What is the problem?

Much of the inefficiency in today’s air transportation system can be attributed to a lack of communication and coordination amongst the operators who are responsible for managing the phases of flights in busy airspace environments. Concepts and technologies to handle arrival, departure, and airport surface traffic have been under development by NASA, the Federal Aviation Administration (FAA), and industry, but to date, these capabilities have largely been developed and implemented independently. NASA’s investigation into the needs of air transportation stakeholders (e.g., airlines, air traffic service providers, airport authorities, and technology vendors) revealed that an integrated approach is needed to address this inefficiency. Without shared information across the operation, the result is a lack of predictability of aircraft movement times, overall system inefficiency, and greater fuel burn and emissions. The Airspace Technology Demonstration 2 (ATD-2) effort provides solutions to several problems in the complicated, multi-airport metroplex environment. At most airports today, departures are managed in the order they push back from the gate, which can overload runways and cause excessive taxi and hold times.

Additionally, significant uncertainty in the duration of the taxi-out and climb phases of flight leads to inaccurate demand predictions and decreased situational awareness. To manage the system in these conditions, traffic managers are compelled to apply overly conservative airspace restrictions.

What is NASA’s solution?

Together with the FAA and industry, NASA’s ATD-2 integrates arrival, departure, and surface (IADS) concepts and technologies to demonstrate the benefits of an IADS traffic management system for Metroplex environments. These technologies will increase predictability of the air traffic system and enhance operational efficiency, while maintaining or improving throughput. Improvements in predictability, efficiency, and throughput are anticipated, leading to reduced environmental impact, greater predictability in airport surface resource allocation, and better, more coordinated scheduling across national, regional, and local traffic management initiatives.
The FAA's NextGen Advisory Committee recommended establishing an initial airport surface departure metering capability that reflects the FAA's Surface Collaborative Decision Making (S-CDM) Concept of Operations. The NASA-FAA ATD-2 effort will demonstrate tactical surface departure metering at the Charlotte-Douglas International Airport (Charlotte, NC) beginning in 2017, followed by increasingly sophisticated strategic surface scheduling demonstrations and the addition of adjacent En Route Center participation through 2020. The project demonstrations culminate in a Metroplex-level technology demonstration with ATD-2 terminal departure scheduling capability and electronic flight data with ATD-2 surface and airspace scheduling.

ATD-2 will combine multiple concepts and technologies leveraging previous investments by NASA, the FAA, and industry, including the FAA’s three major operational decision support system technologies (Traffic Flow Management System (TFMS), Time Based Flow Management (TBFM), and Terminal Flight Data Management (TFDM)). ATD-2 will incorporate specific elements of TFDM such as the Electronic Flight Data user interface in the airport tower and the S-CDM departure metering functionality.

From NASA, proven scheduling technologies include the Spot and Runway Departure Advisor (SARDA) and the Precision Departure Release Capability (PDRC).

SARDA, developed from a NASA-industry-FAA partnership, improves the efficiency of airport surface operations at the nation’s busiest airports through time-based metering of aircraft and improved situational awareness of flight operations information amongst the various airport surface stakeholders. SARDA created a tactical surface scheduler that computes gate pushback advisories displayed via the Ramp Traffic Console (RTC) user interface software that represents virtual aircraft data, and enables scheduling activities, on a touchscreen monitor.

NASA's PDRC demonstrated the benefits from coupling a trajectory-based surface decision support tool (similar to TFDM) with the tactical departure scheduling capabilities of the TBFM en route metering decision support system. The result is more precise scheduling of surface departures into constrained overhead flows, better communication between the en route and tower controllers, and significant improvement in compliance with target takeoff times.

In ATD-2, PDRC tactical departure scheduling technologies will be integrated with the latest TBFM capabilities, coupled with SARDA technology, and extended to address metroplex coordination challenges in the ATD-2 integrated system.

Projected benefits

Initial projections of 10 congested airports (Dallas/Fort Worth, San Francisco, Chicago-O’Hare, Los Angeles, John F. Kennedy, Newark, Phoenix, Charlotte, LaGuardia, and Atlanta) show the potential for ATD-2’s Metroplex departure scheduling to substantially reduce overall departure delay by 40% and enable flights to absorb their delays at the gate, which leads to more environmentally friendly operations. Over a 20-year lifecycle, conservative estimates indicate a potential savings of $8.2B.

The baseline IADS demonstration phase will include participation from the American Airlines ramp tower in Charlotte, NC, the American Airlines Integrated Operations Center (IOC) in Fort Worth, TX, the FAA’s Charlotte Airport Air Traffic Control Tower, and Washington En Route Center in Leesburg, VA.

For more information on Airspace Technology Demonstration 2, please visit www.aviationsystems.arc.nasa.gov.