UAS Research Status

NextGEN

REDAC Aviation Safety Subcommittee

Claude Jones, ANG-C21
Date: July 31, 2018

FAA

Agenda

- UAS Research Status
- UAS COE Status

FY17 UAS Research Execution

#	Control Acct. No	Research Requirement Title	Status	Notes
1	**A11L.UAS.2**	Multi Sensor Data Fusion Strategies	On-going	
2	**A11L.UAS.6**	Test Site Data Collection	On-going	
3	**A11L.UAS.7**	Ground Collision Severity Evaluation	On-going	
4	**A11L.UAS.15**	Maintenance, Modification and Repair	In-Active	
5	**A11L.UAS.22**	sUAS DAA Requirements Necessary for Beyond Visual Line of Sight (BVLOS)	Not Started	Pending COE grant
6	**A11L.UAS.23**	C2 Link Compatibility	On-going	
7	**A11L.UAS.24**	Human Factors Considerations	Completed	
8	**A11L.UAS.30**	Human Factors Control Station Design Standards	Completed	
9	**A11L.UAS.25**	UAS Navigation Accuracy	In-Active	
10	**A11L.UAS.35**	C2 Link Interference Mitigation	Completed	
11	**A11L.UAS.36**	UAS Detection at Airports	Completed	
12	**A11L.UAS.38**	UAS Fuel Cells	On-going	
13	**A11L.UAS.39**	UAS Lithium Batteries	On-going	

FY17 UAS Research Execution, cont'd

#	Control Acct. No	Research Requirement Title	Status	Notes
14	A11L.UAS.42	sUAS In and Around Busy Commercial Airspace	Completed	
15	A11L.UAS.50	UAS Flight Test Data Collection and Analysis	Not started	Pending COE grant
16	A11L.UAS.49	Assessing the Risk of UAS Integration	Completed	
17	A11L.UAS.51	ASSURE COE Management	On-going	
18	A11L.UAS.52	eCommerce, Emerging UAS Network and Implications on NAS Integration	Not started	Pending COE grant
19	A11L.UAS.54	UAS Traffic Management (UTM)	On-going	
20	A11L.UAS.55	UAS Safety Research Facility	Not started	
21	A11L.UAS.56	UAS EXCOM/SSG Research Priorities for Science and Research Panel (SARP)	On-going	
22	A11L.UAS.57	UAS Standards Analysis: American National Standards Institute (ANSI)	On-going	
23	A11L.UAS.58	Airborne Collision Severity Evaluation-Engine Impact	Not started	Pending COE grant
24	A11L.UAS.60	Airborne Collision Severity Evaluation-Structural Impact	Not started	Pending COE grant
25	PM 7	Science Technology Engineering & Math (STEM) I	Completed	
26	A11L.UAS.53	STEM II	On-going	

FY18 UAS Research Execution

#	Control Acct. No	Research Requirement Title	Status	Notes
1	**A11L.UAS.2**	Multi Sensor Data Fusion Strategies	On-going	
2	**A11L.UAS.23**	UAS Command and Control Link Compatibility (BRLOS & L-Band)	On-going	
3	**A11L.UAS.26**	UAS Training Device Qualification Criteria	In-Active	
4	**A11L.UAS.30**	UAS Human Factors Control Station Design Standards	In-Active	
5	**A11L.UAS.61**	UAS Automation and Intelligent Systems	Not started	
6	**A11L.UAS.43**	UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program	Not started	Pending COE grant
7	**A11L.UAS.47**	Minimum Detect and Avoid (DAA) Display and Flight Path Information	Not started	

FY19 Planned UAS Research Execution

#	Control Acct. No	Research Requirement Title	Status	Notes
1	**A11L.UAS.31**	High Visual Contrast for UAS	Not Started	
2	**A11L.UAS.43**	UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program	Not Started	
3	**A11L.UAS.44**	Air Carrier Operational Considerations for Unmanned Aircraft Systems	Not Started	
4	**A11L.UAS.47**	Minimum Detect and Avoid (DAA) Display and Flight Path Information	Not Started	
5	**A11L.UAS.48**	UAS Automation/Autonomy	Not Started	

FY20 Planned UAS Research Execution

#	Control Acct. No	Research Requirement Title	Status	Notes
1	**A11L.UAS.43**	UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program	Not started	
2	**A11L.UAS.44**	Air Carrier Operational Considerations for Unmanned Aircraft Systems	Not started	
3	**A11L.UAS.61**	UAS Automation and Intelligent Systems	Not started	
4	**A11L.UAS.64**	UAS High Performance Command and Control (C2) Link Systems and Networks	Not started	

Research Status

Detect and Avoid (DAA) Multi-Sensor Data Fusion Strategies

A11L.UAS.2

Need/Approach

Need – In order to comply with 14 CFR 91, UASs are required to perform detect and avoid duties analogous to see and avoid conducted by pilots on manned aircraft.

Approach

- (1) the development of generic sensor models to accommodate new sensors that were not addressed in the original MOPS, and
- (2) the development of a tracker to filter the sensor data.

Major Activities

Activity	Status
Develop a reference tracker that meets surveillance performance requirements of RTCA SC-228 Phase 2 MOPS	1/2019
Develop an end to end simulation environment in order to be able to conduct simulations as required to support SC-228 Phase 2 DAA and SC-147 ACAS Xu MOPS development.	1/2019
First iteration of surveillance software models for sensors.	1/2019
Technical report documenting the research findings, sensor and error model development and tracker development.	1/2019

Period of Performance
FY2014 – FY2019

Program Manager	Partners
Karl Garman, ANG-C21	NASA and RTCA Committee Members

Sponsor	Research Performers
Sheila Mariano, AIR-6B4	WJHTC

Notes

- This Research supports section 3.1.5.3 and 3.4 of the UAS Implementation Plan.
- Provided a sample tracker as reference that can meet the surveillance performance requirements of RTCA SC-228 DAA Phase 1 MOPS
- Software models developed for sensors and tracker were shared with the RTCA community. They will be leveraged to support surveillance performance requirements development for SC-228 Phase 2 and ACASXu MOPS. (Update existing and/or build new)

FAA

NextGEN

sUAS Well Clear Definition in “under flight” Conditions in Class B/C/D Airspace

A11L.UAS.56

Need/Approach

Need - This research will provide a sUAS well clear definition in "under flight" conditions in Class B/C/D airspace.

Approach – This requirement will drive looking into particular research priorities which will try to ensure that UAS have ample time to correctly maneuver when interacting with manned aircraft. The research priorities in this research include looking into the definition of "Well Clear" for operations beyond transitioning large UAS and will focus on terminal areas for sUAS. The identification of the sUAS well clear will facilitate what separation standards should be in terminal airspace. This will help mitigate safety risks of sUAS in controlled airspace.

Maior Activities

Activity	Status
Finalize sUAS "Under Flight" use cases and define metrics to use on Well Clear performance.	4/2018
Characterize intruders and airspace structure.	4/2018
Provide a the well clear volume that has been reviewed by the SARP	Due – 8/2018
Provide report detailing recommended well clear volume and the associated performance level for "under flight" conditions.	Due – 9/2018

Period of Performance
FY2018 – FY2019

Notes

- None

Program Manager	Partners
Karl Garman, ANG-C21	MIT LL

Sponsor	Research Performers
Sabrina Sunders-Hodge, AUS-300	MIT LL

FAA

NextGEN

UTM Architecture Integration
A11L.UAS.54

Need/Approach

Need – This research is being conducted in response to a Congressional Directive for FAA and NASA to partner in order to advance safe sUAS Integration at the lower altitudes through traffic management. It provides a forum for industry collaboration with NASA and FAA to evaluate and demonstrate UTM technologies and capabilities while supporting development of enterprise capabilities, testing, and evaluation leading up to a successful UPP demonstration.

Approach –Develop UTM architecture, UTM prototype, and necessary infrastructure to support the pilot program demonstration in partnership with industry and NASA.

Major Activities

Activity	Status
Kickoff Meeting	Complete - 1/2018
Establish SWIM infrastructure contract at NIEC Lab	In Progress
Draft Pilot Program architecture plan	Complete - 2/2018
UTM Con Ops	Complete -6/2018
Initial testing of NASA FIMS & USS Prototype	Upcoming
Develop USS Checkout Requirements	Upcoming

Period of Performance
FY2017 – FY2019

Program Manager	Sponsor
Praveen Raju, ANG-C5	Steve Bradford, ANG-3

Research Performers	Partners
WJHTC	FAA (ANG, AIT, AJV, AJM, AUS)
NIEC Lab	NASA
	UTM RTT Industry Partners

Notes

- If Industry partnerships are not established in a timely manner, then the pilot program will suffer risk to its schedule.

FAA

NextGEN

UAS Command and Control Link Compatibility Testing
A11L.UAS.23

Need/Approach

Need – To complement the current validation efforts for Control and Non Payload Communications (CNPC) standards by evaluating the operating compatibility with other L-band and C-Band avionics equipment. Further research to support needs for SC228.

Approach – Construct a hardware-in-the-loop laboratory environment and conduct laboratory testing using selected equipment of interests (i.e. TACAN, UAT, etc.).

Major Activities

Activity	Status
Phase 1: Final report for Phase 1 activity on interference testing involving airborne TACAN equipment.	Complete – 2/2017
Phase 2: Conduct Airborne and Ground Co-Site Compatibility Validation	In Progress
Phase 3: Conduct CNPC Coexistence Compatibility and Link Budget Validation	Planning
BRLOS C2 CONOPS	In Progress

Period of Performance
FY2016 – FY2018

Program Manager	Partners
Ben Bradley, ANG-C21	TBD

Sponsor	Research Performers
Steve VanTrees, AIR-130 (RTCA SC-228, WG2-C2 Co-chair	WJHTC

Notes

- This Research supports section 3.1.5.3 and 3.4 of the UAS Implementation Plan.
- Contribute to RTCA 228 ‘s effort to maturing standards for command and non-payload communications for UAS flying within point-to-point of a ground transmitter for the UAS ground control station.
- Contract award for L-Band radios and support delayed.
- The results from this task will help determine the viability of use of L-Band frequencies for CNPC operations.

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NextGEN

Ground Collision Severity Studies
A11L.UAS.7

Need/Approach
Need – Research is required to develop simplified testing method for testing injury potential of sUAS to provide a clear path for applicants to apply for a flight over people waiver under Part 107 or provide a safety case that can be consistent with future flight over people rulemaking.

Approach

- Develop a clear and easily repeatable test method to determine the injury potential to a person upon impact by a UAS under various conditions and scenarios
- Evaluation and validation of the UAS Quadcopter and Fixed Wing FE Models for ground collision conditions. Update if necessary.
- Conduct high biofidelity human head/neck-UAS impact simulations to procure the onset of concussion, the severity of injury and a more localized injury assessment

Major Activities

Activity	Status
Define Research Task Plan	Complete - Aug 2017
Individual University Reports	Nov 2018
Ground collision testing with cadavers	June 2018
Final Report	Jan 2019

Period of Performance
FY2018 – FY2019

Notes
- None

Program Manager	Partners
Ben Bradley, ANG-C21	ASSURE

Sponsor	Research Performers
Wes Ryan, AIR-600	University of Alabama – Huntsville Wichita State University Ohio State University Virginia Tech

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NextGEN

sUAS Detection at Airports
A11L.UAS.36

Need/Approach

Need - Assessment of newly emerging UAS detection system technologies in a variety of airport environments

Approach – Document the performance capabilities and limitations of various types detection technologies via operational evaluations, vendor interviews, literature review, and data analysis. Conduct research and analysis to produce interim findings with the UAS COE on current DoD and DHS assessments of UAS detection technologies and systems

Major Activities

Activity	Status
Deploy and evaluate CACi, Liteye & Sensofusion detection system at DEN	Complete - 1/2016
Deploy and evaluate Gryphon's detection system at DFW	Complete - 4/2017
Data Analysis for UAS Center of Excellence (ASSURE) and Congressional reports	Complete – 5/2018

Period of Performance
FY2016 – FY2017

Program Manager	Partners
Elizabeth Soltys, AUS-410 Karl Garman, ANG-C21	Industry, DoD, DHS, FBI, DoE, US Secret Service

Sponsor	Research Performers
Rob Pappas, AUS-410	WJHTC

Notes

- This Research supports section 3.8.6 of the UAS Implementation Plan.
- Data analysis extending into FY18 per COE grant

FAA

NextGEN

Fuel Cell Energy Supply Systems for UAV Systems and Aerospace Applications

A11L.UAS.38

Need/Approach

Need - Identify the Safety risk based upon a system of open/closed cathode PEM fuel cell concept in which the cathode reactant and coolant delivery systems are shared. Identify the designs and operational principles that may be used to safeguard against these hazards. The simplicity of the air-cooled stack and its reduced balance of plant make it attractive for smaller UAS applications in general, while the closed cathode (oxygen-using) component of the design is beneficial for dense air and high altitude applications. These systems are proposed to give UAV more time on station at high altitude.

Approach - Leverage the work in the Electrical System TCRG and target UAV system applications of fuel cell systems.

Major Activities

Activity	Status
Participation in the FAA ARC on Fuel cells that include UAS	On-going
Contract award	Complete- 10/2016
Initiate Physical Testing- Develop detailed test plans	Complete- 9/2017
Initiate Physical Testing- Initiate Testing	Complete- 12/2017
Deliver Interim Report	9/2018
Deliver Final Report	9/2019

Period of Performance
FY2016 – FY2019

Program Manager
Claude Jones, ANG-C21

Sponsor
Stephen Slotte, ANM-11

Partners
S&T Electrical and Wiring Systems Interagency Group
Energy Supply Device Aviation Rulemaking Committee
SAE AE7 Fuel

Research Performers
WJHTC Infinity Fuel Cell and Hydrogen Inc.

Notes

- This Research supports section 3.1.4.3 and 3.1.5.3 of the UAS Implementation Plan.
- Building on the work of the Energy Supply Device Aviation Rulemaking Committee (ESD ARC); mapping the ARC recommendations for applicable parts of the regulations as they apply both to a generic fuel cell system and to the UAV fuel cell system currently under development. The goal is to provide a detailed framework for qualification of a generic fuel cell system for UAS and other aircraft.

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NextGEN

Lithium Batteries and Battery Systems for UAV
A11L.UAS.39

Need/Approach

Need - UAS Li Battery requirement is addressing a broad range of safety issues, but will focus on a more detailed investigation of thermal runaway in efforts of developing consistent testing approaches leading to increased safety for aerospace vehicles.

Approach - The program will have commercial involvement and oversight from a Commercial Advisory Board (CAB) comprising General Atomics and Boeing Phantom Works.

Period of Performance
9/28/2016 – 9/28/2019

Program Manager	Partners
Claude Jones, ANG-C21	RTCA WG 226, SAE AE7B, NASA JSC, UL
	S&T Electrical System and Wiring Group

Sponsor	Research Performers
Nazih Khaouly, ANM-111	WJHTC and DNV-GL

Major Activities

Activity	Status
Contract award	Complete – 10/2016
Participation in the SAE AE7 and RTCA SC 225, SC-235 and DO-311	On-going
Initiate Physical Testing- Develop detailed Test Plans	Complete- 5/2017
Initiate Physical Testing- Initiate Testing	Complete- 6/2017
Deliver Interim Report	4/2019
Deliver Final Report	4/2020

Notes

- This Research supports section 3.1.4.3 and 3.1.5.3 of the UAS Implementation Plan.
- This program will establish validation methods to be used in aerospace industry standards from RTCA and SAE on rechargeable LI Battery system that are directly applicable all UAS systems. This program is directly supporting working RTCA SC-225 and SAE AE-7B, with a EUROCAE counterpart for each committee.

FAA

NextGEN

Collect and Analyze UAS Safety Data from the Congressionally Mandated Test Sites

A11L.UAS.6

Need/Approach

Need – UAS Data will require reduction and analysis to determine technical and operational trends in order to derive conclusions supporting critical safety-related decision-making processes required for UAS-NAS integration.

Approach – This research will provide the data reduction and analysis of data collected from UAS test site operations. Data must be put into a format that is usable by the FAA to make safety-related decisions and to support regulatory and standards development processes needed for safe UAS integration into the NAS.

Major Activities

Activity	Status
UAS Dashboard – Develop a conceptual UAS dashboard displaying analytical data derived from COA-online, and new reporting tool	Complete 6/2015
Rolled out Mission Logging System (MLS) to all Test Sites for Data Collection	Complete - 7/2015
Final Report for Data Collection and Analysis	Complete – 9/2015
Reports summarizing data collected and analyzed and how conclusions may impact or enable UAS into the NAS (FY16)	Annually

Period of Performance
FY2015 – FY2018

Program Manager
Mike Reininger, ANG-C21

Sponsor
John Reinhardt, AUS

Partners
FAA (ANG, ATO)
Test Sites (ND, AK, TX, NV, VA, NY, NMSU)

Research Performers
WJHTC
NextGen (ANG-C2)
Titania

Notes

- Report(s) described above used to identify and address gaps and challenge areas for UAS integration as documented in UAS ConOps and Roadmap
- Test results disclosed as appropriate in accordance with Congressional mandate and agreements between FAA and respective test sites

FAA

NextGEN

sUAS In and Around Busy Commercial Airspace

A11L.UAS.42

Need/Approach

Need -Three primary purposes: (a) understand/integrate data across numerous uses/users; (b) understand and forecast UAS activities and operational implications of NAS integration; and (c) formulation of a quantitative framework to formulate/evaluate regulations.

Approach - Organized as combination of reports/analytical framework:

- UAS Data Catalog: Internal Research across Agencies and Outside
- UAS Industry Outreach Synthesis: Summarizing Industry Interactions
- UAS Forecasts: Methods and Forecasts
- UAS Regulatory Risk Profile and Cost: Analysis Document

Major Activities

Activity	Status
FAA/TRB UAS Forecasting Workshop	Complete – 10/2016
Project Kick-off Meeting	Complete – 12/2016
Technical Exchange Meeting	Complete – 1/2017
Data Catalogue Delivered	Complete – 4/2017
Final Report	Complete - 6/2018

Period of Performance
FY2016 – FY2018

Program Manager
Karl Garman, ANG-C21

Partners
N/A

Sponsor
Mike Lukacs, APO-100

Research Performers
The MITRE Corporation
Center for Advanced Aviation System Development (CASSD)

Notes

- This Research supports section 3.1.4.1 of the UAS Implementation Plan.
- Integrated UAS data together with forecasting leading to harmonious integration, improved regulations and overall safety
  - Data availability
  - Benchmark current activities and forecast short/long range
  - Safety implications and regulations of UAS integrations into NAS

FAA

NextGEN

Assessing the Risk of UAS Integration
A11L.UAS.49

Need/Approach

Need - This study will inform current and future rulemaking and the work of the new UAS Safety Team by focusing on methodologies to characterize the risk of UAS and manned aircraft interactions. The study also supports Section 2210 of the 2016 FAA Reauthorization.

Approach – National Academies of Sciences, Engineering, and Medicine will appoint an ad-hoc committee with representation from industry, academia, and government to undertake a study to evaluate the potential of probabilistic assessments of risks and other risk assessment methods for streamlining the process of integrating unmanned aircraft systems (UAS) into the national airspace system (NAS) and identify supporting research and development opportunities in this field.

Period of Performance
FY2017 – FY2018

Program Manager	Partners
Sabrina Saunders-Hodge, AUS-300 Claude Jones, ANG-C21	

Sponsor	Research Performers
AUS-300	National Academies of Sciences, Engineering and Medicine

Major Activities

Activity	Status
Award Contract	Completed- May 2017
Establishment of Committee	Completed - 9/2017
Convene Four Committee Meetings	9/2017 – 9/2018
Final Report	Complete – 6/2018

Notes

- This Research supports section 3.1.5.3 of the UAS Implementation Plan.
- Streamlined risk assessment processes and performance-based goals and milestones enabling the FAA to make short-term (1-5 years), mid-term (5-10) years, and long-term (10-20 years) decisions related to the safe integration of UAS in the NAS.

FAA

NextGEN

UAS STEM Outreach
A11L.UAS.53

Need/Approach

Need - Provide multiple STEM outreach approaches to the FAA that use UAS's as the central learning platform. Each University has its own unique approach toward STEM Outreach.

Approach – The STEM minority outreach program uses an embedded approach that highlights diversity in all efforts by planning and executing "UAS Roadshow" events and summer camps that includes presenters of various ages, gender and ethnicities.

Major Activities

Activity	Status
Summer Camp at Tuskegee University	Complete – 6/2017
Summer Camp at NMSU	Complete – 7/2017
Drone Day at Tuskegee University	Complete – 11/2017
Drone Day at University of Alaska-Fairbanks	Complete – 12/2017
Summer Camps (all universities)	Complete -Summer 2018
Final Report	Fall 2018

Period of Performance
FY2016 –FY2018

Program Manager	Partners
Diane Ford (ANG-C21)	N/A

Sponsor	Research Performers
Nick Lento (ANG-C2)	New Mexico State University (NMSU)
	Tuskegee University
	University of Alaska-Fairbanks
	Montana State University
	University of California-Davis

Notes

- Target minority or underserved students by organizing community outreach activities unique to each university
- Conduct summer camps at each university – 2018

FAA

NextGEN

UAS COE

FAA Center of Excellence (COE) for UAS Program Overview

Hector Rea, Deputy Program Manager for the ASSURE COE for UAS

FAA COE UAS Highlights

- Congressionally mandated under the Consolidated Appropriations Act of 2014
- August 2014, FAA issued a Final Competitive Solicitation for the FAA COE UAS
- May 2015, DOT/FAA selected the Alliance for System Safety of UAS through Research Excellence (ASSURE) led by Mississippi State University (MSU) as the FAA's first COE for UAS
  - The FAA COE UAS is intended to focus on research, education and training in areas critical to the safe and successful integration of UAS into the National Airspace System (NAS)
  - FAA and other government funding will be matched by the COE one-for-one
- Companion contract planned award date is Aug 2018

Key Participants

ASSURE COE for UAS http://www.ASSUREuas.org	
Executive Management (MSU)	
Marty Rogers	Steve Luxion
Dallas Brooks	Brandy Akers
Performing Universities	
Mississippi State University	Wichita State University
Drexel University	Ohio State University
Embry-Riddle Aeronautical University	University of California- Davis
Kansas State University	*Auburn University*
Montana State University	*Concordia University- Canada*
New Mexico State University	*Louisiana Tech University*
North Carolina State University	*Tuskegee University*
Oregon State University	*Indiana State University*
University of Alabama- Huntsville	*University of Southampton- UK*
University of Alaska- Fairbanks	*Sinclair Community College*
University of Kansas	*Technion Israel Institute of Technology*
University of North Dakota	

*Italics indicate affiliate universities

Federal Aviation Administration (FAA)
FAA COE Program Office
Pat Watts, ANG-E
FAA New Entrants Division (COE UAS)
Nick Lento, ANG-C2 Hector Rea, ANG-C2 Rebecca Grahsler, ANG-C2
FAA Stakeholders
ANG
AUS
AVS
ATO
AFS

NextGEN

COE UAS Active Projects

COE ID	Control Account Number (CAN)	Abbreviated Research Title	Focus Area	PoP		Technical Monitor	ASSURE Performer	ASSURE Task Lead Principal Investigator	Technical Sponsor
A14	A11L.UAS.7	Ground Collision	Low Altitude Operations Safety	FY17	FY19	Ben Bradley	**UAH**; MSU; WiSU; OSU	Dave Arterburn	Wes Ryan, ACE-114
A15	A11L.UAS.53	STEM II	Other	FY17	FY20	Diane Ford	**NMSU**; MtSU; UCD; Alaska Fairbanks	Henry Cathey	Sabrina Saunders-Hodge, AUS-300

Completed COE UAS Projects

COE ID	Control Account Number (CAN)	Abbreviated Research Title	Focus Area	PoP		Technical Monitor	ASSURE Performer	ASSURE Task Lead Principal Investigator	Technical Sponsor
A1	A11L.UAS.11	ASTM/ Test Case	Low Altitude Operations Safety	FY15	FY16	Sabrina Saunders-Hodge	**KSU**; WiSU	Kurt Carraway	Chris Swider, AFS-80
A2	A11L.UAS.22	BVLOS	Low Altitude Operations Safety	FY15	FY17	Karl Garman	**UND**; NMSU	Mark Askelson	Chris Swider, AFS-80
A3	A11L.UAS.7.2	Airborne Collision	Low Altitude Operations Safety	FY15	FY17	Ben Bradley	**WiSU**; MTSU; MSU; OSU	Gerardo Olivares	Paul Campbell, AFS-80
A4	A11L.UAS.7.1	Ground Collision	Low Altitude Operations Safety	FY15	FY17	Ben Bradley	**UAH;** ERAU; MSU; KU	Dave Arterburn	Chris Swider, AFS-80
A6	A11L.UAS.9	Surveillance Criticality	Low Altitude Operations Safety	FY15	FY17	Karl Garman	**NCSU**; ERAU; UND; MSU; OSU; ORSU	Kyle Snyder	Chris Swider, AFS-80
A8	A11L.X.Noise	Noise Certification	Noise Reduction	FY16	FY16	Rebecca Cointin	**MSU**	Ratan Jha	Mehmet Marsan, AEE-100
A11	A11L.UAS.41	Part 107 Waiver Case Study	Low Altitude Operations Safety	FY16	FY16	Sabrina Saunders-Hodge	**UAH**	Dave Arterburn	Chris Swider, AFS-80
A13	A11L.UAS.7.2	Airborne Collision Peer Review	Low Altitude Operations Safety	FY17	FY17	Ben Bradley	**WiSU;** MtSU	Gerardo Olivares	Paul Campbell, AFS-80

Completed COE UAS Projects

COE ID	Control Account Number (CAN)	Abbreviated Research Title	Focus Area	PoP		Technical Monitor	ASSURE Performer	ASSURE Task Lead Principal Investigator	Technical Sponsor
A9	A11L.UAS.35	Interference Mitigation	Control and Communication	FY16	FY18	Ben Bradley	OSU	John Volakis	Sabrina Saunders-Hodge, AUS-300
A5	A11L.UAS.15	Maintenance	Unmanned Aircraft (UA) Crew Training and Certification, including pilots	FY16	FY17	Karl Garman	**KSU**; ERAU; MtSU	Kurt Barnhart	Sabrina Saunders-Hodge, AUS-300
A7	A11L.UAS.30	Human Factors	Human Factors	FY16	FY18	Ashley Awwad	**DU**; UND; NMSU; MtSU; OSU	Ellen Bass	Steven Plishka, AUS-420
A10	A11L.UAS.30	Human Factors	Human Factors	FY16	FY18	Ashley Awwad	**ERAU**; UND; MSU; UAF; KSU; NMSU; MtSU; OSU; DU	Richard Stansbury	Steve Plishka, AFS-86
A12	A11L.UAS.36	Airport Detection	Low Altitude Operations Safety	FY17	FY18	Karl Garman	**MSU**; NMSU UND	Dallas Brooks	Rob Pappas, AUS-410
PM7	A11L.UAS.OUT	STEM I	Other	FY16	FY19	Diane Ford	**NMSU** Tuskegee	Henry Cathey	Nick Lento, ANG-C2

Back Up Slides