



AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

APR-JUN 2017 | Quarter 3



Approved FAA-NASA Research 5
Transition Plan

ATDs Featured at NASA Tech Day 15
on the Hill

AOSP IN THE NEWS

[America's Plan to Somehow Make Drones Not Ruin the Skies](#)

Wired US (5/03) reports that NASA is supporting the quest with its unmanned aircraft traffic management research program.

[Air Traffic Control for Drones Is Coming. Here's How It Could Work](#)

The Los Angeles Times (5/05) reports that NASA, along with the Federal Aviation Administration and an extensive list of industry partners, has been researching the requirements needed to establish a drone traffic management system. This summer, some of those ideas will be tested in the field.

[Drones Flying by Airports Coming Soon\(ish\)](#)

Nextgov (5/05) reports the sheer number of potential drones in the airspace mean FAA and its partners NASA and various technology companies continue to look at how automation and "self-separation" play roles in the UAS Traffic Management system expected sometime in 2019.

[New FAA Regulation Opens the Door to Drones Responding to Events in Real Time](#)

Commercial UAV News (5/09) reports "this work is intended to be a first step toward a comprehensive UTM system. By agreeing on things like the data format for reporting flight plans and a common system for organizing that data, the industry and the FAA are defining the fundamental building blocks of the UTM: who is flying, where they are flying, and when. We're also leaning on NASA's efforts and the Global UAS Traffic Management Association (GUTMA) to help inform the LAANC working group. There is still a lot of work to be done before we get to a truly comprehensive UTM system, but I'd be lying if I said it isn't fun working to make this happen."

[NASA, University Sign Agreement to Advance UAS Technology](#)

Unmanned Aerial (5/10) reports today that representatives from NASA Armstrong Flight Research Center, Lone Star UAS Center of Excellence and Innovation (LSUASC) at Texas A&M University-Corpus Christi (Island

University), and Texas A&M University System will sign a new space act agreement to further autonomous unmanned aircraft systems (UAS) technology.

[Drones Are Getting Their Own Air Traffic Control with No Need for Humans](#)

Gizmodo (5/16) reports one way NASA research is dealing with this is by facilitating what is called uncontrolled airspace, basically space that isn't regulated by air traffic management. Requiring drones to operate in this specific air space can prevent them from potentially crashing into commercial aircraft. That said, NASA is planning to eventually integrate drones into air space with manned-aircraft.

[How to Track Drone Traffic? NASA Uses This Mobile Command Center](#)

Product Design & Development (5/16) reports at AUVSI's Xponential show last week, NASA was on hand to demonstrate the traffic management systems that will be needed if large "swarms" of drones start operating as part of big industry in commercial airspace.

AOSP IN THE NEWS

[The Real Reason to Get Pumped about Drone Delivery](#)

CNET (5/20) reports that NASA just announced new technology it developed for autonomous crash management to potentially help delivery drones land safely in highly populated areas should something go wrong.

[NASA's New Tech Could Help Drones Safely Land During Emergencies](#)

Fortune US (5/28) reports that Patricia Glaab, an aerospace technologist at NASA Langley Research Center, said she and her fellow NASA colleague and husband, Lou Glaab, have developed crash-landing software for drones.

[NASA Drone Traffic Management Tests Take Off in Reno](#)

ITS International (5/30) reports NASA and its partners are in the midst of testing the next, more complex version of its unmanned aircraft systems (UAS) traffic management (UTM) technologies with live, remotely-operated aircraft, or drones, at six different sites around the US.

[NASA Creating Air Traffic Control System for Drones](#)

KGO-TV (6/06) reports pilots have flight simulators and NASA has a full-sized simulator for air traffic control. They're building a whole new kind of air traffic control, not for airplanes but for drones.

[NASA Tests Drone Traffic Management](#)

GCN.com (6/09) reports NASA wrapped up the second level of testing for its cloud-based unmanned aircraft systems traffic management platform.

[Drone Delivery Hinges on Block-by-Block Weather Forecasts](#)

Bloomberg US (6/21) reports weather reports for drones will rely on multilayered systems of ground-based weather gauges, sensors on the drones themselves, and data from national weather services, all feeding computer models, said Marcus Johnson, a research aerospace engineer at the NASA Ames Research Center at Moffett Field, California. "It's not an easy solution," he said.

[Senators Look to Boost Safe Drone Use in New Legislation](#)

Fedscoop (6/23) reports that the bill would require NASA and the Secretary of Transportation to create an implementation plan for UAS air traffic management, due within a year of the bill's passage in addition to establishing a working group to recommend federal policy for future communications.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

TCL-2 National Campaign Tests Completed

POC: [ARWA AWEISS](#)

This quarter proved to be very exciting for the Unmanned Aircraft Systems (UAS) Traffic Management (UTM) team. Connectivity testing of each National Test Site with the NASA Flight Information Management System (FIMS) began in mid-April. This testing was critical to prepare the team to fly UAS in UTM controlled airspace for the Technology Capability Level 2 (TCL-2) National Campaign during the following months. NASA provided the check-out documents for testing the connections from each industry partner to the FIMS platform. Partners continued testing their connections to the FIMS according to NASA's Application Program Interfaces (APIs), Interface Control Documents (ICDs), and other checkout documents. Researchers began shakedown testing in mid-May at NASA and the FAA's UAS test sites and concluded data collection runs with NASA's FIMS research platform on June 9, according to NASA's APIs, ICDs and check-out documents for TCL-2. Each test site flew multiple UAS in beyond visual line of site operations for several use cases. Project team members observed flight tests at the test sites and monitored the campaign from the UTM Lab at NASA's Ames Research Center in California. The Nevada UAS National Test Site hosted a media day on May 25 to showcase UTM and example

operations of UAS as part of TCL-2. The flight demonstration, called the UTM TCL-2 National Campaign, focused on flying small, remotely-operated aircraft—or drones—beyond the pilot's line of sight in sparsely populated areas to demonstrate, evaluate, and refine functional designs and UTM technology prototypes. Participants in the Nevada tests included Amazon Prime Air, Airmap, the Reno Tahoe Airport Authority, the University of Nevada Reno, Carbon Autonomous, and Flirtey UAS. Thomas Prevot, the lead UTM representative, was interviewed by a local television station and other media. The news clip can be found at: <http://www.ktvn.com/category/170899/video-landing-page?clipId=13361871&autostart=true>

From June 5 through 9, NASA researchers completed the data collection flight tests, conducting multiple, simultaneous beyond line of sight operations with about 40 partners connected to the NASA research platform for the TCL-2 campaign at the Alaska, New York, North Dakota, Texas and Virginia test sites. The Nevada test site completed testing in May. All test sites used NASA's UTM research platform, a prototype of the FIMS that will be transitioned to the FAA, and a UAS Service Supplier (USS) technology prototype that determines performance standards and requirements of industry and visualization tools for iPads, PCs and the UTM lab video wall. These tools

allowed researchers to view the data sent to the data collection system, observe the operations, and validate the data feeds at Ames in real-time. Five companies implemented their USS and connected them to the NASA systems. NASA researchers in the field collected data on information requirements for operators and determined what types of information service suppliers will need to share with each other. Results from the TCL-2 national campaign will feed into designs and features of the next technical capability level for FIMS and USS, as well as refined operation concepts and use cases.

A separate media day was held on June 6 at Ames' UTM Lab and three of the UAS National test sites to highlight UTM TCL-2 National Campaign testing. Local media were invited to visit the sites, observe and film UTM and unmanned vehicle flights, and to interview NASA and test site personnel. J.D. Harrington of the Public Affairs Office at NASA Headquarters (HQ) led the media day. NASA attendees included Tom Prevot, Joey Rios, Ron Johnson, Marcus Johnson, and Jeff Homola. Below are links to media coverage of the event:

[Alaska](#)

[North Dakota](#)

(Posted by The Bismarck Tribune and Grand Forks Herald)

[Texas](#)

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[NASA Ames](#)

KGO-TV (ABC, Channel 7)

[Facebook Live](#)

Following the conclusion of the data tests, TCL-2 national campaign debriefs with the six national test sites were completed between June 13 and 23. Data analysis is ongoing, with more data and final reports from the test sites expected by the end of June. This collaborative effort between NASA, the FAA, industry, and academia was a success, and demonstrated close-proximity BVLOS operations in sparsely-populated areas. The operational scenarios included package delivery, farmland survey, search and rescue, railway inspection, and video surveillance. The tests will be used to evaluate concepts developed by the FAA-NASA Research Transition Teams.

ATD-2 Post Requirements Freeze (FRZ1) Workshop

POC: [SHIVANJLI SHARMA](#)

The NASA Airspace Technology Demonstration-2 (ATD-2) team held a Post-Evaluation Requirements Freeze (FRZ1) workshop from April 3 to 5 at NASA's Ames Research Center in California. More than 50 participants from the NASA ATD-2 team were in attendance, including team members from Human Solutions Inc., Mosaic ATM, Science Applications International



The ATD-2 Team

Corporation, San Jose State University Research Foundation and Universities Space Research Association. The FRZ1 meeting was held on March 29, with field demo partners and other stakeholders expected to reach an agreement on capabilities to be included in the Phase 1 Field Demo, which will go live in September of this year. The objective of the post-FRZ1 workshop was to discuss key points from the FRZ1 meeting and to review critical path tasks to be completed before the Phase 1 Field Demo. The workshop provided a plan for completing these tasks, consistent with Field Demo Partner expectations and project timelines. The agenda included an overview of the concept of use, software development plans during the Phase 1 Field Demo, and plans for the next six months. The Phase 1 effort has shifted from system development to

system hardening, and the Phase 2 Agile development process is now underway.

Approved FAA-NASA Research Transition Plan

POC: [TOM PREVOT](#)

FAA Administrator Michael Huerta recently signed off on the joint FAA-NASA Research Transition Plan in early April. The next steps are finalizing the Unmanned Aircraft System Traffic Management (UTM) pilot project. It is expected that the UTM pilot project will continue some of the Technical Challenge Level-2 national campaign activities. As part of a collaboration with industry, the pilot project demonstration is expected to have a Notification and Authorization Capability, a UTM prototype, and a digital ID capability.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

ATD-2 Highlighted at Collaborative Decision Making (CDM) Meetings

POC: [RICH COPPENBARGER](#)

NASA engaged with both industry and FAA regarding NASA's Airspace Technology Demonstration-2 (ATD-2) research efforts during the Collaborative Decision Making (CDM) meetings held on Dallas on April 11 and 12. ATD-2 demonstrations also were provided at the NASA North Texas Research Station (NTX) to the CDM Automation Team (CAT) and Surface CDM Team (SCT) on April 10 and 11. Also participating in the demos at NTX were FAA managers and ATD-2 field demo partners from the Charlotte Douglas International Airport Tower, Terminal Radar Approach Control Center, the National Air Traffic Controllers Association, and American Airlines.

At the SCT meeting on April 11, NASA presented insights from field demo partners gathered during shadow evaluations and simulations, along with details on ATD-2 scheduling and metering functions. The following day, ATD-2 was the primary topic presented by the SCT during their progress update at the yearly CDM Spring General Session. During this session, NASA presented the ATD-2 project plan and technology maturation efforts leading up to the Phase 1 Field Demonstration. SCT representatives described how ATD-2 is "bringing to life" the Surface CDM concept that resulted from nearly a decade of collaboration between FAA and industry. A primary topic of discussion was ATD-2's need for departure intent data from airlines in the form of Earliest Off Block Time (EOBT), and the need for scheduling algorithms that are robust

to varying levels of EOBT quality. Also discussed were the ways that mobile applications for ATD-2 could allow data exchange directly with pilots for departure scheduling at small airports, or for operators not equipped with ramp facilities. NASA also met with FAA managers to discuss how ATD-2 will influence requirements for the Terminal Flight Data Manager program, under which NextGen surface automation will be incrementally deployed nationwide.

ATD-3 TASAR and AGI Meeting at NASA Langley Research Center

POC: [KAPIL SHETH](#)

A meeting to discuss the Airspace Technology Demonstration-3 (ATD-3) Traffic Aware Strategic Aircrew Requests (TASAR) Flight Trial 3 (FT-3) and Air-Ground Integration was held at NASA's Langley Research Center in Virginia, from April 11 through 13. The TASAR FT-3 will be held in May 2018, and preparations have begun to establish the goals for this activity. During the meeting, the goals and objectives were discussed by personnel from Langley, NASA Ames Research Center in California, and Advanced Aerospace Solutions (AdvAero), a subsidiary of Marinvent, a Canadian company. The main goals of FT-3 are to develop functionality to combine



The ATD-2 team conducting presentations of their research activities at NTX.

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ATD-3 Air-Ground Integration Team in front of a Langley Research Center Falcon 20.

airborne and ground weather data, to enhance the existing human-machine interface, and to evaluate the effectiveness and benefits of this functionality. The FT-3 will be conducted on a Langley Falcon 20 aircraft, which the team had a chance to visit (see image above). The TASAR software received the 2016 NASA Software of the Year award and a ceremony was held to present awards to the team members. A meeting to discuss the plans for demonstration of the air-ground integration activity was also held on the last day. The plans were presented to the ATD Project Manager on Wednesday, April 19.

IDM TBFM Development “Mini-HITL”

POC: [NANCY SMITH](#)

Researchers from the Airspace Operations Laboratory at NASA’s

Ames Research Center in California conducted a three-day Integrated Demand Management (IDM) working meeting with retired subject matter experts from April 11 through 13. Activities included an IDM “mini-Human-in-the-Loop” (HITL) simulation to evaluate and refine scenarios, procedures, and a new Time Based Flow Management adaptation in preparation for a June HITL simulation. A briefing about the status of this year’s IDM research was presented to the Collaborative Decision Making Flow Evaluation Team, and included presentations by AOSP researchers from the Dynamic Routes for Arrivals in Weather (DRAW) element of Airspace Technology Demonstration-3 (ATD), and DRAW’s proposed Optimized Route Capability (ORC). Both ATD and IDM researchers recognized the possibilities for operational integration of IDM with

DRAW, as well as the potential for adapting the ORC algorithm to support IDM re-route advisories.

IDM Briefing to the FAA/ Industry CDM Flow Evaluation Team

POC: [HEATHER ARNESON](#)

Under NASA-funded NASA research announcements supporting Integrated Demand Management (IDM), METRON Aviation, Inc. and MOSAIC ATM, Inc. are developing a decision-support capability for setting rates across multiple Flow Constrained Areas in Collaborative Trajectory Options Programs and predicting Trajectory Option Sets given the traffic demand, available capacity, and airspace and weather constraints. On April 12, during an IDM briefing to the Collaborative Decision Making Flow Evaluation Team (FET), Heather Arneson and Deepak Kulkarni from NASA’s Ames Research Center in California, Bob Hoffman from METRON, and Bill Hall from Mosaic ATM, provided presentations on this work. The intent of the presentations was to inform the FET about the ongoing efforts by the research teams that complement IDM. The presentations were well-received by the FET, who expressed interest in continuing the dialog on the research efforts. Representatives

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from the National Business Aviation Association (NBAA), Southwest Airlines, JetBlue, American Airlines, Delta, FedEx, and United Airlines also attended.

Autonomy and Next Generation Flight Deck Symposium

POC: [DR. RICHARD MOGFORD](#)

The NASA Aeronautics Research Institute, in cooperation with SAE International, hosted the Autonomy and Next Generation Flight Deck Symposium on April 18 and 19 at NASA's Ames Research Center in California. The Autonomy and Next Generation Flight Deck Symposium provided a forum for aerospace companies, government agencies, universities, and individuals to meet and share their ideas with researchers and industry leaders. The meeting encouraged discussions on the latest developments in engineering practices and fostered debate on possible future trends in autonomy and flight deck technology. The technologies and engineering practices that were discussed at the symposium are applicable to NASA research efforts involving Next Generation Air Transportation System NextGen, Unmanned Aircraft Systems (UAS), UAS Traffic Management, spacecraft, smart sensors, artificial intelligence, the International Space Station, cybersecurity and transformative advanced flight decks and aircraft. Approximately 60 people attended the two-day event.

Workshop for ATD-2 NAS-Wide Benefits Assessment

POC: [RICH COPPENBARGER](#)

On April 19, NASA's Ames Research Center in California hosted a workshop with the ATAC Corporation-led team responsible for a NAS-wide assessment of the benefits and costs of Airspace Technology Demonstration-2's (ATD-2) Integrated Arrival, Departure, and Surface Operations (IADS) system. The purpose of the workshop was to convey details on IADS scheduling and metering functions in preparation for ATAC's upcoming modeling and simulation studies for benefits assessment. The ATAC team will run fast-time simulations using NASA's Surface Operations Simulator and Scheduler for key sites that include Charlotte Douglas International Airport, Dallas-Fort Worth International Airport, and Newark Liberty International Airport. Simulations will use traffic scenarios based on FAA selected canonical days in 2016, designed to facilitate the extrapolation of benefits across the national airspace system. Benefits and costs will be assessed for technology increments representing each phase of ATD-2. Where applicable, studies will capture IADS benefits related to the entire metroplex, including potential benefits at satellite airports and within shared departure airspace. The ATAC team, which includes MIT Lincoln

Laboratory and MCR, is conducting this investigation under a NASA research announcement contract that will conclude in 2018. To support discussions during the workshop, a live IADS demonstration was provided to the ATAC team; the demo was controlled remotely from the NTX and broadcast over WebEx.

CLT ATCT/TRACON Back room ATD-2 Training and System Familiarization Session

POC: [SHIVANJLI SHARMA](#)

On February 1, NASA's Ames Research Center in California hosted tours of some of its unique aeronautics facilities to members of the FAA's Unmanned Aircraft Safety Team (UAST). The FAA requested the visit, which began with an overview of Ames and its aeronautics research presented by Deputy Director of Aeronautics, William Van Dalsem. The group then toured the Airspace Operations Laboratory, FutureFlight Central, the National Full-Scale Aerodynamics Complex and the small Unmanned Aerial System Autonomy Research Complex. In addition to the FAA, attendee organizations included AT&T, DJI, Inc., CNN, Amazon, the News Media Coalition, Pierce Aerospace, Cape Productions, Resilient Solutions and the Technology Exploration Group. Attendees also participated in the UAST's second team meeting held in Mountain View on February 2.

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Technical Interchange on System-Wide Safety with FAA RTT

POC: [JESSICA NOWINSKI](#)

A meeting on System Wide Safety Assurance Research Technology Transfer (RTT) took place on April 25 at the FAA Headquarters. Jessica Nowinski from NASA Headquarters in Washington, DC, Guillaume Brat, and, by phone, Bryan Matthews and Matthew Daigle from NASA's Ames Research Center in California had a discussion with FAA stakeholders about progress on Verification and Validation, Data Mining for precursor detection, and Real-Time Safety Prediction. The RTT meeting enabled participants to look for new opportunities to share and build on research conducted by FAA, NASA, and other government agencies; clear roadblocks to technology sharing and transfer; and plan for future collaborative efforts. Various FAA stakeholders expressed interest in further engagement on Data Mining and Real-Time Safety Prediction work.

DFW Airport Executive Vice President of Operations Visits North Texas Research Station

POC: [PAUL BORCHERS](#)

On April 25, the NASA North Texas (NTX) Research Station team hosted executives from Dallas-Fort Worth International Airport (DFW), including the Executive Vice President of Operations, the Vice

President for Environmental Affairs, and the Vice President of Operations. The visitors received an orientation to the NTX Research Station, and reviewed the data-sharing arrangement between DFW and NASA established through a non-reimbursable Space Act Agreement. The executives also observed an overview of the Airspace Technology Demonstration-2 (ATD-2) project, including the concept, technologies, and plans for the Phase 1 Field Demonstration that will begin this fall at Charlotte Douglas International Airport. Phase 3 of the ATD-2 demonstration, scheduled to begin in September 2019, will include an evaluation of the ATD-2 system capabilities in the DFW metroplex environment. The DFW Airport leaders expressed their support for this ongoing collaboration.

Air-Ground Integration Demonstration Meeting at Alaska Airlines

POC: [DAVID WING](#)

A meeting to discuss the Airspace Technology Demonstration-3 Air-Ground Integration (AGI) activity was held at Alaska Airlines in Seattle, from April 26 through 28th. During the meeting, personnel from NASA's Ames Research Center in California, NASA's Langley Research Center in Virginia, and Robust Analytics discussed the implementation of air and ground integration parameters. Alaska Airlines submitted a strong

proposal for partnering with NASA for the 2020 demonstration of NASA's air-ground integration technologies. Under a previous Space Act Agreement (SAA), Alaska Airlines is installing the Traffic Aware Planner (TAP) software on three Boeing B737 aircraft. Under an extended SAA, to be developed and signed by September, Alaska Airlines will install the National Airspace System Constraint Evaluation and Notification tool in their Air Traffic Control Coordinator/Dispatch operations, and extend the installation of TAP to approximately seven more aircraft. Under a Small Business Innovative Research Phase II contract, Robust Analytics developed an air-ground integrated solution that provides message communications infrastructure but lacks the generation of efficient rerouting advisories. Robust Analytics has proposed to extend the work and be a partner in this AGI activity with Alaska Airlines and NASA.

FAA Low Altitude Authorization and Notification Capability (LAANC) Meeting

POC: [DR. THOMAS PREVOT](#)

On May 1, NASA participated in the FAA's Low Altitude Authorization and Notification Capability (LAANC) Industry Workshop III in Washington, DC. LAANC will provide an early capability towards Unmanned Aircraft System (UAS) Traffic Management. The LAANC

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

workshop reviewed the timeline, use-cases, and on-boarding procedures for industry partners that will participate as UAS Service Suppliers (USS) in the planned LAANC demonstration. The NASA/FAA UTM Research Technology Transfer Concepts working group and the LAANC team are coordinating LAANC and UTM messaging, terminology, concepts, and activities.

ATD-2 Project Completes FAA Safety Risk Management Review of Phase 1 Field Demo

POC: [AL CAPPS](#)

From May 9 through 11, the FAA conducted a Safety Risk Management (SRM) Review of the Airspace Technology Demonstration-2 (ATD-2) Phase 1 Field Demonstration. NASA and its field demo partners will demonstrate ATD-2 integrated surface metering and airspace departure scheduling technologies at the American Airlines Ramp Control Tower, FAA Charlotte Douglas International Airport Air

Traffic Control Tower, and FAA Washington En Route Center starting in late 2017. Meeting at the Carolinas Aviation Museum in Charlotte, the SRM Panel was composed of representatives from the FAA, the National Air Traffic Controllers Association, and American Airlines, who were responsible for implementing operational changes, accepting risks, validating identified controls, and implementing safety mitigations.

The first day of the demonstration was focused on assessing the safety impacts related to the integration of the ATD-2 system with the FAA's Time-Based Flow Management (TBFM) system. The last two days were dedicated to analyzing risks associated with the ATD-2 system, Phase 1 Concept of Use, and field demo site operations. The SRM process consists of reviewing the current state and the proposed change, identifying potential safety risks, and analyzing each risk by evaluating existing controls and its effect, then determining the

severity and likelihood of the risk. Preliminary analysis of the safety risks of the ATD-2 system integration with TBFM indicate minimal impact to current operations. However, the plan is to implement the appropriate controls prior to the Phase 1 Demo. The SRM Panel's report is expected to conclude that the ATD-2 project did not increase any safety risks to operations and its users. These results will be recorded in an SRM Document, which will complete a key step before operational use of the ATD-2 system begins.

NASA's ATM Research Featured at ATCA Technical Symposium, May 16-18

POC: [BRYAN BARMORE](#) AND [TOM PREVOT](#)

NASA's Air Traffic Management research and development was showcased during the annual 2017 Air Traffic Control Association (ATCA) Technical Symposium's Tech Center Tuesday event on May 16 at the FAA William J. Hughes Technical Center in Atlantic City. This year's theme was "Transformation through Operational Integration," and featured technical tours, demonstrations, and exhibits in a variety of aviation fields from over 40 different projects, programs and organizations. NASA had two booths that showcased the Airspace Technology Demonstration (ATD) sub-projects and the Unmanned Aircraft System (UAS) Traffic Management (UTM) technologies.



Attendees participating at the FAA's SRM Review of the ATD-2 Phase 1 Field Demo

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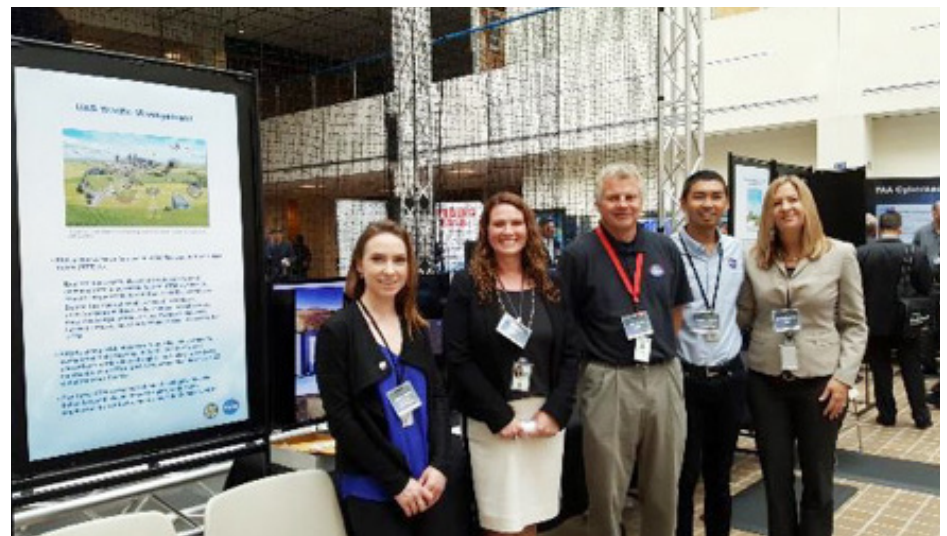


NASA team staffing the NASA ATD/TBO booth at Tech Center Tuesday

The ATD-1 concept animation and Avionics Phase 2 flight test video was featured. The ATD-2 materials included live data views of the technologies that will be used as part of the Phase 1 Field Demonstration, as well as camera feeds of surface operations at CLT. The ATD booth also premiered the new ATD-3 concept animation about the integration of ground-based tools and a flight-deck-based tool focusing on improving en route and arrival phases of flight. The UTM booth featured joint NASA/FAA posters, and was staffed by both NASA and FAA personnel. Exhibit visitors included government and industry representatives who showed considerable interest throughout the event. They were treated to a simulated scenario of traffic at the six FAA UAS test sites and in the San Francisco Bay Area. They could also view functions of the UTM research platform on three iPad apps running Insight-UTM, the UTM

research visualization app, and on a display showing selected UAS in a Google Earth environment.

In addition, briefings of NASA's ATD's research were provided to Congressmen Frank LoBiondo (R-NJ) and Rick Larsen (D-WA). Jim Eck, the FAA's Assistant Administrator for NextGen, accompanied them.



NASA UTM team in front of the UTM booth at Tech Center Tuesday

Following Tech Center Tuesday, on May 17, Bryan Barmore and Tom Prevot of NASA participated as speakers on technical panels at the Technical Symposium in Atlantic City. Barmore participated in a panel discussion titled *Transition of the NAS to a Time-Based Management System - Technologies and Capabilities*, which also included senior representatives from the FAA and MITRE. The panel featured the research and technical capabilities planned to support time-based management as part of the FAA's NextGen concept. Prevot participated with industry members in an FAA moderated panel on *Risk Mitigation Activities for Enabling UTM Operation*. Approximately 500 people attended the ATCA conference, with representatives from a wide range of industry supporting the FAA and air traffic control.

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SBIR Phase II Kickoff Meeting for the IMMA Prototype for Trajectory-Based Operations

POC: [BRYAN BARMORE](#)

A kickoff meeting for the Integrated Multi-Mode Automation (IMMA) Phase II Small Business Innovation Research (SBIR) program was held at NASA's Langley Research Center in Virginia on May 17. Led by ATCorp, this SBIR is tasked with designing, building, and demonstrating two prototypes of the IMMA concept in support of Trajectory Based Operations (TBO).

IMMA provides automation support to air traffic controllers that simplifies the inherent complexities of using a variety of different TBO and trajectory implementation strategies, such as speed and path control, required time-of-arrival, and interval management. Additionally, IMMA helps the controller execute the desired trajectories, maintain situational awareness at all times, and support off-nominal situations. This support tool provides automation by focusing the controller interactions on common core functions that all TBO operations must support, like determining the initial clearance and monitoring compliance. The first prototype that will be developed targets a near-term TBO environment, potentially within the next five to ten years,

while the second prototype targets farther-term TBO operations more than a decade away.

During the Phase I effort, ATCorp successfully demonstrated the technical feasibility of IMMA through a proof-of-concept demonstration. IMMA supports NASA's far-term TBO research and has high potential for technology transfer to the FAA. Steve Bradford, Marc Buntin, Biruk Abraham, and Rob Hunt of the FAA have already expressed interest in staying abreast of the IMMA prototype development. This SBIR is being supported by the Shadow Mode Assessment Using Realistic Technologies for the National Airspace System testbed for Safe TBO project in AOSP.

First Dynamic Routes for Arrivals in Weather (DRAW) HITL Simulation Completed

POC: [KAPIL SHETH](#)

The Airspace Technology Demonstration-3 project successfully conducted its first human-in-the-loop (HITL) simulation data runs of the Dynamic Routes for Arrivals in Weather (DRAW) concept this past quarter. In preparation for the HITL, the team conducted a shakedown HITL on April 5 and 6 that included a recently retired traffic manager, an area

supervisor, and seven controller subject matter experts (SME). The simulation went smoothly, with no significant simulation-related anomalies, allowing the DRAW team to focus on their objectives of evaluating operational procedures and scenario traffic levels to be used for DRAW HITL #1—the team's first data collection simulation scheduled for mid-May.

Feedback from the shakedown SMEs showed that the DRAW functionality worked well, but the scenario complexity needed to be increased for the data collection runs, which were successfully completed from May 16 through 25. The DRAW HITL #1 was held in the Air Traffic Controller Lab at NASA's Ames Research Center in California in two three-day sessions over a two-week period. Each session involved two recently retired traffic managers using and evaluating the DRAW tool, with the same team of five recently retired controllers working traffic downstream in both sessions. The primary technical objective of DRAW HITL #1 was to obtain feedback on DRAW tool usage and the single-scheduler concept of operations.

Initial feedback from the traffic managers highlighted the ease of managing arrival traffic with DRAW. Traffic managers and controllers suggested DRAW's effectiveness

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Subject Controllers Supporting the DRAW HITL Simulation

and benefit over current operations could be accentuated further with more complicated scenarios in future HITLs. The next DRAW HITL is planned for late September.

ATD-2 Familiarization for FAA Executives

POC: [SHAWN ENGELLAND](#)

NASA researchers Gautam H. Shah and Kevin Cunningham from the

Langley Research Center in Virginia hosted two groups of American Airlines (AAL) fleet managers and senior check airmen on March 8 and 9. As part of an ongoing collaboration between Langley and AAL, Langley provided technical briefings and a flight simulator demonstration of technologies to enhance critical stall recognition and recovery simulation fidelity. The representatives from AAL also



FAA executives visiting FAA Tower at CLT

observed demonstrations of the Integration Flight Deck, among other briefings and demonstrations of in attention management technologies and display concepts by Technologies for Airplane State Awareness (TASA) researchers.

Research conducted at Langley within the TASA subproject has enabled improvements in the flight dynamics models of transport airplane simulations, so that full stall training may be performed during airline pilot training. The FAA has required airline training programs to add full stall training by 2019. Langley and AAL personnel plan additional visits to each other's facilities during the coming months.

Management by Trajectory NRA Technical Interchange Meeting

POC: [BRYAN BARMORE](#)

On June 1, the Advanced 4D Trajectory Based Operations (4DT) research team conducted a technical interchange meeting with Mosaic ATM, Inc. on their ongoing Management by Trajectory (MBT) NASA Research Announcement (NRA) contract at NASA's Langley Research Center in Virginia. The MBT research team is tasked with defining an MBT concept of operations, studying the impacts of possible changes in roles and

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responsibilities between the various agents in the air traffic system, and identifying the concept's potential impact on system safety in a way that brings the National Airspace System closer to a full Trajectory Based Operations environment. In addition to representatives from Mosaic ATM, other attendees at the meeting included representatives from NASA, Honeywell, and Systems Engenuity, Inc. Langley researchers and Mosaic ATM discussed the contractor's draft concept of operations document, mainly focusing on the applicable use cases and possible degraded modes associated with an MBT air traffic environment. This NRA is supported by the Shadow Mode Assessment Using Realistic Technologies for the National Airspace System (SMART-NAS) Project, and is focused on improving and enhancing the management and flow of airspace traffic within the National Airspace System.

Build 1.1 delivered for TBO Toolkit for Integrated Ground and Air Research

POC: [BRYAN BARMORE](#)

Researchers at NASA's Langley Research Center in Virginia delivered build 1.1 of the Trajectory Based Operations Toolkit for Integrated Ground and Air Research (TBO-TIGAR) system on June 2.

TBO-TIGAR is a rapid prototyping and testing environment for advanced Air Traffic Management concepts and technologies. TBO-TIGAR previously integrated Data Communications, Advanced Interval Management, and Dynamic Required Navigation Performance routing capabilities. TBO-TIGAR works within the Airspace and Traffic Operations Simulation and Shadow Mode Assessment Using Realistic Technologies for the National Airspace System testbed environments, allowing the use of many other NASA air traffic management simulation components. Version 1.1 increases the fidelity of the vehicle trajectory modeling, introduces the use of the Efficient Universal Trajectory Language (EUTL) to store and communicate trajectories, adds performance models for many more vehicle types, adds the ability to load and display separate truth and predicted wind fields, models speed advisories from the FAA Ground Interval Management for Spacing system to meet a scheduled time of arrival, and improves data collection abilities. The new trajectory modeling and EUTL format will allow for easier inclusion of emerging vehicle types such as supersonic aircraft, Unmanned Aircraft Systems, and personal air vehicles for future research. This version of TBO-TIGAR will be used to support an upcoming batch study

measuring the trade-offs between different methods of delivering aircraft to a metering schedule.

Remote ATD-2 Briefing and Demo to Stakeholders

POC: [AL CAPPIS](#)

On June 9, NASA provided a remote Airspace Technology Demonstration-2 (ATD-2) briefing and demonstration to 70 stakeholders. FAA headquarters participants hailed from a variety of organizations, including NextGen, Program Management, System Operations and System Requirements. FAA and National Air Traffic Controllers Association members of the Terminal Flight Data Manager Operations team participated. Participants also included representatives from air carriers operating at the Charlotte Douglas International Airport field demo site, pilot unions, Dallas-Fort Worth International Airport, McCarran International Airport, and various other industry stakeholders. The demonstration started with a briefing on the ATD-2 concept, the process to gather requirements from stakeholders for the Phase 1 Field Demonstration, Surface-Collaborative Decision Making principles used in the ATD-2 system, data exchange and integration features that facilitate collaboration among participating

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operational facilities, interchange between the sub-components, and analysis tools. Following the briefing, NASA presenters conducted a demonstration of the functions of ATD-2 user interfaces and concept of use using the latest software running with live CLT traffic. Remote ATD-2 demonstrations will be hosted occasionally, with the goal of providing regular outreach to all interested stakeholders.

WebEx Telecon Meeting/ Briefings with ONERA Representatives

POC: [KEE PALOPO](#)

A WebEx meeting was held on June 12 between NASA and ONERA representatives in Toulouse, France, to discuss collaboration opportunities on environmental modeling work, Unmanned Aircraft Systems Traffic Management (UTM), and the Shadow Mode Assessment Using Realistic Technologies for the National Airspace System (SMART-NAS) testbed. Attendees included ONERA representatives Henry de Plinval Salgues, Thomas Dubot, Sebastien Aubry, Antoine Joulia, and Claire Sarrat, and NASA representatives Kee Palopo, Tom Prevot, and Barry Sullivan. The purpose of the meeting was to explore the next steps of the joint NASA-ONERA collaboration on

performance modeling for fuel, noise, and emissions. ONERA presented their work on the Air Transport Systems Evaluation Infrastructure platform, UTM, and environmental studies. NASA presented development on UTM and the SMART-NAS testbed. Each of the organizations discussed possible joint collaboration efforts and agreed to come up with a combined list of candidates to be coordinated with AOSP Deputy Director Akbar Sultan. There was also discussion of a possible visit by ONERA to NASA's Ames Research Center in the near future.

ATDs Featured at NASA Tech Day on the Hill

POC: [LEIGHTON QUON](#)

On June 15, the Airspace Technology Demonstration (ATD) Project featured the three ATD subprojects at NASA's Tech Day on the Hill at the Rayburn House Office Building, in Washington, DC. Congressional representatives, congressional staff, NASA's Acting Administrator Robert Lightfoot, and NASA Headquarters staff all attended the event. ATD Project Manager Leighton Quon hosted the event and provided the attendees with descriptions of each of the ATD subprojects, the phases of flight and key objectives they each address, and their recent progress and

accomplishments. Other highlights included the recent ATD-1 Flight Interval Management flight test and implementation of tools by the FAA.

Lightfoot discussed recent NASA activities, including the visits by former NASA Administrator Charles F. Bolden to Charlotte Douglas International Airport (CLT) for the ATD-2 CLT Lab ribbon-cutting ceremony. Lightfoot also shared progress on the ATD-2 system development in the lab and subsequent initial hardware deployments to prepare for ATD-2 Phase 1 testing in September 2017. He then discussed the previous visit to the American Airlines Operations Center to look at rerouting tools that were being tested, and the progress and extensions of ATD-3 rerouting tools. Lightfoot expressed



ATD Project Manager Leighton Quon briefing Acting NASA Administrator Robert Lightfoot

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his thanks for the progress and hard work from the entire project team.

Rep. Bobby Scott from Virginia's 3rd district, where NASA's Langley Research Center is located, was present for part of the event, and asked about Langley's Traffic Aware Strategic Aircrew Requests. Rep. Scott also was present for the ATD flight deck-related highlights.

Technology Transfer of UTM Products to FAA

POC: [JOSEPH RIOS](#) AND [TOM PREVOT](#)

On April 28, the Unmanned Aircraft Systems (UAS) Traffic Management (UTM) completed the second technology transfer of deliverables to the FAA, per the Joint Management Plan schedule. This technology transfer included the following items:

- An overview paper on the deliverables, including a summary of the hazard-based scenarios.
- A NASA Technical Memorandum of the final report on the Data Exchange and Information Architecture working group (DWG) demo summarizing activities that define and execute the first demonstration of the NASA-FAA Research Technology Transfer (RTT) DWG. The demonstration focused on testing the interactions between two key components in the future UTM System through

a collaborative and distributed simulation of key scenarios. The summary incorporated written feedback from each of the participants in the demonstration. In addition to discussing the activities, this report also provided some insight into future steps of this working group.

- A set of slides showing classifications of known vehicle-based hazards, along with their contributing factors, impacts and outcomes.

On June 23, the joint NASA-FAA RTT Concept Working Group completed its draft Concept & Use Cases Package #1: Technical Capability Levels (TCL) 1 & 2. The document details the following information:

- TCL-1: Visual line of sight operations in uncontrolled airspace under 400' AGL in rural areas.
- TCL-2: BVLOS operations in uncontrolled airspace under 400' AGL in rural areas.

For TCLs 1 and 2, the CWG developed the following products:

1. Terms and Definitions
2. Foundational Principles
3. TCLs 1 and 2 Concept Narratives
4. TCLs 1 and 2 Use Cases
5. TCLs 1 and 2 Operational Views (OVs)
6. Roles and Responsibilities of actors interacting within TCL 1 and 2 environments.

The document is in final review before being released outside of the CWG.

Initial Exploratory HITL on IDM Convective Weather Operations

POC: [NANCY SMITH](#)

Familiarization briefings were held this quarter with FAA Stakeholders supporting Airspace Technology Demonstration-2 (ATD-2). The first occurred on February 2, when NASA provided a demonstration of the ATD-2 system to the National Time-Based Flow Management (TBFM) Operations Team Co-Leads, representatives from the FAA's Future Standards and Procedures Group (AJV-85) and the Mission Support Group to the Air Traffic Organization. The National TBFM Operations Team and AJV-85, which sponsors the TBFM team, is responsible for all aspects of TBFM system operations, including software implementation, and testing, creating operating procedures, and providing training for the operational facilities. Participants included the AJV-85 Group and Team Manager, and the National Air Traffic Controller Association National Representative for TBFM. On March 23, the NASA team demonstrated the ATD-2 system to FAA Headquarters representatives from the NextGen Portfolio Management and Technology

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“Command Center” traffic managers assess the situation and develop a CTOP plan.

Development Office (ANG-C), and AJV-85. Participants included the ANG-C Director, ANG-C5 Manager and AJV-85 Group and Team Managers. The ATD-2 demonstrations were hosted at NASA’s lab at the Charlotte Douglas International Airport and used live data. The ATD-2 system overviews included a description of the goals, benefits, and tools developed for use across the various user groups, from air traffic control tower personnel to ramp managers and controllers. ATD-2 subject matter experts from Human Solutions, Inc., also supported the visit, and provided key insights on how the ATD-2 system will be used operationally. The visits provided NASA with the opportunity to have valuable technical interchange discussions with AJV-85; in particular, to understand

the FAA’s TBFM plans and inform the FAA on how the ATD-2 system integrates with TBFM.

Convergent Paths Workshop

POC: [BRYAN BARMORE](#)

On June 20 and 21, Steve Velotas and Bryan Barmore from NASA’s Langley Research Center in Virginia participated in the Convergent Paths Workshop at NASA’s Ames Research Center in California. The meeting was organized by NASA and the International Air Transportation Association (IATA). NASA and IATA focused on the airspace needs of emergent and legacy airspace users and how those needs converge into common operations. The meeting was attended by senior officials from NASA, FAA, IATA, multiple

traditional airlines, commercial space, urban air mobility, Unmanned Aircraft System package delivery companies, global air navigation service providers, Eurocontrol, and high-altitude, long-duration vehicle companies.

Discussions focused on the current problems and future needs of the different aviation communities and how each community can learn from the others. There were engaging discussions about the needs of vehicles that travel at speeds between 25 knots (e.g., solar-powered surveillance vehicles) to Mach 2.7 (e.g., commercial space launch rockets) operating in a system designed for vehicles traveling at speeds similar to one another. Some of the emergent users talked about their expected growth plans and the need for regular access to the National Airspace System.

The discussion in the afternoon on June 20 focused on how the whole system can learn and improve from the new ideas of the emergent community. Several actions were taken to engage the emergent users with the existing community, including the opportunity to influence International Civil Aviation Organization operational recommendations at a once-a-decade conference in December. NASA identified several potential research topics that will be considered during the ongoing formulation of

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the Trajectory-Based Operations Services and other projects.

TASAR Project Review and Connectivity Test Held at Alaska Airlines

POC: [DAVID WING](#)

On June 20 and 21, a status review of NASA's Traffic Aware Strategic Aircrew Requests (TASAR) collaboration with Alaska Airlines was held at Alaska Airline's Flight Operations and Maintenance and Engineering facilities at Seattle-Tacoma International Airport. The TASAR software application, Traffic Aware Planner (TAP), developed by NASA's Langley Research Center in Virginia and contractor Engility Corporation, provides flight crews with flight-path optimization advisories that account for traffic, convective weather, and restricted airspace, providing greater acceptability to pilots and air traffic controllers. NASA is partnering with Alaska Airlines to install and operationally test TASAR in revenue service. Attending the review with NASA, Engility, and Alaska Airlines were industry collaborators UTC Aerospace Systems (UTAS), Gogo, and ACSS, who are providing the hardware, data connectivity services, and TAP software hosting capability to enable the TASAR system on board three Alaska B737 aircraft. The project remains on track for initial flights beginning in August, following the

pending completion of software packaging by Gogo and UTAS, and the receipt of FAA certification and operational approval.

New collaborator ACSS presented plans to upgrade and certify the traffic computer to provide traffic data to TAP. Alaska's pilot training and mobile technology leads discussed the review of NASA's TASAR training materials and found those materials to be "impressive" and well-suited for Alaska's use. The development team also discussed plans for soliciting pilot feedback through online surveys following each flight.

The meeting was held in conjunction with a TASAR hardware connectivity test conducted overnight on board one of the aircraft. The partially successful test demonstrated high-bandwidth communication between the UTAS and Gogo hardware. Additional configuration changes and on-aircraft testing will be conducted to ensure sufficiency for TAP data flows prior to the upcoming commencement of operational TASAR flights.

Flight Testing of Small UAS (sUAS) Safety Technologies

POC: [STEVEN YOUNG](#)

On June 21 and 27, 21 test flights were successfully completed over Victory St. at NASA's Langley

Research Center in Virginia's City Environment for Range Testing of Autonomous Integrated Navigation—nicknamed "CERTAIN"—test range. This marked the first use of this range for untethered research flights of small unmanned aircraft system (sUAS). The flight test vehicle was a DJI S-1000, equipped with various types of research equipment and supported by a Ground Control Station, safety pilot, and range safety officer.

During the summer months, NASA researchers and support staff conducted a series of autonomous small UAS flights over the streets of Langley, west and north of B2102. These tests serve in part to stage a major UAS Traffic Management (UTM) project milestone called Technical Capability Level-3, currently planned for Fall 2017. These tests also provide data and a baseline capability that support efficient start-up of the new System-Wide Safety (SWS) Project beginning in FY18. As part of the research, various integrated air-ground systems are being investigated as enablers for safe autonomous small UAS operations beyond visual line-of-sight and near and over populated areas.

Airborne research instrumentation includes sensing, monitoring, and contingency management technologies that provide (1) safeguarding through independent

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and dependable geo-conformance to defined “stay-in” and “stay-out” areas; (2) autonomous flight management and control to ensure maintaining safe proximity from potential hazards by using Integrated Configurable Algorithms for Reliable Operations of Unmanned Systems (ICAROUS); and (3) infrastructure inspection technology with ultraviolet sensors adapted to transmission line fault detectors.

Ground-based systems reside within a ground-control station that hosts three functions under test: (1) real-time risk assessment capability that advises operators of predicted risks along or near the planned route of flight; (2) Safeguard/ICAROUS configuration management and data archiving; and (3) a UTM-connected client that requests airspace access, acquires relevant UTM-based information services, and informs UTM of aircraft states such as position reports.

Continuing Shadow Evaluations Completed for the ATD-2 Phase 1 Field Demo

POC: [SHIVANJLI SHARMA](#)

The second and third Engineering Shadow Evaluations (ESE) continued for the Airspace Technology Demonstration-2 Phase 1 Field Demonstration this past quarter. The second evaluation, commonly referred to as ESE1, was conducted at the American Airlines (AAL) ramp



Training session providing Ramp Managers and Controllers hands-on time with the IADS system

tower and in the NASA Charlotte Douglas International Airport Laboratory (CLTLab) from May 30 through June 2. In the AAL ramp tower, two days of training and system familiarization sessions took place with ramp controllers using the Integrated Arrival and Departure Surface (IADS) prototype systems in the operational floor and backroom areas. This training session enabled ramp managers and controllers hands-on time with the IADS system running with live data. During the session, data exchange and integration features were demonstrated, and detailed information regarding their use and implementation was provided.

In addition to the training session, a meeting was held in the CLTLab with CLT Air Traffic Control Tower

traffic managers, the National Air Traffic Controllers Association (NATCA), AAL ramp controllers, and NASA personnel. This meeting focused on the ESE1 process and timeline, the steps taken to ensure software features for the Phase I Field Demonstration were implemented as agreed upon, the training procedures in development, and the infrastructure for operational use. The meeting also allowed for continued discussion on micro-benefits analysis, focusing on characterizing the typical traffic banks at CLT to help identify potential off-nominal events that may occur during operational use. The third ESE1 session was conducted on June 27 and 28, at CLT, and again included field demo partners from NATCA, CLT Airport Ops, AAL, FAA Headquarters, and

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CLT ATCT, who participated in the ESE1. The first day offered a preview of recently developed capabilities of the IADS system at the AAL Ramp Tower and CLT ATCT backroom areas. These capabilities included refinements to the surface management user interfaces and analysis dashboard, a what-if capability, and a chat application for use by Traffic Managers. On the second day in the CLT Lab, feedback was gathered on these capabilities, along with a discussion to finalize training processes and methods, and to provide updates on benefits analysis and data sharing.

At the end of the day, field demo partners reviewed the IADS system readiness for the Operational Shadow Evaluation to support the Phase 1 Field Demonstration (OSE1), and approval was obtained. During OSE1, operational users will assess the ATD-2 system via live-data shadow testing in the operational

areas. The IADS system has been fully deployed to all operational areas in the CLT ATCT/ Terminal Radar Approach Control Center and AAL Ramp Tower, and OSE1 plans and procedures have been vetted by the field demo partners. The focus of OSE1 is to assess readiness for operational use, and will include controller training and baseline human factors data collection. OSE1 started on July 10, and will be conducted through September. Successful completion of the OSE1 will be the final checkpoint before the Phase 1 Field Demonstration commences on September 29.

ATD-2 Quarterly Update to Surface Collaborative Decision Making Team

POC: [AL CAPPS](#)

On June 30, NASA researchers participated in the joint government/industry Surface Collaborative Decision Making Team (SCT)

meeting. The session began with an update from the FAA on the status of the Terminal Flight Data Manager program. The remainder of the session was devoted to technical interchange on Airspace Technology Demonstration-2 (ATD-2). NASA presented an update on recent progress made towards the Phase 1 field demonstration at Charlotte Douglas International Airport. ATD-2 topics also included a review of efforts to capture and report hard-to-quantify benefits provided by the ATD-2 Integrated Arrival and Departure Surface (IADS) system, a preview of the IADS system development roadmap for the coming year as NASA builds toward ATD-2 Phase 2, and a discussion about reducing barriers to successful technology transfer. The SCT remains engaged with ATD-2 plans, and will be integral in the technology transfer process to FAA and industry.

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Panel Participation on “Transportation Security in the Era of Drones”

POC: [PARIMAL KOPARDEKAR](#)

On April 3, Parimal Kopardekar participated in “The Evolution of Unmanned Aircraft Systems (UAS)” with a panel at a forum entitled “Transportation Security in the Era of Drones.” The forum was hosted by the Transportation Security Administration (TSA) Office of Chief Counsel, in conjunction with the Federal Bar Association, and took place in Arlington, Va. The purpose of the forum was to discuss emerging UAS legal and regulatory issues in the nascent drone era. Kopardekar participated remotely and discussed the evolution of unmanned aircraft systems. Other members of the panel included representatives from the Department of Homeland Security, Wiley Rein, DJI, and TSA.

Aviation Safety Seminar – Moscow, Russia

POC: [AKBAR SULTAN](#)

From April 3 through 8, Akbar Sultan, AOSP Deputy Director, traveled as part of a NASA delegation to Moscow to participate in an aviation safety seminar with the Central Aerohydrodynamic Institute (TsAGI). This seminar provided an opportunity to share best practices

in the area of aviation safety and to demonstrate the capabilities and the importance of aviation safety, not only to Russia and the United States, but to the global aviation safety community. During the trip, Jaiwon Shin, ARMD Associate Administrator, also received a background briefing from U.S. Embassy officials, provided a presentation to U.S. aviation industry representatives in Russia, and met with the students and future leaders of TsAGI at the Moscow Institute of Physics and Technology.

High Confidence Software and Systems Conference

POC: [DR. ALWYN E. GOODLOE](#)

From May 8 through 10, members of the Safe Avionic and Air Traffic Management Future Evolutions TC team participated in the High Confidence Software and Systems (HCSS) Conference along with researchers, practitioners and managers from institutions, such as the National Security Agency, Defense Advanced Research Projects Agency, National Institute of Standards and Technology, MITRE, Carnegie Mellon, and Google. This year’s conference focused on three major themes: Industrialization of Formal Methods, Privacy, and Artificial Intelligence from a security and privacy perspective. Noteworthy presentations ranged in topics from

anonymizing personal data in large data sets to security and privacy for machine learning-based systems.

AUVSI XPONENTIAL Conference

POC: [LOU GLAAB](#)

On March 7, John Cavolowsky, NASA’s Director of Airspace Operations and Safety Program, briefed the staff of the Senate Commerce Committee at the Russell Senate Office Building in Washington, DC. The Senate Commerce Staff requested the briefing to provide an update regarding the recent developments of Unmanned Aircraft System Traffic Management research. Paul Fontaine and Sherri Magyarits from the FAA’s NextGen Division, and Sabrina Saunders-Hodge from the FAA UAS Integration Office, were also present at the briefing.

Media Day at the Nevada Test Site During TCL-2 National Campaign

POC: [ARWA AWEISS](#)

On May 25, NASA researchers supporting the Unmanned Aircraft Systems (UAS) Traffic Management effort will coordinate with NASA Public Affairs on joint NASA/ test site/industry media events for the Technical Capabilities Level-2 National Campaign. The first such event will be held during the flight

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evaluation at the Nevada test site at the Reno Stead Airport. The site is managed by the Nevada Institute for Autonomous Systems on behalf of the Governor's Office of Economic Development. Participants in the Nevada tests include Amazon Prime Air, Airmap, the Reno Tahoe Airport Authority, the University of Nevada Reno, Carbon Autonomous, and Flirtey UAS. A second media day will be held on June 6, when the other test sites conduct flight evaluations.

NSF Center for High-Performance Reconfigurable Computing Workshop

POC: [CESAR MUNOZ](#)

On June 5 and 6, Cesar Munoz from NASA's Langley Research Center in Virginia attended the mid-year Workshop of the National Science Foundation Center for High-Performance Reconfigurable Computing (CHREC), held by the University of Pittsburgh in Pittsburgh. CHREC, which was founded in 2007, conducts basic and applied research on advanced computing for embedded aerospace systems. As part of its research portfolio on Advanced Systems and Missions, CHREC is currently investigating protocols and services for robust distributed computing, such as NASA's Core Flight Systems (CFS) and Object Management Group's Data Distribution Service Standards. Langley recently re-joined CHREC to work on

the integration of CFS and Data Distribution Services as a reliable middleware for the development of autonomous Unmanned Aircraft Systems applications. At the meeting, Munoz presented the Integrated Configurable Algorithms for Reliable Operations of Unmanned Systems (ICAROUS) software architecture. He also proposed a preliminary research plan for a collaborative work with the University of Pittsburgh under CHREC's Advanced Systems and Missions project. ICAROUS is being developed under NASA's UAS Traffic Management subproject.

AIAA Aviation 2017-ATD-3 Panel

POC: [LEIGHTON QUON](#)

Researchers from the Airspace Technology Demonstration 3 (ATD-3) project hosted a panel during the Aviation 2017

Conference on June 7, in Denver. ATD-3 is the third in a series of subprojects under ATD, and deals with the Applied Traffic Flow Management aspect in domestic en route airspace. The panel was moderated by Pete Kostiuk from Robust Analytics, and Kapil Sheth, Karl Bilimoria, Leighton Quon, and David Wing from NASA. The panel members briefly described the ATD project's overall goal and its three focus areas, and the ATD-3 team leads described the technologies being developed under ATD-3. These technologies are the Multi-Flight Common Route, Dynamic Routes for Arrivals in Weather, Traffic Aware Strategic Aircrew Requests, and Air-Ground Integration. Attendees specifically commented on the benefit of seeing the overall context of the ATD project and the overall context of the ATD-3 subproject technologies.



NASA ATD-3 team at the Aviation 2017 Conference

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ATD-2 Highlighted at National Customer Forum

POC: [AL CAPPIS](#)

On June 15, NASA was invited to speak at the National Customer Forum held at the FAA David J. Hurley Air Traffic Control System Command Center in Warrenton, VA. The audience included representatives from the major U.S. passenger and cargo airlines, general aviation, FAA, and the National Air Traffic Controllers Association. NASA presented an overview of the Airspace Technology Demonstration-2 (ATD-2) concept and technology maturation effort leading up to the Phase 1 Field Demonstration, focusing on the benefit to industry and FAA at Charlotte Douglas International Airport. Interactions during the meeting provided unique perspectives on the benefits of ATD-2 technology, and further emphasized the need for strong collaboration. The audience expressed its appreciation for the NASA-led overviews and technical discussions and the desire for continued engagement on ATD-2 going forward.

TASAR Presented at EFB Users Forum

POC: [DAVID WING](#)

The State of California's "Aerospace and Aviation Days" event, held on March 28 at the state capitol

in Sacramento, presented NASA's Unmanned Aircraft System (UAS) Traffic Management (UTM) concept and project. Joseph Rios, Technical Lead for NASA's UTM effort, sat on a panel to describe the joint effort between NASA and the FAA to enable access to the low-altitude airspace for small UAS. Attendees included California assembly members and industry group representatives.

NASA Participates in Global UTM Conference

POC: [JOSEPH RIOS](#)

Joseph Rios, Acting Chief Engineer for the UTM Project, attended the Global Unmanned Aircraft Systems Traffic Management (UTM) Conference in Montreal on June 26. Approximately 100 participants attended this conference sponsored by the Global UTM Association. Rios served as a panelist on the topic of UTM perspectives from around the world, which included participants from Japan, Europe, and Singapore.

Science and Research Panel (SARP) Multiple UAS, Single Operator Workshop

POC: [SHARON GRAVES](#)

On June 27 and 28, a workshop was held by the Unmanned Aircraft System (UAS) ExCom Science and Research Panel (SARP) at MITRE's McLean, Va. facility to discuss issues

related to multi-UAS simultaneous operations. Participants included a broad cross-section of public UAS users, such as Alameda County Sheriff's Department, state agencies, and government agencies like the Department of Justice, Department of Homeland Security, National Oceanic and Atmospheric Administration, and NASA. The workshop identified a number of high-value "use cases" where multi-UAS operations using a single operator or a small number of operators would be the only way such a use case would be feasible. These use cases typically fell into two main categories: synchronous and asynchronous operations, where synchronous operations refer to multiple UAS that are focused on one goal, and asynchronous operations refer to multiple simultaneous operations that perform multiple tasks. Next, attendees identified gaps and barriers—both technological and regulatory—that prevent those applications from coming to fruition. Discussions also were held on policy questions such as whether a swarm of aircraft flying in unison should be treated as a single aircraft, or whether each individual aircraft should be treated as a separate entity, as is currently the case. Next steps are for the SARP to disseminate the results of the workshop and, ultimately, present it to the Executive Committee, where agencies can address gaps.

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Air Traffic Management in the National Airspace System Presentation

POC: [MATT UNDERWOOD](#)

On June 29, Matthew Underwood of NASA's Langley Research Center in Virginia presented Air Traffic Management in the National Airspace System (NAS) to a group of students and civil servants. The talk was part of the American Institute of Aeronautics and Astronautics Hampton Roads

Section Career and Professional Development Seminars.

Approximately 50 students and civil servants attended. Discussion focused on defining the NAS, highlighting the operational and technological complexities of the NAS, explaining a brief history of Air Traffic Control, describing what the future state of the NAS will look like, and discussing NASA's role in developing that future state. Furthermore, an interactive demo

was given with crowd participation that illustrated how a typical flight from Los Angeles International Airport to Baltimore-Washington International Airport is managed by air traffic control. The presentation was well received by the audience, and additional information and follow-up were requested by several attendees— some of whom were students interested in career opportunities with NASA.

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