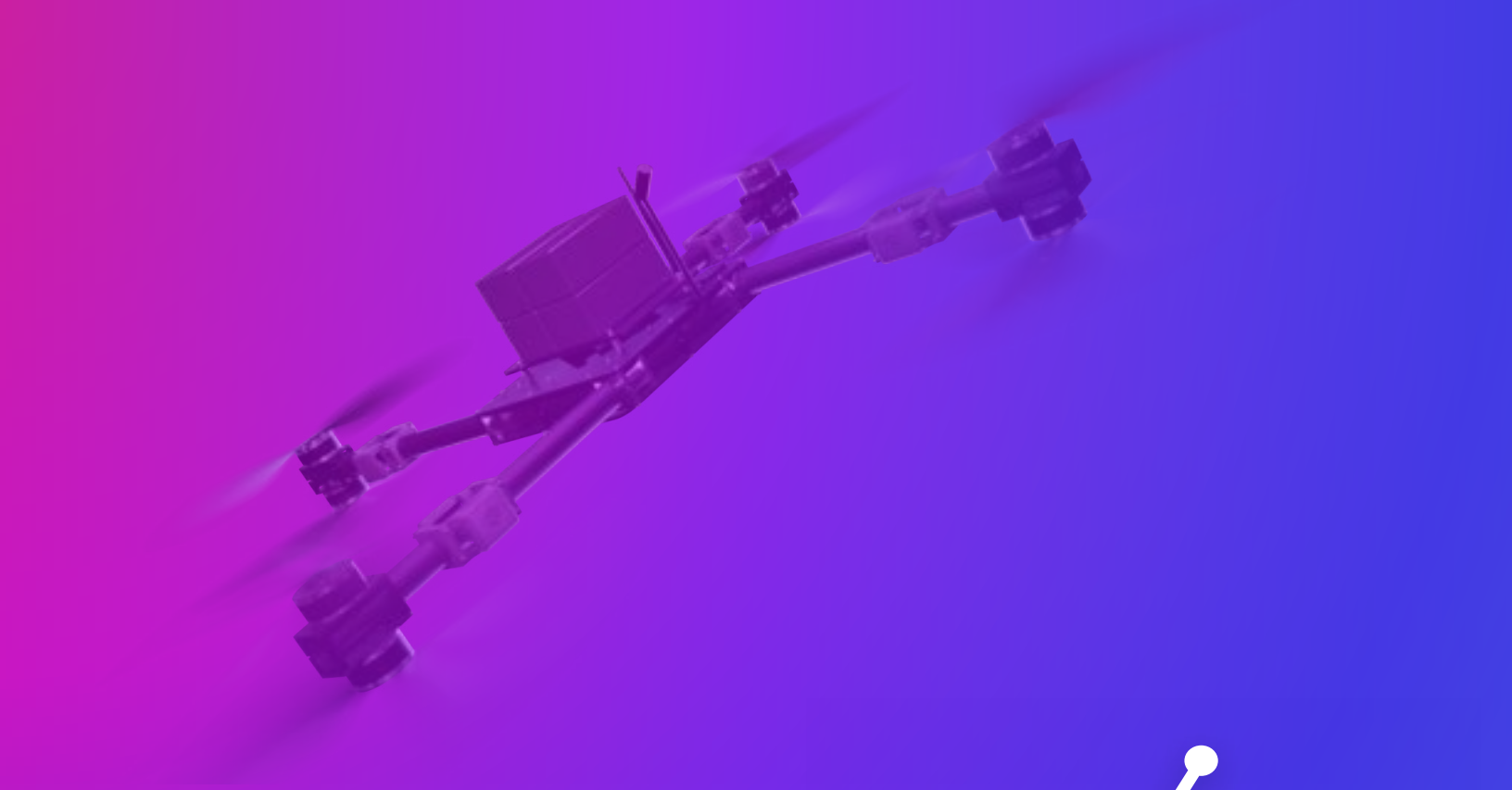


Amador Valley Unmanned Aerial Vehicles Team

Sponsorship Packet 2022/2023

@amadoruavs officers@amadoruavs.com @amadoruavs amadoruavs.com

Outline

AmadorUAVs

Our Story

Amador Unmanned Aerial Vehicles (AmadorUAVs) is a high-school club at Amador Valley High School in Pleasanton, California that competes in the annual Student Unmanned Aerial Systems (SUAS) competition.

Beginning in early 2018 with original plans of flying planes, the club pivoted towards drones after being gifted a buildable set of what is now Macron. When the 2020 pandemic hit, we decided to go big, creating a larger, more powerful drone: Boreas.

At SUAS 2022, and also our first competition, we placed **2nd internationally**

Core vision and goals

Create a fun environment that commends a dedication to learn and experience

Promote diversity within our club by giving people from all and backgrounds a chance to experience robotics

Constantly improve, not only our skills, but also our relations with other members in the club

Above: the 2022 AmadorUAVs competition team posing with our competition drone, Boreas

AmadorUAVs

Club Divisions

Amador Valley High School

AmadorUAVs

Mechanical

- Designs, manufactures, and builds our drone, Boreas
- Models using Onshape CAD, 3D prints with our Voron 2.4, and tests our designs, both through simulations and experiments

Mechanical team sketches new leg designs

Electrical

- Designs custom printed circuit boards on KiCAD for power distribution, sensor suites, and gimbal control
- Wires, crimps, solders, and designs the electrical infrastructure, connecting the batteries to motors, Pixhawk, and GPS

Electrical members wire ESCs at competition

Software

- To fly autonomously, writes code for competition tasks like path planning, image processing, and payload drop
- Integrates external components like our custom Picofusion, gimbal, and Pixhawk

Software members reference PX4 documentation

Business

- Secures funding, grants and sponsorships to cover club expenses
- Organizes publicity for the club through posts, outreach, and community events
- Other miscellaneous tasks like website, merchandise design, and budgeting

Business members present our drones at a fair

SUAS Competition

The SUAS (Student Unmanned Aerial Systems) Competition is an international collegiate competition that tests each teams' self-made Unmanned Aerial Vehicles (UAVs). In 2022, over 70 different teams from 10 countries competed.

SUAS is split into 3 scoring categories:

- **Technical Design Paper**, assessing our competition strategy and design decisions
- **Flight Readiness Report**, presenting our drone's specifications in video form
- **Mission Demonstration**–the largest category–measuring our ability to complete different tasks, including waypoint navigation, image processing, and payload drop

In 2022, AmadorUAVs placed 2nd overall, besting many internationally-recognized colleges like Cornell, MIT, UCSD and CMU.

2nd place team picture!

Boreas after completing the competition mission

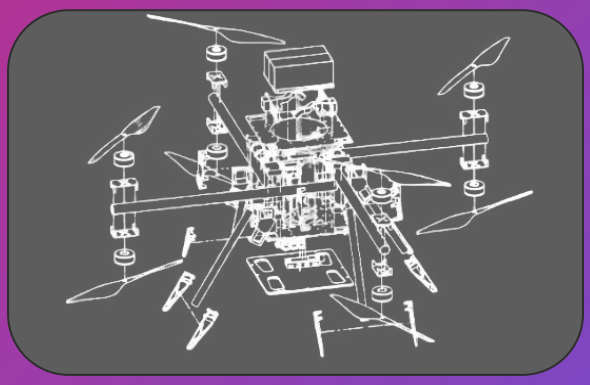
Last minute checks while waiting for takeoff

AmadorUAVs

Competition Drone: Boreas

Boreas 2022-2023

AmadorUAVs



An exploded view of Boreas' CAD model

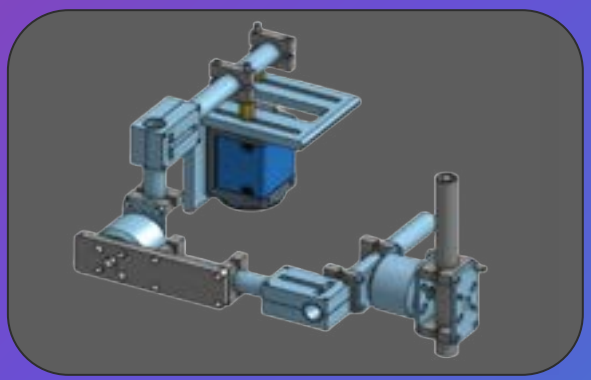
Mechanical Overview:

- ❏ Design: Carbon fiber bodied coaxial octorotor
- ❏ Weight: Full/11 kg (25 lb), Empty/3.5 kg (7.5 lb)
- ❏ Air Times: Flight/35 minutes, Hover/50 minutes
- ❏ Air Speed: 15 m/s (34 mph)
- ❏ Attachments: custom gimbal, payload mechanism, plywood modular auxiliary plate

Airdrop Mechanism shown with a water bottle

Airdrop:

- ❏ Drop Mechanism: Simple servo release that pulls a pin, letting the payload go
- ❏ Weight of Payload: 5lb max
- ❏ Payload: Water Bottle with a parachute attached to the top + padding around the sides



A 3D CAD model of Boreas's Gimbal

Gimbal:

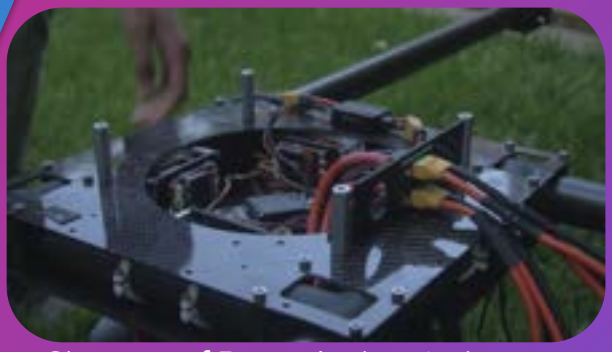
- ❏ Camera: Industrial Imaging Source DFK 33UX183
- ❏ Design: Custom 3D printed 3-axis brushless
- ❏ Motor: (SMC PM series 3510 Brushless)?
- ❏ Connection: Python script captures images over USB on onboard computer

AmadorUAVs

Competition Drone: Boreas

Boreas 2022-2023

AmadorUAVs



Close-up of Boreas's electrical center without battery plate on top

Electrical Overview:

- ❑ Flight Controller: Pixhawk 5x
- ❑ Motors: 8x T-Motor MN601-S Navigator Series brushless motors
- ❑ ESC: Zubax Myxa
- ❑ Battery: 2x 6s, 30,000mAh connected in series

Close-up of Boreas's internals—GPS, ESCs, and aluminum clamps

Custom Boards

- ❑ Picofusion: a sensor suite with Mahony filters to create accurate telemetry data, better than commercial options
- ❑ Gimbal: uses FOC control with MOSFET drivers to precisely control a brushless DC motor

Side view of Boreas's long-range radio to ground station

Components

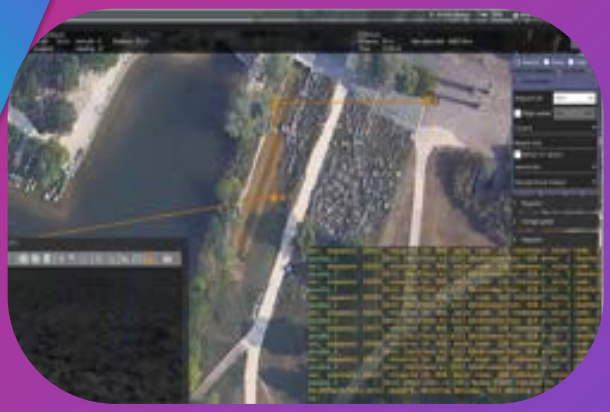
- ❑ Telemetry: P900 Holybro Radio
- ❑ GPS: Holybro F9P
- ❑ RC Controller: FrSky SBUS

AmadorUAVs

Competition Drone: Boreas

Boreas 2022-2023

AmadorUAVs



QGroundControl, the software we use to communicate with the drone

Software:

- Algorithms
  - Path Planning
  - Obstacle Avoidance
  - Image Processing
- Embedded Systems: gimbal motor drivers, IMU estimation boards

Filtering through the background to better recognize the ODLC

Imaging:

- Strategy: Map split into overlapping rectangles, zigzag pattern locates center of each for camera to take photo
- Object Detection: YOLOv5 localization model identifies ODCL's, crops out regions of interest
- Classification: IMS models classify orientation/shape/color, manually reviewed

A map of all the waypoints and the boundaries the drone flies through

Path Planning/Obstacle Avoidance:

- Pilot: Receives missions from Interop, projects onto cartesian grid, constructs a flight plan, uploads back to Boreas
- Path Planning: After obstacles are fenced, A-star algorithm is run to find optimal path. Post-path compression algorithms run to ensure autopilot not overwhelmed

AmadorUAVs

Other UAVs: Macron + Micron

Macron + Micron 2022-2023

AmadorUAVs

Above: A close-up of Macron's wiring

Mechanical*: *Macron

- Motors: 8x T-Motor MN4012 480KV Brushless Motors
- Design: octocopter, but able to become both a hexacopter and quadcopter

Software*: *Macron

- Radio: HolyBro p900, 902/928 MHz Telemetry Radio 100 mW

Electrical*: *Macron

- Flight Controller: Pixhawk 6c
- Battery: 2x 6s 10,000mAh LiPo

Above: 2022 Finalized Micron Drone

Mechanical*: *Micron

- Motors: 4x Holybro brushless 2216-880KV
- Design: Medium-size S500-frame quadcopter

Software*: *Micron

- Radio: HolyBro 433/915 MHz v3 Telemetry Radio 100 mW

Electrical*: *Micron

- Flight controller: Pixhawk 6c
- Battery: 2x 4s 3,000 mAh LiPo

AmadorUAVs

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MAVSDK

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px4 autopilot

AmadorUAVs

Contact Us!

This year we are looking forward to meeting new sponsors. Feel free to contact us if you have any questions or concerns, or if you simply want to see the drone and team in person!

Mailing Address:

Write check to: Amador Valley High School

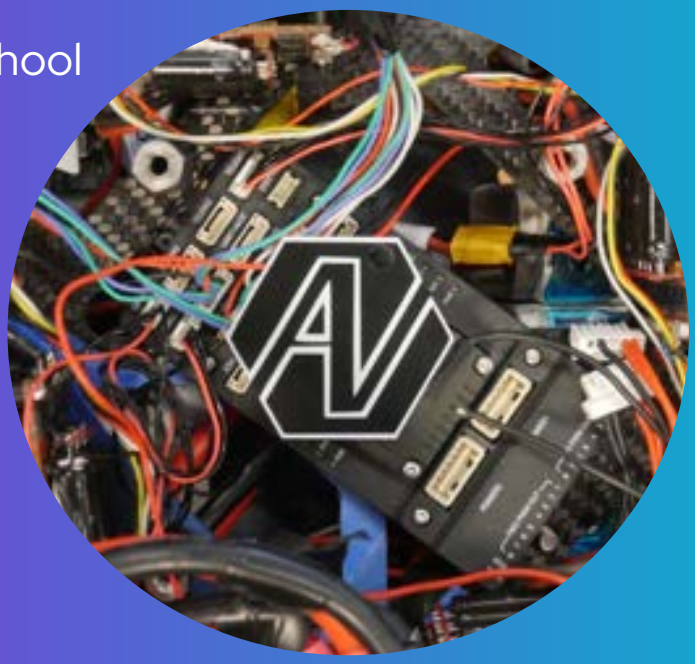
Memo Line: AmadorUAVs Donation

Mail to:

AmadorUAVs

3546 Ballantyne Drive

Pleasanton, CA 94588



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