UAM Spectrum Demand: Initial Assessment

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ATM-X UAM Subproject CNS Arch. Workflow

Review ConOps Documents

- FAA NextGen ConOps, NASA Vision ConOps, HDV ConOps, RTCA DO-304A ConOps, SAIC UAM CNS Study, Industry ConOps

Roadmap for CNS Needs

- Identify CNS services required for each UML
- Contribute CNS input to the NASA's UAM Roadmap

Data Service Architecture

- Identify all required/desired CNS services
- Planning on soliciting industry/OGA feedback for future revisions

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Link Technology Assessment

- SAIC CNS Study..."Reliable, Secure, and Scalable Communications, Navigation, and Surveillance (CNS) Options for Urban Air Mobility (UAM)" (NTRS, Doc. ID 20205006661)

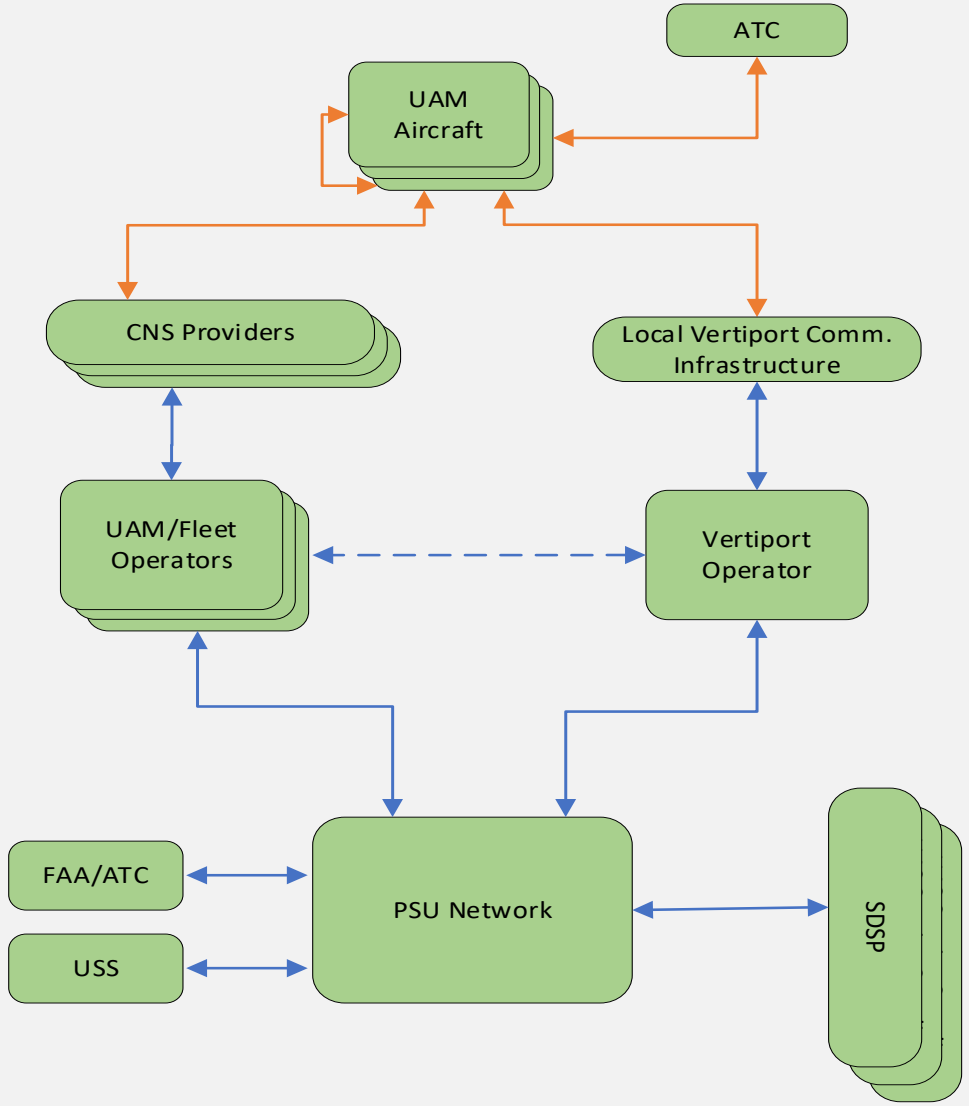
R&D Prioritization and Planning

- Define future direction of NASA CNS support
- Identify CNS technology gaps
- Standardization of available technologies?

High-Level UML-4 Communications Perspective

Assumptions/Assertions:

- Multiple communications providers may be required to support all required data services
- Reliance upon existing ATC/FAA infrastructure will decrease over time
- Two distinct wireless service volumes: En Route and Vertiport Operational Area
- UAM aircraft should be able to communicate directly with Vertiport Operators in the event of a failure of the PSU network or C2 data services



List of Potential UML-4 UAM CNS Data Services

En Route Services

- Pilot/Passenger Voice
- Telemetry (Nominal)
- Flight Path Updates/Command
- Enhanced Communications for Contingencies
- PNT Services
- Coop. Separation Assurance
- On-Demand Interrogation of On-Board Instrumentation
- Passenger Data Services
- Distribution of DAA Data
- V2V Data/Voice Relay

Vertiport Proximity Services

- Telemetry/Command
- Vertiport PNT
- Guidance/Landing Assist
- Voice
- Coop. Sep. Assurance?

Existing CNS Services

- Mode C
- ADS-B/TCAS?
- ATC Voice

Pre/Post-Flight Services

- Vehicle Health/Flight Readiness Reporting
- Flight Path, Airspace Data Uploads
- Vehicle SW/FW Updates?
- Passenger Briefings/Ads
- Post-Flight Vehicle Telemetry and Health Download

NOTE: Each service should not require its own link technology!

Assessing UAM Spectrum Requirements

Spectrum demand depends on:

- Data throughput requirements under peak demand conditions
- Scalability considerations (i.e. 10's of aircraft vs 1000's)

→ NASA is addressing these considerations through its CNS architecture work, modeling/simulation activities, and UAM ConOps/roadmap efforts.

- Spectral efficiency of candidate link technologies (bps/Hz/km^3)

→ NASA will be performing flight test evaluations of multiple spectrally-efficient comm. technologies to identify candidates.

- Regulatory restrictions

→ NASA maintaining awareness through continued engagement with FAA/FCC/NTIA.

Too many unknowns at this point to answer the question
"How much spectrum will UAM operations need?"