NASA Expands Research In The Airline Domain

U.S. Space Agency Learns From Airlines In Airspace And Flight-Efficiency Issues

By Mike Harkin

NASA, the U.S. National Aeronautics and Space Administration, embraces the lessons learned by airlines, as well as a lot of experiential knowledge from the carriers' service providers to inform, improve and enhance NASA's airspace and efficiency studies.

During many years past, research conducted by NASA has contributed significantly to aviation safety, air-traffic efficiency and new technologies. However, during that time, airline operational objectives and the inner workings of airlines (from network strategies to passenger services) have not generally played an especially significant role in NASA's research efforts.

Today, that pattern is changing, as Robust Analytics Inc. and Sabre Airline Solutions are partnering on three aeronautics research projects currently being conducted by NASA. These projects share the common theme of bringing airline information, decision-making processes, automated solutions, operational objectives and passenger-service interests to NASA's air-traffic-management research programs.

Under the new Airspace Operations and Safety Program, NASA has specifically added emphasis on a much better, more thorough understanding of airline considerations to its fundamental approach in aviation research.

▲ THREE AERONAUTICS RESEARCH PROJECTS CONDUCTED BY NASA, IN PARTNERSHIP WITH ROBUST ANALYTICS INC. AND SABRE AIRLINE SOLUTIONS, AIM TO BRING AIRLINE INFORMATION, DECISION-MAKING PROCESSES, AUTOMATED SOLUTIONS, OPERATIONAL OBJECTIVES AND PASSENGER-SERVICE INTERESTS TO NASA'S AIR-TRAFFIC-MANAGEMENT RESEARCH PROGRAMS.

Air Traffic Management

The first of these current research projects involves the development of an air-traffic-management (ATM) cost model, which NASA projects as a model to estimate the cost savings or the cost impact of alternative ATM concepts and technologies.

Existing cost models, quite typically, are limited to simple flight-cost factors, with occasional added detail on fuel burn and flying time.

It is the goal of this current NASA project that the ATM cost model will provide more comprehensive and accurate cost and economic impact data to support project development, portfolio evaluation, trade studies and cost-benefit analyses.

The model is intended to offer researchers and project managers a greater understanding of the cost drivers for aircraft operators, as well as to help validate the cost and revenue impacts.

For example, the model may be used to support a cost-benefit assessment of an airline's network impact, driven by significant improvement in the air traffic control (ATC) system.

A hypothetical case might involve a technical and procedural improvement in the ATC system that could reduce flight times across the National Airspace System (NAS) by an average of two minutes.

AMONG NASA'S RESEARCH PROGRAMS IS AN AIR-TRAFFIC-MANAGEMENT COST MODEL DESIGNED TO ESTIMATE THE COST SAVINGS OR COST IMPACT OF ALTERNATIVE AIR-TRAFFIC-MANAGEMENT MODELS AND TECHNOLOGIES.

The most direct savings to airlines through such a reduction would be in fuel consumption, which the model can determine based on current fuel prices. However, determining the impact or benefit to an airline's network has to be modeled using a combination of fixed and variable costs, aircraft utilization assumptions, market drivers and, most significantly, the specific action taken by the airline.

In theory, if an airline's 200-aircraft-based network has an average aircraft utilization of 15 hours a day, and that utilization rate could be reduced by 12 minutes of flight time per aircraft per day, that same 15-hour utilization could be accomplished using 198 aircraft, thus allowing for a fleet reduction by the airline of two aircraft.

Or, conversely, the two aircraft could be used by the airline to enter new markets or to fly additional segments in existing markets.

Determining the true benefit to the airline would involve how a specific action would fit within the airline's network, and exactly what fixed or variable costs would thereby be impacted.

Using this particular example, the model would be intended to enable NASA researchers to explore the range of savings or revenue impacts for a single airline, or for the entire U.S. airline industry, applying publicly available data from the U.S. Department of Transportation to provide valid, verifiable cost and revenue data that can be updated quarterly, thereby accounting for the diversity among airlines with regard to aircraft fleets, networks and financial constraints.

Then, individual flight segments could be aggregated considering the full airline network, as well as other operating and indirect costs, to provide the required cost and revenue impact data.

Efficient Routing

The second concept being explored by the Robust Analytics and Sabre is described by NASA as "Networked Air Traffic Management for Efficient Routing," a topic that focuses primarily on how the communication process for proposing, evaluating and executing a tactical route change can be improved through data exchange among the pilot on the flight deck, the airline operations center (AOC) and the U.S. Federal Aviation Administration's Air Route Traffic Control Center (ARTCC) traffic-management unit.

Flights in the National Airspace System are often planned on less-than-optimal routes, to avoid areas of forecasted hazardous weather en route or airspace traffic congestion.

Often, close to a flight's departure time or while a flight is en route,

the weather improves or the traffic condition changes, thus potentially allowing an opportunity for the route to be changed to one that could save time and reduce fuel consumption.

However, route-change opportunities of this nature are not often taken advantage of due to the insufficient coordination time necessary to be presented as a viable and safe option, evaluated for operational benefit (meaning time and fuel savings), and then shared among the air traffic controller, the ARTCC traffic manager, the airline dispatcher and the pilot in command for agreement, regardless of which of these parties first identifies the opportunity as viable and safe.

The key limitation of the current process is the dependence on verbal communication between and among the pilot and air traffic controllers, airline dispatch and traffic management, and text-based communication between dispatch and pilots (through the Aircraft Communications Addressing and Reporting System, or ACARS).

Robust Analytics and Sabre, with the assistance of NASA's National Airspace System Constraint Evaluation and Notification Tool (NASCENT) team, intend to demonstrate route-change proposals exchanged between NASCENT and Sabre AirCentre Flight Explorer and Sabre AirCentre Flight Plan Manager systems, either of which could be the initial system that identifies the opportunity or evaluates the other system's proposal.

Communication of the proposal must then be presented to the flight deck on the pilot's electronic flight bag (EFB) as a text route description, modified flight plan and graphical map presentation.

Plans are for the demonstration to use both Sabre AirCentre eFlight Manager, which will exchange modified flight-plan information from Flight Explorer or Flight Plan Manager to eFlight Manager, along with the Robust Analytics EFB Data Connection Network (EDCN), which will provide free text-messaging capabilities between the AOC and the pilot for items such as the route proposal pasted from NASCENT, and graphical map imagery from Flight Explorer.

Also, the EDCN will serve to confirm that the route-change proposal is approved by the traffic manager, the dispatcher and the pilot.

The demonstration is to be run as a real-time simulation, with team members onboard actual flights (in the aircraft cabin), and with the EFB communicating via aircraft-cabin Wi-Fi systems to the ground participants using NASCENT, Flight Explorer, Flight Plan Manager and the EFB Data Connection Network.

An additional benefit of the demonstration (beyond the potential improvements to the route-change process) will be at least a partial evaluation of using cabin Wi-Fi as a suitable means for providing imagery such as graphical weather in real-time to aircraft EFBs (currently, this capability has not been sanctioned and approved by the U.S. Federal Aviation Administration).

Mobile Location Services

Finally, Robust Analytics and Sabre have joined with IBM to examine the potential benefits to airlines and airline passengers of mobile location services.

The question is actually fairly simple: If an airline passenger has a mobile application that can identify his or her location from home, on the road or in the airport, and that information could be provided to the airline (on a voluntary participant basis), and then could be associated with the passenger's flight reservation and check-in status, would there be benefits to the passenger, as well as to the airline?

From the passenger's perspective, the benefit question is: If I know with reasonable predictive accuracy how long it will take for me to get to the airport, check in (if needed), get to security, clear security, then go to my departure gate, would that be useful knowledge? Could a reasonable "departure gate ETA" reduce passenger anxiety, especially for infrequent travelers or passengers at unfamiliar airports?

▲ ANOTHER RESEARCH CONCEPT NASA IS EXAMINING IS CALLED "NETWORKED AIR TRAFFIC MANAGEMENT FOR EFFICIENT ROUTING," WHICH FOCUSES ON HOW TO IMPROVE THE COMMUNICATION PROCESS FOR PROPOSING, EVALUATING AND EXECUTING A TACTICAL ROUTE CHANGE THROUGH DATA EXCHANGE AMONG PILOTS, THE AIRLINE OPERATIONS CONTROL CENTER AND THE U.S. FEDERAL AVIATION ADMINISTRATION'S AIR ROUTE TRAFFIC CONTROL CENTER TRAFFIC-MANAGEMENT UNIT.

For example, if my app told me that my departure time is 10:40 a.m. Eastern Daylight Time and my transit time from home to my departure gate is estimated at an hour and 26 minutes, would I sign up?

From the airline's perspective, would knowledge of participating passenger location (either inside the airport or outside the airport) be of benefit to the airline's operations or, perhaps, specifically affect on-time performance?

Additionally, if location services could be used to determine queue lengths at the airport posts of the Transportation Security Administration (the TSA, of the U.S. Department of Homeland Security) for originating passengers or immigration areas for international connecting passengers, would that information provide an operational benefit to the airline?

During this examination, the team will be meeting with key stakeholders, exploring the technical feasibility of location services (particularly inside an airport) and, most importantly, identifying any privacy issues related to voluntary participation in a location-services agreement.

Imaginative Research

All three of the research areas being studied require a certain degree of imagination, but also a firm foundation of strong analytics.

The strongest analytics, in fact, have always represented a hallmark of NASA research, both interplanetary and earth-bound. Practical applications of NASA research continue to expand, and to positively affect airline operations. ASCEND

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