Introduction to Uncrewed Aircraft Systems (UAS) for Atmospheric Science

This form is designed as a companion tool for the online course "Introduction to Uncrewed Aircraft Systems (UAS)". **Please use the spaces in this form to submit your answers to the assessment questions embedded throughout the course.**

Once submitted, you can follow up with ceee@colorado.edu to receive your micro-credential through the University of Colorado Boulder.

You can access the online course here: https://ceee.colorado.edu/online-workshops/introduction-uncrewed-aircraft-systems-uas-atmospheric-science.

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Lesson One: Introduction to UAS research at CU Boulder

Why use drones? *

They allow remote control navigation and integrate sensors that can record in real time any environmental change. Additionally, they can fly around and through climate phenomena

What does IRISS stand for? *

Integrated Remote and In-Situ Sensing

What are some of the recent areas of research IRISS has been involved in? *

Mapping of archaeological sites and developing research even outside the STEM field, including legal, ethical, social, and cultural implications

Define the major features of each of these eras: 1) 1995-2003 Early Years; 2) 2003-2007 Coalescence: Research and Engineering Center for Unmanned Vehicles (RECUV); 3) 2007-2015 Building Partnerships, Maturing Technologies, and Leading Airspace Integration; 4) 2015-Present: IRISS, MUSAS, and Expanding Partnerships. *

- 1995-2003 Early Years : Construction of remote-control aircraft. Initially powered by gas
- 2003-2007 Coalescence: Research and Engineering Center for Unmanned Vehicles (RECUV): Federal funding projects to develop mobile communications including sensors, computers, and radio equipment
- 2007-2015 Building Partnerships, Maturing Technologies, and Leading Airspace Integration: Advancement of regulations and FAA permission to fly in the national Airspace System. The Vortex 2 project was developed during this era
- 2015-Present: IRISS, MUSAS, and Expanding Partnerships: Redefine the use of UAS to target observation phenomena, working with meteorologists CU colleges.

Lesson Two: Overview of MUSAS platforms and equipment

Which platform would be best suited for vertical flight with a significant payload? *

Helix

Which platform can fly for over two hours? *

The Raaven

Which platform is easiest to transport due to its size and weight? *

The Conptersonde 3

Which platform has the largest wingspan? *

The Super Raaven

In addition to multiple UAS platforms, which tools does MUSAS use to conduct field research? *

Ford Explorer vehicles, a catapult system to launch the RAAVEN, and the MURC, which has monitors, computer infrastructure, and a mountable weather station

Lesson Three: Rules of the Sky

What does it mean to operate as a class G UAS? *

It means the operation is running in uncontrolled airspace. The UAS must weigh less than 55 pounds and be operated by a pilot who has passed a knowledge test

What is a COA? *

A Certificate of Waiver or Authorization (COA) is issued by a government agency and enables operations outside the standard Part 107 rules, ensuring acceptable operational safety.

Why might you need a COA? *

To ensure that a crew can conduct safe operations within the controlled airspace system

Which section of the FAA rules governs UAS flight? *

Part 107 (Chapter 1, Subchapter 7)

Lesson Four: Fun with FARE and FIRP

What is the purpose of FARE? *

Provides community access to research infrastructure.

What is the difference between LOAF and a CIF? *

LOAF is focused on providing access to services and labs, while CIF is more focused on being a resource for scientists who need specialized equipment for lab-based studies or educational purposes

Do the following represent components of an LOAF or a CIF? *

Yes, because FIRP describes the mechanism by which the research community can propose projects that require access to instrumentation and facilities sponsored by FARE.

Why would I need a FIRP? *

To formally request use of FARE facilities for a research project

What are the three FIRP tracks? *

Education and Outreach, Single Facility Request, and Field Campaigns

Lesson Five: Case studies

What is the MoSAIC project? *

It was a year-long international expedition based in the Arctic, studying sea ice and the impact of heat transfer, near-surface atmospheric conditions, and the effects of ice breaking apart.

What does ICECHIP study? *

It studies how hail moves within storms, trying to model and analyze the patterns of hail formation and behavior.

What was learned during the TORUS project? *

Through observation, it was possible to observe the evolution of storm dynamics. They found that pre-existing air mass boundaries affected the genesis and dynamics of a storm/tornado, and in May 2019, a study led to the finding that the environment did not support tornado formation, even when conditions suggested otherwise. All of this was achieved even when the data was limited.