

UC Irvine

SSOE Research Symposium Dean's Awards

Title

UAV Forge Unmanned Aerial System

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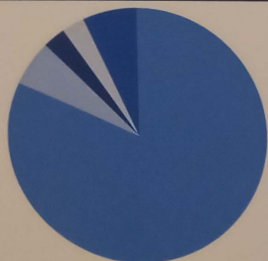
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Peer reviewed

ABOUT US

- Participate in the AUVSI SUAS competition
 - Compete against international teams
 - Location: Webster Field, Maryland
 - Date: June 15th, 2022
- Build an unmanned aerial system that:
 - simulates package delivery
 - accomplishes path planning
 - performs object detection, localization, classification, and air delivery

TOTAL COST



- Aircraft
- UGV
- Navigation
- Communications
- Imaging

Estimated cost including competition expenses
~\$15,000

TESTING PLAN

	DATE	TESTS
WINTER	JAN 15 - 29	Static Thrust Auto T/O and Land Manual Flight
	FEB 5 - 26	Auto Waypoint Auto Flight Descent
	MAR 5 - 26	Imaging Static obstacle avoidance Detect & Classify
SPRING	APR 2 - MAY 21	Dynamic obstacle avoidance Geolocation & Mapping Airdrop Full Mission Testing

UNMANNED AERIAL SYSTEM (UAS)

Unmanned Aerial Vehicle (UAV)

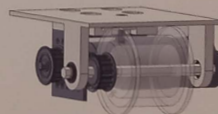
- Six electric motors
- 20kg thrust capacity
- 23 minute flight time
- Modular airframe
- High-bandwidth WiFi

Performs ODCL, Mapping, Obstacle Avoidance → Payload Delivery

The Copter V3.0



Drop command → winch activates



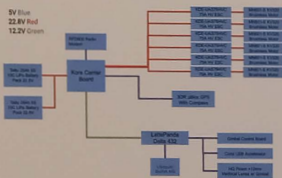
Descent: Winch System

Fishing line unspools → line is cut to detach UGV



UGV 3D Model

Lands → Autonomously Delivers Payload



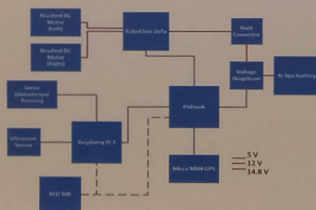
UAV Power Architecture

Descent and Decoupling

- Structure printed from PETG
- 5.2:1 pulley gear ratio, 25 second descent time

Unmanned Ground Vehicle (UGV)

- Custom suspension
- Omnidirectional navigation
- High toughness



UGV Power Architecture



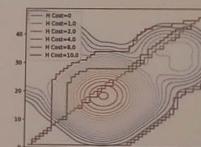
Image Stitching Output using webODM

Mapping

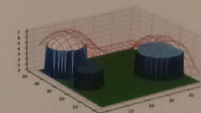
- Combine multiple smaller images into terrain map
- Utilizes GPS data to accelerate computation

Path Planning

- Optimization function generates constraint surface for UAV flight path
- A* algorithm used to traverse surface



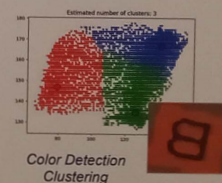
A* Algorithm Cost Heuristics



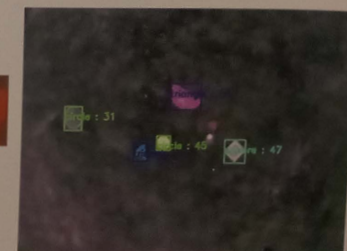
Planar surface in R³ for Obstacle Avoidance

Object Detection, Classification, and Localization

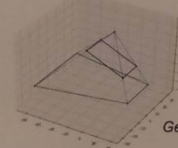
- 4k resolution images
- EfficientDet deep learning architecture



Color Detection Clustering



ODCL Test Result



Geolocation Projection