



Team #32 Reaper Drone

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Objective Statement

The objective of Team #32 is to win an aerial drone competition while remaining within the allocated budget. The drone must use machine learning to identify and collect data on certain specified features.

Background

The competition requires the drone to have a 3D printed body, identify objects and their location, and meet certain marks on flight performance.

Safety

- Return to Home Feature (Signal Loss)
- Running Lights
- Failsafe & Killswitch
- System Warnings on OSD
- Precautions for LiPo Batteries
- 3D Position-Hold Flight Mode

Engineering Specifications

Specification	Projected Specs	Actual Specs
Weight	<2.5 kg	2.32 kg
Flight time	25 min	28 min
Flight Range	1.75 miles	1.5 miles
Budget	\$1,800 USD	\$2,506.27 USD

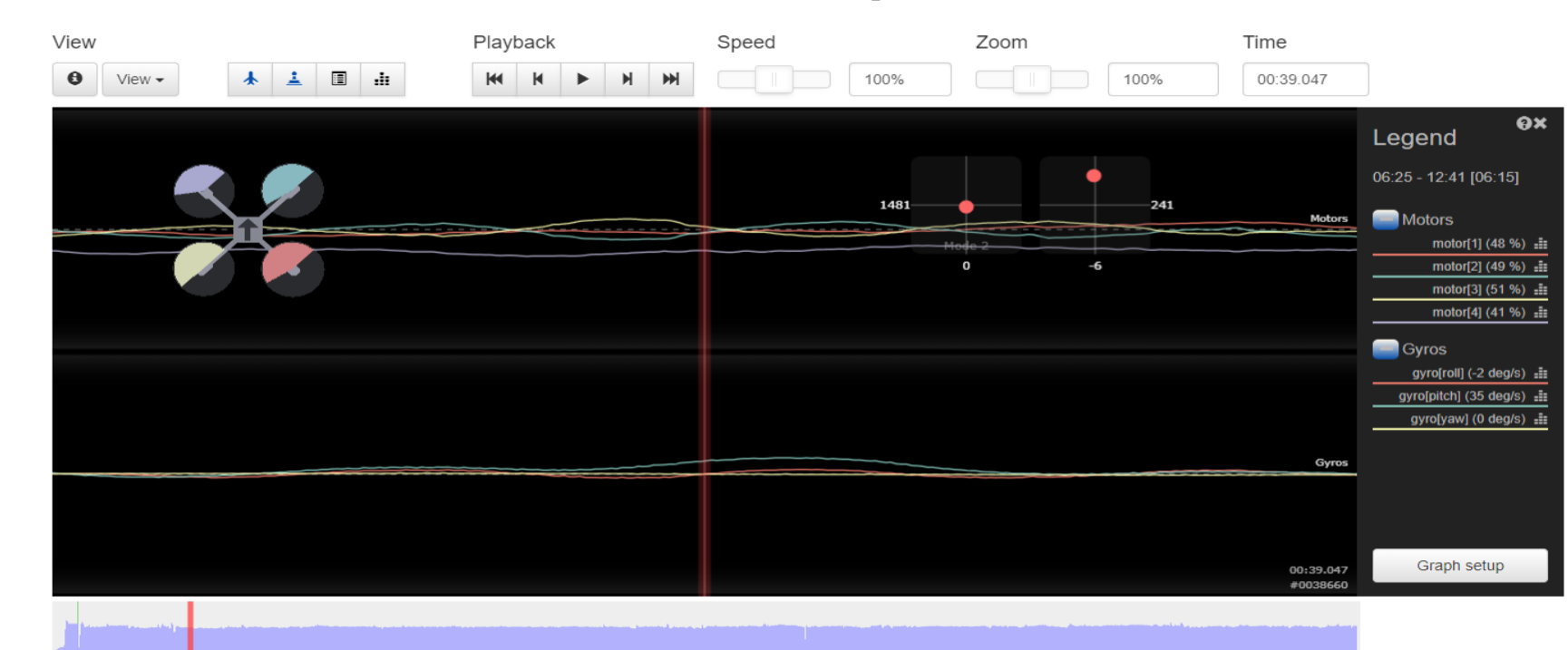
Test Flights Found Below



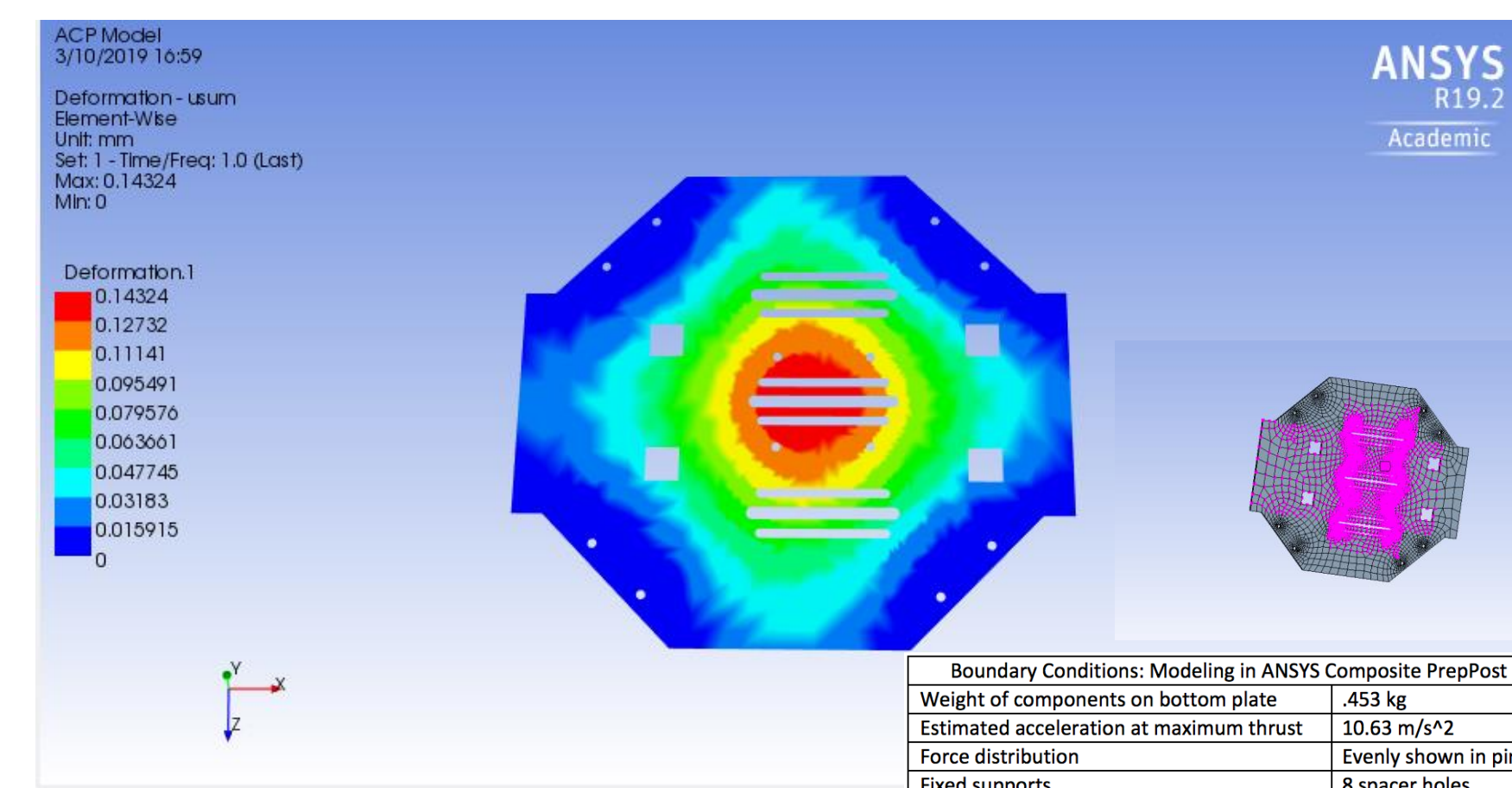
Drone and Flight Analysis



The Reaper



Blackbox Data Explorer



Structural Analysis



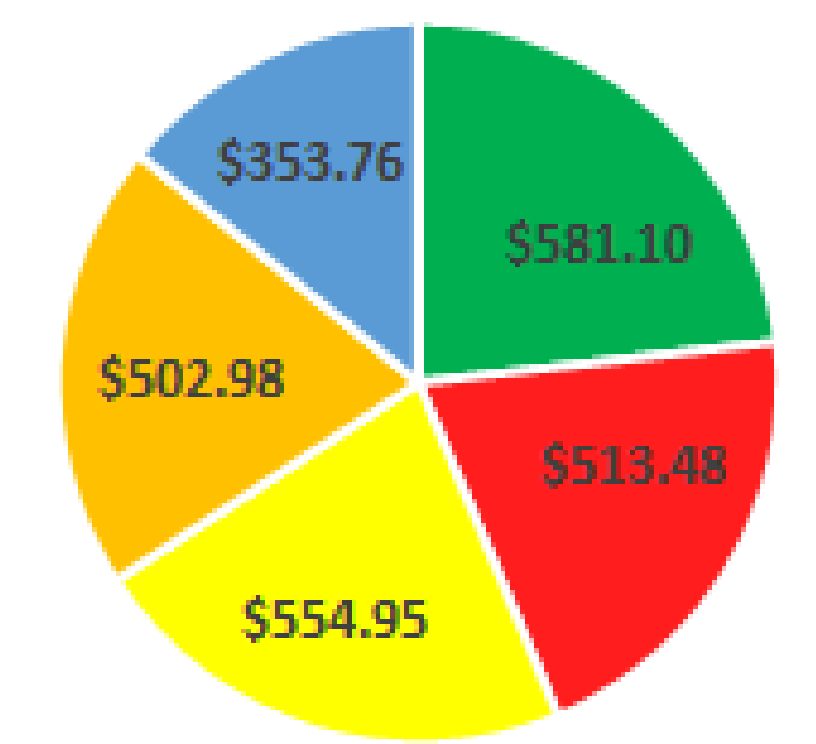
3D Mapping of Competition Flight

Regulations and Standards

- FCC Part 15 puts restrictions on signal strength and allowed bandwidths.
- FAA gives regulations and rules on operating drones.
- LSU Drone Guidelines

Budget

- Object Detection System
- Flight System
- Communications and Controls
- Structure
- Power



Total: \$2,506.27

Electrical Systems and Analysis

Flight Time Consideration

- Initial calculations gave an estimated flight time of 25 min.
- An actual flight time of 28 minutes was achieved with ~8% battery capacity left to use without over-discharging the 12500 mah battery.

Flight Range Consideration

- Ideal calculations and range analysis gave an estimated operational range of 1.75 miles
- An actual operational range of 0.8 miles was acquired.
- The team believes this was due to the testing method used being susceptible to the multi-path effect.
- Due to the visual line of sight restrictions from the FAA, the team could not conduct a true range test and fly the drone to the specified range.

Object Detection and Identification

- Onboard object detection system that utilizes the Tiny YOLO v3 algorithm
- Runs on NVIDIA Jetson TX2 module mounted on an Orbitty carrier board
- Identifies structures on the ground and determine the condition and geolocation of structures.
- Capable of detecting airplanes, fire trucks, train cars, fuel tanks, and semi tractor trailers, as well as fire damage and collision damage on the listed objects



Image of airplane located at LSU FETI that has been processed by the trained object detection system.



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