AOSP Newsletter

Airspace Operations and Safety Program (AOSP)

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AOSP IN THE NEWS

Human Pilots Are Helping NASA To Advance Autonomous Air Taxis—Here's How

Tech Times (10/5) reports "NASA is actively engaged in research to ensure the safety of fully autonomous flight technology, a critical aspect in preparing for the potential future of air taxis. This endeavor involves a collaborative effort between NASA, DARPA, and aircraft manufacturer Sikorsky."

One Headwind Facing Urban Air Taxis Is, Well, The Wind

Aerospace America (10/25) reports "If hundreds of air taxis are ever to ferry passengers or cargo around major cities, they will have to contend with urban wind environments — the most extreme being urban canyons between high-rise buildings that can funnel and accelerate wind and cause turbulence on city rooftops. While helicopters have served as air taxis in some large cities, the anticipated proliferation of electric air taxi rotorcraft would represent a new scale of aviation in such environments. As far as NASA knows, no one can yet predict the impact of wind and turbulence on air taxi operations, or what kinds of cityscapes and locations drive the strongest winds."

NASA Completes Key Step In Aviation Safety Research

Space Daily (11/2) reports "NASA's aeronautical innovators have completed a significant step in their pursuit of safer, more efficient aviation technologies that spot hazards before they occur. Through its System-Wide Safety project, NASA and its partners in government, industry, and academia are exploring new technologies and techniques to improve current aviation safety and potentially enable widespread use of new types of aircraft such as drones or air taxis."

FAA Establishes Committee to Examine Air Traffic Controller Fatigue

FlightGlobal (12/21) reports "the US Federal Aviation Administration has established a panel to examine air traffic controller fatigue. The three-person board, which the US regulator named on 20 December, will investigate 'how the latest science on sleep needs and fatigue considerations could be applied to controller work requirements and scheduling.' ... Charles Czeisler, chief and senior physician, at the division of sleep and circadian disorders at Brigham and Women's Hospital and Erin Flynn-Evans, head of the NASA Ames Research Center Fatigue Countermeasures Laboratory will also be on the panel."

Joby, NASA Simulation Demonstrates Up to 120 Air Taxi Operations Per Hour In Busy Airspace

AP (12/20) reports "Joby Aviation, Inc. (NYSE: JOBY), a company developing electric vertical take-off and landing (eVTOL) aircraft for commercial passenger service, today announced it has successfully completed a series of air traffic simulations with NASA's Ames Research Center that evaluated how air taxi operations can be integrated into today's airspace, including at busy airports, using existing air traffic control (ATC) tools and procedures. This press release features multimedia."

Joby, NASA Simulate Weaving Air Taxis into Busy Airport Activity

Dayton (OH) Daily News (12/21) reports "JoeBen Bevirt, founder and chief executive of Joby, aims to have his company's quiet, battery-powered flying vehicles entering commercial air taxi service by 2025. In the meantime, the market and an array of regulatory hurdles need to be better understood. NASA and Joby said they recently had representatives from the Federal Aviation Administration (FAA), the National Association of Air Traffic Controllers and others view a simulation at NASA's Ames' air

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traffic control simulation facility, called FutureFlight Central."

NASA Is Conducting Research on Air Taxis by Autonomously Flying Drones

Mashable (12/25) reports "researchers at NASA's Langley Research Center in Virginia have achieved a significant milestone by conducting successful flights of multiple drones to assess the autonomous flight capabilities of air taxis. These drones were able to fly without the need for a visual observer, surpassing the visual line of sight."

To The Skies: 3 Flying Car Stocks to Buy for the Future of Transportation

Insider (12/28) reports "flying car stocks encompass the realm of electric vertical takeoff and landing (eVTOL) vehicles and have been soaring in popularity among investors recently. This sector is buzzing with activity, with forecasts indicating compound annual growth rates of 58% from 2022 to 2040. ... Further bolstering its position, Joby has completed air traffic simulations with NASA's Ames Research Center, proving its willingness to effectively integrate air taxis into existing aerospace systems."

NASA Drones Offer Glimpse of a Future with Self-Piloted "Air Taxis"

Washington Post (12/30, Blakemore) reports "self-piloted 'air taxis' moved a step closer to reality recently with a recent NASA experiment involving multiple autonomous drones. The drones flew beyond observers' line of sight, dodged one another and successfully maneuvered around obstacles before safely landing, the agency announced Dec. 21."

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

IAS middleware ground display.

ATM-X Completes NC Integration of IAS Team Spiral-2 Flight Testing

POC: WANESSA PRIESMEYER AND ADAM YINGLING

On Oct. 26, the Air Traffic Management – eXploration (ATM-X) project successfully completed the Integration of the Automated Systems (IAS) flight test. The former Advanced Air Mobility project's National Campaign's (NC's) IAS team previously conducted this work. The test was the third and final test of the IAS Spiral-2 flight test campaign and built on the success of the IAS Spiral-1 tests from late last year and the IAS Spiral-2A and 2B tests from February and June 2023. The IAS team spent two consecutive weeks flight testing automation algorithms using the Sikorsky Autonomous

Research Aircraft (SARA) and the Sikorsky Optionally Piloted Vehicle (OPV). This test used the IAS middleware, which commands both vehicles simultaneously, to set up

SARA and OPV at take-off.

intentional interactions in which to test the NASA-developed Aircraft Flight Contingency Management's (AFCM's) Flight Path Management (FPM) and Hazard Perception

TECHNICAL AND PROGRAMMATIC HIGHLIGHTS

Test team participants inside the control room.

Group photo of IAS Spiral-2 flight test team.

publications, recommendations for standards bodies, and researchers looking to further the advancements in autonomous aircraft. The Spiral-2C flight test incorporated NASA personnel from the NC's IAS and AFCM's FPM and HPA. Participation also included Sikorsky, the Defense Advanced Research Projects Agency and the Air Force's Agility Prime program. Overall, the combined team included over 35 personnel. The IAS team will now transition into the Pathfinding for Airspace with Autonomous Vehicles subproject within the ATM-X project but will consolidate their findings into the IAS final report, scheduled for delivery late in calendar year 2023.

SWS Project Successfully Passes TC Tollgate for IASMS for Commercial Aviation Operations

POC: KYLE ELLIS

On Oct. 3, the System-Wide Safety (SWS) project successfully presented its tollgate package for its newest technical challenge (TC) focused on an In-time Aviation Safety Management System (IASMS), TC-6: IASMS for Commercial Aviation Operations, to Aeronautics Research Mission Directorate (ARMD) leadership. The research specifically addresses the safety call to action former FAA administrator Billy Nolen put forth for the aviation industry to improve the

and Avoidance (HPA). The test also included improved Ground Collision Avoidance System and autoland capabilities. Twelve successful sorties were accomplished, resulting in over 70 test points and roughly 30 cumulative flight hours

for each aircraft. Representatives of each of the algorithms tested participated in the flight test and all parties agree the data collected from this experiment provides a wealth of knowledge that will be used for years to come in

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way safety management systems function and assure safety as new entrants introduce new hazards to the airspace. The needs the FAA call to action and the industry at-large identified are directly addressed by NASA's concept of the IASMS. The TC-6 focus on maturing current safety management systems' best practices in data monitoring and analytics to be increasingly in-time paves the way to safely transform the aviation systems of today and tomorrow. This work directly supports NASA's ARMD Strategic Thrust 5, In-Time System Wide Safety Assurance, and is part of the AOSP research portfolio.

SWS Presents Use of Advanced Automation to Understand Aviation Data and Prediction
POC: MISTY DAVIES

On Oct. 5, AOSP office safety liaison Misty Davies presented to the Commercial Aviation Safety Team (CAST) (https://www.cast-safety.org/). The briefing provided an overview of NASA's aeronautics research on artificial intelligence and machine learning, as those topics relate to safety. CAST is an organization of government, labor, and industry partners founded in 1997 to share information that allows U.S. aviation to detect risks and address problems before accidents oc-

cur. CAST now oversees voluntarily provided safety data that represents 99 percent of U.S. air carriers and provides insight into millions of aviation operations. Davies' presentation gave CAST members further insight into how NASA is using advanced automation techniques to understand aviation data and predict future behaviors, and how these new techniques may be assured for safety.

AOSP Presents to NITRD SPSQ on NASA's Advancements Toward Assurance of Highly Automated Systems Containing Untrusted Components
POC: MISTY DAVIES

On Oct. 5, AOSP office safety liaison Misty Davies gave a presentation to the Networking and Information Technology Research and Development (NITRD) program's Software Productivity, Sustainability, and Quality (SPSQ) interagency working group. In her briefing, Davies updated the SPSQ members on NASA's recent advancements toward the safety assurance of highly automated systems containing untrusted components. She also presented the recent results of the NASA Aeronautics Research Mission Directorate-funded, independently generated Autonomy Validation and Verification Road-

map 2045 (https://ntrs.nasa.gov/citations/20230003734) and brainstormed approaches for a potential whole-of-government response.

Collaboration and Technical Interchange Meeting Held with DLR on Aviation Safety Topics
POC: STEVEN YOUNG AND EVAN DILL

On Oct. 9–10, System-Wide Safety (SWS) project researchers Evan Dill and Steven Young met with colleagues in the German Aerospace Agency's (DLR's) Institute of Flight Guidance in Braunschweig, Germany. Over the course of the two-day technical interchange, research topics being investigated by SWS and DLR were discussed with a primary focus on safety assurance for future aerospace operations such as Urban Air Mobility, Advanced Air Mobility, and Unmanned Aircraft Systems. Two specific areas of mutual interest were identified and discussed in detail: 1) safely enabling required navigation performance in challenging flight environments; and 2) designing and evaluating effective human-machine interfaces supportive of risk/hazard assessment and mitigation. Potential collaboration between NASA and DLR on these two topics was planned in accordance with an umbrella interagency agreement enacted in 2020 via NASA's Air Traffic Management

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– eXploration project, which was created to collaborate on research that will improve international harmonization of airspace operations and supporting technologies.

SWS Kicks-Off Cooperative Agreement with ERAU

POC: NIKUNJ OZA

On Oct. 16, the System-Wide Safety (SWS) project hosted a team from Embry-Riddle Aeronautical University (ERAU). The purpose of ERAU's visit was to present its planned work to NASA as part of a one-year cooperative agreement. The purpose of this work is to examine various data sources to find evidence of resilient performance and continuous learning opportunities within the National Airspace System. The SWS project is working to identify opportunities to learn from the much larger pool of data that does not contain incidents or accidents, but where there are examples of a system drifting away from nominal operation and then being corrected well before an incident could arise, which demonstrates system resilience. The data ERAU will examine includes existing mishap data, data already collected as part of the SWS project's Human Contributions to Safety effort, National Transportation Safety Board accident dockets, and

other relevant data ERAU has collected independently. The goal is to identify data streams that reveal strategies and practices that promote resilience.

System-Wide Safety Participates in Fourth Annual Autonomy in Aviation Symposium

POC: NATASHA NEOGI

On Oct. 18, System-Wide Safety project researcher Natasha Neogi attended the American Society for Testing and Materials' Fourth Annual Autonomy in Aviation Symposium in New Orleans. The symposium's theme was "Human Roles in Autonomous Aviation," and it allowed for the exploration of human roles and responsibilities for autonomous flight operations. Additionally, the examination of various paradigms for human roles in urban and regional air mobility was considered, as were the types of standards needed to advance autonomy in aviation. Neogi moderated a panel titled "Enabling Human-Autonomy Teaming Through Run-Time Assurance." The panel consisted of Wes Ryan (Northrop Grumman), Pranav Nagarajan (German Aerospace Center), Loyd Hook (University of Tulsa), and Lyle Chamberlain (Near Earth Autonomy). The panel addressed the safety implications

of the shifting locus of control for safety critical decision making in novel, increasingly autonomous, human-machine teaming paradigms. Discussion time was also devoted to how consensus-based standards approaches may be used to capture patterns in run-time assurance architectures that may enable assurance of non-traditional roles and responsibilities allocations.

System-Wide Safety Subproject Manager Participates in ALPA IAT Meeting

POC: NIKUNJ OZA

On Oct. 18–19, the System-Wide Safety project's subproject manager Nikunj Oza participated in the Issues Analysis Team (IAT) meeting at the Air Line Pilots Association's (ALPA's) United Master Executive Council in Chicago. This meeting continued discussions previously held at the September meeting on the Aviation Safety Information Analysis and Sharing (ASIAS) Systems Artificial Intelligence Strategy, moving ASIAS to the cloud, MITRE's efforts on vulnerability discovery, as well as the usual discussions around requested uses of ASIAS data and getting approval from airlines to do so. Oza will follow up with United's Natural Language Processing team and with MITRE's Kunal Sarkhel, who leads their vulnerability discovery work.

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AMP team at NASA's Glenn Research Center in Cleveland.

AMP Project Meeting

POC: KAREN CATE

On Oct. 23–26, the new Air Mobility Pathfinders (AMP) project held their first face-to-face meeting at NASA's Glenn Research Center in Cleveland. This was the first opportunity for the newly realigned team to meet in person and discuss project planning moving forward. The project also had the opportunity to meet with Chris Williams, the NASA Glenn deputy director of Aeronautics, and tour the new Aerospace Communications Facility (ACF). The ACF will house the laboratories that will support AMP Communications, Navigation, and Surveillance research.

ATM-X DIP Team Conducts Virtual Meeting with PANYNJ

POC: YOON JUNG

The Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team engaged with the Port Authority of New York and New Jersey (PANYNJ) via a virtual meeting on Oct. 25. Their point of contact with PANYNJ was Ralph Tamburro. Both parties discussed the opportunity to collaborate on improving efficiency of operations in the New York airspace, using a machine learning-based predictive engine the DIP team developed. The DIP team invited Tamburro to NASA's North Texas Research Station to see a live demonstration of the Collaborative Digital Departure Reroute tool, scheduled for January 2024. Tamburro also supported the DIP team's engagement with the Northeast Corridor Next Generation Integration Working Group and agreed to share data, such as restrictions data in the New York Terminal Radar Approach Control airspace and surface metering data at John F. Kennedy International Airport, with the DIP team.

SWS Demonstrates Novel Pilot Training Technology to AAL

POC: JON HOLBROOK

On Oct. 25–26, System-Wide Safety (SWS) project aviation subject matter expert (SME) Daniel Kiggins and other SWS researchers met with American Airlines (AAL) personnel at the AAL Flight Training facility in Charlotte, North Carolina. The purpose of the meeting was to discuss applying NASA technology to their airline operations. AAL managers and instructors identified immediate impacts the technology can have to airline operations. Next steps are to continue discussions at the AAL headquarters to facilitate licensing and deploying

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SWS team participating with AAL

NASA technology at AAL. The instructors were enthusiastic about the evidence-based training and real-time aspects to support teaching moments, especially when the trainee is a new and proficient pilot or when an experienced pilot is transitioning between different types of aircraft. The instructors also noted the potential improvement in training and insights into flight crew behaviors that contribute to safety

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efficiency the NASA technology could enable. Comments from SMEs included how the NASA team's work addresses future planning efforts undertaken by major airlines to manage pilot shortages and changes in pilot demographics or experience level. AAL managers and instructors recommended further discussion with AAL personnel at AAL headquarters in Dallas, to enable licensing and deploying NASA technology at AAL. Follow-on meetings are to be scheduled soon.

ATM-X DIP Visits United Airlines' Arlington Heights Network Operations Center
POC: YOON JUNG

On Oct. 26, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team visited United Airlines' Network Operations Center in Arlington Heights, Virginia. The purpose of the visit was to observe operations and learn about positions that may be engaged during the demonstration of the Collaborative Digital Departure Reroute (CDDR) tool in the Sustainable Flight National Partnership (SFNP)-Operations-1b demonstrations in Houston. The CDDR operational evaluation in Houston is the second in a series of pre-departure reroute

demonstrations the DIP team is conducting in support of NASA's SFNP mission. After a round of observations, United Airlines and NASA teams shared respective near-term plans and discussed how NASA's CDDR capability could be integrated with United Airlines' operations. Fruitful exchange helped to identify immediate needs.

SWS Attends ASTM Committee Week for F44 General Aviation Aircraft
POC: NATASHA NEOGI

On behalf of the System-Wide Safety (SWS) project, several researchers attended the American Society for Testing and Materials (ASTM) International's Committee Week in Washington, DC from Oct. 30 – Nov. 3. Representing the SWS project were Natasha Neogi, Nicholas Borer, and Vincent Shultz from NASA's Langley Research Center in Virginia; Sean Clarke and Ethan Baumann from NASA's Armstrong Flight Research Center in California; and David Avanesia from NASA's Glenn Research Center in Cleveland. They participated in the F44 Main Committee and the F44.10 (General), F44.20 (Flight), F44.40 (Powerplant), F44.50 (Systems and Equipment), and F44.90 (Executive) subcommittees. These standards committee meetings allowed for a robust discussion on the use of autonomy in aviation

and how it will impact safety of aviation operations under a host of emerging market conditions, including the incorporation of regional air mobility, urban air mobility, unmanned aircraft systems, and other novel operations and technologies. Work relating to NASA's X-57 Distributed Electric Propulsion Flight Demonstrator was presented throughout the F44 general meeting as well as during the individual subcommittee meetings. Neogi helped arrange for a talk addressing the electronic subsystems of the X-57 to be given to the F44.50 subcommittee, which was enthusiastically received.

ATM-X PAAV Team Attends 2023 Regional Air Cargo Carriers Association Annual Meeting
POC: MIWA HAYASHI AND ARWA AWEISS

Representatives from the Air Traffic Management – eXploration (ATM-X) project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject attended the Regional Air Cargo Carriers Association annual meeting in Scottsdale, Arizona, from Oct. 31 – Nov. 2. Earl Lawrence of Xwing Aviation gave the keynote presentation, "Future Technologies and the Regional Air Cargo Industry." The researchers also attended sessions about United Airlines' new pilot training

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programs, Transportation Security Administration (TSA), and safety management systems, as well as an interactive question and answer session with Lawrence. The event offered regional cargo aircraft displays at the Scottsdale Airport, including the Ampaire's hybrid-electric EEL aircraft (modified Cessna 337 Skymaster). The goal of the visit was to expand NASA's regional air cargo industry and government connections, as well as learn about the latest issues and demands in the industry. The researchers successfully accomplished these goals by renewing and establishing new connections with Xwing Inc., Sabrewing Aircraft Company, United Parcel Service, the Department of Homeland Security, TSA, Garmin, and others.

SWS Researcher Participates at IEEE International Workshop

POC: ALWYN GOODLOE

On Nov. 2, System-Wide Safety (SWS) project researcher Alwyn Goodloe participated in the Second Institute of Electrical and Electronics Engineers (IEEE) International Workshop on Assured Autonomy, Artificial Intelligence (AI) and Machine Learning (WAAM 2023). The workshop was co-located with the Fifth IEEE International Conference on Trust, Privacy and Security in Intelligent Systems, and Applications, and was organized by researchers representing the National Institute of Standards and Technology. Approximately 20 invited participants from government, industry, and academia attended, including Darren Cofer (Collins Aerospace), Carl Elks (Virginia Commonwealth University), Cody Fleming (Iowa State University), Alessandro Pinto (Jet Propulsion Laboratory), and Sandeep Neema (Vanderbilt University). The workshop was comprised of a sequence of panels with rotating panelists. Goodloe served on two panels. One panel addressed questions regarding whether traditional software engineering processes are effective at producing trustworthy machine learning-enabled systems. The other panel focused on questions involving regulation and certification. In response to a question about regulation of AI, Goodloe suggested a model similar to the Institutional Review Board model adapted by research universities. This generated quite a lively discussion.

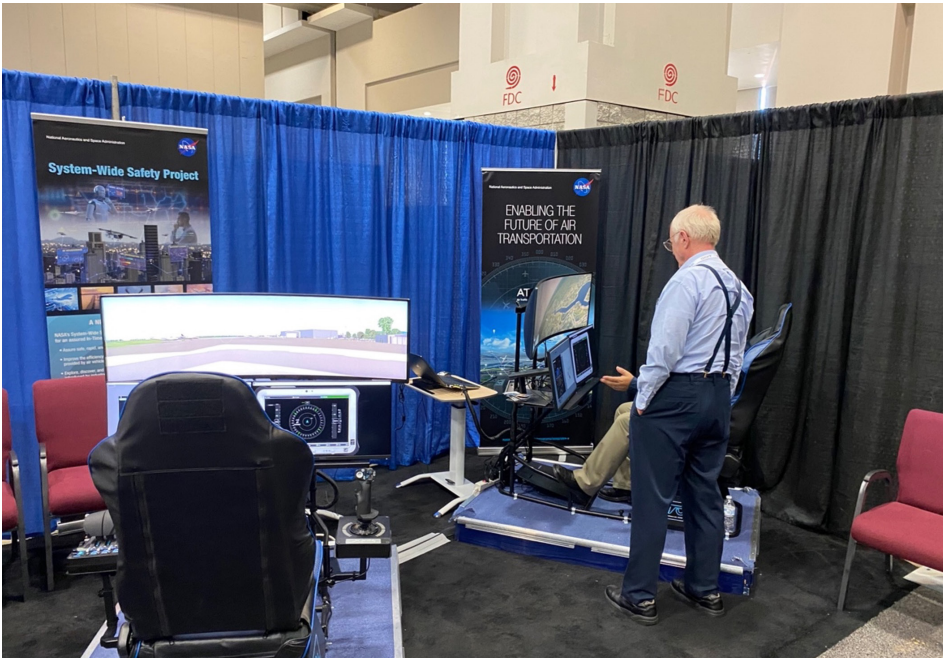## AOSP Participates at ATCA Global Conference and Expo

POC: PAUL KROIS, ABIGAIL GLENN-CHASE AND BARRY SULLIVAN

Representatives from AOSP and its projects participated at the Air Traffic Control Association (ATCA)

NASA staff manning the AOSP booth.

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NASA staff demonstrating UAM Flyers.

Global Conference and Expo in Washington, DC, on Oct. 31 – Nov. 3. The event was held at the Walter E. Washington Convention Center. AOSP hosted a booth portraying its "Sky for All" Vision for 2050, with banner stands representing the Air Traffic Management – eXploration and System-Wide Safety projects. Additionally, two Urban Air Mobility (UAM) flight simulators were brought up from NASA's Langley Research Center in Virginia as part of the AOSP exhibit. AOSP director Akbar Sultan participated in a panel titled "Highest Aviation Priorities for Government Agencies," which NASA Aeronautics Research

Institute Director Parimal Kopardekar moderated. Other NASA speakers included NASA Langley aeronautics director John Koelling, who participated on the "Sustaining an Invigorated Aviation Workforce Now and into the Future" panel, and researcher Krishna Kalyanam from NASA's Ames Research Center in California, who participated in the "Artificial Intelligence and Aviation – Transformative, Trustworthy, Responsible" panel. Also noteworthy, both Akbar Sultan and AOSP deputy director Cheryl Quinn were recipients of ATCA's President's Award. This award is

selected by ATCA's president and recognizes individuals, or a group of individuals, for their outstanding contributions and achievements in the advancement of the science of air traffic control, and outstanding actions in the ongoing preservation of a safe flight environment. Other personnel supporting the NASA booth included Abigail Glenn-Chase, Paul Krois, Steve Weidner, Pallavi Hegde, Melody Lin, Jeremy Coupe, Yoon Jung, Neil O'Connor, Terence McClain, Nelson Guerrero, Jason Prince, Bryan Petty, David West, Raj Pai, William Chan, and Barry Sullivan. The NASA booth received numerous visitors from the FAA, its contractors, and industry consultants. Notable visitors included chief scientist Steve Bradford in the FAA's NextGen Office, Kristina Carr of the FAA's NextGen Office, and Eric Neidermann and Paula Nouragas from the FAA Technical Center.

Wide Industry Use of SWS-Developed Open-Source Prognostic Software, ProgPy

POC: CHRIS TEUBERT

Recent increased use by industry partners has brought attention to the wide industry use of the System-Wide Safety (SWS) project's development of open-source prognostic software. Since January

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2021, SWS, in collaboration with the Transformational Tools and Technologies and Convergent Aeronautics Solutions projects, has maintained the open-source prognostic software ProgPy. Through this software, SWS has transferred technology and knowledge in predictive algorithms, models, architectures, and metrics to industry and academia. The software has spurred collaborations with Northrop Grumman (Space Act Agreement), Vanderbilt (Software Usage Agreement), German Space Agency (DLR) (Software Usage Agreement/ Interagency Agreement), and others. Due to its open-source status, full use of the software is difficult to track. However, since 2021, the software has been downloaded more than 30,000 times and is used by Northrop Grumman, Joby, DLR, the U.S. Army, Tyto Robotics Inc., University of Central Florida, Vanderbilt University, Georgia Tech, Technical University, Delft, RISE, European Research Center for Information Systems, IntelliPredikt, University of Zurich, and others to build prognostic tools.

ACERO Receives Authority to Proceed
POC: MARCUS JOHNSON

The Advanced Capabilities for Emergency Response Operations (ACERO) project received official approval from the Aeronautics Research Mission Directorate's Program Management Council to proceed in the project implementation phase following the Key Decision Point for Project Approval presentation conducted on Nov. 7. ACERO project manager Marcus Johnson presented the project goals, objectives, and concept-to-technology transfer approach. He also described how the project will work to address current wildland fire operation challenges. The ACERO project briefing also included a summary of the project plan and additional data to ensure project objectives are aligned with AOSP goals, evidence provided that the project is well planned to meet the project objectives.

ATM-X Hosts Honeywell Visit to NASA Ames Research Center
POC: MIRNA JOHNSON

On Nov. 7, the Air Traffic Management – eXploration (ATM-X) project hosted representatives from Honeywell at NASA's Ames Research Center in California. The purpose of the trip was to learn about AOSP projects and tour the various aeronautics laboratories at NASA Ames. Air Mobility Pathfinders, ATM-X, and System-

Honeywell staff visiting the Unmanned Aircraft Systems Traffic Management lab.

Honeywell team visiting the ACEL-RATE Lab.

Wide Safety project presentations were provided. Honeywell was guided on tours of four labs: FutureFlight Central, the Airspace Operations Lab, the Vertical Motion Simulator, and the ACEL-RATE Lab. Next steps with Honeywell will consist of them providing AOSP with a Flight Management System in the cloud introduction, a possible ACEL-RATE future lab collaboration, and further discussions about project activities.

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System-Wide Safety Project MIKA Toolkit Published via NASA GitHub

POC: HANNA WALSH

On Nov. 9, the Manager for Intelligent Knowledge Access (MIKA) toolkit was published via NASA GitHub (https://github.com/nasa/mika), and is now publicly available for academia, government, and industry to view and use. The System-Wide Safety project developed MIKA, which includes several state-of-the-art natural language processing techniques that have been tested for use with technical engineering documents, with particular focus on emerging application areas in the Safety Demonstrator Series, for example, Unmanned Aircraft Systems and wildfire response incident reports. The toolkit is packaged in a way that is accessible for novice users and convenient for applying multiple techniques to the same dataset. MIKA is broadly intended to be used to learn from past incidents to inform design and operations for making safer systems.

ATM-X/NASA Glenn Participate in Stakeholder Tag Up

POC: RAFAEL APAZA

On Nov. 8, researchers from the Air Traffic Management – eXploration (ATM-X) project's NASA Glenn Research Center in Cleveland team participated in the "Unmanned Aircraft System (UAS) and Advanced Air Mobility (AAM) A2X Stakeholder Tag-Up" virtual meeting hosted by the FAA and MITRE. Representing NASA Glenn was the ATM-X project's Pathfinding for Airspace with Autonomous Vehicles subproject 2.0 Air to Anything (A2X) investigation team. Michael Weiler from the FAA's AJW-19 Spectrum Services Office delivered an introductory keynote address emphasizing the relevance of an A2X link toward enabling new capabilities, assisting in the evolution of air traffic management, and supporting emerging AAM entrants. Presentations and discussions included FAA roles in assisting A2X concept of operations development, needs analysis investigation, and roadmap development. Additional discussion topics included spectrum challenges, use case development, waveform analysis, architecture concept development, and determination of the work that needs to be done in the upcoming years in support of standards development. Finally, the status of RTCA working group SC-228 activities in A2X was provided and a white paper on vehicle-to-vehicle communications was shared with the audience. The FAA Spectrum Office requested input from participants in the areas of A2X to link technology need identification, use case development, and recommendations on how FAA can best assist this effort. Meeting participants included representatives from government and industry. FAA Traffic Alert and Collision Avoidance System program manager Neal Suchy and MITRE's Greg Orrell co-chaired the meeting.

SWS Project Hosts TIM with SkyGrid

POC: NATASHA NEOGI

On Nov. 13, System-Wide Safety (SWS) project researcher Natasha Neogi organized a technical interchange meeting (TIM) between SkyGrid Inc., a Boeing/SparkCognition company, and NASA's Langley Research Center in Virginia. The meeting included attendance by key technical and managerial personnel. SkyGrid Inc. was represented by Jia Xu (chief executive officer), Nadine Akari (Boeing UAM program integration manager for Wisk and SkyGrid), Khin Paing (vice president of program management), Alex Natchev (director of research development), and Suda Bharadwaj (head of research and development). NASA representatives included John Koelling (director, Aeronautics Research Directorate at NASA Langley), Kyle Ellis (SWS project manager), Robert McSwain (Advanced Capabilities for Emergency Response Operations project deputy lead, Second Shift Capabilities), Louis Glaab, (Advanced Air Mobility, High Density Vertiplex subproject technical lead), and Eric Cooper (branch head). The SkyGrid team toured the Airspace Operations Laboratory and the Remote Operations for Autonomous Missions Unmanned Airspace Systems Opera-

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tions Center, where their software is being installed and used for flight testing activities at the City Environment Range Testing for Autonomous Integrated Navigation range. Evan Dill gave a presentation surrounding relevant services, functions, and capabilities for enabling emerging operations related to navigation, weather, threat proximity, and separation management. Neogi guided the TIM successfully to identify critical points of collaboration with SkyGrid across multiple projects and line organizations. Neogi will co-organize a workshop in Q1 of calendar year 2024 with SkyGrid to formalize several key common research thrusts with NASA. This has the potential to formulate subsequent annexes to the current Space Act Agreement that is in the process of being executed.

ATM-X NExCT Team Conducts Face-to-Face Meeting
POC: WILLIAM CUMMINGS

On Nov. 14, the Air Traffic Management – eXploration (ATM-X) project's National Airspace System Exploratory Concepts and Technologies (NExCT) subproject members gathered for a one-day meeting at NASA's Langley Research Center in Virginia. The purpose of the meeting was to discuss the upcoming year of work for the new subproject. NExCT picks up on some of ATM-X's Extensible Traffic Management subproject objectives but focuses more on development of a cohesive

system across multiple air traffic management domains. The face-to-face meeting was held to build relationships between team members, better understand the full capabilities of the team, and discuss tasking for the next year. Will Cummings from NASA Langley hosted the group and Elaine Blount organized tours of several relevant facilities.

AOSP Supports NASA Aeronautics Day on the Hill
POC: NELSON M. GUERREIRO AND MARCUS JOHNSON

On Nov. 15, the Aeronautics Research Mission Directorate (ARMD) hosted a "Flight Night on the Hill" event at the Russell Senate building in Washington, DC. U.S. Senator Jerry Moran and NASA Administra-

tor Bill Nelson gave keynote remarks. The Air Traffic Management – eXploration project's National Airspace System Exploratory Concepts and Technologies (NExCT) subproject demonstrated the Urban Air Mobility (UAM) Flyer capability. Researchers from NASA's Langley Research Center in Virginia participating in the event included Nelson Guerreiro, Neil O'Connor, and Dave West. The UAM Flyer was featured as part of NASA's Advanced Air Mobility (AAM) research area, which highlights NASA's contributions enabling emergent operations in aviation.

The UAM Flyer is a low-cost research platform that simulates vertical takeoff and landing operations and allows researchers to immerse pilots in a realistic environment as

ACERO and System-Wide Safety project leads with NASA Ames Research Center in California aeronautics director Huy Tran, AAM Mission integration manager Parimal Kopardekar, and ARMD associate administrator Bob Pearce.

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part of airspace integration research activities. At the event, the UAM Flyer allowed attendees to experience the role of a pilot for these emergent operations as they flew through the New York city environment. The UAM Flyer is a research capability supported by NASA's Air Mobility Pathfinders project and actively supports the NASA/FAA Laboratory Integrated Test Environment and the Operational Integration Assessment research area in collaboration with the FAA. In addition, the Advanced Capabilities for Emergency Response Operations (ACERO) project manager Marcus Johnson and outreach lead Hillary Smith engaged congressional staffers on the wildland fire challenges NASA and ACERO are working to address. More than 100 staffers attended the exhibit. The NASA Aeronautics Day on the Hill event allowed congressional members and their staffers an opportunity to learn about NASA's ongoing research activities, specifically focused on the aeronautics element. The event included attendance from several NASA senior leaders, including the NASA administrator.

ATM-X DIP Team Conducts Oceanic Operations Technical Interchange Meeting

POC: MIWA HAYASHI

On Nov. 15–16, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team hosted their third workshop. The purpose of the workshop was to learn the current re-routing process and challenges with oceanic flights. Two pilot subject matter experts (SMEs), Orval Sword and Tom Moser, shared their understanding of the current oceanic flight operations, re-routing process, challenges, and datacom limitations. A portion of the workshop was made open for participation by other researchers, while the balance focused on discussions with specific use cases to support the DIP Sustainable Flight National Partnership (SFNP)-Operations (Ops)-2 demo planning. The pilots performed a transatlantic nominal flight walkthrough from John F. Kennedy International Airport to London Heathrow Airport North Atlantic Organized Track System including pre-departure (dispatcher and captain), oceanic airspace entry point, post-departure altitude changes, and route amendments. They presented oceanic contingencies, including weather deviations and the inability to maintain altitude. The second use case presented was a walkthrough of the Dallas-Fort Worth International Airport to Narita International Airport North Pacific Route System nominal flight. Pilot SMEs also gave a demonstration of the Weather Services International weather app. There was open discussion on potential SFNP-Ops-2 use cases for airborne trajectory negotiations. The team will use this information in Ops-2 planning.

SWS Project Participates at RTCA AI/ML Workshop

POC: NATASHA NEOGI

On Nov. 28, the System-Wide Safety (SWS) project's senior technical advisor of assurance Natasha Neogi attended the RTCA Artificial Intelligence/Machine Learning (AI/ML) Workshop in Washington, DC. Neogi gave a presentation regarding the SWS project's position on the creation and use of AI/ML standards for aviation. The agenda for the workshop focused on eliciting the thoughts of RTCA members regarding what standards are needed to certify AI/ML aviation products. The workshop began with a presentation by Trung Pham, the FAA chief scientific and technical advisor (CSTA) for AI/ML, and continued with a presentation by George Romanski, the FAA CSTA for Airborne Software. In addition to the FAA and NASA, presentations were given from the Department of Transportation, U.S. Navy, and MITRE. These rounded out the government inputs to the workshop. Industry stakeholders were represented by presentations from xWing, Joby, Saab, Daedalean, and Collins Aerospace. The workshop stakeholders agreed that AI/ML was an emerging topic that needs immediate focus, but they recognized all efforts to standardize needed to be considered carefully. Based on the warm reception to NASA's presentation in this forum, RTCA Inc.
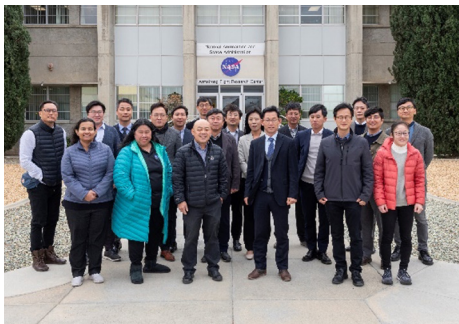
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president and CEO Terry McVenes invited Neogi to become a core team member of the working group that will produce the RTCA's AI/ML standards roadmap in conjunction with the FAA.

AMP Hosts KARI Visitors to NASA Armstrong

POC: JEFF LEIGH AND HANBONG LEE

On Nov. 28–29, the Air Mobility Pathfinder (AMP) project's Flight

Photos of combined AMP and KARI teams.

Operations subproject team hosted the Korea Aerospace Research Institute (KARI) to a partnership meeting at NASA's Armstrong Flight Research Center in California. The agenda included progress briefings, dialog regarding next steps, and guided tours of both AMP Urban

Air Mobility infrastructure at NASA Armstrong and the Agility Prime/Joby flight test facilities at Edwards Air Force Base, North Base.

SWS AOSP Safety Liaison Presents at the NASA Aeronautics Council

POC: MISTY DAVIES

On Nov. 29, System-Wide Safety (SWS) associate chief for aeronautics systems Misty Davies presented to the NASA Aeronautics Council. Her briefing was on the status of the NASA Aeronautics Research Mission Directorate's (ARMD's) Verification and Validation (V&V) work and included the successful conclusion of the SWS project's V&V for Commercial Aviation Systems technical challenge that closed out in 2021, as well as recent progress toward the Complex Aviation Systems Assurance technical challenge that will close out in 2024. Finally, the briefing concluded with an update on ARMD's V&V Vision 2045 roadmap and a discussion of NASA's plans for next steps.

ATM-X DIP Team Hosts Workshop with Collins Aerospace

POC: SWATI SAXENA

On Nov. 29–30, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team hosted a workshop with Collins

Aerospace. The meeting was held at the NASA North Texas Research Station. Representing NASA were ATM-X project manager Shivanjli Sharma and DIP subproject leadership. Participants from Collins Aerospace included representatives from their Air Traffic Solutions Development, Aeronautical Radio Incorporated Systems, Advanced Research and Technology Artificial Intelligence/Machine Learning, and their Advanced Air Mobility programs. The purpose of the workshop was to discuss potential collaboration opportunities on a series of Sustainable Flight National Partnership Operations (SFNP-Ops) demonstrations the DIP team is conducting. The workshop included updates on the SFNP-Ops-1 Collaborative Digital Departure Rerouting (CDDR) capability being demonstrated with the FAA and airline partners in the North Texas area. Future SFNP-Ops demonstrations, which includes flight deck based airborne reroute capability (Ops-2), irregular operations and disruption management capability

ATM-X staff briefing the Collins team.

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(Ops-3), and 4-dimensional trajectory optimization capability (Ops-4), were also discussed for potential collaboration. Collins Aerospace presented their air traffic management solution products in support of sustainable aviation, including their air-to-ground datalink communication network, online flight planning system, and flight profile optimizer. The Collins team visited the American Airlines Integrated Operations Center to see the live deployment of the CDDR tool at the facility. The workshop concluded with a list of potential collaboration topics, and both organizations agreed to conduct follow-on meetings to discuss technical details and develop a plan to establish a collaboration agreement.

NASA Signs Non-Reimbursable SAA with AeroVironment
POC: JEFF HOMOLA AND KENNETH FREEMAN

On Dec. 6, NASA signed a non-reimbursable Space Act Agreement (SAA) on behalf of the Air Traffic Management – eXploration (ATM-X) project's National Airspace System (NAS) Exploratory Concepts and Technologies (NExCT) subproject, with AeroVironment, Inc. The agreement enables AeroVironment to conduct research, development, testing, and evaluation of a prototype NASA Upper Class E Traffic Management (ETM) system. Many entities are interested

in ETM and are willing to collaborate with the ATM-X project's NExCT subproject to develop safe, scalable operations within the NAS at high altitudes. AeroVironment, Inc. will work with NExCT on an experiment to be conducted in the spring of 2024, which will use the ETM system to enable cooperative operations in upper Class E airspace through data exchange.

AOSP SWS Liaison Participates at the AAM Interagency Working Group Meeting
POC: MISTY DAVIES

On Dec. 7, System-Wide Safety (SWS) associate chief for aeronautics systems Misty Davies participated in a Department of Transportation quarterly meeting hosted at the Naval Post-Graduate School in Monterey, California. The purpose of the meeting was to bring together national experts on the topic of advancing automation and autonomy for transportation. Davies provided an overview of the Aeronautics Research Mission Directorate's (ARMD's) research toward Advanced Air Mobility (AAM) and then briefed recent progress toward the SWS project's Complex Aviation Systems Assurance technical challenge. Finally, the briefing concluded with an update on ARMD's Verification and Validation Vision 2045 roadmap, a discussion of NASA's plans for next steps, and a few of the recommendations and

gaps being discussed by the AAM interagency working group's Automation Strategy subgroup.

ATM-X DIP Participates in NEC NIWG Meeting
POC: YOON JUNG

On Dec. 7, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team participated in the Northeast Corridor (NEC) NextGen Integration Working Group (NIWG) meeting. The NEC NIWG is composed of representatives from various aviation communities in the United States, including the FAA, the National Air Traffic Controllers Association, commercial aviation (passenger and cargo), business aviation, and the Port Authority of New York and New Jersey. Their goal is to address challenges in the operations within the New York airspace and to seek solutions to improve operational efficiency. Acting deputy subproject manager Swati Saxena gave introductory remarks on the DIP subproject. This was followed by the DIP Sustainable Flight National Partnership (SFNP) Operations (Ops) lead Jeremy Coupe, who gave a briefing on NASA's SFNP mission. This included detailed plans for a series of operational demonstrations to support the SFNP mission by the DIP team through fiscal year 2030. The first operational demonstration in the series is currently

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being conducted in the North Texas area (Ops-1a) and will be conducted in the Houston area in fiscal year 2025 (Ops-1b). This demonstration will provide participating airlines and air traffic control with a pre-departure rerouting capability built on machine learning-based predictive engine and user interfaces developed by the DIP team. The presentation was well received by the NIWG group, and the significance of NASA's contributions made to the development of ATM research protype systems and technology transfer to the aviation community was recognized by many participants. Future exchanges between the DIP team and the NEC NIWG group were also discussed for establishing use cases and potential applications of DIP technology to address NEC operational challenges.

ATM-X DIP Team Conducts Virtual Meeting with Honeywell

POC: SWATI SAXENA

On Dec. 8, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team hosted a virtual meeting with Honeywell's Connected Flight Management System (cFMS) group. The DIP team introduced the ATM-X DIP subproject and explained the operational demonstrations the team is planning to conduct over the next few years. The cFMS group gave

an overview of their products and their capabilities. They presented the cFMS ecosystem and the communication data link between FMS, cloud, and ground stations. They also presented a list of cFMS/Electronic Flight Bag use cases they are interested in developing. The DIP team discussed potential areas of collaboration opportunities and plan to follow up with the Honeywell team for further deep dive discussions.

SWS Participates in the AGU 2023 Meeting

POC: JOSEPH COUGHLAN

On Dec. 11–15, System-Wide Safety (SWS) senior technical advisor of autonomy Joseph Coughlan attended the American Geophysical Union (AGU) 2023 meeting in San Francisco. This hybrid meeting convened

more than 25,000 attendees from over 100 countries to share research and connect with colleagues. Scientists, educators, policymakers, journalists, and communicators attend AGU to learn about topics that cover a majority of the NASA Science Mission Directorate's portfolio. Coughlan presented on ODIN-Fire, which is an Open Data Integration Framework for Wildland Fire Management, in an open-source software session, which NASA's Disasters Program co-sponsored. By invitation, Coughlan also judged student posters in a session, "Rapid Fire Detection and Prediction Using New Generation Artificial Intelligence Techniques." ODIN-Fire is part of RACE-ODIN, a software architecture to create field deployable servers that can import, process, and display data from heterogeneous sources includ-
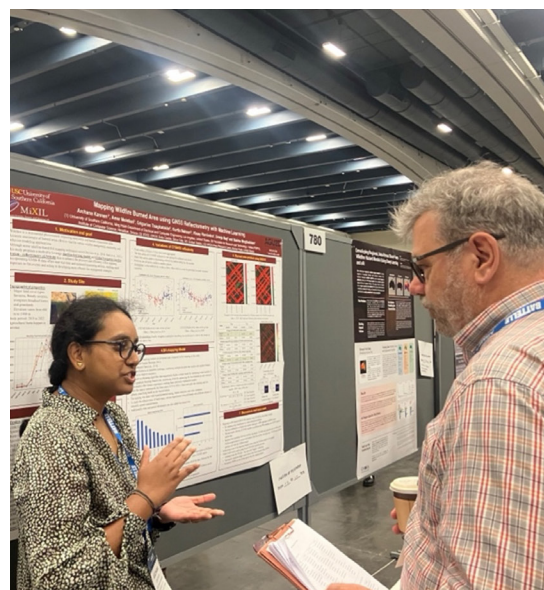
Coughlin engages with attendees at the AGU 2023 meeting.
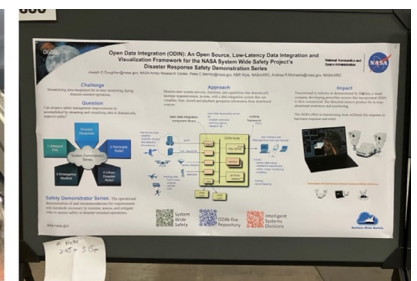
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ing geospatial data such as landcover, roads, infrastructure, weather, fire location, forecasted weather including surface winds, and real-time location of aircraft, ground vehicles, and personnel. The open-source approach AOSP uses is consistent with the broader open science initiative to share data, software, analysis, and results to accelerate discovery and innovation. Unmanned Aircraft Systems (UAS) are increasingly used in Earth Science studies, and while 59 submissions mentioned UAS in the title, many more used UAS for lower remote sensing, measuring and monitoring, and filling the observational gap between field measurements, high-altitude aircraft, and space-based observations providing a low-cost, observing platform for localized studies and rapid response.

Nikunj Oza, Lance Prinzel, Bryan Matthews, and Dan Kiggins (SWS) and Kyle Quakenbush (MITRE) attended the NASA and MITRE technical interchange meeting in person, while Chad Stephens (SWS), Ed Walsh (MITRE), and Kristin Heckman (MITRE) attended online.

NASA and MITRE Hold Informal Meeting at the Fall 2023 Aviation Safety InfoShare

POC: NIKUNJ OZA

On Dec. 12–14, the System-Wide Safety (SWS) project delivered several presentations at the fall Aviation Safety InfoShare Conference in Dallas. Bryan Matthews delivered a presentation titled "An Approach to Identifying Aspects of Positive Pilot Behavior Within the Aviation Safety Reporting System" on behalf of himself, Immanuel Barshi, and Jolene Feldman as part of the Human Contributions to Safety effort. Following his talk,

Matthews met with staff from American and Southwest Airlines regarding applicability to their data and another related software. In addition, Mary Keller gave five talks on the Aviation Safety Reporting System (ASRS) including "NASA ASRS Reports: CPDLC Domestic Operational Issues" in the Flight Operations track, "NASA ASRS Reports About Ground Operations" in the Ground Operations track, "NASA ASRS Reports About Rotorcraft and Drone Interactions at Low Altitudes of Operation" in the Rotorcraft track, "NASA ASRS Reports About Dispatch Operations" in the Dispatch track, and "NASA ASRS Reports About Busi-

ness/General Aviation Operations" in the Business/General Aviation Operations track. Keller met with several InfoShare attendees including members of the FAA, National Transportation Safety Board, and various industry stakeholders to discuss safety topics related to ASRS. Jon Holbrook and Immanuel Barshi also participated as panelists in a session titled "Learning from All Operations: Implementing Safety II in Practice" that discussed the concepts of Learning from All Operations (LFAO) and Safety II as well as how it is implemented in industry. Barshi was invited to present LFAO and the SWS Human Contributions to Safety work at the

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upcoming Boeing Global Aviation Safety Conference in Abu Dhabi this February.

AOSP Projects Hold Quarterly Review with the FAA

POC: KEN FREEMAN AND BARRY SULLIVAN

On Dec. 12–14, AOSP and its projects hosted a three-day quarterly review with the FAA. The first day focused on Urban Air Mobility (UAM) efforts including discussions on the FAA's UAM Airspace Management Demonstration, Low Density Unmanned Aircraft Systems (UAS) Communication Evaluation, Automation Framework Working Group, Airspace Performance and Operations project. This was followed by NASA updates on the Air Mobility Pathfinders project replanning effort, UAM concepts, requirements, use cases, architecture and modeling, UAM prototype and simulation, and operational integration assessment efforts. Day two focused on UAS Traffic Management (UTM) Beyond Visual Line-of-Sight (BVLOS) operations and included FAA presentations on rulemaking, UTM policy topics, BVLOS concept of use and standards gaps/parameters, near term approval process, key site updates and UTM implementation security considerations. Day three began with a presentation on the Cross-cutting Research for UAS Integration, Services and Engineering project. This was followed by discussions on the Digital Information

Platform, Pathfinding for Airspace with Autonomous Vehicles, National Airspace System Exploratory Concepts and Technologies, and UTM BVLOS Rules of the Road projects. Additionally, there were some side meetings addressing Research Transition Team activities. The next quarterly review is planned for the spring of 2024.

System-Wide Safety Executes Collaborative SAA with SkyGrid

POC: NATASHA NEOGI

On Dec. 14, NASA's Langley Research Center in Virginia and SkyGrid Inc., a Boeing SparkCognition company, formalized their upcoming collaboration via a signed and executed Space Act Agreement (SAA). The SAA captures the cooperative research that will be conducted in the areas of system safety, operational assurance, and domain-specific use cases that were discussed in the technical interchange meeting on Nov. 13 at NASA Langley. Key SkyGrid technical and managerial personnel, such as Jia Xu (chief executive officer), Nadine Akari (UAM program integration manager for Wisk and SkyGrid), Khin Paing (vice president for program management), Alex Natchev (director of research development), and Suda Bharadwaj (head of research and development) approved the research topics. The agreement will allow for the exchange of critical data and

software between NASA Langley and SkyGrid, such as specific services, functions, and capabilities for enabling emerging operations related to navigation, weather, threat proximity, and separation management. System-Wide Safety project researcher Natasha Neogi helped guide the SAA successfully to identify critical points of collaboration with SkyGrid, Inc. across multiple projects and line organizations. She will be organizing a kickoff workshop in Q1 of calendar year 2024 with SkyGrid to identify potential cross-project touchpoints with the Air Traffic Management – eXploration and Air Mobility Pathfinders projects.

ATM-X DIP Team Engages with JetBlue Airways

POC: YOON JUNG

On Dec. 14, the Air Traffic Management – eXploration (ATM-X) project's Digital Information Platform (DIP) subproject team introduced its Sustainable Flight National Partnership Operations (SFNP-Ops) demonstration plan and its platform to managers from JetBlue Airways. Representing JetBlue were members of its Air Traffic System Operations, Enterprise Planning, and Flight Operations groups. The DIP team provided an overview of their SFNP-Ops demonstration plan and provided information about NASA's cloud-based capability and data services that are available on the DIP today. JetBlue's point of contact

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and Business Intelligence team that have been engaged with the DIP team and actively using DIP services for the past 6 months initiated this meeting. JetBlue's managers showed interest in the Fuser Streaming and the NASA Traffic Management Initiative Services. Follow-on discussions will take place in January 2024.

SWS Researcher Selected to FAA Fatigue Evaluation Panel
POC: ERIN FLYNN-EVANS

System-Wide Safety (SWS) project researcher Erin Flynn-Evans was selected as one of three experts by the FAA to identify new ways to address air traffic controller fatigue on a panel. This is in reaction to recent reports of FAA air traffic controllers undergoing fatigue (https://www.faa.gov/newsroom/faa-moves-address-air-traffic-controller-fatigue).

In response to these concerns, the FAA has tasked a panel of fatigue experts. The three-member panel will examine how the latest science on sleep needs and fatigue considerations could be applied to controller work requirements and scheduling. The panel will identify potential ways the FAA could better address controller fatigue. As part of its work, it will review previous controller-fatigue research. The panel will begin its work in early January and provide a final report to the FAA about six weeks later.

ATM-X NExCT Team and FAA Agree on Updated Set of RTPs
POC: KEN FREEMAN

Established under the interagency Research Transition Teams (RTT) Convening Authority, the Upper-Class E Traffic Management (ETM)

RTT was established to focus on exploring operational concepts, engineering, data management, security, interoperability, and performance challenges to realize future ETM implementation efforts. This RTT has been a collaborative undertaking of research, development, testing, and evaluation activities among the ETM stakeholder community. On Dec. 18, the Air Traffic Management – eXploration (ATM-X) project's National Airspace System Exploratory Concepts and Technologies (NExCT) subproject and the FAA Next Generation Air Transportation System Office agreed on an updated set of Research Transition Products (RTPs) and activities to further the research in ETM concepts. These ETM RTPs and activities have been documented in version 2.0 of the ETM Joint Management Plan.

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AOSP Participates at IEEE/AIAA DASC

POC: STEVEN YOUNG, JORDAN SAKAKEENY AND ARWA AWEISS

On Oct. 1-5, several AOSP researchers participated in the 42nd Institute of Electrical and Electronics Engineers (IEEE)/ American Institute of Aeronautics and Astronautics (AIAA)/Digital Avionics System Conference (DASC) in Barcelona, Spain. Representing the System-Wide Safety project were Trey Arthur, Maria Consiglio, Evan Dill, Chester Dolph, Mallory Graydon, César Muñoz, Natasha Neogi, Truong Nguyen, and Steven Young. DASC is the preeminent research and development conference in the field of digital avionics, and NASA's participation helps to disseminate recent research findings in formal methods, safety assurance, certification, and crew-vehicle interfaces to an appropriate audience. Four papers were presented: 1) "Safety Expertise and the Perils of Novelty," by Mallory Graydon (presenter), et al.; 2) "Position Correlated Vision Dataset from Multirotor and Fixed-wing sUAS of General Aviation, Fixed-wing sUAS, Multirotor sUAS, and Birds" by Chester Dolph (presenter), et al.; 3) "High Intensity Radiated Field (HIRF) Map - An Avoidance Approach for Unmanned Air Mobility (UAM), Advanced Air Mobility (AAM), and Uncrewed

Aircraft Systems (UAS) vehicles" by Truong Nguyen (presenter), et al.; and 4) "Pilot Controls for a Hybrid Turbine-Electric 17 Engine Aircraft" by Jarvis (Trey) Arthur (presenter), also selected as best paper of session. In terms of leadership, Consiglio co-chaired the Cyber, Systems, and Software track (30 papers), while Young co-chaired the Unmanned Aircraft Systems and AAM track (80 papers). Consiglio, Dill, Graydon, Muñoz, Neogi, Dolph, and Young also served as session chairs within these tracks.

In addition, several papers by members of the Air Traffic Management – eXploration project's Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject were presented at the conference. Jordan Sakakeeny and Felix Sievers of the German Aerospace Center (DLR) Institute of Flight Guidance jointly presented their paper titled "Comparative Analysis of Airspace System Accessibility for Uncrewed Aircraft Systems for Regional Operations." Bernd Korn, the department head for pilot assistance at DLR, attended and remarked that this work was an excellent example of collaborative work between NASA and DLR. Sakakeeny also presented work led by David Thipphavong titled "Initial Study of Tailored Trajectory Management for Multi-Vehicle Uncrewed Regional Air

Cargo Operations." Conrad Rorie presented work titled "Assessing Helicopter Pilots' Detect and Avoid and Collision Avoidance Performance with ACAS Xr"; this paper won best of session. Cynthia Wolter presented a paper titled "Remote Pilot Handoffs in Large UAS Multi-Vehicle Operations: Best Practices and Supportive Technologies," which summarized the fourth in a series of tabletop exercises held with subject matter experts discussing highly scalable remotely piloted operations. Rafael Apaza from NASA's Glenn Research Center in Cleveland presented two papers at the conference. One paper stemming from his PAAV work was titled "Communications Concept Architecture for Uncrewed Aircraft Cargo Operations." The second paper was titled "Multi-Agent Deep Reinforcement Learning for Spectrum and Air Traffic Management in Urban Air Mobility (UAM) with Resource Constraints." In addition to presenting papers, Sakakeeny and Rorie also served as session chairs for several lecture sessions. PAAV team members also engaged with an international audience of scholars and industry representatives, attended presentations, and promoted the increasingly autonomous aircraft research ongoing in the PAAV subproject. For more information go to the following website: https://2023.dasconline.org/.

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System-Wide Safety Associate Project Manager Awarded Patent
POC: WENDY OKOLO

On Oct. 3, the System-Wide Safety project's associate project manager Wendy Okolo was awarded a U.S. patent titled "Aerospace Vehicle Entry Flightpath Control" with U.S. Patent No. 11,772,828 B2. This patent explores the dihedral effect of an aerospace vehicle (demonstrated on an asymmetric deployable entry vehicle) to control a vehicle's bank angle by modulating the sideslip. This will enable aerospace vehicles to use novel control mechanisms for control and reduce propulsive requirements required to steer during entry operations.

SWS AOSP Safety Liaison Participates in Select Group of SMEs in Dagstuhl Seminar
POC: MISTY DAVIES

On Oct. 8-13, AOSP System-Wide Safety (SWS) project liaison Misty Davies participated as one of a select group of international subject matter experts (SMEs) in a special Dagstuhl Seminar in Schloss Dagstuhl, Germany. The goal of this seminar was to understand and document the current limits of accountability in software systems. Participation in this seminar confirmed and strengthened NASA's claim to world-class expert status on the assurance of autonomy. For more about this seminar, please see the official website: https://www.dagstuhl.de/en/seminars/seminar-calendar/seminar-details/23411.

AOSP Projects Participate at INFORMS 2023 Conference
POC: NIKUNJ OZA AND JEREMY COUPE

On Oct. 15-18, System-Wide Safety (SWS) and Air Traffic Management – eXploration (ATM-X) project members represented AOSP at the Institute For Operations Research and the Management Sciences (INFORMS) Conference in Phoenix. INFORMS is the largest professional society in the world for professionals in the fields of operations research, management science, and analytics. The annual meeting serves as a gathering point for researchers, practitioners, academics, and students interested in these disciplines. The Aviation Applications Section of INFORMS is interested in any aspects of aviation operations including, but not limited to, airline operations, network planning and scheduling, air traffic control, air traffic/airspace management, surface operations optimization, revenue management, data mining and machine learning application, and many more aviation-related topics. SWS project subproject manager Nikunj Oza delivered an invited presentation at the conference. Oza's presentation was titled "Machine Learning for Anomaly Detection and Precursor Identification in Commercial Aviation," during the Forecasts and Machine Learning in Air Transportation session. The presentation was an overview of machine learning work the SWS project performed in terms of algorithm development and the domain-vetted insights that were identified. In addition, ATM-X researcher Jeremy Coupe participated as a session chair for the Sustainable Aviation session and also gave a talk in the "Digital Air Traffic Services: Human Performance Perspective" session.

ATM-X-NExCT Data Reasoning Fabric Presented at AUVSI Cascade Fall Symposium
POC: KENNETH FREEMAN

On Oct. 17, Supreet Kaur, a researcher within the Air Traffic Management-eXploration (ATM-X) project's National Airspace System Exploratory Concepts and Technologies (NExCT) subproject, presented at the Association for Uncrewed Vehicle Systems International (AUVSI) Cascade Fall Symposium in Seattle. AUVSI is the world's largest nonprofit organization dedicated to the advancement of uncrewed systems and robotics, which represents corporations and professionals from more than 60 countries around the world involved in industry, government, and academia. Kaur's presentation covered her work supporting the Data Reasoning Fabric

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concept, which provides a trusted service discovery and exchange backbone to manage complex and dense airspace operations.

ATM-X Researcher Participates in the BayLearn Machine Learning Symposium

POC: JEREMY COUPE

On Oct. 19, Air Traffic Management – eXploration (ATM-X) project researcher Jeremy Coupe participated in the BayLearn Machine Learning Symposium. The symposium is an annual gathering of machine learning researchers and scientists from the San Francisco Bay area. Google, Apple, Netflix, and AT&T Research co-hosted the event. While it promotes community building between local researchers from academic and industrial institutions, it also welcomed visitors. This event combined invited talks and posters to foster exchanges of ideas. Coupe presented on his work in validation of the ATM-X project's Digital Information Platform subproject machine learning model at the Dallas-Fort Worth International Airport.

AOSP Representatives Honored at Global Women in Emerging Aviation Technologies Awards

POC: MISTY DAVIES

On Oct. 25, AOSP deputy director Cheryl Quinn and System-Wide

Group photo of awardees (l) and Davies accepting her award (r).

Safety project AOSP safety liaison Misty Davies were honored as two of the "Women to Watch" during the Global Women in Emerging Aviation Technologies Awards by Women and Drones in a special ceremony at the Smithsonian National Air and Space Museum in Washington, DC. Quinn was recognized for her leadership in helping develop and demonstrating airspace, vehicle and safety capabilities that will enable routine access to the airspace by new entrants such as Unmanned Aircraft Systems, Advanced Air Mobility, and future autonomous systems. Davies was recognized as a world-class expert and advocate on the safety assurance of complex, highly automated aviation systems, particularly those which components contain machine learning or artificial intelligence. For more information, please see: https://womenanddrones.com/7th-anniversary-women-to-watch-global-awards/.

SWS Researcher Chetan Kulkarni Selected as PHM Fellow

POC: CHETAN KULKARNI

System-Wide Safety (SWS) project researcher Chetan Kulkarni was recently selected as a fellow by the Prognostics and Health Management (PHM) Society. The PHM Society is an organization focused on the advancement of PHM technologies that can monitor the health and performance of systems or components, predict their remaining useful life, or detect anomalies and faults. The award ceremony was held at the Hilton Salt Lake City in Salt Lake City on Oct. 31. The citation for the fellowship reads: "Dr. Chetan Kulkarni is a KBR Technical Fellow in Fault Diagnostics, Prognostics

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and Predictive Maintenance. He leads the KBR team at the Prognostics Center of Excellence, NASA Ames Research Center. The significance of Dr. Kulkarni's work is demonstrated by his ability to develop and apply state-of-the-art prognostics in six key aerospace application areas: Advanced Ground Systems maintenance, UAVS, Electro-chemical, Electric powertrain, Avionics Electronics, and Energy storage systems. He is an AIAA Associate Fellow and leads the Intelligent Systems Health Management track at AIAA SciTech. He serves as Associate Editor of the SAE Aerospace Journal and the International Journal of PHM." Kulkarni co-chaired the technical program committee for the fourth consecutive year and has been supporting it for over 10 years. The Diagnostics and Prognostics group has been supporting and contributing to the PHM conference significantly since inception. This year, four papers from the group containing SWS-relevant or -funded research were presented at the conference.

SWS Subject Matter Experts Participate in DARPA ARCOS Principal Investigators Meeting
POC: MALLORY GRAYDON, PAUL MINER AND NATASHA NEOGI

On Oct. 31 – Nov. 1, System-Wide Safety (SWS) project researchers

Mallory Graydon, Paul Miner, and Natasha Neogi participated in a principal investigators meeting of the Defense Advanced Research Projects Agency's (DARPA's) Automated Rapid Certification of Software (ARCOS) project. ARCOS participants discussed plans to refine assurance-case-related tooling that they are constructing. Graydon, Miner, and Neogi used their expertise in safety assessment and safety assurance to provide constructive feedback that will help keep participants on track to deliver rapid, low-cost means to assess and assure the safety and security of high-consequence software systems following changes. While ARCOS aims to reduce the cost of certifying software-intensive military systems, the tools and techniques it develops may have applications to software used in aviation and spaceflight applications. For more information go to: https://www. darpa.mil/program/automated-rapid-certification-of-software.

SWS Participates at the AHFE Conference 2023
POC: JOLENE FELDMAN

System-Wide Safety (SWS) project researcher Jolene Feldman co-chaired a session on the "Application of Emerging Technologies: Transportation Research II" at the Applied Human Factors and Ergonomics (AHFE) International Conference 2023 on

Feldman presenting at the AHFE Conference.

Dec. 4–6 in Honolulu, under the sponsorship of 12 international scientific boards consisting of 485 members. Feldman also presented SWS-funded work on emerging technologies, specifically results from a study investigating the usability of risk prediction tools and services to support small Uncrewed Aircraft Systems Traffic Management. The resulting paper presented is titled "Usability of pre-flight planning interfaces for supplemental data service provider tools to support uncrewed aircraft system traffic management." The event was an opportunity to interact with fellow international associates and learn about related research in other governmental sectors, academia, and industries. There were 589 participants, both in-person and online, together with 48 technical sessions and 77 posters.

ATM-X Participates at ICAO Drone Enable Symposium
POC: SUPREET KAUR

On Dec. 6, Air Traffic Management – eXploration (ATM-X) project

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researcher Supreet Kaur presented the Data and Reasoning Fabric (DRF) concept at the International Civil Aviation Organization (ICAO) Drone Enable Symposium in Montreal, Canada. ICAO is a United Nations agency that has helped 193 countries to diplomatically and technically realize a uniquely rapid and dependable network of global air mobility, promoting sustainable growth and socio-economic prosperity wherever aircraft fly. The DRF concept provides a trusted service discovery and exchange backbone to manage complex and dense airspace operations, enabling global interoperability and harmonization in support of advanced air mobility.

DIP Awarded Engineering Team of the Year Award

POC: SWATI SAXENA

The Air Traffic Management – eXploration project's Digital Information Platform (DIP) subproject team has been awarded the 2023 American Institute for Aeronautics and Astronautics' San Francisco Section Engineering Team of the Year Award. The DIP team received this award for their achievements in 2022 and 2023 with establishing partnerships with five major U.S. airlines, and for successfully conducting field demonstration of a pre-departure aircraft re-routing model to achieve sustainability benefits (fuel and CO2 emissions savings). The section celebrated the team's award during their annual banquet on Dec. 9.

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