



# AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

JAN-MAR 2018 | Quarter 2



First ATD-2 Display Deployed to DFW Airport 5

UTM Technical Capability Level 3 Testing at Nevada UAS Test Site 11

## AOSP IN THE NEWS

### [What is NASA's Urban Air Mobility Initiative?](#)

Federal News Radio (1/10) reports “many cities look for ways to reduce vehicle traffic on clogged streets. They’re also looking at how to safely increase air traffic above those streets and among all the buildings. It’s known as urban air mobility. NASA’s aeronautics research mission directorate has been helping this effort with research.”

### [NASA-Backed Study Envisions ‘In-Time’ Aviation Safety System](#)

Aviation Week (1/18) reports “industry, government and academia should start research into the requirements of a comprehensive ‘in-time aviation safety management system’ (IASMS) that would continuously monitor all components of the U.S. national airspace system (NAS), the National Academies of Sciences, Engineering and Medicine recommends in a NASA-funded study released Jan. 18.”

### [‘In-Time’ Could Be Future Safety Standard](#)

Aviation Week (1/24) reports “not content to rest on the laurels of a safety record that last year counted zero passenger airline fatalities, aviation planners in the U.S. are exploring creation of a domain-wide safety management system that would continuously monitor the airspace and adapt to new entrants such as drones, commercial space vehicles and small urban transport aircraft. At the behest of NASA, the National Academies of Sciences, Engineering and Medicine...”

### [Tech and the Future of Transportation: From Here to There](#)

ZDNet (2/01) reports “meanwhile, NASA is developing an Unmanned Aircraft System (UAS) Traffic Management system, or UTM. This is essentially automated air traffic control for drones — another key component of a commercial drone ecosystem.”

### [Freight First as Jetmakers Study Single-Pilot Airplanes](#)

Reuters (2/08) reports “a NASA study published in September was not encouraging. U.S. airline pilots tested solo in Boeing 737 simulators found the workload ‘unacceptable’ even in normal flight conditions, let alone when something went wrong. The study projected the prospect of having one of two pilots take a nap while the other sat at the controls was as being more plausible, suggesting it might be possible for airlines to reduce long-haul crew numbers in the future.”

### [Opinion: Is Automation Causing Manual Flying Skill Degradation?](#)

AeroTime (2/15) reports “the NASA study revealed that during flights with automation, pilots’ thoughts were unrelated to task 20% of the time. This could suggest that for a human it can be hard to engage to the monitoring part during all the time. Our mind starts to drift, we get bored.”

## AOSP IN THE NEWS

### [Amazon, Google, Others Are Developing Private Air-Traffic Control for Drones](#)

The Wall Street Journal (3/09) reports that “in conjunction with the National Aeronautics and Space Administration, validation tests are slated over the next three months at a handful of sites. The intent is to develop a ‘totally different, new way of doing things,’ Parimal Kopardekar, NASA’s senior air-transport technologist who first suggested the idea of an industry-devised solution, told approximately 1,000 attendees at the conference.”

### [NASA Completes Third Phase of UAS Airspace Testing](#)

GPS World magazine (3/26) reports “this third phase of NASA’s Unmanned Aircraft Systems (UAS) testing (TCL 3) again focused on airspace management technologies that will enable the safe integration of UAS into the national airspace. See below for more on the TCL testing program.”

### [NASA, NIAS Test Unmanned Aircraft Traffic Management Tech](#)

ExecutiveGov (3/27) reports “NASA and the Nevada Institute for Autonomous Systems have tested unmanned aircraft systems and airspace management technologies as part of efforts to integrate Unmanned Aircraft Systems (UAS) into the U.S. national airspace system. NIAS said Monday the week-long demonstration occurred at a UAS test site at the Reno-Stead Airport in Nevada and involved UAS ground control systems, communication, navigation, surveillance, human factors, data exchange and network platforms.”

### [NASA Bags Landmark Achievement with Successful UTM Testing Programme](#)

Commercial Drone Professional (3/28) reports “NIAS, which manages the Nevada UAS Test Sites and its NASA Unmanned Aircraft Systems (UAS) Traffic Management (UTM) partners, has announced that NASA provided a Flight Information Management System (FIMS) research platform that will serve as a future prototype system for the FAA to use to coordinate with Unmanned Service Supplier’s (USS) operating throughout the nation.”

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### NASA Synthetic Vision Research at Boeing 787 Miami Training Center Completed

POC: [KYLE ELLIS](#)

On January 30, a team from NASA's Langley Research Center in Virginia completed a flight simulation assessment of Synthetic Vision System (SVS) flight deck display technology's ability to help combat loss-of-control, the leading commercial aircraft accident category. A Space Act Agreement enabled the flight simulation study to be conducted in the Boeing 787 high-fidelity full flight simulator at the Boeing Miami Training Facility with a full suite of integrated SVS displays and other NASA technologies. Twelve international 787 flight crews from an international airline, some with fewer than 500 hours of flight experience, participated in the assessment. A preliminary review of the data suggests that SVS significantly enhances terrain and attitude awareness compared to the traditional blue-over-brown Primary Flight Display. These results support that the display technology may have great potential to aid less experienced commercial airline flight crews by providing enhanced attitude awareness to help detection of, prevent entry into, and aid in recovery from unusual attitudes, especially in high terrain environments. The assessment and results support the RTCA Special Committee 213 (SC-213)

in providing research data to help establish minimum aviation system performance standards and pave the way toward certification of the SVS technology. To date, the research has addressed numerous SC-213 research needs and has been highly successful in meeting all the Commercial Aviation Safety Team Safety Enhancement 200 requested research actions through a systematic research strategy. Additionally, this successful collaboration with Boeing opens the door to future research opportunities and access to a unique facility and pilot subject pool. The research was recently highlighted in the December 18, 2017, Aviation Today article (see related URL below).

Related URL: <http://www.aviationtoday.com/2017/12/18/boeing-nasa-test-nextgen-synthetic-vision-787-sims/>.

### ATM-X Meeting with FAA NextGen Office

POC: [BRYAN BARMORE](#)

On January 16, NASA researchers supporting the Air Traffic Management-eXploration (ATM-X) Project met with representatives from the FAA's NextGen Office. Bryan Barmore at NASA's Langley Research Center in Virginia led discussions on potential coordination and collaboration on trajectory negotiation demonstration flights. The ATM-X project is currently working with Boeing to demonstrate

trajectory negotiation capabilities using airborne internet connectivity and data communications on the Boeing EcoDemonstrator in 2019. Separately, the FAA's NextGen Office is beginning an activity to show trajectory negotiation capabilities using airborne internet connectivity in live flights that will take place in late 2019. At this meeting, each group talked about existing plans and potential areas for collaboration and coordination to ensure best use of government money. NASA will allow the FAA the opportunity to comment on the negotiation concept of operations as it is developed. The FAA will invite NASA to the FAA's industry day. As plans develop, each agency will continue discussions to ensure that the tests contribute to advancing trajectory negotiation capabilities.

### UAS in Controlled Airspace Aviation Rulemaking Committee

POC: [WILLIAM CHAN](#)

NASA researchers supporting the Air Traffic Management-eXploration (ATM-X) Project attended the third plenary meeting of the Unmanned Aerial Systems in Controlled Airspace (UASiCA) Aviation Rulemaking Committee Meeting held in Washington, DC, from January 17 through 18. The UASiCA Aviation Rulemaking Committee is providing recommendations to

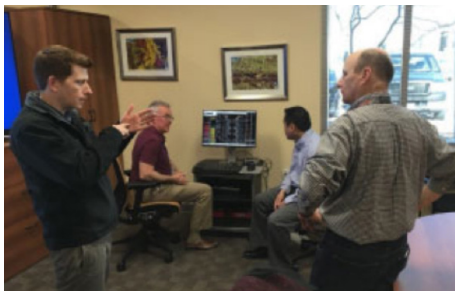
## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the FAA for regulations to allow normalized unmanned aerial systems (UAS) access to class A (high-altitude, positive controlled) airspace. The first day consisted of meetings by each of the five working groups to start developing FAA recommendations. The second day was a plenary session with briefings from the FAA and Eurocontrol on the current status of UAS operations in class A airspace and status out-briefs from each working group.

### First ATD-2 Display Deployed to DFW Airport

POC: [PAUL BORCHERS](#)

On January 18, the NASA North Texas Research Station (NTX) personnel deployed the first of several Airspace Technology



*DFW Airport ATD-2 Display.*

Demonstration-2 (ATD-2) displays to facilities at Dallas-Fort Worth (DFW) International Airport. The equipment, which was installed in the Environmental Affairs Office, provides a similar ATD-2 Surface Trajectory-Based Operations display currently in use at the

control towers of the airport and other FAA air traffic control facilities. This display will provide real-time situational awareness of local air traffic management decisions to DFW Airport Board employees, fostering a collaborative environment for more efficient airport operations. Subsequent installations, made possible through a Non-Reimbursable Space Act Agreement between NASA's Ames Research Center in California and DFW Airport, will be made to the DFW Airport Operations Center, as well as the airport-controlled ramp towers.

### FAA Trajectory-Based Operations and Autonomous Use-Case Development Workshop

POC: [WILLIAM CHAN](#)

On January 24, NASA researchers supporting the Air Traffic Management- eXploration (ATM-X) Project attended the FAA Trajectory-Based Operations and Autonomous Use-Case Development Workshop at the Boeing Long Bridge facilities in Crystal City, Virginia. The purpose of the meeting, hosted by the FAA, was to develop an experimental use case that exercises the integrated laboratory environment being defined by the FAA, which is to include assets from partners such as Boeing, MITRE Corporation, and NASA's Shadow Mode Assessment Using Realistic Technologies for

the National Airspace System Testbed. These discussions could lead to collaborations for the external use of the testbed and inform research in the Integrated Diverse Operations sub-project.

### ATD Technical Interchange Meeting for ATD-2 and ATD-3 Sub-Projects

POC: [LEIGHTON QUON](#)

On January 26, the Airspace Technology Demonstration (ATD) Project Office held a 1-day technical interchange meeting (TIM) between the ATD-2 and ATD-3 sub-projects. The purpose of the TIM was to identify common areas of technical work and share lessons learned. The ATD TIM was attended by the ATD-2 and ATD-3 project management teams, chief engineers, software/system architects, and systems engineering teams. The agenda included an overview, status and demo of the ATD-2 and ATD-3 systems, as well as a discussion on how the sub-projects are related. The demo focused on system interfaces with FAA and other industry systems, and each sub-project also presented their technology transfer strategy and progress. The TIM provided a forum for the ATD-2 and ATD-3 teams to become more familiar with the technical details and stakeholders and users of each system, and the discussions led to insights on potential areas for further research.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### ATD-2 Participation in FAA Predictability Workshop

POC: [RICH COPPENBARGER](#)

On January 30, NASA's Airspace Technology Demonstration-2 (ATD-2) team members participated in a workshop led by the FAA's NextGen Systems Analysis and Modeling Division in Washington, DC. The workshop's purpose was to explore methods for measuring and monetizing predictability improvements resulting from Trajectory-Based Operations (TBO) and originating from recent NASA-FAA discussions on predictability goals shared between ATD-2 and broader NextGen TBO concepts. During the workshop, participants brainstormed how to further clarify benefits associated with on-the-day trajectory prediction enhancement, and discussed how to reduce uncertainty in flight arrival times and traffic demand forecasts that can lead to better resource allocation decisions by both service providers and flight operators. Improving predictability can benefit decisions regarding the FAA's setting of traffic management initiatives, and the airlines' use of available fleet equipment as well as gate and crew resources. The FAA and their contractors supporting TBO analysis expressed strong interest in the benefits that NASA is using for evaluating ATD-2.

The group may hold a follow-up meeting in April 2018, in which the FAA would provide an update on its forthcoming efforts to engage with airlines on predictability improvements and better operational decisions. NASA would also provide an update on its ATD-2 benefits assessments and initial field demonstration findings.

### NTX Personnel Tour American Airlines Command Center at DFW and Discuss Collaboration

POC: [PAUL BORCHERS](#)

On January 30, the American Airlines (AAL) Dallas-Fort Worth (DFW) Control Center Manager hosted a tour of the airline's new Command Center facility, located in Terminal A of DFW, for NASA's North Texas Research Station (NTX) personnel. This 10,000 square foot windowless facility replaced the 1,500 square foot ramp tower positioned between Terminals A and C, and it serves as a model for future airport control centers



*American Airlines Command Center.*

that will be built at other AAL hubs. AAL consolidated its airport ramp control, airport maintenance, passenger operations, and ramp operations coordinators in this single location, complete with its own emergency operations center. A video wall provides high definition and wide-angle views from cameras located around the terminals of DFW and ramp controllers are positioned immediately in front of this wall with large surface traffic displays. AAL has offered to make space available behind the ramp controllers for NASA Airspace Technology Demonstration-2 (ATD-2) sub-project observers, including an area for a Surface Trajectory Based Operations display that shows inputs from the DFW air traffic control towers. Such an installation would be utilized in Phase 3 of the ATD-2 effort.

### Management by Trajectory Technical Interchange Meeting

POC: [BRYAN BARMORE](#)

On February 1, NASA researchers supporting the Air Traffic Management- eXploration (ATM-X) Project hosted a technical interchange meeting (TIM) with the Management by Trajectory (MBT) NASA research announcement (NRA) team at NASA's Langley Research Center in Virginia. The MBT NRA team, led by Mosaic

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

ATM, is tasked with developing an MBT concept of operations, studying the impacts of possible changes in roles and responsibilities between 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. The TIM, hosted by the Increasing Diverse Operations sub-project team, focused on the definition of the goals, requirements, and execution plan for the fast time simulation experiment that the contractor team will conduct during FY18 to examine various aspects of the MBT concept of operations.

### **ATD-2/ATD-3 Independent Cost Estimate Briefing to ARMD OAA**

POC: [LEIGHTON QUON](#)

On February 7, Leighton Quon, the Airspace Technology Demonstration (ATD) Project Manager, provided a briefing to the Aeronautics Research Mission Directorate (ARMD) Office of the Associate Administrator (OAA) to discuss the Independent Cost Estimate for the ATD-2 and ATD-3 sub-projects at NASA Headquarters in Washington, DC. The purpose of the meeting was to provide the ARMD OAA with a report from an analysis conducted by an independent

agency to assess the full life-cycle costs of the two sub-projects to ensure overall project success.

### **Smart and Secure Cities and Communities Challenge Kickoff 2018**

POC: [JOHN KOELLING](#)

From February 6 through 8, NASA researchers supporting the System-Wide Safety (SWS) Project attended the Internet of Things - Enabled SmartCity Framework Workshop, hosted by the National Institute of Science and Technology (NIST) in Washington, DC. As a result of this event, NASA and NIST are considering strategic partnerships with relevant participants in this very broad activity, particularly regarding safety-related information services that may support or become part of the envisioned In-Time System-Wide Safety Assurance (ISSA) Emerging Operations system architecture and concept of operations. One action resulting from the meeting was to forward the soon-to-be-released ISSA Request for Information announcement to the NIST point of contact, who offered to distribute it to the Integrated Engineering Services community, and/or to help coordinate a webinar on the subject that may serve to facilitate future collaboration with interested organizations or communities.

### **FAA and UAST Meeting**

POC: [JOHN KOELLING](#)

On February 8, NASA researchers supporting the System-Wide Safety Project participated in the second meeting of the FAA and the Unmanned Aircraft Safety Team (UAST) in Washington, DC. At the request of the FAA and UAST, NASA researchers supported the study team in analyzing the recent accident/collision of a small consumer unmanned aerial system (UAS) with a U.S. Army Black Hawk helicopter. The team is charged with identifying effective and feasible intervention strategies that can be implemented to avoid future accidents like these. Status and findings were reported at the UAST meeting held on March 9 in Baltimore, Maryland, in conjunction with the FAA's UAS Symposium.

### **ATD-2 Briefing to NextGen Advisory Committee Subcommittee**

POC: [AL CAPPIS](#)

On February 15, NASA provided an Airspace Technology Demonstration-2 (ATD-2) update to the NextGen Advisory Committee Subcommittee (NACSC) at their monthly meeting in Washington, DC. The NextGen Advisory Committee (NAC) provides a venue where the FAA

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

can solicit a consensus-based set of recommendations on issues that are critical to the successful implementation of NextGen. It is also a forum to obtain a commitment of resources and synchronized planning between government and industry. The NACSC supports the NAC and is comprised of FAA and aviation industry representatives with broad knowledge and expertise related to the implementation of NextGen. This briefing reported early benefits, findings, and lessons learned for three aspects of the ATD-2 Field Demonstration: data exchange and integration, collaborative surface metering, and overhead stream insertion. NACSC participants expressed appreciation for NASA's leadership of the ATD-2 effort and strong interest in seeing the results of this research effectively transferred to the FAA and industry recipients.

### Cyber Physical Systems Steering Group/Smart Cities and Communities Task Force Meeting

POC: [YURI GAWDIAK](#)

On February 15, Yuri Gawdiak, Associate Program Director for the Airspace Operations and Safety Program, participated in the Cyber Physical Systems Steering Group/Smart Cities and Communities Task Force Meeting in Washington, DC. At the meeting, hosted by the

National Institute of Standards and Technology, there was a briefing on the Cybersecurity for Internet of Things Program to include a list of additional efforts the program office should be aware of and may want to leverage in designing prototypes for our own tools, facilities, ground systems, etc.

### NASA Hosts Air Traffic Controller Leadership for ATD-2 Familiarization

POC: [AL CAPPIS](#)

On February 16, NASA hosted Paul Rinaldi, the President for National Air Traffic Controllers Association (NATCA), and members of his leadership team for familiarization on the Airspace Technology Demonstration-2 (ATD-2). The visit

began with a briefing, demonstration, and a question-and-answer session at NASA's lab at the Charlotte Douglas International Airport (CLT). The visitors then went to the FAA Air Traffic Control Tower and Terminal Radar Approach Control facility to observe the ATD-2 Integrated Arrival/Departure/Surface Operations system in use there. The familiarization visit wrapped up with observations in the American Airlines Ramp Tower at CLT. NATCA has been a partner from the beginning of the ATD-2 Field Demo effort, providing invaluable expertise and support. During this visit, NATCA's leadership expressed interest in the early results from the field demo, a desire to expand its use in other locations, and continued support for the collaborative effort.



*ATD-2 demo and briefing to NATCA leadership at CLT.*



## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

### **NASA/FAA RTT Quarterly Review Held at NASA's Ames Research Center in California**

POC: [MIKE MADSON](#)

On February 21 and 22, the FAA and NASA conducted their joint quarterly review of current and potential future Research Transition Team (RTT) collaborations at NASA's Ames Research Center in California. These quarterly meetings provide a valuable two-way exchange of information related to technology development and transition planning. Current collaborations include the Airspace Technology Demonstration (ATD), Air Traffic Management-eXploration (ATM-X), and the Unmanned Aircraft Systems (UAS) Traffic Management Projects. During this meeting, updates on ATD-2 (focused on Integrated Arrival/Departure/Surface Operations) and ATD-3 (focused on Applied Traffic Flow Management) efforts were provided, as well as the status of the ATM-X Project formulation. ATD-2 Phase 1 field demonstration preliminary benefits and lessons learned were presented; the FAA was impressed by the ATD-2 development and expressed interest in the results of the field demonstrations. The first RTT technology transfer is scheduled for September 30. ATD-3 provided updates on: 1) the December 2017 Multi-Flight Common Route Tech

Transfer to the FAA, 2) the upcoming Dynamic Routes Around Weather (DRAW) simulation, 3) preparations for DRAW Tech Transfer #1 in June, and 4) the Multi-Agent Air/Ground Integrated Coordination activity in partnership with Alaska Airlines. The NASA airside technology, Traffic Aware Planner, was identified by the FAA as a product of interest for technology transfer through the RTT. Finally, NASA provided updates on the UAS Traffic Management Pilot Program and the Technology Capability Level Demonstration Status. The next quarterly review is tentatively scheduled for the week of May 28 or June 4.

### **NASA/Boeing Space Act Agreement Annex**

POC: [WILLIAM CHAN](#)

On February 22, NASA researchers supporting the Air Traffic Management-eXploration (ATM-X) Project in collaboration with counterparts from Boeing finalized a NASA/Boeing Space Act Agreement for both stakeholders to work toward completing their goals for a joint activity on the 2018 Boeing EcoDemonstrator flight. The EcoDemonstrator 2018 flight is scheduled for early April and is a connectivity checkout in preparation for the proposed NASA-Boeing EcoDemonstrator Flight in 2019. In 2019, the

ATM-X Project will work with Boeing and the FAA Tech Center to understand real-world issues related to an eventual goal of improving automated management of a flight from pre-departure and en route.

### **ATD-2 Kicks Off Phase 3 Activities in North Texas**

POC: [ANDREW GING](#)

On February 26 and 27, NASA met with North Texas Field Demonstration Partners at the Dallas/Fort Worth Terminal Radar Approach Control (TRACON) facility (D10) to kickoff Airspace Technology Demonstration-2 (ATD-2) Phase 3 activities. Representatives from the FAA included FAA Headquarters, the Southwest Regional Office, D10 TRACON, Fort Worth En Route Center (ZFW), and the Dallas/Fort Worth International Airport (DFW) and Dallas Love Field (DAL) Air Traffic Control Tower. Representatives from the DFW Board, American Airlines, and Southwest Airlines were also in attendance. Phase 3 will build on existing ATD-2 Integrated Arrival/Departure/Surface Operations (IADS) system installations at DFW, D10, and ZFW to operationally test terminal departure scheduling coordination between DFW and DAL and enable increased collaboration via data exchange and integration. NASA and Phase 3 Field

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*North Texas Field Demo Partners Meeting.*

Demo Partners discussed better use of existing capacity at the terminal departure boundary as a key expected benefit of the technology. Participants expressed concurrence with the near-term objectives, the agile development plan, and next steps. The NASA team will meet regularly with North Texas Field Demo Partners to refine the IADS terminal departure scheduling concept and technology via the agile requirements identification process used for ATD-2 Phases 1 and 2. A subset of the participants toured the North Texas Research Station lab and were given demonstrations of the ATD-2 systems currently operating at the Charlotte Douglas International Airport as well as at DFW. One of the demonstrations was a new capability to schedule Call for Release/Approval Request from the ATD-2 Time Based Flow Metering (TBFM) clients for DFW and DAL towers, to a prototype of TBFM En Route

Departure Capability, adapted to the D10 terminal boundary.

### Human Factors Data Collection for ATD-2 Phase 1 Completed

POC: [LINDSAY STEVENS](#)

From March 4 through 9, NASA completed the third and final round of subjective human factors data collection for Phase 1 of the Airspace Technology Demonstration-2 (ATD-2) Field Demonstration. Data were collected at the Charlotte Douglas International Airport (CLT), American Airlines (AAL) Ramp Control, FAA Air Traffic Control Tower (ATCT), and Terminal Radar Approach Control (TRACON). CLT, FAA's ATCT, TRACON, and AAL Ramp Control Managers and Controllers completed feedback forms during the data collection. The first set of human factors data were collected in September 2017 to gather information about baseline operations prior to the installation of ATD-2 tools in the field. The second data collection period occurred 2 months later (November 2017), focusing on the impacts of ATD-2 tools in the operational environment before surface metering was introduced. In the third round of data collection, users provided feedback about the impact of ATD-2 tools in the operational environment following the introduction of surface metering into the field. Human

factors data collection will continue during the Phase 2 demonstration.

### JARUS Working Group Meetings

POC: [MARCUS JOHNSON](#)

The Joint Authorities for Rulemaking on Unmanned Systems (JARUS) held a meeting for their Detect and Avoid (#4) and Risk and Safety Assessment (#6) working groups to further discuss a risk-based safety methodology for unmanned aircraft systems (UAS) operations called the Specific Operations Risk Assessment (SORA), at NASA's Ames Research Center in California, from March 5 through 9. During the meeting, Joseph Rios presented the Unmanned Aircraft Systems (UAS) Traffic Management (UTM) concept to the JARUS working groups and engaged in follow-on discussions on how UTM fits within the SORA methodology. Overall, UTM was broadly viewed as valuable to the SORA development and the FAA has requested NASA UTM project contribution to the UTM Appendix of the SORA. The JARUS working group's membership includes mainly U.S. and European Civil Aviation Authorities (CAAs). The SORA methodology has been gaining momentum among many of the CAAs as a potentially suitable means for demonstrating compliance with regulations.

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*UTM Technical Capability Level 3 testing at the Reno-Stead Airport UAS test range in Nevada.*

### UTM Technical Capability Level 3 Testing at Nevada UAS Test Site

POC: [ARWA AWEISSI](#) AND [QUANG DAO](#)

From March 5 through 9, the Nevada Institute for Autonomous Systems (NIAS) and its partners flew multiple unmanned aircraft systems (UAS) over a week-long testing period at the Reno-Stead Airport UAS Range. Five days of operations were scheduled with 87 operations completed (54 UAS flights and 33 simulations) during the week. The Nevada test site conducted tests on data and information exchange between UAS service suppliers, communication and navigation reliability onboard UAS, and focused on how UAS

Traffic Management (UTM) can enable key use cases, such as: critical medical supply delivery, hotel surveillance/inspection, disaster response surveillance/assessment, and first responder area security.

NASA UTM provided test support in the UTM lab at NASA's Ames Research Center in California during the testing to ensure data quality and track operations. NASA human factor researchers were onsite in Nevada observing and interviewing flight crews to inquire about UAS operator perspectives on UTM concepts and to learn about their operational models. Technology Capability testing will continue at five other UAS test sites through the end of May.

### FAA's TFM System's Deployment Team Attends IDM HITL Simulation

POC: [NANCY SMITH](#) AND [PAUL LEE](#)

On November 29, MITRE, the FAA NextGen Organization (ANG) and NASA held a General Aviation (GA) User Forum at Charlotte Douglas International Airport (CLT). The forum focused on information sharing for GA flight operations at CLT. In addition to representatives from MITRE, NASA and FAA/ANG, participants included representatives from the National Air Traffic Controller Association, CLT Air Traffic Control Tower, American Airlines, National Business Aviation Association and corporate flight operators at CLT. An overview of the Air Traffic Demonstration-2 (ATD-2) Field Demonstration and the role of data exchange and integration in the ATD-2 Integrated/Arrival/Departure/Surface system was presented by NASA. NASA also discussed the importance of information sharing for GA operations at CLT and lesser-equipped airports.

MITRE described a prototype mobile device application they developed under FAA/ANG sponsorship. They also outlined the procedures that GA pilots are using to submit an Earliest Off-Block Time/Ready-to-Taxi Time in the

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*Members of the TFMS DT team met with NASA researchers for IDM HITL simulations.*

current beta-test of the mobile application. Pilots provided feedback that NASA can use to understand GA operations and their departure procedures at CLT. Specific data elements that may be available to pilots were also discussed. Pilots provided additional feedback on the potential usefulness of receiving each of the data elements.

### ATD-2 Team Conducts Training Sessions

POC: [LINDSAY STEVENS](#) AND [SHIVANJLI SHARMA](#)

The Airspace Technology Demonstration-2 (ATD-2) team continued providing supplemental training on the Integrated Arrival/Departure/Surface (IADS) system to FAA personnel at Charlotte Douglas International Airport (CLT) this past quarter. The first training session (January 29 through February 2) focused on training new Traffic Management Coordinators and supervisors on the IADS system to broaden the use of the electronic Call for

Release process between CLT and the Washington, DC-based En Route Center during all shifts. The training combined a series of short classroom sessions in the terminal area facility back room environment followed by hands-on training in the operational areas. The ATD-2 team conducts regular training sessions to familiarize new users as well as inform current users of refinements to the IADS capabilities.

On February 13, Shadow Session 15 for the ATD-2 Phase 1 Field Demonstration was conducted in the NASA ATD-2 Lab located at CLT. The objective of the shadow session was to review the use of surface metering, demonstrate new features of the recent IADS software release, and discuss plans for future software releases. Field Demo Partners from the National Air Traffic Controllers Association, American Airlines (AAL), FAA Headquarters, and CLT Air Traffic Control Tower (ATCT) participated in the shadow session. Discussion topics included IADS system robustness and fidelity over the last 2 months, evolution of the Data Analysis and System Health (DASH) capabilities, and analysis of the impact of surface metering along with initial benefits metrics in fuel burn and emissions savings. Discussions provided valuable feedback on the progress of the Phase 1 Field Demonstration,

and field demo partners agreed to extend surface metering to bank three starting on February 19. At another training session on March 8, the ATD-2 team conducted a virtual training session for FAA ATCT and AAL Ramp Managers on the new features and updates to the IADS system. The IADS system is deployed at CLT and is in daily operational use in the AAL Ramp Tower and FAA ATCT during the Phase 1 Field Demonstration. The training session was for IADS software release 3.1.1, which features a new Surface Metering Display that enables metering by individual runways, new DASH interface, and continued expansion of data exchange and integration elements.

### Emergent Aircraft Systems and the Dispatcher Workshop

POC: [RICHARD MOGFORD](#)

On March 14, NASA's Ames Research Center in California hosted a workshop to build awareness of fleet management services in the burgeoning emergent vehicle research and development community at the Ames Conference Center. The workshop familiarized NASA researchers and the emerging aviation industry with the roles and capabilities of current airline operation centers (AOCs). There are many types of new aircraft and operations being developed to support transportation

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS



*Attendees at the Emergent Aircraft Systems and the Dispatcher Workshop.*

of cargo, urban air mobility, package delivery, infrastructure surveillance, agricultural survey, environmental monitoring, and other areas. However, the infrastructure and technology to enable and safely manage widespread use of these aircraft does not yet exist. The various classes of new vehicles will need adaptations of traditional air traffic management to ensure safe separation from each other and from other aircraft. These aircraft will also require services that have been traditionally provided by AOCs to manage commercial aircraft fleets. This includes flight planning, flight following, weather avoidance, equipment monitoring, maintenance, weight and balance, and crew scheduling. The workshop focused on how AOC services (or fleet management) could be applied to future manned and unmanned flight operations and on NASA's

work on new aircraft systems. There were 92 attendees (and 15 to 20 online attendees) from the airline industry, FAA, NASA, and new technology companies. The Airline Dispatchers Federation supported the planning and conduct of the meeting.

### **NASA-FAA Joint UTM Pilot Program Partnership Workshop**

POC: [JOSEPH RIOS](#)

On March 15, NASA researchers leading the Unmanned Aircraft Systems (UAS) Traffic Management (UTM) Project hosted the NASA-FAA Joint UTM Pilot Program Partnership Workshop at NASA's Ames Research Center in California. The purpose of the workshop was to define pilot programs; review the concept of operations, scenarios, use cases, and requirements; and

define the UAS service supplier role. NASA and the FAA are currently defining requirements for the development and integration of a UTM System Pilot Program (UPP) as mandated by Congress in the FAA Extension, Safety, and Security Act of 2016. Continuing the industry partnership with NASA and the FAA on the Flight Information Management System prototype, and the Low Altitude Authorization and Notification Capability, the UPP will demonstrate the integration of these capabilities and develop an ability to dynamically restrict airspace to support UTM operations.

### **FRET Team Investigating Integration of Existing Analysis Tools**

POC: [JOHN KOELLING](#)

On March 16, NASA researchers supporting the System-Wide Safety (SWS) Project at NASA's Langley Research Center in Virginia began investigating the integration of existing analysis tools in parallel with completing the new graphical interface for creating requirements. The Formal Requirements Elicitation Tool (FRET) team is considering two options. The first one connects FRET to CoCoSim, which verifies formal properties on Simulink design models. It involves generating formal requirements in the form of Simulink observers (i.e.,

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

made of Simulink blocks instead of a logical formula). The other option would connect FRET with the Sorbent Polymer Extraction and Remediation System, the Rockwell Collins tool used by the Air Force Research Laboratory to either check requirement consistency or verify formal (linear temporal logic) requirements on system models (possibly expressed in Architecture and Analysis Design Language). The team is currently giving priority to the first option, connecting FRET to CoCoSim, because it will allow NASA to have a more complete solution during the in-house evaluation of FRET by the “flight/mission” colleagues. Checking it this way is a good evaluation before providing it to industry.

### **TBO Technical Interchange Meeting with MITRE, FAA, and NASA**

POC: [BRYAN BARMORE](#)

On March 19, a technical interchange meeting (TIM) with NASA and several FAA organizations focused on future Trajectory-Based Operations (TBO) was hosted at the MITRE Center for Advanced Aviation System Development, in McLean, Virginia. Bryan Barmore, Jennifer Kibler, and Ryan Chartrand—researchers from NASA’s Langley Research Center in Virginia—attended the second TBO TIM with MITRE and the

FAA. The first meeting was held at Langley in October 2017. The goal is to bring major TBO research organizations together to ensure common awareness of ongoing work and to identify collaboration and leverage opportunities. MITRE presented several briefings on time-based management operations, advanced trajectory modeling, and arrival management. They also provided tours of their Integrated Demonstration and Experimentation for Aeronautics Lab. The meeting identified several opportunities to learn from and leverage each other’s work to more efficiently develop and test TBO concepts and tools. A series of teleconferences are planned over the next few months to finish introducing the various groups’ current research portfolios. The next face-to-face meeting will take place at the FAA Technical Center in Atlantic City, New Jersey, sometime over the summer.

### **FAA Sponsored 91.113 See and Avoid Mitigation via Technology Workshop**

POC: [MARCUS JOHNSON](#)

Marcus Johnson was invited to speak about NASA’s Unmanned Aircraft Systems (UAS) Traffic Management (UTM) approach to complying with the intent of 91.113 for small UAS operations at the MITRE Center for Advanced Aviation System Development in

McLean, Virginia, from March 19 through 20. The FAA’s Aircraft Certification Office and MITRE have had ongoing discussions on UAS FAR 91.113 See and Avoid concepts and mitigation procedures and technology development. Topic areas discussed at this meeting included: technology mitigations, safety and risk considerations, performance standards, and impacts to air traffic control. Johnson presented NASA’s UTM research activities.

### **IDM Researchers Conduct Workshop with the FAA’s CDM Flow Evaluation Team**

POC: [NANCY SMITH](#) AND [PAUL LEE](#)

From March 20 through 21, Integrated Demand Management (IDM) researchers at NASA’s Ames Research Center in California conducted a two-day workshop with the FAA’s Collaborative Decision Making (CDM) Flow Evaluation Team (FET). The purpose of the meetings was to gain stakeholder feedback on the perceived benefits of the IDM concept and a better understanding of stakeholder concerns about the FAA’s Collaborative Trajectory Options Program (CTOP) automation and procedures. IDM briefings and demonstrations were followed by a series of mixed-equipment “part-task” simulation runs. During these runs, FET members were asked

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

to role-play as traffic management coordinators for airlines with different CTOP capabilities that either limited or enhanced their ability to benefit from the operations.

Assigned equipage levels varied between runs which gave operators a chance to see how benefits were distributed system-wide, as well as the differential impact between “early” and “late adopters.” A longer “full-simulation” that looked at the broader impact of IDM during convective weather on multi-airport operations was run on the second day. Participants found the mixed-equipage scenarios particularly enlightening and were pleasantly surprised to see how the benefits (reduced ground delay, improved schedule conformance, and improved throughput) were shared across all users.



*The CDM Flow Evaluation Team joined IDM researchers and subject matter experts for a 2-day exploratory human-in-the-loop simulation in the Ames Airspace Operations Laboratory.*

### RTCA SC-186 Working Group 4 Meeting to Progress ADS-B Standards

POC: [BRYAN BARMORE](#)

RTCA SC-186 Working Group 4 (WG4) is working on updating the Interval Management Safety and Performance Requirements (SPR) and Minimum Operational Performance Standards (MOPS) to add additional operational capabilities such as connection with data communications and multiple runway operations. Bryan Barmore at NASA’s Langley Research Center in Virginia participated in this meeting under a reimbursable agreement with the FAA to provide subject matter expertise for Advanced Interval Management. The meeting was held at RTCA in Washington, DC, from March 20 through 22. The purpose of the meeting was to review updates to the SPR to support additional capabilities for Advanced Interval Management and their impact on equipment and safety requirements. Closely spaced parallel runway operations will require more stringent safety and performance requirements. Briefings were presented covering the outcomes from several associated activities including planned flight operations by American Airlines for their Phoenix operations. The next meeting is currently planned for July in Grand Rapids, Michigan.

Final updates to the SPR and MOPS are planned for December 2019.

### UAS in Controlled Airspace Aviation Rulemaking Committee

POC: [BRYAN BARMORE](#)

The Unmanned Aircraft System (UAS) in Controlled Airspace Aviation Rulemaking Committee, from NASA’s Ames Research Center in California, met at Amazon in Washington, DC for their fourth plenary meeting. Ames is developing recommendations to the FAA to enable normalized operations of a UAS in Class A airspace within 3 to 5 years. Bryan Barmore, from NASA’s Langley Research Center in Virginia, attended as part of the Navigation and Performance working group. Due to a snowstorm, the plenary meeting was canceled on March 21 and working groups met via teleconference. On March 22, NASA presented plans from the UAS in the National Airspace System Project for a System Integration and Operationalization activity by Will Johnson. The FAA also presented information on how they conduct cost/benefit analyses to support new regulations and rules. In the afternoon, each working group presented their initial drafts of recommendations. Discussions focused on relationships between recommendations from

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

the different working groups and concerns and ideas from other Ames members. The next plenary meeting will be in May with a full review of recommendations by Ames. Final recommendations will be agreed to by August 2018, and the final report and recommendations will be submitted to the FAA by December 2018. Ames will remain open until June 2019 to address any questions and clarifications from the FAA.

### **Northeast Region Use-Case Discussions with External Stakeholders**

POC: [BRYAN BARMORE](#)

Researchers supporting the Air Traffic Management-eXploration (ATM-X) Project engaged with several external stakeholders during meetings held in Washington, DC.

Discussions with Steve Bradford (Chief Scientist, FAA Office of NextGen), Mark Hopkins (Director, Air Traffic Management, Delta Air Lines), and Rob Goldman (Senior Manager, Air Traffic Management, Delta Air Lines) took place at NASA Headquarters on March 27. On March 28, a meeting with Mike Cirillo, Managing Director for Air Traffic Management at Airlines for America (A4A), occurred at A4A; and another meeting with Joe Bertapelle, Director, Strategic Airspace Programs at JetBlue Airways was held at NASA Headquarters. During all four stakeholder meetings, discussions focused on candidate Northeast (NE) Region use-cases being considered for investigation within the ATM-X Increasing Diverse Operations (IDO) sub-project.

These stakeholders' feedback will significantly influence the selection and refinement of the NE Region use-case scenario that will be used to develop an initial IDO Concept of Operations (ConOps). Additionally, these stakeholders agreed to review and comment upon portions of the initial IDO ConOps as they are developed throughout the remainder of FY18.



## RECOGNITION

### Parimal Kopardekar on CES Panel

POC: [PARIMAL KOPARDEKAR](#)

Parimal Kopardekar, Senior Technologist for Air Transportation Systems at NASA's Ames Research Center in California, was invited to participate on a conversational-style panel at the 2018 Consumer Electronics Show on January 10, titled "New Frontiers in Mobility Technologies," organized by Deloitte, and part of the "Smart Cities: Thriving in the Future" track. Other panelists included Julie Richman, the Chief Information Officer from the City of Boulder, Colorado; Charles Wald, the Federal Practice Senior Advisor from Deloitte (U.S. Air Force, Retired); and Bibop Gresta, Chairman of Hyperloop Transportation Technologies. The panel was moderated by the Deloitte Global Aerospace and Defense lead, Robin Lineberger. Kopardekar's comments included how drones and urban air mobility operations will be enabled by NASA's Unmanned Aircraft Systems (UAS) Traffic Management (UTM) concept.

### Keynote at AHS Conference

POC: [PARIMAL KOPARDEKAR](#)

Parimal Kopardekar, Senior Technologist for Air Transportation Systems at NASA's Ames Research Center in California, was one of three keynote speakers at the opening session of the American Helicopter Society (AHS)

International's Aeromechanics Design for Transformative Vertical Flight conference on January 16 in San Francisco, California. Kopardekar's talk focused on the airspace operations for the emerging electric vertical take-off and landing vehicles and their operations in the context of urban air mobility. The keynote address was attended by more than 300 participants. On January 19, Kopardekar chaired a panel on the "Challenges of Urban Air Mobility Airspace," and panelists included representatives from Uber, MIT, Voom/A3, and Levitate Capital.

### ConOps for European UTM Systems Project Advisory Board

POC: [AKBAR SULTAN](#)

On October 19, senior technologist for Air Transportation Systems at NASA's Ames Research Center in California, Parimal Kopardekar, was presented with an Air Traffic Control Association (ATCA) President's Citation of Merit Award. ATCA recognizes the outstanding achievement of individuals and organizations engaged in the development, operation or maintenance of the worldwide air traffic control system. Kopardekar's award was for his technical and community leadership in Unmanned Aircraft System (UAS) Traffic Management, and advancing safe UAS integration forward.

### AIAA Announces Its Class of 2018 Fellows and Honorary Fellows

POC: [KENNY MCCOMBS](#)

On February 1, Parimal Kopardekar, Senior Technologist for Air Transportation Systems at NASA's Ames Research Center in California, and Steve Young, Formulation Lead for the System-Wide Safety Project at NASA's Langley Research Center in Virginia, were elected to the American Institute of Aeronautics and Astronautics (AIAA) Class of 2018 Fellows and Honorary Fellows. AIAA confers the distinction of Fellow upon individuals in recognition of their notable and valuable contributions to the arts, sciences, or technology of aeronautics and astronautics. Both will be inducted at a ceremony on May 2, 2018, at the AIAA Aerospace Spotlight Awards Gala in Washington, DC.

### Parimal Kopardekar Serves as Panelist at the Third FAA UAS Symposium

POC: [PARIMAL KOPARDEKAR](#)

Parimal Kopardekar, Senior Technologist for Air Transportation Systems at NASA's Ames Research Center in California, was invited to participate at the third FAA Unmanned Aircraft Systems (UAS) Symposium, on March 7 in Baltimore, Maryland. Kopardekar was a panelist on the

## RECOGNITION

“Understanding and Enabling Air Traffic Management for UAS panel” moderated by FAA Chief Scientist for NextGen Steve Bradford, with participation from Jay Merkle (FAA Air Traffic Organization), Susan Roberts (General Electric), and Matt Fanelli (Skyward). Kopardekar presented the Unmanned Aircraft System (UAS) Traffic Management (UTM) architecture and the FAA’s industry components. Merkle discussed the low altitude authorization and notification capability, used for the FAA’s drone authorization and authentication function in UTM, and gave credit to NASA’s UTM project for identifying this requirement. The panel also discussed the UTM System Pilot Project Industry Day scheduled for March 15 at NASA’s Ames Research Center in California. The Symposium also showcased keynote addresses from Gur Kimchi (Amazon Prime Air) and James Burgess (Project Wing), with the topic of “Research to Reality.” Both speakers described

their respective companies’ development efforts, needs and approaches, and clearly indicated their eagerness to establish UTM services within their businesses.

### **Presentation at the FAA Interagency Planning Office Core Cyber Team Monthly Meeting**

POC: [PAUL NELSON](#)

On February 15, Paul Nelson, Airspace Operations and Safety Integration Manager for Cybersecurity and Communications, provided a briefing on the Unmanned Aircraft Systems Traffic Management project and cybersecurity issues at the FAA NextGen Interagency Planning Office Core Cyber Team Monthly International Council on Clean Transportation meeting. This meeting was held at FAA Headquarters in Washington, DC. Meeting attendees considered the briefing extremely informative and well-received.

### **NITRD Cyber-Physical Systems IWG**

POC: [PAUL NELSON](#)

On March 15, Paul Nelson, Airspace Operations and Safety Integration Manager for Cybersecurity and Communications, attended the Networking and Information Technology Research and Development (NITRD) Cyber-Physical Systems (CPS) Interagency Working Group (IWG) by teleconference. At the meeting, there were three short presentations by David Corman (National Science Foundation), Ariel Gold (U.S. Department of Transportation), and Edward Griffor (National Institute of Standards and Technology), which focused on different aspects of CPS within the transportation industry.

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