



### Team #41 Project Orb

Brandon Clancey (ME), Luis Diaz (EE), Vuong Huynh (ECE), Scott Laiche (ME),  
Spencer Link (EE), Chris Myers (ME), Joshua Vrettos (ME)

*Jack Rettig*

#### 1. Objective

Design an aerial drone with a 3D printed body that is capable of classifying objects based on their dimensions and condition.

#### 2. Engineering Specifications

Specification	Goal	Actual
Flight Time	≥20 minutes	~14
Range	≥1.5 Miles	0.764

#### 3. Competition

- Object Detection
- Flight Time
- Range
- Strength of Materials
- Advantages of 3-D printing



Aerial View FETI

#### 4. Object Identification



- YoloV3 detection model
- 7-10 frames/second
- Processing done on GeForce GTX 860M

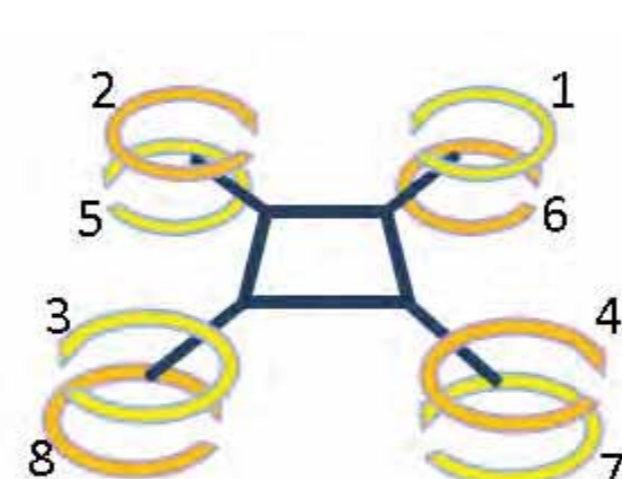
#### 5. Assembled Prototype



\*Not Pictured

Team Milestones	Dates
Motor Tests	2/14/2019
Completed assembly of Electronics	3/12/2019
Completed assembly of drone	3/14/2019
Connected 4G for Camera	3/14/2019
First successful flight	3/25/2019
Competition phase 1	4/5/2019
Competition phase 2	4/17/2019
Competition phase 3	4/17/2019

#### Rotation of propellers



#### 6. Manufacturing

Frame & Arm Composite Layout

Images produced via Markforged X7 Eiger software

Advantages of 3-D Printing:

- High Resolution
- Individual fiber orientation selection
- Able to lay inner components mid-print
- Rapid prototyping and redesign
- Little to no wasted material
- Complex geometries easily created
- Quick part replacement

3-D Printed Composite Material	
Matrix (White)	Nylon mixed with chopped Carbon Fibers (Onyx)
Reinforcement (Blue)	Carbon Fiber or Fiberglass

#### 7. Safety

- | Electrical Components   | Mechanical Components  |
|---|--|
| <ul style="list-style-type: none"> <li>• Battery Safety</li> <li>• Loss of communication</li> </ul> | <ul style="list-style-type: none"> <li>• Clearance between propellers</li> <li>• Kill Switch</li> <li>• Pedestrian clearance from drone</li> </ul> |

#### 8. Analysis

Arm Free Body Diagram:

Cross-Section:

ANSYS Model:

**Mechanical Component Strength**

Onyx-Carbon Fiber (Arm)	26.9 GPa
Onyx-CF (Frame)	19.3 GPa
Polyactic Acid (PLA)	3.5 GPa

**Other Component Information**

Battery Discharge	240A
Power	268.8W
Average Current Drawn	58.06A
Flight Time (Minutes)	13.23
Battery Voltage (Full)	16.8V
Battery C-Rating	15C
Battery Capacitance	16000mAh
All Up Weight	6.53 lbs

#### 9. Testing



Motor Test

Material Tests

#### 10. Budget

Component	Price
Material	\$767.99
Electronics	\$741.71
Motors	\$558.93
Camera	\$399
Coaxial Mounts	\$78.12
Props	\$51.72
<b>Total</b>	<b>\$2547.47</b>

#### 11. Recommendations for Improvement

- More efficient motors for higher thrust to weight ratio
- Higher quality speed controllers to avoid burnout/replacements
- Dedicated server for unlimited range over 4g

January

February

March

April

3D Printing of Parts

Testing of Parts

Assembling of Parts

Hardware and Software Integration

Competition