Vertical Flight Society

2024-2025 Design-Build-Vertical Flight Competition

Request for Proposal

Version 2

Website: www.vtol.org/FLY

Questions: FLY@hq. vtol.org

Welcome Letter

Dear Students, Faculty, Staff, and Mentors,

It is with heartfelt enthusiasm that the Committee and I welcome you to the 2024-2025 Vertical Flight Society (VFS) Design-Build-Vertical Flight (DBVF) Student Competition! To all students competing this year - we are excited to celebrate the innovation, passion, and creativity that each of you will bring to the challenge. This competition is more than just an academic exercise—it is an opportunity to explore and push the boundaries of eVTOL capabilities, drone technology, and yourselves. Your dedication to solving complex problems through engineering and teamwork will shape the future of this transformative and limitless field.

Competitions like these come with many challenges, especially when balanced with classes and other commitments. There will be moments when you feel tested whether by a tough technical problem, a design oversight, or an unexpected setback. In these moments, we encourage you to embrace the struggle and find your resilience. These challenges will not only make you stronger as engineers and innovators, but they will also provide you with skills and experiences that will serve you throughout your future careers. The friendships you forge and the lessons you learn along the way will be just as valuable as the final design you present.

We would like to thank the faculty, staff, and mentors who have committed their time, resources, and expertise to guide the student teams they work with. Your support is invaluable, and this competition would not be possible without your dedication and commitment to your team’s excellence. Finally, students—challenge yourselves, think boldly, and collaborate fiercely. We are excited to see your innovations take flight!

Warm regards,

Adithya Ramaswami

Chair, VFS DBVF Student Competition

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Overview

Introduction

The Vertical Flight Society (VFS) is excited to announce the Design-Build-Vertical Flight (DBVF) 2024-2025 Student Competition. This competition challenges student teams to design, build, and fly a singular remote-controlled electric vertical takeoff and landing (eVTOL) aircraft, specifically tailored to address the demands of wildfire response. The fly-off event will be hosted at the Survice Engineering Applied Technology Operation (ATO) facility located at Harford Airport (3538 Aldino Rd., Hangar 6) in Churchville, MD.

Scenario: The Role of Drones in Wildfires

Wildfires present an increasingly significant threat to ecosystems, communities, and infrastructure worldwide. Drones, with their versatility and rapid deployment capabilities, have emerged as essential tools in combating these natural disasters. They can provide real-time surveillance, assess fire boundaries, and even deliver payloads like fire retardants or rescue supplies in hard-to-reach areas. By offering aerial perspectives and precise operations, drones help to enhance the effectiveness of firefighting efforts while reducing risks to human responders on the ground. In this competition, students are tasked with developing an eVTOL aircraft designed for wildfire missions, focusing on speed, maneuverability, autonomous operation, and precision in payload delivery, all critical factors in real-world wildfire management.

Timeline for Deliverables & Awards

- **Letter of Intent to Compete**: Oct. 30, 2024 at 11:59 pm ET
- **Safety & Risk Mitigation Plan:** January 13, 2025 at 11:59 pm ET
- **Team Fly-off Participant List**: January 20, 2025 at 11:59 pm ET
    - Must include pilot's proof of FAA Part 107 Drone Certification or equivalent certifying authority for non-US based teams.
- **Final Technical Report (FTR):** March 3, 2025 at 11:59 pm ET
- **Team Fly-Off Withdrawal Deadline:** March 10, 2025 at 11:59 pm ET
- **Final Presentations (Virtual):** Week of March 17, 2025
    - Will be scheduled 2-3 weeks in advance.
- **Video Submission Deadline:** April 1, 2025 at 11:59 pm ET
- **Competition Fly-off Dates:** April 8 – 11, 2025
    - Exact days, times, and schedule will be provided in advance. The event will last 3-4 days, and teams attending the fly-off are expected to stay for the full event.

The competition will provide awards for competitors. Please see the Awards section for more information.

The VFS DBVF Committee reserves the right to modify dates and timelines as necessary. Any changes will be communicated to all participating teams in advance.

Team & Pilot Requirements

Team eligibility rules are as follows:

- All team participants:
    - Must be full-time university students: Students may be at the undergraduate or graduate level, but they must be currently enrolled during the competition semester(s).
    - At least one (1) Team Captain must be identified: this team member will be the POC for all VFS correspondence related to the competition.
    - One (1) faculty advisor must be named.
    - The student team captain(s), including faculty advisor(s), must be a current member of VFS (student membership is US$25/year) at the time of submitting the Letter of Intent. Find VFS membership information at vtol.org/membership.
- Teams can have any number of student participants on their team working on design, development etc.
- For the fly-off portion of the competition:
    - Teams are restricted to **no more than five (5) participants**, including students and faculty members.
    - The team members attending the competition fly-off should attend the entire duration of the fly-off (3-4 days).
    - These strict rules are set by available space at the competition host site to ensure safe support of the competition and teams. Note: VFS DBVF Committee and the competition host reserves the right to reduce or increase the maximum number of teams or team members allowed at the fly-off.
- Teams can also adjust their team rosters as appropriate throughout the year: please notify VFS of any changes to the main team roster.
- Before the fly-off portion, teams will submit a list of students and faculty advisors to VFS following these guidelines:
    - A number of team members equal to or less than the maximum allowable participants stated above, including faculty.
    - Attendance of at least one (1) Faculty Advisor at the fly-off is recommended but not mandatory.
    - Teams will fill out a team roster of individuals attending the fly-off portion of the competition and submit it to the VFS DBVF committee. Please see the Overview section above for exact dates and timeline. Foreign national (non-US Citizen) team members are permitted to attend the fly-off, but additional information may be required from the competition host.
- Only teams that have submitted their Final Technical Reports and Flight Videos will be allowed to compete in the fly-off.

- Each team's pilot must also hold an FAA Part 107 Drone Certification or equivalent certifying authority for non-US based teams, e.g. European A2 Drone Flying License. The name of the pilot(s) must be identified in the attendee list.
- If there is more than one team per school, VFS reserves the right to limit the number of teams based on review of the letters of intent. If two or more separate teams from the same university apply and must be down selected, the teams will be given the option to combine into a single team entry that meets all RFP requirements.
- Team Withdrawal: if a team needs to withdraw from the competition, VFS must be notified in writing as soon as possible. Please see the Overview section for exact deadlines. Withdrawing from the competition after this date or not attending the fly-off may result in penalties, including your university being barred from competing the following year.

Note that the aircraft is restricted to FAA's Part 107 requirements, notably a maximum takeoff weight (MTOW) less than 55 lb (24.94 kg) at takeoff. The vehicle along with any power supply and payload must be less than 55 lb (24.94 kg). However, the requirements of this RFP may be more restrictive than the requirements of Part 107. Please refer to the Aircraft Requirements portion of the "The Fly-Off Competition" section for more information.

Pilot Requirements

Team pilots must hold an FAA Part 107 Drone Certification or an equivalent UAS pilot certification for non-US teams in order to fly at the competition. Requirements include:

- Pilot(s) must be identified by the deadline listed in the Overview section, when the fly-off team list is due to the competition host**.**
- Pilots of non-US-based teams may hold an FAA Part 107 certification or hold an equivalent UAS pilot certification from another certifying organization.
- Teams can name more than one (1) pilot if all pilots hold FAA Part 107 Drone Certification or an equivalent UAS pilot certification for non-US based teams.
- The pilot(s) will be required to complete the relevant pre mission and ground mission checks at the competition before being permitted to make flight mission attempts.

Letter of Intent (LOI) to Submit

The VFS Design-Build-Vertical Flight Competition proposal submission window will be open until the deadline listed in the Overview section; LOIs should be emailed to FLY@HQ.vtol.org, and will be accepted on a rolling basis until the stated deadline. Teams are encouraged to continue their progress while awaiting final approval of their LOI after submission.

The LOI submission is limited to 4-pages (including the cover page but excluding the Letter of Support) and must be written by the students. The LOI should include the following sections:

- Cover page including university and team name
- Team Introduction
- Organization
    - Team roster to include name, email address and class standing.
    - Teams can have any number of student participants working on the different phases of the competition.
    - At least one (1) team lead/captain — and no more than two (2) co-leads/co-captains — must be identified. The team captain(s) will be the main contact for all communications related to the competition.
    - Tentative project schedule.
- Overview of Technical Approach
    - Briefly summarize any initial conceptual designs the team is considering.
- Letters of Support: Please include one (1) letter of support from a Faculty Advisor — letters of support do not count against the 4-page limit.
    - Include any secured or planned team funding, either through the university or outside sponsors.

Letters of intent are reviewed for completeness only.

Safety & Risk Mitigation Plan

As part of the Vertical Flight Society (VFS) Design-Build-Vertical Flight (DBVF) Student Competition, it is imperative that each team prioritizes safety during the design, building, and testing phases of their aircraft. VFS assumes no liability for safety; it is the responsibility of each student team and their respective faculty advisors to establish and adhere to safety protocols they establish for themselves during testing outside of the Fly-Off event. While this ensures a safer testing environment for teams outside of the event, it also allows teams to better prepare for the requirements provided by the host while occupying their airspace. All teams must adhere to the policies and requirements provided by the competition host during the fly-off event.

Safety Plan & Risk Mitigation Document Requirements:

- This document should outline the safety measures and protocols your team will implement throughout the testing and competition phases.
- While the final document length is up to each team and their advisor, it is recommended that this document be no shorter than 4 pages.
- The Safety Plan should include:
    - Safety Procedures: Guidelines for maintaining a safe environment during aircraft construction and testing.
    - Risk Mitigation: Strategies for identifying and addressing potential risks associated with your efforts.
    - Communication: Methods for ongoing communication with your faculty advisor regarding safety measures and concerns.
    - Emergency Protocols: Procedures for handling emergencies or accidents, including first aid and an agreed pre-flight, mid-flight, and post-flight emergency protocol.
- Signatures Required: The Safety & Risk Mitigation Plan document must be signed by the team captain(s), all certified Part 107 (or equivalent licensure) holders, and the faculty advisor. This signature indicates that both parties have reviewed and agreed to the safety procedures outlined in the document.
- Submission: The Safety & Risk Mitigation Plan must be submitted by the deadline listed in the Overview section.
- Non-Graded Requirement: The Safety & Risk Mitigation Plan submission is required for participation to ensure that each team has thought about, planned, and discussed with their faculty advisor on how they will ensure safety and mitigate risks during the competition. The document itself will not be graded, scored, or evaluated. VFS will only check that the plan is signed by both the team

captain(s) and faculty advisor to ensure agreement on the team's safety measures and plans.

By submitting your Safety & Risk Mitigation Plan, your team affirms its commitment to maintaining a safe environment during your participation in VFS's DBVF competition.

Video Submission

The intention of this video is to display flight-readiness for competing aircraft prior to the fly-off event. This video will be due by the deadline listed in the Overview section. Instructions on how to share this video with VFS will be provided to teams prior to this deadline.

Prior to the fly-off, teams must submit a video of their aircraft in-operation to certify their flight-readiness. This helps to ensure safe flight during the fly-off event. All videos must show the competing aircraft completing the “manual safety flight” requirements of Ground Mission 1 listed in the “The Fly-Off Competition” section of this RFP.

FTR

The FTR is limited to 15 pages and is due by the deadline listed in the Overview section, and must be emailed to FLY@HQ.vtol.org.

All information should be within the 15-page limit, including any referenced materials. The details of this report must include (but are not limited to) the list below. The order of sections shown below is mandatory for the FTR, although teams may add additional sections as needed to support the required sections. The scoring criteria for the FTR is shown in the Scoring section. Teams are strongly encouraged to create the document with the scoring criteria as a checklist for maximum possible points.

Required sections include:

- Executive Summary
- Management Summary
- Business Case Study
- Design Trade Studies
- Technical Innovations
- Design Definition
- Drawing Package
- Fabrication Methods
- Test Plan
- Flight Test Results

Presentation

Final presentations will summarize the design and testing processes for each team. Teams should include an overview of the content from the Final Technical Report to share with fly-off attendees. Please see the Scoring section for the exact requirements.

The maximum time allowed for the presentation is 10 minutes. There is a 5-minute Q&A session after each presentation.

The presentation must be in English and should include, but is not limited to:

- Team member overview
- An overview of the business case
- Trade studies and analysis leading to the selection of the conceptual design used
    - Plots, videos, or images of any quantitative methods, including theoretical design and performance calculations, finite element analysis (FEA), or computational fluid dynamics (CFD) simulations completed
- Final design and fabrication
- Ground and flight testing
    - Videos or images of testing are encouraged

The presentations are graded according to the rubric in the Scoring section. Teams are strongly encouraged to use the scoring criteria as a checklist for maximum possible points.

The Fly-Off Competition

Aircraft Constraints

Each team will only be permitted to compete with one singular aircraft during the fly-off event. Below is a list of constraints and requirements that any aircraft competing in the fly-off must meet:

- RemoteID:
    - To maintain compliance with FAA Part 107, all competing aircraft must be equipped with remoteID functionality. VFS is not responsible for any non-compliant UAS operations.
- Battery Power System:
    - The aircraft must be electric (electric power source and electric motors).
    - For the purpose of competition safety, unaltered commercially available LiPo batteries of six cells or less (6S or less) may be used. The team needs to select the proper capacity for their vehicle.
        - Batteries with chemistry that allow charging up to 4.35V per cell may be used, but will not be permitted to be charged above 4.2V per cell at any point during the fly-off event.
        - Up to 2 batteries following the requirements in this section can be combined in series (not parallel) for the propulsion system.
            - For batteries tied together in series, each battery must be identical.
            - Note that a separate battery system is required to power the flight control system. It can be a different capacity from the main flight batteries, but must still follow the battery guidelines specified throughout the RFP.
    - When connecting multiple batteries, ensure that the batteries are a) of the same chemistry, voltage and capacity; b) at the same charge level; and c) of the same age, charge cycle history, and health. Crashes, damage, and poor multi-battery wiring may not immediately lead to a thermal event. However, if you try and charge damaged batteries, it can immediately lead to a thermal event. As such, batteries should be fully inspected before any flight to assess their readiness for continued use.
    - The propulsion and flight control systems must have separate battery systems. A propulsion system battery monitor running through the flight control system is acceptable so long as the connection between the propulsion system battery and the flight control system is not a high-power

carrying line. i.e. Any connection should transmit a signal only, and no substantial amount of power. This separation of propulsion and flight control system power allows for a rapid disarming and re-arming process that safely turns off the propulsion system without power cycling other electronics. This is commonly done to improve safety when working near electric aircraft.
    - All LiPo batteries at the competition must be charged and stored inside a LiPo charging bag. They are only allowed outside the bag while being actively used with the aircraft.
    - The host will provide power and a location to charge batteries, but teams should bring their own charging equipment to the event.
- Onboard Kill Switch (Shunt Plug):
    - The purpose of the shunt plug is to provide an easy and quick way to manually disarm the aircraft.
    - A shunt plug must be wired between the leads of the battery system and the electronic speed controller for manual disarming and arming of the aircraft's power system. This must be connected to the propulsion system, but not the flight control system (see battery requirements for more information).
    - The shunt plug must be red.
    - The shunt plug vehicle-side connector must be an XT90 female plug. See Figure 1 for a visual of an XT90 female plug.

Figure 1. XT90 Female Plug

    - The shunt plug must be removable with only one hand and without any tool.
    - **The tip of the shunt plug, where someone would grab it, must be located outside the dotted line as shown in Figure 2**.
        - The dotted line, if extended both into and out of the page, creates a box around the aircraft that extends outward from the rotors by 6 inches in all directions. The shunt plug must be accessible by hand outside of this box, near the top and center of the aircraft.

- A physical switch mounted on the drone would not be permitted and is not considered a valid shunt plug.

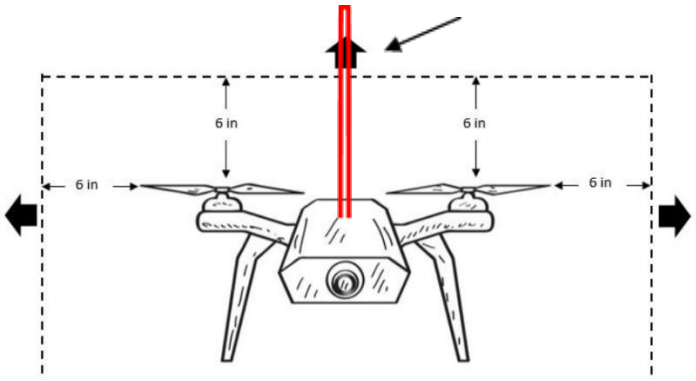

Figure 2. Allowable Location for Propulsion System Shunt Plug

- Remote Kill Switch:
  - During all flights, the aircraft must have the ability to remotely shut-off all propulsion components using a command from the pilot on the ground.
  - The command must not allow for a re-arming of the propulsion system after being issued.
    - For example, this command could fully power-off the entire propulsion system by disconnecting the propulsion battery. The command could also fully disarm the drone without disconnecting batteries.
- Remote Disconnection Functionality:
  - During all flights, if all ground-based control systems are disconnected from the aircraft for longer than 3 seconds, the aircraft must immediately turn off its propulsion system. This functionality must meet the same types of constraints as the remote kill switch, specifically that the function must not allow the vehicle to re-arm after being used.
- Comms Device Kill Switch: To ensure a lack of electromagnetic interference between aircraft during the fly-off event, teams must have the ability to power their system without powering RF devices. This includes any communication modules used for telemetry, direct command & control, or video. This will be tested with a spectrometer prior to passing the pre-mission checks.
  - This could be accomplished in multiple ways, including a switch or plug removing power from all communication modules. However, this could not be accomplished via command issued over remote transmission.

    - **For safety, any switching or plugging/unplugging of the comms device kill switch cannot and should not happen while the propulsion system is powered and has the potential to turn on. Please have your shunt plug removed so your aircraft cannot be accidentally armed and propulsion system turned on. Safety is top priority, and please exercise caution and proactive communication with your team and those nearby for any assembly of, changes to, and operations for your aircraft.**
- Vertical Flight:
    - The aircraft must be capable of sustaining vertical flight during all takeoff and landing phases. This means that no significant sideways motion can occur during these phases.
- Camera Systems:
    - Live camera and video transmission systems are permitted, alongside ground-based displays. There are no constraints on the direction of the camera.
- Line of Sight (LOS):
    - All flights must be performed within the line-of-sight of the RPIC (Remote Pilot In Command).
- Maximum Weight:
    - Including any payloads attached during this competition, the aircraft and all on-board attachments must weigh below 25 lbs at all times.
        - Please note that your aircraft weight without payload may limit the amount of payload that your aircraft will later be allowed to carry during specific missions.
        - The air boss and flight safety personnel reserve the right to land the aircraft and lighten the payload if the aircraft is noticeably over-stressed and/or unstable upon takeoff.
- Transmission Frequencies:
    - Must follow US Federal Communications Commission (FCC) Part 15 rules for transmission frequencies and International Telecommunication Union (ITU) Region 2 frequency allocations. This means that telemetry, video, and control transmitters must operate on 902-928 MHz, ~2.4 GHz or ~5.8 GHz.

- FAA Waivers:

    - No FAA waiver will be required at the competition. The UAS will be operated within the host's COA airspace. As such, the host will set any

rules and restrictions for flight operation within their private airspace such that all teams operate in a safe fashion and in accordance with the rules given to the host by the FAA for their airspace. Teams and team pilots must adhere to the rules set forth during the safety and pre-flight briefs at the host's facility by the range officials. Non-compliance may result in immediate disqualification from the competition.

- Size:
    - There are no constraints on aircraft size, beyond being able to fully fit within any zones that require landings or takeoffs in each mission. Each aircraft will be checked to ensure that it fits within these specified zones when fully assembled for flight.
    - **PLEASE NOTE: A bigger drone does not always mean a better drone. Your sizing and weight decisions may depend on a variety of factors beyond payload capacity.**

Pre-Mission Check

During the fly-off event, the pre-mission check will involve each team giving the judge an explanation of how the aircraft works, safety considerations, and operating procedures prior to a thorough inspection. This will provide an opportunity for judges to ensure the safety of the aircraft, make any required modifications before moving on, or disqualify an aircraft deemed unsafe or non-compliant.

If an aircraft does not meet all the safety requirements, the team can apply modifications and ask for an additional pre-mission check. If a team still does not meet the safety requirements, the team will not be permitted to fly during the fly-off event. VFS and the competition host reserve the right to run the pilots through additional checks or tasks during the pre-mission check.

The judges will check for the following:

- Judge must confirm that the aircraft and any utilized payloads meet the stated requirements.
- Team must display that their aircraft can fit fully within the required take-off and landing zones when fully assembled.
- Team must show that their aircraft battery systems meet the requirements of this RFP detailed above in the Aircraft Constraints subsection.
- The following tests may involve intentionally (or potentially accidentally) arming the aircraft, and must be done with propellers removed. Please note: the removal of propellers is required to ensure the safety of all individuals near the aircraft

during this test. Running motors without propellers onboard can also result in wear over significant periods of time, so these tests should be concluded shortly after an arming event.

- **Shunt Plug/Onboard Kill Switch:** The team must arm their aircraft and show the judge that their aircraft can be manually powered-off using the onboard kill switch.
- **Comms Device Kill Switch:** Teams must display their ability to power their aircraft without powering any communication modules. This will be tested by the host.
- **Remote Kill Switch:** While the aircraft is armed, the team must show the judge their remote kill switch function.
- **Remote Disconnection Functionality:** While the aircraft is armed, the team must show the judge their remote disconnection functionality. The aircraft should disarm after at most 3 seconds of disconnection from all ground-based control systems.
- Team must display any mechanically actuated systems, if present.

Missions

The Fly-off will consist of 4 missions, each testing a different aspect of aircraft operations and performance. The missions include two ground missions (GM-1 and GM-2) and two Flight Missions (FM-1 and FM-2).

For all Flight Missions, a standardized course will be used, as shown in Figure 3. This course includes a “Home” location for take-offs and landings, designated “H”. Four waypoints (labeled 1-4) are also present, alongside five potential ground zones with tents present (labeled A-E). Dimensions are also provided, with Home and waypoints 1-4 forming a right triangle, with the right angle displayed in-figure. All ground zones will be roughly located at the specified distance from each waypoint, but ground zone positions may vary slightly during the fly-off.

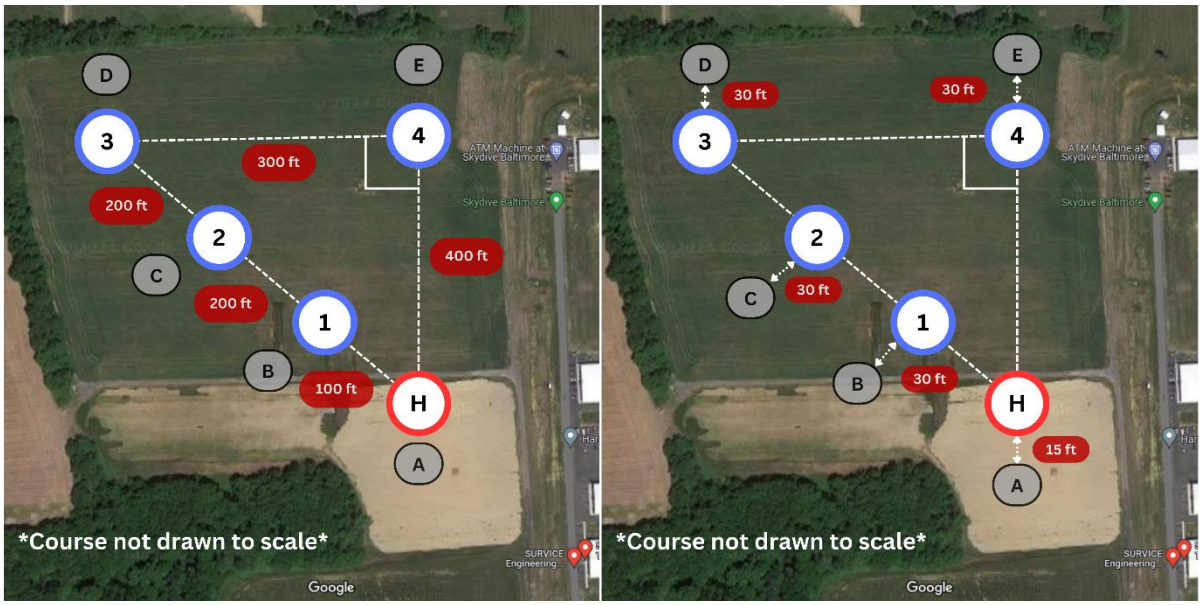

Figure 3. Course Layout, with Waypoint Locations (Left), and Ground Zone Locations (Right). Course Scale and Location(s) Not Drawn or Displayed.

The locations and total number of courses running at a given time may also vary during the fly-off. However, specific GPS coordinates and further information will be available and provided to teams during the event.

A few additional notes for the Fly-off are included below:

- Some missions may involve teammates communicating over long distances. In these cases, handheld radios will be provided by the competition host for team members and staff to utilize. Teams may optionally use mobile phones for communications instead.
- A power station will be available both in the staging area and back in the team working locations for laptops, ground stations, and other powered equipment. The charging of LiPo batteries will happen at a separate location
- Components, other than batteries, cannot be changed out on the aircraft between missions. Any component that is used on the aircraft for a single course or aspect of the competition must be on the aircraft for all Flight Missions and attempts. Components may be switched 1-for-1 to replace a failed component between flight attempts. On-board payloads required in certain Flight Missions are not required to be on-board in other Flight Missions. Any components that would be used to hold the payload(s) must be on the aircraft for all Flight Missions and attempts.
- Swapping battery packs will be allowed between mission attempts, but only a 1-for-1 swap that matches the nominal voltage, chemistry, weight, and capacity of

the swapped battery. State of charge (the remaining charge percentage of a battery) does not need to be 1-for-1.

- The aircraft configuration is also not allowed to be manually changed for the different missions. Mechanical systems that actuate components mid-attempt, however, will be allowed. Each team's pilot will be required to demonstrate controlled operation of any such mechanical systems during the pre-mission checks. For example, retractable gear, tilting rotors, a dropping mechanism, or a tilting wing would be allowed, but would be checked during pre-mission checks.
- A panel of judges will be appointed for the scoring of each aspect of the competition. The course scoring will be carried out by the competition host, VFS organizers, and other applicable judges. Points for the fly-off portion of the competition will be awarded based on quantitative metrics, thus removing the potential for bias. If there are safety tests required by VFS and the host, they will be on a pass/fail basis.
- **Of note: The fly-off is a safety-first event.** Due to weather constraints, it is possible that not all intended missions will be completed by teams. In the event of inclement weather, all teams may universally be asked by staff to complete a limited number of missions and attempts during the fly-off, with additional missions/attempts occurring if time permits. At any point during the competition, a judge may also instruct the aircraft pilot to safely land, or even kill-switch, their aircraft mid-flight due to safety concerns for the nearby area or fellow participants. Failure to comply with these instructions will result in full disqualification from the fly-off event.

Multiple teams will be competing in this year’s Fly-Off event. During the event, it is possible that technical issues could cause delays prior to take-off for one team, potentially delaying multiple other teams in completing their missions. Out of respect for all teams participating, please be aware of and prepared for general etiquette during the event. This includes:

- For all missions, teams will on-deck and off-deck from specified areas within or near a provided COA. At the host’s discretion, and if weather necessitates, staging for some missions may be performed in a nearby indoor facility.
- While performing or placing their aircraft for a mission attempt, teams will be considered on the “flight line”.
- Teams will complete missions in a pre-assigned order, and teams will be placed on-deck once the prior team has entered the flight line. While on-deck, teams will be required to power and set up their external devices (such as laptops, handheld controllers, and ground control software) and onboard flight control

system (with both the propulsion system and communication modules shut down via kill switches/unplugging) to help prepare them prior to their flight line entry. While the on-deck time of each team may vary, teams are guaranteed at least 4 minutes after being called on-deck for setup.

- Teams will have a 2-minute window to turn on and set up all remaining systems while on the flight line preparing for takeoff.
- The team pilot must then request permission to takeoff from the air boss, who will be a host company member managing the airspace.
- After completing a mission, teams must then power down their aircraft and quickly make way for the next team to set up. Teams must pull their shunt plug, turn off their communications, and then remove their aircraft from the flight line within 2 minutes of completing their mission.
- We want all teams to show off their hard work and take flight. To ensure that every team has a fair chance to fly, delays in operations for the event could result in disqualification or rescheduling of a team's mission attempt at the discretion of the host or judge. These delays could include, but are not limited to:
    - Arriving late to a call on-deck.
    - Taking excessive time beyond the stated times above.
    - Taking more than 1 minute to take-off after a judge has granted permission to your team for flight.
    - Taking a significant amount of time to perform a reload of payloads.
    - Intentionally misinforming a judge of your aircraft's operations or current state.
    - Intentionally misinforming a judge about your readiness to take off.
    - Taking off prior to receiving approval from the air boss.

The next subsections contain more information on each mission that will occur during the fly-off. All teams are required to complete the Pre Mission and Ground Mission 1 before performing any Flight Missions. Teams are also required to complete Ground Mission 2 before completing Flight Mission 2. However, teams may compete in as many or as few of the Flight Missions as they see fit. The intentions of each team to compete in a Flight Mission must be communicated to staff by the first day of the fly-off. **Each team will receive at least one attempt at each Flight Mission during the fly-off. However, if time and weather permit, teams may be granted up to two attempts at a Flight Mission, which will be determined and communicated to all teams during the fly-off.**

For all Flight Missions, takeoffs and landings will be done vertically to a specified minimum or maximum altitude. If the aircraft has significant sideways motion during this

process, the judges and flaggers reserve the right to verbally say “Restart”, at which point the aircraft will either return to the required altitude of 10ft AGL to vertical land again, or land to vertical takeoff again. In either case, any ongoing timers will continue during this process.

- Of note: “significant sideways motion” does not include horizontal movement above 10ft AGL (above ground level). However, significant sideways motion and adjustments below 10ft AGL will not qualify as a successful vertical takeoff or vertical landing. Successful vertical take-offs and landings are up to the discretion of the judges present.
- All times that the RFP mentions taking off vertically and landing vertically, it is only from the ground to 10ft AGL.
- Aircraft motion due to significant wind/gusts will not disqualify a vertical landing or vertical takeoff.
- Teams will need to successfully takeoff or land vertically before they can continue the Flight Mission. Multiple tries are permitted.

Ground Mission 1 (GM-1): Essential Flight and Verbal Communication

Consistent, reliable, and safe flight is key in many sUAS operations. The goal of this mission is to display that the competing aircraft can perform consistently and safely.

Each team may have up to 2 attempts for this mission. In two flights, the first lasting at least 60 seconds, and both at an altitude of 40 feet or less, teams must display the ability of their pilot to:

- Manual Safety Flight Requirements:
    - Perform a controlled vertical take off
    - Steadily hover in place for at least 5 seconds
    - Steadily yaw (turn) the aircraft left and right
    - Steadily translate the aircraft forward, backward, left, and right
    - Perform a controlled vertical landing
    - If the aircraft is a VTOL Plane, the aircraft must display forward flight, and then transition into and out of forward flight.
- If the team is planning to perform in any autonomous flight operations, they must show the ability to manually override an autonomous mission and land. Requirements below:
    - Teams will be asked to plan a mission with an autonomous takeoff and land at one location only.
    - Then interrupt the takeoff with manual control, hover steadily in place for 15 seconds with small yaw movements every 3 seconds, and then land.

    - The team may then re-arm in a manual mode to complete the additional requirements below.

Of note: during all armed portions of aircraft operation, all participating team members must remain behind a host-defined boundary. Approaching the aircraft while armed will result in immediate disqualification of the attempt. The pilot of the aircraft must also verbally signal major flight events prior to performing them, including any:

- Takeoffs and landings
- Intentional motions/movements in the air (ie/ yaw left, yaw right, forward, backward, left, and right)
- Arming and disarming events
- Flight mode changes

Flight Mission 1 (FM-1): Speed, Maneuverability, and Autonomy

The scenario: Imagine your drone is part of a crucial pre-emergency exercise for a wildfire response team. The field is marked with circles representing key locations where quick access could be vital during a fire. Your task is to demonstrate that your drone can swiftly and accurately navigate to each waypoint, practicing its agility and speed without any payload. Each waypoint represents a critical spot in a wildfire zone where precise maneuvering could make a difference in a real emergency. Your mission is to pilot the drone manually through these waypoints, showcasing its capability to handle tight turns and rapid adjustments as if preparing for a live wildfire response. Additionally, the drone may need to operate through smoke without visual observation, making autonomy an important feature. This exercise will highlight your drone's readiness to tackle real-world challenges by practicing essential navigation skills.

In this mission, teams will display the capabilities of their aircraft without additional payload. Each team will have a maximum time of 15 minutes per attempt. Prior to the mission:

- Circles with waypoints 1-4 and Home as their center will be marked on the field. These circles will have a diameter of 10 feet.
- One flagger will be stationed at ground zones B, C, D, and E. Optionally, up to two team members (not the pilot or any other operator of the aircraft) may also be stationed at two of the four ground zones (B, C, D, or E) of the team's choosing. These team members may not leave their respective zones during the mission, but they may communicate with the pilot verbally, visually, or over radio/cellular device.
- The aircraft will be safely assembled and turned on in the Home zone by the team.
- All remaining team members, including the pilot, will remain in ground zone A. Please see Figure 3 for reference. If at any point a team member leaves their designated zone while the aircraft is armed, the attempt will be disqualified.
- The aircraft must be set in either a manually piloted or autonomous flight mode prior to takeoff.

In this mission, the aircraft will complete as many laps as possible within the allotted time. The rules for this mission are as follows:

- LAP 1 (autonomous or manual):

    - A timer will begin on first take-off. The aircraft must take-off vertically, and then achieve an altitude of at least 50 feet while flying to waypoint 1.
    - The aircraft must land at waypoint 1 vertically, touching down on the ground. The aircraft is not required to disarm, but significant sideways motion during landing will result in a failed landing.
        - A landing also means no ‘bouncing’, or violently rapid touch-downs. Whether or not the aircraft ‘bounces’ will be up to the corresponding flagger.
        - If the aircraft does not take back off within 30 seconds of touching down at any given point, the judge may disqualify the attempt.
    - A flagger will raise their flag to signal a successful landing at this waypoint. This means that the aircraft has landed vertically, and that the majority of the aircraft is within the circle.
    - At any time during the mission, the aircraft may not proceed to the next waypoint without a signal from the flagger.
        - If an autonomous mission results in the aircraft unsuccessfully passing beyond a waypoint, the pilot may default to a manual flight mode to correct the error. In this event, the drone must remain in a manual mode for the rest of the mission, and this lap will not be considered autonomous.
    - After successful landing, the aircraft will then take-off vertically again to reach an altitude of 50 feet while proceeding to the next waypoint.
    - This process will repeat for waypoints 2, 3, and 4, until the aircraft comes back to home and lands vertically.
    - When the aircraft lands at home, it has completed its first lap. If not already in a manual flight mode, it must then transition to a manual mode immediately after landing.
- ALL REMAINING LAPS (manual):
    - The aircraft must take-off vertically, and then achieve an altitude of at least 50 feet while flying to waypoint 3.
    - The aircraft will maintain at least 50 ft in altitude until the flagger has signaled that the aircraft has either reached the point above or flown through waypoint 3.
    - The aircraft can then fly to waypoint 4, maintaining altitude until signaled by the flagger. The signal will be made using the same criterion as waypoint 3.

    - The aircraft may then return to home, landing vertically.
    - This process will repeat for all remaining laps
- If the timer runs out during a lap before the aircraft successfully lands at home vertically, the lap will not be counted.
- If any emergency landings occur during the run, the attempt will be disqualified.

The total number of laps completed will factor into scoring, alongside points for completing the first lap autonomously. See the scoring section for more details.

Ground Mission 2 (GM-2): Fully Loaded Flight Test

The goal of this mission is to display that the competing aircraft can perform consistently and safely when fully loaded with payload.

Each team may have up to 2 attempts for this mission, which is only required of teams competing in FM-2. The requirements are below:

- Load the aircraft with the maximum payload weight your team plans to use during FM-2. Your team will not be permitted to carry a heavier payload than this chosen weight throughout any FM-2 attempts.
- Complete the “Manual Flight Safety Requirements” process in GM-1 above, with payload attached.
- After this flight, a judge will determine if you are all-clear for flying in FM-2. If not, the team will be required to lower their maximum payload weight. Calls will be made by the judge based on stability and apparent structural readiness

Of note: during all armed portions of aircraft operation, all participating team members must remain behind a host-defined boundary. Approaching the aircraft while armed will result in immediate disqualification of the attempt. The pilot of the aircraft must also verbally signal major flight events prior to performing them, including any:

- Takeoffs and landings
- Intentional motions/movements in the air (ie/ yaw left, yaw right, forward, backward, left, and right)
- Arming and disarming events
- Flight mode changes

Flight Mission 2 (FM-2): Precision & Accuracy

The scenario: Your drone plays a crucial role in wildfire suppression efforts. The scenario involves navigating to multiple waypoints where you will drop payloads representing fire retardant for effective fire management. Each waypoint on the field signifies a key area in need of immediate fire suppression. Your task is to manually or autonomously pilot the drone to these waypoints, accurately deliver the fire-retardant payloads, and demonstrate the aircraft's ability to perform critical operations. The mission will assess the drone's precision in reaching each waypoint, with some being more challenging or higher priority than others, and effectiveness in deploying multiple payloads. This simulates a real-world scenario where timely and accurate fire-retardant application can significantly impact wildfire containment efforts. Success in this mission will showcase the drone's operational capabilities in supporting fire response teams and aiding in the fight against wildfires.

In this mission, teams will display the precision and accuracy of their aircraft in dropping payloads. Teams are required to complete GM-2 before beginning this mission. Each team will have a maximum time of 10 minutes per attempt. Prior to the mission:

- Circles with waypoints 1-4 and Home as their center will be marked on the field. These circles will have diameters:
    - Waypoint 1: *10 feet*
    - Waypoint 2: *7 feet*
    - Waypoint 3: *5 feet*
    - Waypoint 4: *3 feet*
- One flagger will be stationed at ground zones B, C, D, and E. Optionally, up to two team members (not the pilot or any other operator of the aircraft) may also be stationed at two of the four ground zones (B, C, D, or E) of the team's choosing. These team members may not leave their respective zones during the mission, but they may communicate with the pilot verbally, visually, or over radio/cellular device.
- The aircraft will be safely assembled and turned on in the Home zone by the team.
- All remaining team members, including the pilot, will remain in ground zone A. If at any point a team member leaves their designated zone while the aircraft is armed, the attempt will be disqualified.
- The aircraft may be set in either a manual or autonomous flight mode, at the team's discretion. Flight mode changes during the mission are permitted, so long as they are performed safely.

A team may have unlimited payloads, so long as the loaded aircraft weight in flight never exceeds the stated weight limit in the Aircraft Requirements subsection. Each payload will be a plastic water bottle filled with water (minimum weight of 8 ounces or 0.5 lbs) marked with bright red tape. Of note – attachments to bottles that mount them to the aircraft or a separate onboard dropping mechanism will not be included in the minimum 0.5 lbs payload weight requirement. Only the water bottle and respective attachments to the water bottle may be dropped. Dropping additional items or having an individual attachment to the payload or the payload itself shatter (more than 4 separate pieces) on impact, will result in zero points for the waypoint in which it was dropped. See Figure 4 for an example of an 8 ounce water bottle. Teams are responsible for supplying and bringing their own payloads.

Figure 4: Eight Ounce Water Bottle

Of note: attachments to payloads may be of varying shape and size. However, payload attachments are not permitted to cause either the payload or attachment to sharply embed itself into the ground or puncture the ground. This action will result in immediate disqualification of the full mission attempt.

The requirements for this mission are as follows:

- Waypoints 2, 3, and 4 begin as “locked”, while 1 begins as “unlocked”. Unlocked waypoints will be indicated by a flag at the nearest ground zone. Any payload drops at locked waypoints will not be counted in the final scoring.
- A timer will start on first vertical take-off.
- The aircraft must remain above 30 feet in altitude for the remainder of the mission (specifically, any time a payload is dropped), unless returning to vertically land at Home for a “reload” or to complete the mission. Payload drops below the minimum altitude will not be counted as a “try” or in scoring,

and emergency landings during an attempt will result in the disqualification of that attempt.
    - Payloads and their respective attachments must be fully disconnected from the aircraft during a drop, and must be in free-fall during the drop. The point of detachment must also be at or above 30ft.
    - Teams are only permitted to drop one payload and its respective attachment (optional) at a time. Multiple payloads may not be dropped in a collective single group. Multiple payloads may be dropped one at a time in sequence.
    - Each command to drop (from either the pilot or a mission plan) must only result in one drop. Regardless of the level of autonomy, the pilot should always be able to stop the next drop from happening, in the event of an emergency situation. Multiple sequential drops cannot be chained together through a single command.
- The aircraft must try to drop at least one payload within the circle at waypoint 1.
    - A “try” means that a flagger can see that at least one payload has been dropped from the aircraft at or near the required waypoint. The payload does not need to be successful in landing in the waypoint to qualify as a try.
- From here, waypoint 2 will become unlocked, which means that the aircraft may make a try at dropping at least 1 payload at waypoint 2.
- By trying waypoint 2, waypoint 3 will become unlocked. By trying waypoint 3, waypoint 4 will become unlocked.
- Payloads dropped in locked waypoints will not factor into scoring. A team does not need to unlock all waypoints, but is allowed to do so. A team can drop as many payloads in-sequence as they wish between reloads. A payload that is dropped on the “try”, which also lands and stays in the waypoint, will unlock the next waypoint while also counting towards scoring. A team can try a payload drop, wait, and then perform one or multiple sequential payload drops at the same waypoint before moving on. Teams may also return to previous waypoints in any order.
- During the missions, teams may land at Home to “reload”. The aircraft may not be reloaded in any other region.
    - To reload, a team must land vertically and disarm their aircraft.
    - While disarmed, the timer will pause. Up to two team members from ground zone A may then approach the aircraft to pull its shunt plug

(onboard kill switch). The pilot must be the team member to pull the shunt plug.
    - At this time, the pilot and team member can reload the aircraft with more payloads. Remember, the aircraft with payloads cannot exceed the stated weight limit(s) (max payload determined in GM-2 and max total weight constrained by the Aircraft Requirements subsection). After this, the pilot may then re-insert the shunt plug and back away from the aircraft.
        - Please note that no swaps of batteries will be allowed during a reload.
        - However, a swap of autonomous mission plan is permitted during this period, so long as it is transferred to the aircraft wirelessly.
    - The pilot and team member must return to ground zone A (Figure 3) before arming. If not, the entire attempt will be disqualified.
    - The drone may then be re-armed to take-off vertically and continue the mission. The timer un-pauses once the aircraft takes off.
    - This process, from the timer stopping up until it starts again, must take less than 4 minutes. If a reload takes longer than 4 minutes to complete, 10 points will be deducted from the final score for this attempt. An additional 10 points will be deducted for every additional 30 seconds taken beyond 4 minutes.
    - **In an attempt, a maximum of 3 reloads may be performed.**
- The mission must end with a successful vertical landing at Home before the maximum time is reached. If time runs out before a successful landing, the attempt will be disqualified.
    - Of note – reloads will not count as a completion of the mission. Teams should communicate at Ground Zone A whether they are reloading or concluding their attempt. A team does not need to use all 3 reloads in an FM-2 attempt. If the aircraft re-arms to continue the mission after a reload, it must still perform a final landing before the timer runs out.
    - Also of note – All payloads, even those that roll into or out of bounds, or fracture upon impact, will be scored based on their initial touchdown point observed by the nearest flagger.
        - Flaggers will also count and clear previously dropped payloads from the field during reloads.
        - “In bounds” will also include touchdowns that occur on the edge of a waypoint.

        - In order for a touchdown to count toward scoring, the payload itself must make contact with the ground. Attachments may also contact the ground, but will not contribute toward this requirement.

- Scoring will be based on the number of payloads successfully dropped, and at which waypoints they were dropped. Please see the scoring section for more details.

Scoring

FTR Scoring

Table 1: Final Technical Report Scoring Criteria	
Section	**Requirement**
Executive Summary (13 points)	Contains objective statement
	Brief description of problem to be solved (purpose of design)
	Discussed the planned approach to achieve all objectives
	Summarizes main point from subsequent sections
	Clear and concise, uses proper grammar; 2 pages max.
Management Summary (8 points)	Overall description of team organization (leadership, sub teams and responsibilities)
	Schedule includes key actions through report deliverable and presentation
	Schedule includes detail on design, prototype, and testing phases
	Schedule includes detail for subcomponent design
Business Case Study (23 points)	Discussion of team's background research on the real-world use cases of drones in wildfire scenarios.
	Select one Flight Mission scenario to model a business case around.
	Identify a target market, end-user, and customer to sell to.
	Clarify a value proposition for this end-user, and how your solution would solve either the end-user's or the customer's problem.
Design Trade Studies (8 points)	Mission requirements decomposed into aircraft subsystem requirements
	Sensitivity study of design parameters discussed; major design drivers detailed
	Review of configurations considered
	Describe concept weighting, selection process and results (e.g. configuration, motors, props, etc.)
Technical Innovations (13 points)	Detail any unique design considerations or technologies used by the team
	Describe "mission model" used for predicting system performance
	Mission model description includes equations
	Mission model discusses source of inputs (aero, propulsion, environment, etc.)
	Mission model includes discussion of assumptions and uncertainties
Design Definition (18 points)	Sub system discusses all key components (airframe, propulsion system, electronics)
	Structural analysis of key structural components, includes max. expected loads
	Document dimensional parameters of final design
	Document mission performance for final design
	Weight and balance of final design
	Provide estimate of aircraft lift and drag and method of prediction
	Provide estimate of static and dynamic stability and method of prediction

Drawing Package (18 points)	Drawing of aircraft: front view
	Drawing of aircraft: side view
	Drawing of aircraft: top view
	Drawing of aircraft: isometric view
	Structural arrangement drawing present (showing mechanical interfaces, spars, ribs, gear, etc.)
	Systems layout/location drawing present (showing motor, servos, speed controllers, batteries, receiver, etc.)
	Quality, detail and thoroughness of drawings
Fabrication Methods (13 points)	Manufacturing processes investigated, discussed, and compared
	Discussion on how investigated materials and methods were down-selected
	Final manufacturing process presented in detail
Test Plan (8 points)	Discussion of major tests planned (i.e. wind tunnel, structural, propulsive, flight, etc.)
	Test objectives for each
	Describes proposed set up and data to be collected for each
Flight Test Results (8 points)	Describe the demonstrated performance of key subsystems (propulsion, structure, electrical, etc.)
	Compare to predictions and explain any differences and improvements made
	Describe the demonstrated performance of your complete aircraft solution (flight testing)
Presentation and Organization (20 points)	Proper grammar, spelling, formatting
	Figures & texts taken from published works are referenced
	Reference list at the end of the document in numerical order as cited in the text
	Logical progression of report; easy to read with headings, etc.
Total (150 points)	

Final Presentation Scoring

Table 2: Final Presentation Scoring Criteria	
Section	**Requirement**
Team Organization (5 points)	Showed breakdown of team roles and responsibilities throughout competition
	Gantt chart discussing timelines proposed vs. actual
Originality (7 points)	Major subassemblies not off-the-shelf (e.g., airframe — excludes motors, props, batteries)
	Innovative engineering used to solve the competition challenges (out of the box ideas)
Business Case (3 points)	Summary of Background research, selected Flight Mission, end-user, customer, and problem identification

Engineering (12 points)	Presentation of concepts considered and down selection process to final design concept
	Validation/testing process (bench testing, wind tunnel, flight testing, etc.)
	Flight video
Drawings (7 points)	Aircraft 3D CAD renderings of vehicle and pertinent sub-systems
	Structural arrangement drawing or rendering (showing mechanical interfaces, spars, ribs, gear, etc.)
Publicity (7 points)	Use of graphics or charts to convey vehicle performance
	Successfully conveyed why final design was the rational choice given their assumptions
Presentation (7 points)	Clear, easy to follow, logical presentation of material
	Good speaking presence and breakdown of material across presenting team members
Public Relations (2 points)	Successfully fielded audience and/or judges' questions
Total: 50	

Mission Scoring

Below is a summary of the scoring system for each mission. For missions where a team has made multiple attempts, the attempt with the highest point-value will be used for scoring. Disqualified attempts will be given 0 points. For all missions, final scores will be rounded to the nearest hundredth decimal. Please refer to Table 3 for an explanation of variables used in scoring calculations.

Table 3. Scoring Nomenclature Breakdown

Variable	Explanation
X	Whether the team completed their first lap of FM-1 autonomously (X=1 if autonomous, X=0 if manual)
m	The number of laps achieved by the team being scored
A	The number of payloads successfully dropped in waypoint 1 by the team being scored
B	The number of payloads successfully dropped in waypoint 2 by the team being scored
C	The number of payloads successfully dropped in waypoint 3 by the team being scored
D	The number of payloads successfully dropped in waypoint 4 by the team being scored
P	The maximum number of points available for the mission
Z	The final mission point score of the team

MAX()	A function for the maximum value achieved by any team. For example, "MAX(m)" would be the most laps completed by any competing team.

GM-1

In this Ground Mission, up to 30 points can be earned (P=30). All 30 points will be awarded for successfully completing the mission (Z=30). If the mission is not successfully completed, no points will be awarded (Z=0). GM-2 is fully unscored, but is required to compete in FM-2.

FM-1

In Flight Mission 1, up to 135 points can be earned (P_1=90, P_2=45). The equation below will be used to calculate the final score of each team.

$$Z = P_1 * \frac{m}{MAX(m)} + P_2 * X$$

FM-2

In Flight Mission 2, up to 135 points can be earned (P=135). The equation below will be used to calculate the final score of each team. Essentially, scoring increases as more payloads are dropped, and as more payloads are dropped in smaller areas.

$$Z = P * \frac{A + 2B + 3C + 4D}{MAX(A + 2B + 3C + 4D)}$$

Final Overall Scoring

Final scores for the fly-off will be calculated by adding together all points from each mission. Scores from the presentation and FTR will be calculated from the points earned in each individually. The rankings, including 1st, 2nd, and 3rd place awards, will be calculated by adding the points across the fly-off, the FTR, and the presentation. A maximum of 500 points are available across the fly-off, FTR, and presentation.

Awards

Competition awards will include the following.

- Overall competition winners will be awarded a trophy (1st place), plaque (2nd place) and certificates (3rd place, and other award categories) and the following monetary amounts:
  - **1st Place Overall: $2200**
  - **2nd Place Overall: $1300**
  - **3rd Place Overall: $700**
  - **Top Score Final Technical Report: $400**
  - **Top Score Fly-off: $400**

Final Notes

Expenses and Support

VFS will not provide any travel or accommodation support for competing teams or pay or reimburse any other expenses. Teams are encouraged to search for university or company sponsors for travel, accommodation, equipment, etc., and are free to display any sponsors logos on their team shirts and on their aircraft.

Statement on Autonomy

Refer to the *Appendix A, "Achieving Autonomy: An Overview,"* which is available on the competition web page at www.vtol.org/FLY . This document, created in 2020 for the inaugural competition, provides a helpful guide on the autonomous flight portion of the competition.

Assistive autonomy is permitted in missions requiring manual flight modes. An example of assistive autonomy would be a system that keeps altitude at 20 ft during cruise or a system that holds the aircraft in place when the pilot releases control input. In all autonomous flight modes, the pilot must not have their hands on the controls, but must be capable of rapidly taking control and transitioning to a manual mode in case of emergency or as requested by judges or the competition host.

Questions

Questions should be sent to fly@HQ.vtol.org. The Frequently Asked Questions (FAQ) document will be posted to the competition site on a semi-monthly basis.

- Updated FAQ document will be periodically posted to the DBVF website https://vtol.org/FLY

Disclaimers

Safety is paramount in this competition. The rules are designed specifically to minimize risk to all participants and to comply with US government restrictions at the test site. VFS and the Committee assume no responsibility for any actions caused by any participants of the DBVF Competition.

These rules are subject to change. Any updates will be published at the end of a revised document and it will be posted to www.vtol.org/FLY. All registered competitors will be notified of any clarifications on the rules or necessary adjustments.

Participation in the competition explicitly gives permission to VFS to use text, graphics, photographs, and video documentation of the competition and all competitors for educational and promotional purposes only. The competition event, participating schools, and team names may be the subject of VFS *Vertiflite* magazine articles, web page postings, social media, or other forms of publicity.

Final Word

The VFS DBVF Committee wishes you all the success possible in undertaking this year's VFS Design-Build-Vertical Flight Competition, and we look forward to meeting you at the fly-off competition. Good luck, and safe flying!

Revision History

Document Version	Update Notes	Release Date
1	First Release	10/01/2024
2	The changes below have been highlighted in yellow throughout the document: -Provided clarification on number of aircraft permitted per team. This is limited to one aircraft per team. (See the Overview and The Fly-Off Competition sections for highlights on additions/updates) -Clarified that all aircraft must be able to fit fully within any zones requiring take-off/landing. (See The Fly-Off Competition section for highlights on additions/updates) -Provided clarification on requirements for a successful payload drop in FM-2. (See The Fly-Off Competition section for highlights on additions/updates) -Provided clarification on maximum cell voltages for batteries. (See The Fly-Off Competition section for highlights on additions/updates) -Clarified that the water bottle payloads must be bottles made of plastic that are filled with water. (See The Fly-Off Competition section for highlights on additions/updates) -Provided clarification on payload drop altitudes and methods. (See The Fly-Off Competition section for highlights on additions/updates) -Provided clarification on payload drop touchdowns and their impact on scoring. (See The Fly-Off Competition section for highlights on additions/updates) -Clarified criteria for “shattering”, which applies to either a water bottle or attachment individually, not a collective group. (See The Fly-Off Competition section for highlights on additions/updates) -Provided cautionary statement of safety for operating the comms device kill switch. (See The Fly-Off Competition section for highlights on additions/updates)	11/13/2024

	-Clarified details on permitted payload attachment geometry. (See The Fly-Off Competition section for highlights on additions/updates) -Teams are only permitted to drop one payload at a time. If a team wishes to drop multiple payloads, they may be dropped in sequence. Only one command per single payload drop is permitted. (See The Fly-Off Competition section for highlights on additions/updates)	