



# AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

JUL-SEP 2019 | Quarter 4



UTM Successfully Completes  
TCL 4 Testing 4

UTM Wins Software of the Year 16

## AOSP IN THE NEWS

### [Two Corpus Christi Parks Close Briefly For Drone Testing](#)

Corpus Christi (TX) Business News (7/25) reports that “drone testing by NASA in two Corpus Christi parks Friday, July 26, and Monday, July 29, will close those parks to the public for a short period of time each of those days. Watergarden Park closes 10AM-2PM Friday, while Cole Park closes 8:30AM-3:30PM Monday for drone testing in an urban setting by NASA and the Lone Star UAS Center for Excellence and Innovation at Texas A&M University-Corpus Christi. NASA selected Corpus Christi as one of two sites in the nation for these tests.”

### [Meet George Jetson's Ride: Air Taxis Are Closer To Reality Than Many Commuters And Travelers Realize](#)

Milwaukee Journal Sentinel (7/25) reports “the Jetsons may be closer to reality than we think. Americans of a certain age who watched George Jetson commute to work at Spacely

Space Sprockets in his personal spaceship have been wondering when we'll get to fly to work and soar above traffic jams. ... Many of the urban air mobility designers at EAA AirVenture are participating in Boeing's GoFly Prize, a \$2 million contest to create new ways of flying. Last year NASA launched the Urban Air Mobility Grand Challenge to help companies through the regulatory process.”

### [NASA's Air Traffic Control System For Drones Nearing Completion](#)

Discover Magazine (8/15) reports that “highways in the sky are one step closer to becoming reality as NASA conducts the final planned tests of its traffic management system for unmanned drones in Corpus Christi, Texas this week. The system would act like air traffic control for drones, tracking them to help avoid collisions and ensure smooth flight paths. Testing the cloud-based system's capabilities in windy urban areas like Corpus Christi is one

of the biggest remaining obstacles before drone traffic oversight can be transferred from the aeronautics division of NASA to the FAA (Federal Aviation Administration).”

### [NASA Testing Urban Drone Safety Over Corpus Christi](#)

Associated Press (8/20) reports “NASA is flying drones over a south-east Texas city to test the safety of the unmanned devices in a dense urban environment. The tests this month in Corpus Christi are part of a four-year project with the Federal Aviation Administration to develop a national drone traffic management system. NASA said in an Aug. 9 news release that the drones are flying at altitudes between 200 and 400 feet. It says a city presents obstacles that can reduce line of sight and hinder communication. Urban weather conditions can hamper flight, and cities often lack safe landing options.”

## AOSP IN THE NEWS

### [NASA Advances UTM Concept With Dual Drone Flight Demonstrations](#)

Aviation Week (9/2) reports “results from NASA’s Unmanned Aircraft Systems Traffic Management (UTM) project point to the complexity of managing small drone operations at low altitudes. The space and aeronautics agency completed successive rounds of drone flight demonstrations in two U.S. cities on Aug. 23 using a UTM construct for traffic management.”

### [Grand Challenge Will Bring NASA, FAA And Industry Together On UAM](#)

Aviation Week (9/18) “For the many new entrants in the nascent urban air mobility (UAM) market, dealing with the different parts of the FAA responsible for aircraft certification, pilot licensing, operating approval and airspace integration is a challenge. To streamline that interface, NASA has formulated its UAM Grand Challenge (GC) as both a proving ground for vehicles and procedures and an environment where industry and regulators can work together to understand the requirements and work toward consensus.”

### [NASA Grand Challenge Structured To Advance Urban Air Market](#)

Aviation Week (9/25) “With a White House shout-out, NASA has launched a grand challenge aimed at accelerating electric vertical-takeoff-and-landing (eVTOL) technology and the urban air mobility (UAM) market. But what is the role for a government research agency in a sector driven by entrepreneurial startups?”

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## UTM Successfully Completes TCL 4 Testing

POC: [RON JOHNSON](#)

The Unmanned Aircraft System (UAS) Traffic Management (UTM) project successfully completed the second set of Technical Capability Level 4 (TCL 4) flight tests in Corpus Christi, Texas, this past quarter. The first set of TCL 4 demonstrations took place in June, in Reno, Nevada. This second round of testing began with shakedown tests conducted during the week of July 25, at the Corpus Christi test ranges, with actual data runs being conducted from August 12-23. The Lone Star UAS Center of Excellence (LSUASC) coordinated the Corpus Christi testing, which included over a dozen industry partners and the Corpus Christi fire department. During the tests, eight live UAS (with as many as seven flying simultaneously) executed beyond-visual-line-of-sight operations in a true urban



*UAS takeoff from USS Lexington Aircraft Carrier Museum for flight to Corpus Christi.*



*TCL 4 test team in Corpus Christi.*



*Three UAS flying over the waterfront area.*

environment in downtown Corpus Christi, along the shoreline, and in a nearby park. Throughout the test period, over 419 live flights and 647 simulated flights were flown to create high density UAS operations. The vehicles were outfitted with onboard systems to investigate their communication, navigation, and identification performance.

Seven industry partners provided UAS Service Suppliers (USS) connected to the NASA Flight Information Management System. The USS controlled the drone air traffic through multiple scenarios including remote launch and land, building rooftop-to-rooftop operations, emergency responder operations, and airspace volume

## TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

restrictions. Early results indicate that the UTM system performed well in the traffic management functions, and areas of improvement were noted regarding radio frequency interference on UAS controls, global positioning system errors due to tall buildings, and micro weather in urban canyons. A media day was held on August 15 and was attended by local television and print media. The UTM system was demonstrated and the press could see live flight operations. Speakers at the press conference included Jay Dryer, deputy associate administrator for aeronautics programs; Huy Tran, director of aeronautics at NASA Ames Research Center in California; and Ronald Johnson, UTM project manager.

### Discussion and Demo of IDM Concept with FAA's Northeast Corridor Operations Team

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

From July 9–10, Integrated Demand Management (IDM) researchers held discussions and demonstration sessions of NASA's IDM concept for FAA representatives from the Northeast Corridor (NEC) operations team at the NASA Ames Research Center in California. The team consisted of Mike Benson, Greg Hendricks, Larry Larkin, Blake Locke, and Brian Reddy. Vern Payne, the district traffic management officer for Philadelphia International

Airport (PHL) and Washington Center (ZDC), was also present. NEC operations team members were present to view and evaluate collaborative trajectory options program (CTOP) preconditioning of Newark Liberty International Airport (EWR) arrival flights before entering the Time-Based Flow Management (TBFM) environment. They also came to view NASA's PHL CTOP/TBFM adaptation and compare it with their own PHL setup for TBFM that uses extended metering exclusively. They wanted to evaluate if NASA's IDM concept would be a beneficial addition to their work. The initial day one discussion was a summary of past work on the IDM project to the NEC operations team representatives. IDM simulations of EWR and PHL airport operations were shown to illustrate the benefits of preconditioning traffic destined for EWR/PHL. This preconditioning would replace miles-in-trail restrictions that are currently used for flights before they enter the TBFM environment. Arrival fix balancing is also being used in the simulations. An additional discussion concerned the concept of the continued use of TBFM in weather conditions. Currently, weather causes a cancellation of TBFM in the northeast (EWR and PHL). CTOP preconditioning, in conjunction with TBFM, allowed aircraft to reroute around weather when one of the arrival fixes was blocked by the

weather. The second day included a presentation of a PHL CTOP/TBFM simulation. The feedback received from the visitors was encouraging. The visiting team does have their own solution for the PHL TBFM problem, namely extended metering, but they saw significant value in implementing the IDM concept with CTOP preconditioning in testing and evaluation of new adaptations. They believe that CTOP could be used effectively in conjunction with extended metering. The visitors saw NASA's capabilities as an attractive early alternative to their work. The NEC project requires the participation of approximately 10 facilities and will take years to complete. The NASA setup could be tested almost immediately, significantly reducing the testing and evaluation time frame. In the wrap up discussion, the NEC operations team presented the idea of NASA going to the FAA technical center with their CTOP software and creating a joint simulation of the PHL TBFM concept.

### ATM-X Completes Shakedown Tests with the FAA for 2020 Boeing EcoDemonstrator Flights

POC: [RICH COPPENBARGER](#)

The Air Traffic Management-eXploration (ATM-X) project team conducted a couple of shakedown simulation flights this past quarter

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*Testbed laboratory showing flight data received from the FAA technical center on July 18.*

between the NASA Ames Research Center in California testbed and the William J. Hughes FAA technical center cockpit simulation facility (CSF) near Atlantic City, New Jersey. The purpose of these shakedown flights was to test the communications data that will be used in the upcoming Boeing EcoDemonstrator flight demonstrations in 2020. The first test was conducted on July 2 and the second test on July 18. The purpose of the flight simulations were to test data transfer and flight plan execution aimed at acquiring detailed flight data for NASA's tailored arrival manager (TAM). TAM relies on NASA's autoresolver technology to compute trajectory solutions that ensure safe separation from other aircraft, while managing time-based metering constraints in busy arrival

airspace. TAM will be used in the upcoming EcoDemonstrator 2020 flight demonstration to calculate and send trajectory-based advisories over Controller Pilot Data Link Communications. TAM solutions are designed to be flown using the aircraft's Flight Management System. During the first flight, four piloted simulation runs were conducted over a six-hour test period. This second shakedown simulation was used to evaluate fixes for a number of issues discovered during the first shakedown tests. These issues included the transfer of top-of-descent and arrival time predictions from the aircraft, flight routing anomalies, and data frequency concerns. Results from the recent testing, which included three arrivals to Moses Lake, Washington, where the 2020 flight will occur, have

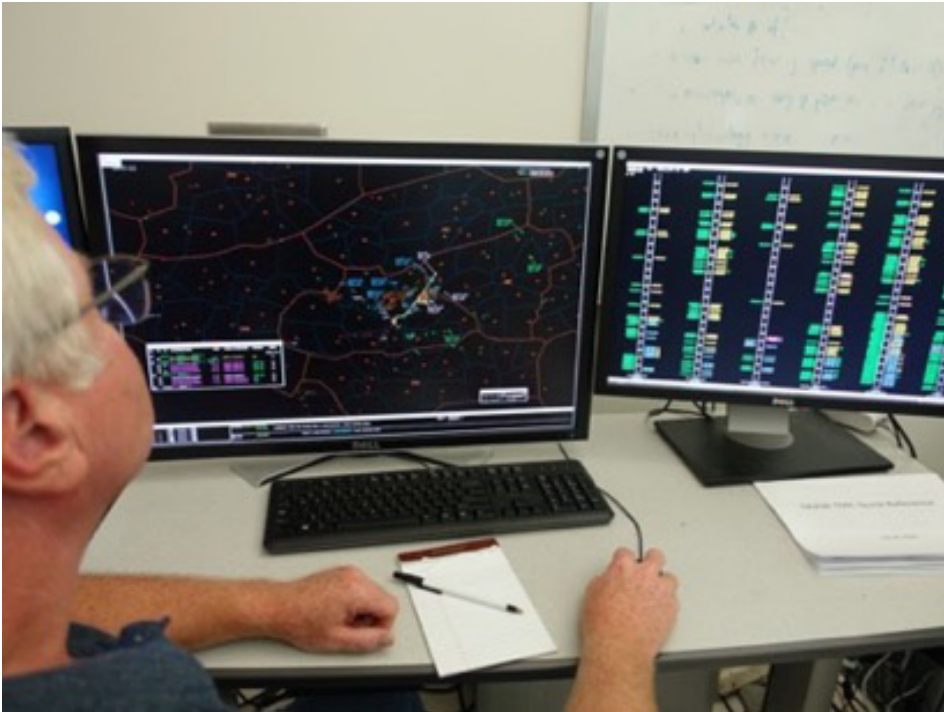
shown that all previously identified issues were successfully resolved. For the actual EcoDemonstrator flights in 2020, aircraft data reporting will rely on Automatic Dependent Surveillance Contract services, supported by Future Aircraft Navigation System avionics.

### **Dynamic Routes for Arrivals in Weather Human-in-the-Loop Simulation #5**

POC: [DOUG ISAACSON](#)

The fifth in a series of human-in-the-loop (HITL) studies of the Dynamic Routes for Arrivals in Weather (DRAW) tool was conducted from July 24–August 1 in the air traffic control laboratory at the NASA Ames Research Center in California. DRAW HITL #5 was the final DRAW HITL study and the first to use a DRAW-enhanced version of the FAA's Time-Based Flow Management (TBFM) system; the culmination of over three years of development and testing within a NASA rapid prototyping system and two years of software development to modify and enhance TBFM software to include core DRAW capabilities. This study investigated the use of DRAW in an arrival metering context within the Fort Worth (ZFW) Air Route Traffic Control Center airspace. Study participants included four recently retired ZFW Traffic Management Coordinators (TMCs). Two TMCs participated each week of the

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*TMC participant uses DRAW to reroute flights around weather while maintaining acceptable delays.*

study, with each participating as the primary DRAW user in parallel, independent simulations. Each TMC was presented with four weather-impacted arrival traffic scenarios, both with and without DRAW functionality (32 total runs). DRAW provided TMCs with reroute advisories and schedule impact/delay information. TMCs used the DRAW trial planning capability to evaluate candidate reroutes for weather avoidance, assess their schedule delay impact, and amend flight routes as necessary to maintain effective arrival metering. Questionnaires were administered to the TMC participants and data was collected to analyze arrival

metering and DRAW performance. The objectives of DRAW HITL #5 were to evaluate the stability and reliability of DRAW as part of the enhanced version of TBFM and to assess DRAW performance for four-corner-post arrival operations into the Dallas-Fort Worth International Airport Terminal Radar Approach Control Center. DRAW exceeded all expectations for performance, stability, and reliability, even with scenarios designed to represent a very high traffic demand for weather impacted airspace. Representatives of the FAA's NextGen office observed DRAW HITL #5 activities during the second week of the study and discussed technology transfer and

next steps with DRAW researchers and the Airspace Technology Demonstration project management. Results are being analyzed by DRAW team researchers and will be shared in a project out-brief planned for September 2019.

### **NASA and MITRE Collaborate on ATD-2/Mobile App at EAA AirVenture**

POC: [DEBI BAKOWSKI](#)

NASA and the MITRE Corporation collaborated in supporting the Airspace Technology Demonstration-2 (ATD-2)/mobile app exhibit at the Experimental Aircraft Association's (EAA) AirVenture, in Oshkosh, Wisconsin, from July 22–28. EAA AirVenture, often referred to as Oshkosh, is a week-long air show and the largest fly-in air show in the world, with more than 640,000 attendees this year. NASA and MITRE team members worked together to support the ATD-2/mobile app exhibit table inside the NASA pavilion at Oshkosh. NASA and MITRE used this opportunity to introduce ATD-2 to the general aviation pilot community and demonstrate how mobile app technology can enable their engagement with ATD-2. NASA's presentation highlighted the ATD-2 Phase 2 field demonstration at Charlotte Douglas International Airport (CLT). Visitors learned how short gate holds enable surface

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*Demonstration provided by NASA Ames researcher Ehsan Talebi.*

metering and how more efficient overhead stream insertion can reduce delay. Team members described the use of NASA-developed software tools at CLT, the ramp traffic console and surface trajectory-based operations client; and the role of NASA's FutureFlight Central simulation facility in software development and testing. NASA highlighted the benefits of ATD-2 since its October 2017 deployment to CLT, which include 357,181 gallons of fuel saved, CO<sub>2</sub> savings equivalent to 55,954 urban trees, and 298.2 hours of surface delay saved (through May 2019). MITRE demonstrated several examples of their mobile app technology and highlighted how this technology

allows the general aviation or corporate pilot to participate in, and benefit from, ATD-2. Visitors used an iPhone to interact with MITRE's prototype Pacer app, which enables general aviation or corporate pilots to submit a ready-time for their flight and provides users with a view of predicted surface demand at the airport. Better predictions of ready-times for general aviation flights enable the ATD-2 scheduler to more accurately predict demand at the runway and terminal-area boundary departure fixes. In coordination with the FAA's NextGen program office, the National Business Aviation Association, and NASA, MITRE is testing the Pacer app this summer at Dallas Love Field Airport. The

team also discussed their work at CLT, where corporate pilots submit a ready-time for their flight via MITRE's prototype mobile texting capability. At CLT, information generated by the ATD-2 scheduler is passed to the user via the Terminal Flight Data Manager terminal publication that NASA is publishing on the System Wide Information Management research and development network. In addition, MITRE demonstrated an air traffic control interface that enables the delivery of instrument flight rules clearances to a mobile device and the negotiation of an instrument flight rules release/cancellation at non-towered airports. Visitors also had the opportunity to fly an approach using an interactive flight simulator as part of MITRE's trajectory-based operations app demonstration. The trajectory-based operations app provides en route speed guidance to pilots to enable compliance with a required time of arrival at a fix. NASA organizers estimate that approximately 50,000 Oshkosh attendees visited the NASA pavilion during the week-long airshow.

### **ATM-X EcoDemonstrator 2020 Team Holds Critical Design Review**

POC: [BARBARA BURIAN](#)

On July 25, the Air Traffic Management-eXploration (ATM-X) EcoDemonstrator 2020 team conducted a critical design



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*EcoDemonstrator CDR participants at NASA Ames human factors integration facility.*

review (CDR) at the NASA Ames Research Center in California. The purpose of the CDR was to review work and progress to date in testing, planning, and preparing for participation with Boeing and FAA colleagues in EcoDemonstrator 2020 flights demonstrating: 1) digital data transfer among NASA, Boeing, and FAA technologies, facilities, and a Boeing aircraft, and 2) a tailored arrival manager solution when a flight crew is informed of a change to their materials in preparation for the CDR, which lasted three hours. The CDR was divided into two main sections. In the first section, new information beyond the read-ahead material was presented, and critical issues (including some from the read-ahead material) were discussed. In the second section, a deep dive into the technical aspects of one of the critical steps to be completed during the demonstration was presented. Cross-cutting issues associated with completion of that step, such as testing and the testing schedule, risks and their mitigations, and contingency



planning, were discussed. Reviewers and stakeholders provided feedback, and actions (if any) were completed within two weeks.

### Enabling Autonomous Flight & Operations in the National Airspace System

POC: [PARIMAL KOPARDEKAR](#)

From August 6–7, the NASA Aeronautics Research Institute (NARI) hosted the second event in the Enabling Autonomous Flight & Operations in the National Airspace series at the NASA Ames Research Center in California. The event included over 200 attendees, from aircraft manufacturers to operators of passenger, cargo or delivery services, venture capitalists, airport designers, machine learning specialists, and more. NASA is taking the initiative to gather input from the full spectrum of players contributing to the development of increasing autonomy in aviation.

For more technical information, visit the NARI website: <https://nari.arc.nasa.gov/>

### FAA-NASA Quarterly Research Transition Team Meeting

POC: [MIKE MADSON](#)

On August 13, FAA representatives met with AOSP researchers at the NASA Ames Research Center in California to coordinate several topics in the ATM-X research portfolio such as Urban Air Mobility (UAM) and the upcoming Boeing EcoDemonstrator 2020 flight tests. NASA described how they are building a UAM management system by extending the existing Unmanned Aircraft System Traffic Management system and testing it with an external UAM partner. Both the FAA and NASA have separate activities on the same EcoDemonstrator flight. During this meeting, the participants also discussed tighter collaboration for going forward in creating a far-term airspace management concept document. Both parties agreed to continue discussing these topics at the next FAA quarterly meeting scheduled in early December 2019.

### Urban Air Mobility Listening Session

POC: [JEREMY COUPE](#)

On August 14, both the Air Traffic Management-eXploration (ATM-X) and Advanced Air Mobility projects attended an Urban Air Mobility (UAM) listening session organized by the NASA Aeronautics Research Institute (NARI) at the

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NASA Ames Research Center in California. NARI hosted several UAM companies to discuss their progress and perspective of the UAM market. Vehicle development and airspace management topics were discussed with the attendees, allowing the audience to better understand industry plans to reach full-scale UAM operations in the near future. This session will help ATM-X planning and focus its UAM-related research.

### Simulation Evaluation of IDM Concept for Two Airports in Convective Weather

POC: [PAUL LEE](#)

AOSP researchers in the Integrated Demand Management (IDM) team have built a capability called Traffic Management Initiative Automated Simulation, or TMIAutoSim, that can run the IDM human-in-the-loop simulation software in a mode that mimics human traffic management and air traffic clearances without direct participant inputs. This enables both fast time simulation and evaluation of full-day scenarios that would not be possible using humans in the loop. This capability has been developed to run the IDM concept under many different weather scenarios for multiple airports and evaluate its impact over the course of a day. The simulation capability has been adapted to run six different representative weather

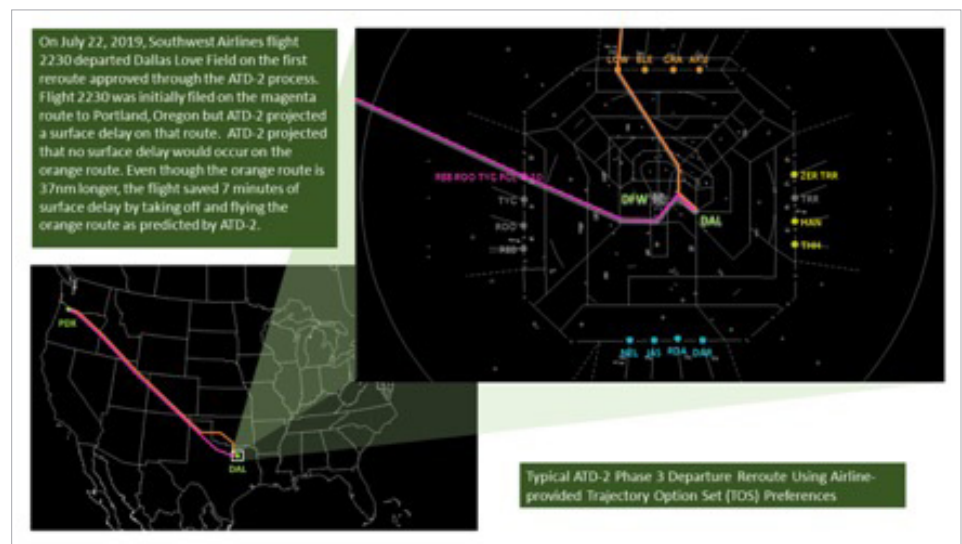
scenario days in the Northeast Corridor region, specifically for Newark and LaGuardia airports, under three different experimental conditions. The conditions compare IDM operations with different baseline conditions to assess potential benefits and challenges. The simulation capability and the airspace adaptation was successfully built and validated in late August. The IDM team subsequently began collecting data for the study, and expect to have preliminary results of the study by late September. Final analyses and results are expected by December.

### ATD-2 Completes Phase 3 Initial Concept Evaluation

POC: [ERIC CHEVALLEY](#), [KEENAN ROACH](#),  
[GREG JUR0](#) AND [BOB STAUDENMEIER](#)

NASA's Airspace Technology Demonstration-2 (ATD-2) team

and its North Texas-area field demonstration partners have completed the Phase 3 initial concept evaluation that targeted the 2019 storm season. The Phase 3 live testing began on June 10, with additional capabilities introduced in July and August. The six field facilities involved as demonstration partners include: American Airlines Integrated Operations Center, Southwest Airlines Network Operations Center, Dallas-Fort Worth tower, Dallas-Fort Worth Terminal Radar Approach Control Center, Dallas Love tower, and Fort Worth center. Approximately 90 individuals from the six field facilities received training from NASA ATD-2 personnel in preparation for the testing. Additionally, NASA personnel provided onsite and telecon support during numerous test periods to accelerate operational personnel



ATD-2 reroute approval on July 22, 2019, saves Southwest Airlines seven minutes of flight time.

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familiarization with the ATD-2 system. Between July 22–August 26, the team logged 54 hours during 11 days of operational testing. Both airlines successfully submitted multiple flights for reroutes to air traffic control which resulted in delay savings and positive impacts for the National Airspace System (NAS).

Following this initial testing period, the field facilities have continued Phase 3 testing on a target of opportunity basis. The use of ATD-2 Phase 3 has resulted in key findings and lessons learned that are being utilized to refine system requirements in preparation for the fiscal year 2020 Phase 3 telecons conducted by NASA personnel with the field users. Several of the refinements are associated with expanding the integration capabilities of the system to incorporate other traffic management initiatives that are in place in the NAS. These improvements will assist the field users in more expeditiously identifying aircraft that are eligible for delay savings. A follow-up review and planning meeting is scheduled to discuss enhancements and prepare for the 2020 evaluation. Additionally, NASA personnel are conducting follow-up training with personnel from the participating field facilities on an as-needed basis. Consistent positive feedback has been received from all field facility participants during the evaluation period.



*NASA Ames hosts the German Aerospace Center.*

### German Aerospace Center Visit to NASA Ames

POC: [JEFF MCCANDLESS](#) AND [MIKE FLETCHER](#)

The NASA Ames Research Center in California hosted a visit from the German Aerospace Center (DLR) on August 29. The DLR attendees included Jean Daniel Sülberg, founding director, DLR Unmanned Aircraft System (UAS) Test Center, Cochstedt; Oliver Pape, deputy director, DLR Washington liaison office; and Charles Ben, assistant to the DLR executive board member for aeronautics. Also in attendance were Kent Bress, director, Aeronautics and Cross Agency Support Division, Office of International and Interagency Relations, NASA headquarters; and Terry Pagaduan, Ames' lead

for international relations. A day of briefings and tours was held. Recent DLR activities were presented by Sülberg. For NASA, overviews were presented by Jay Shively for the UAS in the National Airspace System project, Mike Madson for the Air Traffic Management-eXploration project, and Gloria Yamauchi for the Revolutionary Vertical Lift Technologies project. Tours followed, including a visit to the Vertical Motion Simulator led by Steve Beard, a UAS Traffic Management lab demonstration and Technical Capability Level 4 summary with Ron Johnson, and a FutureFlight Central demo with Steve Beard. The day ended with an open discussion about potential research collaborations.

# TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

## NASA ATD-2 Team Hosts Industry Workshop

POC: [AL CAPPS](#) AND [WILLIAM CHAN](#)

From September 4–5, AOSP hosted its Airspace Technology Demonstration-2 (ATD-2) industry workshop in Dallas, Texas. The workshop objectives were: to transfer to National Airspace System (NAS) users the lessons learned from the field demonstration of NASA's ATD-2 technologies; identify emerging needs for tools, services, and platforms for the aviation market; provide a deeper understanding of the transformational potential of the future surface system; and enable industry operators to meet upcoming Terminal Flight Data Manager (TFDM) requirements for their organization while achieving benefits. Over 200 attendees

participated in the workshop, including representatives from the FAA, the National Air Traffic Controllers Association, academia, airlines, airports, and aviation industry solution providers. Three panel sessions focused on: 1) capabilities the aviation community will need to be ready for TFDM; 2) communicating initial results from an ongoing field demonstration that is focused on the integration of surface and metroplex departures; and 3) providing an opportunity for formulation input into NASA's future aviation research plans. NASA, along with other ATD-2 partners, presented over 20 hours of material on surface system capabilities, understanding and quantifying NAS performance and benefits, understanding TFDM from a multi-system

decision support viewpoint, and the future vision and needs of the NAS. The ATD-2 industry workshop facilitated active engagement across various groups and provided additional insights on any remaining tech transfer needs.

Recordings and presentations from the ATD-2 industry workshop can be found at: <https://aviationsystems.arc.nasa.gov/atd2-industry-workshop/>

Additionally, the Air Traffic Management-eXploration (ATM-X) project participated on a joint panel with the ATD-2 team at the workshop. The joint panel gave the audience an opportunity to provide input to the ATM-X and ATD-2 teams for their planning activities. ATM-X is interested in leveraging ATD-2 technologies and identifying collaborative research activities for traditional operations to inform Phase 2 planning of the ATM-X project.

## ATD-2 Supports the Surface Collaborative Making Team and Flow Evaluation Team

POC: [ERIC CHEVALLEY](#)

On September 6, the Airspace Technology Demonstration-2 (ATD-2) team met with the joint surface collaborative decision making team (SCT) and flow evaluation team (FET) at Southwest Airlines headquarters in Dallas,



*Panel discussion as part of the ATD-2 industry workshop.*

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*Joint SCT and FET at Southwest Airlines headquarters in Dallas, Texas.*

Texas. The group discussed lessons learned from the initial field test of Phase 3 capability in the North Texas region during the summer of 2019. The group discussed how to extend ATD-2 Phase 3 capability to leverage trajectory option sets in conjunction with National Airspace System (NAS)-wide restrictions in order to increase situational awareness and account for the impact of NAS-wide constraints, which leads to more efficient rerouting of traffic to mitigate flight delay. This input will be used by the ATD-2 team in its Phase 3 planning. The inputs from the collaborative decision making teams consisted of both FAA and flight operator comments, which were useful in identifying improvements for the entire aviation community. A follow-up

meeting with the joint group is scheduled for October to discuss additional details of Phase 3 plans.

### **Non-Reimbursable Space Act Agreement between NASA and GE Flight Efficiency Services, Inc.**

POC: [KEE PALOPO](#)

On September 12, NASA and GE Flight Efficiency Services, Inc. signed a Non-Reimbursable Space Act Agreement consisting of a five-year umbrella and a one-year annex (Annex One). The agreement is intended for collaborative development and use of the NASA Air Traffic Management-eXploration (ATM-X) testbed for integrated air traffic management research. Specific to Annex One with the ATM-X testbed, the

testbed team will prepare the connectivity infrastructure with GE to support any future collaborative research. The team will work with GE to establish a connectivity between a designated GE facility and testbed, test the connection, and document the results. Future candidate collaborations for subsequent annexes includes other ATM-X research and the System-Wide Safety project.

### **NASA-Uber End-to-End X-2 Test Simulation**

POC: [DAVID THIPPHAVONG](#)

On September 17, the Air Traffic Management-eXploration (ATM-X) team completed its first end-to-end test of the first NASA Urban Air Mobility (UAM) air traffic management system with an external partner ahead of a series of engineering evaluations, named X-2, scheduled for the end of the month. The ATM-X UAM team coordinated and collaborated with the Uber team to run a complete 40-minute simulation in which hundreds of flights were simulated, with NASA submitting operations for one set of flights and Uber doing the same for a different set of flights, all operating in a common airspace. During the X-2 build up, NASA and Uber identified several scalability issues and developed and tested solutions to mitigate these issues. NASA and Uber are on track to complete

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*End-to-end X-2 test simulation of NASA and Uber operations in a common airspace.*

the X-2 engineering evaluations at the end of September. During the simulation, Uber remotely connected from their lab to the X-2 airspace management system developed by the NASA UAM team. NASA will further adapt and extend this system for use in the NASA UAM Grand Challenge (GC). This activity with Uber reduces risk and expedites the future integration of GC partners into this system for GC activities. With X-2, the ATM-X UAM sub-project is on track to fulfill its responsibilities for the GC, including running GC scenarios with GC partners in lab simulations to demonstrate their capabilities and components prior to GC flight test activities.

### ATD-2 Exhibit at NATCA Communicating for Safety Conference

POC: [SHAWN ENGELLAND](#)

AOSP researchers collaborated with American Airlines to exhibit Airspace Technology

Demonstration-2 (ATD-2) technologies at the National Air Traffic Controllers Association (NATCA) hosted Communicating for Safety (CFS) conference, in Las Vegas, Nevada, from September 16-18. The CFS conference was attended by over 1,500 participants and approximately 70 sponsors and exhibitors. This year's CFS theme, "Every Day is a Training Day," is also the name of the NATCA's important new safety initiative. The NASA team presented live-data views of the ATD-2 Integrated Arrival/Departure/Surface system running at Charlotte Douglas International Airport (CLT) to familiarize CFS attendees with the technology and how it will impact operations at airports across the country in the near future. The ATD-2 system currently being demonstrated at CLT is blazing the

trail for the FAA Terminal Flight Data Manager (TFDM) program. Beginning at CLT in the spring of 2021, the FAA TFDM program will deploy surface traffic management capabilities similar to the ATD-2 system to 27 airports across the country. The NASA ATD-2 system includes decision support tools for both FAA air traffic controllers and for the American Airlines personnel that control ramp operations at CLT. FAA TFDM decision support tools, which were also exhibited at the CFS conference, will replace the ATD-2 system in the CLT air traffic control tower. The TFDM program will provide data feeds which airline and airport operators will use to run their decision support tools. NASA and American Airlines used this CFS exhibit to emphasize the need for industry (i.e., flight operators, airport



*Pictured left to right: Bernie Davis, American Airlines; Shawn Gorman, NASA/Mosaic-ATM; John Short, NATCA; and Shawn Engelland, NASA.*

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operators, and solution providers) to equip in a timely manner so as to be ready for TFDM deployment.

### FAA's 14th Annual Verification & Validation Summit

POC: [TERRY MORRIS](#)

The FAA held its 14th Annual Verification & Validation (V&V) Summit from September 25–26, in Atlantic City, New Jersey. The purpose of the summit was to address innovative methods and strategies that embrace V&V philosophies and principles. The focus of the summit was on resilience. Terry Morris from the NASA Ames Research Center in California attended the summit to understand how V&V strategies and philosophies of the FAA align with the V&V strategies resident within the technical challenges of the System-Wide Safety (SWS) project. The summit included representative presentations from the FAA (air traffic control, technology development, chief data officer, etc.), military (Air Force



*FAA's 14th Annual Verification and Validation Summit, held from September 25-26, 2019.*

test & evaluation divisions and the Air Force Research Laboratory), academia (Rowan University), industry partners (Boeing, CACI, Noblis, Objectstream, etc.), and other government agencies (U.S. DOT Volpe Center). The essence of the summit appeared to focus on ensuring that the National Airspace System (NAS) design and architecture is robust and resilient enough to handle the emerging Unmanned Aircraft System Traffic Management system. Creating

a more resilient NAS involves ensuring that the system can handle the volatility, uncertainty, complexity, and ambiguity involved with the transition to increasing automation. Although the principles of the FAA approach to V&V are similar to SWS, the focus and presentations appeared to be geared more towards ground test and evaluation, versus the tough reality of ensuring that automation in the NAS is verified and validated end to end.

## RECOGNITION

### UTM Wins Software of the Year Award

POC: [JOSEPH RIOS](#)

The Unmanned Aircraft System (UAS) Traffic Management (UTM) project was recently selected as the winner of the 2019 NASA Software of the Year award for the UTM software. The NASA-wide annual Software of the Year competition rewards high-quality, innovative, and robust software using efficient software engineering processes that meet NASA's stringent safety and reliability standards. Sponsors of the competition include the NASA chief engineer, the NASA chief information officer, and the NASA office of safety and mission assurance. The UTM software is a novel concept with the goal of enabling small UAS to access low-altitude airspace in a safe, efficient, and fair manner. The true innovation of UTM is the overall concept embodied within the system architecture. Traditional air traffic management relies on a central



*UTM software at work in the airspace operations lab at the NASA Ames Research Center in California.*

body (like the FAA) to manage and control the airspace. UTM allows for distributed management of the airspace wherein private companies collaborate to maintain a safe and accessible environment.

### National Transportation Safety Board Accident Investigation Training

POC: [JOHN KOELLING](#)



*Accident investigation exercise at the National Transportation Safety Board.*

John Koelling attended and completed the National Transportation Safety Board (NTSB) basic accident investigation course AS-101 in Ashburn, Virginia, from September 9-20. John was offered an opportunity to attend by Dana Schulze, the newly named director of the NTSB office of aviation safety. While the focus of the course was on topics directly related to accident investigation, it also gave significant insight into the kinds of forensic analysis that will be required in accident investigations for future concepts like Urban

Air Mobility. In addition, it also provided insight into the kinds of data required for analysis supporting these investigations. Of particular interest was a half-day workshop on Asiana Flight #214, which is often used as an example of where an In-Time Aviation Management System could likely have prevented an accident that resulted in a loss of life and significant resources.

### Vertical Flight Society Workshop

POC: [JOHN KOELLING](#)

On September 11, John Koelling gave a presentation at the Vertical Flight Society's workshop on "eVTOL Defining Challenges for Urban Air Mobility: System Safety, Infrastructure, and Airspace Management." This talk was titled, "How Does the Transition to a More Autonomous Mobile Future Affect Aviation Safety?" and was given at the Navy Memorial visitors center in Washington, DC. The talk was very well received, with individuals from several organizations asking for contact information and for the talk to be repeated at another meeting or for their organization.



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