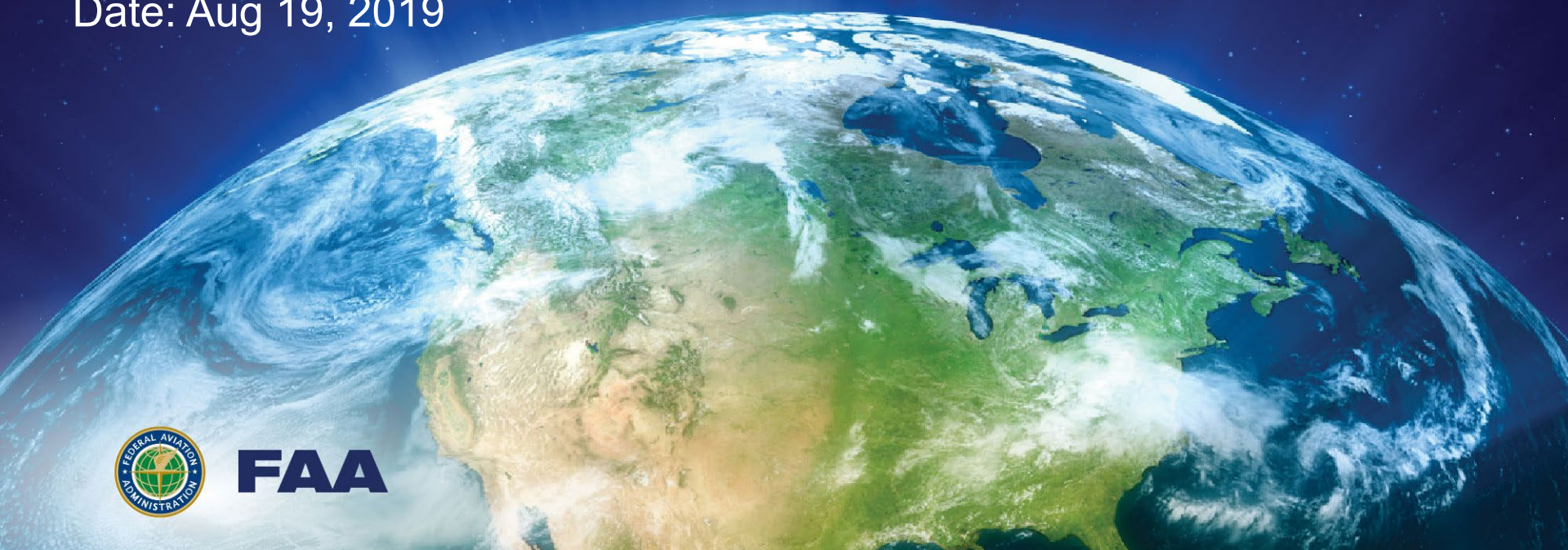
UAS Research Status

NextGEN

REDAC Aviation Safety Subcommittee

Claude Jones, ANG-C21
Date: Aug 19, 2019



FAA

Agenda

- UAS Research Status
- UAS COE Status

UAS Research Program

UAS R&D informs safe, efficient, and timely integration of UAS in the NAS. This research supports the development of :

- Standards and processes for the certification of UAS systems, pilots/crewmembers, and supporting UAS technologies
- Policies, guidance materials, and advisory circulars for regulatory compliance for UAS operating in the NAS
- Procedures and mitigation strategies to ensure safe UAS operations

UAS Research Overview

- Research Projects since 2016:
  - Completed: 19
  - In-progress: 19
  - Not Started: 11

Completed Projects

Control Acct No	Research Requirement Title
A11L.UAS.01	Sense and Avoid (SAA) system certification obstacles
A11L.UAS.06	Test Sites Data Collection
A11L.UAS.07	Ground Collision Severity Evaluation
A11L.UAS.09	Surveillance Criticality for SAA
A11L.UAS.10	Integration of ACAS-X Into SAA for UAS
A11L.UAS.11	Certification Test Case
A11L.UAS.15	Maintenance, Modification and Repair
A11L.UAS.24	UAS Human Factors Considerations
A11L.UAS.30	Human Factors Control Station Design Standards
A11L.UAS.35	Secure Command and Control Link with Interference Mitigation
A11L.UAS.36	UAS Detection at Airports
A11L.UAS.37	sUAS Part 107 Electronic Accident Reporting Portal

Completed Projects, cont'd

Control Acct No	Research Requirement Title
A11L.UAS.40	Part 107 Electronic Waiver Processing Development
A11L.UAS.41	Part 107 Waiver Request Case Study
A11L.UAS.42	sUAS In and Around Busy Commercial Airspace
A11L.UAS.49	Assessing the Risk of UAS Integration
A11L.UAS.57	UAS Standards Analysis: ANSI
A11L.UAS.67	UAS COE Companion Contract
A11L.X.	UAS Noise Certification

Projects In-progress

Control Acct No	Research Requirement Title
A11L.UAS.02	Sense and Avoid (SAA) System Multi-sensor Surveillance Data Fusion Strategies
A11L.UAS.07	Operations over Moving Vehicles
A11L.UAS.22	Small UAS Detect & Avoid Requirements Necessary for BVLOS Operations
A11L.UAS.23	UAS Command and Control Link Compatibility Testing
A11L.UAS.31	High Visual Contrast for UAS
A11L.UAS.38	Fuel Cell Energy Supply Systems for UAV Systems & Aerospace Applications
A11L.UAS.39	Lithium Batteries & Battery Systems for UAV Systems & Aerospace Applications
A11L.UAS.43	UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program
A11L.UAS.44	Air Carrier Operational Considerations for Unmanned Aircraft Systems
A11L.UAS.47	Minimum Detect & Avoid (DAA) Display and Flight Path Information
A11L.UAS.50	UAS Safety Case Development, Process Improvement, and Data Collection
A11L.UAS.51	ASSURE - Management Support Budget
A11L.UAS.52	eCommerce, Emerging UAS Network and Implications on NAS Integration

Projects In-progress, cont'd

Control Acct No	Research Requirement Title
A11L.UAS.53	Minority Outreach UAS as a STEM minority outreach learning platform for K-12 students
A11L.UAS.54	UAS UTM Architecture integration
A11L.UAS.58	Airborne Collision Severity Evaluation - Engine Ingestion
A11L.UAS.60	UAS Airborne Collision Severity Evaluation - Structural Impact
A11L.UAS.61	UAS Automation & Intelligent Systems
A11L.UAS.68	Disaster Preparedness and Response

New Projects

Control Acct. No	Research Requirement Title
A11L.UAS.55	Safety Research Center
A11L.UAS.62	Centralized UAS Sightings Data Repository
A11L.UAS.69	Integrating Expended and Non-Segregared UAS Operations into the NAS: Impact on Traffic Trends and Safety
A11L.UAS.70	UAS Well Clear
A11L.UAS.71	Establish Risk-Based Thresholds for Approvals Needed to Certify UAS for Safe Operation
A11L.UAS.72	Safety Risks and Mitigations for UAS On and Around Airports
A11L.UAS.73	Develop Risk-Based Training and Standards Needed for Waiver Review and Issuance
A11L.UAS.74	Establish Pilot Profiency Requirements
A11L.UAS.XX	Determine UAS Noise and Emmissions Requirements
A11L.UAS.XX	Aircraft Certification Considerations for Urban Air Mobility
A11L.UAS.XX	Identify Wake Requirements for UAS

Research Status

Detect and Avoid (DAA) Multi-Sensor Data Fusion Strategies
A11L.UAS.2

Need/Approach

Need - This research task will enable the FAA the ability to validate any minimum performance standards that might be developed and help ensure that the required safety and desired operational suitability for UAS operations being integrated into the NAS are being met

Approach

- Develop surveillance sensors software models, assess their ability to provide surveillance data and examine various data fusion strategies and tracking algorithms to develop a reference tracker.
- Develop an initial version of the UAS Terminal Encounter Model (MIT/LL)

Major Activities

Activity	Status
FY18 Interim report documenting R&D until December 2018	Complete
Initial Ver: UAS Terminal Encounter Model (MIT/LL)	Complete
Interim Report #2 documenting R&D until December 2019	02/2020
Software deliverable (Final) : Surveillance sensors and Tracker	9/2020

Period of Performance
FY2014 – FY2020

Program Manager
Deepak Chauhan, ANG-C33

Partners
NASA
RTCA Committee Members

Sponsor
Sheila Mariano, AIR-6B4

Research Performers
William J. Hughes Technical Center (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

Operations Over Moving Vehicles
A11L.UAS.7

Need/Approach

Need – This research sets out to answer several questions:

- What are the unintended effects of UAS operating over moving vehicles in the NAS?
- How does the risk hierarchy look when operating UAS over moving vehicles?
- Would UAS operating over vehicles cause more distracted driving?

Approach – This research will investigate the impact of UAS operating over moving vehicles and the hazards that it could introduce such as distracted driving. This research will also explore the potential transfer of overall systemic risk from the airspace into ground vehicle operations and understanding its impact to overall transportation safety.

Major Activities

Activity	Status
Kickoff Meeting	Complete
Conduct Literature Review	10/2019
Determine use cases and risks for UAS operations over moving vehicles	2/2020
Transition completed research to Academic performer	3/2020

Period of Performance
FY2019 –FY2020

Program Manager	Partners
Richard Lin, ANG-C21	N/A

Sponsor	Research Performers
Sabrina Saunders -Hodge, AUS - 300	WJHTC
	Civil Aerospace Medical Institute (CAMI)

Notes

- The output of this research will be used to inform possible regulations and guidelines for UAS to be utilized over moving vehicles. It will help inform different governmental agencies on how they can streamline their use of UAS over moving vehicles to ensure overall transportation safety.

FAA

NextGEN

Small UAS Detect and Avoid Requirements Necessary for Limited BVLOS Operations
A11L.UAS.22

Need/Approach

Need – This research will provide a test method recommendation to evaluate sUAS DAA systems and assess their capability to provide separation in the NAS.

Approach – Research will be completed cooperatively using the combined resources of the six ASSURE performers. This is done through expansion and development of the separation framework, coordination with standards agencies (ASTM), and flight tests to validate well clear definitions and the separation framework.

Major Activities

Activity	Status
Expanded Operational Framework	Ongoing
Standard Agency Framework	Ongoing
DAA Testing Plan	Complete
Flight Tests	Ongoing
Final Report	5/2020

Notes

Period of Performance
FY2019-FY2021

Program Manager
Michael Reininger, ANG-C21

Sponsor
Bill Oehlschlager, AUS-300

Partners
N/A

Research Performers
University of North Dakota
New Mexico State University
University of Alaska Fairbanks
Kansas State University
The Ohio State University
Mississippi State University

FAA

NextGEN

UAS Command and Control Link Compatibility
A11L.UAS.23

Need/Approach

Need - This research supports the design of robust command and control links that can achieve sufficient link availability while not experiencing or causing interference issues. Robust links will in turn support the safe integration of this new technology into the NAS.

Approach - Conduct testing to assess, validate and demonstrate the safety, security, and performance of network terrestrial and SATCOM C2 Link Systems.

Major Activities

Activity	Status
Part 1-L-Band CNPC and TACAN Compat Validation	Complete
Part 2-Part 2 Validation of L-Band CNPC compatibility	Award in Legal Review
Part 4 & 5 C2 BRLOS Link Compatibility and Interworking	In Award Process
Part 6 CONOPs and OSED for BRLOS C2 Link Systems	5/2021

Period of Performance
FY2019 – FY2021

Program Manager
Melanie Flavin, ANG-C35

Partners
RTCA-228

Sponsor
Steve Van Trees AIR-6B0

Research Performers
Part 2-WJH Tech Center
Part 4,5 SE2025 Vendor
Part 6 Marv Hammond

Notes

- This Research supports section 3.1.5.3 and 3.4 of the UAS Implementation Plan
- The results from this task will help determine the viability of use of L-Band frequencies for CNPC operations
- 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.
- The Aircraft Certification Office will implement the research outputs to develop airworthiness and operational approval guidance and regulatory material for the use of satellite CNPC Links by UAS in the NAS by 2020.

FAA

NextGEN

High Visual Contract for UAS
A11L.UAS.31

Need/Approach

Need - With the proliferation of UAS in the NAS, it is critical to reduce the risk of collision with manned aircraft. One risk reduction method will be to make Unmanned Aircraft (UA) easier for the pilots of manned aircraft to see and avoid the UA.

Approach - Determine if possible to increase the visual conspicuity of sUA to a visual observer on the ground and to the pilots of manned aircraft in the air. To make it easier to locate and track sUA, options available including paint schemes and colors to increase visual contrast and the use of anti-collision/position lighting conditions.

Major Activities

Activity	Status
Literature Review and Meta-Analysis on methods to increase sUA visibility	9/2019
Research Plan with Recommendations	12/2019
Phase 2-Develop research plan for a field study based on findings from Phase 1. Conduct field study to collect data and validate potential methods for increasing the saliency of sUA to both manned pilots and observers on the ground	TBD

Period of Performance
FY2019 – FY2020

Program Manager	Partners
Melanie Flavin, ANG-C35	

Sponsor	Research Performers
Michelle Yeh, AIR-6B4	CAMI

Notes

- Phase 2 will only occur if sponsors decide that the field study is worthwhile

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
Initiate Physical Testing- Develop detailed test plans	Complete
Initiate Physical Testing- Initiate Testing	Complete
Deliver Interim Report	Complete
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.

FAA

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.

Major Activities

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

Period of Performance
FY2016 – FY2019

Program Manager
Claude Jones, ANG-C21

Partners
RTCA WG 226, SAE AE7B, NASA JSC, UL
S&T Electrical System and Wiring Group

Sponsor
Nazih Khaouly, ANM-111

Research Performers
WJHTC
DNV-GL

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

UAS Parameters, Exceedances, Recording Rates for ASIAS A11L.UAS.43

Need/Approach

Need – Enable safe integration of UAS in the NAS through building upon existing aviation database and data-sharing efforts. Through this research, a data architecture for unmanned air and ground vehicles and operations will be developed in alignment with the FAA's ASIAS program.

Approach – The team will use a multi-disciplinary research approach and will combine appropriate quantitative and qualitative techniques. This effort will help develop system requirements for data collection and analytical capabilities needed for processing UAS safety data. This will be done through literature reviews and surveys, interviews with a diverse assortment of stakeholders, and economic and technical analyses.

Major Activities

Activity	Status
State-of-the-art UFDM Report	Complete
Report describing the safety, productivity, and economic benefits of UFDM	Complete
Parameters, Recording Rates, and Exceedances for ASIAS Report	Ongoing
Ranking UAS FDM data types by importance to safety analysis	Ongoing
Identification of data types that are common across commercial, general, and unmanned aircraft	Upcoming

Notes

Period of Performance
FY2019-FY2020

Program Manager
Michael Reininger, ANG-C21

Sponsor
Tim Evans, AVP-200

Partners
Northrop Grumman

Research Performers
University of North Dakota
Embry Riddle Aeronautical University
Mississippi State University

FAA

NextGEN

Detect and Avoid (DAA) Display and Flight Path Information
A11L.UAS.47

Need/Approach

Need - To remain compliant with 14 CFR Part 91.111, 91.113(b), and 91.181(b), as well as to integrate safely into the NAS, UAS aircraft require the capability to Detect and Avoid (DAA) other air traffic. In UAS operations, DAA guidance must be provided to aid the pilot in remaining vigilant to other aircraft in the vicinity of ownship and compensate for the inability to see-and-avoid.

Approach - This research is intended to support the development of the DAA Phase 2 MOPS by providing human factors considerations for the design and evaluation of DAA symbology

Major Activities

Activity	Status
Design experiment of the human factors considerations of current DAA alerting and guidance used to maintain well clear during heading command changes and reversals	9/2019
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.	12/2019
Technical report documenting the research findings, sensor and error model development and tracker development.	12/2019

Period of Performance
FY2019 – FY2020

Program Manager	Partners
Melanie Flavin, ANG-C35	

Sponsor	Research Performers
Michelle Yeh, AIR-6B4	CAMI

Notes

FAA

NextGEN

UAS Safety Case Development and Data Collection
A11L.UAS.50

Need/Approach

Need - Enable an enhanced test data collection framework and safety analysis tools to inform the UAS Integration Research Plan by enabling users to cross-check needs for UAS data/research with test data stored in the system as well as enabling analysis to determine if the data meets the need and whether additional data/testing would be required.

Approach - Develop the technical data requirements, test methods, risk assessments, safety risk management processes, etc. to inform safety cases in support of the UAS integration regulatory framework. Develop a system to capture test objectives and categorize them consistent with the FAA's UAS Integration Research Plan functional areas and research domains. The analysis of this data will inform the development of regulatory products (i.e. rules, standards, policy, etc.) need to reach UAS integration milestones.

Major Activities

Activity	Status
Draft overarching risk-based framework	Complete
Draft Data Schema	Complete
1st System Review	Complete
Revised System	Ongoing
2nd System Review	Upcoming
System Demonstration	Upcoming

Period of Performance

FY2019 - FY2020

Program Manager

Michael Reininger - ANG - C21

Sponsor

Paul Rumberger - AUS-300

Partners

None

Performers

University of North Dakota

Virginia Tech

University of Alaska Fairbanks

New Mexico State University

Mississippi State University

Notes

- The safety case framework will be used in subsequent research as the base process for obtaining Part 107 waivers.

FAA

NextGEN

eCommerce, Emerging UAS Network and Implications on NAS Integration A11L.UAS.52

Need/Approach

Need:

The proposed research is designed to address this particular aspect of sUAS integration by analyzing and compiling data on sUAS use of terminal areas and populated areas in their use of delivery mode so that the implications of integration can be better understood, regulatory guidance can be modified, and future investments, if needed, can be designed.

Approach:

This research proposes to gather & survey market & business intelligence, existing data & sources for UAS. The data will be compiled & gathered to support risk & hazard analysis for safety goals of the agency as new business models are incorporated.

Major Activities

Activity	Status
Task 1: Data Examination and Evaluation	4/2020
Task 2: Network and Safety Analysis	7/2020
Task 3: Emerging Network and NASA's UTM	2/2021
Task 4: Emerging Network and Environment Footprints	4/2021
Task 5: Emerging Network and Regulatory Framework	7/2021

Period of Performance
FY2019 – FY2021

Program Manager	Partners
Claude Jones, ANG-C2	NA

Sponsor	Research Performers
Michael Lukacs, APO	Mississippi State Univ

Notes

- This Research supports section 3.1.5.3 and 3.4 of the UAS Implementation Plan
- Expected outcomes are:
  - Knowledge, understanding and availability of sUAS network data for operations usage and safety risks implications.
  - Understanding of emergent network, interactions with NAS infrastructure including manned air transportation, environmental implications and associated regulations requirements for both users and the FAA;
  - Critical foundation for forecasting UAS for the entire NAS using emergent business trends, and network.

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, genders, and ethnicities.

Major Activities

Activity	Status
Drone Day at University of Alaska-Fairbanks	Complete
Summer Camp at NMSU	Complete
Summer Camp at Montana State University	Complete
UC Davis Demonstrations	Complete
Summer Camps (all universities)	Complete

Period of Performance
FY2016 –FY2025

Program Manager	Partners
Richard Lin , 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
- The long-term goal of the project is to ignite an interest in UAS/STEM and, therefore, nurture part of the possible future UAS workforce
- Next wave of work, STEM III will begin in FY20

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
Establish SWIM infrastructure contract at NIEC Lab	In Progress
Draft Pilot Program architecture plan	Complete
UTM Con Ops	Complete
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

Airborne Collision Severity Evaluation-Engine Ingestion
A11L.UAS.58

Need/Approach

Need - The use of unmanned aerial vehicles (UAVs) has increased dramatically in recent years. As the number of UAVs sold continues to increase, proper integration of UAVs into the airspace is a major safety concern due to the potential for a UAV-airplane collision. These UAVs tend to be relatively small and have the potential to be ingested into an engine.

Approach - Understand the interaction of a fan and UAV during an ingestion scenario. (i) Create a generic high bypass ratio fan model is representative of a fan in a modern engine typically found on a large commercial transport; (ii) develop model of a quadcopter UAV at the conditions of the ingestion event; and (iii) simulate various ingestion events to understand the sensitivity of a collision to various parameters

Major Activities

Activity	Status
Representative High Bypass Ration Fan Model,	In Progress
Bird Ingestion and Blade out Test Cases	In Progress
Completion of Ingestion simulations, data analysis and final report	9/2020

Period of Performance
FY2018 – FY2020

Program Manager
Melanie Flavin, ANG-C35

Partners
ASSURE COE

Sponsor
Jorge Fernandez, ANE-111

Research Performers
THE Ohio State University
Wichita State University
University of Alabama Huntsville

Notes

FAA

NextGEN

Airborne Collision Severity Evaluation-Structural Impact
A11L.UAS.60

Need/Approach

Need - The effect of an airborne collision between a UAS and a manned aircraft is a concern to the public and government officials at all levels. While the effects of bird impacts on airplanes are well documented, little is known about the effects of more rigid and higher mass UAS on aircraft structures and propulsion systems.

Approach –

1: Identify the probability of impact deflection due to boundary layer interactions.

2: Evaluate the severity of small UAS collisions with Rotorcraft.

3: Evaluate the severity of small UAS collisions with General Aviation.

Major Activities

Activity	Status
Representative High Bypass Ration Fan Model,	In Progress
Bird Ingestion and Blade out Test Cases	In Progress
Completion of Ingestion simulations, data analysis and final report	9/2020

Period of Performance
FY2019 – FY2020

Program Manager
Melanie Flavin, ANG-C35

Sponsor
Sabrina Saunders-Hodge, AUS-300

Partners
ASSURE COE

Research Performers
Wichita State University
University of Alabama Huntsville
Montana State University
Embry-Riddle Aeronautical University

Notes

FAA

NextGEN

UAS Automation & Intelligent Systems
A11L.UAS.61

Need/Approach

Need - This Research Requirement documents the need for research related to automation and intelligent systems. This research will develop a long-term automation strategy to work towards approval of intelligent systems. This program proposes a phased approach beginning with UAS and moving toward cargo and passenger carrying aircraft. The intent is to identify considerations for certification, including general human factors. The execution of this research requirement attempts to address both systems certification criteria and human factors considerations in coordination.

Approach - (Tentatively) Two Phased Research Approach

Major Activities

Activity	Status
Identify State-of-the-Art in Automation across all Modes	T+6
Development & Integration of new Cockpit Interface in a Simulator	T+10
Develop Test Scenarios for New Aircraft & Automation Tech	T+12
Draft Report identifying new & current automation needing policy	T+8
Draft Report characterizing human contributions to system safety	T+14

Period of Performance
FY2019 – FY2021

Program Manager
Philip Maloney, ANG-C35

Partners
NASA
The Ohio State University
University of Michigan

Sponsor
Michelle Yeh, AIR-6B4

Research Performers
WJHTC, ANG-E271

Notes

- The Research Requirement & PREP are currently under review and tasking/deliverables may change.
- The ASSURE COE may be contributing to the second phase of this research
- **Expected Outcomes**: (1) Collaboration with industry to investigate the state of the art of automation in the field, (2) Identify the challenges for evaluation of these systems and recommended solutions for filling those gaps, and (3) Develop a research plan for evaluating the impact of increased automation for the operator/monitor.

FAA

NextGEN

Back Up Slides