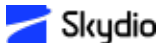




UAS4STEM





DRONE ENGINEERING CHALLENGE

NEW TEAM GUIDE





What does it take to be a UAS4STEM team manager?

You don't need to be a drone expert, and you don't need to have all of the answers. What you do need to have is the ability to care about your team and guide students as they seek answers. You will help students prioritize goals and cultivate a positive team dynamic. Most importantly, you will provide a safe, fun, and educational environment. **In short, you inspire.** One of the most rewarding aspects of becoming a UAS4STEM team manager is being able to witness the incredible growth of the students in your care.

Thank you for taking on this role. It's my honor to welcome you to the UAS4STEM competition!

Sincerely,

Kyle Jaracz, AMA Education Director

Kyle Jaracz (far left in blue) congratulating the Advanced Division first-place team, Some Assembly Required, during the awards presentation at EAA AirVenture 2024.



UAS4STEM Permission

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REWARD YOUR STUDENTS!

Top performers in each division
earn great prizes totaling over
\$42,000 across all divisions!

**BEGINNER
REGISTRATION:**
\$995

**INTERMEDIATE
REGISTRATION:**
\$1,495

**ADVANCED
REGISTRATION:**
\$1,495

BEGINNER AWARDS

1st place: **\$995**
2nd place: **\$895**
3rd place: **\$795**

*Beginner division awards are
provided as a voucher for the
next season's competition.*

INTERMEDIATE AWARDS

1st place:
\$1500 + Skydio2
2nd place: **\$1300**
3rd place: **\$1100**

ADVANCED AWARDS

1st place:
\$2500 + Skydio2
2nd place:
\$2000 + Skydio2
3rd place: **\$1500**

The Dewey O. Broberg Jr. award is presented by competition judges to recognize a student competing in the championship who shows dedication to their team, determination, and adherence to the rules and purpose of the competition. \$500

The Gardner Chambliss award

is presented to a team manager who exemplifies the spirit of mentorship, dedication, and care. The award is based on nominations from students, parents, and co-managers via an online form. Visit this QR code for more information.



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modelaircraft.org

UAS4STEM.ORG

If you have questions about the UAS4STEM program, please contact the Education Department at education@modelaircraft.org, or (765) 287-1256

WHAT IS UAS4STEM?

UAS4STEM is a drone engineering challenge like no other! Students work in a team to build, program, and fly a drone. With Beginner, Intermediate, and Advanced divisions, it's a competition for everyone that allows you to participate from anywhere in the world!

Each season mission challenges are presented. These challenges require new teams to build a drone to specifications and learn how to program it for autonomous flight. Returning teams maintain and update their previous drone. Beginner division teams complete a UAS4STEM virtual ground school course to learn the basics of safe and legal drone operations in the national airspace. Intermediate and Advanced divisions complete a ground school course that prepares them to earn the FAA Remote Pilot Certificate.

Beginner teams focus on learning to fly missions manually and autonomously using ArduPilot Mission Planner software. Intermediate and Advanced teams face additional challenges like conducting search missions and designing and fabricating a mechanism for the drone to complete a specific task.



Advanced division Flight Readiness Reviews are conducted at the EAA Museum.

New teams are encouraged to start in the Beginner division, but may opt for other divisions based on students' skill sets.

The scored competition for the Beginner division is conducted virtually and takes place at the end of May.

Intermediate and **Advanced** divisions have a virtual preliminary competition in April, from which the top-scoring teams are invited to the championship competition at Experimental Aircraft Association's EAA AirVenture in Oshkosh, Wisconsin, at the end of July. See full competition details at www.uas4stem.org.

ELIGIBILITY

Students ages 11-19 are eligible to compete. Teams must consist of between four and ten students and one adult team manager, with an optional adult assistant team manager.

BENEFITS OF COMPETING

Participants of UAS4STEM become members of the Academy of Model Aeronautics (AMA). Membership includes liability insurance related to model aircraft operations and opens access to thousands of chartered clubs across the United States. The lead team manager also gains membership to the Experimental Aircraft Association (EAA).

Prizes, equipment, and trophies are awarded to the first, second, and third place finishers in each division.

UAS4STEM students display growth in career-focused skills, including approximately 100 hours of technical experience, leadership development, communication, problem solving, increased self confidence, and positive interactions with aviation professionals.

COSTS

Begin your UAS4STEM experience for only \$299, and then pay the remainder of the balance. See inside cover of rulebook for total registration costs. *There is a 50% discount for additional teams.*

An initial investment is needed to purchase drone



Finalists attending AirVenture, taken prior to the Wednesday night airshow and awards presentation.

components. Complete drone kits can typically be purchased for under \$1,900. **Beginner division kits are even more accessible**, typically costing around \$500 to build. You can source your own components based on the drone specifications list.

Additional equipment is required (laptop, tools, etc.).

Intermediate and Advanced teams advancing (by invitation) to the in-person championship are responsible for travel costs to AirVenture in Oshkosh, WI. Admission and campsites for AirVenture are provided by our partner, the Experimental Aircraft Association, at no cost for teams and up to 5 accompanying adults. Camping equipment (or alternative lodging arrangements), meals, and other miscellaneous expenses are the responsibility of each individual team. *Local fundraising can be a great way to defray the costs associated with the competition.*



Competitors have many chances to share ideas and collaborate across team lines during the challenge.

SUGGESTED BEGINNER TIMELINE

Phase 1: Foundation (September - November)

Register your team, understand the mission, attend meetings, and learn the fundamentals.

- **Register Your Team:** Sign up at UAS4STEM.org. All registration costs must be paid by March 31 to compete.
- **Assemble Your Crew:** Form a team of 4-10 students (ages 11-19). Submit the team roster. This information is used by AMA staff to process memberships and to create login credentials for the virtual ground school course which will be sent to you via email.

- **Rulebook Deep Dive:** Read your division's rulebook from cover to cover. Review the UAS4STEM.org website.

TEAM ROLES

A Team Manager and a Safety Officer are required. The roles described below are necessary, but how your team chooses to delineate tasks and titles is up to you as you develop your team.

Team Manager

The adult mentor who oversees the team's overall strategy, organization, and performance, ensuring that objectives are met and resources are allocated effectively.

Assistant Team Manager

An adult who supports the team manager in coordinating team activities and logistics, stepping in as needed to maintain continuity and focus.

Remote Pilot in Command (RPIC)

The designated pilot responsible for the operation of the drone during flight, making critical decisions related to navigation, safety, and mission execution.

Safety Pilot

A trained pilot who assists the RPIC by monitoring flight conditions and maintaining situational awareness, ready to take control if necessary to ensure safety. An adult may act as the safety pilot for drone test flights during training, but this role will need to be transferred to a student team member for the actual flight operations during the competition. The safety pilot should be someone who can fly the aircraft manually using a radio control transmitter.

Visual Observer

A team member tasked with maintaining visual contact with the drone during flight, providing real-time updates on its position and surroundings to enhance situational awareness.

Safety Officer

Responsible for enforcing safety protocols and procedures, ensuring that all team members adhere to safety guidelines and managing risk during operations.

Ground Station Officer/Flight Operations

Manages the ground control station, including communication with the RPIC, monitoring telemetry data, and executing flight plans to support mission objectives.

BEGINNER COMPETITION

Held the second half of May, UAS4STEM staff will coordinate with the team manager to establish a time slot that fits your schedule. This rulebook contains details necessary to compete. This is a 50-minute virtual session with official judges that includes the following:

Flight Readiness Review (FRR) presentation: The team is welcomed and will appear on camera to give a prepared presentation. This will include your pre-recorded proof of flight video.

Five questions: For the Beginner division, the judges will ask five different scored questions selected from the ground school course.

Question and answer: The judges may ask unscored questions regarding the FRR presentation.

Mission Planner challenge: Judges will provide special instructions for a mock mission to be programmed using Ardupilot Mission Planner software. Airframe

DRONE EQUIPMENT RECOMMENDATIONS

Smaller drones are cheaper and easier to build. If you advance to other divisions in the future, you will build a larger drone to meet those mission objectives. You can use this smaller drone for training missions in the future!

AIRFRAME SPECIFICATIONS

Frame & Power System

Quadcopter configuration (4 motors)

Frame: 200mm maximum frame size (center of one motor shaft to the center of the diagonally opposite motor shaft). Another way to describe a frame this size is “a 4 inch drone”, referencing the size of propeller the drone can safely accommodate. We recommend a 4” build for this division, but smaller alternatives are accepted. Most frames come with hardware to affix your FC/ESC stacks. Be sure to consider this, and be certain your stack is separated from the frame using plastic and rubber hardware to avoid grounding failures.

Power System: 4S LiPo Battery (XT30 or XT60 connector). Battery weight target: ~100g – 130g

Motors: 4x 1404 2750KV–3000KV brushless motors (KV Choice: Lower KV ensures smooth, efficient throttle profiles on 4S power without overheating)



This challenge is great for many different groups. This team formed from both a Civil Air Patrol unit and a Scouting troop.



UAS4STEM Technical Director Archie Stafford.



A team presenting their FRR for judging staff.



Students enjoying donuts on the final morning at AirVenture.



during autonomous stationary loiters) We recommend having a spare motor on hand.

Propellers: 4" props. Fewer blades are more efficient, but provide less thrust on average. Lower KV motors can accommodate a higher pitch prop, enabling more thrust but less speed. Higher KV motors use a lower pitch prop, allowing for more speed at the cost of less initial thrust. Always have several prop sets available in reserve. We recommend the HQProp T4x2.5 (Bi-Blade) or similar.

Flight Controller (FC) Electronic Speed Controller (ESC) & Avionics

FC/ESC Stack: We recommend SpeedyBee F405 Mini 20x20 Stack or similar. Integrated sensors: onboard barometer for barometric altitude hold and high-precision current sensor for battery tracking.

Receiver & Telemetry Link: 2.4 Ghz RC control system. (Any brand legal in the US.) We recommend a RadioMaster RP1 V2 ExpressLRS Receiver. This can act as both the control link and the MAVLink telemetry connection to Mission Planner, allowing both manual and autonomous flight.

Outdoor Navigation Package (GNSS + Compass)

GPS Unit: Beitian BN-880, Holybro Micro M10 GPS w/ Magnetometer, or similar. Look for an integrated 3-axis compass module. Make sure your mount (designed or purchased) for the GPS has direct visibility to the sky, ensuring better reception of satellites.

DRONE COMPONENT SOLUTIONS

You may purchase any component that meets the requirements of the specifications within this rulebook. Please reach out to staff to learn about available options. If there are any questions about an airframe or components, please contact UAS4STEM Technical Director Archie Stafford at archie@modelaircraft.org

YOUTH SAFETY

Please take a moment to review some safety recommendations. Pay attention to and incorporate any local/organizational requirements.

- Complete background checks for all adult participants.
- Consider child abuse prevention training. These will differ between states, so we recommend researching the requirements of your state.
- Never be one-on-one with a youth. Ensure that there are other people around.
- Have a clear set of rules that are on display and easily accessible for your attendees/participants, and make sure that you enforce these rules.
- Consider sending a Code of Conduct that formal participants must sign prior to attending specific events. Some of these rules may include: following basic safety rules, not possessing dangerous substances, exhibiting good sportsmanship, and treating all individuals and equipment with care and respect.
- Have a comprehensive written child protection policy.
- Ensure that adults working/volunteering understand their roles and responsibilities.
- Limit communication to sharing program information through the following: telephone calls or texts to the parent's telephone (not the youth's mobile phone), emails addressed to both the youth and their parents, and written information sent to the parents' home.
- Always report suspicions of abuse, neglect, or injury to the appropriate authorities and guardians.





UAS4STEM

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NOT YOUR TYPICAL
FLIGHT CLUB



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