

2026-27 Design, Build, Fly Rules

Cessna | Beechcraft
BY TEXTRON AVIATION

AIAA FOUNDATION

Summary

The AIAA through the Applied Aerodynamics, Airplane Design, Design Engineering and Flight Test Technical Committees and the AIAA Foundation invites all university students to participate in the AIAA Student Design, Build, Fly Competition. The contest will provide a real-world airplane design experience for engineering students by giving them the opportunity to validate their analytic studies.

Student teams will design, fabricate, and demonstrate the flight capabilities of an electric powered, remote-controlled airplane that can best meet the specified mission profile. The goal is a balanced design possessing good flight handling qualities and practical and affordable manufacturing requirements while demonstrating high vehicle performance.

To encourage innovation and maintain a fresh design challenge, the design requirements and performance objectives are updated for each new contest year. The changes provide new design requirements and opportunities, while allowing for application of technology developed by the teams from prior years.

Check the rules package carefully as items and approaches that were legal in past years may not be legal for this contest year. Only the contents of this year's Rules package along with the current FAQ and Q&A documents hold bearing on the requirements and/or allowances for the current contest year.

NOTE: Items in the rules that are critical to the safety and execution of the competition or are new are hi-lighted in RED text. Please take note of these requirements and rules.

It is the responsibility of the teams to know and follow all provided rules, the FAQ and Q&A, and all contest day briefings.

Cash prizes are **$3000** for 1st, **$2000** for 2nd and **$1500** for 3rd place. The winning team(s) may be invited to present their design at AIAA's AVIATION Forum. The team with the best Report Score will receive a **$100** prize from the Design Engineering Technical Committee.

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1. General Information

1.1 Team Requirements

All team members (except for a non-student pilot) must be full time students at an accredited University or College and student members of the AIAA. At least 1/3 of the team members must consist of underclassmen, which is defined as students who are NOT in their final year of the university's bachelor's degree program (freshman, sophomores or juniors in a common four-year program). Team members may include graduate students limited to no more than 1/3 of the team. Teams may request an exception to this rule if they believe their university graduate program meets the intent of the team membership requirements. Graduate students who have previously worked in industry (excluding internships) are not eligible as they do not meet the requirements for AIAA Student Membership.

There is no set requirement for the number of students that must attend the fly-off. It is preferred, but not required, for the team advisor or responsible faculty member to attend.

Team members may be updated/changed at any time during the contest but must always comply with the 1/3 rules. Following the initial team roster submitted with the contest entry, a “One Time” update to the official team roster may be submitted with the Design Report in February.

Each educational institution may submit one (1) team entry.

For schools with multiple campuses in different cities each campus will be considered as a separate entity.

Two or more schools may combine to submit a single entry.

Schools which already have an entry may not have additional students from their school participate as members of a team from a different (shadow) school.

International Teams: Special information for non-US teams may be found at https://www.aiaa.org/dbf/travel-information/international-teams.

1.2 Team Pilot

The team pilot must be an AMA (Academy of Model Aeronautics) member. Teams may use a non-university member for the pilot if desired. All pilots must sign in and verify AMA membership at the fly-off.

Qualified, volunteer pilots will be available at the contest fly-off on an as-available basis to assist teams who are unable to have their pilot attend. The contest administrators will facilitate communication between teams and volunteer pilots at the fly-off, but will not be involved in matching teams and pilots. Details on how to coordinate with a volunteer pilot will be in the Contest Information Sheet. Requests of the organizing committee to coordinate with a volunteer pilot prior to the fly-off will not be acknowledged.

1.3 Sponsorship

Teams may solicit and accept sponsorship in the form of funds or materials and components from commercial organizations. All design, analysis, major component fabrication and assembly of the contest entry airplane is the sole responsibility of the student team members.

1.4 Communications

The contest web site is https://www.aiaa.org/dbf and is the primary location for all contest information, schedules, rules and contest documentation, forms and links to required forms and sites. The primary method of communication between AIAA and the DBF Organizing Committee and all teams will be by email.

It is the team's responsibility to make sure the e-mail contact addresses supplied with the entry process for the Faculty Advisor and Primary and Secondary Contacts remain active during the contest period as e-mail will be the primary means to provide information and updates. Do not use an internal team correspondence e-mail list server as your point of contact e-mail address. If any of the contact information requires updating, contact Student Programs at studentprogram@aiaa.org with a request to update the information.

AIAA and the DBF Organizing Committee will utilize social media as an additional means of communicating with the teams during the contest weekend only. This will NOT be a means of communicating rules, FAQ's, Q&A, protests, etc., but only used in case of emergencies, weather delays or contest weekend schedule updates. Additional information will be included in the contest information sheet to be sent out to registered teams prior to the fly-off.

Questions regarding contest administrative items such as help with the online submission process, visa letter requests, information for international students, participation certificates and events at the fly-off not related to direct execution of the competition should be sent to Student Programs at studentprogram@aiaa.org. Questions and comments related to the competition execution, excluding rules interpretation questions, should be sent to the DBF Director email at director@aiaadbf.org.

1.5 Question and Answer (Q&A) Process

Questions regarding rules interpretation will be submitted using the online submission system at https://www.aiaa-awards.org/a. **Questions submitted by email will not be accepted.**

Rules interpretation questions may be submitted after the entry date (when all participant e-mail addresses are known), so that all teams will have equal access to all rules information. The online submission site will open on 1 November for the first Q&A. Questions with answers will be posted on the website **Q&A** and delivered by email to all teams. The email with the Q&A document will be sent to the Primary and Secondary Contacts and Faculty Advisor on record in the on-line submission system.

At the discretion of the DBF Organizing Committee, based on number of questions received and criticality of answers, the online submission site will be closed for the first Q&A. Once the questions have been received and answers documented in the Q&A on the website, the online submissions system will re-open for the next set of questions. This process will be repeated until a few weeks before the fly-off, at the discretion of the committee.

Questions submitted for consideration in the published Q&A releases must adhere to the following requirements:

- All questions must be submitted using the official DBF Q&A form on the DBF website. Questions submitted without using this form **will be ignored**. The form may not be altered and must be saved with the university name in the following format: "DBF_Q&A_(university name).xlsx"
- Teams are limited to no more than five (5) questions for the initial Q&A release. Once a Q&A is published, teams may submit up to 3 questions for each subsequent Q&A.
- Each question must be limited to a single topic.
- **Proposed questions MUST be reviewed by ALL team members AND the Faculty Advisor prior to submittal to assure everyone has thoroughly reviewed the rules, FAQ and prior Q&A for the answers to the questions. The Faculty Advisor must assert on the form that this requirement was satisfied.**
- Questions requesting approval of a specific design approach or implementation will not be answered. Teams must submit question to clarify a rule, not to approve a design. Review of generic design concepts may be accepted if it aligns with guidelines herein.
- Questions submitted that do not meet ALL of the above requirements **will be ignored**.
- Questions must adhere to the following guidelines:
  - Questions are limited to rules interpretation and clarification only, including answers or updates to rules provided in previous Q&A documents, needed to design, build and test airplanes and payloads.
  - Questions should be limited to no more than two sentences, preferably a single sentence question. Discussion or background information on why a team is asking the question is unnecessary. A valid question does not need additional information included with it. Keep in mind that questions are copied directly into the Q&A document and the additional information becomes burdensome in creating the document with appropriate answers.
  - Questions out of curiosity or asking why a rule was written will be ignored.
  - Questions asking how something will be executed at the fly-off will be ignored. Details of the fly-off execution will be in the Contest Information sheet and in the daily pilot briefings.
  - Graphics may be submitted with questions but should only be used if absolutely necessary to clarify the question. Graphics must be inserted into the form in the space provided. Any graphic should be of sufficient quality such that it can be copied into the Q&A document with clarity.

1.6 Flight Order

A flight order list will be generated and emailed to the teams on the Wednesday prior to the fly-off weekend. Teams will always rotate in this order. The flight order will be repeated continuously.

The flight order list will carry over from Thursday to Friday, Friday to Saturday, and Saturday to Sunday at whatever spot in the rotation it leaves off. The flight order list is used for all queues during the contest. These queues include, but are not limited to Tech inspection, Flight Line Missions, and Ground Missions. Note that the Organizing Committee reserves the right to open up any of the queues to first-come-first-served if no teams come when called or return to the flight order if lines begin to form. This will be done at the sole discretion of the Organizing Committee.

Each team's position in the flight order will be determined from their **Total Report Score**, the highest total report score goes first.

Design Report scores along with Total Report scores will be available following the pilot briefing at the start of the contest (they will not be included with the flight order e-mail).

To help streamline the contest flow and maximize flight opportunities for each team, the Tech inspections will be conducted in the same order as the flight rotation (which is based on total report scores) so that the first teams inspected will be the first teams in the flight queue. Teams may use the sequence to help estimate when they need to arrive at the contest site to make sure they do not miss their slot in the first tech inspection rotation.

Note: It is each team's responsibility to monitor the notifications from the scoring table in order to respond if ready. Teams MUST Check-In with the scoring table before proceeding to the flight line. A contest official will be available to help teams enter the staging box.

1.7 Protest Procedure

Submitting a protest is a serious matter and will be treated as such. Teams may submit a protest to the Contest Administration at any time during the competition. Protests MAY NOT be submitted after the conclusion of the competition. Protests must be submitted in writing and signed by the registered team advisor; designees are not allowed for protest submissions. If the team advisor is not present, he or she may send by electronic method a signed protest to the team for them to present. Electronically submitted protests must be on hard copy (printed by the team) and have the advisor's signature. A phone number where the advisor may be contacted must be provided. Protests may be posted for review at the discretion of the Contest Administration.

Protests and penalties (up to disqualification from the contest for deliberate attempts to misinform officials, violate the contest rules, or safety infractions) will be decided by the Contest Administration. Protests submitted but not upheld by the judges may be given a penalty of the loss of one flight score to the team submitting the protest. The decision of the Contest Administration is final.

Teams may only protest events involving their own team. Protests against other teams or actions not specifically involving their own team will not be accepted.

1.8 Sportsmanship

All teams and students participating in DBF are expected to uphold the highest standards of sportsmanship during the competition and abide by the AIAA Code of Ethics (https://aiaa.org/about-aiaa/governance/code-of-ethics/). **Attempts to intentionally violate the rules or negatively impact the performance of other teams will not be tolerated. Penalties for violations will be decided by the Contest Administration and may range from a warning to a loss of flight score up to disqualification from the current and future competitions.**

2. Schedule and Location Information

Event	Open	Close
Entry, Proposal & Team Roster	15 October 2026 at 8 AM (0800) US Eastern Time	31 October 2026 at 5 PM (1700) US Eastern Time
Design Report	1 February 2027 at 8AM (0800) US Eastern Time	19 February 2027 at 5 pm (1700) US Eastern Time
Fly-Off	15 April 2027	18 April 2027

2.1 Entries

The entry period OPENS **15 October 2026 at 8 AM (0800) US Eastern Time**. No entries will be accepted before that time. A completed entry must be RECEIVED no later than **31 October 2026 at 5 PM (1700) US Eastern Time**. Entries will be collected through the AIAA Online Submission System.

Proposals and Team Rosters must be submitted as part of the entry process. Proposals and Team Rosters will not be accepted outside of the online submission system.

Teams must include ALL required information requested by the online submission. Once submitted, corrections to the entry, including any corrections or updates to the Proposal, will not be accepted.

Team Rosters must be submitted using the official form located on the DBF Website. All team members must have a valid AIAA Student Membership. Membership numbers of all team members must be submitted with the team rosters. Students may join at any time by going to the AIAA Student Membership website. Membership numbers are provided instantly upon payment of membership fees.

Incomplete entries will not be accepted.

An entry is not complete until the "Save and Finalize" function is selected in the online submission system and confirmed.

2.2 Proposal Schedule and Submission Information

Proposals will be submitted using the online system at https://www.aiaa-awards.org/a

The proposals will be scored as defined in the proposal requirements section. The top **100** proposals plus ties will be invited to submit design reports and potentially become eligible for the fly-off. Teams will be notified no later than 20 November 2026 if their proposal has been accepted.

Proposals submitted by email will not be accepted.

Proposals will be judged "as received". No corrections/additions/changes will be allowed by the organizers so check your proposals carefully before submitting them. Once a Proposal is submitted, no changes are allowed.

Submission of Proposals is electronic only (no hard copy required). Details for the electronic format and submission are at the end of the proposal section in this rules document.

2.3 Design Report Schedule and Submission Information

Design Reports will be submitted using the online system at https://www.aiaa-awards.org/a

The design report submission period OPENS **1 February 2027 at 8 AM (0800) US Eastern Time**. The design report must be RECEIVED no later than **19 February 2027 at 5 PM (1700) US Eastern Time**.

The reports will be scored as defined in the design report requirements section. Reports submitted by email will not be accepted.

Reports will be judged “as received”. No corrections/additions/changes will be allowed by the organizers so check your reports carefully before submitting them. Once a Report is submitted, no changes are allowed.

Submission of Reports is electronic only (no hard copy required). The details for the electronic format and submission, including a requirement for an additional, separate configuration drawing, are in the report section in this rules document.

2.4 Contest Fly-off Site

The fly-off is planned to be held at the Tucson International Modelplex Park Association (TIMPA) in Tucson, AZ. A Contest Information sheet will be emailed to all qualified teams 2 - 3 weeks prior to the flyoff. The Contest Information sheet will contain details about the fly-off site, access, parking, schedule and any other information on events during the fly-off. Teams may check on historical weather conditions at www.weatherunderground.com.

Teams are advised to check with their airlines on what materials they will be allowed to bring both to and from the contest site. Hazmat items like paints, thinners and glues may need to be purchased locally and PROPERLY disposed of following the contest. **NOTE: It is the team’s responsibility to ensure that their airplane arrives at the fly-off location. Neither AIAA nor the corporate sponsors will assist in getting team airplanes or materials to the fly-off location. Teams may hand carry their airplane, use a shipping company to have it delivered to their hotel, or use any other means of transportation that they feel is appropriate. But each team must coordinate all aspects of getting their airplane to the fly-off.

2.5 Contest Fly-off Schedule

The contest fly-off is scheduled for **15 - 18 April 2027** and is anticipated to run from 10 AM (1000) to 6 PM (1800) on Thursday, 7 AM (0700) to 6 PM (1800) on Friday, 7 AM (0700) to 6 PM (1800) on Saturday and 7 AM (0700) to 5 PM (1700) on Sunday (local time). Awards will be presented at 5:30 PM (1730) on Sunday. All teams should plan their travel so that they may stay for the awards presentations on Sunday. A final contest schedule will be e-mailed to the teams prior to the contest date.

Tech inspections will begin on Thursday afternoon and will continue as required on Friday, Saturday and Sunday.

PLEASE NOTE: All schedule deadlines are strictly enforced

All deadlines are based on when an entry or submission is **Received** (Save and Finalize) by Contest officials via the online submission system.

Late entries and proposals will NOT be accepted.

Late report submissions will NOT be accepted.

There is no allowance for computer, internet, or power outages by the submitter, or any other type of error beyond the control of the DBF Organizing Committee.

Teams which do not submit the required electronic report and configuration drawing will **NOT** be allowed to participate in the fly-off.

It is the team’s responsibility to assure that all deadlines are known, understood, and met.

2.6 Fly-Off Registration Fee

Teams that are eligible to participate in the fly-off by submitting the required Design Report and Configuration Drawing will be required to pay a team fee prior to attending. This fee is used to align the DBF Fly-off with AIAA premier events and will help enhance the DBF experience. The fee is **$550** per team. More information will be available from AIAA Student Programs and on the DBF website. For all questions and comments, please contact Student Programs at studentprogram@aiaa.org.

3. Airplane and Mission Requirements

UAV with Sensor Suite

The objective for this year is to design, build and test a UAV with a towed sensor. Missions will include delivery of the UAV, transportation of sensors in shipping containers, and surveillance by deploying, operating, and recovering a towed sensor.

3.1 Mission and Payload Requirements

- General
  - Maximum allowable wingspan is 6 feet.
  - A second payload transmitter may be used for deployment, operation and recovery of the towed sensor only and, if used, must be operated by the Observer crew member.
- Payloads
  - Mission 1 – No payload.
  - Mission 2 – sensor(s) in shipping container(s).
    - All sensor shipping containers (includes the sensor in its shipping container and all shipping container simulators) must be secured sufficiently to assure safe flight without possible shift of aircraft CG outside of design limits during flight.
  - Mission 3 – deployable sensor.

3.1.1 Sensors

- The sensor is a towed device that must be deployable from and recoverable by the airplane in flight.
- Teams may have only one sensor. Once Tech Inspection is completed with that sensor, any damage to the sensor during a mission must be repaired and reapproved by Tech Inspection.
- The sensor must have a minimum overall length of six inches.
- The sensor must be aerodynamically stable during deployment, operation and recovery of the sensor [aerodynamically stable is defined as remaining in a fixed orientation in the horizontal plane (not spinning or rotating) with no effect on the stability of the aircraft, at the discretion of the Flight Director].
- The sensor weight may be changed for any Mission 3 attempt; the weight may not exceed the maximum declared weight in Tech Inspection. Weight that is added to the sensor to achieve a desired mission weight must be internal to the sensor (i.e., the added weight is not visible in the mission/flight configuration).
- The sensor may have fixed fins, wings or other aero stability surfaces. These may not be removed for installation in the sensor shipping container or deployed during the deployment process. The sensor must remain in the same external geometric configuration for all missions.
- The sensor must connect to the deployment and recovery device using a single tow line. The tow line must have a mechanical and electrical connection to the sensor.
- The sensor must have the following functionality:
  - The sensor must have three separate lights, a forward light, a center light and an aft light, along the longitudinal axis of the sensor body. Each of these three separate lights may be a single light or an array of lights to increase the visibility from the ground. The lights must be visible in flight by the Flight Director (there's lots of bright sunshine in Arizona in April!). The type and color of the lights is up to each team to decide to assure visibility from the ground.

- The lights must have three modes - “OFF”, “SOLID ON” and “FLASHING ON”. “SOLID ON” is all lights are on and stay on until commanded to a different mode. “FLASHING ON” is all lights automatically turn on and off at the same time until commanded to a different mode. The duration of the on and off cycle is up to each team to decide, but it must be distinguishable from the ground by the Flight Director.
- The lights must be commanded on and off remotely via the flight or payload transmitter. The Rx for the payload signal must be in the airplane, it may not be in the sensor.
- The control electronics that operate the lights and change modes must be in the sensor. The signal to the electronics to select modes must come from the airplane over the tow line through the sensor electrical connection.
- The sensor must contain its own battery to power the lights and control electronics. The battery must be compliant with the battery requirements in section 3.2.3. There are no restrictions on battery type or chemistry. The battery must be internal to the sensor airframe or body.

- The sensor must be carried internally to the airplane. No part of the sensor may be outside of the airplane external surfaces or features until commanded to deploy. If the opening for the sensor is not covered by a door or hatch for Mission 3, it may NOT be covered for Mission 1 and 2.
- Prior to deployment and after recovery, the sensor must be securely restrained by the deployment and recovery mechanism for take-off, flight and landing.
- Teams must have a sensor test box to test the functionality of the sensor. The test box simulates the signal from the airplane over the tow line to command the three modes of the sensor lights. The test box must connect to the sensor tow line electrical connection.

3.1.2 Deployment and Recovery Mechanism

- The deployment and recovery mechanism for the sensor must be internal to the airplane.
- The deployment and recovery mechanism must be permanently installed in the Mission 3 location for all missions.
- The deployment and recovery mechanism must deploy the sensor with a tow line to a distance equal to or greater than 1.5 times the airplane wingspan when measured from the exit location of the airplane to the forward tip of the sensor.

3.1.3 Sensor Shipping Container & Simulators

- The sensor shipping container must fully enclose the sensor and protect it from drop shock events as required in the Ground Mission.
- The sensor shipping container must be a rectangular prism.
- The sensor shipping container must meet the following requirements:
  - The top surface of the sensor shipping container must be marked with “TOP”. The surface marked “TOP” must be upright when loaded in the airplane for Mission 2.
  - Each pair of opposing sides of the sensor shipping container must be marked with the letters “O” or “E” on opposite sides. (Example: the top surface may be marked with an “O” and the bottom surface marked with an “E”; the left surface may be marked with an “O” and the right surface with an “E”; the forward surface may be marked with an “O” and the aft surface with an “E”). Teams may choose which side of pair of sides are marked with each letter.
- For mission 2, the sensor shipping container with the maximum weight sensor declared in Tech Inspection must be loaded and secured in the airplane with the surface marked “TOP” facing up.

- To facilitate the Ground Mission, teams must provide rigging to support the sensor shipping container and connect to the quick release mechanism.
    - The rigging must attach to the sensor shipping container as shown in Figure 1.
    - The rigging must terminate in a single metal lifting ring with a minimum inside diameter of 1/2 inch and maximum cross-section of 1/8 inch diameter.
    - The metal lifting ring will be suspended by a 1/4 inch diameter brass pin in the quick release mechanism.
    - The rigging must be designed and manufactured to suspend the sensor in shipping container parallel to the ground prior to the drop test for each direction.
    - The total distance from the rigging ring to the bottom surface of any container side should be less than 15 inches to assure teams will have the ability to drop up to the maximum drop height. The test fixture will be designed to accommodate various lengths of rigging and container sizes but will only guarantee that a maximum drop height of 60 inches may be achieved with a maximum rigging plus container length of 15 inches.
    - The feature(s) where the rigging attaches to the sensor shipping container must be flush or below the surface when the rigging is not attached; how the rigging attaches to the sensor shipping container is up to each team to decide.
    - There may be different rigging for each side of the sensor shipping container.

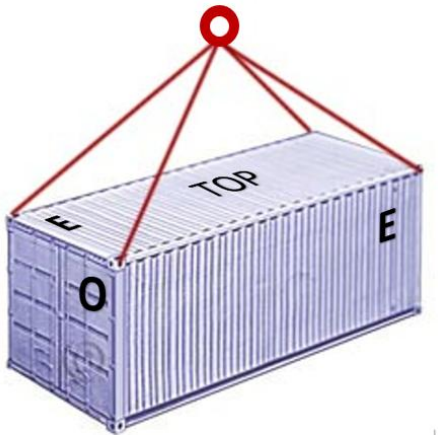


Figure 1. Sensor Shipping Container Rigging.

- Teams may attempt Mission 2 with optional shipping container simulators. The shipping container simulators have no function other than to replicate the size, shape and weight of the sensor shipping container with sensor. The construction and materials used in manufacturing of the shipping container simulators are not required to be the same as the sensor shipping container.
- All shipping container simulators must meet the following requirements:
    - The shipping container simulators must be the same shape and size as the sensor shipping container within +/- 1/8 inch.
    - The shipping container simulator must be the same weight as the sensor shipping container plus the maximum weight sensor declared in Tech Inspection within +/- 1 ounce.
    - The shipping container simulator must have “TOP” marked on the surface which corresponds to the top surface of the sensor shipping container.
- For Mission 2, the shipping container simulators must be loaded and secured in the airplane with the surface marked “TOP” facing up.

3.2 Airplane Requirements

3.2.1 General Requirements

- The airplane may be of any configuration except rotary wing or lighter-than-air.
- The airplane must be capable of performing all required missions.
- During Tech Inspection, the airplane must pass the wing tip load test in the flight configuration with the maximum designed takeoff weight, to include the heaviest weight payload declared and heaviest battery pack(s) to be flown.
- The loaded and empty CG locations must be marked on the exterior of the airplane.
- The maximum load demonstrated will be recorded and may not be increased after completing Tech Inspection.
- No structure nor components may be dropped from the airplane during flight unless required by a mission specific objective.
- All structure, components, and payloads must be mechanically fastened and not rely on friction to be the primary retention method.
- No form of externally assisted take-off is allowed. All energy for take-off must come from the on-board propulsion battery pack(s).
- The airplane must be propeller driven and electric powered with an unmodified, over-the-counter model, brushed or brushless electric motor.
- The airplane must be radio-controlled with manual flight by the pilot. No autopilots/flight controllers are allowed under any circumstances, even in manual mode. No onboard GPS systems are allowed. Flight stabilization subsystems and rate gyros are allowed.
- The radio-control Transmitter/Receiver must be a commercially available controller with fail-safe capability and operating on a legal US frequency (72MHz, 900MHz, 2.4GHz).
- Telemetry data transmitted via the receiver to the pilot's RC controller are allowed. Telemetry systems using stand-alone transmitters and receivers or ground stations are not allowed. On-board data recording systems without the ability to transmit or receive radio frequency signals are allowed.
- Cameras on or in the airplane are not allowed during the competition under any circumstances.
- The airplane may use multiple motors and/or propellers.
- Propellors may be driven with direct connection to the motor or with gear or belt reduction.
- Commercial ducted fan units are allowed.
- For safety, each airplane will use a commercially produced propeller/blades. The propeller may have folding blades. The propeller blades may be modified to reduce the propeller diameter by clipping the tips. Paint may be applied to the blades to balance the propeller. The propeller mounting bore hole may be modified using a commercially procured propeller shaft reaming tool only. No other modifications to the propeller are allowed.
- The propeller (diameter/pitch) may be changed for each flight attempt.
- This is an Academy of Model Aeronautics (AMA) sanctioned event. The following compliance requirements will be strictly enforced:
    - The airplane TOGW (take-off gross weight with payload) must be less than 55-lb.
    - The exact airplane being presented at Tech Inspection must have been flown prior to the contest date. Proof of flight must be presented upon entering Tech Inspection.

Note: Proof of flight is a video showing controlled straight and level flight and will be presented to the inspector when called to Tech Inspection.

- The airplane must remain substantially the same as documented in the report (for example teams may not change a flying wing design to a conventional tail design). Teams may make small modifications to the design to improve flight performance after the report submission (one example would be changing a control surface size). The configuration drawing supplied in PDF form as described below in the Design Report section will be used to verify the airplane configuration during Tech Inspection.
- Note: There is no requirement for the configuration of the airplane presented in the Proposal to be the same as presented in the Design Report.
- The airplane must have an externally accessible SWITCH to turn on the radio control system. It may not be internal or under a panel or hatch. An arming plug is NOT considered an acceptable switch. The radio control system switch must be separate from the propulsion system fuse & arming system.
- All components must be adequately secured to the vehicle and all permanent fasteners shall be tight with a secondary retention method such as safety wire, thread locker (Loctite™), or nuts/screws with a mechanical interference fit (Nylocks™). Clevises on flight controls and steering mechanisms must have an appropriate mechanical locking device to prevent them from disengaging in flight.
- All control horns must be adequately and properly secured to the control surfaces. Commercially available control horns MUST be installed per manufacturer's instructions. NOTE: Control horns may not be adhered to film surfaces as sole attachment method.
- All control surfaces, wing-surfaces, and fuselage components supporting aerodynamic surfaces must have adequate stiffness to resist flutter & aero-elastic effects.
- All motors and propellers must be secured to airplane with sufficient strength and integrity to withstand all expected flight loads, including but not limited to thrust, torque, flight maneuvers, and landing loads.
- All electrical connections shall be fully insulated with no visible wires or exposed surfaces which may conduct electricity.

3.2.2 Arming and Safety

- The airplane must have an external motor arming plug for each propulsion system separate from the onboard radio receiver (Rx) switch.
- The arming plug may be commercially procured similar to the one shown in Figure 2 or manufactured by the teams.



Arming Plug Example Link

Figure 2. Motor Arming Plug Example.

- The arming plug wire must be the same gauge or larger diameter than the propulsion battery wire.
- **No part of the arming plug may be closer than 6 inches from the plane of any propeller as shown in Figure 3. Note that the propeller plane extends beyond the physical dimensions of the airplane.**

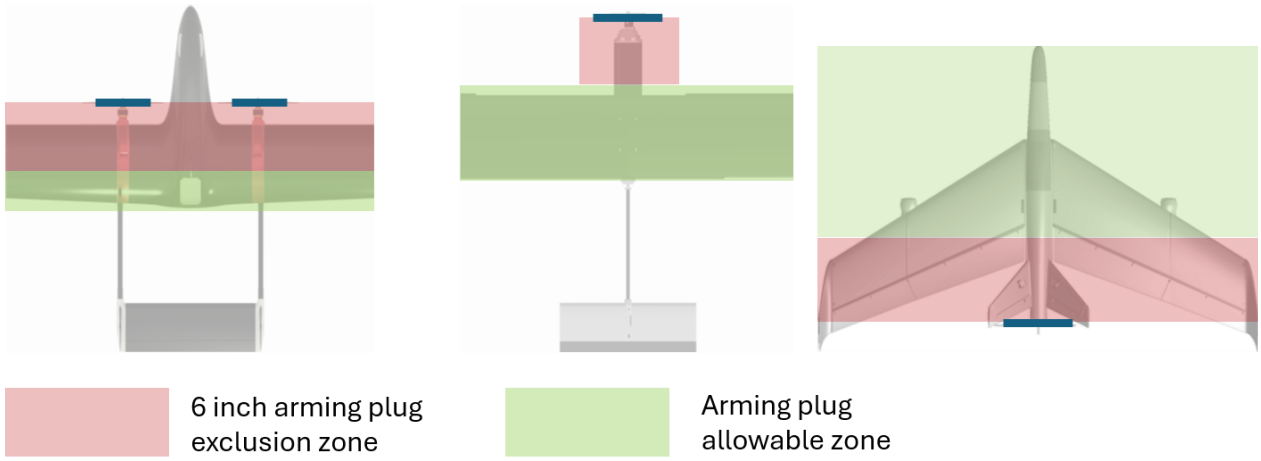


Figure 3. Arming Plug Location Requirements.

- The arming plug must be located so it is accessible by a crew member standing ahead of the propeller(s) for pusher airplanes and standing behind the propeller(s) for tractor airplanes (*i.e.* the crew member must not reach across the propeller plane to access the arming plug). The airplane Rx should always be powered on and the throttle verified to be "closed" prior to installing the arming plug.
- The arming plug MUST be mounted on the outside of the airplane (it may NOT be behind an access panel or door) and MUST act as the system "safing" device.

Note: The airplane must be "safed" (arming plug removed) any time the airplane is being manually moved, or while loading/unloading payloads during the missions. The arming plug must be removed anytime the airplane is in the hangar or team tent area.

- **The arming plug MUST be mounted on the top or upper surface of the airplane such that is easily accessible. Any location that is deemed unsafe by the Tech Inspector must be corrected in order to pass Tech Inspection.**
- **The arming plug shall be integrated into the electrical circuit on the positive (+ Red) wire between the fuse and the electronic speed controller (ESC), as shown in Figure 4.**

3.2.3 Batteries & Power

- All battery packs must be un-altered and commercially procured as Commercial-Off-The-Shelf (COTS) battery packs. Custom battery packs are not allowed.
- **The Original Manufacturer's Label must be clearly visible on ALL battery packs.**
    - The Original Label MUST clearly state the Battery Chemistry, Battery Capacity (mAh), Voltage (V), and C-Rating or maximum current rating.
- A separate battery is required for the Rx/Servos on the airplane. There is no restriction on the Rx/Servo and Transmitter battery type regardless of the propulsion battery type.
- If the ESC has a Battery Eliminator Circuit (BEC), it must be disabled.
- All battery connections must be "fully insulated" style connectors.
- Manufacturer-installed intra-pack charging connectors are allowed.
- All batteries must be stored and charged in a commercially-available, unaltered and manufacturer-labeled battery charging sack or manufacturer-labeled charging box – the only time batteries may be out of the sack is for tech inspection or while in the airplane. The fuse harness shall be connected to the battery and stored in the charging sack prior to entering the staging area.

3.2.3.1 Propulsion Systems

- There shall be a maximum of one battery pack connected to a propulsion system. A propulsion system consists of one battery, one fuse, one externally accessible arming plug, one or more electronic speed controllers (ESC), and one or more motors as shown in Figure 4.
- If more than one propulsion system is implemented, the following rules apply:
    - All propulsion battery packs must be identical (same manufacturer, part number, size, voltage, power, rating, etc).
    - Each battery pack must be independently connected to its own propulsion system. Batteries may not be connected in series or parallel.
    - If a battery pack has more than one output connector, the output must be combined in wiring prior to the fuse. A battery pack with more than one output connector may not be wired to more than one propulsion system.
    - Each battery/propulsion system is required to have its own fuse and arming plug.

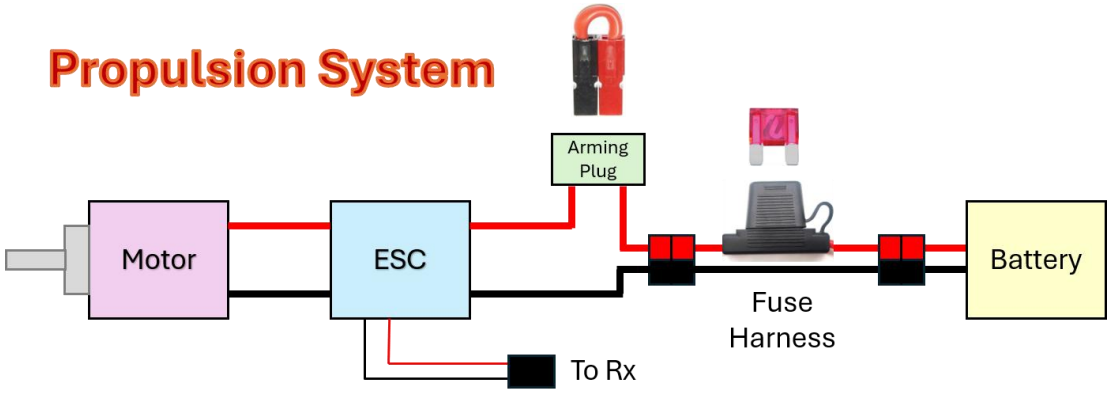


Figure 4. Propulsion System Wiring Requirements.

- The fuse must be a blade style fuse as shown in Figure 5. The fuse must be in a separate fuse harness between the battery and arming plug.



100 Amp Blade Style Fuse



100 Amp Fuse Holder

Figure 5. Fuse and Fuse Holder.

3.2.3.2 Propulsion Batteries

- All propulsion batteries used in the competition must be approved in tech inspection and will be indicated with an approved contest decal.
- Propulsion batteries may be NiCAD, NiMH or lithium-based chemistries.

- Total Propulsion Energy stored on airplane (sum of all propulsion batteries) shall not exceed 100 Watt-hours.
- Individual battery packs may not exceed the FAA limits for hand carry on commercial air flights of 100 Watt-hours (rated capacity * rated voltage) per battery pack and as further defined in:

  https://www.tsa.gov/travel/security-screening/whatcanibring/items/lithium-batteries-more-100-watt-hours

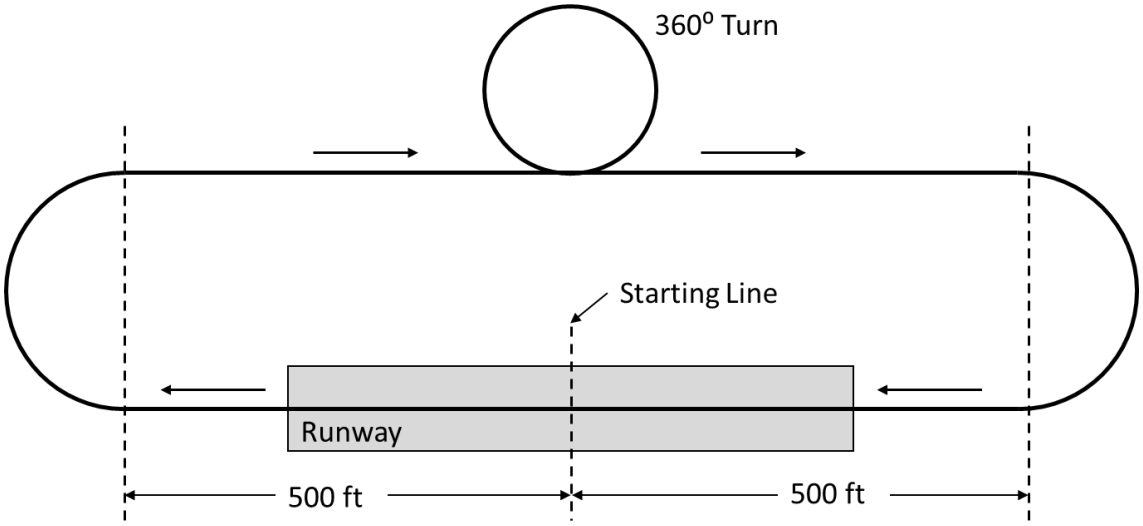
- The maximum current rating for the fuse is the maximum continuous discharge current rating of the battery pack (battery capacity * C-rating or maximum labeled discharge current) up to 100 amps.

NOTE: It is the responsibility of each team to ensure compliance with all laws and regulations for shipping or hand-carrying batteries.

3.3 Mission Operations

3.3.1 Flight Course

The nominal flight course is shown below. The orientation (direction) of the flight course will be adjusted based on the prevailing winds as determined by the Flight Line Judge. The flight course will be positioned to maintain the greatest possible safety to personnel and facilities.



Flight Course

3.3.2 Staging

- When called to the flight line, teams will first enter the staging area. Teams will be assigned a staging box to prepare for the flight attempt.
- The airplane will be brought to the staging area with the propulsion battery pack(s) with fuse harnesses attached, payloads, and arming plug removed from the airplane.
    - The airplane must be in the desired configuration to start the assembly. Once a team enters the **staging area**, no adjustments are allowed to the airplane configuration such as opening hatches or any other work necessary for the installation of batteries and payloads.
    - All payload restraints must be in the airplane prior to entering the staging area.
    - Ballast may be used in the airplane but it must be installed prior to entering the staging area and may not be moved or adjusted during payload and propulsion battery installation.
    - For Mission 2, the sensor must be the maximum weight declared in Tech Inspection and the total weight of the sensor in shipping container and optional shipping container simulators will be measured and recorded. The sensor in shipping container and optional shipping container simulators will be installed and secured within the aircraft during the 5-minute assembly time in the staging box.
    - For Mission 3, teams will enter the staging area with the sensor packed in the sensor shipping container separate from the airplane. The sensor will be removed from the sensor shipping container and attached and secured to the deployment and recovery device during the 5-minute assembly time in the staging box.
- Each team must bring all tools, assembly aids, consumable materials (tape, rubber bands, etc.) with them to the staging area. If a team forgets something they must leave the staging box and forfeit their flight attempt.

- Only the mission support crew may go to and enter the staging box. The mission support crew may include a pilot, an observer and a ground crew member. The observer and ground crew member must be students.
- The ground crew member is the only person who may touch the airplane while inside the staging box while preparing the airplane for flight. One exception is to check balance using the wing tips with the aid of the observer or pilot. Additional exceptions for the safety of the airplane and personnel due to weather conditions may be allowed at the discretion of the Staging Judge.
- Prior to starting assembly of the airplane, the propulsion battery pack(s) will be inspected to verify it has been approved in Tech Inspection and that the fuse harness is attached with correctly sized fuse.
- There will be a 5-minute time limit in the staging box once time has been started as declared by the Staging Judge. Any and all work required to install the propulsion battery pack(s) and payloads, check flight controls and prepare the airplane for flight must be completed within the 5-minute time limit.
- Prior to starting the 5-minute assembly time, teams may place the airplane, payloads, batteries, tools and materials in any configuration desired within the staging box. Staging boxes will be adequately sized to accommodate this.
    - **Absolutely no work is allowed until the 5-minute time has started. This will be strictly enforced. Teams beginning work on the airplane prior to the Staging Judge starting the time will be given a single warning. Any further violations may result in a forfeit of the flight attempt at the discretion of the Staging Judge.**
- Teams are allowed to use a fixture or stand to hold the airplane for payload installation and preparation for flight. There are no restrictions on the orientation of the airplane during the 5-minute staging assembly time.
- There is no work allowed on the airplane after the 5-minute assembly and checkout time. The airplane must be ready to fly prior to being called to the flight line, less the installation of the arming plug. If the assembly is not completed or the airplane is not ready to fly, the team forfeits the flight attempt and must return to the flight queue. No work is allowed on the airplane after leaving the staging box enroute to the flight line other than installation of the arming plug, and controls and propulsion checks prior to take-off.

Staging Area Entrance Criteria

The airplane is in the configuration desired to start staging box assembly
Payload restraint systems are inside the airplane
Propulsion batteries are NOT installed, and are in an approved charging sack; the fuse harness with appropriate size fuse is attached to the propulsion battery
For Mission 2, the max weight sensor in shipping container plus optional shipping container simulators
For Mission 3, the sensor in shipping container
Arming Plug
All tools, consumable materials, assembly aids, etc

3.3.3 Flight Missions

- The Flight Missions must be flown in order.
- **NEW THIS YEAR: Teams may elect to waive a Mission 1 attempt and proceed directly to Mission 2 as their first mission attempt. A successful Mission 2 then also results in a Mission 1 score for the team. If a team waives Mission 1 and then fails to complete Mission 2, the team may not then attempt a Mission 1. The team must continue to attempt to complete Mission 2 before proceeding.**
- A new mission may not be flown until the team has obtained a successful score for the preceding mission.
- After successfully completing all three flight missions, teams will be allowed one additional attempt for both Mission 2 and Mission 3 to improve their score.
- The airplane must be flown in the same configuration for all three missions unless specifically cited herein.
- The airplane will use ground rolling takeoff and landing. There is no limit on take-off distance this year.
- The upwind turn will be made after passing the upwind marker. The downwind turn will be made after passing the downwind marker. Upwind and downwind markers will be 500 ft from the starting line. The airplane must be "straight and level" when passing the turn marker before initiating a turn.
- The airplane must complete a successful landing at the end of each mission for the mission to receive a score. A successful landing is defined as landing on the paved portion of the runway. The airplane may "run-off" the runway during roll-out. The airplane may not “bounce” off the runway.
- Airplanes obtaining “significant” damage during landing will not receive a score for that flight. Determination of “significant” is solely at the discretion of the Flight Line Judge.
- Flight altitude must be sufficient for safe terrain clearance and low enough to maintain good visual contact with the airplane. Decisions on safe flight altitude will be at the discretion of the Flight Line Judge and all rulings will be final.
    - **All instructions from the Flight Line Judge must be followed IMMEDIATELY. Failure to do so may result in a loss of mission attempt or in the case of multiple or serious infractions, loss of future flight attempts.**

3.3.3.1 Mission 1 – Staging Flight

- There is no payload for this mission.
- Teams must complete 3 laps within the flight window.
- There will be a 5-minute flight window for this mission.
- Time starts when the airplane throttle is advanced for the first take-off (or attempt).
- A lap is complete when the airplane passes over the start/finish line in the air (landing is not part of the 5-minute time window).
- A successful landing must be completed to get a score.

Scoring:

M1 = 1.0 for successful mission

3.3.3.2 Mission 2 – Delivery Flight

- The payload for Mission 2 is sensor in shipping container and shipping container simulators; the minimum payload must include the sensor in shipping container.
- Teams may select the number of additional sensor container simulators flown but may not exceed the maximum number declared at Tech Inspection.

- Teams must complete 5 laps within the flight window.
- There will be a 5-minute window for this mission.
- The score will be a function of the total weight of the sensor in shipping container plus optional shipping container simulators flown / flight time.
- Time starts when the airplane throttle is advanced for the first take-off (or attempt).
- A lap is complete when the airplane passes over the start/finish line in the air.
- Time stops when the aircraft passes over the start/finish line in the air at the end of the fifth lap (landing is not part of the 5-minute time window).
- A successful landing must be completed to get a score.

Scoring:

M2 = 1 + [N_(weight/time) / Max_(weight/time)], where Max_(weight/time) is the highest weight/time score of all teams

3.3.3.3 Mission 3 – Sensor Flight

- The payload for Mission 3 is the sensor.
- After a successful take-off, the sensor must be deployed by remote command and must be fully deployed prior to the first downwind 180-degree turn. The sensor lights must be in the "OFF" mode when deployed.
- After crossing the start/finish line to complete the first lap, the sensor lights must be commanded to the "SOLID ON" mode prior to the next upwind turn.
- After crossing the start/finish line to complete the second lap, the sensor lights must be commanded to the "FLASHING ON" mode prior to the next upwind turn.
- After completion of the final lap, the sensor will be commanded to the lights "OFF" mode and stowed by remote command; the sensor must be fully stowed inside the aircraft prior to landing.
- There will be a 5-minute window for this mission.
- The score is a function of number of laps flown and sensor weight.
- Time starts when the airplane throttle is advanced for the first take-off (or attempt).
- A lap is complete when the airplane passes over the start/finish line in the air (landing is not part of the 5-minute time window).
- A successful landing must be completed to get a score.

Scoring:

M3 = 2 + [N_(#laps X sensor weight) / Max_(#laps X sensor weight)] , where Max_(#laps X sensor weight) is the highest #laps X sensor weight score of all teams

3.3.4 Ground Mission

- The Ground Mission is a demonstration of the ability of the sensor shipping container to protect the sensor during shipping and handling.
- There will be a five minute time limit for this mission.
- The sensor must be at the maximum weight declared in Tech Inspection.

- The assembly crew member is the only team member to participate in the Ground Mission.
- Prior to entering the mission box, the sensor weight will be measured and verified to match the maximum Tech Inspection weight. The assembly crew member will demonstrate that the lights are functional using the sensor test box and then install and secure the sensor in the sensor shipping container. This is not part of the 5-minute mission time limit.
- The assembly crew member will roll the die. If the result is an even number, all drop tests will be on the container surfaces marked with an "E" and if the result is odd, all drop tests will be on the container surfaces marked with an "O".
- The assembly crew member will select the order of the sides of the container for the drop test.
- The assembly crew member will declare the drop height in whole inches up to a maximum of 60 inches. This will be the drop height for all three sides measured from the ground to the surface that will impact the ground.
- There will be a total of six drops. The sensor in shipping container will be dropped two successive times on each side.
- The drops will be onto a concrete floor.
- The 5-minute mission time limit will be for attaching and changing the rigging, then loading into the quick release mechanism and then removing the sensor from the shipping container after all drops are completed.
    - Time starts when the crew member begins attaching the rigging to the sensor shipping container for the first time.
    - Time stops when the metal lifting ring of the rigging with sensor shipping container attached is secured in the quick release mechanism and the mission judge has closed the quick release mechanism.
    - After the first set of 2 drops, the time will restart when the assembly crew member starts to remove the rigging and then attach the rigging to the next side to be dropped.
    - Time stops when the metal lifting ring of the rigging with sensor shipping container attached is secured in the quick release mechanism and the mission judge has closed the quick release mechanism.
    - After the second set of two drops, the time will restart when the assembly crew member starts to remove the rigging and then attach the rigging to the final side to be dropped.
    - Time stops when the metal lifting ring of the rigging with sensor shipping container attached is secured in the quick release mechanism and the mission judge has closed the quick release mechanism.
    - After the final set of two drops, the time will restart when the assembly crew member starts to remove the rigging from the sensor shipping container.
    - Time stops when the rigging has been removed from the shipping container and the sensor shipping container has been opened and the sensor removed.
    - The actual drop test and reattachment of the rigging to the quick release mechanism between drops for a given side is not part of the 5-minute mission time.
    - The mission will be a failure if all of the above tasks are not completed within the 5-minute mission time.
- The mission judge will open and close the quick release mechanism when the assembly crew member is ready to attach the rigging metal lifting ring. The quick release mechanism at the start of the mission will be approximately four feet above the floor.

- After the rigging is attached to the quick release mechanism, the mission judge will then set the drop height for first pair of drops to the declared value with the assistance of the assembly crew member, if necessary, and confirm the bottom surface is parallel to the ground.
- The quick release mechanism will remain at the height set for first pair of drops until assembly crew member attaches rigging for third drop. The mission judge will then set the drop height for second pair of drops to the previously declared value.
- The quick release mechanism will remain at the height set for the second pair of drops until assembly crew member attaches rigging for fifth drop. The mission judge will then set the drop height for the final pair of drops to the previously declared value.
- The quick release mechanism will remain at the height set for the final pair of drops through the end of the ground mission.
- The quick release mechanism and test fixture is shown in Figure 6. The quick release mechanism will be suspended from the test fixture with an adjustable height for each drop.

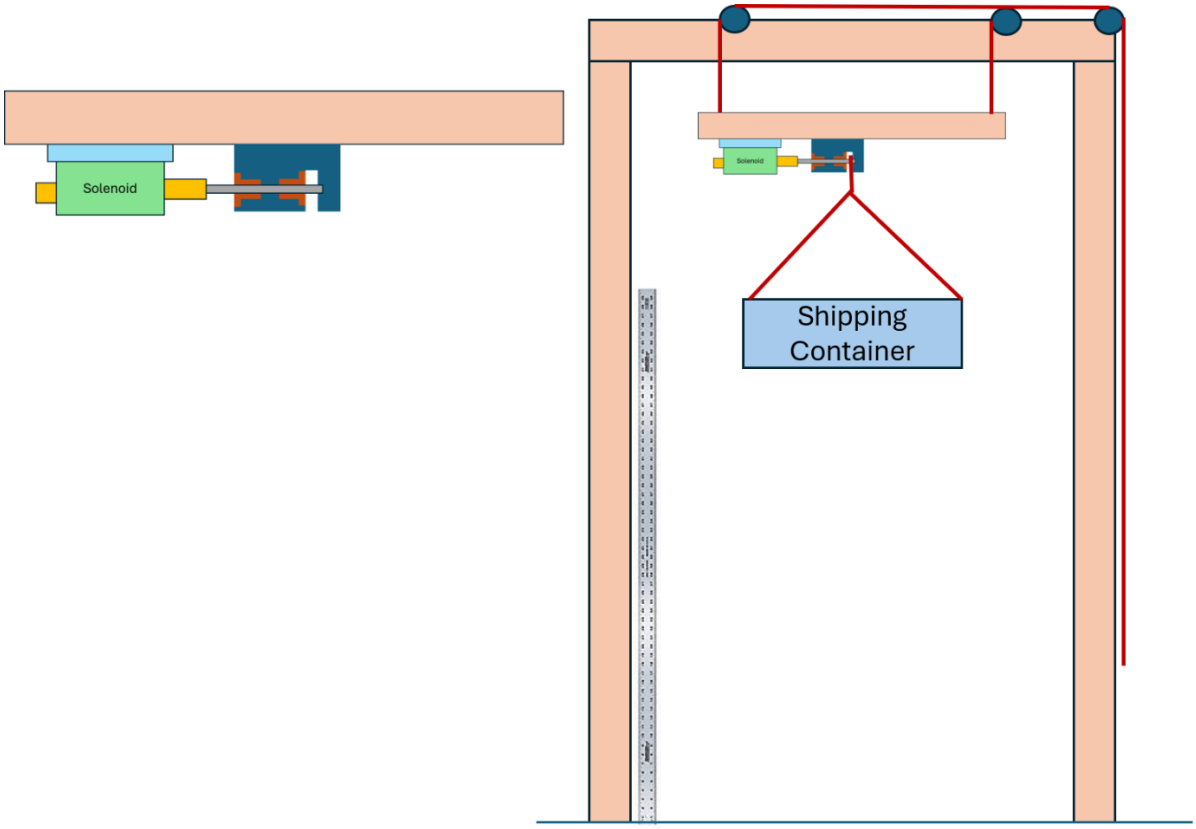


Figure 6. Adjustable Height Quick Release Mechanism.

- If any drop damages the rigging or damages the container such that the rigging cannot be removed from the sensor shipping container or attached to the next side, the mission is a failure.
- After the sensor has been removed from the sensor shipping container, the mission judge will inspect it for damage. Any physical or structural damage is a mission failure. The decision of the mission judge will be final. Examples of physical or structural damage include but are not limited to the following:
    - Pieces that have broken away from the sensor.
    - Buckling or denting of the sensor airframe or body.

    - Damage to any fins, wings or aero control surfaces.
    - Damage to the tow line attachment feature(s), including the electrical interface to the sensor.
- The assembly crew member will then connect the sensor test box to the sensor and demonstrate that the lights are functional by cycling through the sensor light modes (“OFF”, “SOLID ON” and “FLASHING ON”). Altered or missing function of the sensor lights is a mission failure.
- The mission score is a function of sensor weight and drop height.
- After successfully completing the ground mission, teams will be allowed one additional attempt to improve their score.

Scoring:

$GM = 0.5 + [N_(weight\ X\ height) / MAX_(weight\ X\ height)]$, where Max_(weight X height) is the greatest (weight X height) for all teams.

4. Fly-off Technical Inspection

Each team may only submit one airplane (airframe) to technical inspection for the fly-off. All airplanes, along with batteries, payloads and required hardware, will undergo a technical inspection by a designated contest Tech Inspector. The Tech Inspection will verify that all safety, design and mission requirements are satisfied prior to attempting any competition flights or ground mission. All decisions of the Tech inspector are final.

To speed up the tech inspection process, each team MUST present a paper copy of a signed Pre-Tech and First-Flight Certification when called to begin their on-site tech inspection. Teams may not begin the on-site tech inspection without a completed and signed certification. The Pre-Tech and First-Flight Certification sheet will be provided to each team prior to the fly-off and made available on the contest website.

The Pre-Tech must be conducted by, and signed off by, a non-team member RC pilot or the team faculty advisor. The Pre-Tech will cover the same safety of flight requirements and mission compliance as the on-site tech inspection and will assist teams in making sure they are ready and able to pass the on-site tech inspection the first time. An expanded First-Flight requirement, which also must be signed off by a non-team member RC pilot or the team faculty advisor, requires demonstration of a complete flight including take-off, flying a minimum flight pattern, and landing in a pre-designated location without damage to the airplane. The non-team member RC pilot who signs the inspection and flight certifications may be the same as a team's non-student contest pilot. This certification is independent of the AMA compliance video demonstrating controlled straight and level flight.

Each team will also present their proof of flight video showing controlled straight and level flight to the Tech Inspector when called to Tech Inspection.

The Tech Inspector will verify the airplane presented for Tech Inspection matches the configuration documented in the configuration drawing submitted with the Design Report.

Only two student team members are allowed in Tech Inspection. Additional team members may help carry airplanes and hardware to and from the Tech Inspection area but must exit before starting.

A second inspection station may be established for batteries and payloads only at the discretion of the DBF organizing committee. If so, a third team member will be allowed to present batteries and payloads for inspection in parallel to inspection of the airplane.

In order to speed up Tech Inspection, teams must be able to install payloads and make configuration changes in a timely manner. At the sole discretion of the Tech Inspector, teams may be required to return to the Tech Inspection queue if the time it takes to make these changes is excessive.

Teams may be allowed, at the sole discretion of the Tech Inspector, to correct minor non-conformances during Tech Inspection. The primary criteria will be how long it is estimated by the Tech Inspector to complete the modifications.

4.1 Airplane Staging

- The airplane will enter Tech Inspection without any payload items or propulsion batteries installed in the airplane. The deployment and recovery mechanism must be permanently installed in the airplane.
- Team members will declare the maximum number of Mission 2 shipping container simulators.
- The sensor must be at its maximum weight and not in the sensor shipping container. This will be the maximum weight of the sensor for any mission attempt.
- All propulsion batteries and battery packs that teams intend to use over the full duration of the competition, including back-up batteries, must be brought to Tech Inspection in an approved charging sack.
- Teams must bring all fuses and fuse harnesses that teams intend to use over the full duration of the competition.

Tech Inspection Entrance Criteria

Signed Pre-Tech and First-Flight Certification form – **all signatures required**
Video showing straight and level flight of the airplane being brought to Tech Inspection
The airplane to be inspected
All propulsion batteries in an approved charging sack
All fuses and fuse harnesses
All payload components ○ Sensor at maximum weight ○ Sensor shipping container ○ Shipping container simulators ○ Sensor test box
Arming Plug(s)

Note: Teams failing to bring the required documents, video and hardware noted above when entering Tech Inspection will be denied entrance and must return to the Tech Inspection queue.

4.2 Minimum Safety Inspections

The following minimum safety inspections will be performed. Additional inspections may be conducted at the discretion of the Tech Inspector.

In order to speed up tech inspection, it is the sole responsibility of the teams to ensure all inspections may be easily completed by the Tech Inspector. The required inspections below must be easily accessible and visible for the inspector. If required inspection items are hidden behind permanent panels/bulkheads, buried under wiring or other airplane components or not easy to find and identify, teams may be required to leave Tech Inspection, correct the problems identified and return to the Tech Inspection queue at the sole discretion of the Tech Inspector.

4.2.1 Physical Inspection

- Verify all components are adequately secured to the vehicle. Verify all permanent fasteners are tight and have either safety wire, thread locker (LoctiteTM), or nuts/screws with a mechanical interference fit such as nylon inserts or patches or self-locking threads. Clevises on flight controls and steering mechanisms must have an appropriate mechanical locking device to prevent their disengaging in flight.
- Verify each hatch or access panel has a positive, mechanical latching method to assure it does not come loose in flight. Spring latches, fasteners, cotter pins, tape, etc are examples of acceptable methods. Magnets are not an acceptable latching method. Velcro may be an acceptable method depending on the implementation, but a secondary method may be required at the discretion of the Tech Inspector.
- Verify propeller structural and attachment integrity.
- Verify propulsion is provided by a commercially available electric motor.
- Verify motor attachment integrity.
- Visually inspect all electronic wiring to assure adequate wire gauges and connectors are used and all wires are fully insulated (no bare conductors).
- Verify there are no illegal components or subsystems (autopilots/flight controllers, GPS, cameras).
- Verify all control rods are of the proper gauge/strength, and are securely attached to control horns.

- Verify all control horns are properly secured to the control surfaces. Commercially available control horns **MUST** be installed per manufacturer's instructions. **NOTE**: Control horns may not be adhered to film surfaces as sole attachment mechanism.
- Verify all control surfaces and connections and wings/stabilizer are of adequate stiffness to resist flutter and aero-elastic effects.

4.2.2 Arming and Safety

- Verify the arming plug and wiring is same gauge or larger diameter than the propulsion battery wire.
- Verify the arming plug location on the airplane meets ALL safety requirements.
    - It is located at least 6 inches from any propellor plane that extends beyond the physical dimensions of the airplane.
    - It may be accessed easily from behind the propellor, not from the side of the airplane, of tractor airplanes and from in front of the propellor on pusher airplanes without having to reach around or avoid other components during insertion and extraction.
    - It is on the top surface of the airplane and there are no blind or hard to reach locations.

4.2.3 Batteries and Propulsion Systems

- Verify all batteries are an approved chemistry.
- Verify there is a separate receiver battery and the BEC, if equipped, has been disabled.
- Verify all propulsion batteries are the same chemistry with manufacturer's label and in original packaging.
- Verify each propulsion battery does not exceed 100 W-hrs in capacity.
- Verify there is only one battery per propulsion system.
- Verify the battery original wire leads are intact and connectors are of proper size and insulated.
- Verify each fuse harness has a blade style fuse holder and fuse on the positive lead of the propulsion battery.
- Verify all batteries are adequately secured in the airplane for all phases of flight.
- Verify the team has a compliant battery charging sack and it is properly used.

NOTE: Teams will be allowed to have additional batteries or battery packs inspected after passing Tech Inspection due to damage, real time power change requirements, etc. However, teams must follow the Tech Inspection queue or wait until Tech Inspection is open for all for additional battery inspections. Any team attempting to use batteries that have not passed Tech Inspection will lose that flight attempt and may not attempt any further flights until the batteries have passed inspection.

4.2.4 Structural Verification

The airplane will be lifted with one lift point at each wing tip with the airplane configured with the maximum weight of payloads and batteries (MGTOW) to verify adequate wing strength (this is "roughly" equivalent to a 2.5g load case) and to verify the required vehicle cg location markings. Verify the MGTOW does not exceed 55 lbs. Special provisions will be made at the time of the contest for airplanes whose cg does not fall within the wing tip chord.

4.2.5 Radio Range Check and Fail-Safe Validation

Note: Teams must put the RC controller in the Range Check (low power) mode while conducting this test. It is the team member's or pilot's responsibility to know how to put the RC controller in this mode prior to entering Tech Inspection.

- Verify the Radio-Controlled Transmitter/Receiver is a commercially available controller with fail-safe capability and operating on a legal US frequency (72MHz, 900MHz, 2.4GHz).

- Verify the propulsion system(s) does not operate with arming plug removed.
- Verify the airplane does not respond to commands with receiver switch OFF and arming plug installed.
- Verify airplane controls respond to commands with ¼ propulsion power and in the proper direction.
- Verify fail-safe mode by turning the airplane receiver on and then turning the RC controller off and confirm the airplane controls respond as follows:
    - Throttle closed
    - Full up elevator
    - Full right rudder
    - Full right aileron
    - Full Flaps down

For airplanes not equipped with a particular control, then the tech inspector must be satisfied that the intended function of the fail-safe system will be carried out.

The radio Fail Safe provisions will be strictly enforced.

4.3 Mission Compliance

- Verify the airplane, payloads and any mission specific components or systems are compliant to the current mission requirements. This includes but is not limited to the airplane configuration and size, compliance of any team-supplied payloads, proper restraints of all payloads and any other items related to specific design or performance requirements for the contest mission.
- Verify and document mission payloads (quantity, size, weight, etc), to include but not limited to the following:
    - Sensor length
    - Sensor max weight
    - Max sensor weight in shipping container
    - Sensor container markings
    - Size and weight of each shipping container simulator
    - Shipping container simulator markings
    - Minimum sensor deployment length

5. Reports

All material contained within all proposals and design reports must be original work of the teams or appropriately cited in the bibliography section of the report or in the footnotes of the proposal. All proposals and reports will be reviewed using standard AIAA tools. Any material that is found to be uncited and non-original work will be subject to a penalty as determined by the DBF Organizing Committee. Based on severity, penalties may include points deducted from the proposal or report score up to a 100% reduction or full disqualification for the competition year.

5.1 Proposal

Note: The proposal score will be incorporated into the final team score as a percentage of the Total Report Score. Details can be found in the Scoring section of the Rules.

Each team will submit a proposal as outlined below that will be judged.

Examples of top scoring proposals from prior contest years are posted on the contest website. Note that the formatting and content requirements may have changed from one year to the next. Prior year proposals may not reflect or meet the rules listed for the current year.

Note: Proposals must strictly adhere to the following requirements. Failure to meet requirements will result in penalties that range from score reduction to elimination from the contest.

5.1.1 Proposal Formatting Requirements

- Proposals must be in PDF format. **Proposals that are not in PDF format will not be accepted.**
- Proposals must be one and one-half line spacing with a 10-pt font, Arial font is recommended. Text, tables, and figures should be clear and readable for the judges. Proposals will be assessed for format and readability at the judges' discretion.
- Proposals must have the University name on the first page.
- Absolute maximum page count for the proposal is **6** pages, the PDF reader "pages" value will be used as the official page count.
- **Proposals exceeding the maximum page count will not be accepted.**
- Proposal PDF must be formatted as 8.5" x 11" pages.

5.1.2 Proposal Submission Requirements

Each team must provide an electronic copy of their proposal as outlined below to the online Submission site.

- The proposal must be named: "2027DBF_[university name]_PROPOSAL.pdf" .
    - University name should not be an acronym.
    - Universities with multiple campuses should specify which campus in the university name.
- The proposal must be a single file with all figures/drawings included in the proper sequence in PDF format.
- Note: The proposal should have all figures compressed to print resolution to reduce file size to a recommended 20 MB maximum.

5.1.3 Proposal Scoring

Proposals will be scored on a 100-point basis following the guidelines outlined below.

All information used for scoring must be in the outlined sections. **Content that is out of sequence will be treated as missing and scored accordingly.**

ALL items requested below should be present, easy to locate and identify, well documented and in the correct section for full scoring. Note that all proposals are assessed relative to each other so that simply addressing each of the sections

below may not be sufficient for full credit. Proposals will be assessed on how well they communicate the required information given the size and length constraints.

Summary of Proposal Non-compliance Penalties

Requirement	Penalty
Must be in PDF format	Rejection (Not Accepted)
Maximum page count of 6 pages	Rejection (Not Accepted)

5.1.4 Proposal Scoring Rubric

All section scores include format, completeness and readability.

Executive Summary (**5** points):

- Objective Statement.
- Planned approach to achieve all objectives.
- Includes main points from subsequent sections.

Management Summary (20 points):

- Describe the organization, the roles of each team and individual skill sets required.
- Organization chart (by team/function, individual names are not required for the proposal).
- Schedule / Major Milestone chart.
- Budget (not only for expected materials and manufacturing of the airplane, but for travel to the competition site and any other expenses associated with the competition).

Conceptual Design Approach (55 points):

- Decomposition of mission requirements into sub-system requirements.
- Trade Studies conducted with results.
- Preliminary design / sizing results; concept sketch, if available (does not have to be representative of the final design).
- Sensitivity Study of Design Parameters.
- Description of design approach for each mission including initial targets for contest specific scoring parameters such as payloads, weights, and/or lap times.

Manufacturing Plan (10 points):

- Preliminary manufacturing flow.
- Describe critical processes or technologies required.

Test Planning (10 points):

- Component and ground test plan.
- Flight test plan.

5.2 Design Report

Each team will submit a design report as outlined below that will be judged.

Examples of winning team design reports from prior contest years are posted on the contest website. Note that the formatting and content requirements have changed from one year to the next. Prior year reports may not reflect or meet the rules listed for the current year.

Note: Reports must strictly adhere to the following requirements. Failure to meet requirements will result in penalties that range from score reduction to elimination from the contest.

5.2.1 Design Report Formatting Requirements

- Reports must be in PDF format.

Reports that are not in PDF format will not be accepted.

- Reports must have a minimum line spacing of one and one-half with a minimum 10-point font. Ariel font is recommended.
- All tables and figures must adhere to the one and one-half line spacing and 10-point font requirement.
- Any section failing to meet the line spacing or font requirement will not be graded.
- Reports must have the University name on the cover page.
- Absolute maximum page count for the report is 60 pages, the PDF reader "pages" value will be used as the official page count.

Reports exceeding the maximum page count will incur a 10-point penalty for each additional page.

- Report PDF must be formatted as 8.5” x 11" pages.
- May use 11” x 17" pages for the drawing package only.
- An additional stand-alone configuration drawing must be submitted along with the report file. See description below in the requirements section.

5.2.2 Design Report Submission Requirements

Each team must provide an electronic copy of their design report as outlined below to the online Submission site.

- The report files must be named: “2027DBF_[university name]_DESIGN_REPORT.pdf”.
- The report must be a single file with all figures/drawings included in the proper report sequence in PDF format.

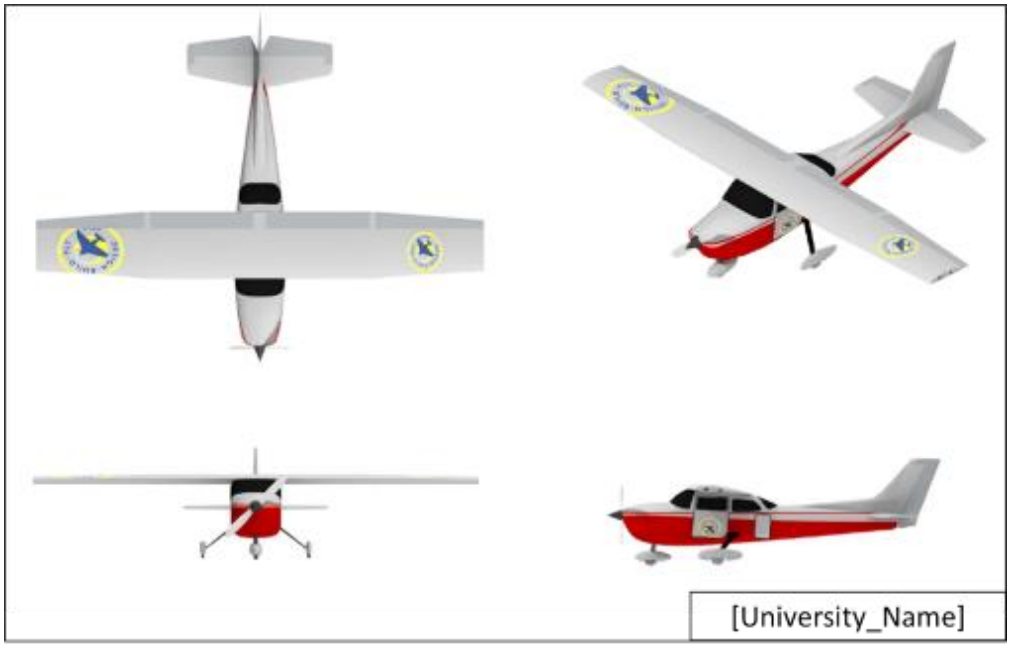
Note: The proposal should have all figures compressed to print resolution to reduce file size to a recommended 20 MB maximum.

5.2.3 Stand Alone Configuration Drawing Requirements

- In addition to the drawings included within the design report, an additional, separate file with a one page configuration drawing formatted to fit 8.5" x 11" paper must be submitted with the report for confirmation of the basic configuration. Note that this page DOES NOT count toward the report total page count.
- The configuration drawing shall include the following configuration items as a minimum:
    - Wing configuration
    - Propulsion/propellor location(s)
    - Tail configuration
    - Landing gear configuration (tricycle vs tail-dragger for example)
- The configuration drawing must be in the format shown in the figure below and must include a top, side, front and isometric view.

- The configuration drawing file must be named: "2027DBF_[university name]_CONFIG.pdf".
  - University name shall not be an acronym.
  - Universities with multiple campuses shall specify the campus in the university name.
- The university name shall be clearly shown on the drawing.
- The configuration drawing file is limited to 5 MB in size.

Configuration drawings that do not contain the configuration items above or are not in the format shown in the figure below will incur a 10 point penalty against the design report score.



Configuration Drawing Format and Content

5.2.4 Design Report Scoring

Reports will be scored on a 100-point basis following the guidelines outlined below.

All information used for scoring must be in the outlined sections. **Content that is out of sequence, including the drawing package, will be treated as missing and scored accordingly.**

ALL items requested below should be present, easy to locate and identify, well documented and in the correct section for full scoring. Note that all reports are assessed relative to each other so that simply addressing each of the sections below may not be sufficient for full credit. Reports will be assessed on how well they communicate the required information given the size and length constraints.

Summary of Report Non-Compliance Penalties

Requirement	Penalty
Must be in PDF format	Rejection (Not Accepted)
Maximum page count of 60 pages	10 points per additional page
Configuration drawing content and format	10 points

5.2.5 Design Report Scoring Rubric

All section scores include format, completeness and readability.

Executive Summary (5 Points):

- Maximum of 1 page. If exceeded, score as 0 points.
- Summary description of selected design and why it best meets the mission requirements.
- Main points from subsequent sections.
- Document the performance/capabilities of your system solution.

Management Summary (5 Points):

- Describe the organization of the design team.
- Chart of design personnel and assignments areas.
- Milestone chart showing planned and actual timing of major elements.

Conceptual Design (15 Points):

- Describes mission requirements (problem statement).
- Translate mission requirements into sub system design requirements.
- Present a scoring sensitivity analysis.
- Review solution concepts/configurations considered.
- Describe concept weighting and selection process and results.

Preliminary Design (20 Points):

- Describe design/analysis methodology.
- Document design/sizing trades.
- Describe/document methodology for prediction of airplane performance (include capabilities and uncertainties).
- Provide estimates of the airplane lift, drag and stability characteristics and method of prediction.
- Provide estimates of the airplane mission performance.

Detail Design (15 Points + 15 Points for Drawing Package):

- Document dimensional parameters of final design.
- Document structural characteristics/capabilities of final design.
- Document systems and sub-systems selection/integration/architecture.
- Document Weight and Balance for final design.
- Must include Weight & Balance table empty and with each possible payload/configuration.
- Document flight performance parameters for final design.
- Document mission performance for final design.
- Drawing package:
    - Configuration drawing with dimensions of all configurations.
    - Structural arrangement drawing.
    - Systems layout/location drawing.
    - Payload(s) accommodation drawing(s).

Manufacturing Plan (5 Points):

- Document the process selected for major component manufacture.
- Manufacturing processes investigated and selection process and results.
- Manufacturing milestones chart: plan and actual.

Testing Plan (5 points):

- Describe all major ground and flight tests performed.
- Objectives and schedule for each.
- Data to be collected and how applied.
- Test and flight check lists.

Performance Results (10 Points):

- Describe the demonstrated performance of key subsystems following execution of testing plan.
- Compare test results to predictions and explain any differences and improvements made.
- Describe the demonstrated performance of your complete airplane solution.
- Compare test results to predictions and explain any differences and improvements made.

Bibliography (5 Points):

- Must include list of all published works referenced in the text must be present in this section.
- Any material taken from a published source in all previous sections must have a numerical subscript corresponding to the appropriate citation in this section.
- References should appear in numerical order.
- Format should match AIAA provided guidelines:

  https://www.aiaa.org/publications/journals/reference-style-and-format

6. Fly-Off Scoring

In the event that, due to time or facility limitations, it is not possible to allow all teams to have the maximum number of flight attempts, the contest committee reserves the right to ration and/or schedule flights. The exact determination of how to ration flights will be made on the contest day based on the number of entries, weather, and field conditions.

6.1 Judging

Students must design, document, fabricate, and demonstrate the airplane they determine to be capable of achieving the highest score on the specified mission profile(s). Mission scores will be based on the demonstrated mission performance obtained during the contest.

Each team must also submit a written Proposal and Design Report. A maximum of 100 points each will be awarded for the proposal and design report. The Proposal and Design Report scores will then be combined as defined herein to establish a Total Report Score. The overall team score is a combination of the Total Report score and Total Mission Score plus a Participation score. The team with the highest overall team score will be declared the winner. Scores will be FINAL 7 working days after the completion of the contest. This period will allow for review of the scores in a timely fashion following the contest.

All submitted reports are the property of AIAA and Textron Aviation and may be published or reproduced at their discretion.

6.2 Units of Measure

The units of measure for scoring will be based on the US English system. Unless otherwise specified in the rules, all times or physical measurements will be rounded to the number of decimal places shown below. Conventional rounding will be implemented (<0.5 --> round down, >= 0.5 --> round up).

Units of Measure and Numbers of Decimal Places

Item	Unit of Measure	Decimal Places
Time	Seconds (s)	2 (e.g. X.XX)
Length	Inches (in)	2 (e.g. X.XX)
Weight	Ounces (oz)	2 (e.g. X.XX)
	Pounds (lbs)	2 (e.g. X.XX)

6.3 Total Score

Each team's overall score will be computed from their Total Report Score, Total Mission Score, and Participation Score using the following equation below. The Total Report Score will be used as a tie breaker.

Competition Score = Total Report Score * Total Mission Score + Participation Score

Total Report Score = 0.15 * Proposal Score + 0.85 * Design Report Score

Total Mission Score = M1 + M2 + M3 + GM

Participation Score is as follows:

Score	Participation
1	Attending the Fly-off
2	Completing Tech Inspection
3	Attempting a Flight Mission

Appendix A. Frequently Asked Questions

***** All Rulings in This FAQ Supplement The Official Rules! *****

A.1 Flight / Mission Questions

Question: Do we have to fly all of the different missions to get a score?

Answer: You will get a score for each mission you successfully complete. The flights must be completed in the order specified to obtain a score.

Question: If the airplane is damaged on a flight can we use another copy of the airplane which has the same design?

Answer: No, you must repair the original airplane.

Question: Can we tailor the configuration of the airplane differently for the different missions? For example, could we use different sized propulsion systems for each flight?

Answer: You may not change the hardware configuration of the airplane for the different missions unless specifically allowed by the rules for each year (i.e., batteries, payloads, payload support, etc).

Question: What constitutes a successful landing?

Answer: The airplane must touch down ON the runway. It may roll/slide, not bounce, off the runway after touchdown.

Question: Is there a minimum altitude for flying the course?

Answer: No. Altitude must be high enough for safe flight as set by the discretion of the Contest Director.

Question: What would constitute “non-critical” versus “significant damage” on landing as described in the rules?

Answer: The decision will be at the discretion of the flight line judges. In general, “non-critical” damage would allow the airplane to be easily returned to safe flight status. A couple of examples of “non-critical” damage would be a broken propeller, bent landing gear, sheared nylon bolts or minor scratches to the finish. If any component is structurally damaged and would be considered a hazard to safe flight then it will be considered as “significant damage”.

Question: At what wind speed will the contest be called.

Answer: It will be up to each team to determine whether they want to fly or not. The contest director will determine if it becomes unsafe for teams to fly. Wind speed is not the only factor that may be considered.

A.2 Airplane Configuration Questions

Question: Can there be thrust vectoring via rotating the engine, nozzles, blown surfaces etc.?
Answer: Yes. Any of the above options is allowed and may be varied during flight. However, "rotary wing" vehicles are not allowed,

Question: What constitutes a major configuration change between the configuration submitted in the 3-view drawing and the airplane presented to Tech Inspection?

Answer: Only minor configuration changes are allowed from the airplane design presented in the Design Report and documented in the 3-view drawing and the airplane presented to tech inspection such as control surface size changes, placement or size of landing gear, location of propulsion motors, etc. Examples of major configuration changes that will not be allowed are, but not limited to:

- Change between Tricycle landing gear and tail dragger landing gear
- Change in tail configuration (Conventional tail, T-Tail, V-Tail)
- Change in wing configuration (Conventional wing, flying wing, blended wing body)
- Change in propulsion configuration (Tractor propulsion, pusher propulsion, number of propulsion motors)

The Tech Inspector will make a final determination if an airplane has had a major configuration change.

Question: Can we change the airplane geometry, such as wing sweep or span, for different missions?

Answer: Variable geometry is allowed provided it is controlled remotely through the RC control system. You may not "swap out" parts for different missions.

Question: Do the external arming plug accessibility requirements (from behind if tractor, from the front if pusher) exclude the use of a pusher-puller type multi-engine configuration?

Answer: You may use a push-pull configuration but must locate the arming plug(s) such that they may be accessed by the crew member without having to reach over or around either propeller or being in the propeller disk plane of either propeller.

Question: Are folding propellers allowed?

Answer: Yes, commercial, folding propellers are allowed.

Question: Are modifications to commercially procured propellers allowed?

Answer: Only the propeller tips may be modified for length adjustment.

A.3 General Questions

Question: What is the maximum number of people that can make-up a team?

Answer: There is no specific limit on team size. It is up to the team itself to determine a size sufficient to meet the required tasks and small enough to remain manageable. Keep in mind that space at the fly-off for each team is limited and must be considered in team size and team members that will travel to the fly-off.

Question: Is it necessary to list all team members on the entry.

Answer: Yes, we need to know all the team members to verify that at least 1/3 of the team members are Freshmen, Sophomores or Juniors and that no more than 1/3 of the team members are Graduate students. Team members may be updated/changed at any time during the contest but must always comply with the 1/3 rules.

Question: Is it allowed to have more than 1 pilot on a team (in case one of them cannot go to the contest, or simply have a back-up pilot)?

Answer: Yes, teams may use multiple pilots as long as each pilot meets the requirements listed in the rules.

Question: Can the plane be flown FPV for competition?

Answer: No.

Question: How can we disable a battery eliminator circuit (BEC) that is built into the electronic speed control (ESC)?

Answer: Follow the manufacturer's instructions on how to disable the BEC function of the ESC. Typically, this involves removing the red wire on the connector from the ESC to the throttle channel on the RC receiver.

- Nearly all speed controllers come with a BEC as standard, so assume that it exists and needs to be disabled.
- The power wire (usually red) from the Motor controller back to the receiver needs to be disconnected.
- This will be functionally verified during the Radio Check.

