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Exploring Dynamic Delegated Corridors and 4D Required Navigation Performance Trajectory to Enable UAM Aircraft to Integrate into the Existing Airspace System

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Dynamic Delegated Corridors and 4D Required Navigation Performance for Urban Air Mobility (UAM) airspace integration

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A Bit About the Author

- Ph.D. Student (Ph.D. in Aviation, School of Graduate Studies, COA, ERAU)
- Professional background
  - Air Traffic Management Lecturer
  - Air Traffic Control Instructor
  - Air Traffic Controller
  - Researcher (Air Traffic Management Research Institute – Singapore)
- Academic background
  - MS, Flight Operation and Air Traffic Management (ENAC- France)
  - BS, Mechanical Engineer, Can Tho University, Vietnam

Urban Air Mobility

- Increased traffic congestion on urban road networks has impacted the travel time for commuters in highly populated urban centers.
- Urban Air Mobility (UAM) is recognized as a system that transports the passenger and air cargo from any location to any destination within a metropolitan area. UAM may offer a solution to the problematic issue of automobile urban surface transportation congestion.

Urban Air Mobility

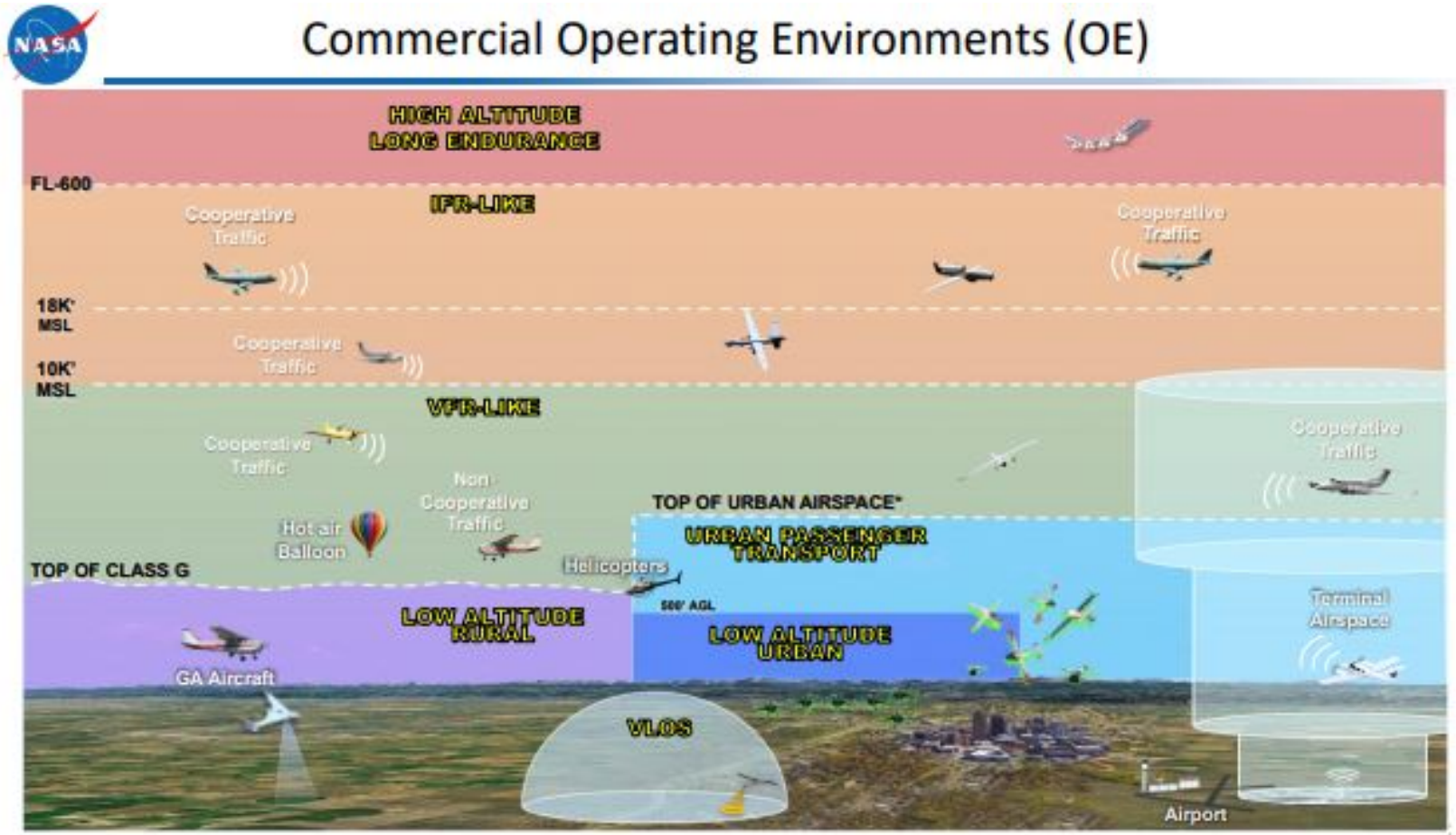


Figure 1. Commercial Operating Environment (OE) – Adapted from NASA (2018)

Urban Air Mobility

Figure 2. Market: Urban Air Mobility – Adapted from NASA (2018)

Problem Statement

- The new entrant UAM may create more complexity, more delays, and an increased hindrance to existing facilities and resources of the current airspace system.
- Providing safe separations between UAM aircraft and other aircraft in high traffic volume airspace poses a severe challenge to ATC.
- The predicted significant growth in the demand for integration of UAM operations into the existing airspace system in the next 20 years and beyond may exceed the capacity of current air traffic control (ATC) system resources, particularly the ATC workload.

The Most Critical Challenges to UAM

- The capacity of the existing air traffic management system
- The accessibility of take-off and landing areas and charging systems on the ground
- Regulations and certifications
- Adverse weather conditions
- Pilot shortage
- Public acceptance of aircraft noise

The Most Critical Challenges to UAM

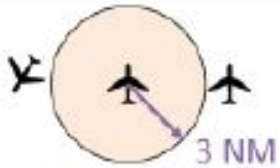
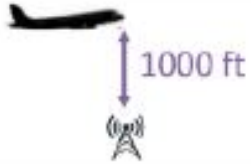
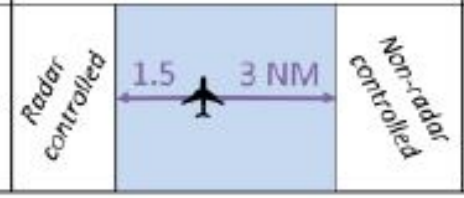
Aircraft Involved	Lateral Separation Req.	Vertical Separation Req.	Longitudinal Separation Req.
IFR to IFR *All classes*			
IFR to VFR *Class: B,C*			
IFR to Obstruction			-
IFR to Edge of Adjacent Airspace		-	-

Figure 3. U.S. ATC separation standards for IFR terminal area operations – Adapted from Vascik et al. (2018)

On going Research Projects & Studies on UAM issue

The National Aeronautics and Space Administration (NASA) has carried out numerous ongoing research projects that support substantially to UAM .

- UAS Traffic Management (UTM) & UAS Integration in the NAS (UAS-NAS)
- Flight Demonstrations and Capabilities (FDC), X-57
- Air Traffic Management - Exploration (ATM-X)
- System Wide Safety (SWS)
- Transformative Tools & Technologies (TTT)
- Revolutionary Vertical Lift Technologies (RVLT)
- Advanced Air Mobility (AAM)

Proposed Approach

- Specialized airspace sectors and trajectories to allow UAM aircraft to operate safely and efficiently in specific corridors, which are separated from other airspace users at low altitudes in controlled airspace.
- The combination of the Dynamic Delegated Corridors (DDCs) and full four-dimensional (4D) Required Navigation Performance (RNP) trajectories are proposed to enable UAM aircraft to integrate into the existing airspace system.

Proposed Approach

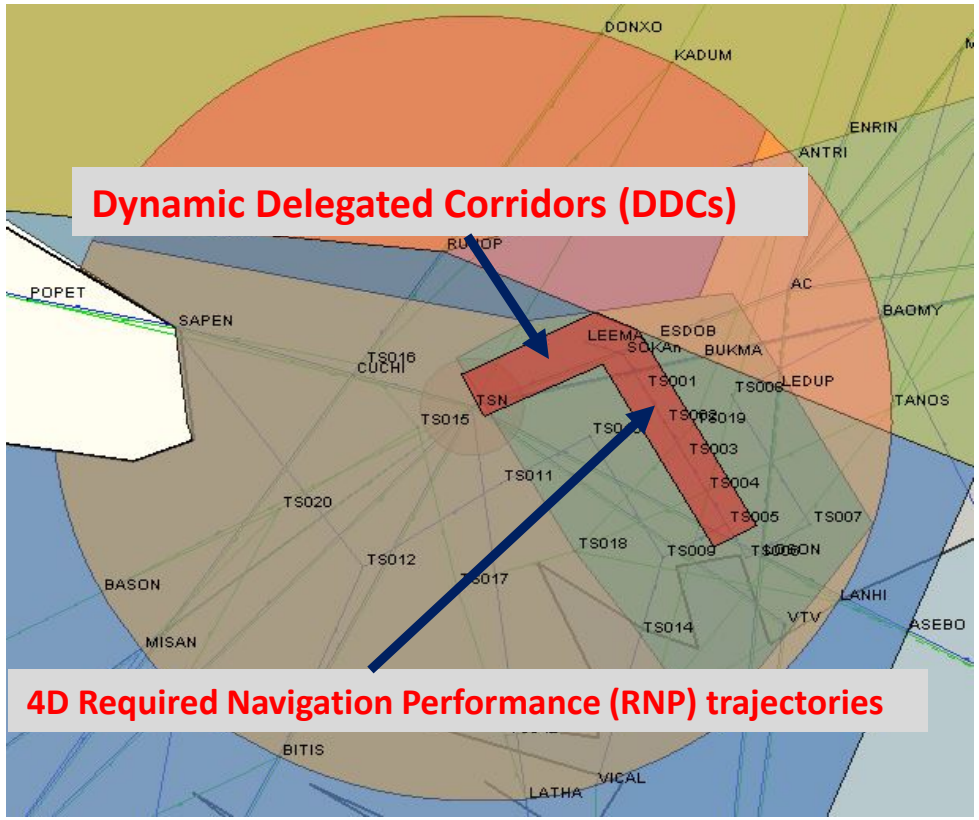


Figure 4. Dynamic Delegated Corridors (DDCs) & 4D RNP Trajectory in plan view

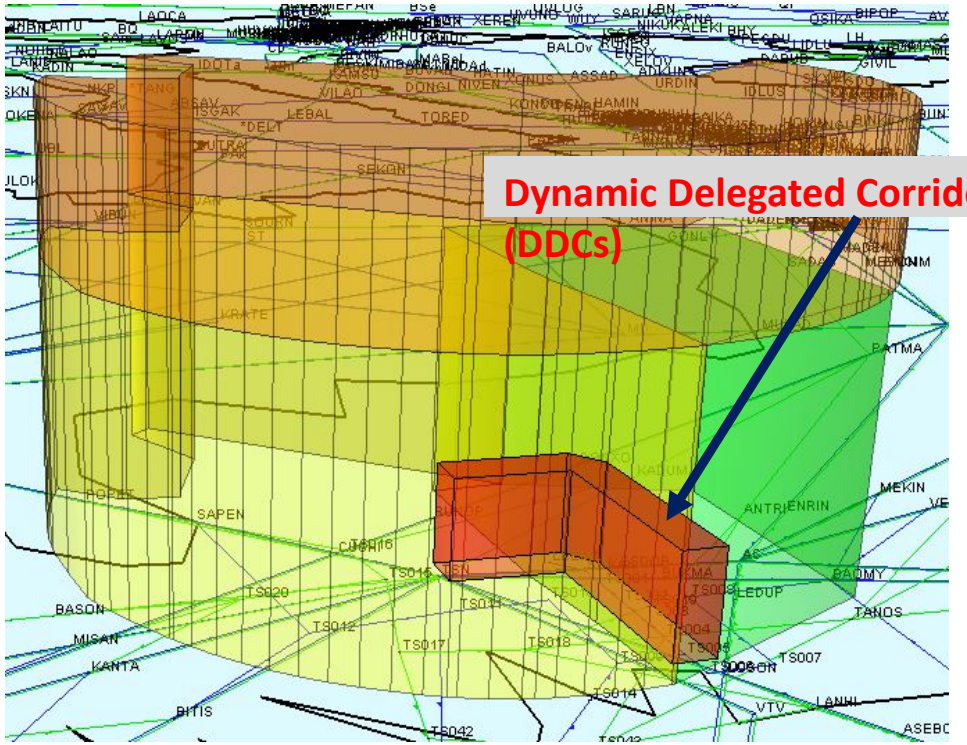


Figure 5. Dynamic Delegated Corridors (DDCs) & 4D RNP Trajectory in side view

Proposed Approach

See metadata page for streaming video animation.
Click for metadata page

Please click the play button to play an animation.

Potential Contribution

The proposed approach is expected to help reduce the workload of ATC dramatically and contribute to the viability of UAM airspace integration into the existing airspace system to operate at low altitudes in the terminal controlled airspace together with other airspace users safely and efficiently.

References

Vascik, P. D., Balakrishnan, H., & Hansman, R. J. (2018). Assessment of air traffic control for urban air mobility and unmanned systems.

The National Aeronautics and Space Administration (NASA) (2018). Aeronautics Research Mission Directorate (ARMD). Urban Air Mobility (UAM) Grand Challenge Industry Day. Retrieved from https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20190003422.pdf

Thank you for your attention.