

Integrated Demand Management Summary Report



Brief Summary of Completion / Accomplishment:

Over the period 2016 to 2020, Integrated Demand Management (IDM) concept, procedures, and tools have been developed - first for clear-weather and a single airport constraint and then expanded to handle a multi-constraint problem during convective weather at Newark (EWR), LaGuardia (LGA) and Philadelphia (PHL) airports. The concept was evaluated in a series of human-in-the-loop simulations to confirm concept benefits in terms of better schedule predictability, reduction of delays, and increased throughput, especially during convective weather. In addition, other conditions with mixed participation of multi-trajectories from the airlines were evaluated that showed significant benefits to the individual airlines as well as the overall traffic flow.

The IDM concept was initiated in the SMART-NAS project, was completed under the ATM-X project, and was developed collaboratively with the FAA and airline partners. Over the course of IDM development, NASA researchers produced 19 conference papers and publications. Outside supporting organizations, funded by IDM, produced 20 additional conference papers and publications, in which they advanced fundamental research on topics such as better stochastic traffic demand prediction, and application of machine learning techniques for modeling traffic management initiatives.

Final concept procedures and tool specifications have been transferred to the FAA Air Traffic Organization Operational Concepts, Validation, and Requirements group.

Beginning TRL 1, Final TRL 4



Integrated Demand Management Publications

Publication Title / Description	Conference(s) Where presented
Hodell, G. et al; Demonstrating Early Adopter Benefits of Submitting Multiple Trajectory Options for Airlines	AIAA Aviation Forum and Exposition, June 2020, Virtual Event
Yoo, H. et al; Benefit Assessment of the Integrated Demand Management Concept for Multiple New York Metroplex Airports	AIAA SciTech Forum, Jan 2020, Orlando, FL
Glaab, P. et al; Simulating Fleet Noise for Notional UAM Vehicles and Operations in New York	IEEE/AIAA 38 th DASC, Sept 2019, San Diego, CA
Evans, A. and Lee, P. U.; Using Machine-Learning to Dynamically Generate Operationally Acceptable Strategic Reroute Options	ATM R&D Seminar 2019, Vienna, Austria
Arneson, H. et al; Using an Automated Air Traffic Simulation Capability for a Parametric Study in Traffic Flow Management	AIAA Aviation Forum and Exposition, June 2018, Atlanta, GA
Yoo, H. et al; Impact of Different Trajectory Option Set Participation Levels within an Air Traffic Management Collaborative Trajectory Option Program	AIAA Aviation Forum and Exposition, June 2018, Atlanta, GA
Hodell, G. et al; Evaluation of Multiple Flow Constrained Area Capacity Setting Methods for Collaborative Trajectory Options Program	IEEE/AIAA 37 th DASC, Sept 2018, London, UK
Mohlenbrink, C. et al; Evaluation of Integrated Demand Management looking into Strategic & Tactical Flow Management	ATM R&D Seminar 2017, Seattle, WA
Arneson, H. et al; Analysis of convective weather impact on pre-departure routing of flights from Fort Worth Center to New York Center	AIAA Aviation Forum and Exposition, June 2017, Denver, CO
Evans, A. and Lee, P. U.; Predicting the Operational Acceptance of Route Advisories	AIAA Aviation Forum and Exposition, June 2017, Denver, CO
Kulkarni, D.; Models of Maximum Flows in Airspace Sectors in the Presence of Multiple Constraints	IEEE/AIAA 36 th DASC, Sept 2017, Tampa, FL
Smith, N. et al; Integrated Demand Management: Coordinating Strategic and Tactical Flow Scheduling Operations	AIAA Aviation Forum and Exposition, June 2016, Washington D. C.
Evans, A. and Lee, P. U.; Analyzing Double Delays at Newark Liberty International Airport	AIAA Aviation Forum and Exposition, June 2016, Washington D. C.
Parke, B. et al; Reducing Departure Delays for Adjacent Center Airports using Time Based Flow Management Scheduler: Checkbox ON or OFF?	IEEE/AIAA 35 th DASC, Sept 2016, Sacramento, CA
Yoo, H. et al; Required Time of Arrival as a Control Mechanism to Mitigate Uncertainty in Arrival Traffic Demand Management	IEEE/AIAA 35 th DASC, Sept 2016, Sacramento, CA

Integrated Demand Management (IDM) Concept

Problem

- Current air traffic system consists of numerous uncoordinated and locally-focused constraint management systems, resulting in inefficient trajectory management of traffic flow through these constraints

Objective

- Integrate strategic and tactical air traffic management capabilities to manage multiple constraints holistically, thereby improving efficiency and predictability within the National Airspace System, and providing a framework for gate-to-gate trajectory-based operations (TBO)

Results

- Developed concept and method for integrating traffic flow management capabilities from strategic Traffic Flow Management System (TFMS) with tactical Time-Based Flow Management (TBFM) system to provide coordinated traffic flow plan across all phases of flight
- Developed, assessed, and validated feasible IDM operations in clear-weather scenarios into high-traffic areas in Northeast Corridor near New York Metroplex, and in convective weather scenarios in Northeast Corridor
- Transferred IDM concept to the FAA to be evaluated in a field test trial

Significance

- IDM leverages existing TFMS and TBFM systems to develop a concept that spans from pre-departure to arrival phases of flight, providing a credible near-term implementation of gate-to-gate TBO and a pathway to more advanced TBO in the future

Near-term gate-to-gate TBO concept demonstrated with efficient flight trajectories accomplished by coordinating existing traffic flow management systems

