



Establish Recommendations for Pilot Certification Requirements for Multi-Unmanned Aircraft Systems (UAS) Operations

A26 A11L.UAS.74

William Oehlschlager August 31<sup>st</sup>, 2021

#### Categorizing UAS Integration Research: Research Informs Operational Capabilities



#### Research Purpose

- Identify knowledge gaps that are currently a barrier to the safe, efficient, and timely integration of systems composed of multiple unmanned aircraft (UAS) into the NAS
- **Define operating scenarios** where the multiple UAS may be operating in said scenarios that include *n* UAS that have *n* unique paths distributed over an area of operation
- Coordinate with industry stakeholders on how multi-UAS operations have currently been investigated, and determine gaps in current multi-UAS operation risk-mitigation strategies
- Explain current gaps in the package delivery field so that FAA stakeholders, such as BEYOND and PSP, can start to showcase knowledge in this field





- The FAA Integration Pilot Program (IPP), Partnership for Safety Plan (PSP), and other operational approval programs have begun investigating the UAS industry's desire to operate multiple UAS at once
  - Intel multi-UAS light shows were the first approved multiple UAS operation, due to strict flight limitations
  - FAA IPP investigated several operations that could utilize multi-UAS, ranging from home-health safety to package delivery
- Package Delivery, Disaster Preparedness, Agriculture operations are beginning to investigate the safe ratio of pilot to UAS
- The research is meant to discuss the following points:
  - Human factor limitations
  - Human factor differences for a single pilot controlling multiple UAS vs. a technician monitoring automated UAS
  - Defining preliminary training and certification insights to be researched





# Legislative Direction

- Research supports:
  - Human in the loop (HITL) testing will be used to identify both best practices and gaps that will need to be filled. The sponsor intends to use the results of the research to accelerate integration of UAS into the NAS and shape policy.
  - It will also inform **development of modified regulations and/or new regulations**, standards and guidance regarding UAS crewmember training and certification.
  - **Development of guidance** for identifying the one pilot to many UAS fatigue factors and the impact of autonomy is expected. The goal of this research is to standardize UAS pilot training/certification, and procedures to facilitate UAS pilots' transition from one UAS to another





# Projected Benefit of Research

#### Policy

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- Determine the ability and policy implications of operations that contain multiple UAS to a single pilot
- Understand the policy implications of different CONOPS that may utilize multi-UAS strategies, and how that data per each CONOP can drive universal operational assessments of multi-UAS operations

#### **Concept Development**

- Identify human factors differences, limitations and use cases for operating multiple UAS
  - Use Cases include: Package Delivery, Agriculture, Disaster Preparedness, etc.
- Identify available control systems, capabilities, limitation and maturity levels of automation and situational awareness protocols for pilots operating multiple vehicles at once
- Determine and model predicted limitations for pilots and automation systems, and describe the balance between the human-machine interface



# **Research Approach**

- Task 1: Literature Review
  - Categorization of literature findings and identification of research gaps.
- Task 2: Peer Review
  - A peer reviewed Research Transition Plan (RTP) and report detailing other potential multi-UAS research areas that are outside the scope of this project and need further study.
- Task 3: Assess Human Factors Limitations
  - An initial analysis of human factors limitations to monitoring multiple UAS to include identification of potential hazards, mitigations and controls.
- Task 4: Assess Required Aptitude and Human Factors Differences for Pilots Controlling Multiple UAS vs. Technicians Monitoring
  - A computational predictive analysis of human factors outcomes to include identification of potential hazards, mitigations and controls.
- Task 5: HITL Simulation
  - A completed HITL evaluation to collect empirical results for validation.
- Task 6: Final Report
  - Compilation of a comprehensive report that covers the entirety of this research effort.





# Research Team & Level of Effort

• Sponsor

- Sabrina Saunders-Hodge, AUS-300
- FAA Co-Sponsor:
  - AFS
- Research Partners:
  - FAA's Center of Excellence for UAS Research, Alliance for System Safety of UAS through Research Excellence (ASSURE)
    - Oregon State University
    - Drexel University
    - Kansas State University

- Primary Technical Monitor
  - Katie Constant-Coup (AUS-310)
- ANG-C2 PM
  - Zachery King (ANG-C21)
- Expected level of Effort by Fiscal Year
  - \$0.500M FY18



#### Status

- Task 1 Literature Review Report
  - Final draft under FAA review.
- Task 2 Stakeholder Focus Group
  - Meeting #1 is scheduled for 5/19. It will be an introductory meeting of the research team and FAA SMEs/Stakeholders to hear from the research team on the scope and major questions to be answered in the research.
- A28/A26 Collaboration
  - Collaborating with A28 Disaster Preparedness and Emergency Response research project to determine how some A26 multi-UAS use cases could be used to inform a subset of use cases for A28 flight testing
  - Wildland Fires aerial surveillance use case is the frontrunner
  - The A26 SFG (5/19) will be meeting prior to the A28 peer review (6/7)
- Industry Partnership with Wing
  - OSU has entered an NDA with Wing, which prohibits the use of any proprietary information in reports.
  - OSU will generalize the use case and modeling development to ensure they end up with something deidentified from Wing's unique use case.





# Key Accomplishments to Date

- Kickoff held April 2020
- Literature Review Report completed March 2021
- A26/A28 Collaboration Meeting held May 2021
- Task 3 Assess Human Factors Limitations Aug 2021
- Task 4 Assess Required Aptitude Aug 2021



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#### Future Plans

• Task 5 – HITL Simulation: 11 Jan 2021 – 11 May 2022





#### Master Schedule



- Task 1 Literature Review: 12 Feb 2020 11 Oct 2020 (March 2021)
- Task 2 Peer Review: 12 Feb 2020 11 Nov 2020 (April 2021)
- Task 3 Assess Human Factors Limitations: 11 Sept 2020 11 Aug 2021
- Task 4 Assess Required Aptitude: 11 Oct 2020 11 Aug 2021
- Task 5 HITL Simulation: 11 Jan 2021 11 May 2022
- Task 6 Final Report: 11 April 2022 11 July 2022



# Challenges and Risks

• N/A





# Questions?



