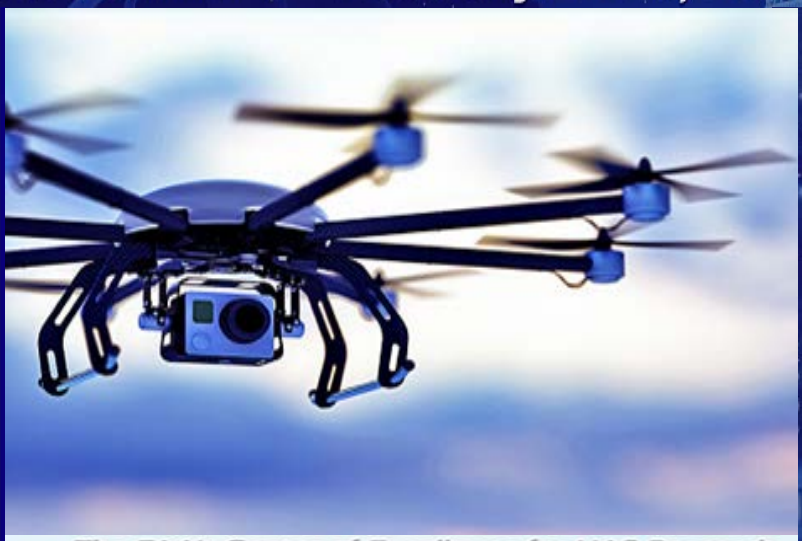
Federal Aviation Administration's Center of Excellence for Unmanned Aircraft Systems Research

Research EXPO – February 22-23, 2016



The FAA's Center of Excellence for UAS Research

ASSURE

Alliance for System Safety of UAS through Research Excellence

About the FAA UAS Center of Excellence Research EXPO

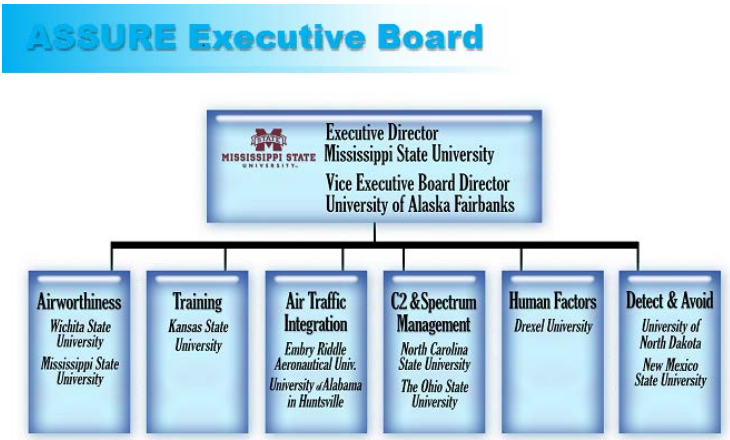
This FAA Research EXPO provides an opportunity for FAA staff and other government UAS stakeholders to become acquainted with the capabilities and leadership of the FAA's first Center of Excellence for UAS: Alliance for System Safety of UAS through Research Excellence (ASSURE).

Day 1 – Monday, February 22, 2016 **Opening Session: ASSURE UAS COE Research Panel and FAA UAS Stakeholder Panel** ***Location: Elwood R. "Pete" Quesada Auditorium (3rd Floor)***		
8:45 AM	**Welcome and Introductions**	**Sabrina Saunders-Hodge**, FAA, NextGen UAS COE Program Manager
9:00 AM	**Opening Statements** **Q&A**	**Ed Bolton**, FAA Assistant Administrator for NextGen **Earl Lawrence**, FAA Director UAS Integration Office **Marke Gibson**, Senior UAS Advisor to FAA Deputy Administrator
9:45 AM	**UAS COE Panel Session:** ASSURE Research • Panel Introduction • Executive Overview **Research Areas:** • Airworthiness • Air Traffic Integration • UAS Crew Training and Certification • Control and Communication & Spectrum Management • Human Factors • Detect and Avoid **Q&A**	**Sabrina Saunders-Hodge**, FAA NextGen UAS COE Program Manager **Jim Poss**-ASSURE Executive Director **Dallas Brooks**-ASSURE Associate Director for Research **Andi Meyer** – Wichita State University **Susan Allen** – Embry Riddle Aeronautical University **Steve Ley** – Kansas State University **Kyle Snyder** – North Carolina State University **Ellen Bass** – Drexel University **Mark Askelson** – University of North Dakota
11:00 AM	**FAA Panel Session:** FAA UAS Research Stakeholder Perspectives • Panel Introduction **Lines of Business:** • Aviation Policy and Plans • Aviation Safety • Small Airplane Directorate • Air Traffic Organization • Air Traffic Program Management Office • Environment and Energy • Airport Safety and Standards **Q&A**	FAA Stakeholders (*Proposed speakers) **Sabrina Saunders-Hodge**, NextGen UAS COE Program Manager **Nan Shellabarger**, APO Executive Director **Chris Swider**, UAS Integration Office, Research Division Manager **Wes Ryan**, AIR Focal for UAS Integration **Randy Willis**, Emerging Technologies Team, Strategic Operations Team Manager **Dan Gutwein**, AJM Senior Technical Advisor, UAS Program Manager **Jim Hileman**, Chief Scientist and Technical Advisor for Environment and Energy **John Dermody**, Airport Safety and Standards Deputy Director
12:30 PM	**Networking Lunch**	

Day 1 – Monday, February 22, 2016 Afternoon Session: ASSURE UAS COE EXPO and Demonstrations *Location: Bessie Coleman Conference Center (2nd Floor)*		
	ASSURE UAS COE Research Area Exhibits:	**Exhibitor:**
1:30 PM-4:00 PM	• Airworthiness • Air Traffic Integration • UAS Crew Training and Certification • Control and Communication & Spectrum Management • Human Factors • Detect and Avoid • Low Altitude Safety	**Andi Meyer** – Wichita State University **Gerardo Olivares** – Wichita State University **Susan Allen** – Embry Riddle Aeronautical University **Dave Arterburn**- University of Alabama Huntsville **Steve Ley** – Kansas State University **Kurt Carraway** – Kansas State University **Kyle Snyder** – North Carolina State University **Jim Gregory**- The Ohio State University **Ellen Bass** – Drexel University **Kurt Izzeetoglu**- Drexel University **Mark Askelson** – University of North Dakota **Henry Cathey** – New Mexico State University **Kim Underwood** - Consultant

Day 2 – Tuesday, February 23, 2016 ASSURE UAS COE EXPO and Demonstrations *Location: Bessie Coleman Conference Center (2nd Floor)*		
	ASSURE UAS COE Research Area Exhibits	**Exhibitor:**
9:00 AM-3:00 PM	• Airworthiness • Air Traffic Integration • UAS Crew Training and Certification • Control and Communication & Spectrum Management • Human Factors • Detect and Avoid • Low Altitude Safety	**Andi Meyer** – Wichita State University **Gerardo Olivares** – Wichita State University **Dave Arterburn-** **Susan Allen** – Embry Riddle Aeronautical University **Dave Arterburn**- University of Alabama Huntsville **Steve Ley** – Kansas State University **Kurt Carraway** – Kansas State University **Kyle Snyder** – North Carolina State University **Jim Gregory**- The Ohio State University **Ellen Bass** – Drexel University **Kurt Izzeetoglu**- Drexel University **Mark Askelson** – University of North Dakota **Henry Cathey** – New Mexico State University **Kim Underwood** - Consultant

ASSURE is organized to conduct the following focus areas:



Airworthiness

Currently, the majority of civilian UAS airframes are small (less than 55 lbs). Designs, materials, system integration and manufacturing methods of these vehicles do not always adhere to traditional manned aerospace engineering practices. Additionally, as UAS capabilities are increased, it is expected that airframe sizes and system complexities will begin to mirror the manned general aviation fleet. For these reasons, it is important to have airworthiness standards, guidance, and even regulations in place to 1) define minimum design/manufacturing expectations and 2) outline a consistent process for approval or certification. Characterizing airworthiness requirements has the potential to help both the FAA and UAS manufacturers by providing a framework for airworthiness assurance to reduce the need for case-by-case reviews.

Air Traffic Integration

Integration of UAS onto airport surfaces can be seen as three levels of integration: segregated (near-term), integrated (mid-term), and

NextGen surface management system (SMS) integrated (long-term). Under each level of integration, UAS operations (procedures, runway occupancy rules, ATC coordination, etc.), aircraft requirements (lighting, sensors, flight controls, etc.), and supporting facilities (hangars, tie-downs, signage, etc.) must be compliant with regulations (i.e. various parts of Title 14 Code of Federal Regulations), policies (e.g. advisory circulars), and procedures (e.g. Aeronautical Information Manual or AIM) to ensure a sufficient level of safety. Herein, this literature will be referenced as "governance materials".

ASSURE is conducting research which seeks to inform and assist the FAA with development of or alteration of existing governance materials related to UAS surface operations, focusing on manned/unmanned integrated UAS operations. By identifying gaps within the current governance materials, recommended changes can be suggested to accommodate UAS that have minimum impact on existing manned aircraft operations, ATC procedures, and airport facility design, while ensuring the safety of airport operations stakeholders.

UAS Crew Training and Certification

Crewmember training and certification requirements do not exist for Unmanned Aircraft Systems (UAS) operations. Although the FAA's proposed small UAS (sUAS) NPRM addresses certification requirements for operations under very specific environments, there are still areas where UAS, including sUAS, require airman certification standards. Because there is overlap between UAS and manned aviation, ASSURE proposes a four-phased research approach to develop UAS crewmember training and certification standards to be offered by appropriately organized flight schools. This effort will include all classes of UAS to be operated beyond the sUAS NPRM and will address Airman certification standards which parallel manned standards, i.e. Private Pilot (outside of "Hobby Rule

criterion"), Commercial Pilot, Flight Instructor and, if appropriate, will consider a need for certificates in areas that do not exist in manned aviation (for example, beyond line of sight).

C2 and Spectrum Management

Control and Communication (C2) links are essential for high-precision execution of UAS missions. The expected release of most government-controlled spectrum for secondary access presents opportunities to augment existing spectral resources while further exacerbating the latter two challenges. While there are several existing efforts to control channel access in secondary / dynamic spectrum communication systems, they primarily concentrate on static and low mobility systems with static or slowly-varying demands. For this research effort, ASSURE will first evaluate the performance of UAS systems as secondary users of spectrum through analysis and simulations. Next, expertise will be used in development of dynamic spectrum access algorithms for mobile systems to develop new cross-layer sensing and channel access algorithms custom tailored for UAS systems in dynamic spectrum settings.

Human Factors

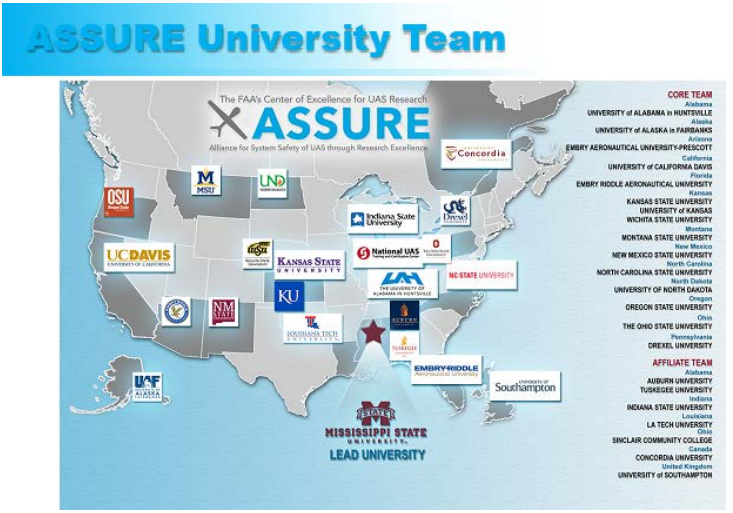
In order to define future requirements for safe and efficient operation of UAS in the NAS, it is necessary to identify and evaluate alternatives regarding roles and responsibilities for humans and technology. This determination in turn depends upon assumptions regarding the capabilities and reliabilities of potential supporting technologies and the definition of procedures that define the operational functions and tasks of humans and technologies in this system. The proposed research effort will include the identification of the work involved with UAS operations and the development of uses cases that serve to identify the range of operational scenarios that need to be considered in defining roles and responsibilities (for humans and technology) and associated procedures and tasks. The

use cases will guide the completion of task analyses that in turn will inform the definition and evaluation of alternative functional allocations across different individuals as well as across different technologies, and to consider the emergent performances expected as a result of interactions.

Detect and Avoid

Detect and avoid (DAA) is a challenging issue for unmanned aircraft of all sizes, especially considering the types of objects that must be detected (e.g., small versus large aircraft, slow- vs. fast-moving aircraft, etc.). Some of the DAA equipment is too large, too heavy, or requires too much electrical power to install on a small UAS (too great of SWaP; Size, Weight, and Power). This research project will examine the operating characteristics of various DAA equipment. The information that will be collected includes intended UAS size class (1-5), size, weight, electrical requirements, communications requirements, intended operational space (class A, G, etc.), and types of objects that can be detected, and functional characteristics such as detection distance and failure modes. A comprehensive list such as this does not exist. This project would focus on the current DAA equipment on the market for all sizes of UAS platforms. Once a comprehensive list of the equipment is created and aligned with different types of use case needs, testing of the equipment in various airspace classes (E, G, and A) could occur.

Get to know the ASSURE team and panelist speakers



James (Jim) Poss, Executive Director ASSURE, Mississppi State University is a 30 year US Air Force veteran with combat experience in four wars and two Bronze Stars. The Major General (Ret.) was the Air Force's Senior Career Intelligence Officer at transition from active service in November 2012 and was one of the Air Force's leading experts on Unmanned Aerial Systems (UAS). At Headquarters, USAF he was the Chief of Staff's lead for the Air Force UAS Roadmap, which set priorities for Air Force UAS acquisition and fielding until 2025. He has a Bachelor of Arts from the University of Southern Mississippi, and a Master's Degree from the University of Southern California and the US Navy College of Command and Staff.

Dallas Brooks, Director of Raspet Flight Research Laboratory at Mississippi State University and the Associate Director for Research of the ASSURE FAA UAS Center of Excellence (COE) has over 30 years aviation and technical experience. As Director, he is responsible for all aspects of MSU's broad spectrum of government

and commercial manned and unmanned aviation research, development, test and engineering (RDT&E) programs. As the Associate Director for Research of the ASSURE FAA UAS Center of Excellence (COE), Dallas leads a coalition of 22 of the nation's leading aviation and unmanned systems research universities to develop technical solutions to address the challenges of safely integrating UAS into the national airspace system. He is the Executive Vice Chairman of the National Board of Directors for the Association of Unmanned Vehicle Systems International (AUVSI). Dallas also brings 20 years military services at home and overseas.

Andi Meyer, Senior Research Engineer at the National Institute for Aviation Research, Wichita State University and UAS Research Program Manager at the Applied Aviation Research Center, Kansas State University Polytechnic Campus, conducts ASSURE research relating to airworthiness and certification methodologies. Andi's background includes applied aviation research with UAS focusing on the development of airworthiness standards. As senior research enginer, Andi supports all facets of product lifecycle management including composite material testing, fabrication, laminate design, product development, design verification and validation testing. As UAS Program Manager, Andi manages a team of UAS researchers and cultivates new R&D opportunities. She obtained her Bachelors of Science in Mechanical Engineering from Wichita State University.

Susan Allen, Distinguished Professor of Mechanical Engineering and Associate Dean for Research, Embry Riddle Aeronautical University, Daytona Beach (ERAU DB) primary research is on the interaction of light, usually laser light, with matter and ranges from the development of stand-off and proximity laser sensors to laser materials processing to light based disinfection. Prior to joining ERAU DB, she served as Distinguished Professor and Director of the Arkansas Center for Laser Applications and Science (ArCLAS) at Arkansas State University, Vice Chancellor for Research and

Academic Affairs, Senior Advisor to the Chancellor and as the ASU System representative to Congress. Susan received her BS in Chemistry from Colorado College, Colorado Springs, CO, after also attending Duke University. Her PhD in Chemical Physics is from the University of Southern California.

Kurt J. Carraway, UAS Program Manager, Professor, and Flight Instructor at the Kansas State University (KSU) Polytechnic Campus, oversees the growth and development of the KSU UAS Program through refinement of both the academic and research programs. He manages a staff of highly skilled UAS professionals that perform hundreds of UAS flights per year in civil airspace. He sets policies and procedures for unmanned flight operations. He also initiates and collaborates on UAS research projects. Kurt served 25 years in the US Air Force as an aviator, including serving as a Commander of a Global Hawk UAS Unit. He holds a Master's Degree in Systems Engineering from the Air Force Institute of Technology, a Master's Degree in Management from Webster University and a Bachelor's Degree in Mechanical Engineering from the University of Missouri—Rolla.

Kyle Snyder, Director, NextGen Air Transportation (NGAT) Consortium, NC State University, reaches across North Carolina to connect researchers and educators with industry and government offices that are preparing for future aviation capabilities. He leads the development of an Unmanned Aircraft Systems (UAS) Ecosystem as part of an effort to transition the state to a modern air transportation system. In his professional aviation career, Kyle has served roles in research, technology development, business development, technology transfer, advocacy, and most recently new program launches. Kyle holds a Bachelor's Degree in Mathematics and Computer Science from Catawba College. He also graduated from the University of Tennessee with a Math Masters and a Masters of Business Administration in Aerospace.

Ellen Bass, Professor and Head of the Department of Information Science in the College of Computing & Informatics and a Professor in the Department of Health Systems and Services Research in the College of Nursing & Health Professions, Drexel University has over 30 years of systems engineering research and design experience including cognitive modeling, cognitive systems engineering, human factors, simulation and formal methods. Her research focuses on understanding and modeling how human operators perform in real-time complex systems in order to inform the systems engineering process: operational concept definition, requirements for decision support and human-computer interaction, procedures the operators will follow, and training requirements.

Mark Askelson, Professor of Atmospheric Science, University of North Dakota has over 20 years of research and applications experience with weather radar, including advanced applications involving radar polarimetry and phased array technologies. His areas of expertise include radar meteorology, numerical weather prediction, data assimilation, and unmanned aircraft systems (UASs). Mark has led multiple UAS research efforts, including multimillion-dollar research efforts focused on integration of UAS into the National Airspace System using both ground-based phased-array radars (development of the Ganged Phased Array Radar-Risk Mitigation System; GPAR-RMS) and cooperative data (the Limited Deployment-Cooperative Airspace Project; LD-CAP).

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