



AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

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[FAA Bill Aims to Prevent Drones Flying Near Airports](#)

USAToday.com (7/11) reports that the bill also called on Federal Aviation Administration to report to Congress every six months for two years about its research and development with NASA of an air-traffic control system for drones. NASA has led a team of industry members for years to determine ways to keep drones separated the way passenger planes are separated.

[Senate Passes FAA Funding Bill with Drone Directives](#)

Radio Magazine (radiomagonline.com) (7/15) reports that NASA and the Federal Aviation Administration have been directed to create comprehensive “testing or modeling” of drones colliding with jet, propeller, and rotary aircraft of various sizes, speeds, and points of contact.

[FAA Bill Has Focus on Drones, Calls for Extensive Collision Testing](#)

AviationPros.com (7/20) reports that the Federal Aviation Administration (FAA) and NASA will continue to develop a research and deployment plan for a traffic management system (UTM), which must be completed in approximately six months. The plan will then be submitted to members of the Senate and the House, and posted on the FAA website.

[White House Unveils Plan to Boost Drones](#)

TheHill.com (8/02) reports that the Federal Aviation Administration is chartering a new unmanned aircraft safety team and a drone advisory committee to analyze safety data and mitigate drone threats, as well as forming a data exchange working group with NASA.

[White House, NSF, NASA Tout Ambitious Drone Application Plans](#)

NetworkWorld.com (8/02) reports the launch of a joint NASA and Federal Aviation Administration (FAA) data-exchange working group under the Unmanned Aerial Systems Traffic Management (UTM) Research Transition Team. The group will address the challenge of coordinating information between operators, entities that use UTM to perform services, and the FAA. The group will also develop a consistent format for data to be shared across the affected parties, with recommendations slated for release in Fiscal Year 2017.

[The FAA Said That Over Half a Million Drones Have Been Registered in Just 8 Months](#)

Quartz (qz.com) (8/02) reports that in the future, as the number of commercial and consumer drones continues to increase and our skies begin to fill with drones buzzing

around for fun and work, a system will need to be in place to manage the massive influx of flying machines in U.S. airspace. The Federal Aviation Administration is working with NASA to develop such a system, and today the White House committed to helping integrate drones into U.S. airspace as quickly as possible.

[Feds Give Google OK to Test Project Wing Drone Deliveries](#)

Engadget.com (8/02) reports that the White House unveiled a flurry of other initiatives. It wants the Federal Aviation Administration (FAA) to develop new regulations to “safely integrate [UAVs, or drones] in the airspace” and have the regulations ready for comment by winter 2016. Additionally, the FAA is being asked to create an unmanned aerial vehicle “safety team” that can analyze safety data and investigate accidents. The White House also enlisted NASA to help develop “detect and avoid” technology, with completion planned by 2020.

[FAA Launches Drone Safety Data Initiative](#)

Airtransport World (atwonline) (8/03) reports NASA is developing the technologies to enable low-altitude Unmanned Aerial Systems (UAS) Traffic Management (UTM) in a series of increasingly capable spirals, with the second of four planned technical capability levels to

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be demonstrated in October at the Nevada UAS test site. NASA plans to turn over its UTM research to the Federal Aviation Administration in 2019 for further testing.

[Federal Aviation Administration Head: Government Must Go Faster than Normal to Cultivate the Drone Industry](#)

MIT Technology Review (technologyreview.com) (8/03) discusses a Federal Aviation Administration regulation that requires the pilot of an aircraft be able to “see and avoid” other aircraft to prevent a midair collision. When there is no pilot in the vehicle, how should this be done? A range of sensing technologies—from advanced digital cameras to sophisticated radar systems—currently under development could give commercial drones the ability to detect moving objects. Software could be used to automate how the drone responds when it senses certain signals. The agency and NASA are also working on an air traffic control system for drones.

[Eyes on the Skies: The Dream of Drone Delivery Starts to Take Flight](#)

PackagingDigest.com (8/10) reports that “the project being run by NASA is responsible for drone integration and an air traffic management system for drones. It’s an issue of integrating

other vehicles in the air, and air-traffic management systems, with drones and building that out.” As further explained, “the plan is to figure out a way to operate these drones at lower altitudes and have this delivery model—going from point A to point B to deliver a package—take place.”

[Air Force Outlines UAS Plans as NASA Pursues Traffic Management](#)

UASMagazine.com (8/23) reports that, while making his second trip to North Dakota this year, John Cavolowsky, director of NASA’s AirSpace Operations and Safety Program, said, “There is an enormous center of gravity here that’s important for us to be a part of.”

[NASA Will Develop Rules For Flying Small Drones](#)

PopularMechanics.com (8/28) writes that the NASA project is meant to develop performance standards for drones that would be used for commercial purposes by companies such as Amazon and Google. It is a virtual system designed to help drone operators deal with weather conditions, restricted air space, airport congestion, and other obstacles.

[Feds Collaborate with NASA for Drone Traffic Plan](#)

NatureWorldNews.com (8/30) reports that NASA is on its second phase in a four-step plan of setting

up small drones used for commercial purposes. The space agency will present its research to the Federal Aviation Administration by 2019.

[Delta Pilots Are Using a New App to Help Spot and Avoid Turbulence](#)

Fortune.com (8/31) reports that, according to NASA’s Weather Accident Prevention Project, turbulence costs airlines a combined \$100 million every year in extra fuel costs.

[A Passenger Plane that Flies Itself?](#)

BBC.com (9/13) reports that NASA has a concept for a Single-Pilot Operations plane that features one seat in the cockpit for a captain, and one seat on the ground for an operator, who would take turns as dispatcher and first officer.

[How to Prevent Drones Colliding in Crowded Skies](#)

MSNBC.com and Newsweek.com (9/14) report that NASA is working with industry partners on an Unmanned Aerial System Traffic Management project and stated that, while this is a great start, further efforts like this are needed.

[Officials Envision a Day When Millions of Drones Fill Skies](#)

JapanToday.com (9/19) reports that NASA is working with industry

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partners and the Federal Aviation Administration to create a new low-altitude air traffic control system specifically for drones. Industry and government officials say such a system will be needed eventually if there will be widespread drone deliveries by Amazon and other companies.

[NASA to Help China improve Air Traffic Management](#)

Reuters.com (9/28) reports that NASA announced on Wednesday

that it has signed an agreement with the Chinese Aeronautical Establishment to cooperate on research that will help China's airports improve their management of air traffic.

[40 Years of Safer Aviation Through Reporting](#)

PhysOrg.com (9/29) states that the United States has an incredibly safe aviation system, one that is unparalleled when compared to other modes of transportation. The basis

for this historic safety record is that safety concerns typically are identified and corrected before they become real problems. NASA's Aviation Safety Reporting System is one of the tools used to make the system as safe as it is.

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Preparations for UTM Flight Test #2 Progressing

POC: KEVIN WITZBERGER AND MARCUS JOHNSON



The Unmanned Aerial Systems (UAS) Traffic Management (UTM) Sub Project completed a series of checkout tests in preparation for its Flight Test #2 scheduled for October 2016. A checkout test was performed on July 1 at the Reno-Stead UAS Test Range, Zone A, in Nevada. This checkout test was the first UTM flight test executed as a joint operation between NASA, the Reno-Stead Airport, and the Nevada Institute of Autonomous Systems. The collaboration merged various processes and procedures from all three entities. Approximately 50 participants from NASA's Ames

Research Center, NASA's Langley Research Center, and commercial partners were involved in the planning and execution of the checkout, during which researchers flew five Cat I Unmanned Aircraft Systems (two fixed-wings and three multi-rotors). The researchers successfully met most of the test objectives, including those involving the evaluation of a surveillance-warning region, protocols for flight crew communication, and methods for human factors data collection. However, a test objective to establish and test a UTM Research Coordinator position remains a work in progress.

The next series of checkout activities was completed August 24. During these activities, the UTM team successfully flew three simultaneous operations up to 1.8 miles from their ground control stations in an "extended visual-line-of-sight" configuration. The team also validated several test scenarios and logistics, including communications protocols and a situational awareness display, in preparation for the planned full demonstration in late October. Several partner organizations also participated in these tests. A number of environmental conditions, including heat and altitude, contributed to unexpected behavior for some of the vehicles. The next UTM checkout is scheduled for

early October, and the team expects the same partners to participate.

NASA Meets with United Airlines Executive Leadership

POC: WILL JOHNSON

On July 7, 2016, William C. Johnson, Sub Project Manager of NASA Airspace Technology Demonstration - 1 (ATD-1), and Leighton Quon, NASA ATD Project Manager, met with several United Airlines (UAL) executives at their headquarters in Chicago. United Airlines—a cost-sharing commercial airline partner for the ATD-1 flight test—is providing a new Boeing 737-900ER with operational support for the flight test. The Project Manager for UAL requested the meeting to educate the airline's executives on the ATD-1 flight test plans and its value to the rest of the Air Traffic Management community, including the Federal Aviation Administration, Radio Technical Commission for Aeronautics (RTCA), original equipment manufacturers, and commercial airlines, among others. The meeting went well, with assurances from UAL leaders of their continued support of the ATD-1 flight test, which is planned for January or February of next year.

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ATD-2 Begins Shadow Mode Evaluations at Charlotte Airport

POC: AL CAPPS, SAVVY VERMA
AND SHIVANJLI SHARMA

During this past quarter, the Air-space Technology Demonstration-2 (ATD-2) Team began conducting shadow mode evaluations of the ATD-2 concept at the recently dedicated lab at Charlotte Douglass International Airport (CLT) in North Carolina. From July 12 through 14, representatives from the Federal Aviation Administration (FAA), Air Traffic Control Tower (ATCT) and CLT operations collaborated with NASA researchers for the first ATD-2 shadow evaluation. The evaluation successfully introduced users to the CLT lab, and included demonstrations of the existing system user-interfaces and the predictive-modeling capability. Participants provided feedback on both the shadow evaluation process as well as specific ATD-2 system capabilities. On July 20, members from the



AAL training at NTX.

ATD-2 team conducted a half-day training session at NASA's North Texas Research Station for American Airlines (AAL) operations research personnel on the ramp management tools that will be used in the upcoming ATD-2 field demonstration at CLT. The tools will also be deployed in the AAL ramp tower and the CLT Air Traffic Control Tower, and at FAA's Washington Air Route Traffic Control Center. American Airlines is the lead carrier for ATD-2 activities at CLT, and the focal point for all stakeholder airline operators. The ramp tools, Ramp Traffic Console (RTC) and Ramp Manager Traffic Console (RMTC), planned for the AAL ramp tower, will provide pushback advisories to the ramp controllers with the aim of reducing taxi congestion and emissions. American Airlines training participants provided feedback on how these tools might fit with the existing tools in the CLT ramp tower, and gave positive reviews on the RTC and RMTC.



Engineering shadow evaluation session at CLT.

The next shadow session took place August 23 through 25, and focused on evaluating ATD-2 ramp management tools with AAL ramp personnel. During this session, the team continued working with representatives from the CLT ATCT and AAL ramp controllers. Air Traffic Control Tower controllers and Traffic Management Coordinators were shown progress of the ATD-2 surface automation system, called Surface Trajectory-Based Operations, and details of the surface modeling, timelines, and information processing that created the displays. The agenda for the AAL participants included a description of the Tactical Surface Scheduler and an overview of the ramp management user interfaces. Participants offered valuable feedback on the ATD-2 system and helped refine requirements for future development. John Greene, Acting Chief of CLT ATCT and Terminal Approach Control, also attended and participated in the discussions of ATD-2 tools and technologies.

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The next engineering shadow session was conducted on September 20 and 22, and combined participants from both ATCT and AAL.

The participants included tower controllers and representatives from Traffic Management Centers, the National Air Traffic Controllers Association, the FAA, the AAL Integrated Operations Center, the AAL CLT ramp, and the AAL CLT airport operations. The session featured an evaluation that focused on the foundational data exchange and integration among users that are required for collaborative decision-making. Participants offered valuable feedback on topics such as the sharing of airport configuration, ground stops, closures, and other areas that enable common situational awareness, and also provided feedback on the manner in which data exchange and integration will be handled with the ATD-2 system tools and technology. The next operational shadow session will be held on October 19, and will bring together both Washington Center personnel and CLT FAA participants.

Air Force Research Labs' Safe and Secure Software and Systems Symposium (S5)

POC: GUILLAUME BRAT

The Safe and Secure Software and Systems Symposium (S5) was held in Dayton, Ohio, from July 12

through 14, 2016. Many practitioners from industry, government agencies, and academia attended the meeting. The symposium addressed three themes: formal methods for validation and verification (V&V), compositional verification, and safety cases. These themes are perfectly aligned with NASA's research efforts in V&V. Most talks described applications of these techniques at the design and requirement levels.

On the last day of the S5, many discussions centered on the work being conducted by Air Force Research Labs (AFRL) on formal V&V. The main themes were safety cases and applications for formal methods to requirements. Dr. Guillaume Brat of NASA's Ames Research Center gave the plenary talk on Wednesday, July 13, during which he offered an overview of the progress made by NASA on reducing the cost associated with the current V&V processes. As Brat described some of the technology developed by NASA over the last five years, he made repeated appeals to industry to work with NASA by using and evaluating the NASA tools. His talk was well-received, and companies like Raytheon, Lockheed Martin, and United Technologies expressed interest in helping to evaluate the NASA tools. Intel Technologies was interested in the Inference Kernel for Open Static Analyzers (IKOS) static analysis

tool, and is already in contact with NASA to install IKOS at their site. Their goal is to deploy IKOS in many of their business units. Lockheed Martin was interested in the design-level tools, especially tools for Simulink models. As a result of the contact established during S5, Lockheed Martin sent to NASA a set of 10 representative Simulink problems. Raytheon was interested in collaborating on V&V techniques for UAV (Unmanned Aerial Vehicle) teaming technology. This possibility may require more discussions before any tangible efforts can be started. John Koelling, of NASA's Langley Research Center, and Brat met several times with representatives from the Air Force Research Laboratory (AFRL) who have been tasked with providing a briefing for the October 2016 meeting of the NASA and AFRL Executive Research Committee. The AFRL was eager to have NASA participate in the development of this briefing for our joint executives. Everyone agreed that an initial working outline of the briefing would include discussions of successful results from past NASA and AFRL cooperation, the possibility of future near-term areas of cooperation, and a proposed framework for longer-term cooperation. One of the goals of the briefing will be to obtain executive level support for these plans, and the direction needed to develop a framework for

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longer-term cooperation and collaboration on common work and goals.

System-wide Information Management Data and National Airspace System Enterprise Services Capabilities and Discussion

POC: KEE PALOPO

As part of a two-day meeting at NASA's Ames Research Center, teams met on July 14, 2016, to discuss how Shadow Mode Assessments Using Realistic Technologies for the National Airspace System program (SMART-NAS) Test-Beds (SNTB) use System Wide Information Management (SWIM). The teams consisted of representatives from SNTB, the Federal Aviation Administration (FAA), Volpe, and other SWIM users, including Airspace Technology Demonstration (ATD) and Unmanned Aerial Systems (UAS) Traffic Management (UTM) projects. Attendees included FAA Director of Enterprise Services Malcolm Andrews, FAA's Jeri Groce, James Hill and Sarasina Tuchen from Volpe, SNTB personnel, and other interested SWIM data-users from NASA. Andrews wanted to know whether the SNTB team experienced any issues while using the SWIM data, and whether they had in mind any missing SWIM data they might consider supporting in the future. The SNTB team alerted the FAA

about a specific speed performance issue SNTB encountered, and suggested a need to better organize the data. They also asked whether the FAA intends to add non-traditional air traffic management (ATM) data as part of SWIM. The FAA indicated that they had been asked only about a part of non-traditional ATM data involving airport parking. Overall, the meeting went well, and the SNTB team appreciated the face-to-face experience with the FAA personnel responsible for SWIM data—an element critical to SNTB.

NASA Hosts National Center for Atmospheric Research Weather Workshop

POC: WILLIAM N. CHAN

NASA's Ames Research Center hosted an Unmanned Aerial Systems (UAS) Traffic Management (UTM) Workshop from July 19 through 21, with co-sponsorship from the National Center for Atmospheric Research. The workshop brought together aviation weather and UTM researchers, and UAS operators to discuss weather impacts and requirements to enable safe and efficient low-altitude UTM operations. Participants presented on topics such as the UTM system, the current weather aviation system, weather phenomena and their impact on UAS operations, and weather

integration. On the final day, two panel sessions were held, one on user experiences with weather in the field, and another on weather research for UAS operations. About 80 people attended the workshop, including representatives from industry, academia, government, and research organizations. The workshop organizers will use the outputs from this workshop to engage a cross-cutting group of users and weather researchers to inform future weather product development and suggest research



Steve Abelman (FAA) speaking during the Weather Research Panel on July 21.



UTM Weather Workshop.

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directions to enable all weather access for small UAS operations.

Training for Attention Management Team Hosts Airbus Researchers

POC: ANGELA HARRIVEL

On July 19 and 20, 2016, the Training for Attention Management (TfAM) Team at NASA's Langley Research Center hosted representatives of Airbus SAS from Toulouse, France. The TfAM team reprised presentations and demonstrations provided at a June interchange with representatives from Boeing. The visit focused on technical interchange regarding the ongoing Scenarios for Human Attention Restoration using Psychophysiology (SHARP) study and crew state monitoring study. The teams also discussed synthetic vision, display studies, and head-worn display technology.

The Airbus team presented recent study results related to psychophysiological measures for human monitoring. Airbus is particularly focused on the understanding and detection of "incapacitation and fascination" —what the TfAM team refers to as "channelized attention." Airbus and TfAM determined that there is significant direct overlap in their respective research aims.

Airbus' interest in this field of research underscores the global importance of NASA's work in the area of human factors and attentional state detection. NASA and the TfAM team greatly benefited through an expanded breadth of knowledge of the state of the art in research approaches for human monitoring as it relates to commercial flight safety. Research in this area offers potential benefits for aviation safety through support of U.S. airlines and U.S. airspace operations. The SHARP study assesses the detection of limited states of cognitive attentional human performance, and aids the mitigation loss of airplane state awareness – two occurrences that the Commercial Aviation Safety Team (CAST) specified as causal factors in commercial aviation accidents and incidents. This work is being conducted in response to CAST Safety Enhancement 211 entitled "Training for Attention Management," which supports the ATD Project within AOSP under the Technologies for Airplane State Awareness Sub Project.

Airbus, like NASA, is a member of CAST. All content presented to Airbus is already publicly available. The TfAM team members include Angela Harrivel, Ray Comstock, Lance Prinzel, Alan Pope, Trey Arthur, Kyle Ellis, Randy Bailey, Chad Stephens.

NASA-FAA RTT Meeting: Unmanned Aerial Systems Integration Concepts

POC: JOEY RIOS AND PARIMAL KOPARDEKAR

On July 20, 2016, NASA's Ames Research Center hosted a NASA-Federal Aviation Administration (FAA) Research Transition Team (RTT) meeting to focus on unmanned aerial systems (UAS) integration concepts. In the morning session, the Federal Aviation Administration (FAA) presented their current work, defining their concept of operations for all altitudes and types of UAS to an audience of more than 100 people from NASA, industry, and academia. NASA's UAS technology partners were invited to attend in-person or remotely. Steve Bradford, Sherri Magyarits, and Maureen Keegan were the FAA speakers. These meetings were the first joint outreach activities for the NASA-FAA RTT for UAS Traffic Management (UTM). During the afternoon session, a group of participants was asked to create a consistent approach for the content and format of UAS data exchanges to enable their integration into the National Airspace System. NASA presented their concept of the UTM architecture, including roles and responsibilities, and defined what data exchange they perceive is required between the UAS operator and the FAA. They asked industry

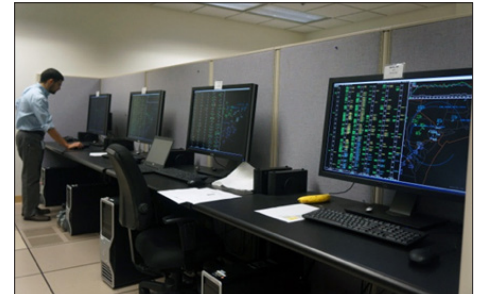
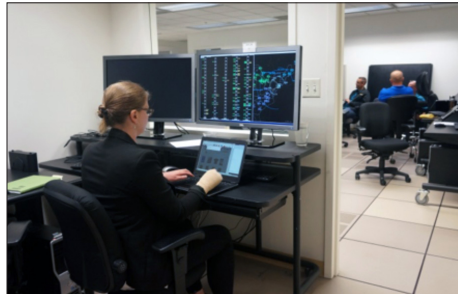
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participants to drive and define the data exchange requirements for UAS operators and support services. Once defined, NASA will test the concepts and gather data for FAA review. From this meeting, a focused working group was formed and tasked with providing the following deliverables within four weeks: definition of data schema, protocols, and procedures for UAS data exchange, and a date for simulation testing. Joey Rios of NASA's Ames Research Center will set the meeting dates and work with the RTT. NASA will provide initial UTM schema, data exchange protocol, annual performance indicators, and architecture documentation as a starting point. The goal of this group is to finalize the message exchanges across architecture elements and to conduct a data exchange demonstration.

Federal Aviation Administration Interest in Ongoing NASA Work on Trajectory-based Operations and Integrated Demand Management

POC: PAUL LEE AND CONNIE BRASIL

On July 21, 2016, the Federal Aviation Administration (FAA) and NASA held a quarterly review at NASA's Ames Research Center. At the meeting, the Shadow Mode Assessments Using Realistic Technologies for the National Airspace



AOL Researchers Gita Hodell (left) and Kostas Speridakos (right) during IDM HOOTL simulation.

System Trajectory Based Operations (TBO) team met with Rob Hunt, Manager of the FAA's ATO Technical Analysis and Operational Requirements, and Patricia Horan, Manager of the FAA's En Route Operational Concepts and Requirements. The purpose of the meeting was to provide an update on recent Integrated Demand Management (IDM) activities, which included a demo in the Airspace Operations Laboratory of an upcoming IDM "HOOTL" (Human-out-of-the-Loop) simulation scheduled for August.

The HOOTL simulation study was completed August 15 through 19. This study evaluated the effectiveness of the IDM concept for preconditioning traffic into Time Based Flow Management (TBFM) during a high-demand arrival flow into Newark International Airport. The HOOTL, led by Connie Brasil of the San Jose State University Research Foundation, presented a follow-on to an earlier human-in-the-loop (HITL) evaluation that was modified to sup-

port a clearer comparison of benefits between a baseline condition and two variations of IDM. Run duration for the HOOTL was extended from three hours to five hours to increase the sample size. Several features of the simulation setup and scenarios were changed based on findings from the earlier study, including environmental wind errors and TBFM settings. Human interactions with the simulation environment were reduced, and either automated or strictly proceduralized. This was in marked contrast to the earlier study, where methods, task timing, and scheduling decisions represented critical components that were left to the discretion of subject matter experts. A preliminary comparison of key quantitative metrics—ground delay, airborne delay, and runway throughput—indicated that IDM preconditioning can greatly reduce airborne delay, when compared to a baseline condition, while maintaining a similar level of throughput. On the last day of the simulation, a telecon was conducted with the Collaborative

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Decision Making Flow Evaluation Team to share these initial observations and to discuss results from the January HITL and future plans.

Federal Aviation Administration Next Generation Air Transportation System Team Visits NASA

POC: SHON GRABBE AND BRYAN BARMORE

On July 21, 2016, Paul Fontaine, Acting Federal Aviation Administration (FAA) Deputy Assistant Administrator for NextGen, John Maffei, Acting Director for Portfolio Management and Technology Development, Wes Wright, and Dr. C. Marc Buntin visited NASA's Langley Research Center for a Technical Interchange Meeting on Trajectory-Based Operations (TBO). The FAA is starting a second wave of development in support of the Next Generation Air Transportation System (NextGen), which is focused on enabling TBO. The Airspace Operations and Safety Program is starting formulation for a new project focused on TBO. The meeting kicked off an exchange of ideas between NASA and the FAA. Buntin presented an overview of the FAA's TBO high-level concept document. NASA presented work on Traffic Aware Strategic Aircrew Request (TASAR), Pair-wise Trajectory Management (PTM), Advanced 4D Trajectory Opera-

tions, and Novel New York Airspace Configurations. The meeting ended with plans to start a recurring TBO workshop between the FAA, NASA, and other stakeholders.

A follow-on meeting was again held at NASA's Langley on August 10 and 11, in which seven people from the FAA's NextGen Office participated, including the NextGen Chief Scientist, Steve Bradford. Discussion and demonstration topics included the TASAR concept led by David Wing, New York Novel Airspace Configurations led by Trish Glaab, and Advanced 4D Trajectories led by Bryan Barmore. Additional technical demonstrations were provided by SMART-NAS Test-Bed Team Lead Mike Guminsky. Randy Bailey, Lynda Kramer, and Steve Young spoke about Flight Deck Interface Technologies for NextGen, and Ray Comstock presented a discussion on UAS in the NAS. The New York Novel Airspace, Advanced 4DT, and SMART-NAS Test Bed components are all sponsored by the current SMART NAS Test-Bed for Safe Trajectory based Operations Project. Attendees showed significant interest in the showcased technologies, especially those concerned with increasing aircraft and user participation in air traffic management. Much of the discussion revolved around potential integration opportunities for NASA-developed

concepts and technologies with FAA plans, possible technology transfer points, and future collaboration.

Presentation of the Aeronautics Research Mission Directorate Thrust 6 (Autonomy) Roadmap

POC: SHIVANJLI SHARMA

The NASA Aeronautics Research Mission Directorate (ARMD) Thrust 6 Strategic Roadmap, *Assured Autonomy for Aviation Transformation*, was presented to the National Academy of Sciences' Aeronautics Research and Technology Roundtable panel and the 2014 Autonomy Study committee on August 2, 2016, by Shivanjli Sharma. Approximately 50 individuals attended the meeting, including senior members from industry and academia in the aeronautics discipline, senior NASA officials in ARMD, and researchers and roadmap team members from a number of NASA centers. The primary purpose of the meeting was to review the Thrust 6 roadmap and evaluate it against the recommendations of the 2014 National Research Council (NRC) Aviation Autonomy study. Sharma also presented a comparison of the roadmap with the recommendations from the NRC study. The roadmap presentation outlined a vision of the future of autonomy in aviation over the next 25 years and beyond,

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and described specific research themes and advancement strategies that will be needed to achieve this vision. The committee provided substantive comments and feedback, including thoughts on how to form partnerships with industry to help support research challenges, and how NASA can move forward with future research and development to implement beneficial autonomous applications in civil aviation.

ATD-2 University at NASA's Ames Research Center

POC: AL CAPPS

On August 2 and 3, 2016, members of the Airspace Technology Demonstration-2 (ATD-2) team presented the fifth ATD-2 University (ATD2U), hosted at NASA's Ames Research Center. The two days of presentations and discussions covered the foundational Federal Aviation Administration (FAA) and NASA technologies that ATD-2 is building on. The first topic covered the FAA three T's: Time-Based Flow Management, Traffic Flow Management System, and Terminal Flight Data Manager. The next presentations discussed NASA's Precision Departure Release Capability and Spot and Runway Departure Advisor, and the "what" and "where" of ATD-2. The ATD2U also included briefings about the latest Time-Based Flow Management and surface electronic integration, surface tactical departure scheduling, surface model-

ing, system analysis, field shadow evaluations, and ATD-2 concept of use. Participants included collaborating team members from the FAA, and representatives from Charlotte Douglas International Airport's Air Traffic Control Tower and Volpe. Future offerings of ATD2U at NASA's Ames Research Center will be held on an as-needed basis.

Terminal Area Detect and Avoid Live Flight Research with SMART NAS Test Bed

POC: MIKE GUMINSKY

On August 4, 2016, NASA's Langley Research Center launched two aircraft: the SR-22, representing an Unmanned Aerial System (UAS) Surrogate aircraft, and the C206, operating as a target aircraft. The airplanes were used to conduct a terminal area detect and avoid (DAA) flight test demonstration. The NASA aircraft flew to Newport News/Williamsburg International Airport, and downlinked flight data to NASA's Langley Research Center UAS Ground Control Station. During the test, the aircraft ran the NASA Daedalus DAA algorithm during multiple traffic-pattern UAS encounter geometries, which were observed from commercial, general aviation, and NASA target aircraft flying in the airport's traffic pattern. The flight data and algorithm were connected in real-time to the Shadow Mode Assessments Using Realistic Technologies for

the National Airspace System program Test-Bed Team (SNTB) Control Center, which launched multiple instantiations of the DAA algorithm used during the test flight. Data gathered during this test flight represent some of the first looks at DAA configuration and capability for UASs operating in an actual terminal area with live commercial and general aviation traffic, in tower-controlled Federal Aviation Administration Class D airspace. One primary goal of SNTB is to enable higher technology readiness-level testing of key aeronautics technologies operating in live, virtual, and constructive environments, as demonstrated during this flight test activity.

ATD Briefings to REDAC NAS Ops Subcommittee

POC: SHERI BROWN

On August 9 and 10, 2016, the Airspace Technology Demonstration (ATD) team provided briefings at the Research Engineering and Development Advisory Committee National Airspace System Ops Subcommittee Meeting in Washington, DC. Over the two days, multiple sessions were held covering ATD project activities. Two sessions on the first day included briefings on the ATD-1 Sub Project Overview and the ATD-1 Operational Integration Assessment (OIA) Joint Test with the Federal Aviation Administration (FAA). Sessions on the second day

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included overviews of ATD-2 and ATD-3 concepts, technologies, goals, and collaborations. In the meeting, the group discussed the foundational technologies and research that NASA is building on with ATDs, and the ‘what’ and ‘where’ of ATDs. Collaborating team members from the FAA’s William J. Hughes Technical Center were in attendance to present their activities, views, and the benefits of working specifically on the joint FAA and NASA ATD-1 OIA Test that occurred in May of 2015. The information on the complexity of the ATD activities was well-received and the subcommittee recognized the significance of the ATDs as the fundamental basis for a full Trajectory-Based Operations future.

Airline Operations Workshop Held at NASA’s Ames Research Center

POC: RICHARD MOGFORD

An Airlines Operations Workshop (AOW) was held at NASA’s Ames Research Center Conference Center Building at Moffett Field, California, from August 2 through 4, 2016. Dr. Richard Mogford, a senior researcher within Aerospace Operations and Safety Program, organized the event. This workshop gathered together government and private sector interests whose research and development work supports the airlines (airline operations center and flight deck). About 200 experts in the field met to exchange new ideas

and discuss objectives. Workshop presentations included examples of projects and applications from NASA and industry that focus on airline operations (as opposed to air traffic control or traditional aeronautics). With the assistance and input of industry, breakout sessions were held to gather suggestions to guide future NASA work in airline systems automation. The workshop helped to create a network of researchers, developers, and users of airline operations tools that will be a resource for future efforts in this domain.

TASAR Briefings at AOW and RTCA NextGen Advisory Committee Task Group

POC: DAVID WING

David Wing of NASA’s Langley Research Center conducted briefings of NASA’s Traffic Aware Strategic Aircrew Requests (TASAR) concept and technology to attendees at both the Airline Operations Workshop, held at NASA’s Ames Research Center from August 2 through 4, 2016, and at the Radio Technical Commission for Aeronautics (RTCA) NextGen Advisory Committee Task Group, which met on August 23.

TASAR features cockpit technology that includes Traffic Aware Planner (TAP) software, an application developed by NASA that looks for flight-optimization opportunities to save flight time, fuel burn, or overall trip cost. Kelly Burke and David

Wing of NASA’s Langley Research Center, and Bob Vivona of Engility Corporation, highlighted the unique features and capabilities of the TAP software to scores of attendees. Feedback on the TASAR presentation and TAP technology demonstrations was highly positive, and comments received indicated a growing consensus of the value of integrating air and ground trajectory management technologies. Multiple vendors, including several small businesses, expressed technology-transfer interest in TAP, and follow-up discussions are expected after the workshop.

At the RTCA Meeting, Wing briefed the RTCA’s NextGen Advisory Committee task group on Time, Speed, and Spacing (TSS) aspects of Performance Based Navigation (PBN). This briefing was specifically requested by the Federal Aviation Administration’s (FAA’s) NextGen Chief Scientist, Steve Bradford, after he received a briefing and demo on August 10 at NASA’s Langley Research Center. The PBN TSS Task Group is composed of representatives from virtually all stakeholder groups that have been engaged in PBN development and implementation, complemented by a diverse set of FAA PBN subject matter experts. The goal of the PBN TSS effort is to “keep the aircraft on the PBN procedure from en route to the runway while maintaining or increasing capacity.” Bradford identified TASAR as being a potential

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TAP technology displayed in cockpit.

tool in achieving this goal through a user-driven path stretching to meet a scheduled arrival time. The briefing was well-received and sparked significant discussion. As a result of the briefing, TASAR may be included in the PBN TSS 15-year plan as a tool in meeting the PBN TSS goal.

2016 Oklahoma Unmanned Aircraft Systems Summit

POC: WILLIAM CHAN

On August 9, 2016, the Unmanned Systems Alliance of Oklahoma hosted the sixth annual statewide summit, whose purpose was to support the unmanned systems indus-

try in Oklahoma. Over 100 people registered for this event, which included presentations from NASA, the Federal Aviation Administration (FAA), the National Oceanic and Atmospheric Association, the University of Oklahoma, Oklahoma State University, Hogan Lovells law firm, and the University of Colo-

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rado at Boulder. Discussion topics included how various research groups are using Unmanned Aerial Systems for environmental monitoring and weather research. The summit also included discussions related to policy, legal updates, and the Small UAS Part 107 FAA Rules. William Chan of NASA's Ames Research Center provided a UAS Traffic Management (UTM) project overview, including research on estimating weather impacts to UAS at low-altitude operations.

Dynamic Routes for Arrivals in Weather Dynamic Routes for Arrivals in Weather Workshop

POC: CHESTER GONG

On August 10, 2016, the Airspace Technology Demonstration-3 (ATD-3) Sub Project hosted a one-day workshop for the Dynamic Routes for Arrivals in Weather (DRAW) technology at NASA's Ames Research Center. The DRAW workshop included 10 subject matter experts in air traffic flow management with experience in operations during convective weather, and 5 representatives from the Federal Aviation Administration's Air Traffic Organization. The workshop opened with a presentation on the DRAW concept, which aims to improve arrival traffic flow when weather impacts arrival routing into major airports, and

a demonstration of the current functionality of the DRAW decision support tool. Following a positive and encouraging discussion, the workshop shifted to discussing the operational details of a number of actual weather scenarios. The DRAW researchers gained valuable feedback to help focus the design of upcoming high-fidelity, controllers-in-the-loop DRAW simulations.

System Requirements Reviews for ATD-2 and ATD-3

POC: RONALD JOHNSON

On August 17 and 18, 2016, System Requirements Reviews (SRR) were held on the Airspace Technology Demonstrations (ATD) Sub Projects, and on the ATD-3 Applied Air Traffic Management and ATD-2 Integrated Arrival, Departure, and Surface Sub Projects, respectively. An Independent Review Board (IRB) convened by the Ames Chief Engineer's Office reviewed both projects. The IRB included members who are experts in air traffic management research, project management, systems engineering, and software engineering, as well as Steve Bradford, the Chief Scientist from the Federal Aviation Administration's NextGen Organization, which is the ultimate customer for the ATD-2 and 3 technologies. Panel members also included Chairperson Ezinne Uzo-Okoro, Todd Lauderdale and

Eric Mueller from the Chief Engineer's Office at NASA's Ames Research Center, Jim Price from NASA's Langley Research Center, and Rhonda Fitz from NASA's Independent Verification and Validation (IV&V) team. The reviews focused on the development of the system requirements and their relationship to the Sub Project objectives, systems engineering processes in place to manage requirements, V&V activities, Key Performance Parameters, and management implementation plans. The IRB verbal brief-outs each day conveyed positive feedback on the progress and state of both Sub Projects since their Formulation Reviews in November 2015. Formal reports from the IRB are expected over the next three weeks.

Gogo Takes Steps Toward TASAR Commercialization

POC: DAVID WING

On August 18, 2016, David Wing of NASA's Langley Research Center met with representatives from Gogo Business Aviation in Broomfield, Colorado, to discuss commercializing Traffic Aware Strategic Aircrew Requests (TASAR). Gogo is moving forward in their exploration of the commercialization potential for TASAR, and they've identified the business aviation market as potentially the best initial market

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opportunity. Wing briefed the Gogo Business Aviation team on TASAR, provided a demonstration of the TAP software, and outlined how the software leverages the “connected aircraft” environment championed by Gogo. The meeting generated positive energy and enthusiasm for moving the technology into the market, and Gogo expects to redouble its efforts in this regard. To that end, they signed an updated Software Usage Agreement for the latest version of the Traffic Aware Planner software, and plan to reach out to the Technology Transfer Office of NASA’s Langley Research Center’s for the next steps.

GE Internal Verification and Verification Workshop

POC: GUILLAUME BRAT

On August 15, 2016, Dr. Guillaume Brat of NASA’s Ames Research Center visited the General Electric (GE) Global Research Center in Niskayuna, New York, to discuss the expanding use of Verification and Validation (V&V) technology developed at NASA. The discussion occurred in the context of the first GE-internal V&V workshop, organized by Mike Durling and John Garrity of GE’s Global Research Center. The workshop was attended by V&V experts from many different business units (including aviation, gas, power, transportation, sensor, healthcare, and their office of chief engineer)

at GE. These experts described their V&V needs and challenges, and shared their experiences using methods and tools available in the commercial sector. In the second part of the workshop, Mike Durling presented the V&V tools that GE is developing and asked NASA and Toyota to describe their research efforts in V&V. Brat then described the current and future V&V capabilities developed by NASA to reduce the cost associated with V&V, while still maintaining the current high-level of safety in aviation. Brat also identified the tools that are ready to be used by industry, emphasizing the fact that NASA’s primary targets are aviation systems. In contrast, Toyota listed research efforts, rather than pointing to available tools. Verification and Validation experts in healthcare (in particular, those developing CT scanners) and transportation were very interested in the NASA tools. The aviation system experts and the office of chief engineer at GE showed great interest in using the NASA tools. For example, the aircraft engine business unit is quite interested in the model checking capabilities for their Safety-Critical Application Development Environment models, and the aviation business unit is interested in the whole tool chain (from requirements to code). Brat expressed plans to work with Durling over the next few months to make this technology transfer a reality.

International Air Traffic Control Association visit to Ames Research Center

POC: KATHARINE LEE

On August 22 and 23, 2016, Director of Air Traffic Management Robert Eagles and Head of ATM Engineering Noppadol Pringvanich of the International Air Transport Association (IATA) visited NASA’s Ames Research Center. The purpose of the visit was to discuss potential collaboration opportunities. Discussion focused on the respective and joint work areas for NASA and IATA, with special emphasis on Unmanned Aerial Systems (UAS) and UAS Traffic Management. In addition to participating in technical discussions, the visitors were given a tour of the Air Traffic Operations Lab and the NASA small UAS Autonomy Research Complex, and met with senior research managers supporting Airspace Operations and Safety Program.

UTM Comm and Spectrum Meeting

POC: PARIMAL KOPARDEKAR

A kick-off meeting for a new focus group on Unmanned Aerial Systems Traffic Management (UTM) related communications, spectrum, and other considerations was held on August 25, 2016, at NASA’s Ames Research Center. Approximately 70 subject matter experts (about 50 in person and the rest remotely)

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attended the meeting. Participants included representatives from the Federal Communications Commission (FCC), industry operators and carriers, the Federal Aviation Administration, and other NASA Centers. The objective of the meeting was to gain an understanding of command and control tracking spectrum and frequencies, especially as they pertain to UTM. The group agreed to develop use cases and operating profiles to assist the FCC in taking the next steps forward related to spectrum and frequency.

Visit from Korean Airlines

POC: WILLIAM CHAN

Aerospace Operations and Safety Program (AOSP) researchers hosted visitors from Korean Airlines, which included Vice President of Safety and Security In Gyu Kim, General Manager of Safety Hyuck You, and Safety Team Manager Yun Ik Jang. The meeting took place August 30 and 31, 2016, at NASA's Ames Research Center. In support of the visit, several aerospace engineers from NASA's Ames Research Center in California gave presentations on current AOSP research activities. William Chan presented Air Traffic Management weather research, with emphasis on turbulence modeling; Kee Palopo of NASA's Ames Research Center in California briefed the group on the Shadow Mode Assessments Using Realistic Technologies for the National

Airspace System program Test-Bed; Chester Gong discussed the Airspace Technology Demonstration-3 (ATD-3) Sub Project and Dynamic Routes for Arrivals in Weather capability; and Yoon Jung, the associate principle investigator of the NextGen Concepts and Technology Department Project, discussed the ATD-2 Sub Project. The visitors also participated in presentations from the Human Systems Integration and the Intelligent Systems Divisions.

NASA Weather Rerouting Tool Deployed at American Airlines Operations Center

POC: KAPIL SHETH

At the end of August 2016, NASA Airspace Technology Demonstration-3 (ATD-3) project leads and research and development staff traveled to the American Airlines (AAL) Integrated Operations Center (IOC). There, the group deployed NASA's National Airspace System Constraint Evaluation and Notification Tool (NASCENT), which is the agency's National Airspace System-based single flight rerouting advisory software. During the visit, two AAL senior air traffic control (ATC) coordinators were trained on NASCENT functionality, and both indicated their eagerness to evaluate time-saving opportunities for the AAL flights across many of their centers. The NASA team also provided an overview of the ATD-3 Sub Project to AAL management

team members, which included IOC Vice President Lorne Cass, IOC Managing Director Scott Ramsay, Air Traffic Management Managing Director Marc Gross, Air Traffic Management Director Tim Niznik, and Information Technology Director John Nash. Cass expressed his appreciation of the time and effort the team put into their discussion of this work, and showed strong support of this collaboration. American Airlines indicated their intent to use NASCENT more often once their single Flight Operating Service certification is completed on October 1.

Federal Aviation Administration hosts ATD-2 Testing Kick-off Meeting at William J. Hughes Technical Center

POC: JANE THIPPHAVONG

On September 13, 2016, the NASA Airspace Technology Demonstration-2 (ATD-2) team met with Federal Aviation Administration (FAA) representatives to kick-off discussions on the Time-Based Flow Management (TBFM) testing strategy for field demonstrations. NASA is proposing integration of the ATD-2 surface system Terminal Flight Data Manager (TFDM) stand-in with the operational TBFM Integrated Departure Arrival Capability web services routing tool (WSRT) capability to enable demonstration of 3T-like integration in the field. The FAA is finalizing the

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implementation design, targeting TBFM release 4.7. The FAA participants included the co-lead of the Integrated Arrival, Departure, and Surface Research Transition Team, and representatives from the FAA's William J. Hughes Technical Center TBFM and Surface Trajectory-Based Operations (STBO) system support and test team. NASA briefed the participants on the ATD-2 system and the FAA provided an overview of the TBFM and STBO lab where release testing is conducted. Follow-on meetings will focus on setting up the ATD-2 surface system in the test lab, and detailing test procedures.

Surface CDM Team Meeting at Charlotte International Airport

POC: RICH COPPENBARGER

On September 21, 2016, NASA's ATD-2 team provided a demonstration to the joint Federal Aviation Administration and industry Surface Collaborative Decision-Making Team (SCT) on the ATD-2 automation operating at the Charlotte International Airport Laboratory (CLT) with live input data. The SCT includes representatives from the major U.S. commercial airlines and general aviation industry, who visited the lab as part of a meeting held at the American Airlines training center. NASA provided an overview of recent shadow testing activities at CLT and its plans to evaluate the strategic departure-scheduling component of ATD-2—a



Surface CDM Team and ATD-2 team members.

component based on automation previously developed by the SCT. The groups discussed the availability and accuracy of airline flight-readiness information required for trajectory predictions in ATD-2 that extend from the gate prior to push-back. They also discussed current airline on-time departure metrics that are potentially at odds with metering holds prescribed at the gate. The SCT expressed willingness to provide data to NASA and collaborate on ways to redefine on-time departure metrics during metering operations. The team was encouraged by the progress observed in the Charlotte lab and expressed their enthusiasm for continued engagement with NASA on ATD-2.

Advanced 4D Trajectory Focus Group Activity

POC: SHERI BROWN

An Advanced 4D Trajectory Focus Group Activity was conducted at NASA's Langley Research Center from September 8 through 19, 2016. The purpose was to discuss a mid-term Trajectory-based Opera-

tions (TBO) concept with subject matter experts and potential TBO end users (airline pilots and retired center air traffic controllers). Attendees included representatives from NASA, airline pilots, and retired air traffic controllers. Testing was conducted over five days in the Air Traffic Operations Laboratory, during which participants were briefed on the TBO concept and participated in an interactive demonstration of various TBO methods of rerouting aircraft around weather such as Dynamic Required Navigation Performance, Dynamic Area Navigation, Required Time of Arrival, Advanced Interval Management, on-demand metering, and user-preferred routing. Overall, the participants were supportive of the TBO concept presented and felt the concept could provide many benefits, such as reduced workload and time and fuel savings whenever aircraft must be rerouted. Participant feedback will be documented and incorporated into future TBO concepts and research activities. Results will be presented in a NASA report and possible conference paper in the future.

Avionics Phase 2 Build 1 Demonstration and Flight Interval Management

POC: WILL JOHNSON

The Airspace Technology Demonstration-1 (ATD-1) team—including members from NASA, Boeing, Honeywell, United Airlines and the

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Federal Aviation Administration (FAA)—conducted several meetings from September 27 through 29, 2016, to discuss preparations for the upcoming Flight Interval Management flight test, and received a demonstration of the Avionics Phase 2 prototype system. On September 27, meetings were conducted in Phoenix at the Honeywell Flight Operations Facility and ramp, where facilitators conducted a walkthrough of the Honeywell 757 flight test aircraft that will be used in the ATD-1 flight test. On September 28, organizers conducted meetings at the Boeing facilities outside of Seattle, where they held a data-gathering workshop, demonstration of the flight test operational testing, and a walkthrough of the operations center. On September 29, local FAA facility managers hosted a review of flight test operations at the FAA's Seattle Center. Later that day, a demonstration of the Avionics Phase 2 Build 1 system was provided at the Honeywell facilities in Redmond, Washington. The meetings highlighted the progress demonstrated across many areas in anticipation of the upcoming flight tests, which are targeted for early 2017.

ATD-3 Technology Transfer 1 Completed

POC: KAPIL SHETH

Under the Airspace Technology Demonstration-3 Sub Project, NASA is performing research and

development on technologies that help airspace users avoid convective weather and gain flight time and fuel savings via flight plan route corrections in en route airspace. The first of three research transition products defined by the Applied Traffic Flow Management Research Transition Team plan were transferred to the Federal Aviation Administration in September 2016, including NASA's Dynamic Weather Routes (DWR) concept of operations, 23 DWR-focused technical publications, functional and performance requirements, and prototype software and documentation.

Federal Aviation Administration Advanced Electronic Flight Strips Training Systems Setup in NASA labs

POC: MICHELLE ESHOW

From September 26 through 28, 2016, Federal Aviation Administration (FAA) contractors from DTIS Corporation configured two Advanced Electronic Flight Strips (AEFS) training systems and conducted two days of training for the NASA Airspace Technology Demonstration-2 (ATD-2) team. The prototype AEFS system was created and designed by the Terminal Second Level Engineering team from the FAA's William J. Hughes Technical Center to replace paper flight progress strips used by air traffic controllers. The AEFS system offers

a paperless system that provides a single source of collective information. Under the FAA's Terminal Flight Data Manager Program Office's early implementation effort, AEFS is being deployed on a limited basis, and will include deployment to Charlotte International Airport in 2017 to support NASA's ATD-2 Field Demonstration. An interface between the ATD-2 and AEFS systems is under development to provide scheduling information electronically. The ATD-2 team will use these AEFS training systems to develop software requirements for the field demonstrations. The AEFS training systems at NASA are currently configured for Cleveland Airport, and accommodate a Traffic Management Coordinator and three controller positions, such as local, ground, and clearance delivery. NASA's North Texas Research Station will receive one of the training systems, which will be set up in the ATD-2 lab for deployment testing.

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Drones: Sharing the Airspace

POC: TOM PREVOT

On July 27, 2016, Dr. Thomas Prevot participated on the “Drones: Sharing the Airspace” panel at the Experimental Aircraft Association’s (EAA) AirVenture Oshkosh 2016. The CEO of AirMap, Ben Marcus, moderated the panel, which included Dave Vos, project lead for Google’s Project Wing, Joseph Morra, Manager of Safety and Data and Flight Operations of the FAA’s Office of Unmanned Aerial Systems (UAS) integration, and Jack Pelton, President of the EAA. The panel discussed how industry, government, and academia are working together to allow for safe and efficient shared-use of the National Airspace System by manned and unmanned aircraft. Prevot discussed NASA’s UAS Traffic Management (UTM) research in this context. The panel discussion was well-attended and favorably received by many general aviation pilots and representatives of industry and government.

First-Ever White House Office of Science Technology Policy Workshop on Drones and the Future of Aviation

POC: PARIMAL KOPARDEKAR

Dr. Parimal Kopardekar of NASA’s Ames Research Center was invited to participate in the White House’s Office of Science and Technology Policy (OSTP) Workshop on Drones

and the Future of Aviation, which took place on August 2, 2016. The OSTP asked Kopardekar to help facilitate a breakout group discussion on “Low Altitude Airspace Operations/Unmanned Aerial Systems (UAS) Traffic Management (UTM).” Other facilitators for this group included Chris Swider, Steve Bradford, and Jay Merkle from the Federal Aviation Administration (FAA), and Sean Cassidy of Amazon Prime Air. There were from 35 to 40 participants in the group. Initial group discussions focused on UTM and why it is needed. Participants then delved further into the details of UTM and the concept of operations. The FAA also commented that it has embraced the notion of UTM and the need for working collaboratively. At the conclusion of the roundtable discussion, participants left with a better understanding of why UTM is necessary for applications such as beyond visual line of sight, high density and scalable operations, enabling exception handling (currently not possible in small rule where aircraft must travel above 400 feet, fly in controlled environments, etc.), and facilitating information about UAS and manned operations to and from operators for safety. The FAA was asked about its current priorities, given the UTM value proposition, and responded that exception handling and trajectory and constraint notification will be offered through UTM data exchanges. A few weeks ago, NASA,

the FAA, and industry initiated their first working group, which is focused on the commonalities of data and trajectory definition, and entry into and exit from FAA Air Traffic Management systems.

Patent Awarded on Optimum Strategies for Selecting Descent Flight-Path Angles

POC: GILBERT WU

In August 2016, the U.S. Patent Office approved a patent application from Dr. Gilbert Wu on Optimum Strategies for Selecting Descent Flight-Path Angles. The technology addresses the issue of trajectory predictability by computing adaptable, fuel- and cost-efficient, and flyable descent profiles for one or more aircraft on an arrival route over a specific duration. The potential benefits of this technology include improving throughput and reducing airline operating costs.

TAP Wins NASA Software of the Year Award

POC: DAVID WING

Software teams from NASA’s Langley Research Center and NASA’s Ames Research Center were selected as co-winners of the 2016 NASA Software of the Year Award for The Traffic Aware Planner (TAP), developed at NASA’s Langley Research Center. As a cockpit-based software tool, TAP is used to aid pilots in identifying in-flight route-

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optimization opportunities that are de-conflicted from known traffic, weather, and restricted airspace. Packaged for low-cost implementation as a “change request” tool, and leveraging the emerging trend of aircraft connectivity, the TAP software represents the first key transformational step towards operational autonomy by enabling aircrews to become proactive managers of their trajectories, while providing today’s operators with a direct operational benefit of this critical first step. In addition to interest by the Federal Aviation Administration, TAP has generated immediate and significant attention from the aviation community for its operational and commercial potential. Inventors include David Wing, Mark Ballin, Kelly Burke, Robert Vivona, David Roscoe, David Karr, Stephen DePascale, Sharon Woods, Brendan LeFebvre, and Andres Danziger.

ATD-1 Journal Article Published in “Quality Engineering”

POC: SHERI BROWN

Recently, the Airspace Technology Demonstration-1 (ATD-1) project published a journal article entitled “Statistical engineering approach to improve the realism of computer-simulated experiments with aircraft trajectory clustering,” by Sara R. Wilson, Kurt A. Swieringa, Robert D. Leonard, Evan Freitag, and David J. Edwards. The journal article is a

joint publication of the Engineering Directorate and the Research Directorate supporting the ATD-1 project at NASA’s Langley Research Center.

Human Factors and Ergonomic Society Conference

POC: KELLY BURKE

Dr. Kelly Burke of NASA’s Langley Research Center attended the 2016 Human Factors and Ergonomics Society International Annual Meeting held in Washington, DC, from September 19 through 23. During the conference, Burke presented a paper entitled “Flight Test Assessments of Pilot Workload, System Usability, and Situation Awareness of TASAR.” Co-authors of the paper include David Wing (also from Langley Research Center) and Mark Haynes of Advanced Aerospace Solutions. Traffic Aware Strategic Aircrew Requests (TASAR) is a NASA-developed onboard automation concept intended to identify trajectory improvement opportunities clear of known traffic, weather, and airspace restrictions prior to the aircrew initiating a trajectory-change request to Air Traffic Control. The presentation focused on the results of the subjective assessments of pilots collected during the second flight test of the TASAR project; specifically, pilot workload, situational awareness, and system usability. During the conference, Dr. Burke gave a real-time demonstration of the Traffic Aware Planner (TAP) software

application, which is the implementation of the TASAR concept. Both the presentation and software demonstration were well-attended and generated interest from professionals in several domains, including human factors, aviation, government, and military. Participants inquired about TAP functionality, usability, and software licensing options, and expressed interest in potential partnerships with NASA.

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