AIRSPACE OPERATIONS AND SAFETY PROGRAM NEWSLETTER

FY 2015 Quarter 1: October - December 2014

In This Issue:

ASP Transforms Into AOSP

With the passage by Congress in December of the federal budget, the Aeronautics Research Mission Directorate (ARMD) has undergone an organizational shift, transforming the Airspace Systems Program (ASP) into the Airspace Operations and Safety Program (AOSP). As part of the reorganization, elements of the former Aviation Safety Program (AvSP) have been integrated within AOSP to forge a new direction for NASA's air traffic management research.

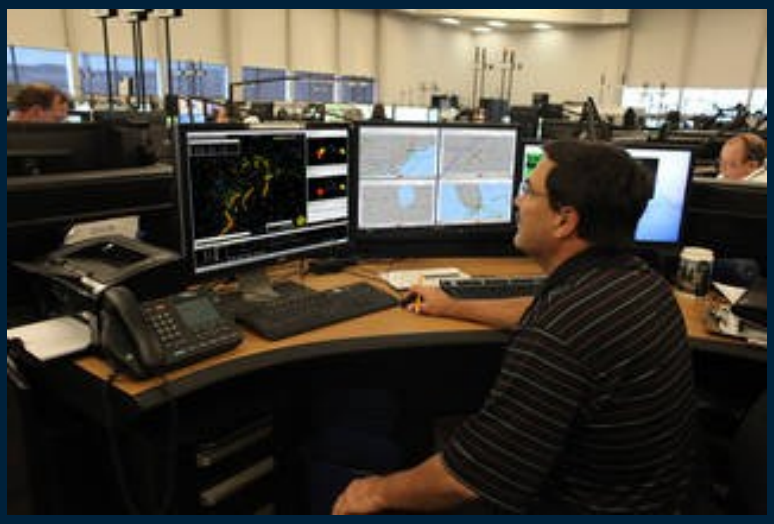
This new direction aligns with the ARMD strategic vision that focuses on three mega drivers expected to shape aeronautics research over the coming decades:

- Global growth in demand for high speed mobility;
- Global climate issues, sustainability and energy transition; and
- Technology convergence.

To meet these challenges, AOSP and our partners will focus on providing safe and efficient global growth that incorporates real-time system-wide safety assurance with an eye towards the future, beyond the Next Generation Air Transportation System, and the benefits available through increasing automation and the maturation of system autonomy.

NASA Technology Provides Navigation Aids to Remote Alaska Pilots

In an October 8 article, the Ketchikan, Alaska SitNews reports the delivery to Alaskan officials of new NASA AOSP technology known as Traffic and Atmospheric Information for General Aviation (TAIGA). The article notes that the technology is a "collection of algorithms, concepts and data [and … the] "result of a joint effort between NASA's Ames Research Center in Moffett Field, California and the State of Alaska." According to Sit-News, TAIGA will help Alaskan pilots "make better flight decisions" when they are "disconnected from vital navigation aids and communication" due to the state's "mountainous terrain and extreme weather events." The next step for the TAIGA concept will be for state engineers "to take the NASA concept and develop it to an app that meets the specific needs of Alaskan pilots."



DWR in use at American Airlines Integrated Operations

Dynamic Weather Routes Tool Helping Airlines Save Time And Fuel

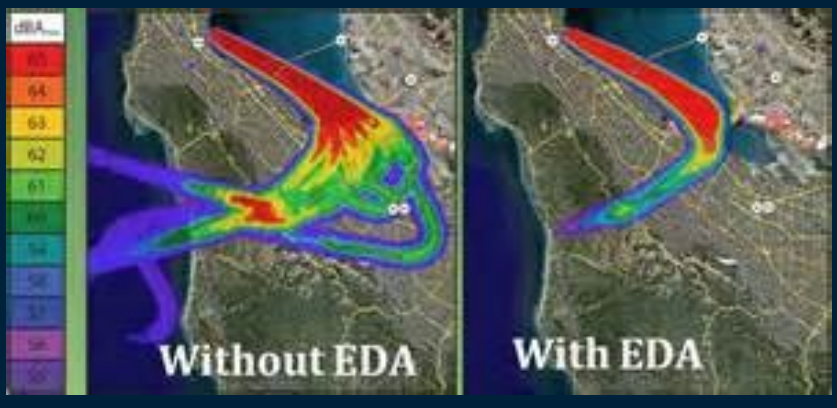
On October 16, the Indo Asian News Service reported that the NASA AOSP Dynamic Weather Routes (DWR) tool is "help[ing] airlines minimize weather delays and save both flight time and fuel." Quoted in the article, David McNally, DWR lead engineer at NASA Ames Research Center said, "The analysis of the DWR test data indicates there was an estimated savings of 3,355 flying minutes for 538 American Airlines flights from July 2012 through September 2014, or about 6.2 minutes per flight on average." NASA Administrator Charles Bol-den added, "This DWR tool, developed and tested by NASA in partnership with American Airlines and the FAA [Federal Aviation Administration], is going to benefit everyone who flies."

Initial EDA Capability Goes Live at Albuquerque Center

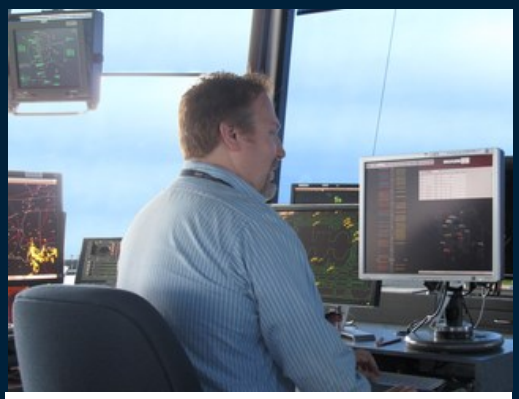
Technology based on NASA's Efficient Descent Advisor (EDA) was declared operational at Albuquerque Air Route Traffic Control Center on September 22. The automation, referred to as Ground Based Interval Management for Spacing (GIM-S) by the Federal Aviation Administration (FAA), provides controllers with speed advisories for accurately delivering aircraft to arrival metering fixes. The targeted metering times are computed by the FAA's Time Based Flow Management (TBFM) scheduler, which is based on previous NASA research and development.

Using speed advisories coupled with extended metering capabilities, controllers can condition arrival flows to balance demand and capacity, and facilitate optimal profile descents up to 600 miles from the destination airport. Initial reports from the field indicate that controllers are very receptive to the speed advisory automation, and have seen smoother westbound traffic flows into Phoenix as a result of its use. Efforts are already underway within the FAA to examine the potential for expanding the GIM-S deployment to additional en route centers, including Oakland, Los Angeles and Denver.

GIM-S represents the first phase in the deployment of EDA, which was developed through a joint government/industry research transition activity that concluded in 2012 with technology transfer to the FAA. Additional EDA capabilities, which include path stretching for metering conformance along with automated conflict detection and avoidance, are expected to be added in future deploy ment packages under the FAA's TBFM program.



EDA is used to synchronize the descents of all arrival aircraft thereby minimizing fuel consumption, environmental emissions, and noise pollution



PDRC in use by employee in tower

Provisional Patent Filed for NAS-based Airborne Rerouting Technology

The National Airspace System (NAS) Constraint Evaluation and Notification (NASCENT) software that implemented NASA's Dynamic Weather Routing (DWR) tool algorithm with a few novel techniques has extended DWR reroute advisories to the national airspace system. DWR automation provides time- and fuel-saving avoidance reroutes during significant convective weather activity for a single air traffic control center. The technology for NASCENT was filed as a provisional patent (#ARC-17419-1); currently, there is one prospective industry partner interested in commercialization.

(POC: Dr. Kapil Sheth)

NASA Langley Welcomes the FAA's Robert Joslin

On September 29-30, Robert "Buck" Joslin, the Federal Aviation Administration's (FAA) chief scientist and technical advisor (CTSA) for flight deck technology integration, visited NASA's Langley Research Center for briefings and hands-on demonstrations of emerging technologies. In a NASA Langley simulator, Dr. Joslin was able to "fly" prototype vision-systems technologies that might enable safe approach, landing and departure operations down to 300 feet during runway visual range conditions. Dr. Joslin also "flew" a demonstration of a head worn display and associated head tracking technologies currently under development.

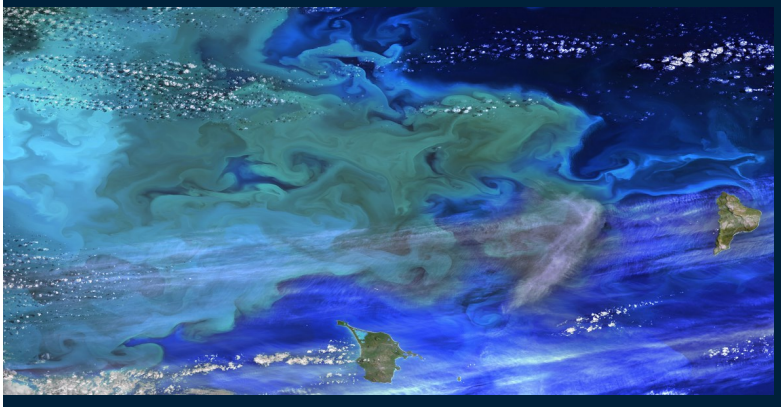
Dr. Joslin was given a tour and briefings of the Langley Air Traffic Operations Laboratory and the latest flight deck interval management research occurring at the Center. Dr. Joslin expressed his appreciation for these demonstrations, and particularly the interactions during a follow-on question-and-answer session. He expressed his belief that hands-on interaction is critical to understanding emerging technologies and the role that they may play in the national airspace.

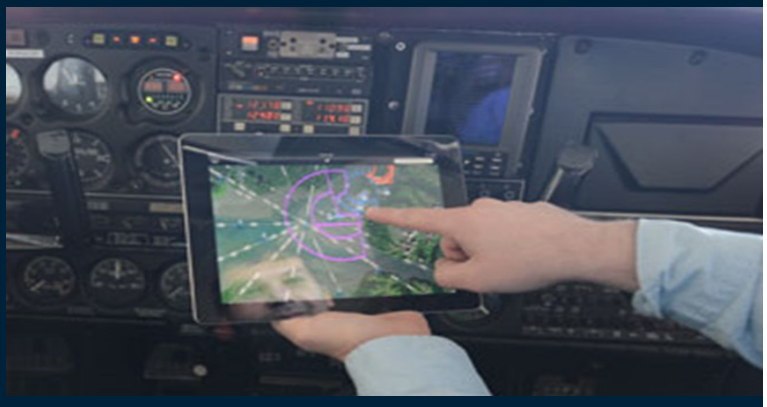
As a CSTA, Dr. Joslin is integrally involved with the FAA's Aviation Safety Organization, and assists in advancing, certifying and regulating aerospace technology and in developing industry standards and FAA policies.
(POC: Stella Harrison)

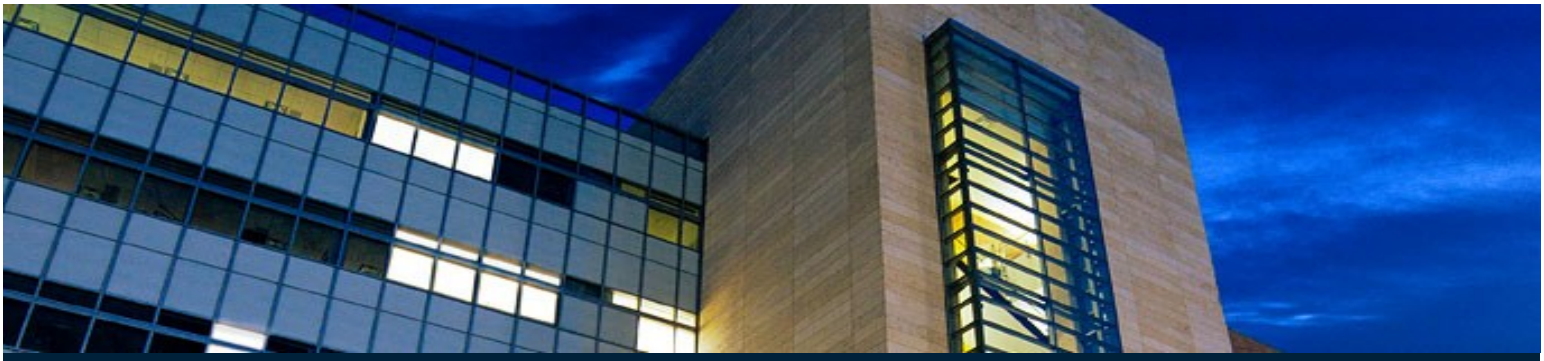
TAIGA Technology Transferred to the State of Alaska

On October 6 NASA officially delivered the Traffic and Atmospheric Information for General Aviation (TAIGA) technology to the State of Alaska. TAIGA, a collection of algorithms, concepts and data, is the result of a joint effort between NASA's Ames Research Center and the State of Alaska. TAIGA - which relies on a satellite-based communication method whereby regional data is sent only to a specific geographical location, with the customized data sets downloaded quickly and plugged into a mobile application - is designed to help pilots make better flight decisions, especially when typical sources of in flight information such as the Internet and traditional telephony are not available.

NASA has also developed a conceptual mobile software version of TAIGA that includes full 3 D terrain visualization. TAIGA algorithms, concepts and data are available as an open source project for further development by industry and the aviation community into an end-user system. In a recent test at NASA Ames, data from a satellite-based messaging system was successfully received on the satellite receiver and viewed on the concept version of the TAIGA mobile app while in flight. Since sending data via satellite can be expensive, NASA has developed a method for tightly bundling the data to be transmitted, thereby decreasing the normal cost of satellite data transmission. (POC: Joseph Rios)







UTA School of Engineering

Meeting with Dean of Engineering, University of Texas at Arlington

Jim Crites, executive vice president of operations at Dallas/ Fort Worth International Airport, arranged a meeting on October 14 between Dr. Khosrow Behbehani, Dean of the College of Engineering, University of Texas at Arlington (UTA), and personnel from the NASA North Texas Research Station (NTX). His goal was to introduce Dr. Behbehani to NTX, enabling possible future collaboration. NASA personnel presented an overview of the research station, collaborations with local Federal Aviation Administration personnel and commercial airline facilities, and summarized earlier collaborative projects with the university. Possible areas for future collaboration with NASA include automation and unmanned aerial systems research.

(POC: Paul Borchers)

NASA Hosts RTCA Special Committee-186 and EUROCAE Working Group-51

On October 6-9, engineers from NASA Langley Research Center hosted 50 people as part of the Radio Technical Commission for Aeronautics (RTCA) Special Committee 186 Working Group 4 and the European Organisation for Civil Aviation Equipment (EUROCAE) Working Group 51 Subcommittee 3 meeting at the National Institute of Aerospace in Hampton, Virginia. These committees are responsible for developing minimum operational performance standards (i.e., avionics standards) for Automatic Dependent Surveillance-Broadcast (ADS B) applications.

The meeting focused on resolving comments on the standards for the Flight Deck Interval Management (FIM) System. For the past decade, NASA has been developing and maturing FIM concepts and technologies under the aegis of the Airspace Systems Program. During the meeting, NASA Langley engineer Dr. Kara Latorella presented results of a recent study on cockpit annunciations to support FIM. Working meetings were also held on pair-wise trajectory management, a NASA developed oceanic-separation concept now being matured and tested by the Airspace Operations and Safety Program, and verified by second-generation FIM applications.

The work of both committees is essential in enabling the Federal Aviation Administration's vision of the Next Generation Air Transportation System, or NextGen, and Europe's Single European Sky initiative, known as SESAR. On October 10, committee members received demonstrations of the first Air Traffic Management (ATM) Technology Demonstration (ATD-1) technologies, which includes FIM, and pair-wise trajectory management in Langley's Air Traffic Operations Laboratory and the Cockpit Motion Facility.

(POC: Bryan Barmore)

Completion of SARDA Human-in-the-Loop Simulation Data Collection

The Spot and Runway Departure Advisor (SARDA) airport surface research team performed three weeks of data collection runs from September 29 through October 24 in NASA's Ames Research Center's FutureFlight Central (FFC) facility. The experiment was the last in a series of six planned human-in-the-loop simulations in fiscal year 2014 to evaluate a surface scheduling technology, including ramp tower displays, using Charlotte Douglas International (CLT) Airport in Charlotte, N.C. as the target airport in the simulation.

American Airlines (formerly US Airways) personnel participated as ramp tower controllers in the experiment, during which the team simulated the new operational conditions added to the scenarios from previous simulations, including traffic flow management initiatives such as expected departure clearance times and miles-in-trail restrictions. In addition, a new feature for the scheduler function was added to suggest different taxiways in order to avoid congestion in the ramp area.

Two engineers from the American Airlines Operations Planning and Performance Group participated during the simulation to collaborate with NASA researchers in fine-tuning the integration of their taxi prediction module with the SARDA scheduler function. The SARDA capability will eventually be tested in the American Airlines ramp tower at CLT within the next two years.
(POC: Dr. Yoon Jung)

An American Airlines air traffic controller participates in the SARDA experiment at the NASA Ames airport tower simulator, FutureFlight Central

Singapore-Based ATMRI Representatives Meet with NASA

On October 23, Airspace Operations and Safety Program researchers at NASA Ames Research Center welcomed representatives of the Singapore-based Air Traffic Management Research Institute (ATMRI). ATMRI director Dr. Chen Chung Hsin and program manager Mr. Zhi Quiang Kuok presented an overview of ATMRI, which is a partnership between the Civil Aviation Authority of Singapore and Nanyang Technological University.

NASA personnel provided overviews of research on traffic flow management, integrated arrival-departure-surface concept development, airport surface automation, dynamic weather routes, and unmanned aerial systems in the national airspace. The visitors expressed appreciation for the briefings and facility tours, and are interested in furthering potential collaborations with NASA.
(POC: Katharine Lee)

NASA's Unmanned Aerial Vehicle, Ikhana

Visit by NIF Software Engineering Team from Lawrence Livermore National Laboratory

On November 5, the air traffic management (ATM) software development team at NASA Ames Research Center hosted six software engineers from Lawrence Livermore National Laboratory's National Ignition Facility (NIF). The NIF's lead for engineering tools had contacted Ms. Michelle Eshow and requested a meeting after reading online about the ATM team's successful transition to the Atlassian software suite (including such applications as JIRA, Confluence, Stash, Bitbucket, Crucible and Clover, among others) and its use of Git, the open-source, version-control system for software development. The ATM team uses such tools for many aspects of software engineering, especially change tracking.

The visitors had many detailed questions about lessons learned, and the pros and cons of ATM tool selection for configuration control, documentation a nd r elease d eployment. The t eam spent about three hours in discussions, then gave the visitors informal tours of the NASA Ames simulation facilities used to support Airspace Operations and Safety Program research activities. The NIF visitors were extremely appreciative, departing wi th mo re confidence that they may also be able to use same tools.
(POC: Michelle Eshow)

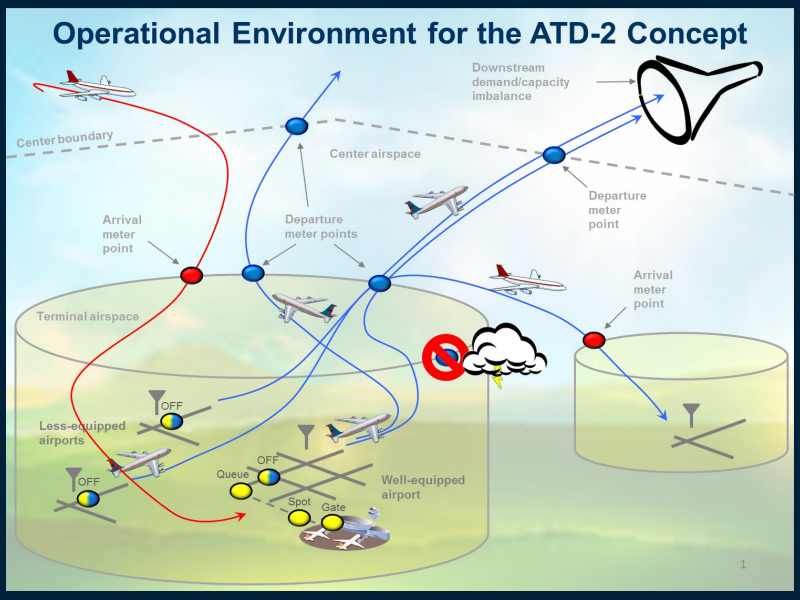
IPO UAS 2030+ Vision Meeting

Tom Davis, one of NASA's Interagency Planning Office (IPO) points of contact, has attended the first of two unmanned aircraft systems (UAS) 2030+ multi-agency vision meetings. Other agencies in attendance included the Federal Aviation Administration, the Department of Defense, the Department of Homeland Security and the Department of Commerce. NASA's UAS (unmanned aerial systems) in the NAS (national airspace system) Project and air traffic management +1 (near-term), +2 (mid-term) and +3 (far-term) plans for the Next Generation Air Transportation System (NextGen) will play key roles in the development of the “NextGen UAS Vision” document that sets the goals and guidelines for U.S. government investment in integrating all UAS operations into the NAS.

NASA's UAS Traffic Management (UTM) concept is mentioned prominently as a key concept in the evolution of the interagency plan. The NextGen UAS Vision document is in the early planning stages and is expected to be ready for review in mid-calendar year 2015
(POC: Tom Davis)

ATD-2 Team Workshop Held

On November 4-6, NASA's Air Traffic Management (ATM) Technology Demonstration (ATD-2) formulation team conducted a three day workshop at NASA Ames Research Center. ATD-2 will be part of the new Airspace Technology Demonstration Project (ATDP), and is focused on demonstrating integrated arrival/departure/surface (IADS) technologies. A pre-formulation planning effort solicited stakeholder feedback to establish the high-level concept and scope for ATD 2.



ATD-2metroplex traffic management concept

During the first day of the workshop, the formulation team reviewed both NASA and non-NASA technologies relevant to ATD-2. On day 2, the team participated in system engineering exercises to further define the high level concept produced by the pre-formulation team. The final day of the workshop was devoted to technology mapping, wherein the formulation team began to identify the specific technologies that will be further developed and integrated during the ATD-2 effort. The formulation team will use the workshop products to develop an integrated concept of operations and detailed project plan for ATD-2. (POC: Shawn Engelland)

ICAO CAEP ISG Workgroup Kickoff Meeting

The International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) includes the Impact and Science Group (ISG) to provide the best possible consensus information to the Committee. The ISG is co-chaired by the Federal Aviation Administration's chief scientist for environment and energy, and the Britain-based Civil Aviation Authority's climate and air quality technical advisor. (Dr. Banavar Sridhar has been nominated as a U.S. member of the ISG.) The ISG has a three-year work cycle, and is tasked to produce white papers on aviation impacts on climate, climate impacts on aviation, aviation impacts on air quality, and aviation noise impacts. A kickoff meeting of the working group was held on November 20 to familiarize new members and prepare for the ISG workshop during February 10-12, 2015, in Washington, D.C. (POC: Dr. Banavar Sridhar)

University of Iowa Conducts TASAR HITL Flight Simulation Experiment

Data collection for the second Traffic Aware Strategic Aircrew Requests (TASAR) human-in-the- loop (HITL) flight simulation experiment was conducted by Dr. Thomas Schnell and Mr. Mathew Cover of the University of Iowa's Operator Performance Laboratory (OPL). Data collection began on October 7 and continued for six weeks. The main objectives of this HITL experiment, conducted under a NASA Research Announcement contract held by Rockwell Collins, were to assess the efficacy, usability, and degree of pilot acceptability of the recently updated human machine interface (HMI) of NASA's Traffic Aware Planner (TAP) software application and of a prototype computer-based training module.

The concept of TASAR combines airborne automation/software with Automatic Dependent Surveillance-Broascast (ADS-B) In and other information to enable user in flight trajectory optimization planning and to increase the likelihood of air traffic controller (ATC) approval of trajectory change requests. TASAR is designed as a near-term application to improve flight efficiency, with potential operational benefits that include reduced flight time, fuel savings, and gaining early benefits from ADS-B IN at minimal in-vestment. Alaska Airlines and Virgin America are pur-suing partnerships with NASA Langley Research Cen-ter to conduct operational use testing on revenue flights starting in 2015.

During the course of the experiment, while flying several scenarios in the OPL fixed-base, full- flight-deck simulator, 12 airline transport pilots (including nine from the two partner airlines) interacted with the TAP software application hosted on a tablet based electronic flight bag (EFB) computer. The simulation environment enabled pilot interaction with a first officer, an air traffic controller, and a simulated airline dispatcher using a realistic radio communication environment.

The test scenarios incorporated the occurrence of realistic normal and non-normal events designed to create TASAR use-case opportunities - such as dis traction tasks for the pilot - as a realistic environment to assess human factors issues of using TAP concurrently with other EFB applications and cockpit tasks. A range of objective metrics were collected in real-time, including physiological measurements such as an electrocardiogram, as well as eye-scan behavior via eye-tracking cameras. Subjective measures of pilot workload, usability and situation awareness were also administered.

The results from data analyses will be used to refine TAP's HMI design and functional capabilities in preparation for an upcoming NASA flight trial and the operational-use trials by partner airlines. The airline partnerships will accelerate the operational readi-ness of NASA's TAP software technology and enable near-term technology transfer to operators in the national airspace system.
(POC: David Wing)

Airline and Industry Meetings Mark Progress towards TASAR Operational-Use Testing

To advance the emerging airline partnerships on the NASA TASAR concept and technology, engineers from NASA Langley Research Center attended meetings at Alaska Airlines on October 27-28, and at Virgin America on October 29. The NASA-developed TAP software application enables TASAR operations by monitoring flight-optimization opportunities during the en route phase of flight, taking traffic, winds, weather and other factors into account to increase air traffic control acceptability of the pilot's route-change request. An initial flight test in late 2013 verified the TAP software's operation in a flight environment. Following a second NASA flight test planned for early-to-mid 2015, TAP is scheduled for cockpit installation by both airlines for operational use testing in collaboration with NASA.

The working meetings included briefings by NASA on projected TASAR benefits and on a human factors evaluation underway at the University of Iowa Operator Performance Lab, for which both airlines supplied evaluation pilots. Technical discussions were held on requirements and processes, for TAP integration on airline hardware and certification/approval by the Federal Aviation Administration. Additional discussions addressed airline pilot training using a NASA-developed computer based trainer developed for TAP. Briefings were given to senior management of both airlines on the concept and collaboration activities, as well as the projected cost savings from TASAR operations. Savings are estimated to be more than 20 times those estimated for similar ground-based products. Significant interest in the TASAR partnership with NASA continues from both airlines. Space Act Agreements are currently in the final stages of preparation.

On a related note, Rockwell Collins Information Management Systems (IMS), formerly ARINC, visited NASA Langley on November 21 to discuss their commercialization interest in TASAR and its potential role in their company's vision for connectivity of air and ground systems. IMS is developing technologies for highly connected cockpit and ground systems and is interested in exploring what this connectivity-enabled, information-rich environment can accomplish. Their interest in TASAR stems not only for its near-term commercial potential, as evidenced by two airlines pursuing NASA partnerships for operational testing, but also for its growth potential to accommodate the expanding connectivity to new information sources on and off the aircraft.

Their interest aligns well with NASA's vision for a "Network-Enabled Air Traffic Management (ATM)" system, an element within the midterm SMART NAS (Shadow Mode Assessment using Realistic Technologies for the National Airspace System) Test Bed for Safe Trajectory Based Operations Project within the Airspace Operations and Safety Program. The meeting included a demonstration of the TAP software, which reinforced their initial commercialization interests. Additional discussions will explore specific opportunities for software licensing of TAP and other future collaborations. (POC: David Wing)

FIAT-5 Shakedown and Data Collection Runs Completed

The Fully Integrated ATD (Air Traffic Management (ATM) Technology Demonstration)-1 Test (FIAT) simulation 5 underwent successful shakedown and experiment data collections runs this past quarter. Shakedown was conducted the week of September 29-October 3 and met all simulation objectives. During this period, the FIAT-5 research team hosted five visitors from the Federal Aviation Administration (FAA), including three William J. Hughes Technical Center (WJHTC) employees who are working on the Operational Integration Assessment (OIA) scheduled for May 2015.

Four days of human-in-the-loop (HITL) simulations were performed with about 25 air traffic controller and pseudo-pilot subjects. The objectives of the shakedown included validating the newest Standard Terminal Automation Replacement System (STARS) software build containing new display capabilities; testing a nearly completed Terminal Sequencing and Spacing (TSS)-enhanced Time-Based Flow Management (TBFM) version 4.2; examining ground-based interval management for spacing (GIM-S) adaptation and its effect on air traffic control procedures; and examining the performance of "TBFM in-a-box" that consolidates all TBFM processes on a single computer. A NASA-configured TBFM in-a-box at the WJHTC is being used for preliminary integration activities, and is planned to be used for the OIA.

During the shakedown runs, the new STARS capabilities performed flawlessly, and were received favorably by the participating controllers. Meanwhile, the performance of the TSS-enhanced TBFM 4.2 was stable and reliable. One of the WJHTC visitors participated in the FAA's GIM-S operational test and evaluation this past May and June, communicating techniques and training to the controller participants. The performance of TBFM in-a-box was acceptable, demonstrating that using a single machine for TBFM at the OIA is viable. The FIAT-5 simulation team transferred the STARS and TBFM 4.2 software to the WJHTC so that it was ready to be used for a planned integration event on October 15 and 16.

Following the earlier shakedown runs, data collection runs were completed December 2-9. Twenty participants, comprised of 11 pseudo-pilots and nine controller subjects, took part in the simulation study. The objectives of the early-December study were to complete the validation of the TSS-enhanced TBFM version 4.2.0, to refine the procedures for off-nominal events, explore baseline performance (without TSS), and to demonstrate air traffic situations relevant to, and to reduce risk for, the OIA and/or operational deployment. In total, 22 runs were conducted over the eight-day period. Questionnaires were administered after each run.

Boeing ecoDemonstrator ATD-1 Flight Trials

In support of the Air Traffic Management (ATM) Technology Demonstration (ATD)-1 Project, this past quarter flight trials were conducted on the Boeing Aircraft Company ecoDemonstrator 787-800 test aircraft that utilizes advanced experimental equipment to accelerate the science of aerospace and environmentally friendly technologies. On November 3-5, ground testing began for the Flight Deck Interval Management (FIM) hard ware and software equipment installed on the ecoDemonstrator. Engineers from both NASA's Langley and Ames Research Centers supported a successful flight test conducted at Moses Lake, Wash. on December 12. The Airborne Spacing for Terminal Arrival Routes (ASTAR) algorithm provided spacing guidance to the Boeing 787 crew as they followed a participant aircraft. This experiment was an initial step in preparation for the ATD-1 flight demonstration expected in 2017, and was the first field demo of the ASTAR 12 algorithm, which successfully provided metered spacing between two participant aircraft. (Further detail can be found in this NASA press release of December 15: http://www.nasa.gov/press/2014/December/nasa tests software that may help increase flight efficiency decrease aircraft/)

ASTAR uses Automatic Dependent Surveillance-Broadcast (ADS B) In information from participant aircraft to provide time-based spacing off a specified target. Using speed commands generated by the ASTAR algorithm, the on-board user is able to input those speeds into the flight director, then achieve and maintain a specified time interval behind the preceding target aircraft. The objective of the flight trial was to provide initial assessment for the feasibility of the ASTAR 12 spacing algorithm in a real-time national airspace environment, which previously had only been tested in simulation. The effort also required the creation of a new communication tool, which reformatted aircraft-state data from a Rockwell device to the data-transfer standard for aircraft avionics known as ARINC 429 that rendered the data usable in a simulated aircraft bus on the test laptop.

NASA and Boeing personnel worked jointly at lab facilities in Chantilly, Va., NASA Langley Research Center in Hampton Va., and in Seattle, Wash. Closely collaborating with Boeing and air traffic controllers in Seattle and Moses Lakes, Wash., the NASA Langley team developed two flight routes that merged prior to the instrument approach to Grant County International Airport in Moses Lake. Similar routes were built to Seattle standard terminal arrival routes (STARs) for testing prior to the demo. Simulation testing for all routes occurred at Langley and contractor facilities with simulated aircraft called ASTORs (Aircraft Simulation for Traffic Operations Research), previously used in other NASA studies such as RAPTOR , Controller Managed Spacing ATD-5 (CA 5), the Fully Integrated ATD (FIAT)-4 simulation, and the Interval Management for Near-term Operations Validation of Acceptability (IM-NOVA) experiment.

The design of the demonstration was to configure two aircraft, one following the other, along a pre-determined arrival route into an airport. Speed commands would be generated on a laptop inside the cabin of the FIM aircraft following the target, then the laptop operator would communicate the speed commands to the FIM pilots. Keeping the technology out of the cockpit helped mitigate testing certification delays. Two separate opportunities arose for FIM operations.

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On December 6, during an in air operational test of the software package, the ecoDemonstrator was able to fly behind a Virgin America flight inbound to Seattle and maintain adequate spacing distance. On December 12, five flights with a designated test airplane as the target on the same route, and on a separate route from the ecoDemonstrator, produced arrival conformance times within a few seconds of the predetermined goal. Pilot acceptability was high, with multiple Boeing and Federal Aviation Administration (FAA) employees stating how "very impressed" they were with the NASA product. All five runs exhibited an arrival time within seconds of the spacing goal with correct sequencing achieved.

Air traffic control facilities partnered with NASA participants during the recent demo have offered data recordings of the flight to assist with the analysis. Future analyses will examine controller workload with a FIM operation and assess air/ground procedures used in the demonstration. Just as valuable was the collaborative effort between NASA, Boeing, and the FAA, which led to a safe and fruitful flight and increased potential for future partnerships.

Feedback from this demonstration will help guide planners for future ATD field activities. Preliminary results were briefed to the project on January 29, 2015. In advance of the expected 2017 ATD-1 flight trials, Boeing has offered NASA another opportunity for an in-flight test of the FIM ASTAR software onboard the ecoDemonstrator. (POC: Sherri Brown)

ATD-2 Planning Team Visit to Boston Logan International Airport and Raytheon

In December, members of the Air Traffic Management (ATM) Technology Demonstration (ATD)-2 Integrated Arrival/Departure/Surface (IADS) Planning Team visited the Jet Blue Airways ramp operation facility, the air traffic control (ATC) tower at Boston Logan International Airport, and Raytheon Company facilities in Marlborough, Mass. to view current air traffic management tools and discuss potential collaborations. At Boston Logan, the NASA team viewed PASSUR Aerospace software used by both the Jet Blue ramp tower and the Logan air traffic control tower.

Traffic conditions in and out of the three alleyways of Logan's Terminal C pose significant challenges to both ramp operators and tower controllers who need to manage incoming arrivals, departures pushing back from gates, and aircraft being towed from overnight parking areas to the gates. The PASSUR system is used by the ramp operator to input a desired sequence of traffic based on flight information. In the ATC tower, the tool has the same sequence information displayed to the ATC ground controller, who would normally accept the sequence requests made by the ramp operator. Use of the software has generated roughly $2,500 per day in fuel savings for Jet Blue.

In Marlborough, the NASA team viewed the Raytheon facility used for demonstrating the IADS concept for a metroplex environment. The facility consisted of a suite of tools including PASSUR Aerospace's Integrated Traffic Management (PITM) system for airport/airline operations through collaborative decision making; Raytheon-developed capabilities including electronic flight strips for ATC tower controllers; and a Terminal Radar Approach Control (TRACON) Standard Terminal Automation Replacement System (STARS) display with a Traffic Management Unit (TMU) position. (POC: Shawn Engelland)

Aviation Systems Division Meeting with Jet Propulsion Laboratory

NASA's Jet Propulsion Laboratory (JPL) has assembled a small team from their Machine Learning and Instrument Autonomy Group to explore the application of machine learning techniques such as data mining and classification to air traffic data, and to develop strategies for dealing with events that disrupt normal air traffic operations. Drs. Tara Estlin and Alphan Altinok from JPL visited NASA Ames Research Center on December 15 and met with Drs. Banavar Sridhar, Karl Bilimoria and Heather Arneson. Their discussions provided JPL an understanding of the various data sources and software used in air traffic management. JPL has requested a copy of the Future Air Traffic Management (ATM) Concepts Evaluation Tool (FACET), and a software usage agreement is in progress. Based on these interactions with division staff, JPL plans to develop a partnership proposal to present to NASA Ames. (POC: Dr. Banavar Sridhar)

Papers

Awardees Honored at the Digital Avionics Systems Conference

Aviation Systems Division research was honored with two awards at the recent Digital Avionics Systems Conference in Colorado Springs, Colorado that took place October 6-10. For their manuscript entitled "Optimizing Integrated Terminal Airspace Operations Under Uncertainty," Christabelle Bosson and co-authors Min Xue and Shannon Zelinski received the best paper award across the entire air traffic management track that included more than 20 papers in five sessions. Michelle Eshow and co authors Max Lui and Shubha Ran jan were also awarded best paper in the Collaborative Decision Making/System Wide Information Manage ment Session for their paper, "Architecture and Capabilities of a Data Warehouse for ATM Research."

L-R: Min Xue, Christabelle Bosson, and Shannon Zelinski

Appointments

Langley Researcher Appointed to TRB Committee

Gary Lohr of NASA Langley Research Center has accepted an appointment by the Transportation Research Board (TRB) to serve on its Committee on Airfield and Airspace Capacity and Delay. The appointment runs through April 2016. The TRB of the National Academies is a division of the National Research Council (NRC), a private, nonprofit institution that provides expertise in science and technology to the government, the public, and the scientific and engineering communities. The NRC is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Members of NRC technical committees serve as individuals, not as representatives of the organizations by which they are employed or of which they may be members.