National Aeronautics and Space Administration

AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

JAN-MAR 2017 | Quarter 2

AOSP IN THE NEWS

NASA's Supercomputers Reveal the Incredible Turbulence Produced By a Drone

Gizmodo (1/13) reported that, to help improve the design and flight characteristics of future drones, NASA had its supercomputers simulate what that air movement actually looks like—it's impossibly complex.

NASA Tests Next-generation Air Traffic Software in Washington State's Skies

GeekWire (2/07) reported that landing planes at busy airports can be a challenging work of aerial ballet, and this week, NASA is testing a computerized choreographer to handle the job in the skies over Washington state.

Airlines Focus on Shaving Seconds to Gain Dollars

Aviation Week (2/17) reported that is the gist of a month-long Flight Deck Interval Management (FIM) flight-test program that NASA and partners are in the midst of completing in the airspace east of the Seattle-Tacoma International.

NASA and the FAA Are Testing Plane Tech to Cut Delays and Shorten Flights

Wired (US) (2/18) reports that this month, the FAA and NASA are running a series of trial flights aimed at making airport arrivals far more efficient. It's just one part of NextGen, the FAA's decades-long, $35 billion overhaul of America's aging, inefficient air traffic control system.

This New NASA Air Traffic Control Tech Aims for Flight Efficiency

Digital Trends (2/26) reports that NASA and the FAA are conducting trial flights to test new air traffic control technology this week around Grant County International Airport in Washington state.

NASA Program Aims to Eliminate Taxiway Waiting

Aviation Week (3/01) reports that if NASA is successful, a frustrating but accepted reality at busy U.S. airports—the inevitability of a "conga line" of aircraft on the taxiway waiting for departure—should begin fading into history before the turn of the decade.

NASA Technology Fights Flight Delays

Scientific American (4/01) reports that "in early 2017 two large passenger planes and a smaller corporate jet practiced landing, one right after the other, without the usual constant help of an air traffic controller. Instead they relied on NASA-developed technology that lets planes automatically "talk" to one another and to control towers, simultaneously. If these flight tests—which took place at an airport near Seattle—prove convincing, the technology could eventually make its way to the Federal Aviation Administration for approval. And if all planes one day adopt the system, more aircraft could land in less time at the country's increasingly congested airports."

Video - NASA Completes Flight Tests of Air Traffic Tool

Aeronews.com (3/29) reports that passengers may soon be spending less time hanging around in airport arrival and departure gates. This after NASA recently completed airborne tests of a flight deck tool that is likely to improve the accuracy of commercial aircraft arrival times. The software and hardware prototype, known as Flight Deck Interval Management (FIM), automatically provides pilots with extremely precise spacing information on approach into a busy airport, enabling more planes to land safely in any given time. The technology is intended to help airplanes spend less time in the air, save money on fuel, and reduce engine emissions.

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ATD-1 Flight Test Campaign Completed

POC: LEIGHTON QUON AND SHERILYN BROWN

On February 22, the Airspace Technology Demonstration-1 (ATD-1) team completed flight tests conducted in the Seattle-Grant County airspace. The tests were under contract with the Boeing Company and their subcontractors Honeywell and United Airlines (UAL). The flight tests required two years of planning, and the Concept of Operations refinement took five years to complete. During this time, researchers from both the Ames Research Center in California and Langley Research Center in Virginia provided inputs and simulations critical to the refinement's development. In preparation for the flight trials, all flight reviews had to be successfully completed and then approved by the responsible board chairs. The reviews included the Langley Airworthiness and Safety Review Board (ASRB), ATD-1 Flight Readiness Review (FRR) and the previous ATD-1 System Acceptance Review. The reviews were completed January 19.

The Boeing Company hosted the FRR Meeting at their Seattle facility in support of the $11 million, two-year Flight Critical Safety Research contract task award entitled "ATD-1 Avionics Phase 2." Fifty individuals attended the meeting, including leaders, engineers, researchers, and key industry stakeholders. The review panel consisted of FRR Chair and Project Representative Stella Harrison, NASA Avionics Lead Denise Scearce, NASA Flight Test Lead Brian Baxley, NASA Algorithm Lead Kurt Swieringa, Ames System Engineer Andrew Ging, and FAA representative Ian Levitt. The panel considered the FRR to be a success and felt that it met NASA's approval to proceed to the flight-test stage. The ATD Project Manager thanked the team members for their contributions, and congratulated them for their efforts under circumstances that were difficult because some necessary information was not available to the team until late in the process. The Langley research team received approval from both the Langley Institutional Review Board and the Johnson Space Center Institutional Review Board to conduct NASA research during this flight test. Additionally, both Honeywell and United passed FRRs of their own. Approval from the NASA FRR review board to proceed with the flight test was the final step necessary for Langley's ASRB to issue the Flight Safety Release to allow the flight test to commence. The first test flight was conducted on Friday, January 20. The ATD-1 flight test

A tablet computer displays air traffic data during ATD-1 flight simulations.

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team called a no-fly day on Monday, January 23, to evaluate data, procedures, and operations from the first day so they could make proper adjustments for successful ongoing flying starting Tuesday, January 24.

The flight-test campaign consisted of 19 flight days and approximately 260 flight hours of data collection from three airplanes. This flight test was the first to use the Flight Deck Interval Management (FIM) prototype as a new technology for air traffic management operations. The Airborne Spacing for Terminal Arrival Routes algorithm demonstrated under real-world conditions improvements to efficiency and throughput of arrival operations into busy airports. The algorithm also verified the FAA's minimum operational standards for FIM.

This flight test consisted of several hundred people from across the United States who worked for the following entities: Honeywell (three engineering groups and two flight operation groups, UAL (one flight operation group), Boeing (two divisions), Jeppesen, Ames (one project management group), Langley (three branches), and five air traffic control facilities in the Washington area. The ATD-1 core flight test team from Langley included Baxley, Swieringa, Harrison, Scearce, Roy Roper, Nina Tappan, Sara Wilson, Will Johnson, Sherilyn Brown and Terry Abbott from the SAIC LITES-II contract. During the remainder of the fiscal year, the research team will analyze the data and present the results at multiple venues, including the RTCA FIM working group meeting. In conjunction with the flight tests, on February 9, the ATD-1 team hosted media from CNN, Aviation Week, the Associated Press, and multiple Seattle news stations and newspapers. Below are several of the news stories released by the media in response:

https://www.ecnmag.com/news/2017/01/prototype-air-traffic-tool-ready-airborne-workout

http://www.geekwire.com/2017/nasa-atd-1-air-traffic-washington/

http://www.king5.com/mb/tech/science/aerospace/nasa-to-test-new-flight-management-system-in-washington/406607703

http://komonews.com/news/local/view-from-nasas-research-lab-20000-feet-above-washington

http://www.heraldnet.com/news/nasa-is-testing-technology-to-help-airlines-fly-more-efficiently/

ATD-2 Integrated Surface and Airspace Simulations

POC: SAVITA VERMA AND ERIC CHEVALLEY

During the past quarter, the Airspace Technology Demonstration-2 (ATD-2) Experiment team successfully conducted a series of three simulations to inform Field Demo Partners about the ATD-2 capabilities expected for the Phase 1 Field Demo. The team had their partners interact with the fully-integrated Phase 1 system in a realistic, closed-loop environment. The first of these tests took place on January 19 at FutureFlight Central (FFC) and the Airspace Operations Laboratory (AOL) at NASA's Ames Research Center in California. There, the ATD-2 Experiment Team successfully performed a third baseline Human-In-The-Loop (HITL) test, integrating the airspace surface traffic simulator's Multi-Aircraft Control System (MACS) with the Air Traffic Generator (ATG). This simulation environment supported the integration of several ATD-2 components, including the Surface Trajectory-Based Operation (STBO) system, its user interfaces and its connection with Time-Based Flow Management (TBFM). The test focused on evaluating the tactical departure scheduler and Call for Release procedure between the Charlotte Douglas International Airport (CLT) and Washington

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Center. The scenario simulated 580 flights that included both arrivals and departures and overhead traffic. Researchers tested the operation at full levels of traffic and included turnaround flights in the South Flow configuration. This HITL test also included the 360-degree simulation of the airline ramp operations, along with the smaller-scale virtual Air Traffic Control Tower (ATCT). Future follow-on test scenarios will feature different runway configurations, and continue to test the integration of surface metering and tactical departure scheduling.

The second of these tests occurred the week of February 13. The primary objective of the HITL shakedown simulation was to conduct supplemental tests of the integration of the STBO subsystem and the TBFM-Integrated Arrival Departure Capability subsystem. The secondary objective was to refine ATD-2 procedures for surface departure metering and the Call for Release process between CLT Air Traffic Control Tower (ATCT) and Washington Center. The simulation environment required considerable effort integrating the AOL Terminal Radar Approach Control (TRACON) and en route airspace-simulation capabilities with the FFC ATCT and Airline Ramp Tower simulation capabilities. Traffic scenarios involving nearly 600 flights included CLT arrival and departure banks, as well as overhead traffic to Washington Center. At the FFC, researchers used the primary 360-degree tower cab to simulate airline ramp operations while using a secondary virtual tower to simulate the ATCT. At the AOL, the TRACON and en route sector-controller displays used the MACS stations, while the Washington Center Traffic Management Unit station ran TBFM. The TBFM Integrated Departure Scheduling Tool for Washington Center was also used for four airports: Richmond, Dulles, Raleigh and Baltimore.

The HITL simulation involved 19 former air traffic controllers and managers from various FAA facilities, including CLT ATCT, American Airlines (AAL) Ramp Tower and Washington Center. The former CLT and AAL Tower controllers managed surface traffic in the HITL simulation using the Ramp Tower Console, Ramp Manager Tower Console and the STBO user-interface to schedule departures into the Washington Center overhead stream. There was one Washington Center Traffic Management Coordinator position; the rest of the participants staffed the en route and TRACON sector-controller positions. Fourteen pseudo-pilots managed flights using MACS and the Airspace Traffic Generator system. This HITL shakedown was in preparation for data collection scheduled for March 7 through 9, where FAA and air carrier participants will evaluate the ATD-2 system and expected operational procedures for the Phase 1 Field Demonstration.

The ATD-2 Team posing for a group photograph after successfully completing the March simulation.

The third simulation took place March 7 through 9. The primary objective of this HITL was to inform field demonstration partners about the ATD-2 capabilities expected for the Phase 1 Field Demo by enabling them to interact with the fully-integrated Phase 1 system in a realistic, closed-loop environment. The simulation environment included four distinct operational facilities: an airport ramp traffic control tower, ATCT, a Terminal RADAR Approach Control (TRACON) and Air Route Traffic Control Center. Faithful emulation of these facilities required integration of the AOL terminal and en route airspace simulation capabilities with the FFC airport surface simulation

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capabilities. This simulation built on the capabilities introduced in the previous tests. The HITL simulation involved participants from all of the ATD-2 Field Demonstration operational facilities, which included the National Air Traffic Controller Association, Charlotte ATCT/TRACON, AAL Ramp Tower, Washington Center and Atlanta Center. Participants in the HITL evaluated the expected ATD-2 procedures for surface departure metering implemented in the ramp management tools, and the "call for release" process between Charlotte ATCT and Washington Center. They also evaluated procedures associated with information sharing between the Charlotte ATCT and AAL Ramp Tower. Participants received training on the morning of March 7, followed by eight data runs where researchers collected quantitative and qualitative data. Debriefings at the end of each day provided more in-depth discussions to refine the ATD-2 system for the field demonstration. American Airlines Operations Research personnel and representatives from the FAA's NextGen, Surface and Operational Requirements and Validation Offices were present to evaluate the ATD-2 system and contribute to discussions. The NASA ATD-2 team and Field Demo partners gained valuable insight on how the ATD-2 system will operate during the field demonstration. Results from the HITL simulation will feed into the final set of capabilities for the Phase 1 Field Demonstration, and will be reviewed at the Evaluation Requirements Freeze 1 meeting scheduled March 29.

ATD-2 Demonstration to Collaborative Decision Making (CDM) Flow Evaluation Team (FET)

POC: AL CAPPS

On January 5, Airspace Operations and Safety Program researchers provided a demonstration of the Airspace Technology Demonstration-2 (ATD-2) system to the Collaborative Decision-Making (CDM) Flow Evaluation Team (FET) at NASA's ATD-2 laboratory located at the Charlotte Douglas International Airport. The team is a joint government and industry initiative aimed at improving air traffic flow management through increased information exchange among aviation community stakeholders. The FET is a CDM sub-team that strives to increase system efficiency by reducing route coordination time and enhancing system planning through the creation of common situational awareness of potential route alternatives, procedures and coordination processes. The FET requested that a regular quarterly meeting be held in conjunction with the ATD-2 lab visit. The ATD-2 team presented a system overview and described the goals, benefits, and tools developed across the various user groups, from Air Traffic Control Tower personnel to ramp managers and controllers. A description of the data exchange, integration activities, surface modeling, scheduling and metering also were provided. The FET expressed interest in the results of the field demonstrations.

ATD-2 Briefing to FAA's NextGen Advisory Committee Subcommittee

POC: JANE THIPPHAVONG

On January 12, Airspace Operations and Safety Program researchers provided an ATD-2 update to the FAA's NextGen Advisory Committee Subcommittee (NACSC) at their monthly meeting held in Washington, DC. The NextGen Advisory Committee (NAC) provides a venue where the FAA can solicit a consensus-based set of recommendations on issues that are critical to the successful implementation of NextGen. The NAC is also a forum to obtain a commitment of resources and synchronized planning between government and industry partners.

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The NACSC supports the NAC, and is composed of FAA and aviation industry representatives with broad knowledge and expertise related to the implementation of NextGen. The NACSC meeting included remarks from FAA Deputy Administrator (Acting) Victoria Wassmer and other regular participants. The ATD-2 briefing detailed past accomplishments, featured the concept animation video and highlighted ATD-2 partnerships and stakeholder engagement activities. Under ATD-2, NASA is collaborating with the FAA and industry to conduct a field demonstration of surface departure metering, in response to a recommendation from the NAC. Several NACSC members expressed their support for ATD-2 and an interest in results from the field demonstration.

ATD-3 Team Hold "Air-Ground Integration" Operational Meetings with Potential Stakeholders

POC: DAVID WING AND KAPIL SHETH

The Airspace Technology Demonstration-3 (ATD-3) Team held several meetings with potential stakeholders in January to solicit potential partnerships for NASA's upcoming "Air-Ground Integration" operational trials, to be conducted by fiscal year 2020, in which these technologies would be linked and leveraged for their respective strengths in an integrated operational demonstration. The first of these meetings occurred January 10, at United Airlines (UAL) World Headquarters in Chicago. Participants discussed a potential partnership between UAL and NASA. David Wing and Stephanie Harrison from NASA Langley Research Center – accompanied by Mike Madson and Kapil Sheth from NASA Ames Research Center – met with senior UAL officials including the Director of Communication, Navigation and Surveillance Programs and Cockpit Technology; the Senior Manager for Flight Operations Programs; the Chief Technical Pilot for Surveillance; and the Director of Network Operations Center and Flight Dispatch. Officials with UAL requested the meeting because of their interest in NASA technologies for airborne Traffic Aware Strategic Aircrew Requests (TASAR) and ground-based Dynamic Weather Routes (DWR). NASA presented demonstrations of the TASAR and DWR technologies, and hosted discussions on integration requirements and partnership expectations. Officials with UAL reaffirmed their interest in the partnership, assessed the business factors necessary to proceed, and committed to respond to NASA within the next couple of months.

The next meeting, held on January 20, took place at the FedEx Global Operations Center (GOC) in Memphis, TN. Wing, Harrison, Madson and Sheth met with senior FedEx officials, including the Managing Director for Flight Technical and Regulatory Compliance, the Manager of GOC Air Traffic Coordination, the Manager of Aircraft Engineering, the Senior Manager of Air Traffic Operations, and two senior captains. FedEx has closely followed NASA's developments on airborne TASAR and ground-based DWR technologies, and affirmed their interest as a potential partner for NASA's upcoming "Air-Ground Integration" operational trials. The NASA team presented demonstrations of the TASAR and DWR technologies, and discussed integration requirements and partnership expectations. FedEx has several aircraft with the required broadband connectivity, and has significant interest in data communications. NASA intends to release a Request for Information to the airline community regarding the planned Air-Ground Integration operational trials, and FedEx anticipates submitting a response.

On January 25, Boeing Research and Technology (R&T) also met with NASA in Seattle to discuss potential partnership opportunites.

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These NASA representatives also met with the Boeing R&T personnel responsible for planning the next round of ecoDemonstrator flights scheduled for 2018 and 2020. Boeing anticipates submitting a response to NASA's request for information, and expressed significant interest in including NASA's TASAR technology in these flights as part of NASA's upcoming "Air-Ground Integration" operational trials. The groups discussed cockpit integration requirements for TASAR and potential operational scenarios to digitally request and approve NextGen Data Communications emulation of airborne-generated route-change solutions to Air Traffic Control.

NASA and Alaska Airlines met on January 26 to discuss a strategic partnership to explore expanding their current Space Act Agreement to include "Air-Ground Integration." The expansion would include installing NASA's ground-based route-optimization technology – National Airspace System Constraint Evaluation and Notification Tool– in Alaska's Dispatch Center, while adding the Traffic Aware Planner to additional aircraft, and then testing the integrated air and ground technologies together. In attendance from Alaska were the Director of Operations, the Director of Dispatch, and the Chief Technical Pilot, along with several line dispatchers and Flight Operations personnel. Attendees discussed partnership objectives and parameters, including expectations for NASA and Alaska Airlines contributions. Alaska Airlines management was enthusiastic about the potential expansion and the opportunity to respond to NASA's pending Request for Information.

These outreach meetings identified at least one suitable airline-aircraft operator partner for conducting operational trials of Air-Ground Integration in support of ATD-3.

ATD-2 Software Release with Significant New Capabilities

POC: MICHELLE ESHOW

On January 20, the Airspace Technology Demonstration-2 (ATD-2) Software Development Team delivered version 2.1 of the Integrated Arrival, Departure, and Surface (IADS) system. ATD-2 has followed an agile requirements definition and software development process. Field demo partners were exposed to the IADS system in live-data shadow mode evaluation sessions, and provided the research team with the opportunity for feedback regarding system requirements. The IADS v2.1 release implements a large percentage of the requirements identified during five shadow sessions conducted from July through November 2016.

The software team completed 434 issues (i.e., Jira tickets) since the last major IADS version release in mid-October. Development included these key areas:

1. Refinement of a data fuser system to handle the vast array of input data feeds;
2. New user interface components to support air traffic control tower (ATCT) and ramp tower collaboration;
3. Significant maturation of the tactical scheduling and metering functions;
4. Re-engineering of the Ramp Traffic Console user interface for better support;
5. Re-design of ATCT controller interface for usability;
6. Enhancements to the departure-scheduling interface between IADS and the FAA's TBFM system; and
7. Adaptation enhancements to reflect operations at Charlotte Douglas International Airport (CLT).

The upcoming shadow evaluation sessions at the ATD-2 lab at CLT will highlight the IADS v2.1 release. During these sessions, NASA researchers will review the latest capabilities with field demo partners and use their feedback to further

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refine the IADS system to prepare for upcoming tests and the ATD-2 Phase 1 field demonstration.

Technical Interchange Meeting for the Management by Trajectory NRA

POC: BRYAN BARMORE

A technical interchange meeting between researchers took place at NASA's Langley Research Center in Virginia on January 24. The meeting included researchers from NASA's Trajectory-Based Operations (TBO) subproject team and Mosaic ATM, Inc., the prime contractor on the ongoing Management by Trajectory (MBT) NASA Research Announcement (NRA) contract. The MBT NRA team is tasked with defining an MBT concept of operations, studying the impact of possible changes in roles and responsibilities between the various agents in the air traffic system, and identifying the concept's potential impact on system safety in a way that brings the National Airspace System closer to a full TBO environment. Langley researchers participated in technical discussions with the contractor team about the draft concept of operations, scenarios and use cases applicable to an MBT air traffic environment. These discussions accompanied NRA team preparations to collect input from subject matter experts. NASA's Shadow Mode Assessment Using Realistic Technologies for the National Airspace System Test-bed for Safe TBO Project supports this NRA.

ATD-2 Engagement with the Surface Collaborative Decision Making Team

POC: RICH COPPENBARGER

On January 25, NASA participated in the joint government-industry Surface Collaborative Decision Making Team (SCT) Meeting, held in Washington, DC. The team meets quarterly and consists of representatives from major U.S. passenger and cargo airlines, general aviation, the FAA and the National Air Traffic Controller Association. The team provides broad stakeholder input regarding requirements, policy, and procedures related to surface traffic-flow automation and data exchange.

The morning sessions included an update on the status and deployment plans for the Terminal Flight Data Manager Program, and a briefing by the MITRE Corporation on the effects of early scheduling departures into time-based traffic flows. The rest of the day was devoted to technical interchange on Airspace Technology Demonstration-2 (ATD-2). ATD-2 researchers presented an update on recent progress made towards the Phase 1 field demonstration at Charlotte Douglas International Airport. ATD-2 topics also included the status of the cost-benefits analysis and a preliminary study of the accuracy of airline gate departure intent data at Charlotte as a function of look-ahead time and airline category. Such analysis is critical for establishing expectations for the performance of ATD-2 departure scheduling functions in Phase 1. Interactions during the meeting provided valuable input on ATD-2 data collection plans for measuring benefits and for refining the investigation of departure intent accuracy. The team expressed their appreciation for NASA's overviews and technical discussions, and reaffirmed their desire for continued engagement on ATD-2 going forward.

Meeting participants at the Surface Collaborative Decision Making Team Meeting.

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Visit to Los Angeles Air Traffic Control Tower

POC: GARY LOHR

On January 31, Gary Lohr from NASA's Langley Research Center in Virginia visited the air traffic control tower at the Los Angeles International Airport (LAX) to discuss automation tools that support the traffic flow management (TFM) process. Effective TFM is particularly important to LAX—the fourth busiest airport in the nation—because the airport's surface operations are characterized by limited area and unbalanced traffic loading. The primary tool used for TFM at major air traffic facilities is time-based flow management (TBFM); a sub-component of TBFM is the Integrated Departure Arrival Capability (IDAC) that organizes arriving and departing traffic. This organization is particularly challenging at LAX because of the high percentage of departures that are subject to constrained departure release times based on airspace capacity considerations at the destination airport. The IDAC requires highly constrained staging of aircraft and insertion into the flow of departure traffic for the appropriate runway. Information gained from this visit will be used in concept development at NASA to ensure compatibility with existing and envisioned capabilities in the national airspace system.

Tour of Ames Aeronautics Facilities for the FAA Unmanned Aircraft Safety Team (UAST)

POC: TOM PREVOT

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

Members of the FAA Unmanned Aircraft Safety Team

ATD-2 Project Successfully Completes FAA Enterprises Infrastructure Services Assessment

POC: SHAWN ENGELLAND

NASA, together with the FAA Communications, Information and Network Programs (CINP) Team, presented an Enterprises Infrastructure Services (EIS) Assessment on the Airspace Technology Demonstration-2 (ATD-2) Field Demonstration Prototype System to an FAA Architecture Review Board (ARB) in Washington, DC, on February 8. The EIS Assessment focused on the interfaces between FAA and NASA information systems necessary for the ATD-2 field demonstration. The ATD-2 project will conduct a field demonstration of its integrated surface metering and airspace departure scheduling technologies at the FAA's Charlotte Douglas International Airport Air Traffic Control Tower, Washington En Route Center and Atlanta En Route Center, in 2018. The ARB—composed of

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FAA representatives from the System Wide Information Management (SWIM) Program Office, Enterprises Engineering, Mission Support and Telecommunication Office and Security Offices—reviewed ATD-2 plans for installing equipment in the FAA facilities, SWIM interfaces, and the ATD-2 Integrated Arrival, Departure and Surface (IADS) management system interface with the FAA's operational TBFM. FAA NextGen and NASA ATD-2 representatives presented the ATD-2 overview, which included the ATD-2 concept animation video. The CINP Team described details of the interfaces; enterprise services; and telecommunication, security, and SWIM requirements needed to support the ATD-2 field demonstration. The meeting was very successful, as ARB members expressed appreciation for the ATD-2 presentation and indicated that they gained a clearer understanding about the interagency field demonstration collaboration. The ARB typically conducts such reviews to assess enterprise infrastructure impacts of formal FAA acquisition programs. This review of the ATD-2 field demonstration prototype is considered as a model for upcoming reviews of future, high-impact NASA and FAA prototyping activities.

NASA-FAA Technical Interchange Meeting for DRAW

POC: CHESTER GONG AND STEPHANIE HARRISON

On February 8 and 9, the Airspace Technology Demonstration-3 (ATD-3) project held a technical interchange meeting (TIM) for the Dynamic Routes for Arrivals in Weather (DRAW) technology at FAA Headquarters. More than 20 representatives from NASA, FAA, and the MITRE Corporation attended, as well as a representative from the National Air Traffic Controllers Association. At the meeting, NASA was represented by Stephanie Harrison from the Langley Research Center in Virginia, as well as Kapil Sheth and Chester Gong from the Ames Research Center in California. The meeting prompted an engaging discussion that successfully accomplished the objectives of the TIM, which were to first, provide detailed answers to FAA questions regarding DRAW technology and a Concept of Operations (ConOps); second, to receive feedback to help NASA revise the draft DRAW ConOps document; and finally, to present and receive feedback on the experiment plan for the first DRAW controllers-in-the-loop simulation, scheduled for May 2017.

ATD-2 Shadow Mode Evaluations #6 and #7

POC: SHIVANJLI SHARMA AND BECKY HOOEY

Shadow Mode Evaluations continued this past quarter. From January 24 through 26, the sixth Shadow Evaluation was held in the Charlotte Douglas International Airport Airspace Technology Demonstration-2 (ATD-2) lab. During the evaluation, traffic managers from the CLT air traffic control tower, AAL ramp controllers, CLT airport operations representatives, the FAA, the National Air Traffic Controller Association and NASA personnel met for discussions and demonstrations of the ATD-2 system with live data. Each day of the shadow evaluation included an overview and demonstration of new software capabilities to enable data exchange and integration between tower and ramp controllers for enhanced situational awareness. The presentation of these features allowed users to discuss efficient ways of collaboration and information sharing, which further refined the requirements for the ATD-2 team. A prototype of a real-time reporting tool was also demonstrated to the users to solicit detailed feedback about the benefit-related measures of performance. In addition, presenters introduced tactical surface metering concepts with a demonstration

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Participants attending a Shadow Evaluation Session

of the proposed functionality. The seventh Shadow Evaluation occurred February 21 through 23, and was again held in Charlotte at both the ATD-2 Lab and the American Airlines Training. The evaluation yielded similar results from the previous shadow evaluations, and allowed both the air traffic management and pilot communities to provide significant feedback regarding methods of ATD-2 implementation from a pilot perspective. The evaluations also defined requirements for pilot training materials for the field demonstration.

Releasing "The Kraken" - TIM with Naval Aeromedical Research Unit - Dayton

POC: KYLE ELLIS

On February 8 and 9, NASA researchers Kyle Ellis, Ron Daiker and Gautam Shah from the Langley Research Center in Virginia traveled to Wright-Patterson Air Force Base in Dayton, OH, to meet with the Naval Medical Research Unit (NAMRU) for a technical interchange meeting. NASA has established an Interagency Agreement with NAMRU to conduct research in the Navy's Disorientation Research Device named "The Kraken." The Kraken is a one-of-a-kind, high-fidelity flight research simulator capable of full-motion and sustained g-loading that more accurately replicates the forces a pilot feels during flight relative to conventional motion training simulators. This partnership enables NASA to conduct aviation safety research beyond the operational envelope of typical training simulators in a safe, repeatable manner, while maintaining a necessary level of realism. In addition to technical discussions related to test planning and simulator capabilities, the meeting also focused on NASA and NAMRU roles and responsibilities, schedules, and task coordination needed to prepare for operational research testing in early fiscal year 2018. The focus of this research is to develop and evaluate technologies for aircraft state awareness to reduce loss-of-control incidents in commercial aviation operations. This research is being conducted by the Technologies for Airplane State Awareness sub-project, within the ATD Project.

Video of the Kraken: https://www.youtube.com/watch?v=m-QRfUWWKlo

NASA and FAA Quarterly Meeting

POC: LEIGHTON QUON

From February 28 through March 1, the FAA and NASA conducted their joint quarterly review of current and potential future collaborations at NASA's Ames Research Center in California. These reviews provide a valuable two-way exchange of plans, constraints, ideas and possibilities that affect the two agencies. Current collaborations discussed included the Airspace Technology Demonstration (ATD)-1, -2 and -3 subprojects, the Integrated Demand Management subproject under Shadow-Mode Assessment Using Realistic Technologies for the National Airspace System and the FAA-NASA Research Transition Team for Unmanned Aircraft System Traffic Management.

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Potential future collaborations include NASA's emerging plans for a new Trajectory-Based Operations research project. Specific discussions about ATD-3 focused on the current ground-based and cockpit-based rerouting technologies, along with the concept of integrating these two technologies. Discussions featured Multi-Flight Common Route and Dynamic Routes for Arrivals in Weather as ground-based technology, and the Traffic Aware Strategic Aircrew Requests as cockpit-based technology. The ground-based technologies are slated for integration into FAA operational infrastructure, while NASA is working with flight operators and industry to implement the integrated technologies.

Integrated Demand Management (IDM) CTOP Development HITL

POC: NANCY SMITH AND CONNIE BRASIL

NASA researchers Nancy Smith and Connie Brasil from the Ames Research Center in California, working with the Integrated Demand Management (IDM) team, recently completed the first in a series of FY17 Human-In-The-Loop (HITL) simulations that will extend the IDM concept to address convective weather operations. This three-day "mini" HITL, held February 28 through March 2, emphasized the strategic subset of IDM operations that uses the NextGen Collaborative Trajectory Options Program (CTOP) toolset. This toolset develops and initiates a traffic flow plan that matches demand to the expected downstream capacity.

New convective weather traffic scenarios were presented to retired air traffic management subject matter experts (SMEs), who discussed their implications for IDM operations and suggested changes for this year's development activities. The SMEs also evaluated new capabilities added to the simulation environment's CTOP emulation. The CTOP emulation replicated the operational system's ability to assign departure times and routes selected from operator-submitted sets of multiple trajectory options per flight. Additionally, the emulation has a capacity-allocation advisory capability for managing load distribution across multiple constraints

The SMEs also demonstrated prototype decision-support tools for multi-sector traffic flow planning to share more capabilities that could improve information access and decision-making, monitoring, and revision during IDM plan development.

Another three-day mini HITL in April will focus on the tactical, Time Based Flow Management subset of IDM operations. Findings from both of these activities will help plan an initial end-to-end simulation of IDM operations during convective weather in the June through July 2017 timeframe.

Human-in-the-Loop Shakedown of Multi-Flight Common Routes

POC: KAPIL SHETH

A Human-in-the-Loop (HITL) evaluation of the Multi-Flight Common Routes (MFCR) tool took place at the Air Traffic Control Laboratory at NASA's Ames Research Center in California, March 6 through 8. The evaluation was a "shakedown" rehearsal in preparation for a formal evaluation by FAA traffic flow managers, scheduled for March 28 through 30. MFCR is a NASA-developed concept and associated decision support tool designed to assist air traffic flow managers in efficiently and continuously updating weather avoidance routes in case of convective weather system changes. MFCR groups together multiple flights to reduce the number of advisories that the traffic flow manager needs to evaluate, and merge these flights on a common route segment to provide an orderly flow of rerouted traffic. Four recently retired FAA traffic flow managers

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provided feedback on the MFCR tool and its concept of use. Specific topics of evaluation included the operational acceptability of MFCR reroute advisories, the usability of MFCR's graphical user interface, and the overall viability of MFCR's concept of use. Data was collected across 120 evaluation points. Overall, the SMEs provided positive feedback, indicating that MFCR identified many time-saving rerouting opportunities that would be difficult to manually identify during air traffic operations in bad weather conditions.

Alaska Airlines Meetings on TASAR Technical Implementation and Testing

POC: DAVID WING

A Traffic Aware Strategic Aircrew Requests (TASAR) technical implementation meeting took place January 25 at Alaska Airlines' Maintenance and Engineering facility in Seattle. TASAR enables pilots to optimize their flight trajectory while airborne, saving flight time and fuel by using the NASA-developed Traffic Aware Planner (TAP) software application on their Electronic Flight Bag (EFB) system. Alaska Airlines partnered with NASA to operationally test TAP in revenue service on three aircraft, the first of which was delivered on January 23. Representatives from NASA, Engility Corporation, Alaska Flight Ops and Engineering, UTC Aerospace Systems, and Gogo attended the meeting, and reviewed preparations for a mid-February "Stage 0" ground test of TAP's connectivity to onboard avionics. Additionally, attendees planned logistics and procedures for software testing, packaging and loading, and established a timeline leading up to a mid-May "Stage 1" initial testing of TAP in flight, which was initially a background process. The full TAP system will enter "Stage 2" testing by select Alaska Airlines pilots in the third quarter of Fiscal Year 2017.

An Alaska Airlines aircraft initiated integration testing of the TAP software onboard with an overnight test on March 7 at Seattle-Tacoma International Airport. The objective of this "Stage 0 Ground Test" was to use data received from the United Technologies Aerospace Systems Aircraft Interface Device to test avionics data subscriptions and parameter decoding, and feed aircraft data parameters to TAP in flight. The aircraft performed two ground tests: a pilot-static simulation test where the aircraft simulates high-altitude flight in the hangar, and a high-speed taxi test on the runway. The tests successfully verified subscriptions and correct decoding for many of the required parameters. Researchers plan to conduct further testing after additional analysis of the parameters. Engility Corporation Research and Development lead David Roscoe supported the testing on-site. Applications to the FAA for certification and operational approval of EFB and TAP software installation will be submitted this spring. Researchers and Alaska Airlines anticipate operational testing of TAP will begin this summer.

Langley Collaborates with American Airlines for Improved Aviation Safety

POC: GAUTAM SHAH

NASA researchers Gautam H. Shah and Kevin Cunningham from the Langley Research Center in Virginia hosted two groups of American Airlines (AAL) fleet managers and senior check airmen on March 8 and 9. As part of an ongoing collaboration between Langley and AAL, Langley provided technical briefings and a flight simulator demonstration of technologies to enhance critical stall recognition and recovery simulation fidelity. The representatives from AAL also observed demonstrations of the Integration Flight Deck, among other briefings and demonstrations of in attention management technologies and display concepts by Technologies for Airplane State Awareness (TASA) researchers.

Research conducted at Langley within the TASA subproject has enabled improvements in the flight

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

UTM Technology Transfer to the FAA

POC: TOM PREVOT

NASA sent the first installment of Unmanned Aircraft System Traffic Management (UTM) technology transfers to the FAA on March 14. This technology transfer is a result of the Joint Management Plan co-approved by NASA and FAA. The technology transfer includes descriptions and results of the Technology Capability Levels 1 and 2 testing from the UTM subproject. The FAA will use this information for its UTM development activities.

NASA and DLR Collaboration Discussion

POC: JOSEPH TOTAH

A meeting between NASA and German Aerospace Center (DLR) took place March 14 at NASA's Ames Research Center in California. The DLR delegation included Juergen Drescher, head of the DLR Liaison Office in Washington, DC, and Florian Adolf, from DLR Institute of Flight Systems, Braunschweig, Germany. The meeting's goal was to identify potential new areas of collaboration that would leverage DLR's unmanned freight operations research and NASA's research in areas such as adaptive control, real-time path planning, computer vision and software verification and validation. To facilitate the discussions, DLR presented research on "unmanned freight operations," and NASA presented research in the areas of real-time safety modeling, software verification and validation, intelligent adaptive control, Unmanned Aircraft System autonomy and autonomous surface operations. During the coming weeks, DLR and NASA will refine the terms of their collaboration, and present the outcome to the Airspace Operations and Safety Program for future consideration.

FAA-NASA Telecon Explores Potential Collaboration on Aviation Ontologies

POC: DR. RICH KELLER

A joint teleconference between NASA and the FAA took place March 14. The two agencies discussed their respective activities in ontologies and aviation data management. Attendees included NASA's Rich Keller and Michelle Eshow, and the FAA's Natesh Manikoth, Deborah Cowell, Diana Takata, Richard Cagan, Candace Buchanan and Shalini Jerath. The FAA discussed a system that supports regulatory compliance for aviation safety by using an ontology to facilitate document browsing and search. NASA discussed its Air Traffic Management (ATM) ontology, which is designed to support ATM data integration, query and search. FAA Chief Data Officer Natesh Manikoth expressed his interest in publishing these ontologies through open-sourcing to stimulate global collaboration and partnership with industry, standards bodies, academia and other Air Navigation Service Providers, especially EUROCONTROL. The FAA and NASA also discussed possible joint projects that would leverage existing efforts and engage industry and government in more collaborative partnerships to evolve ontologies.

Flight Test Plans Supporting UTM's National Campaign

POC: TOM PREVOT

On March 3, task orders were awarded to the six National Test Sites for conducting National Campaign testing of the Technology Capability Level 2 (TCL2) Unmanned Aircraft System Traffic Management (UTM) system. Each test site submitted a proposal for multiple Beyond Visual Line of Site (BVLOS) flights for several use cases. Following

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the awards, test sites held kickoff meetings while waiting for more detailed test plans. Preliminary flight test plans from the National Test Sites were received March 21, and the final flight test plans detailing intended testing of Unmanned Aircraft Systems at the TCL2 were received March 31. Each test site will fly multiple UAS in BVLOS operations for several use cases. The flight tests will be at sites in Nevada, Alaska, North Dakota, New York, Virginia and Texas. From May 22 to June 9, each test site will connect to NASA's UAS Traffic Management platform during the testing.

Augmented Flight Deck Countermeasures Experiment-3.0 Completed

POC: SHERILYN BROWN

The Augmented Flight Deck Countermeasures Experiment 3.0 (AFDC-3.0) began operations on March 21. During a four-week period, 12 pilots conducted the experiment in the Research Flight Deck simulator at NASA's Langley Research Center in Virginia.

Each of the 12 pilots was subjected to a one-day experiment schedule. Each day, the pilots completed a series of unusual attitude recovery scenarios. In these scenarios, the displays were blanked while the environment was simulated to produce instrument meteorological conditions, removing visual cues and measuring the idea of leaving or pulling synthetic vision during an unusual attitude. The experiment also used a prerecorded playback of vehicle entry into one of several unusual attitude conditions. Once each condition fully developed the displays returned, followed by an aural tone, resulting in the pilot's cue to recover. Some runs showed the subject's synthetic vision throughout the run. In others, the subject initially saw synthetic vision before the visual disappeared and the primary flight display reverted to a traditional blue-over-brown horizon for recovery. After the vehicle recovered, the visual returned to synthetic vision.

Baseline runs showed only blue-over-brown to the subject. Researchers used the eye-tracking tool Smart Eye, MAPPS data-recording station, and the Motion Perception Toolbox for data collection. The AFDC-3.0 experiment concluded runs on April 12 after successfully collecting data for 12 crews flying 288 scenarios in and around the Memphis International Airport visual database.

ATD-2 IADS System Deployed to CLT Tower/ TRACON "Back Room"

POC: SHIVANJLI SHARMA

On March 23, the Airspace Technology Demonstration-2 (ATD-2) team completed deployment of the ATD-2 Integrated Arrival, Departure and Surface (IADS) prototype system to a "back-room" area in the air traffic control tower/Terminal RADAR Approach Control (TRACON) at Charlotte Douglas International Airport (CLT). This ATD-2 IADS system deployment, the first to a field demo partner operational facility, is the culmination of many months of work by the ATD-2 team to prepare the system for use by field demo partners. The ATD-2 team collaborated with FAA and CLT partners to establish network connectivity by NASA equipment elsewhere at the airport with the CLT tower/TRACON complex. The interagency collaboration included cost-sharing contributions from the FAA's Terminal Flight Data Manager Program for portions of the CLT tower/TRACON installation. This back-room installation will support live-data shadow testing and training with FAA personnel at the CLT tower/TRACON as they prepare to operationally use the IADS system when the ATD-2 Field Demonstration commences in September.

ATD-2 Familiarization for FAA Stakeholder Groups

POC: SHAWN ENGELLAND AND ANDREW GING

Familiarization briefings were held this quarter with FAA Stakeholders supporting Airspace Technology Demonstration-2 (ATD-2). The first occurred on February 2, when NASA provided a demonstration of the ATD-2 system to the National

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Visitor briefings at NASA's CLT Lab

Time-Based Flow Management (TBFM) Operations Team Co-Leads, representatives from the FAA's Future Standards and Procedures Group (AJV-85) and the Mission Support Group to the Air Traffic Organization. The National TBFM Operations Team and AJV-85, which sponsors the TBFM team, is responsible for all aspects of TBFM system operations, including software implementation, and testing, creating operating procedures, and providing training for the operational facilities. Participants included the AJV-85 Group and Team Manager, and the National Air Traffic Controller Association National Representative for TBFM. On March 23, the NASA team demonstrated the ATD-2 system to FAA Headquarters representatives from the NextGen Portfolio Management and Technology Development Office (ANG-C), and AJV-85. Participants included the ANG-C Director, ANG-C5 Manager and AJV-85 Group and Team Managers. The ATD-2 demonstrations were hosted at NASA's lab at the Charlotte Douglas International Airport and used live data. The ATD-2 system overviews included a description of the goals, benefits, and tools developed for use across the various user groups, from air traffic control tower personnel to ramp managers and controllers. ATD-2 subject matter experts from Human Solutions, Inc., also supported the visit, and provided key insights on how the ATD-2 system will be used operationally. The visits provided NASA with the opportunity to have valuable technical interchange discussions with AJV-85; in particular, to understand the FAA's TBFM plans and inform the FAA on how the ATD-2 system integrates with TBFM.

ATD-2 Phase 1 Evaluation Requirements Freeze (FRZ1)

POC: SHIVANJLI SHARMA

On March 29, the Airspace Technology Demonstration-2 (ATD-2) Team conducted an Evaluation Requirements Freeze 1 (FRZ1) meeting with 40 field demo partners and other stakeholders to gain concurrence on capabilities included in the Phase 1 Field Demo in September 2017.

The FRZ1 meeting took place at the Old Terminal Building at Charlotte Douglas International Airport (CLT), where NASA's ATD-2 laboratory is located. FAA participants included representatives from Washington and Atlanta Center, CLT air traffic control tower and Terminal RADAR Approach Control, and a trio of FAA headquarters organizations. Participants also included representatives from air carriers operating at the CLT field demo site, ramp controllers and managers, pilot unions, CLT airport operations and the National Air Traffic Controller Association. Field demo partners observed a detailed review of the ATD-2 Phase 1 Field Demo plans, including the concept of use, expected operational training and procedures, details on benefits assessment, software release plan and site maintenance protocol. Field demo partners concurred with the ATD-2 Phase 1 Field Demo plans, and the joint decision will appear in a future FRZ1 decision document.

The FRZ1 meeting marked the end of the ATD-2 system requirements development for Phase I, and the engineering team will assess the readiness of the ATD-2 system for the operational

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Field demo partners and ATD-2 Team members at the ATD-2 Phase I Evaluation Requirements Freeze Meeting

personnel's shadow evaluation during the Engineering Shadow Evaluations for the Phase 1 Demo.

Visit by Commanding Officer of Naval Medical Research Unit-Dayton

POC: SHERILYN BROWN

On March 30, Captain Rees "Chip" Lee, Commanding Officer of the Naval Medical Research Unit – Dayton (NAMRU-D), visited NASA's Langley Research Center in Virginia. Lee discussed his agency's current research partnership with NASA and plans for future collaboration. Langley provided Lee with briefings regarding the Center's capabilities and overall Technologies for Airplane State Awareness (TASA) research. Lee also met with Langley researchers supporting TASA, toured the 14-by-22 wind tunnel and other simulation facilities and received demonstrations of display and crew state monitoring technologies developed under TASA. Langley has established an Interagency Agreement with NAMRU-D to conduct research in the Navy's Disorientation Research Device, a unique high-fidelity flight simulator also known as "the Kraken". The research focuses on improving aircraft state awareness to reduce loss-of-control incidents in commercial aviation operations, and is conducted under the TASA subproject.

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Keynote Speaker at UAVNZ UAV Industry Conference: Drones for Business Success

POC: PARIMAL KOPARDEKAR

NASA's Parimal Kopardekar, NASA's Senior Technologist for Air Transportation Systems at the Ames Research Center in California, was invited to give a keynote address at the Unmanned Aircraft Vehicles (UAV) New Zealand Conference in Auckland, New Zealand on February 13 and 14. The purpose of the conference was to share knowledge about New Zealand's UAV ecosystem. Approximately 300 international participants attended the conference, which featured speakers representing the United Nations, the Auckland University of Technology, the air navigation service provider Airways New Zealand, the New Zealand Civil Aviation Authority (CAA), the Singapore Nanyang Technological University, Facebook and the New Zealand Ministry of Transportation. The UAV community in New Zealand expressed interest in initiating NASA's Unmanned Aircraft System Traffic Management-type construct, including using the NASA/FAA/Industry collaboration model applied to universities, the international UAV industry, Airways New Zealand and the New Zealand CAA.

Kurt Swieringa Named Young Engineer of the Year

POC: SHERILYN BROWN

On February 26, Kurt Swieringa from NASA's Langley Research Center in Virginia accepted the AIAA Peninsula Engineers Council's "Doug Ensor Young Engineer of the Year Award" for 2017. The event took place at the Hampton Roads Convention Center. Langley Director Dave Bowles gave the keynote speech at the banquet. Steve Velotas, Vince Schultz and Will Johnson from Langley also attended.

TAP Highlighted as 2016 Software of the Year in Publicly Released NASA Software Catalog

POC: SHERILYN BROWN

NASA's Traffic Aware Planner (TAP) software, an aircraft route efficiency tool developed at the Langley Research Center in Virginia, was highlighted in the 2017-2018 NASA Software Catalog. Langley was one of two agency winners of the 2016 NASA Software of the Year award. The other winner was Pegasus 5, a revolutionary computational fluid-dynamics tool developed at NASA's Ames Research Center in California. These two award recipients also were cited on AVweb.com in its March 2, 2017, post (http://www.avweb.com/avwebflash/news/NASA-Releases-Massive-Collection-of-Software-for-Free-Public-Use-228584-1.html). The TAP software, sponsored by the Airspace Technology Demonstration Project, was designed and developed by NASA and Engility Corporation. Preparations are underway to test the TAP software in revenue service aboard three Alaska Airlines jets in 2017.

Senate Commerce Briefing on UAS Traffic Management (UTM)

POC: KENNY MCCOMBS

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

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Blue Sky Meeting at Institute of Human Machine Cognition (IHMC)

POC: YOON JUNG

Yoon Jung represented the Airspace Operations and Safety Program at a meeting at the Institute of Human Machine Cognition (IHMC) in Pensacola, FL, on March 7 and 8. The theme of the meeting was "Autonomous Towing for Future Transportation Systems." Attendees, many of whom were experts in autonomy and robotics, represented NASA's Ames Research Center in California, NASA's Johnson Space Center in Houston, the Air Force Research Laboratory, USRA, Boeing, American Airlines, Charlotte Douglas International Airport, Mosaic ATM, PARC, Robotics Research and IHMC. Mike Bryant, America Airlines director of tower operations at CLT, and Jack Christine, Deputy Aviation Director for CLT, discussed the complexity in airport surface operations and the infrastructure requirements for autonomous towing. They also presented other options for autonomous operations on the airport surface, operational architectures to enable human control and supervision of autonomous operations, and the possible roles of humans and machines. During a post-breakout session, Jung discussed Ames' modeling and simulation capabilities to simulate and test autonomous towing or baggage transportation systems in order to validate concepts and technologies. These capabilities included the Shadow Mode Assessment Using Realistic Technologies for the National Airspace System testbed, Moffett Federal Air Field and FutureFlight Central.

ATD-1 Flight Test Presentation to RTCA SC186 Working Group

POC: KURT SWIERINGA

On March 14, NASA's Kurt Swieringa—with support from Brian Baxley, Sara Wilson, Terry Abbott and Roy Roper—presented a briefing to the RTCA SC186 Working Group 4 on the Airspace Technology Demonstration-1 (ATD-1) flight test. Special Committee 186, Automatic Dependent Surveillance-Broadcast (ADS-B), is developing operational requirements and minimum performance standards for airborne and ground-based ADS-B applications. The ATD-1 briefing presented the flight test objectives, a description of the flight test, a high-level description of initial observations, and an outline of the plans for future analysis. The RTCA members who attended the flight test praised the ATD-1 flight test team, stating that it was impressive to see Flight Deck Interval Management (FIM) in operation. The ATD-1 flight test team included NASA partners from Boeing, Honeywell, United Airlines and FAA air traffic control facilities. Additionally, FAA representatives mentioned their plans to leverage the prototype created for the ATD-1 flight test for future advanced FIM testing.

Aviation Safety Assurance Committee 2nd Meeting

POC: KEE PALOPO

The National Academies' Aviation Safety Assurance Committee, sponsored by NASA's Aeronautics Research Mission Directorate, conducted their second-ever meeting, in Washington, DC, on March 15 and 16. The committee focused on recommending research activities during the next 10 to 30 years to support development of an "in-time" safety assurance system. The committee—which consisted of panelists and presenters from public, private and academic communities—discussed the long-term impact on four topic areas: the future of air traffic management, new entrants, issues associated with human operators, and the future of data analytics. The 16-member committee represented these organizations: NASA, FAA, Air Force Research Laboratory, the MITRE Corporation, the Flight Safety Foundation, Charles Stark Draper Laboratory, National Business Aviation Association, the International Air Transport Association, Rockwell Collins,

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Elwell and Associates, Fazio Group International, Aireon, the University of Colorado at Boulder, the Ohio State University, Vanderbilt University, Massachusetts Institute of Technology and the University of Virginia. Presenters and participants represented some of these communities and other public, private and academic institutions. At the committee's request, NASA Airspace Operations and Safety Program researcher Kee Palopo presented a briefing on how the Shadow Mode Assessment Using Realistic Technologies for the National Airspace System testbed would be used in support of research related to Real-Time System Wide Safety Assurance.

FAA UAS Symposium – Reston, VA

POC: KEE PALOPO

From March 27 through 29, John Cavolowsky, NASA's Airspace Operations and Safety Program director, attended and participated as a panel member at the 2nd Annual FAA Unmanned Aircraft Systems (UAS) Symposium. The event was co-hosted by the FAA and the Association for Unmanned Vehicle Systems International in Reston, VA. The Symposium focused on the potential for UAS and methods to achieve its full integration into the National Airspace System (NAS). Attendees heard directly from senior FAA officials about the UAS regulatory environment, and had an opportunity to talk face-to-face with FAA experts about the operational challenges facing UAS pilots today. Cavolowsky participated in one of the workshop sessions covering topics such as options for operating in the NAS, the future of airspace authorization and how to address challenges around traffic management, infrastructure and security.

State of California's "Aerospace and Aviation Days"

POC: JOSEPH RIOS

The State of California's "Aerospace and Aviation Days" event, held on March 28 at the state capitol in Sacramento, presented NASA's Unmanned Aircraft System (UAS) Traffic Management (UTM) concept and project. Joseph Rios, Technical Lead for NASA's UTM effort, sat on a panel to describe the joint effort between NASA and the FAA to enable access to the low-altitude airspace for small UAS. Attendees included California assembly members and industry group representatives.

Human Factors REDAC Meeting Held at ARC

POC: TOM PREVOT

On March 28 and 29, the Human Factors Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) met at NASA's Ames Research Center in California. In addition to hearing about the status of the FAA's human-factors work, the subcommittee presented demonstrations of NASA's work on Unmanned Aircraft System (UAS) Traffic Management (UTM), UAS Detect and Avoid, and Real-Time Safety Monitoring. The subcommittee also heard a presentation on the Aviation Safety Reporting System's UAS findings. Tom Prevot, NASA's Safe Autonomous Systems Operations project manager at Ames, and Richard Barhydt, NASA's Transformative Aeronautics Concepts Program deputy director, are both members of the subcommittee, which is chaired by Air Force Research Laboratory's Jack Blackhurst.

System-Wide Safety RTT, Human Factors Sub-Team Workshop Held at ARC

POC: JESSICA NOWINSKI

On March 30, the Human Factors Subteam of the System Wide Safety Research Transition Team conducted a follow on meeting to their initial workshop held in October of 2016. The agenda focused on opportunities for collaboration to support air traffic management human factors needs. The agenda also addressed more

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detailed planning for collaborative engagements. FAA Chief Scientist and Technical Advisor for Human Factors Kathy Abbott and NASA's Jessica Nowinski from the Ames Research Center in California were the co-organizers of the workshop.

Provisional Patent Application Filing for Crew State Monitoring

POC: SHERILYN BROWN

Crew state sensing remains critical for maintaining and improving safety while addressing the technological barrier of human-machine integration in the new paradigm of shared control and responsibilities between human operators and intelligent machines. However, human status is highly variable and difficult to predict. Unless measured in real time, variations in behavior, skill, medical status and cognitive state impede the efficient assignment of roles and the safe allocation of critical functional tasks. Co-inventors Angela Harrivel, Chad Stephens, Kellie Kennedy and Alan Pope from NASA's Langley Research Center in Virginia have conceptualized a system that can monitor the status of the human operator by measuring multiple variables in real time. Once the system monitors the operator, it communicates that information to an intelligent machine to improve safety and efficiency. Such a system would enable novel technical approaches to human-machine teaming optimization and increasingly autonomous system development. Furthermore, this technology would allow inclusion of the real-time state of the human operator in system-wide prognostics and machine-assisted skill training. A provisional patent application entitled "Multivariate Monitoring for Human Operator and Machine Teaming" has been filed as of March 2017 (Case Number LAR-19051).

David Wing selected as 2016 ARMD AA Award Winner for Strategic Partnership

POC: SHERILYN BROWN

David Wing of NASA's Langley Research Center in Virginia has won the Strategic Partnership Award as part of the Aeronautics Research Mission Directorate Associate Administrator Awards for 2016. This award is given for exemplary performance by an individual to establish or strengthen strategic partnerships with non-NASA entities. Specifically, these partnerhips leverage emerging capabilities within the United States and abroad to significantly impact and advance the achievement of aeronautics research and development goals, generate robust and timely transfer of knowledge, and strengthen trust and credibility with U.S. and foreign partners. As the Technical Lead for the Traffic Aware Strategic Aircrew Requests (TASAR) research activities within Airspace Operations and Safety Program, Wing developed and executed a research and evaluation plan that focused on interactions and partnerships with industry, academia, and other government agencies. Through his perseverance and energy, he executed three Space Act Agreements with two airlines and an avionics manufacturer, as well as two NASA Research Announcements with industry and academia teams to enhance and evaluate the TASAR technology in simulation and relevant in flight operational environments. His partnership approach also resulted in multiple organizations securing evaluation license agreements on the patented TASAR concept. Jaiwon Shin, NASA's associate administrator for aeronautics, will present the award to Wing during his next visit to Langely.

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