NC STATE UNIVERSITY

Search & Rescue / Terrain and Environmental Mapping (STEM) Drone





Department of Mechanical and Aerospace Engineering

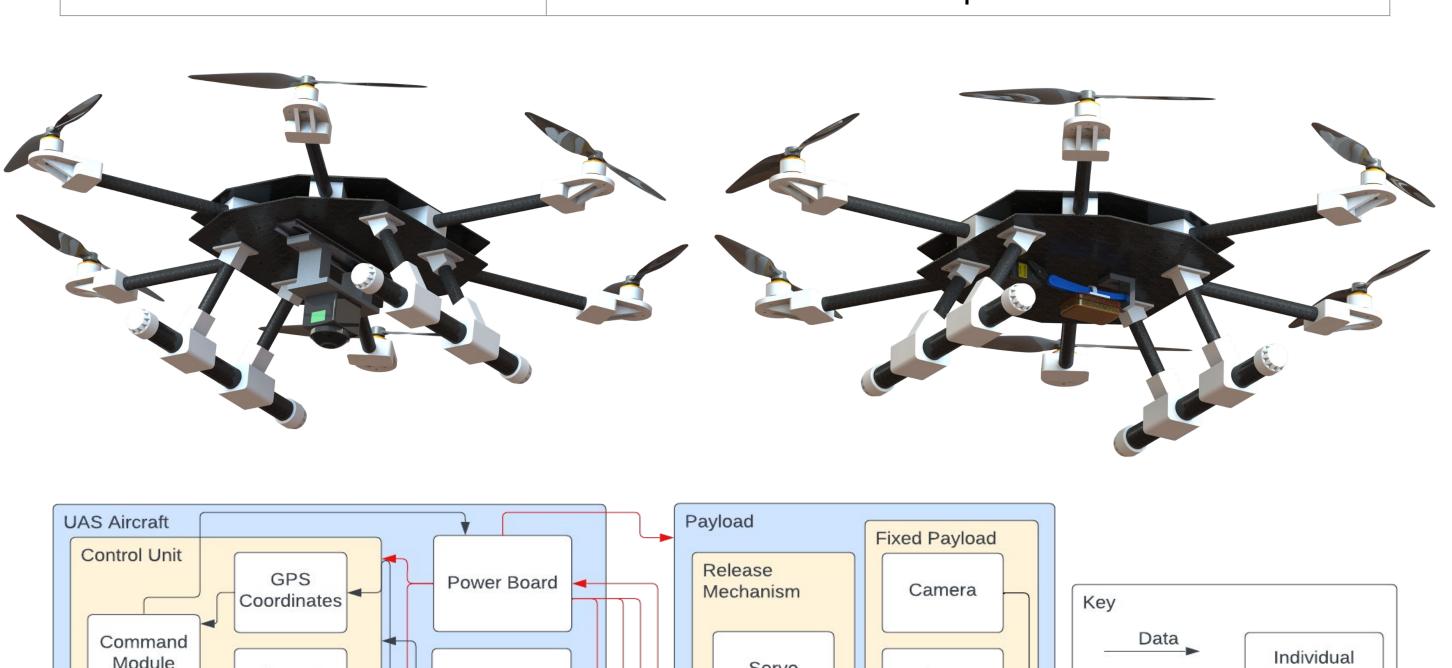
Aerospace Engineering Capstone Senior Design 2022-2023

Team Members: Andrew Gantt, JD Shropshire, Chris Bain, Fernanda D'Agostini Barsanti, and Sam Wood

Course Instructor: Dr. Felix Ewere | TA: S M Abu Naser Shovon | Sponsor: Engineering Trust Fund | Customers: Kevin Gitushi, Michael Hughes and Tom Freeman

Design Solution

Subsystem	Components	
Structures	Carbon Fiber 3D Printed Plastic	
Propulsion	SunnySky X2212 980kV Motors Quanum 11x5.5 Carbon Fiber Propellers	
Controls	DJI NAZA-M V2 Flight Controller FEICHAO 40A Brushless ESC	
Power	Lumenier 16000mAh 4s LiPo Battery Voltaic Systems 1.2W Solar Panel	
Payload	PIXPRO SP360 4K Camera Coleman All-Purpose First Aid Kit	



Functional Prototype

Ground Control

Transmitter

FPV Image

Processing

GPS

Location

Data/Image

RC Reciever

Acceleromete

Compass



Parameter	Mapping Payload	Release Payload
Endurance (min)	24	15
Thrust to Weight Ratio	2.5	3.0
Weight (lbs)	9.7	7.6
Dimensions LxWxH (in)	26.9" x 30.5" x 7.7"	

Team Organization | Chris Bain | Systems Engineer | CAD and Simulation | Structures | Safety Lead | Structures | Safety Lead | Structures | Safety Lead | Structures | Structures | Safety Lead | Structures | States | Safety Lead | Structures | Safety Lead | Structures | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stability and Control | States | Safety Lead | Stabilit

Project Overview

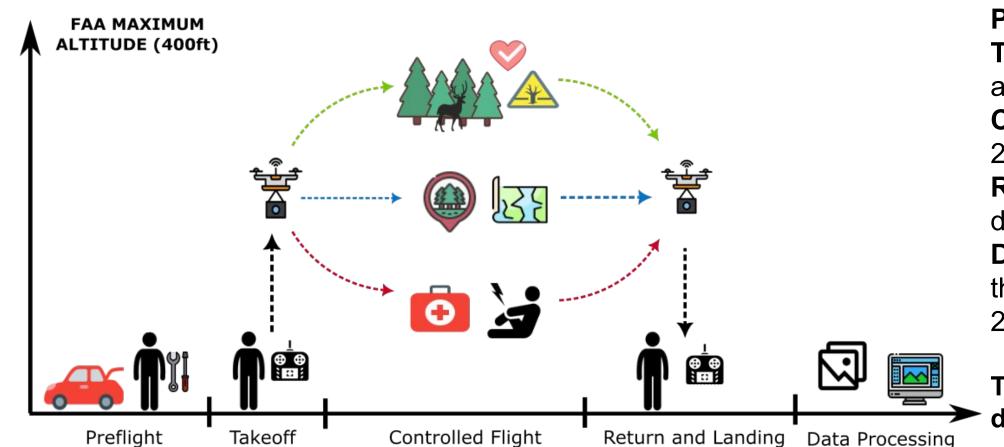
Need Statement: There is a need to develop and produce technologies that can provide rescue/first aid support and achieve the task of conservation and management through monitoring and mapping of landscapes.

Mission Statement: Team Hexadion will construct a multicopter equipped with 2 or more electronic power sources, mapping and surveillance capabilities for assessing the health of North Carolina's natural forests, as well as provide emergency assistance to individuals in need.

Mission and CONOPS Overview

Mapping and Surveillance Mission: Terrain mapping and environment surveillance using a 4K payload camera for monitoring wildlife, plant health, and environmental terrain.

Search and Rescue Mission: Provide emergency medical care by delivering a first aid kit to an injured recreationalist until the rescue team arrives at their location.



Preflight: Multirotor assembly.

Takeoff: Vertical ascent to desired

Controlled Flight: 1. Surveillance, 2. Mapping, 3. Search and Rescue. Return and Landing: Descent and disassembly.

Data Processing: Processing of the image data from missions 1 and 2 for analysis.

The UAS hybrid power is active during takeoff until landing

The UAS will have radio frequency capabilities and will broadcast Remote ID information throughout takeoff and landing

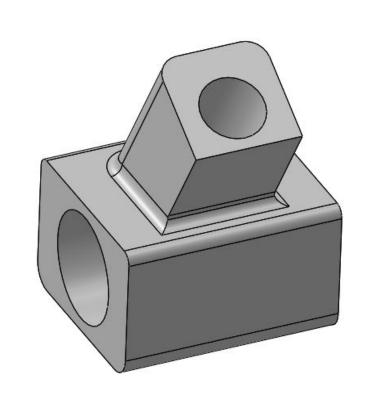
Cost Breakdown Subsystem Cost \$184.43 **Structures** Structures 21.4% \$230.17 **Propulsion** \$272.00 Controls \$15.50 **Power** \$159.50 **Payload** \$861.60 **Total** Propulsion 26.7% \$1000 **Allotted** \$138.40 Surplus

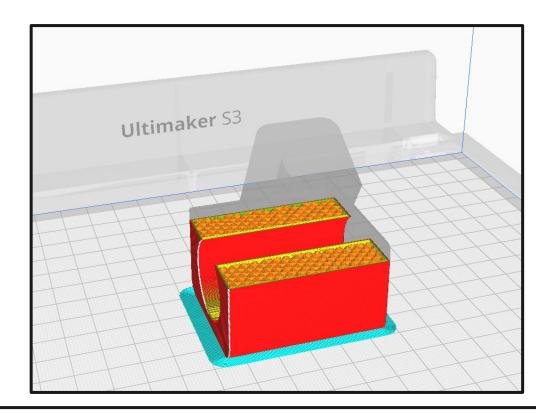
Manufacturing

The manufacturing process for the STEM drone begin in January of 2023 at the beginning of the spring semester and was completed before the Flight Readiness Review Report on February 24th. This manufacturing process primarily consisted of cutting and sanding the composite base, arms, legs, and sleds, as well as 3D printing all of the connection pieces. Soldering and wiring of the electrical components was also completed before the adhesion and assembly of the structural and controls subsystems. After assembly, the propulsive and payload systems were added to complete the STEM Drone.











Flight Test and Mapping

On March 24, 2023, the HEXADION UAS conducted its final flight tests to verify the drones ability to complete both of it's designed missions.

Both missions were a success and video footage was recorded and post processed to create the 3D map of the flight test area shown below.











