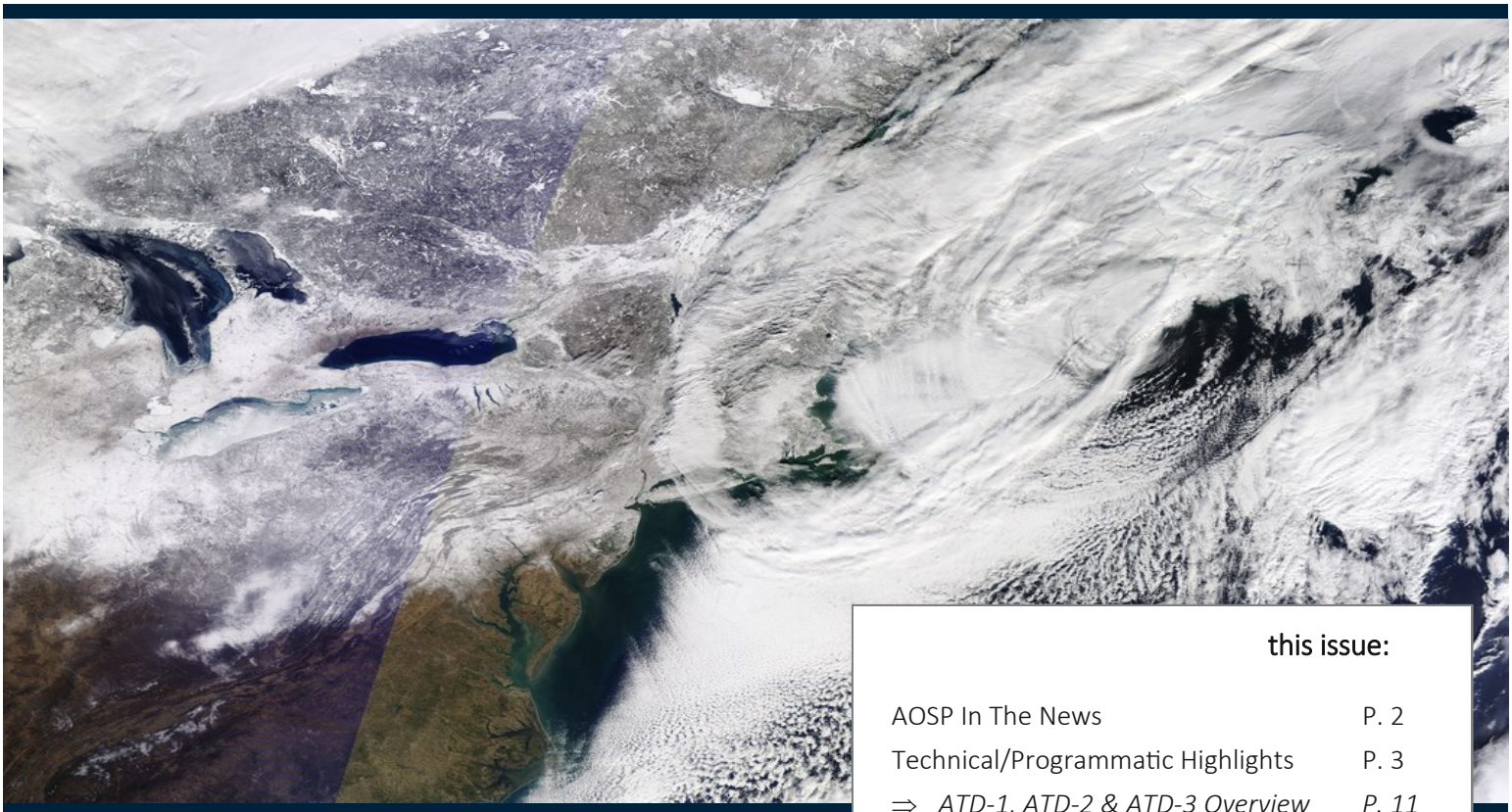
AIRSPACE OPERATIONS AND SAFETY PROGRAM NEWSLETTER

FY 2015 Quarter 2: January —March 2015



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.

Researchers to Test New ATM Technologies at NASA Ames

In an article for its January 12 edition entitled "NASA Hones ATM Technologies," Aviation Week & Space Technology [Aviation Week] reports that a "vision of an air traffic management [ATM] future" will soon be tested at NASA's Ames Research Center. By 2040, air traffic controllers could have the ability "to safely and efficiently manage highly automated passenger aircraft that dynamically collaborate with the air traffic management system to optimize routing, capacity and fuel savings." A related article in the same edition [Aviation Week] reports that Ames researchers will also examine "an airliner flight deck of the future" requiring only a single pilot. The article notes that the concept is now "far less science fiction than it was three years ago." However, single-pilot operations could be "rife with political and public ramifications."

NASA Langley Research Center engineers use flight simulators, such as the Research Flight Deck, to develop cockpit technologies to make airliners safer and more efficient. Airline pilots test the concepts and offer suggestions about how the systems would work in the real world or could be improved.

NASA Study Finds Pilots Not Experienced Handling Unexpected Problems

The January 23 edition of Aviation Week & Space Technology [Aviation Week] reports that a study by NASA of seasoned captains in a simulator show the "broader pilot workforce is not gaining expertise in handling unexpected but realistic problems." When tested on scenarios pilots typically train on, responses were "consistent with accepted standards," but when the "element of surprise" was added to those same events pilots "frequently differed from accepted standards and showed greater variability." Because regulations require the practicing of abnormal events, which are usually in "the same sequence ... under the same circumstances," pilot training has become "highly scripted and predictable," which hurts "pilots' abilities to recognize and respond to abnormal events."

SMART-NAS TBO Researchers Visit New York Air Traffic Facilities

Researchers from NASA's Shadow Mode Assessment using Realistic Technologies for the National Airspace System (SMART NAS) Safe Trajectory Based Operations (TBO) Project, focusing on New York trajectory-based operations, visited several New York air traffic control facilities in February to better understand day-to-day operations. The team is developing and creating strategic traffic flow management decision-support and analysis tools to assist air traffic service providers in selecting and integrating various traffic management initiatives.

The purpose of the trip was to expose team members and researchers to current Federal Aviation Administration operations and air traffic staff, as well as airline and airport operators, in addition to gaining a better understanding of the current operational challenges in the New York area airspace. The team observed a wide range of New York operations from the airport perspective, including those conducted at control towers at Newark Liberty International Airport (EWR), LaGuardia Airport, and John F. Kennedy International Airport (JFK), plus the United Airlines ramp control facility at EWR and a metering control center operated by the Port Authority at JFK through the en route environment at the New York Air Route Traffic Control Center in Islip, New York.
(POC: Heather Arneson)

New York City at night.

New York TBO Researchers Meet with the FAA

On January 7-8, NASA's New York Trajectory Based Operations (TBO) team hosted a Federal Aviation Administration (FAA) and user community forum to inform concept design for New York TBO initiatives in 2015 and beyond. Participation included Mark Novak, program manager for the FAA Traffic Flow Management System (TFMS); Patrick Somersall, the national operations manager at the FAA's Air Traffic Control System Command Center; Ved Sud, integration lead for FAA decision support technologies; Ralph Tamburro, delay reduction manager at the Port Authority of New York and New Jersey; and additional subject matter experts from a number of FAA facilities.

The discussion focused on first identifying integration issues that exist within the FAA's suite of current and planned traffic flow management tools, as well as defining the bounds of the solution space for addressing these integration issues. The New York TBO initiative centers on the development of TBO concepts and technologies to reduce delays, increase throughput, improve flight efficiency, and reduce schedule disruptions while ensuring safety. TBO leverages existing and planned FAA tools, studies what technical and procedural improvements can improve tool integration and operational results, and validates its concepts in the airspace that will deliver the most immediate impact on both a local and national scale.

SMART NAS Test Bed Workshop

On January 27-29 a workshop was held at NASA Ames for the four Shadow Mode Assessment using Realistic Technologies for the National Airspace System (SMART NAS) NASA Research Announcement (NRA) teams, who presented their first-year results, focusing on preliminary architectural designs for the SMART NAS Test Bed. The 20 individuals representing the four teams and 13 organizations included:

1. Boeing (lead) and George Mason University
2. Crown Consulting (lead), Mosaic ATM, and Pragmeering
3. Metron Aviation (lead) and Innovation Laboratory
4. Robust Analytics (lead), SABRE, IBM, ATAC, JVN Communication, and Flight Research Associates

The teams presented executive summaries during the first half-day of the workshop, while the next two days of the workshop were devoted to detailed technical presentations and discussions to fine-tune the conceptual design. During the past year, the NRA teams have independently developed unique architectural designs. This workshop provided each of the teams the opportunity to view each of the other team's approaches.

A major expected outcome is for the teams to initiate collaborations with each other and NASA in order to create the best architecture for the SMART NAS Test Bed during the second year of the NRA contract. NASA intends to leverage the teams' initial designs along with its own internal expertise to start building the SMART NAS Test Bed at [Where? One of the centers?] NASA. Representatives from three NASA facilities – Ames, Glenn and Langley Research Centers – the FAA Technical Center's validation and verification group, SFO (San Francisco International Airport) planning office, MIT LL (Massachusetts Institute of Technology Lincoln Laboratory), UCSC (University of California at Santa Cruz), SaabSensis, and OSI (Office of Strategic Infrastructure) also participated. Forty-eight onsite and 30 online participants attended the meeting. (POC: Kee Palopo)

Boeing Team Visits NASA Ames for DWR Technical Exchange

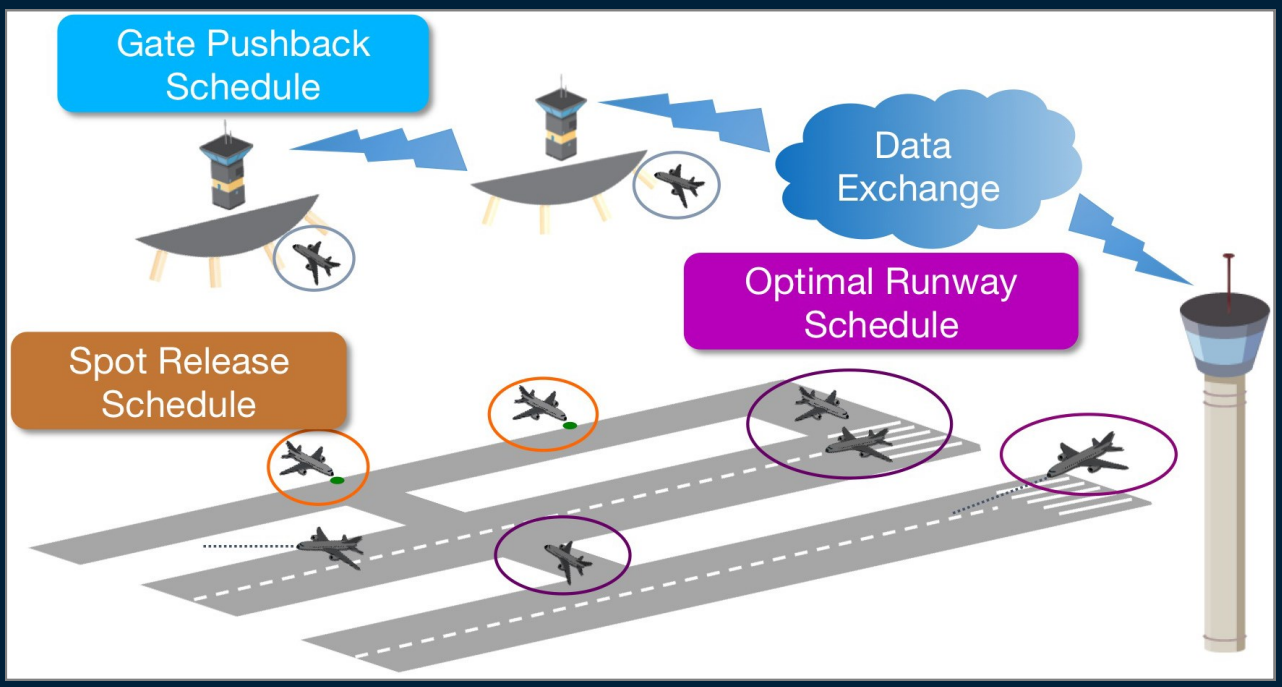
Members of Boeing's InFlight Optimization Services team and Jeppesen [Kenny, don't know what this means …] visited NASA Ames Research Center on January 13 for detailed discussions on Dynamic Weather Routes (DWR) software test results. In 2008, Boeing licensed the NASA-developed direct-to software and has since developed a product called "Direct Routes," which uplinks smart direct-route requests to commercial flight crews for time and fuel savings in United States airspace. In 2014, Boeing licensed the DWR software and is now determining how best to expand their direct routes product to include DWR advisories for more efficient routes around convective weather.

The full-day meeting focused on the test results from the DWR trial at American Airlines, and on the detailed differences between the new DWR software and the direct-to software. The DWR software, including source code, was transferred to Boeing non-exclusively in July 2014. Boeing provided constructive technical questions and feedback related to American Airlines trial results, and NASA provided insights into the DWR-Direct Routes integration. (POC: Dave McNally)

SARDA Operational Field Test Planning Meeting Held in Fort Worth

Managers and researchers supporting NASA's airport surface management research effort, as well as planning team members from the Airspace Technology Demonstration-2 (ATD-2) planning team met on January 20-21 with staff from American Airlines (AA) in Fort Worth, Texas. AA representatives included those from the AA information technology department and the AA managing director of operations planning and performance, and the director of the Charlotte-Douglas International Airport (CLT) ramp tower operations. The purpose of the meeting was to discuss the upcoming plans for a field test of the Spot and Runway Departure Advisor (SARDA) technology at AA's CLT ramp tower.

The teams discussed scheduling around AA's operational considerations, including preferred seasonal weather conditions, and avoiding constraints due to holidays, staffing, and the merger of operational systems between AA and US Airways. Requirements for networking, physical space, and technical questions regarding data-request elements, features and architecture were also discussed. NASA provided updates on the findings from the human-in-the-loop simulation experiments performed at NASA Ames Research Center in the past six months. In order to converge on an acceptable testing matrix and schedule, the teams will gather additional information on potential constraints and conflicts. (POC: Mirna Johnson)



SARDA creates an optimal schedule for releasing aircraft so that departing aircraft can keep their engines off until just before their scheduled release time and proceed straight to the runway, significantly reducing fuel burn and environmental emissions.

Workshop Held to Discuss Ways to Improve Air Navigation Performance Worldwide

On February 11-13 in Asilomar, California, NASA Senior Scientist for Air Transportation Systems Dr. Banavar Sridhar attended the Global Challenges to Improve Air Navigation Performance Workshop organized by the FAA Consortium in Aviation Operations Research (NEXTOR) Consortium and the Federal Aviation Administration (FAA). Dr. Sridhar spoke on a panel to address global air traffic management (ATM) research issues. The panelists presented their views on:

- Global ATM research and how it differs from ATM research in general;
- The grand challenges confronting global ATM research;
- What ATM research areas are the most under- and over-studied;
- When linking ATM research from development to deployment and use, what the weakest links in the chain are and how they can be strengthened; and
- The best advice to give to a young researcher thinking of going into air traffic management.

At the concluding session in the workshop, the panel provided an opportunity for the workshop to reflect on global challenges facing aviation operations. (POC: Dr. Banavar Sridhar)

ICAO CAEP Aviation Environmental Impacts Seminar

NASA Senior Scientist for Air Transportation Systems Dr. Banavar Sridhar attended the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) Environmental Impacts Seminar on February 10-11 in Alexandria, Va. Dr. Sridhar is a member of the Impact and Science Group (ISG), formed to provide the best possible informational consensus to the committee. Dr. Sridhar presented NASA's air traffic operations research designed to balance fuel efficiency and environmental impact. The group will summarize and critique ongoing research on the prediction and rerouting of aircraft around contrail-prone areas. The group will also produce a new white paper on the impact of climate on aviation, summarizing the state of knowledge regarding climate change risk and resilience. (POC: Dr. Banavar Sridhar)

Dr. Banavar Sridhar

NASA FutureFlight Central is a national Air Traffic Control/Air Traffic Management (ATC/ATM) simulation facility. The two -story facility offers a 360-degree full-scale, real-time simulation of an airport, where controllers, pilots and airport personnel participate to optimize expansion plans, operating procedures, and evaluate new technologies.

Cloud ATM Workshop Held at NASA Ames

As part of a NASA Research Announcement to accelerate the pace of cloud-based air traffic management (ATM) advances, a workshop lead by Mosaic ATM was held at NASA Ames Research Center on March 5. The purpose of the workshop was to identify new cloud-based technologies and business models that can lead to the improvement of the national airspace system, and better understand the process for adoption of potential ATM applications.

The workshop included presentations and demonstrations to provide the approximately 40 attendees background for their breakout sessions. Three breakout sessions focused on the inclusion of cloud technologies into the flight deck, traffic flow management, and traffic management on airport surfaces. Attendees included representatives from NASA, the Federal Aviation Administration (FAA), airlines, airports, communications interests, airspace and airport management, and Web services. Presentations were made by NASA, the FAA, Amazon and Delta Airlines. A summary of the workshop and outcomes from the breakout sessions will be made available to the participants. (POC: William N. Chan)

What can TASAR do?

The TASAR software application accesses onboard aircraft systems for real-time flight data, including current position and the active route, to see if more efficient routes are available.

The software then connects with the plane's ADS-B, or Automatic Dependent Surveillance-Broadcast, receiver and scans the broadcast signals of nearby traffic to make sure there are no potential conflicts in any proposed flight path changes – making it easier for air traffic controllers to okay a pilot's route change request.

The TASAR system can go even further by using airborne Internet access for additional airspace information, such as real-time weather conditions and wind forecasts, to help make the flight even more efficient.

Gogo Meeting Explores Partnership Opportunities for TASAR and Net-Enabled ATM

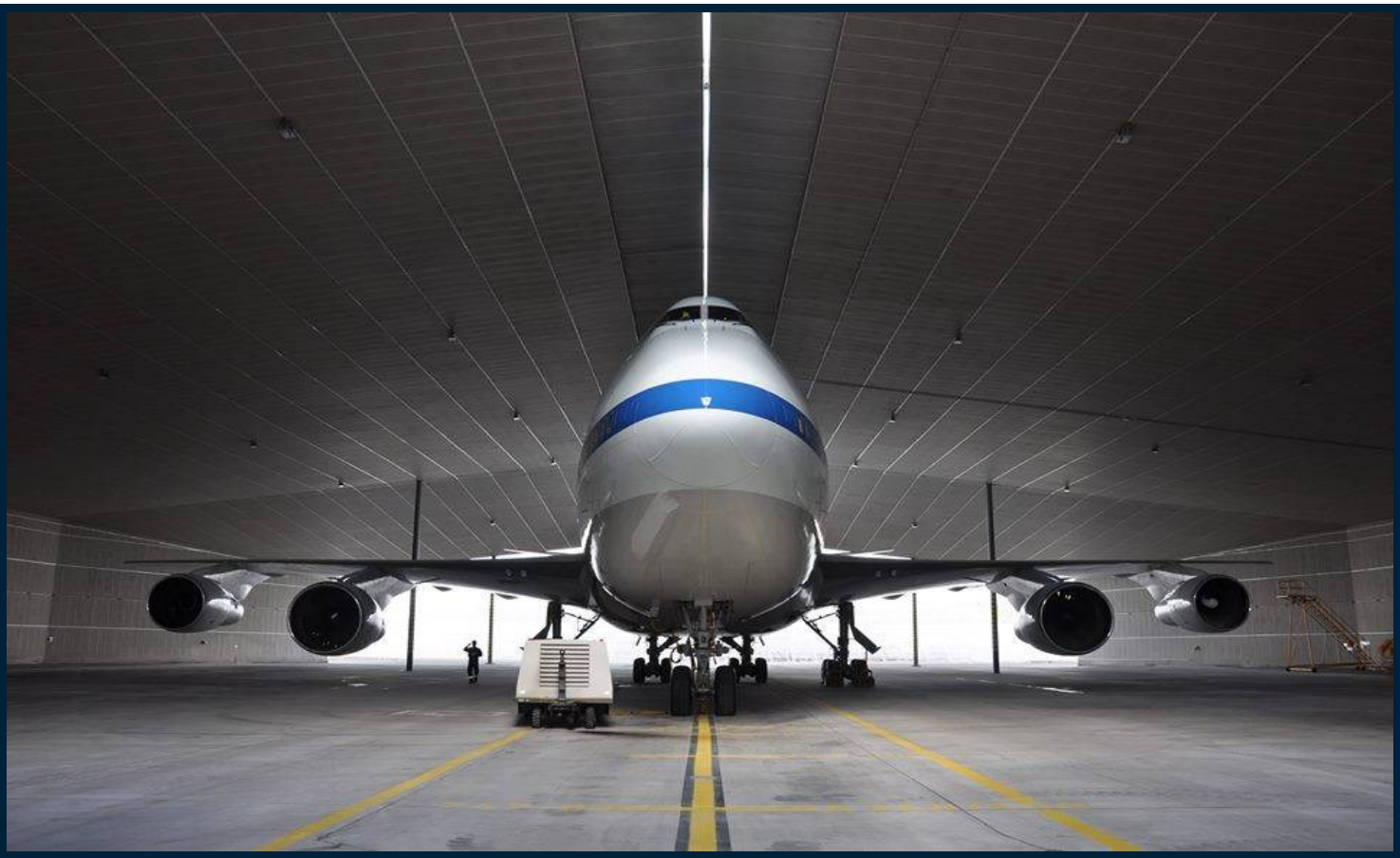
NASA Langley Research Center researchers David Wing and Matt Underwood visited aeronautics communications service provider Gogo at company headquarters in Itasca, Illinois on March 20 to explore partnership opportunities for two Airspace Operations and Safety Program (AOSP) sub-projects.

The TASAR (Traffic Aware Strategic Aircrew Requests) Sub-Project is working on an operational test with Alaska Airlines in 2015 of the NASA Traffic Aware Planner (TAP) software application. TAP computes optimized route and altitude changes accounting for known local traffic, weather, winds and restricted airspace, then displays these trajectory-change solutions to the flight crew for optional use in requesting trajectory changes from air traffic control. Gogo hardware currently onboard Alaska Airlines aircraft may be chosen to host the TAP software, which leverages connectivity to external data sources via airborne Internet, thus providing online connectivity. David Wing presented the TASAR sub-project work and gave a demonstration of the TAP software on a mobile simulation platform.

Additionally, the Network-Enabled Air Traffic Management (ATM) Sub-Project is investigating game-changing applications that leverage advanced networking, machine intelligence, big data analytics, and cloud-computing business models. A presentation on NASA's net-enabled ATM research was given by Matt Underwood. Gogo is pursuing a strategic shift toward offering airline operational services in addition to its traditional customer-connectivity services. Discussion centered on NASA's planned activities and a possible NASA/Gogo partnership in net-enabled ATM.

Attendees included Alaska Airlines' director of B-737 fleet technology, plus nine Gogo senior leaders, including the company's chief operating officer, the vice presidents of engineering, platform and services, products, and marketing, and several department directors. Significant interest was received from Gogo on both AOSP sub-projects. Activities are underway to explore TASAR's use of Gogo infrastructure for Alaska Airlines, and actions were taken to explore possible content for a Space Act Agreement in collaboration with the Net-Enabled ATM Sub-Project.

(POC: Sherri Brown)



Four ORM Simulations Conclude in Preparation for Upcoming TSS Tests

A series of four Operational Integration Assessment (OIA) Risk Mitigation (ORM) Simulations were completed this quarter with the objective of reducing risks for the upcoming testing of NASA's Terminal Sequencing and Spacing (TSS) capability. TSS testing will be conducted at the Federal Aviation Administration's (FAA's) William J. Hughes Technical Center (WJHTC) in Atlantic City, New Jersey in April 2015.

The objective of the first simulation, ORM-1, conducted January 20-23, was to validate the chart change update (CCU) that is required for the OIA, and to test out NASA's implementation of flexible scheduling in the modified Time-Based Flow Management (TBFM) version 4.2.0. ORM-1 heavily leveraged the preliminary CCU update to TBFM and the Multi-Aircraft Control System (MACS) conducted within NASA Ames Research Center's Airspace Operations Laboratory (AOL). Raytheon performed the CCU update for the Standard Terminal Arrival Replacement System (STARS), including updates to video maps. Fourteen simulation runs were conducted over the course of the study. Testing also included off-nominal events with an emphasis on missed approaches. Refinements were made to various routes, adaptation, and software. Questionnaires were administered for the last 12 simulation runs. Although observations in the laboratory indicated that the objectives of ORM-1 were met, more detailed analysis was necessary. Following the simulation, NASA subsequently transferred the updated CCU release to the WJHTC, so that FAA engineers could update their various platforms.

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Four ORM Simulations Conclude in Preparation for Upcoming TSS Tests – *Continued*

The second simulation, ORM-2, was conducted January 27-29, with the objective to train the FAA traffic management coordinators (TMCs) who are expected to participate in the upcoming OIA tests. The OIA will simulate airspace operations for the Phoenix Terminal Radar Approach Control (TRACON) P50, the Albuquerque En Route Center (ZAB), and the Denver En Route Center (ZDV). P50 and ZAB TMCs participated in ORM-2. Overall, about 20 simulation participants, subject matter experts, and FAA observers took part in the ORM-2 simulation. Additionally, input was also gained from other FAA participants to understand the impact to roles and responsibilities, policy/procedures, and/or software requirements for operations in the national airspace system. FAA attendees expressed overall satisfaction with the OIA roles and responsibilities defined.

The third simulation, ORM-3, was conducted February 24-26, at the WJHTC. The primary objective for ORM-3 was to utilize TSS-experienced controllers to identify any performance issues, simulation artifacts, or other conditions that could pose problems in the upcoming human-in-the-loop (HITL) simulation scheduled for April at the WJHTC. The TSS system performed well throughout the simulation, and successfully demonstrated aircraft executing required navigation performance (RNP) approaches to runway 26 and runway 25L in the simulation of Phoenix Airport.

The fourth simulation, ORM-4, was completed at NASA Ames March 10-13, with the participation of nine retired controllers, 12 pseudo-pilots, and one subject matter expert. ORM-4 was conducted to validate three elements of the OIA:

- The final update (version 4.2.0 to v. 4.2.3) of the prototype TBFM, which included additional scheduling command and control restrictions and FAA software defect fixes for the FAA's ground-based interval management for spacing (GIM-S) advisories;
- Various minor modifications to the airspace CCU; and
- The final up-leveled prototype of the Raytheon-developed STARS when integrated with other software platforms, including TBFM and the MACS.

Fourteen simulation runs were conducted over the course of ORM-4, and included several off-nominal events focusing on recent software modifications to the radar surveillance emulator to enable proper simulation of internal departures. Observations and participant feedback indicated that the ORM-4 objectives were successfully met, with more detailed objective data analysis underway.

Upon the successful completion of ORM-4, the TBFM and STARS software versions were transferred to the WJHTC. This final transfer is the culmination of 39 simulation days occurring over a nine-month period (36 simulation days at ARC, and three at the WJHTC). Second-level engineers (SLEs) at the WJHTC have loaded the prototypes on the two respective platforms and will utilize the next lab shot to verify and test this update across their systems, which will be used for the remainder of the OIA. The NASA OIA team is preparing for the first OIA shakedown at the WJHTC, scheduled to begin April 6. (POC: Kevin Witzberger and Shivanjli Sharma)

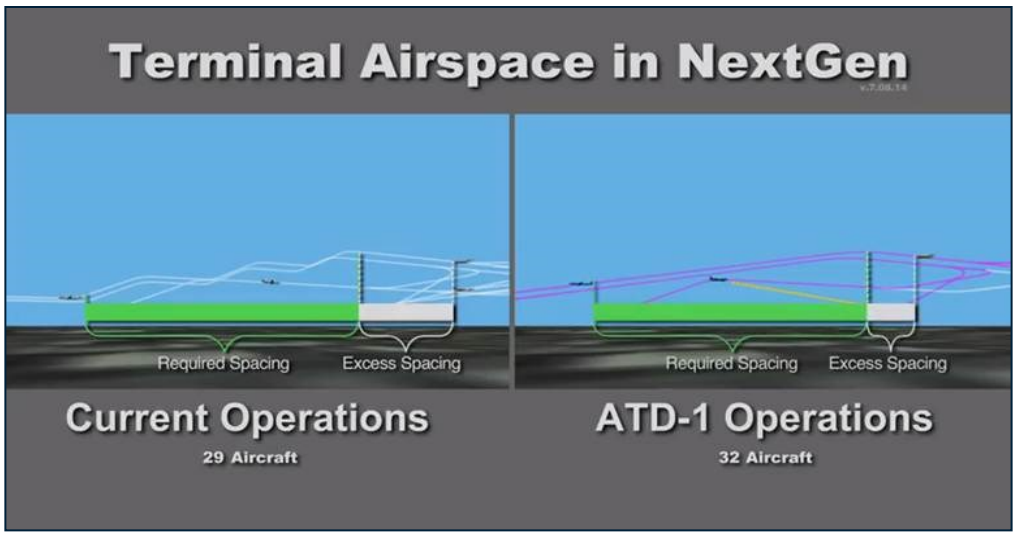
// ATD-1, ATD-2 & ATD-3 Overview and Explanatory Figures

This section is an overview of the frequently-referenced activities under the Airspace Technology Demonstrations (ATD) Project. The ATD Project is comprised of a collection of critical technology development and demonstration activities geared toward delivery of near-term benefits to air transportation system stakeholders:

- The Terminal Sequencing and Spacing or ATD-1
- The Integrated Arrival/Departure/Surface or ATD-2
- The Applied Traffic Flow Management (ATFM) or ATD-3

ATD-1

The Terminal Sequencing and Spacing (TSS) – Flight Deck Interval Management activities, also referred to as ATD-1, will operationally demonstrate an integrated set of NASA arrival management software technologies for planning and executing efficient arrival operations in the terminal environment of a high-density airport. The research involved investigations of methods to improve tight integration of scheduling and merging and spacing capabilities, as well as increasing the fuel efficiency of arrival operations.



The higher precision achieved by ATD-1 technologies will reduce the size of excess spacing buffers, resulting in higher terminal throughput and capacity. Furthermore, ATD-1 operations will reduce fuel-burn, greenhouse gas emissions, and noise.

NASA has recently transferred terminal air traffic management technologies to the FAA to enable use of fuel-efficient performance-based navigation arrival procedures during busy traffic periods. The FAA plans to deploy these tools to several busy terminal air traffic control facilities in the NAS by 2019.

ATD-2

The Integrated Arrival/Departure/Surface activity, also referred to as ATD-2, will develop and adjust precision schedules for gates, spots, runways, arrival and departure fixes while ensuring efficient individual aircraft trajectory. This will reduce the unnecessary buffer imposed by the human workload associated with the tasks of simultaneously coordinating and scheduling of arrivals, departures, and runway and surface operations. These inefficiencies are pronounced when the traffic density is high, and results in lost slots and/or many stop-and-go operations between gates and the runway threshold.

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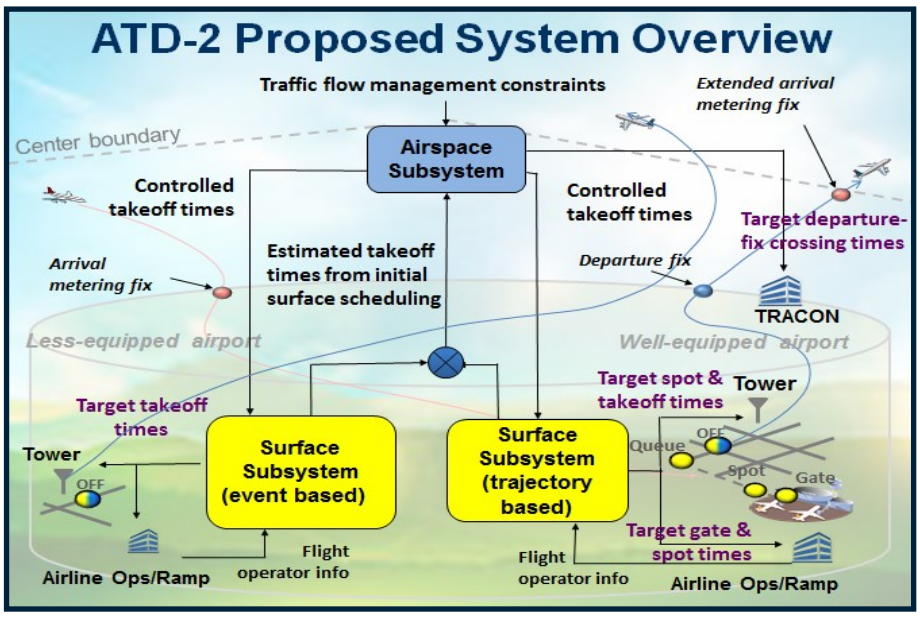
ATD-2 —*Continued*

The basic ATD-2 system consists of a single Airspace Subsystem and multiple Surface Subsystems, one for each airport. Please refer to the figure below, which provides a high-level overview of the proposed ATD-2 system, consisting of a well-equipped and a less-equipped airports.



A high-level overview of the proposed ATD-2 system.

In the figure, the Airspace Subsystem receives and processes local, regional, and national departure restrictions. It also uses flight intent information (e.g., flight plans, takeoff time estimates and departure runway received from the various Surface Subsystems, current state of airborne flights, etc.) to compute demand at the TRACON departure fixes.

When departure fix demand exceeds capacity, the Airspace Subsystem can compute controlled takeoff times that balance demand with capacity in the airspace and equitably distribute any necessary delay. The controlled takeoff times are sent back to the Surface Subsystems and are delivered/displayed to the towers, flight operators and other system stakeholders.

There will be two versions of the ATD-2 Surface Subsystems: event-based and trajectory-based, which will be implemented depending upon an individual airport's capabilities. Event-based subsystems support ATD-2 at less-equipped airports, providing simple takeoff time estimates based on events pertaining to aircraft status without depending on detailed surface trajectory predictions. Trajectory-based subsystems support ATD-2 at well-equipped airports, providing detailed trajectory prediction and scheduling capabilities that de-conflict taxi trajectories, in order to minimize surface congestion and delay.

An important principle of ATD-2 is the use of collaborative planning to allow airline operators to submit strategic changes to the system-generated departure schedule, based on company preferences and priorities. Flight operator information conveying aircraft readiness and company preferences is shown flowing into both the event-based and trajectory-based surface subsystems in the figure.

ATD-3

The Applied Traffic Flow Management (ATFM) activity, also referred to as ATD-3, will explore concepts and develop technologies to execute more efficient flight paths for en route airspace. Delays in flight plans are largely due to weather, and about 65% of these delays are potentially avoidable. ATFM will employ learning automation for traffic flow management and digital traffic management initiatives to develop more effective strategic and tactical flow management procedures.

Proposed high-level goals for ATD-3 are as follows:

1. Efficient Traffic Management Initiatives for better flow management in domestic airspace.
2. Optimal routes with enhanced capacity in oceanic airspace.

FAA experts meeting with TDS-T team.

NASA Provides Technical Assistance to FAA TBFM Contractor

Michelle Eshow, a NASA senior software lead supporting the Airspace Operations and Safety Program, delivered enhancements to the estimated time of arrival (ETA) validation tool that Lockheed Martin uses to validate the ETA accuracy of its Time-Based Flow Management (TBFM) tool for each formal release. NASA developed the validation tool to assist with TBFM validation, included in the Air Traffic Management (ATM) Technology Demonstration-1 (ATD-1) technology transfer to the Federal Aviation Administration (FAA). In December 2014, representatives of Lockheed Martin, who are refining TBFM under contract to the FAA, asked NASA for assistance in using the tool for their latest release, version 4.3. Ms. Eshow collaborated with Lockheed Martin to understand the causes of the tool's predictions of inaccurate TBFM performance, and refined its analysis. The updated version was delivered on March 2, and has now been used to demonstrate that the latest TBFM release meets its statistical performance requirements.

(POC: Michelle Eshow)

TDS-T Team Hosts FAA Experts

On January 22, NASA's Tactical Departure Scheduling-Terminal (TDS-T) team hosted Federal Aviation Administration (FAA) subject matter experts for a workshop at the North Texas Research Station (NTX) in Fort Worth, Texas. The TDS-T research activity addresses the challenge of simultaneously satisfying national, regional, and local departure constraints while accommodating traffic from both well-equipped and less-equipped airports. During this workshop, traffic management supervisors and front-line managers from Dallas/Fort Worth (DFW) Terminal Radar Approach Control (TRACON) and the air traffic control towers at DFW and Dallas Love airports interacted with the TDS-T prototype decision support tool in the NTX laboratory.

The TDS-T prototype tool ran in shadow mode with live data feeds, and prototype user interfaces were configured to represent different terminal departure control environments: center traffic management unit (TMU), TRACON TMU, large airport tower, and small airport tower. The FAA subject matter experts provided feedback on the TDS-T concept and the prototype tool. The feedback will be used to further refine the concept and technology. Members of NASA's Airspace Technology Demonstration-2 (ATD-2) formulation team observed the workshop and participated in ATD-2 concept definition discussions while at NTX. The ATD-2 formulation team is incorporating TDS-T research findings in the ATD-2 metroplex departure scheduling concept.

(POC: Shawn Engelland)

NASA Ames Hosts Transitioning to Autonomy Workshop

NASA researchers and managers participated in the "Transitioning to Autonomy Workshop: Changes in the Role of Humans in Air Transportation," which took place March 10-12 at NASA Ames Research Center at Moffett Field, Calif. The three-day workshop was attended by numerous industry, academia, and government participants, who heard various presentations and participated in several breakout sessions. The presentations included descriptions of work ongoing in the automotive industry, recent advances in automated mining vehicles and applications to health care. Numbered among the attendees were academic researchers from multiple universities, members of the United States military, and senior personnel from NASA's Airspace Operations and Safety Program.

(POC: Katherine Lee)

ATD-3 Planning and Stakeholder Meetings

The Airspace Technology Demonstration (ATD)-3 planning co-leads, Dr. Kapil Sheth from AMES Research Center and Mr. Mike Koch from Langley Research Center met at NASA Langley Research Center on March 3 to complete project milestones and task planning. On March 4, they visited the Air Traffic Control System Command Center (ATCSCC) in Warrenton, Virginia, where they were provided an overview of air traffic flow management functions and a tour of the operations floor. Sheth and Koch also talked with Mr. Bill Murphy of the International Air Transport Association (IATA), who is interested in collaboration with NASA for harmonization of air navigation service provider operations across the world, starting with the Americas.

The team also visited AvMet Application Inc. and Metron Aviation Inc. to discuss the companies' stakeholder questionnaire responses. Responses from various stakeholders are being consolidated with the help of Crown Consulting Inc., headquarterd in Arlington, Va. On March 12-13, the ATD-3 planning team, along with other NASA researchers, met with American Airlines personnel to discuss their stakeholder questionnaire responses, as well as the future direction for the Dynamic Weather Routes tool. (POC: Kapil Sheth)

PTM HMI Workshops Held at NASA Langley

On March 30-April 3, the Pair-wise Trajectory Management (PTM) team conducted multiple, single-day workshops at NASA Langley Research Center with groups of commercial airline pilots to gather feedback on the PTM Human Machine Interface (HMI). A total of 20 active and recently retired pilots with recent oceanic routes flying experience received an introduction to the PTM concept, and were then asked to discuss and comment on detailed schematics of a proposed airborne PTM HMI. The intention of the workshops was to share current design ideas and gather feedback from subject matter experts and potential PTM HMI end users to ensure that flight crews are ultimately provided with an optimized, intuitive PTM tool. PTM team members will use the feedback gathered at the workshop from the pilot participants to refine the PTM HMI.

The HMI will be assessed in conjunction with flight crew PTM procedures during upcoming human-in-the-loop (HITL) simulation testing. NASA Langley researchers Dr. Jennifer Kibler and Mr. Ryan Chartrand, and Mr. Ken Jones and Mr. Tom Graff from the National Institute of Aerospace, conducted the PTM HMI workshops. A PTM HITL experiment is scheduled to be conducted at NASA Langley in support of the Airspace Technology Demonstration-3 (ATD-3) subproject during fiscal year 2016. (POC: Sherri Brown)

Electronic Flight Bag touch screen in the cockpit of an airplane.

Two TASAR Contractors Win Small Business Awards

NASA has recognized Advanced Aerospace Solutions, LLC (AdvAero) and Engility Corporation with 2014 Small Business Industry Awards at the agency and center levels respectively. The awards recognize outstanding performance on NASA contracts: sound practices in small business programs; effective teaming on contracts; value-added and outstanding support provided on schedule and within cost; and innovative solutions to problems that arise during contract execution.

Engility Corporation was selected as NASA Langley Research Center's large business prime contractor of the year for 2014. AdvAero was selected as NASA Langley's small business subcontractor of the year for 2014, and subsequently was recognized at the agency-wide level as NASA's small business subcontractor of the year. The awards recognize excellent work and accomplishments on the Traffic Aware Strategic Aircrew Requests (TASAR) Sub-Project. TASAR is a new NASA concept for aircraft operations, featuring an on-board automation tool that computes route changes to improve flight efficiency while avoiding conflicts with traffic and other hazards. The technology is anticipated to save fuel and flight time, as well as improve flight schedules, passenger comfort, and pilot and controller workload.

Engility teamed with AdvAero to take TASAR from concept formulation to operational readiness on an aggressive schedule. In just 20 months, the two firms helped to transform TASAR from a drawing-board idea to a well-documented concept of operations, quantified the potential user benefits, developed a prototype state-of-the-art cockpit automation tool – Traffic Aware Planner, or TAP – for optimizing flight trajectories, enabled TAP integration in a high-fidelity simulation facility, installed TAP in AdvAero's fully certified Piaggio Avanti aircraft, and collaborated in the flight-test of TAP in the national airspace system. This success directly contributed to two U.S. airlines pursuing formal NASA partnerships to implement TASAR in their regular operations as soon as possible.

More information is available in this NASA press release: http://www.nasa.gov/press/2015/march/nasa-announces-small-business-industry-awards/ (POC: Sherri Brown)

RTCA Invites Stratway+ Submission

The Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC) 228 Minimum Operational Performance Standards (MOPS) for Unmanned Aircraft Systems (UAS) has invited NASA Langley Research Center's Self-Separation and Sense and Avoid Integration (SSI) Subproject (part of NASA's Unmanned Aircraft Systems [UAS] in the National Airspace [NAS] Project) to submit Stratway+'s algorithms and software implementation for consideration to be included in the MOPS appendix. As part of the appendix, Stratway+ will serve as reference implementation for the self-separation and detect-and-avoid logic required for the integration of UAS in the national airspace system.

Stratway+ is a software library of air traffic separation assurance algorithms developed by the Formal Methods Group of the Safety-Critical Avionics Systems Branch at NASA Langley. Stratway+ provides implementations of state-based and intent-based algorithms for air traffic conflict detection, resolution and prevention. Most of these algorithms are generic with respect to the definition of protected volume. Stratway+ supports cylindrical protected volumes, as well as volumes characterized by both spatial and temporal thresholds, such as those used in the definition of UAS self-separation and detect-and-avoid logics.

In particular, Stratway+ provides a software implementation of the well-clear concept developed by NASA Langley's SSI subproject. This concept has been adopted by the community currently developing the SC 228 MOPS. The core algorithms implemented in Stratway+ have been formally analyzed in the Program Verification System, whereby mathematical proofs of correctness of the algorithms are generated. Stratway+ is being currently used in experiments conducted under NASA's UAS in the NAS Project in collaboration with other research groups. The software components of Stratway+ are covered by several invention disclosures that have been released under NASA's Open Source Agreement.

NASA Ames Sub-Project Leads Attend CDM Meeting

On March 24-25 NASA planning leads, Kapil Sheth (ATD-3 planning co-lead), Shawn Engelland (ATD-2 lead), Nancy Smith and Paul Lee (SMART NAS, NY TBO leads) attended a collaborative decision making (CDM) meeting at JetBlue Airlines' Florida training facility near the Orlando International Airport. On the first day, presentations were made to all attendees, and discussions were held on new weather capabilities, the Strategic Flow Management Application (SFMA, Work Package 5), surface data elements, and handling of traffic during the Chicago Center fire last year. On the second day of the meeting, attendees were split into groups, where each of the sub-teams presented progress on assigned tasks.

There were three main take-away messages. First, the Collaborative Convective Forecast Product will be a year-round product, whereas the new Collaborative Aviation Weather Statement will be available this summer. Second, the Dynamic Weather Routing concept developed at NASA Ames Research Center will be a part of the SFMA work for proposing new routes. Third, although the Federal Aviation Administration's AirBorne ReRouting and Pre-Departure ReRouting Tools will be deployed in the Traffic Flow Management System before April 2015, they will not be widely available until fall 2015. (POC: Kapil Sheth)

NASA Langley Hosts Demonstrations of New Crew-State and Cockpit Tools

On March 10, NASA Langley Research Center personnel gave demonstrations to the Federal Aviation Administration and the International Civil Aviation Organization (ICAO) Flight Operations Panel Working Group on head-up displays, enhanced vision, synthetic vision, and combined vision (HESC). The group observed crew-state monitoring tools (psychophysiological technologies) in combination with new concepts for aircraft attitude awareness in the Visual Imaging Simulator for Transport Aircraft Systems. In addition, three simulator demonstrations of a flight deck-based vision system and interface technologies were also conducted.

The ICAO HESC group comprised of members from Australia, Austria, Germany, Sweden and the United States are developing key guidance material for ANNEX 6, the "Operation of Aircraft Annex to the Convention on International Civil Aviation" document, as well as a manual on all-weather operations, both of which are used worldwide in governing low-visibility landing, surface and departure operations. This technical collaboration provided the group with a better understanding and appreciation of the state of vision system technologies and displays, and their economic and operational benefits, thus facilitating their introduction and acceptance for international use. (POC: Sherri Brown)

Aerial view of NASA Langley Research Center.

Aviation Systems Division Staff Honored at NASA Ames

On January 29, Aviation Systems Division researchers received awards selected and conferred by NASA Ames Research Center's Inventions and Contributions Board, sponsored by the NASA Ames Technology Partnerships Division.

Patent Application Awards:

- Steven Green and Minghong (Gilbert) Wu: "Optimum Strategies for Selecting Descent Flight-Path Angles"

Software Release Awards:

- Heinz Erzberger, David McNally, Kapil Sheth: "Dynamic Weather Routes Tool"
- Todd Lauderdale: "Probabilistic Conflict Detection for Aircraft Using Actual Trajectory Prediction Errors"

Tech Briefs Awards:

- Charles Jorgensen, Shivanjli Sharma: "Method for Visualization of Analog Signals"
- Joseph Rios: "Parallel Dantzig-Wolfe Decomposition"
- Gregory Condon, John Freitas, Rebecca Green, William Preston: "Sector 33 App"
- Russell Paielli: "Trajectory Specification for High-Capacity Air Traffic Control"