

Thomas Jefferson Unmanned Aerial Vehicle Club





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Our Team

The Thomas Jefferson Unmanned Aerial Vehicle (TJUAV) Team seeks to teach students about the basics of aeronautical design, flight, and programming by designing and manufacturing an autonomous aircraft for the Association for Unmanned Vehicle Systems International's annual Student Unmanned Aerial Systems Competition (AUVSI SUAS). The team works with technologies such as fixed wing and multirotor aircraft, flight computers, and computer vision to achieve the required capabilities of autonomous navigation, object detection and classification, and payload delivery.



Left Eight team members with the *Avalon v1* at the testing field.

Above, Top The *X8* in flight.

Above, Bottom Seven team members holding the *X8*, a flying wing, while at the testing field.



Mechanical Subteams

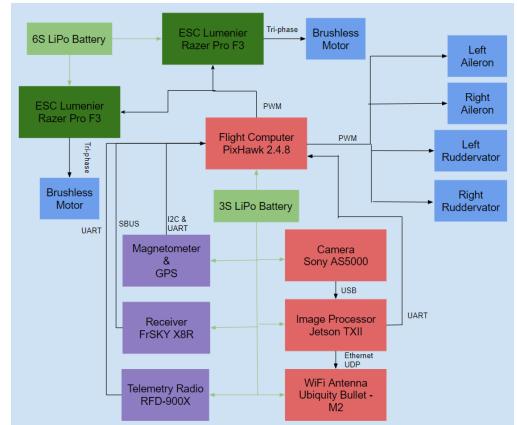
Airframe

The Airframe subteam evaluates mission requirements to design and build an airframe that best meets the competition objective. The subteam plans plane components with CAD software, such as Autodesk Fusion 360, and realizes the designs by 3D printing, laser cutting, and assembling different parts of the airframe.



Electronics

The Electronics subteam is responsible for organizing and wiring the electronics in the aircraft to allow for proper power distribution and wired communication between components. They also configure electronics in the ground station, such as the antenna tracker, telemetry antennas, and router, that connect all of the ground station computers together.



Unmanned Ground Vehicle (UGV)

The UGV subteam designs and builds a UGV that is lighter than 64oz and is capable of delivering a standard 8oz water bottle to a target location. Additionally, the UGV subteam must design a drop mechanism so that the UGV lands safely, is as close to the specified location as possible, and is able to drive after landing.

Top Plywood wing manufacturing being tested for feasibility.

Middle Systemic electrical diagram for the plane.

Bottom UGV testing on blacktop.



Programming Subteams

Autopilot

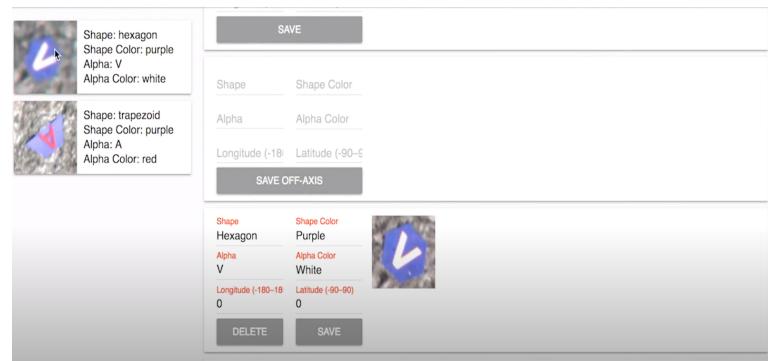
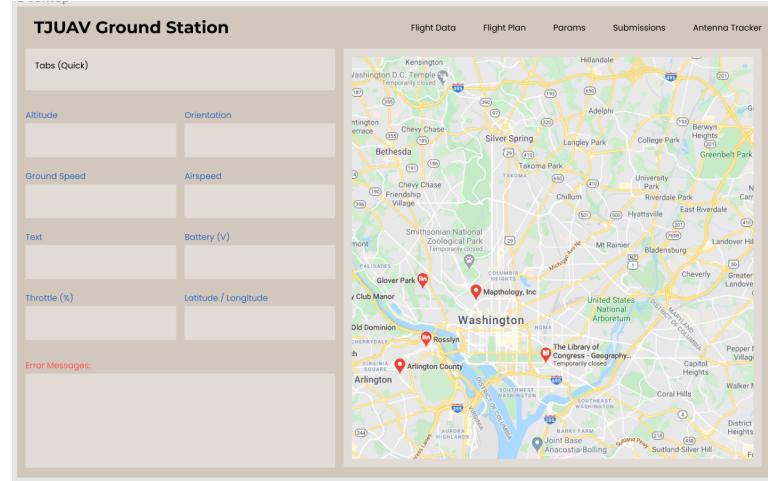
The Autopilot subteam programs and tests a system that can fly the aircraft without the need for human intervention. They also work with the ground control station to plan a flight path that hits all of the waypoints while avoiding obstacles.

Communications

The Communications subteam designs and programs a method to wirelessly relay data between the aircraft and ground station so that the plane can be tracked by the ground station at all times. They also communicate with the competition server to submit telemetry data and any targets that are found.

Imaging

The Imaging subteam programs an algorithm to capture images in flight, parse them, and return useful information to the ground station. Additionally, they program a computer vision algorithm that is used to autonomously detect the presence of targets in the aerial images and classify them.



Top Custom-made ground station software during development.

Middle Human verification system for computer-recognized targets.

Bottom Training target data.



The Competition

AUVSI SUAS is an international, collegiate competition that has hosted over 75 teams in recent years. AUVSI's mission is to simulate an unmanned search and rescue situation.

The competition will be held at the Naval Air Station in Patuxent River, Maryland on June 15-18, 2022.

There are three deliverables:

Technical Paper (20%)

The Technical Paper is a rationale for and technical overview of the system design.

Flight Readiness Review (20%)

The Flight Readiness Review is an introductory video showing the team, system design, and capabilities.

Mission Demonstration (60%)

The Mission Demonstration is a live demonstration of the UAS's ability to perform competition tasks in a restricted timeframe. These tasks include autonomous flight through waypoints, maneuvers around obstacles, detection and classification of ground targets using onboard imagery systems, and submission of live telemetry data to the competition servers.



Razgriz Technical Design
TJ UAV

2019 AUVSI SUAS Competition
Thomas Jefferson High School for Science and Technology



TJ UAV 2019



Top The X8 (named Razgriz)
Technical Paper.

Middle Flight Readiness Review
Video on YouTube.

Bottom A quadcopter team
attempting the UGV drop during
Mission Demonstration.



Accomplishments

2019

AUVSI SUAS 2019 was TJUAV's first time competing. The team developed the Razgriz, a Skywalker X8 airframe that was modified to fit radios in the fuselage for communication and a camera in the nose for imagery.

Out of the 75 teams competing at the 2019 AUVSI Competition, TJUAV placed 23rd overall and 18th in Mission Demonstration. The team achieved over 20 minutes of flight at the competition.



2020

The team developed Hyperion, a Skywalker Titan airframe that was modified to fit a UGV payload drop mechanism, radios for communication, and a camera gimbal for the imagery system.

Due to the threat of COVID-19, the 2020 AUVSI SUAS competition was cancelled.



Above The Razgriz doing the Mission Demonstration.
Left The Hyperion before flight at the testing field.



Accomplishments

2021

The team constructed the Avalon v1, the first plane entirely of their own making.

The team also developed a testing plane to gain building experience and assist the programming subteams with gathering training data.



Due to the threat of COVID-19, the 2021 AUVSI SUAS competition was cancelled.

2022 & Beyond

At the start of the school year, the team modified Avalon v1 by interchanging its foam board wings for a monokote covering, a plastic shrink wrap material.

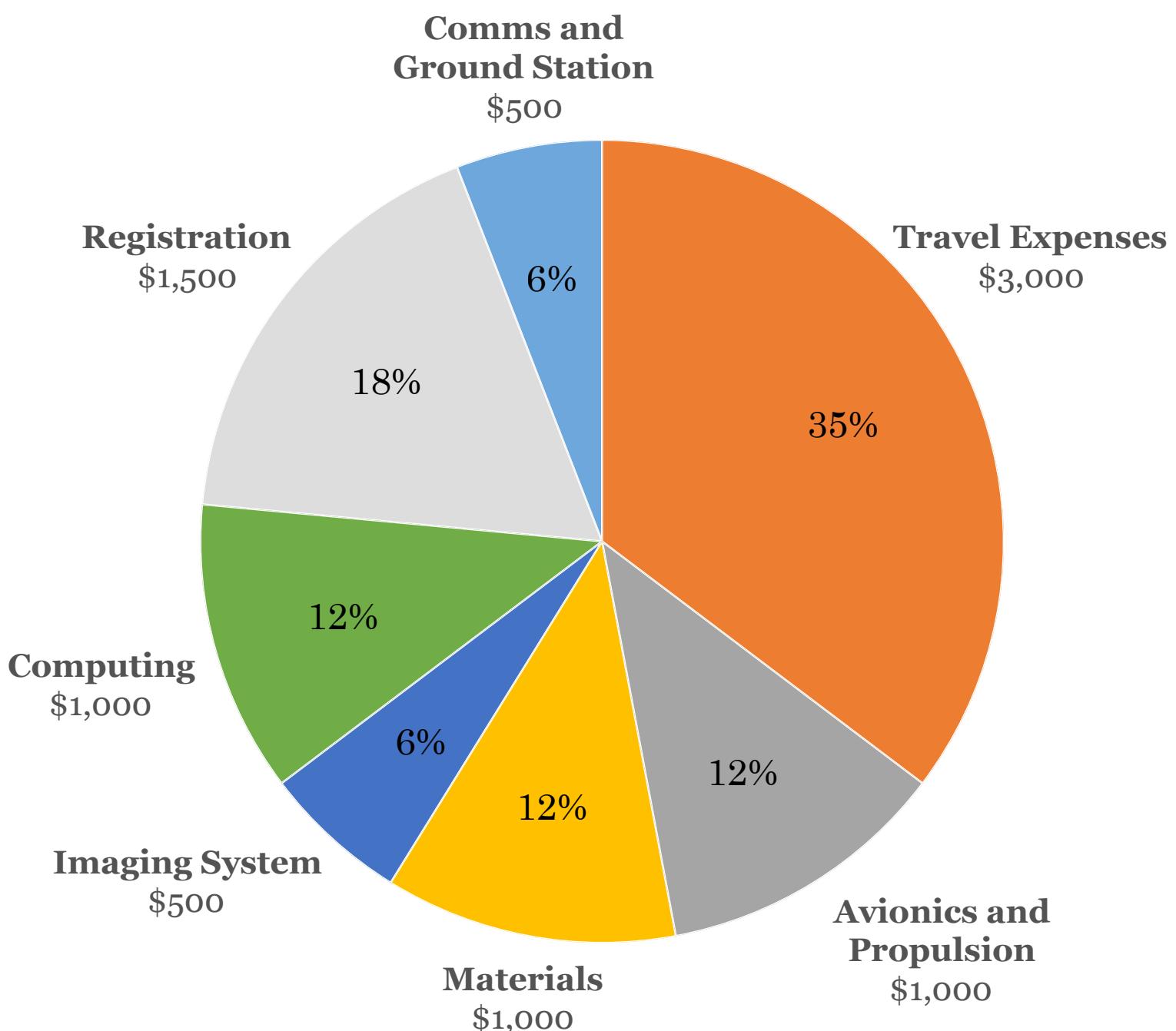
After a mechanical failure that led to crashing Avalon v2 at a recent test flight, the team decided to switch gears and use previous experience to design a more efficient and compartmentalized aircraft. The team is currently registered to compete in the 2022 AUVSI SUAS competition.



Above Avalon v1 after a successful test flight.
Left Avalon v2 before a test flight at the field.



Projected Expenses



Total
\$8,500



Why Contribute

By contributing, you will:

- ✓ Support a 501(c)(3) nonprofit
- ✓ Help provide necessary funds for an elaborate UAS in the future
- ✓ Promote the learning of 30+ high school students and the greater community
 - ✓ Thomas Jefferson (TJ) Techstravaganza: An outreach program hosted by TJ for elementary and middle school children. We will hold a booth to demonstrate the use of RC aircraft and allow children to further explore STEM
- ✓ Promote your company to high school and college students who will soon be entering the workforce

Sponsorship Benefits

Upon any donation, sponsors will receive:

- ✓ Your logo on our team shirt
- ✓ Your logo on our website
- ✓ Your organization's name on our competition deliverables: Technical Design Paper, Flight Readiness Review video, and competition plane

Contact Us

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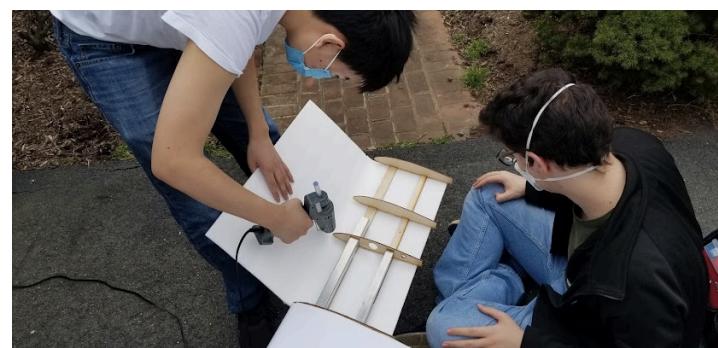
Website:

<https://tj-uav.github.io>



September, 2020 - June, 2021

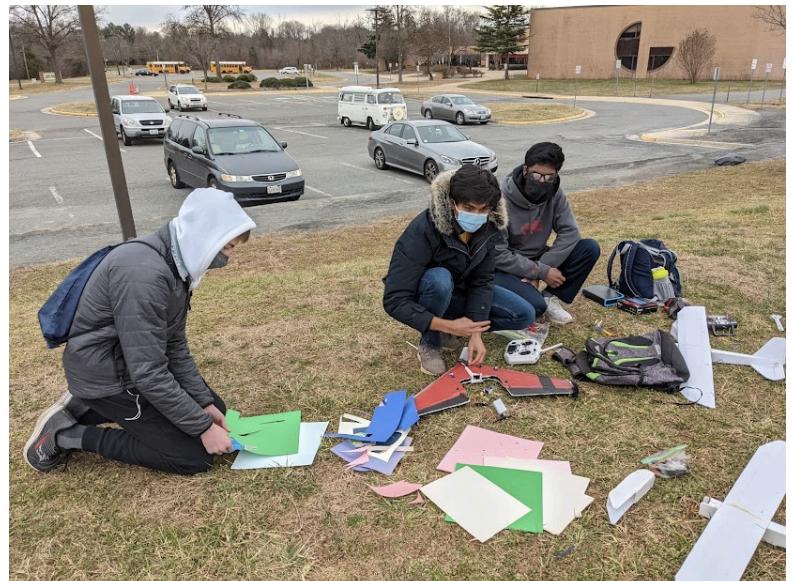
Building Avalon v1





Winter Fun Fly

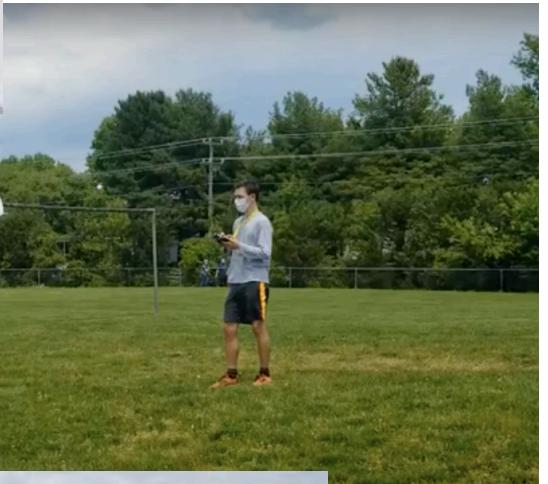
January, 2021





Testing Plane

September, 2020 - June, 2021



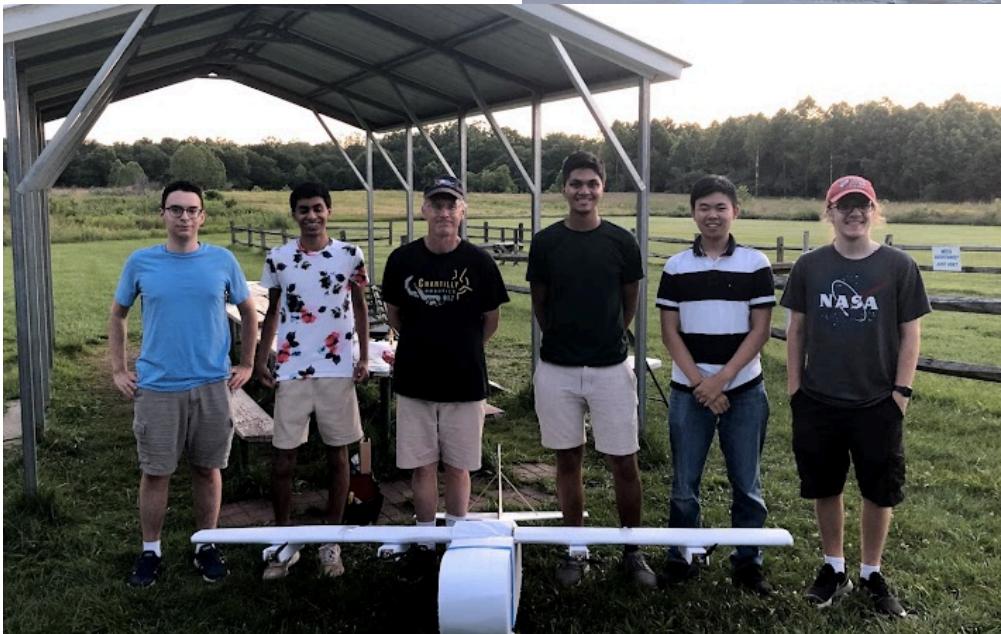
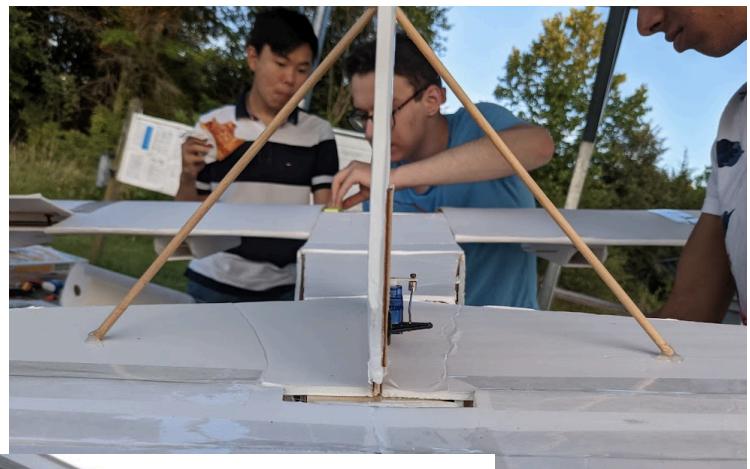


Avalon v1

Test Flight



July, 2021





Successful Avalon v2 Test Flight

October, 2021





Avalon v2

Crash Flight

October, 2021

