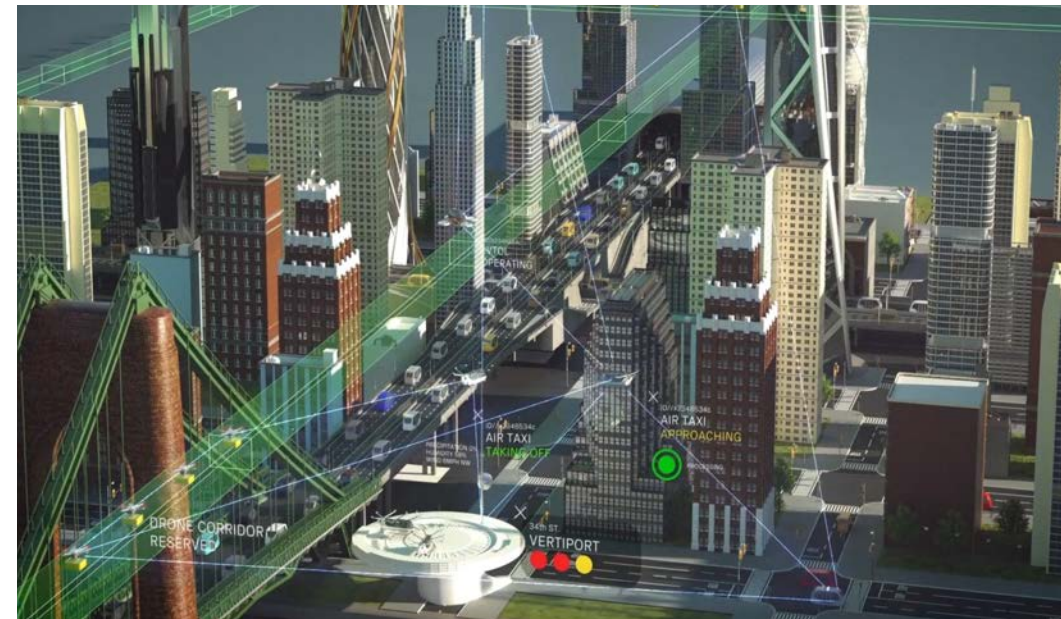
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The Challenge

NASA's historical focus on innovative aeronautics technology has resulted in people having access to time-saving convenience, comfort, and safety in air travel. NASA Aeronautics has historically led the nation and the world in developing continually improving advanced technologies.



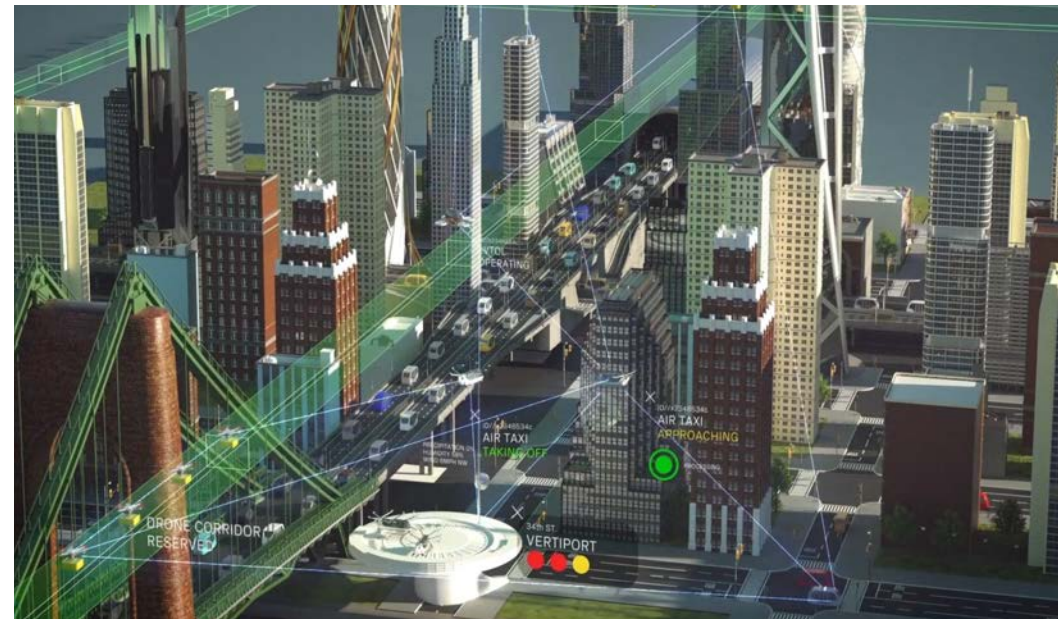
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The Challenge

New challenges must be overcome to realize the advantages of uncrewed, remote transportation, whether it is for packages, people, safety, or myriad other commercial and government needs, and all within an increasingly complex and crowded airspace.



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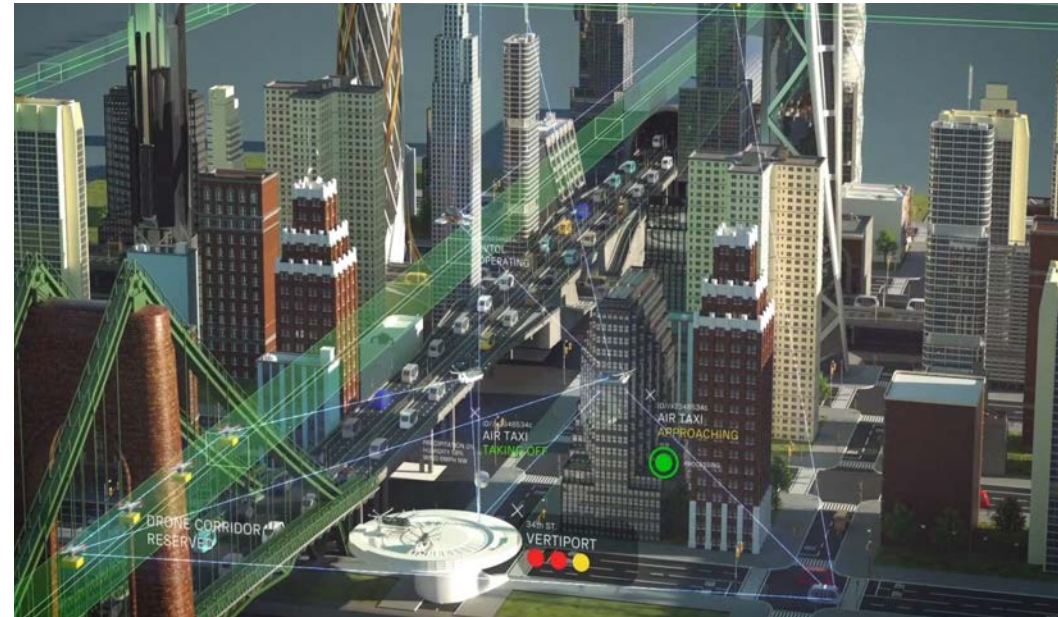
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Where DRF Comes in...

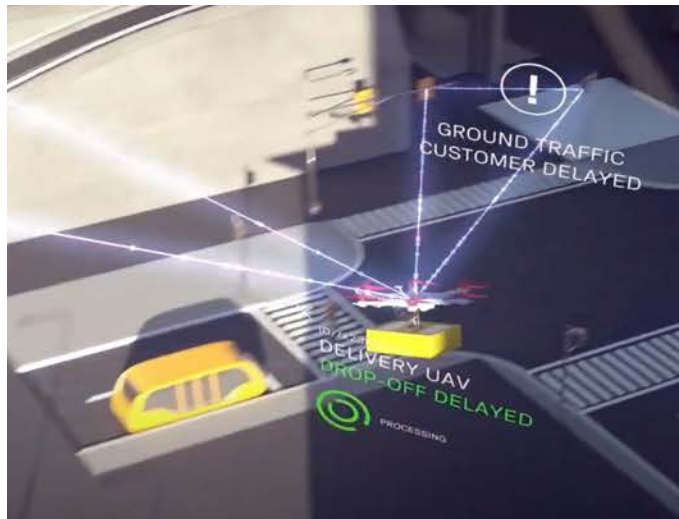
Data & Reasoning Fabric (DRF) is NASA's innovative initiative to organize safe, efficient, environmentally friendly and quiet air mobility.

A self-sustaining ecosystem which will provide data that is reliable, accurate and current, with intelligent reasoning behind it to facilitate data-driven decision making.



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DRF Benefits

We believe DRF will enable the future of air mobility by guiding reasoning and decision-making processes between aerial vehicles and ground-based systems to increase efficiency and safety of operations.

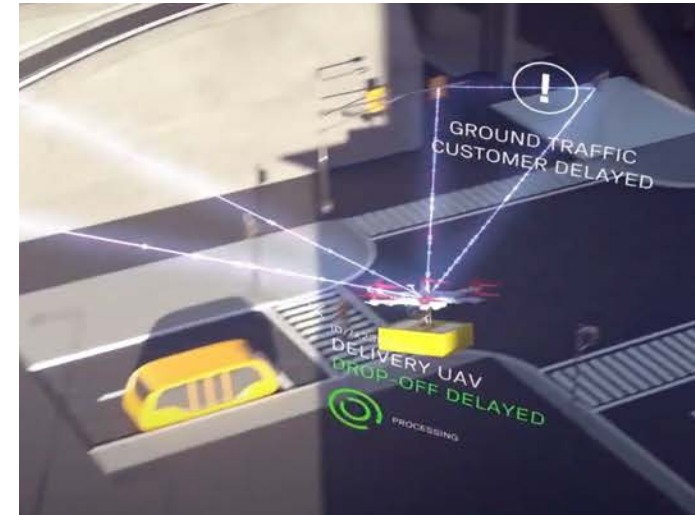
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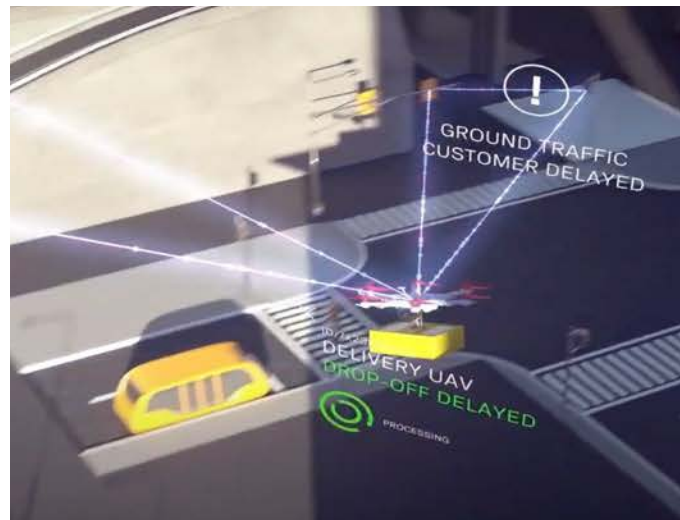
DRF will:

- **PROVIDE** on demand data and reasoning solutions for vehicles and operators
- **ACT** as catalyst to address critical data challenges in building advanced air mobility infrastructure where industry data sharing and reasoning is needed



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DRF will:

- **SUPPORT** processing and sharing of massive multi-sensor monitoring data from aircraft performance models to adaptive flight controls to prescriptive analytics to improve battery technologies
- **ENABLE** high quality and redundancy for safety

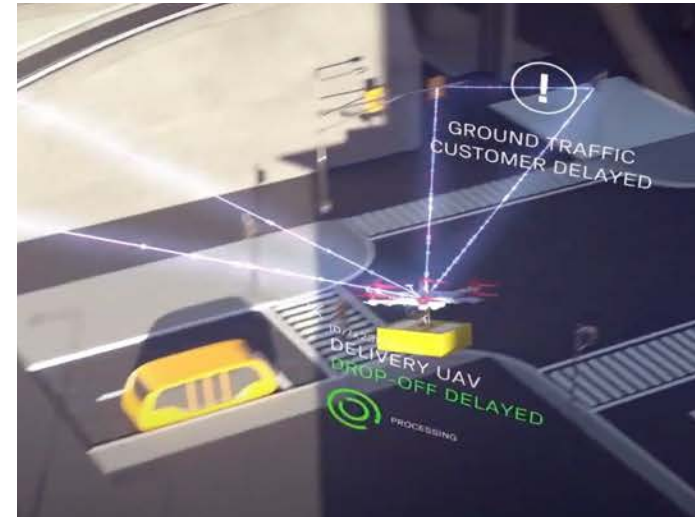
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DRF will:

- **ENABLE** a framework to process available new policies and regulatory approaches from many governing bodies
- **UTILIZE** unique architecture that will enable the Advanced Air Mobility (AAM) ecosystem to combine diverse sets of data on demand and make decisions instantaneously

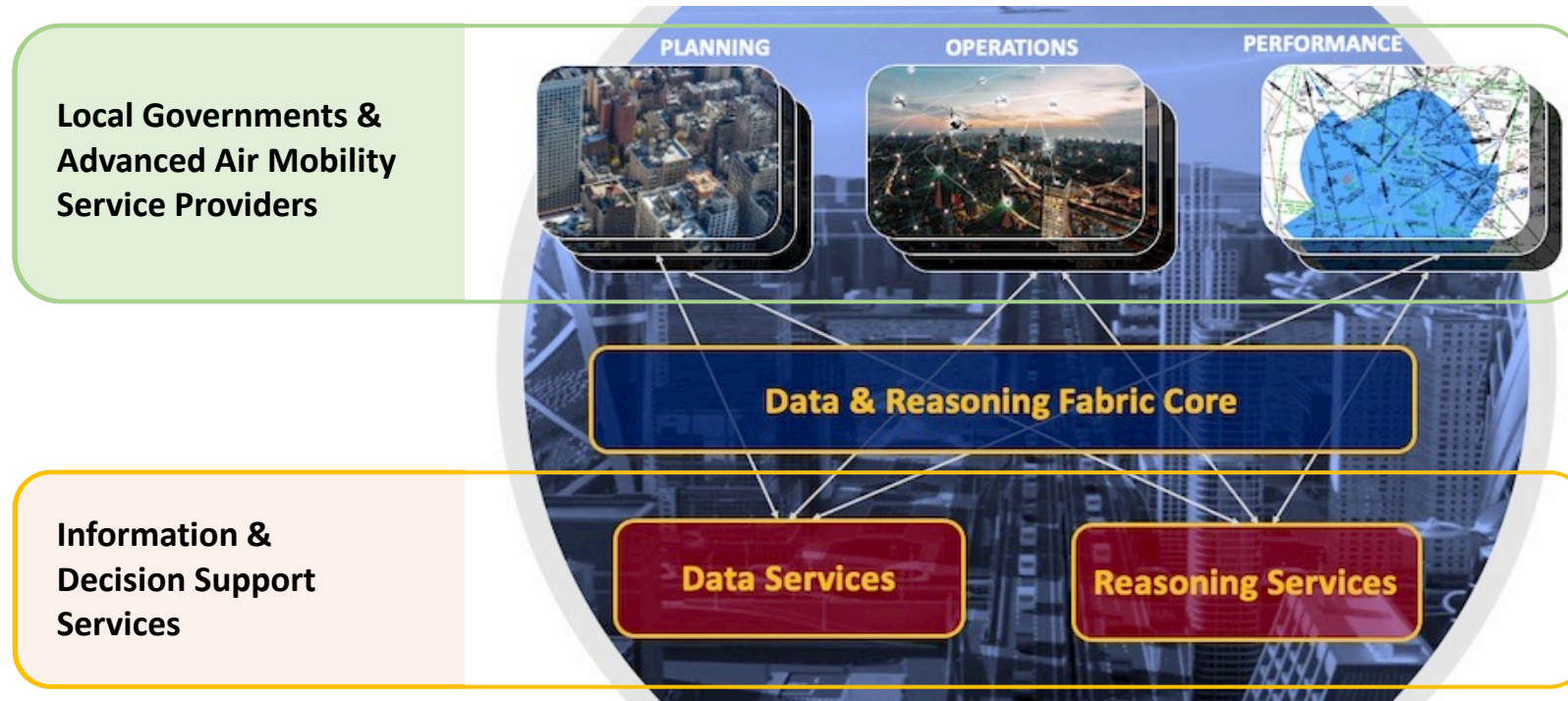


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The DRF Core

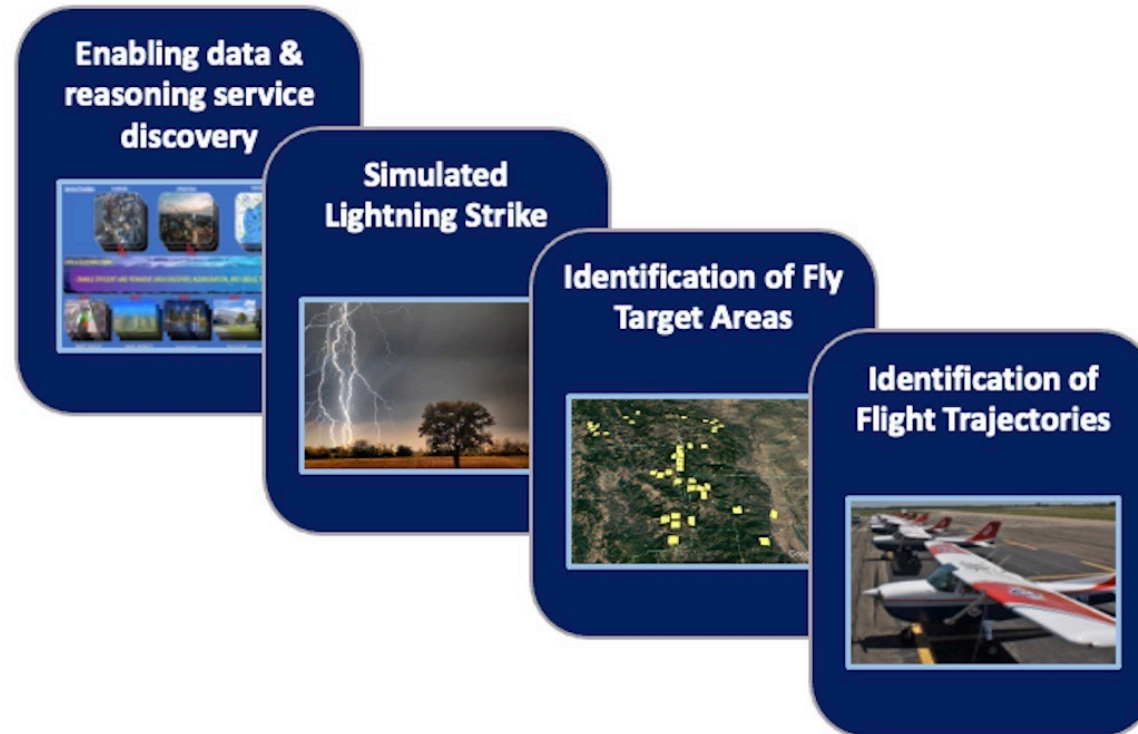
The DRF Core is an open and scalable framework to connect nodes across vehicles, edge and cloud infrastructure to seamlessly work together.

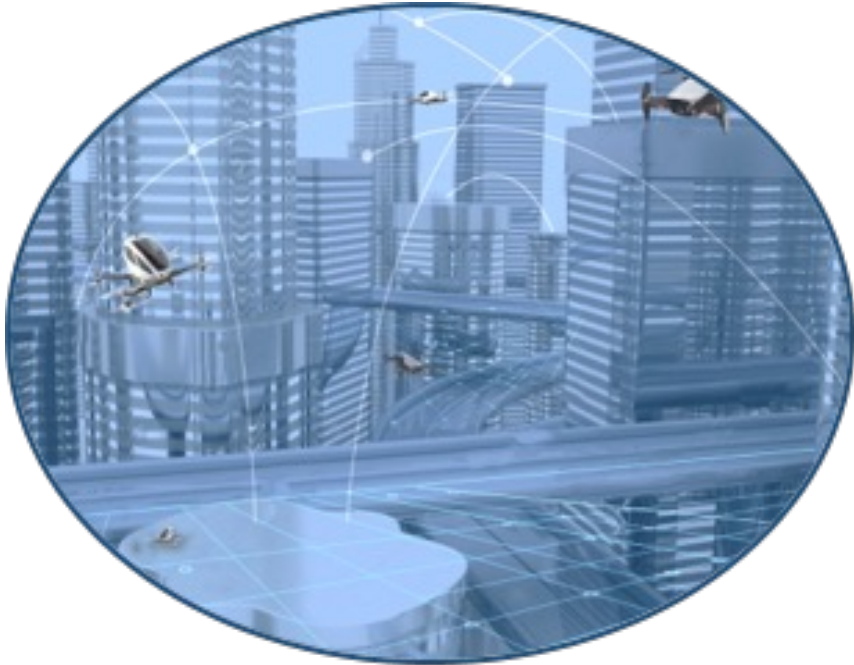


NASA DATA & REASONING FABRIC (DRF)



DRF leverages weather and environmental data and decision support reasoning services to serve multiple stakeholders and missions.





Data Services

Data services provided through the DRF Core ensures **quality, consistency, and democratization of data** for the future of air mobility operations.

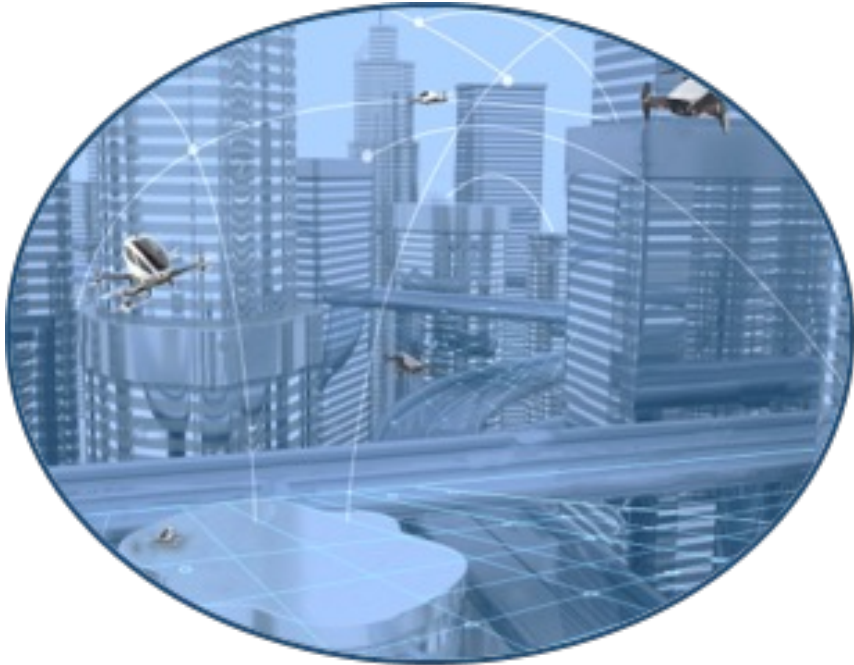
Many of these services will be executed autonomously by smart, unmanned, and/or reasoning agents to enable wide-scale acceptance and usability.



Data Services

DRF Data Services enables the discovery and delivery of reliable, high-integrity datasets, including:

- Weather
- Traffic
- Vertiport status
- Population density





Reasoning Services



The DRF Reasoning Services leverage DRF Core and Data Services, utilizing **Artificial Intelligence (AI)** and **Machine Learning (ML)**, to offer decision-making services that provide logical sequences and predictions in a robust and timely fashion.



Reasoning Services

Reasoning services include:

- Multi-vehicle trajectory generation
- Diagnostics and monitoring of vehicle battery health
- Environmental situational awareness
- Information management





The Fabric



A connected interwoven “fabric” of digital systems enables an ecosystem that can send aircraft specific, tailored information wherever it is needed.

The data and reasoning fabric web-like ecosystem supports advanced air mobility.

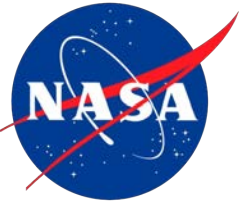


The Fabric

This allows all users to quickly find, verify, purchase, and securely use data from data providers and reasoning services owned by many small and large industry and government organizations.



A Data & Reasoning Fabric



Service Providers

PLANNING



OPERATIONS



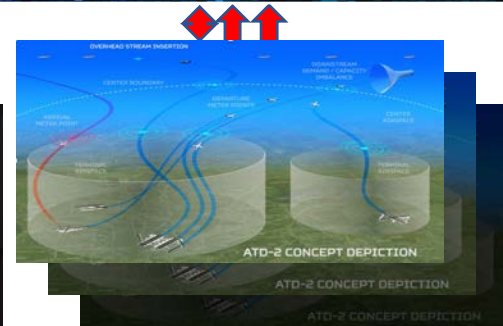
PERFORMANCE



DATA & REASONING FABRIC
ENABLE EFFICIENT AND PERVASIVE DATA DISCOVERY, AGGREGATION, AND DATA/\$ TRANSACTIONS,
IN ORDER TO ENABLE A DATA AND REASONING SERVICE EXCHANGE FOR AAM ENVIRONMENTS



SMART VEHICLES



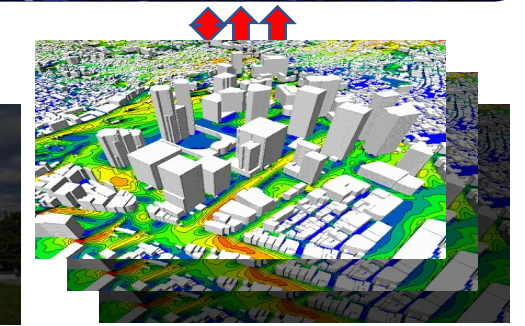
SMART AIRSPACES



SMART CITIES



REGULATORY



MICRO-WEATHER

Data & Reasoning Services



DRF In Action: Wildfire Detection

In 2022 the DRF team collaborated with the **California Civil Air Patrol (CAP)** to execute a series of field tests to potentially bring forth improved accuracy and reduced latency to CAP's mission critical decision making in **wildfire detection**.



DRF In Action: Wildfire Detection

The field tests identified a preliminary set of data and reasoning service areas which can be enabled and enhanced by DRF.

Weather and environmental data and decision-support reasoning services were leveraged for wildfire detection missions.

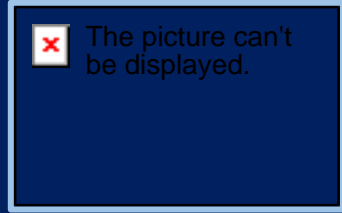
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Registration of Data & Reasoning Services



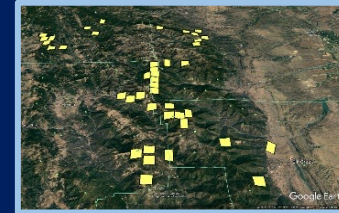
Registration of Users & Service Discovery



Simulated Lightning Strike



Identification of Fly Target Areas



Identification of Flight Trajectories



Leveraging weather and environmental data and decision support reasoning services to plan wildfire detection missions

Onboarding data & reasoning services

Enabling data & reasoning service discovery

Access weather data services

Interoperable access to diverse data to support reasoning service

Leveraging multiple reasoning services for decision support

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Additional DRF Concepts

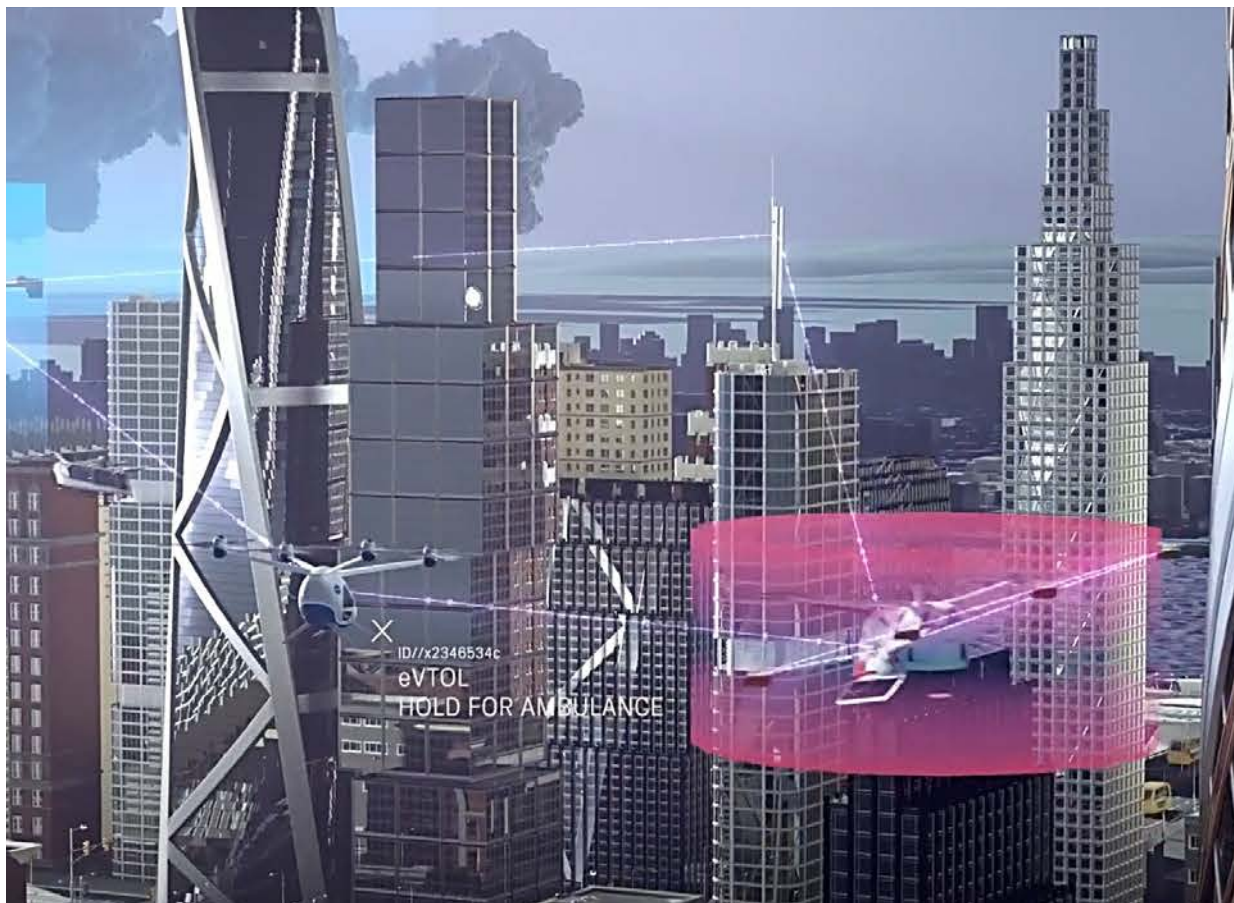
- **Architecture** - Set of rules, policies, standards and models that govern and define the type of data collected and how it is used, stored, managed and integrated within an organization and its database systems.
- **Ecosystem** – Spans foundational economic pillars of production, consumption, and their interactions with the goal of allocating scarce digital and physical resources.

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Additional DRF Concepts

- **Advanced Air Mobility (AAM)** – An air transportation system that moves people and cargo between places previously not served or underserved by aviation – local, regional, intraregional, urban – using revolutionary new aircraft.
- **Reasoning** – systems generating logical sequences and predictions using available data and knowledge in a robust and timely fashion.



Connect With Us

DRF Website: <https://drf.nasa.gov/>

