



# AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

JAN-MAR 2016 | Quarter 2



NASA Technology Could Reduce Air Travel Delays 2

NASA UTM Collaborator Meeting 9

## AOSP IN THE NEWS

### NASA Technology Could Reduce Air Travel Delays

In the February 18 issue of [Government Computer News](#), reporter Derek Major writes about NASA's Dynamic Weather Routes (DWR) system that "compares weather and air traffic data to find alternate routes" for flights when severe weather is expected to affect planes already airborne. DWR "collects and updates weather and air traffic information every 12 seconds," a modern update to the traditional method that "depends on a teleconference held every two hours." A team has been developing DWR since 2010, "and research shows the software could save 10 minutes per flight."

### The Self-Flying Plane Has Arrived

A [Nextgov.com](#) article written on March 3 reports NASA is currently studying the concept of single-pilot air flights, where a first officer on the ground monitors several aircraft at once. In the case of emergencies or unusual circumstances, the ground-based pilot could transfer responsibilities to colleagues for other flights and focus solely on the flight that needs immediate attention. Should the sole airborne pilot become incapacitated, the plane could be remotely controlled for safe landing.

### How Do Airline Pilots Beat Jetlag?

Writing in the March 16 issue of [ScienceAlert](#), David Nield quotes Erin Flynn-Evans, a member of NASA Ames Research Center's Fatigue Countermeasures Group that studies the effects of sleep loss and jet lag, and conducts training to counter these effects. Flynn-Evans advises travelers to determine the geographical direction of travel, which can then determine nap times to prepare the body for time-zone change.

Westerly travel makes for easier physical adjustment than does flying east. Travel direction can be used to determine nap times in order to prepare for cross-timezones travel. According to Nield, quoting Flynn-Evans, "supplements such as synthetic melatonin can help too. The hormone helps to set the body's sleep cycle, and the synthetic version of it is a popular alternative to sleeping pills," although there remains disagreement about which melatonin formulation is the safest and most effective option.

### NASA Studies Help Understanding of Pilot Fatigue

Writing in the March 23 issue of [WIRED Magazine](#), Ashley Nunes reports that, thanks to NASA research on understanding pilot

fatigue, it's now known that the conditions in which pilots fly matter as much as the time they spend at the controls. These findings facilitated a major change in how fatigue was managed on the flight deck.

Achieving the type of deep restorative sleep necessary to avoid fatigue requires that muscles relax, body temperature fall, and brain activity drop. Longer periods of rest between shifts gives the body the chance to do so. Limiting the total amount of flying required of pilots each month also reduces the chances of fatigue accumulating over consecutive work cycles.

In 2011, the Federal Aviation Administration placed its strictest limits to date on night flying by commercial airline pilots, since working after sunset is more fatiguing than doing so in daylight. U.S. carriers must now give their pilots longer rest opportunities prior to flying – 10 hours compared to eight previously – and provide them 25% percent more continuous time off each month.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### Meeting with ONERA

POC: BANAVAR SRIDHAR

On January 11, Dr. Banavar Sridhar met with the Toulouse, France-based Office National d'Etudes et de Recherches Aéropatiales (ONERA) Scientific Director of the Information Processing and Systems Branch Dr. Philippe Bidaud. Dr. Sridhar is the NASA point of contact for the NASA-ONERA environmental modeling agreement. Dr. Sridhar gave an overview of NASA air traffic management research on the generation of efficient aircraft trajectories in the presence of safety, capacity and environmental constraints. The tasks in this research area are aligned with efforts to meet NASA's responsibilities in the collaboration agreement.

### ATD Industry Day PTM/ TASAR Demonstration

POC: SHERI BROWN

On January 13, the Airspace Technology Demonstration (ATD) Project hosted an Industry Day event at NASA's Ames Research Center to showcase several NASA technology concepts under development to improve flight efficiency and traffic flow management. Two of those, Traffic Aware Strategic Aircrew Requests (TASAR) and Pairwise Trajectory Management (PTM), are cockpit-

based tools under development at NASA's Langley Research Center. NASA Langley's David Wing and Dr. Kelly Burke attended the event to represent TASAR. Mike Koch, also from NASA Langley, was in attendance to represent PTM, a concept meant to improve oceanic operations efficiency by enabling the pairwise reduction of traffic separation requirements, thus allowing aircraft to maximize time flown on optimal flight paths.

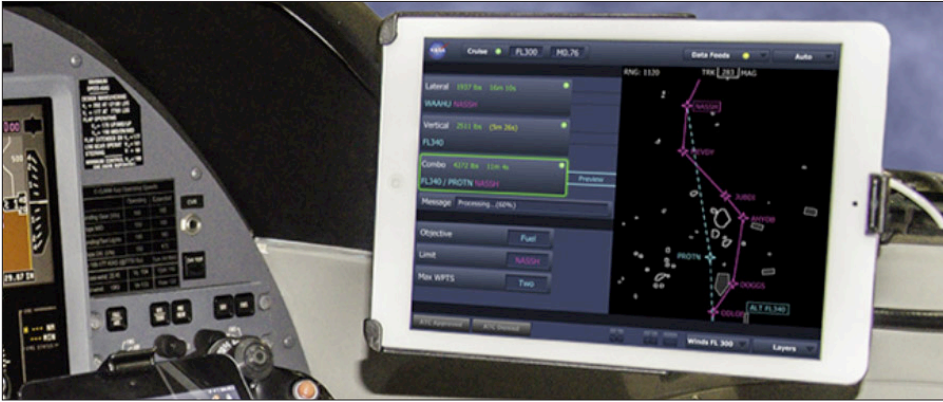
The event was well attended by more than 60 representatives covering a wide range of the aviation community, including airlines, avionics manufacturers, airframe manufactures, product developers, academia, and the Federal Aviation Administration. The format included concept briefings and demonstrations, as well as an open forum with project management to discuss project scope, technology transfer goals, and partnership opportunities. The TASAR and PTM demonstrations used actual and simulated interactive crew interfaces respectively to provide visual aids, while presenters explained the concepts and crew procedures. Both TASAR and PTM drew considerable interest from attendees. The event exposed all concepts to the broad community, and should serve as a springboard for future NASA/ stakeholder collaborations.

### FAA Approval for TASAR Operations Progressing

POC: DAVID WING

Virgin America, one of NASA's two partner airlines on the Traffic Aware Strategic Aircrew Requests (TASAR) activity, has received authorization for TASAR operations from their Federal Aviation Administration (FAA) principal operations inspector (POI). TASAR is a NASA-developed concept that offers onboard automation for the purpose of advising pilots of air traffic control-approvable trajectory changes that are beneficial to their flights. NASA's TASAR technology is comprised of the Traffic Aware Planner (TAP), a software application developed by Engility Corporation for NASA, and designed to be hosted on an electronic flight bag (EFB) in the cockpit. TAP reads aircraft and traffic data directly from onboard avionics and, via internet connectivity, leverages an array of external data sources relevant to flight optimization, such as wind predictions, convective weather, and restricted airspace status. Processing all this information, TAP computes flight-optimizing route changes in real time, and provides the solutions to the aircrew as advisory information. In 2015, NASA entered into multi-year Space Act Agreements with Virgin American and Alaska Airlines to install and test

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*Traffic Aware Planner*

TAP operationally on their Airbus and Boeing aircraft, respectively, in revenue service beginning in 2016.

On January 14, at Virgin's request, NASA briefed Virgin's FAA POI on TASAR. The briefing was held at Virgin's headquarters in Burlingame, Calif., and was conducted by TASAR Principal Investigator David Wing and TASAR Human Factors Lead Dr. Kelly Burke, both from NASA's Langley Research Center, supported by Engility Corporation TAP Chief Engineer Bob Vivona and Advanced Aerospace Solutions TASAR Flight Test Lead and Certification Subject Matter Expert John Maris. The briefing included TAP desktop demonstrations, as well as the software known as Computer Based Trainer. All questions by the POI were fully addressed, in many cases using the direct results of TASAR project activities from the last three-plus years. These activities are all intended to accelerate FAA approval and

airline adoption of TASAR, including in-depth analyses of safety and hazards, certification and operational approval regulations, human factors design and assessments via two human-in-the-loop simulation experiments, and operational readiness assessments via two flight trials. Also on January 14, NASA gave an unplanned briefing to Virgin's FAA dispatch inspector and lead dispatcher. Both recognized TASAR's operational benefits and endorsed moving forward with operational trials. Based on the briefing and demos received, the FAA POI signed Virgin's Operational Specification A061 "Use of Electronic Flight Bag," as updated to include the TAP application, effective January 20. This accomplishment represents a significant milestone on the path toward operational TASAR trials, and future industry adoption should the trials demonstrate benefit. At a separate meeting on March 15, NASA Langley Research

Engineer David Wing and Alaska Airlines Fleet Technology Director Captain Scott Sander briefed the collaborative NASA/Alaska TASAR project to four FAA principal inspectors responsible for overseeing Alaska Airlines' operations, safety and avionics. NASA and Alaska Airlines have a multi-year Space Act Agreement to test TASAR in revenue service. Before TASAR operational trials can commence, signatures from the FAA principal inspectors will be required that approve the installation of TASAR-related hardware and software on Alaska Airlines aircraft and the commencement of TASAR operations.

The general response to the project was strong, and compliments were conveyed as to TAP's intuitive user interface and functional capabilities.

### **FAA Technical Interchange for Weather Routing Technologies**

POC: DAVE McNALLY

On January 20-21, NASA's Ames Research Center hosted a two-day technical interchange meeting with the Federal Aviation Administration's (FAA) Next Generation Air Transportation System (NextGen) organization and MITRE's Center for Advanced Aviation Systems Development. The meeting's purpose was to discuss NASA's current weather routing research capabilities, including Dynamic Weather Routes (DWR)

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

automation, for potential FAA deployment under the Collaborative Air Traffic Management Work Package 5, scheduled for a FAA final investment decision (FID) in 2019, and national airspace system (NAS) deployment in about 2021.

In a separate government-only meeting, the FAA and NASA exchanged technical concepts, test results, and discussed future research towards real-time trajectory automation to improve weather avoidance routes and reduce delay during convective weather events in the NAS. The FAA described their FID preparation requirements, and expressed interest in DWR follow-on research, including common high-value reroutes for multiple flights, and automation to enable time-based metering when weather impedes arrival flows to capacity-constrained airports.

### **ATD-1 Flight Test Demo Milestone Announced**

POC: DENISE SCEARCE

On January 22, in support of the Boeing Company-managed flight test demonstration under the terms of the \$10.9 million, two-year flight-critical systems research contract task entitled “Air Traffic Management Technology Demonstration 1 (ATD-1) Avionics Phase 2,” NASA’s Langley Research Center received an early draft of a Boeing/Honeywell Inc. configurable graphic display

(CGD) and an electronic flight bag human machine interface (HMI) display. NASA Langley will provide pilot orientation to Honeywell and United Airlines crews for the 2017 ATD-1 flight test demonstration of NASA’s avionics prototype Flight Deck Interval Management System (FIM), with orientation for the primary and backup flight crews to occur 30 days prior.

A simulation environment utilizing Langley’s Cockpit Motion Facility will familiarize pilots with 757 and 737 form, fit, and function understanding of FIM operational scenarios. Prior to the simulation and again just prior to the flight test demonstration, a computer-based trainer will reinforce the pilots’ understanding of the avionics prototype interface. Boeing and Honeywell are developing the ATD-1 avionics prototype displays by leveraging an existing NASA reference design used for this past summer’s Interval Management Alternative Clearances Experiment. Boeing is developing the CGD, while Honeywell is developing the HMI displays.

The Boeing/Honeywell wireframes provide the early look necessary for the pilot orientation software developers to begin updating the existing NASA reference design. It is important for the Pilot Orientation displays to be consistent with the ATD-1 avionics prototype displays

so as to reduce pilot-induced errors during the flight test demonstration in order to minimize the impact on the resultant performance data.

The partnership between NASA, Boeing, Honeywell and United illustrates industry’s commitment to ensuring the success of this flight test demonstration and the advancement of the avionics prototype FIM system, which is planned for technology transfer to the Federal Aviation Administration.

### **Technical Interchange with PANYNJ**

POC: YOON JUNG

NASA’s Ames Research Center hosted Mr. Ralph Tamburro, program manager for the Office of Delay Reduction at the Port Authority of New York and New Jersey (PANYNJ), for a technical interchange meeting on January 26. NASA and PANYNJ are collaborating under a Space Act Agreement to conduct collaborative research on efficient surface traffic management through collaborative decision-making (CDM).

During 2009-2010 and again in 2013-2014, NASA Ames researchers conducted a thorough analysis of surface operations data collected before and after the Ground Management Program (GMP) was implemented at the John F. Kennedy International Airport

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

(JFK). The GMP is a departure metering tool managed by the airport authority to improve efficiency of surface operations CDM among air carriers operating at JFK.

The data analysis compared performance measures of surface operations before and after GMP implementation, and PANYNJ data was augmented with publicly available data sources, such as Bureau of Transportation Statistics, to address missing data. Results demonstrated that the implementation of GMP reduced taxi-out and takeoff delays, but increased gate delays. The outcomes were consistent with previous studies, thus validating NASA's approach toward developing a future model of a surface-metering concept. The study was well received by

Mr. Tamburro. Both parties exchanged ideas for future collaboration that could support NASA's Airspace Technology Demonstration-2 (ATD-2) Subproject.

### Data Management (RTT) Team Meeting

POC: MICHELLE ESHOW

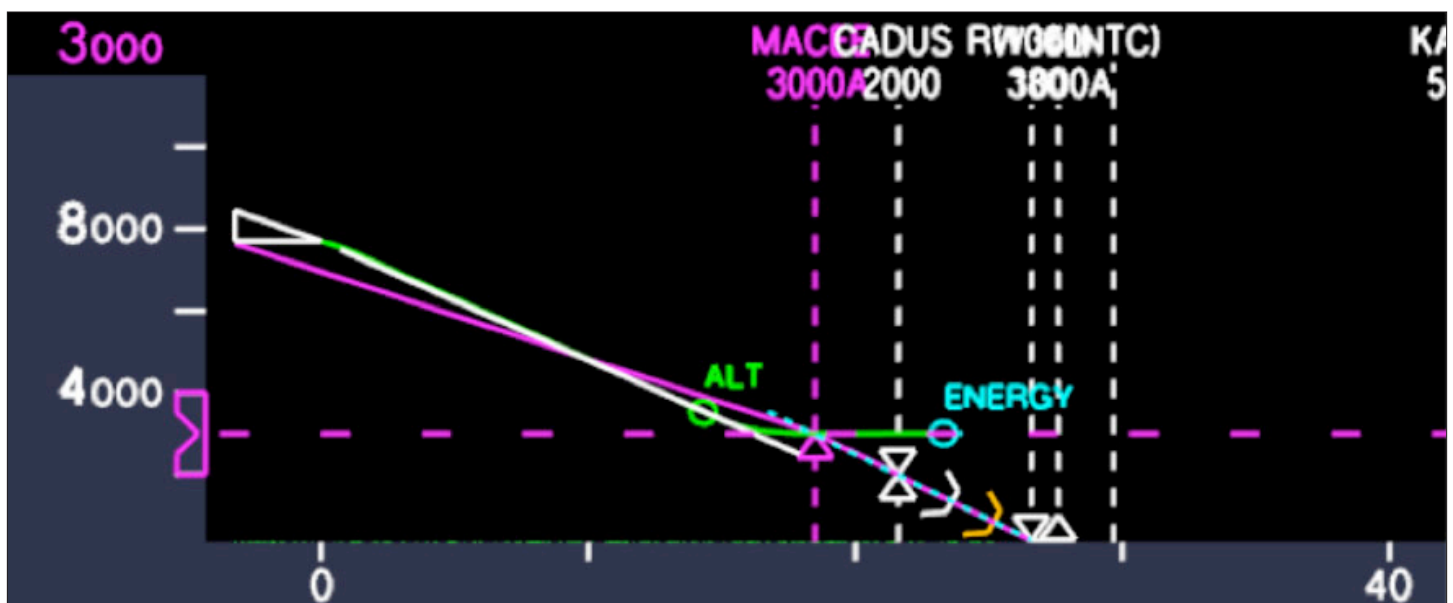
On January 25, NASA's Ames Research Center hosted the first workshop of the NASA/Federal Aviation Administration (FAA) Data Management Research and Technology Transition (RTT). Representing the FAA were Mr. Natesh Manikoth, chief scientist for national airspace system software, and Tom Tessitore, who is involved with data archiving and safety studies at the FAA's William J. Hughes

Technical Center. Mr. Manikoth and NASA researcher Michelle Eshow co-lead the RTT. The purpose of the meeting was to discuss relevant RTT products that could be exchanged between NASA and FAA, including uniform data models, interoperability standards, data sharing, data architecture, and efficient processing algorithms. Six principal investigators within NASA's Airspace Operations and Safety Program presented work with potential relevance to the RTT. Based on the discussions in the workshop, going forward, the leads will write a more detailed RTT plan.

### AIME has Concluded

POC: SHERI BROWN

On January 28, the Automation and Information Management Experiment (AIME) was completed



Representative Display information for AIME Experiment

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

in NASA Langley Research Center's Cockpit Motion Facility's Research Flight Deck (CMF/RFD). Over the preceding 11-week period, 12 airline crews participated, including 24 pilots, completing more than 250 flights and accomplishing a significant milestone in the Air Traffic Management Technology Demonstration 1 (ATD-1) project. AIME's primary objective was to raise the technology readiness level for selected new concepts designed to improve airplane state awareness, particularly in complex situations. Testing occurred across a span of conditions, including scenario emulations encountered in previous accidents. Secondary objectives were to assess the usability of the new technology ideas, such as ease of use, usefulness and overall usage in order to discover previously unknown contributing factors to loss of airplane state awareness; and to advance test infrastructure capability for subsequent studies in the CMF/RFD. The latter included both eye-tracking and physiological measurement systems, and several modifications to create Boeing 787-like flight deck interfaces and supporting systems. AIME was a highly collaborate activity involving personnel from four branches within NASA Langley and NASA's Ames Research Center. External partners included Rockwell-Collins, Ohio University and the National Institute of Aerospace. An overview of AIME was presented at

the American Institute of Aeronautics and Astronautics SciTech Forum January 4-8. Results analysis is underway, with findings expected to be published by autumn 2016.

### SMART-NAS Visit to NextGen FTB

POC: KEE PALOPO

On February 4, to explore collaboration possibilities, the NASA Shadow Mode Assessment using Realistic Technologies for the National Airspace System (SMART-NAS) Test Bed team visited the Next Generation Air Transportation System (NextGen) Florida Test Bed (FTB) Facility, in Daytona, Fla. As the FTB is located next to Daytona Beach International Airport, the visit took place in a structure that houses the airport's international terminal.

At the FTB, Federal Aviation Administration (FAA) NextGen TestBed Lead Mr. Nick Marzelli and FTB team members from Embry-Riddle Aeronautical University met with the NASA team, delivering an overview of operational systems for surface, departure and arrival terminal area airspace, as well as en route and oceanic airspace. These FTB systems include the FAA's Surface Decision Support System, En Route Automation Modernization (ERAM), Advanced Technologies and Oceanic Procedures (ATOPs), and the Traffic Flow Management System.

The SMART-NAS Test Bed does not currently have access to ERAM and ATOPs, which are candidates to be added via a connection to the FTB, and can be included as part of the test bed use-case development consideration.

### FAA's NIWG Surface Team Briefed

POC: SHAWN ENGELLAND

On February 8, Mr. Shawn Engelland, technical lead for the Airspace Technology Demonstration-2 (ATD-2) Subproject, briefed the members of the Federal Aviation Administration's (FAA) Next Generation Air Transportation System (NextGen) Integration Working Group (NIWG) Surface Team. The NIWG, a subcommittee of the FAA's NextGen Advisory Committee, is comprised of several teams; in particular, the NIWG Surface Team generated "Recommendation #2" to the FAA to implement departure-metering capabilities consistent with the FAA's Surface Collaborative Decision Making Concept of Operations.

The FAA's response to the recommendation was a decision to collaborate with NASA on the proposed ATD-2 field demonstration, planned for Charlotte-Douglas International Airport in Charlotte, North Carolina for fiscal year 2018. The NIWG Surface Team is led

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

by Mr. Rob Goldman of Delta Airlines, and Mr. Steve Vail of Mosaic ATM, in partnership with Mr. Andras Kovacs and Ms. Susan Pfungster, both of the FAA.

Mr. Engelland's briefing was positively received and informed the NIWG about NASA's planned efforts to test departure metering and metroplex capabilities through three phases of development and testing.

### **FAA/NASA TIM on TASAR, SWIM and Data Comm**

POC: SHERI BROWN

On February 9, NASA and the Federal Aviation Administration (FAA) held a Technical Interchange Meeting (TIM) at FAA Headquarters to discuss NASA's work on the System Wide Information Management (SWIM), Data Communications, and Traffic Aware Strategic Aircrew Requests (TASAR) software tools. The TIM was hosted by FAA SWIM Portfolio Manager Jon Standley, and was attended by an additional six SWIM team members, Data Communications (Data Comm) Enroute Services Manager John Glassey, NASA TASAR Technical Lead David Wing, and NASA team members from Engility Corporation and the National Institute of Aerospace. The NASA team presented a TASAR overview, as well as demonstrations

of the TASAR software application known as the Traffic Aware Planner (TAP). The FAA provided NASA a demonstration of live SWIM data access via the Jeppesen's Flight Deck Pro application, a modified version of a common electronic flight bag commercial software application, and a prototype airline dispatcher interface.

Information was also exchanged on NASA's TASAR research and development (R&D) activities leading to work with Alaska Airlines and Virgin America in preparation for operational trials, as well as on the FAA SWIM demonstration flight program, which concludes later this year. The FAA is opening a data connection to the SWIM R&D network for the TASAR team, and will allow NASA's airline operational trials to use this SWIM connection.

Discussions were also held on various ways TASAR could integrate with SWIM and, eventually, with Data Comm to mutual benefit. As SWIM data sources grow and as Data Comm services come online enabling digital trajectory change requests and clearances, TASAR is ideally positioned to enhance and accelerate the benefits of these systems to the airspace user. Data Comm initial en route services will come available for testing in 2018.

SWIM access to initial datasets are available for operational use now.

This introductory TIM will be followed by quarterly meetings/telecons to continue information exchange and further explore collaborative opportunities between the FAA and NASA with respect to TASAR.

### **AA Visit Focuses on TASA Collaboration**

POC: SHERI BROWN

As part of an ongoing research collaboration on advanced flight deck technologies – specifically, to coordinate and further define joint activities relevant to research goals in the Technologies for Airplane State Awareness (TASA) Subproject – American Airlines (AA) personnel visited NASA's Langley Research Center on February 16. Visitors included the AA Director of Standards, as well as several check airmen and managers from training centers based in Dallas, Texas; Charlotte, N.C.; and Phoenix, Ariz.

Specific topics included upset/stall training, spatial disorientation, training for attention management, and airplane state awareness technologies. As part of ongoing efforts to implement congressionally mandated stall training for all U.S. airlines, the visitors received



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

TASA background briefings and hands-on demonstrations of the Enhanced Upset Recovery simulator. In addition, tours were provided of the Visual Imaging Simulator for Transport Aircraft Systems Laboratory and the Research Flight Deck.

Under the terms of a Space Act Agreement, efforts are currently underway to provide Langley researchers extensive access to various training simulators/facilities and AA personnel in support of TASA goals. Near-term activities include the development of a video introducing the NASA Langley-AA

partnership, which will be shown in ground school classes for the next AA training cycle starting in April. NASA personnel from several branches supported the demonstrations, tours, and technical discussions, and coordination for the AA visitors was conducted by Captain Dan Kiggins of the National Institute of Aerospace.

### **NASA UTM Collaborator Meeting**

POC: JOEY RIOS

On February 17 in Seattle, Wash., NASA's Unmanned Aircraft Systems (UAV) Traffic Management (UTM)

team met with several dozen commercial partners, as well as representatives from NASA's Airspace Operations and Safety Program and the Federal Aviation Administration. Participants discussed how, going forward, organizations can become UTM service providers. An action item for the NASA UTM group was to create a concept of operations for how multiple, simultaneous instances of UTM might interact. A UTM working group composed of government and industry stakeholders is now in formation to evaluate this concept and potentially use it as a basis for future UTM operations.



# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## NASA NTX ATD-2 Demo Planning

POC: ALAN CAPPS

More than 25 Airspace Technology Demonstration-2 (ATD-2) team members from NASA's Ames Research Center, Mosaic ATM, and Science Applications International Corporation (SAIC) met at the NASA North Texas Research Station (NTX) on February 23-24 to engage in field demonstration planning and training of new personnel. The field demonstration, which will be held at Charlotte Douglas International Airport (CLT) in North Carolina, will begin initial equipment deployment in spring 2016.

The demonstration will gradually integrate arrival/departure/surface operations involving airport, air traffic controllers, and airline personnel, with anticipated full system deployment completed and in daily use at CLT by 2019. The ATD-2 team evaluated surface model tests resulting from the live data systems housed in the NTX laboratory, discussed and planned software and integration testing of the system's physical architecture, and considered the field demonstration test and evaluation strategy. During their two-day gathering, team members toured local operational



*ATD-2 team members at work.*

facilities: the Fort Worth Air Route Traffic Control Center, the Dallas-Fort Worth Air Traffic Control Tower, and the American Airlines Integrated Operations Center. Moving forward toward the field demonstration, the meeting established a common understanding for the ATD-2 team on the many parallel research and development efforts required.

## SMART-NAS Test Bed Architecture Workshop

POC: KEE PALOPO

On February 24-25, NASA's Ames Research Center hosted a Shadow Mode Assessment Using Realistic Technologies for the National Airspace System Project (SMART-NAS) test bed meeting, focusing on architecture design and a cost/benefits assessment. The workshop was attended by more than 80

participants (roughly 60 in person and 20-plus remotely) from NASA's four aeronautics centers, NASA Headquarters staff, personnel from the Federal Aviation Administration, and representatives from industry.

Four NASA Research Announcement (NRA) teams presented their final architectures:

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

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

An important outcome of the workshop was to help solidify the choice of the test bed communication infrastructure for supporting existing and new research, and operational air traffic management systems.

### NASA Langley UA Technology Demonstrations

POC: RANDY BAILEY

On February 24, NASA's Langley Research Center hosted United Airlines (UA) executives for a day of NASA technology demonstrations: a follow-on to a previous workshop held at NASA Langley in October 2015. The UA vice president for corporate safety, security, quality and environment attended the 2015 workshop and requested demonstrations for a larger UA executive group. The demonstrations were conducted in coordination with former Federal Aviation Administration (FAA) Associate Administrator for Aviation Safety Mr. Nick Sabatini.

NASA Langley staff provided briefings and hands-on demonstrations, showcasing NASA research on vision system technologies (specifically, synthetic vision, enhanced flight vision and combined vision systems) and related technologies featured in Langley's Research Flight Deck

Simulator. The simulations focused on the integration of trajectory-based operations, such as area navigation and required navigation performance, with vision system technologies to attain visual flight rules-like airport access and capacities, independent of actual weather or constrained visibility. The group was also provided demonstrations of the enhanced upset recovery simulation in the Integration Flight Deck Simulator, showcasing improvements in stall characteristics and modeling fidelity in support of requirements development to meet new FAA regulations for crew training in a stall environment.

Further, the group received a hands-on demonstration of ongoing NASA research on the employment of multiple psychophysiological measures, including eye gaze tracking, to improve training for commercial airline pilots. Collectively, this work is being conducted under the Technologies for Aircraft State Awareness Subproject, within the Airspace Technology Demonstration Project.

### AOSP Researchers Support California Aerospace Days

POC: RICH COPPENBARGER

On Feb. 29 – March 1, the fifth annual California Aerospace Days

was held at the California State Capitol Building in Sacramento, Calif. Airspace Operations and Safety Program (AOSP) researchers supported this event with a booth highlighting both Airspace Technology Demonstration (ATD)-2 and unmanned aerial systems traffic management research being conducted at NASA's Ames Research Center.

AOSP researchers Rich Coppenbarger and Jane Thippavong hosted exhibits on ATD-2 metroplex departure scheduling and the Dynamic Weather Routes System (DWR), explaining to approximately 1,000 visitors, including students from area schools and state legislators, how these technologies build towards the larger ATD vision of gate-to-gate trajectory-based operations in the national airspace system.



*Rich Coppenbarger speaking with attendee at 5th Annual California Aerospace Days*

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## DFW Board Signs SAA with NASA Ames

POC: PAUL BORCHERS

On March 3, the Dallas/Fort Worth International Airport (DFW) Board of Directors agreed to sign a five-year, non-reimbursable Space Act Agreement (SAA) with NASA's Ames Research Center. This exchange establishes DFW Airport as an active participant in NASA's air traffic management research and development projects through the NASA/Federal Aviation Administration North Texas Research Station (NTX). Under the terms of the SAA, the DFW board will supply accurate aircraft arrival and departure times from the gates at DFW, while NASA will supply repeaters of its advisory displays currently in use at the airport's air traffic control towers.

NTX will be the collection and dissemination point for this data exchange, and will maintain the equipment. The airport will likely use NASA's advisory displays to help manage the ramps it controls at Terminals D and E, and for general situational awareness at its Airport Operations Center. NASA will be able to use the airport data to improve takeoff prediction time accuracy for NASA's advisory tools.

## Stakeholders Briefed on PTM Progress

POC: MICHAEL KOCH

On March 7, Michael Koch of NASA's Langley Research Center briefed the Federal Aviation Administration's (FAA) Manager for Oceanic Air Traffic Procedures Group (AJV-84), Ms. Karen Chiodini, and the FAA's Oceanic Team/Flight Standards Service Reduced Vertical Separation Minimum Lead (AFS-470) Mr. Madison Walton on NASA's Pair-wise Trajectory Management (PTM) Project. Several representatives from the FAA Surveillance and Broadcast Services Program Office were also in attendance.

Since acceptance of the PTM concept by AJV-84 and AFS-470 is crucial to the adoption of the new procedure, the briefing covered the PTM concept and NASA's plans to mature the technology. A continued partnership throughout the lifecycle of the project was also explored. NASA is interested in FAA involvement to help with requirements definition of procedures and ground automation.

The briefing was well received by Ms. Chiodini and Mr. Walton. Both commented that the concept has promise and offered constructive feedback for improvements. NASA will brief Ms. Chiodini and Mr. Walton periodically as the concept matures.

At another meeting on March 9, NASA Langley's Michael Koch, Jennifer Kibler and Ryan Chartrand represented NASA at the quarterly meeting of the Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC)-186 Working Group (WG)-4 in Washington D.C. SC-186/WG4 is tasked with developing advanced interval management (A-IM) minimum operational performance standards, which are new Automatic Dependent Surveillance – Broadcast In capabilities being introduced as part the FAA's Next Generation Air Transportation System Airspace Program. NASA's PTM concept was one of several being considered for inclusion in the A-IM suite of applications. The purpose of the meeting was to assess the feasibility and benefits of candidate concepts to determine which should be included.

The PTM personnel presented three working papers including:

1. Benefits results from a recent fast-time simulation;
2. The design methodology the PTM team used to develop the human machine interface (HMI) for the airborne tools; and
3. A harmonization assessment aimed at identifying PTM functions common to other IM applications, as well as those that are new and must be defined.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

The HMI briefing included a demonstration of display elements and an overview of the display philosophy.

Based on the briefings and other work leading up to the meeting, the committee determined that the concept is reasonably feasible for implementation and the benefits were sufficient enough to include PTM in the A-IM suite of applications for requirements development. It was also noted that the HMI work could be used to inform requirements and serve as a starting point for other applications.

### **NASA Ames Researchers Host Lynbrook High School**

POC: JINN-HWEI CHENG AND WILLIAM CHAN

On March 14, and for the 10th year in a row, NASA's Ames Research Center staff hosted high school students from Lynbrook High School in San Jose, Calif. for the annual Job Shadow Day. The group consisted of 10 students who participated in a presentation of the Airspace Operations and Safety Program's air traffic management work (ATM), which included a discussion of the types of jobs at NASA. The students also toured the NASA Ames ATM labs and flight simulation facilities. Job Shadow continues to be one of the most popular participatory opportunities offered to pupils attending Lynbrook High.

### **ARMD Thrust 6 Autonomy Roadmap**

POC: SHIVANJLI SHARMA

An updated version of the NASA Aeronautics Research Mission Directorate (ARMD) Thrust 6 Roadmap, "Assured Autonomy for Aviation Transformation," was presented at the Aerospace Control and Guidance Systems Committee Meeting (ACGSC) on March 17 in Napa, Calif. ACGSC was focused on design and analysis of control systems for aeronautic and surface vehicles, space systems, and development of autonomous control systems. Ms. Shivanjali Sharma, a Thrust 6 roadmap team member, outlined ARMD's vision of the future of autonomy in aviation over the next 25 years and beyond, and described efforts to develop the roadmap and specific research themes needed to achieve this vision.

The presentation was made to an audience of 25-30 researchers and engineers from government, industry and academia. Attendees had the opportunity for feedback and comments on continuing roadmap development, including thoughts on how partnerships with industry can be formulated to help support research challenges, and how specific applications of near-term autonomous systems can be tested and implemented.

### **First UTM TCL-2 Flight Test Checkout**

POC: KEVIN WITZBERGER

The Unmanned Aerial Vehicles (UAV) Traffic Management (UTM) Subproject completed two days of Technical Capability Level 2 (TCL-2) Checkout #1 flight testing at Moffett Federal Airfield, Calif. on Mar. 23-24. Three NASA Ames Research Center vehicles – a fixed-wing Dragon Eye and two multi-copters known as X8 and IRIS – participated in the visual line-of-site flight test.

Checkout #1 achieved a few firsts for the UTM sub-project: Three UAVs were flown concurrently – the most in the air during a UTM test to date – and, also for the first time, two UAVs were flown in the same area, separated only by altitude. Key participants included 10 flight crew members (including one from NASA's Langley Research Center), one range safety officer, five UTM support staff personnel, several logistics personnel, and five visual observers. Four of the five visual observers were first-time UTM trainees, and soon will be formally certified.

A number of test objectives were identified for TCL-2 Checkout #1, including UTM software capability checks, and personnel procedures and training required to facilitate this test and future flight tests.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

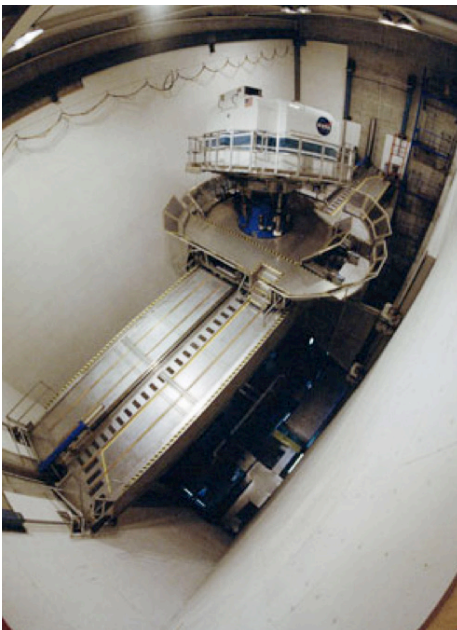
The UTM software appeared to perform as designed. Data analysis is underway. Lessons learned, including those gleaned from the flight-approval process, will be leveraged for the future flight tests.

The next UTM flight test is TCL-2 Checkout #2, scheduled from June 27 to July 1 this year at Reno-Stead Airport in Nevada.

### Third VVAP III Experiment Concludes

POC: SCOTT REARDON

Pilot loss of control is the leading cause of jet casualties worldwide. In response to these incidents, Congress has mandated that aircrews be trained in stall and upset recovery, which airlines attempt to do in



*Vertical Motion Simulator*

motion-based simulators. However, simulator motion-cueing systems may not be configured to provide optimal stall and recovery training.

Third in a series, and aimed at developing cueing requirements for full stall recognition and recovery training, the Visual-Vestibular Active Psychophysics III (VVAP III) experiment, sponsored by the Technologies for Airplane State Awareness Subproject, was performed between April 4 and May 20 in the Vertical Motion Simulator at NASA's Ames Research Center. VVAP III's goal was to develop a model of pilots' combined motion and visual perception dynamics in the pitch/longitudinal, roll/lateral, and heave axes. Results will be used to configure simulator motion cueing systems for stall and recovery training.

Overall, VVAP consists of a multi-axis pitch/roll-tracking task using an aircraft math model near stall. The pilot attempts to keep the aircraft level while a sum-of-sines disturbance is introduced in the pitch and roll axes. The pilot then tracks the disturbance in a simple primary flight display.

Fifteen to 20 general aviation pilots will participate in each of the experiment's iterations, first training with limited or no motion, and

then performing the task with full motion in the pitch, longitudinal, roll, lateral and heave axes. Measurements of simulator visual and motion stimuli and pilot control inputs will be used to estimate the parameters of the pilot model.

## RECOGNITION

### BOE Article Accepted

POC: DR. ANGELA HARRIVEL

Dr. Angela Harrivel of NASA's Langley Research Center is first author on a manuscript entitled "Dynamic Filtering Improves Attentional State Prediction with fNIRS," to be published in the Biomedical Optics Express Journal. The paper describes recent research on the prediction of task engagement via sensing executive attention and resting-state networks in the brain with multi-channel functional near infrared spectroscopy (fNIRS). The work described within contains attentional state prediction accuracy results across various existing and novel fNIRS signal processing methods, details the application of a Kalman filter to accomplish adaptive regression, and discusses dynamic noise removal in the context of functionally connected brain networks. These networks are relevant to external task engagement, mind wandering, meta-awareness, introspective memory recall and rumination.

The co-authors are academic experts in the fields of functional magnetic resonance imaging, psychology, and fNIRS. Flight-simulation motion-based studies currently being conducted at NASA Langley employ fNIRS, electroencephalograms, and sympathetic nervous system measures (known in the aggregate as crew state monitoring technologies)

to detect attentional state. The research aims to mitigate the effects of attentional human performance limiting states by improving crew awareness, thus reducing the frequency of commercial aviation accidents and incidents.

This work is in response to the Commercial Aviation Safety Team, Safety Enhancement 211 entitled "Training for Attention Management" that is supported by the Airspace Technology Demonstration Project.

### NASA Ames Employees Recognized by ARMD AA Awards

POC: KATHY LEE

On March 31, Associate Administrator (AA) for NASA's Aeronautics Research Mission Directorate (ARMD) Dr. Jaiwon Shin presented the 2015 ARMD AA Awards at a ceremony held at NASA's Ames Research Center. The awards are given to individuals and groups, and recognize exemplary performance and essential contributions from across NASA's four aeronautics research facilities.

Airspace Operations and Safety Program individual award winners were Dr. Jaewoo Jung, for High Potentials; Shawn Engelland, for Strategic Partnerships; and Easter Wang, for Program and Mission Support. In addition, NASA Ames

staff were part of the team receiving the Program and Mission Support Group award for the Unmanned Aerial Vehicles (UAV) Traffic Management (UTM) Convention Planning Team.

NASA Ames received the majority of the 2015 awards. Congratulations to the recipients!



L-R: Dr. Jaiwon Shin, Shawn Engelland, Dr. Tom Edwards



L-R: Dr. Jaiwon Shin, Easter Wang, Dr. Tom Edwards



L-R: Dr. Jaiwon Shin, Jaewoo Jung, Dr. Tom Edwards

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