

Competition Rules 2027

UAS **CHALLENGE**

Institution of
**MECHANICAL
ENGINEERS**

Version 1, 260918

INTRODUCTION

The Unmanned Aerial System (UAS) Challenge is an educational challenge organised by the Institute of Mechanical Engineers (IMechE) for the purpose of educating and preparing students of engineering disciplines for their future careers.

The IMechE is supported by volunteers from Industry and Academia that together form the UAS Challenge Committee (the Committee). The rule set for the competition is continuously reviewed and updated at least once a year with the aim of providing the best educational experience for students and volunteers whilst maintaining the highest standards for safety.

CHANGES

Initial issue

1. Corrections – N/A
2. Clarifications – N/A
3. Additions – N/A

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SECTION A – ADMINISTRATIVE REGULATIONS

A1 COMPETITION OVERVIEW

A1.1 Competition Objectives

A1.1.1 The competition challenges teams of university students to conceive, design, build, and compete with their UAS. This year, the envisaged use case is aerial firefighting. The teams will design and build a subscale demonstrator of a larger firefighting UAV.

A1.2 Competition Procedure

A1.2.1 The competition is held over the course of an academic year and is intended to be an activity included in or alongside academic studies.

A1.2.2 There is a schedule of deliverables throughout the competition which are intended to replicate so far as is practicable the typical deliverables expected in industry when delivering a new design to a customer.

A1.2.3 The finale of the competition is a live fly-off event held at the British Model Flying Association's (BMFA) National Visitor Centre near Buckminster in the UK. The event includes a series of judged non-flying and flying activities. Points from the deliverables, non-flying and flying activities contribute to a team's overall score. At the end of the fly-off event is the award ceremony – specific category and overall score awards are presented.

A1.3 Competition Dates

Event	Date
Welcome Webinar	6 November 2026
2 nd Webinar	19 February 2027
3 rd Webinar	23 April 2027
Pre-Flyoff Webinar	4 June 2027
Live Event	28 June – 1 July 2027

Note: It is in teams' best interests to attend the webinars.

A2 DEFINITIONS

A2.1 UAS

A2.1.1 The UAS will consist of an air vehicle, transport and storage container, and a ground control station (GCS). It shall be compliant with and designed to perform the mission required by this ruleset.

A2.2 Language

A2.2.1 'Shall', 'must', or 'will' denotes a mandatory requirement.

A2.2.2 'Should' or 'may' denotes a highly desirable requirement.

A2.2.3 *Blue italics* or "*Note:*" indicates a point of guidance or clarification rather than a requirement.

A3 ELIGIBILITY

A3.1 University Student Competition

A3.1.1 The UAS must be conceived and designed by this year's student team members for the purpose of this year's competition.

A3.1.2 The student team may use information from professionals or from academics provided this information is given as a discussion of alternatives with pros and cons and shall not be given as a directive.

A3.1.3 The students must make all design decisions.

A3.1.4 All design decisions should be evidence based. The team will be asked to provide evidence for design decisions through deliverables. The team will be asked to discuss design decisions by the scrutineering team at the fly-off event.

A4 RULES OF CONDUCT

A4.1 General Officials Authority

A4.1.1 The officials reserve the right to revise the schedule, date and location of the competition and/or interpret or modify the competition rules at any time and in any manner that is, in their sole judgement, required for safe and efficient operation of the challenge.

A4.1.2 All team members are required to cooperate with and follow all instructions from the officials.

A4.1.3 Official announcements shall be considered part of the rules.

A4.2 Plagiarism

A4.2.1 Use of, or iteration on, previous years' UAS and deliverables is not permitted. Students will only be scored on work that is deemed to have been conducted this year for this year's competition.

A4.2.2 For the deliverables, re-use of previous years' work, unattributed use of external sources (books, websites, images, models, consultants etc), unattributed use of AI/LLMs is not permitted. Any work that is deemed to have not originated within the team will not be scored and may attract a penalty. The judges' ruling on this will be final.

A4.3 Official Instructions

- A4.3.1 At the fly-off event, failure of a team member to follow an instruction or command will result in 15 penalty points being deducted, per infraction, from the team's overall score.

A4.4 Arguments with Officials

- A4.4.1 At the fly-off event, argument with, disobedience, or any other offensive behaviour to any official by any team member, academic supervisor, or related party may result in the team being disqualified from the competition.

A4.5 Unsporting Conduct

- A4.5.1 In the event of unsporting conduct by any team member, academic supervisor, or related party, 25 penalty points will be deducted from the team's overall score. Persistent violations may result in the team being disqualified from the competition.

A4.6 Rule Consistency

- A4.6.1 While best efforts are made to prevent them, discrepancies or ambiguity in the ruleset may occur. If you believe that you have identified a discrepancy or the wording is ambiguous the team should contact the IMechE.
- A4.6.2 The first team to identify a specific error, omission, inconsistency, or ambiguity in the rules, which contributes to a rule amendment, may be awarded 5 points. Teams subsequently identifying the same issue in the rules will not be awarded points.

Questions and error submissions may be submitted to the UAS Challenge Judges inbox: UASJudges@imeche.org

A4.7 Violations of Intent

- A4.7.1 Violation of the intent of a rule will be considered a violation of the rule itself.

Note: It is far better to raise a question early on than to find that some aspect of your UAS fails to meet the intent of the rules once it has been built.

Note: This is not F1, if you are looking to exploit loopholes in the rules, this is not the competition for you.

A4.8 Protests

- A4.8.1 A team may protest any rule interpretation, score or official action which they feel has caused some actual, non-trivial, harm to their team, or has had a substantive effect on placement in the competition.
- A4.8.2 All protests must be filed in writing and presented to the officials by the team leader, before the hangar is closed at the end of each day. For protests pertaining to the final day,

the protest must be delivered at least 60 minutes ahead of the scheduled start of the closing ceremony.

A4.8.3 To have a protest considered, a team must post a 50-point protest bond which may be forfeited if their protest is rejected.

A4.8.4 The decision of the officials regarding any protest will be in written form and is final.

A5 GENERAL REQUIREMENTS FOR TEAMS & PARTICIPANTS

A5.1 Team Members

A5.1.1 Each team must have one team member identified as the Team Leader. The Team Leader is the main contact person for the officials during the competition period.

A5.1.2 Team members must be enrolled as degree seeking undergraduate, graduate or postgraduate students in any university. Team members who have graduated within the seven-month period prior to the last day of the fly-off remain eligible to participate.

A5.1.3 Team members must be at least 18 years of age by the fly-off event.

A5.1.4 There is no limit on the number of team members who can contribute to the concept, design, and manufacture of the UAS, or the compilation of deliverables.

A5.1.5 Teams will not be permitted to register more than 8 team members to attend at the fly-off event. Teams shall not rotate team members to be present.

A5.1.6 All team members attending must be present at the safety briefing on the first day of the fly-off event.

A5.2 Academic Supervisors

A5.2.1 Each team must have an academic supervisor or professionally registered engineer to act as supervisor.

A5.2.2 The supervisor shall not design, build or repair any part of the competition UAS or directly participate in the development of any documentation or presentation.

A5.2.3 The supervisor must review and sign for all the competition deliverables.

A5.2.4 The supervisor may attend the fly-off event in addition to the registered team members.

A5.2.5 The supervisor may advise the team and provide support to the team members, but they shall not: build/maintain/repair the aircraft, set the autopilot/radios/GCS, deliver the business presentation, answer technical questions posed to the student team members, cross the flight line (even when the team is flying), or otherwise directly contribute to the team's performance at the fly-off. Failure to comply will result in 15 penalty points being deducted, per infraction, from the team's overall score.

A5.3 Sponsorships & Industry Support

- A5.3.1 Universities are encouraged to approach potential commercial sponsors, particularly aerospace companies at any time prior to or during the Challenge, for both financial support and technical advice.
- A5.3.2 Where technical advice has been received, teams must declare the extent of the advice.
- A5.3.3 All other industry support must also be declared so that the judges can determine which aspects of the UAS are the work of the students.

A5.4 Team Insurance

- A5.4.1 The IMechE will confirm the team insurance requirements.

A5.5 Multiple Teams per University

- A5.5.1 A university may enter multiple teams. If this occurs, the teams must be fully segregated.
- A5.5.2 Teams must identify all team members at the point of registration. Team members may only contribute to the concept, design, and manufacture of the UAS and the competition deliverables for their team. Any instances where it is perceived that teams have been working jointly will be considered plagiarism, will not score points and may attract a penalty.

A5.6 Joint University Teams

- A5.6.1 Multiple universities may enter a joint team, or a team may be made up of students from multiple universities.

A5.7 Registration & Entry Fee

- A5.7.1 Details on team registration can be found at:
<https://imeche-uas-challenge-2027.eventsairsite.com/>

A6 DOCUMENTATION & DEADLINES

A6.1 Competition deliverables

- A6.1.1 Several documents must be delivered prior to the competition live fly-off event. Full details of the documents are provided in their relevant sections.

A6.2 Submission

- A6.2.1 Documents are to be submitted to the IMechE “Mashoom” site. Access details for this will be provided on registration.
- A6.2.2 Team Leaders are responsible for ensuring that all their team’s submissions are uploaded or sent no later than the published deadline.

A6.3 Late Submission or Non-Submission

- A6.3.1 The penalty for submitting documents later than the deadline is 5 points per day, up to 50% the maximum value of that submission. Thereafter no points will be awarded, a deliverable will never result in a negative score.
- A6.3.2 Teams may still receive some qualitative feedback on their submissions even if they are late – especially if the deliverable is expected to contain some safety related information.
- A6.3.3 Volunteer judges evaluate all the required submissions; it is essential that they have enough time to complete their work.

A6.4 Re-submissions

- A6.4.1 For some critical omissions, the team may be requested to resubmit documents in whole or in part. A new submission date will be indicated with the request for resubmission. Failure to re-submit on time will incur further penalties.
- A6.4.2 Depending on the level of safety or airworthiness of the omission, a team may be denied permission to fly at the live fly-off event if they do not resubmit evidence of compliance.

A7 TRANSPORT OF AIRCRAFT TO FLY-OFF EVENT

A7.1 Transport

- A7.1.1 The teams must ensure that they have adequately considered the requirements to transport their UAS to the fly-off event.

Note: This can be a non-trivial planning/management aspect of the competition and teams are encouraged to look into this as early as possible. This is especially important for teams who will be travelling from outside the UK.

A8 RESOURCES

A8.1 UAS Challenge Website

- A8.1.1 <https://imeche-uas-challenge-2027.eventsairsite.com/>

A8.2 Webinars

- A8.2.1 Briefing webinars will be provided, on Zoom, by the IMechE and UAS Challenge Volunteers throughout the year. Teams, or representatives, should make every effort to attend these events.

A8.3 UAS Challenge Mentoring Scheme

- A8.3.1 The Mentoring Programme pairs an Industry Partner with a UASC team. The period of engagement in the programme is between three to nine months. The aim of the Mentoring Programme is to: provide teams with a point of contact for general queries

regarding the plan, design, build, test and marketing of the UAS for the purpose of the Challenge; to help the team integrate with the concept of the Challenge and its guidelines and provide teams with general guidance, advice and a professional role model in terms of a career in engineering.

- A8.3.2 Due to the limited number of industry mentors, not all teams will be able to enter the scheme and those that are provided the opportunity are strongly recommended to engage with their mentors and make full use of the opportunities the Programme provides them.
- A8.3.3 To express interest in the mentoring scheme, please select the option in the team registration form or email uaschallenge@imeche.org. Once assigned an industry mentor, the team is expected to engage with the mentor on a regular basis. Failure to engage with the industry mentor on a regular basis for a duration of a month, will result in your team being removed from the mentoring scheme and replaced by a new team. For more information on the mentoring scheme, please refer here: <https://imeche-uas-challenge-2027.eventsairsite.com/>

A8.4 Project Management Software

- A8.4.1 An online project management software is available free of charge from Mashoom: www.Mashoom.co.uk

A8.5 UAS Challenge Member Session

- A8.5.1 Each team may request a one hour long virtual session with a member of the UAS Challenge event/committee to ask any advice/guidance. Please select the option in the team registration form or email uaschallenge@imeche.org to arrange availability.
- A8.5.2 Additional sessions may be permitted depending on availability of Challenge team members and uptake of this offer.

Note: to date this has been a very underutilised resource

A8.6 The UAS Challenge Live Fly-off Event

- A8.6.1 The fly-off is itself a really useful resource. Even if you cannot complete your aircraft in time for the fly-off event, we would encourage you to bring your team, and your aircraft (in whatever state of build) to the event anyway. You will be able to interact with your fellow challenge competitors, competition volunteers, the sponsors, and see aircraft flying. We believe that it is an unrivalled opportunity to learn, gain experience, see the diversity of design and approach to the challenge. Don't forget that you have your knowledge and your experience to offer other teams too.

SECTION M – MISSION SCENARIO

M1 SCENARIO

- M1.1.1 This year's UAS challenge scenario is based around an aerial firefighting mission.
- M1.1.2 Your team has been asked to build a <10kg subscale demonstrator of a <150kg firefighting UAV.
- M1.1.3 Your team is required to design, build and demonstrate a UAS capable of autonomously navigating whilst carrying a water payload and then dispense it, at low altitude, over a pre-defined waypoint representing a wildfire.

M2 MISSIONS

M2.1 Mission types

- M2.1.1 There will be three flown missions for this year's challenge. They are known as:
- Mission 1
 - Mission 2
 - Manual handling

- M2.1.2 To manage scheduling, the missions must be flown on specific days.

Note: if you are not ready to fly on one of the flying days, you will miss out on the entire score for that mission.

- M2.1.3 All the missions will be operated within visual line of sight.

- M2.1.4 A generic example of the waypoints is provided below:

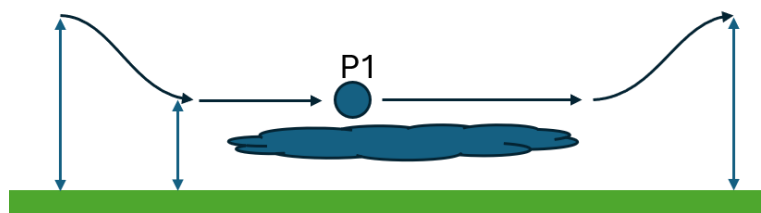


- The white dot is approximately the location of the challenge pilot and team during each mission flight.
- The yellow dots are the Take-Off And Landing (TOAL) point and two alignment waypoints.

- The blue dots are an example set of waypoints – the actual waypoints will be provided at the final webinar.
- The purple dots are the payload drop points
- The solid red line is an example of the geo-fence boundary.
- The dashed red line is approximately 500m radius from the white dot (the CAA's definition of the limit of Visual Line of Sight (VLOS)).

M2.1.5 In addition to the navigation waypoints, waypoints will be provided for the payload release.

M2.1.6 An example of the payload drop is shown below (flown from left to right, viewed from the side):



- The aircraft will start at the navigation altitude.
- It will then descend to drop altitude prior to drop point 1 (P1).
- The aircraft must start dispensing water after descending and prior to P1.
- The aircraft must have stopped dispensing water before it returns to navigation altitude.
- The aircraft will then return to navigation altitude AGL.

Note the fly-off site slopes downwards from E to W. This means that the eastern edge of the site is higher than the take-off location.

M2.2 Mission 1, Empty Mission – 1st flying day

M2.2.1 Mission 1 will be flown without any payload, should be fully autonomous and comprised of:

- Take-off
- 2 laps of waypoint navigation
- Landing

M2.3 Mission 2, Long Mission – 2nd flying day

M2.3.1 Mission 2 will be flown with payload, should be fully autonomous and comprised of:

- Take-off
- 2 laps of waypoint navigation
- Payload dispersal at specified waypoint and altitude
- 1 lap of waypoint navigation

- Landing

M2.4 Mission 3, Manual Handling – half flying day(s)

M2.4.1 The manual handling mission is manually flown by the competition pilot and is comprised of:

- Take-off
- Handling Assessment
- Landing

M3 MISSION SCORING

M3.1 Manual Mission Elements (Mission 1 and 2)

M3.1.1 All teams should attempt to fly Mission 1 and Mission 2 autonomously. However, it is acceptable to request:

- A manual take-off and/or landing.
- A manual trigger for the water drop.

M3.1.2 It is not possible to fly the navigation portion of the mission manually. Should your aircraft be unable to fly the navigation portion of the mission autonomously, then you may request the competition pilot to skip the navigation portions, for which you will receive no score.

M3.1.3 Any non-autonomous elements will attract a lower score.

M3.2 Mission 1 (200 points)

M3.2.1 Take-off. Maximum 20 points.

- 20 points for automatic take-off within box. 5 points if manual or outside box.

M3.2.2 Navigation to release point: 2 laps of 10 navigation waypoints. Maximum 120 points.

- Calculated by: 6 points per waypoint

M3.2.3 Landing. Maximum 60 points.

- 60 points for an autonomous landing that touches down and comes to a full stop within the box. 40 points for an autonomous landing that touches down within the box but stopping outside. 20 points for an autonomous landing. 10 points for a manual landing or any landing which damages the UA.

M3.3 Mission 2 (400 points)

M3.3.1 Take-off. Maximum 20 points.

- 10 points for automatic take-off within box. 5 points if manual or outside box.

M3.3.2 Navigation to first release point: 2 laps of 10 navigation waypoints. Maximum 120 points.

- Calculated by: $(1 + 2 \times \text{payload mass fraction}) \times \text{number of waypoints flown} \times 3$.
- Eg. 3kg payload for 10kg aircraft, 0.3 mass fraction. 18 waypoints successfully rounded. $(1 + 2 \times 0.3) \times 18 \times 3 = 86.4$

M3.3.3 Payload delivery. Maximum 120 points.

- Automatic release over target, calculated by: water mass released $\times 30$
- Automatic release, calculated by: water mass released $\times 20$
- Manual release, calculated by: water mass released $\times 10$

Note: your aircraft will be weighed before and after its flight

M3.3.4 Return navigation: 1 lap of 10 navigation waypoints. Maximum 20 points.

- 2 points per waypoint.

M3.3.5 Landing. Maximum 60 points.

- 60 points for an autonomous landing that touches down and comes to a full stop within the box. 40 points for an autonomous landing that touches down within the box but stopping outside. 20 points for an autonomous landing. 10 points for a manual landing or any landing which damages the UA.

M3.3.6 Energy efficiency. Maximum 60 points.

- Points awarded to top 10 performances, calculated by: Waypoints navigated $\times$ Payload mass [kg] / Energy consumed [Wh].

Posn.	Points	Posn.	Points
1 st	60	6 th	15
2 nd	45	7 th	12
3 rd	34	8 th	9
4 th	26	9 th	7
5 th	20	10 th	6

M3.4 Manual Handling Assessment (50 points)

M3.4.1 For this year's manual handling assessment, if you are ready to fly on the first half day you will receive full points for the manual handling. If you fly the manual handling on the last day, you will receive half points.

M3.4.2 Take-off. Maximum 20 points.

M3.4.3 Manoeuvring. Maximum 10 points.

M3.4.4 Landing. Maximum 20 points.

SECTION T – TECHNICAL REQUIREMENTS

T1 LEGAL REQUIREMENTS

T1.1 UK Law for UAS Flying

- T1.1.1 It is the responsibility of the team leader to ensure that they are aware of and operate within the requirements of UK laws governing the flying of UAS whilst in the UK:
<https://www.caa.co.uk/drones/getting-started-with-drones-and-model-aircraft/>

T1.2 Fly-off event

- T1.2.1 An individual from the team, or a nominated individual from the team's university, shall obtain a UK CAA Operator ID (see above link). This operator ID must be displayed on the air vehicle.

T2 AIR VEHICLE GENERAL

T2.1 Design

- T2.1.1 Any air vehicle configuration is permissible.

Note: Points and incentives are awarded for novel configurations, its in your interest to be explicit about what in your design is novel.

- T2.1.2 In accordance with A4.2.1 the aircraft must be a clean sheet design and must not be an iteration on last year's. Teams who fail to comply with this rule will be penalised and required to redesign the aircraft as a whole or in part depending on the perceived level of re-use. The judges' ruling on this is final.

Note: it is in your best interest to deliberately distinguish this year's entry from previous years (if you have previously entered)

- T2.1.3 The design and construction of the UAS shall employ good design practice with appropriate use of materials, and components.
- T2.1.4 The quality of the air vehicle design and construction will be judged and scrutineered. Failure to pass scrutineering will result in you not being permitted to fly.

Note: It may be helpful to get your UAS inspected during build by an experienced aeromodeller to help with construction details and best practice.

Note: designing for ease of manufacture may also make it easier to repair your air vehicle if/when it is damaged in testing or at the fly-off event.

T2.2 Mass

- T2.2.1 The maximum take-off mass (MTOM) of the air vehicle shall not exceed 10.0kg. This includes the payload, GPS tracker and RF locator.

- T2.2.2 The air vehicle shall have the empty centre of gravity (CG) indicated on the outside. Empty in this case meaning in flyable condition but without payload or trackers. The marking in the form shown below shall be on both sides of the fuselage or the top and bottom of the wing where that is not possible and with a minimum diameter of 12 mm.



T2.3 Maximum dimensions

- T2.3.1 No dimension of the aircraft may be larger than 4m, be it wingspan, overall length or rotor diameter.

Note: this artificial limit is to aid in space management at the fly-off event

T2.4 Materials and Environmental Impact

- T2.4.1 Lead shall not be used in any part of the airframe.
- T2.4.2 The teams should consider and attempt to minimize the environmental impact of their choice of materials in all aspects of the UAS. In the design process consideration should be given to the use of non-hazardous and recyclable/recycled materials; low pollution; low energy usage; low noise.

Note: innovation and novel materials are encouraged.

T2.5 Manufacturing & COTS Items

- T2.5.1 The students should manufacture and assemble as much of the UAS as possible. Outsourcing to external organisations or reliance on university workshop staff should be limited.
- T2.5.2 Where the team have been unable to manufacture or assemble components or systems, these will need to be identified.
- T2.5.3 COTS components may be transferred between aircraft from previous years. Components not permitted under this year's rules must not be transferred. Where components have been transferred their cost must be allocated for this year's aircraft.
- T2.5.4 The total cost of the aircraft's materials should be less than £1800, including COTS items and raw materials. Teams exceeding this limit without adequate justification will be deemed to not be competing in the spirit of the competition and will be penalised.

T2.6 Fly off envelope limitations

T2.6.1 The air vehicle shall not exceed 40 kts ground speed or 200ft AGL at the fly-off event.

Note: These are limits imposed due to safety considerations. It is expected that for autonomous flights this will be controlled by the aircraft's flight computer. During manual flying the competition pilot will judge airspeed and altitude.

Note: The airfield at the BMFA site is not at sea level and the site slopes.

T2.7 Weather Limitations

T2.7.1 The UAS shall be designed to operate in winds of up to 20kts gusting to 25kts and light rain. The air vehicle shall be capable of take-off and landing with crosswind components of 5kts with gusts of 8kts and on wet ground.

Note: It is always the Team Leader's decision whether to fly their aircraft or not.

Note: handling the aircraft on the ground within weather limits should also be considered by the teams.

Note: There is, on average, rain on every other day in July in the UK.

T2.8 Take-off and Landing

T2.8.1 The air vehicle shall be designed to take-off and land from within a 20 m x 20 m box. There are no obstacle clearance requirements.

T2.8.2 After landing the air vehicle shall be capable of being flown again with a fresh battery but without repairs. If this is not the case, the landing portion of the flight will be penalised.

T2.8.3 The aircraft shall be capable of operating from any hard or grass surface.

Note: At the fly-off event, operation will be from a short-grass surface.

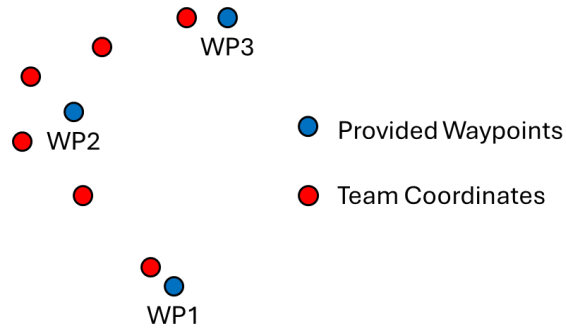
T2.8.4 Use of launch assistance equipment shall not be permitted.

T2.8.5 Hand launching the air vehicle shall not be permitted.

T2.9 Navigation

T2.9.1 The air vehicle shall be capable of automatically navigating around the course defined by waypoint coordinates, which will be provided by the organisers at the final pre-fly off webinar.

T2.9.2 The waypoints that will be provided are the locations of the course turns. It is up to the teams to provide adequate instructions to your air vehicle to successfully navigate those turns whilst remaining within the geo-fence boundary (example below).



- T2.9.3 The air vehicle must fly around the “outside” of the waypoints. See example above, in a turn to the right, the course turn waypoint must be off the aircraft’s starboard (right) side.
- T2.9.4 The air vehicle must remain within a pre-designated geo-fence. The coordinates will be provided by the organisers at the final pre-fly off webinar.
- T2.9.5 Apart from during take-off, landing and payload drop, the aircraft shall fly no lower than 150ft AGL and no higher than 200ft AGL.

T2.10 Mission Range and Endurance

- T2.10.1 The missions will be capped at 10 minutes, but your air vehicle shall be designed to fly for 15 minutes with 20% battery capacity remaining.

Note: Battery power remaining will be measured at the end of each autonomous flight.

- T2.10.2 Each lap of the autonomous missions will be about 1.5nm/2800m measured waypoint-to-waypoint.

Note: You should assume that your aircraft will fly a longer path to ensure that it correctly passes the waypoints on the outside of the turns.

T2.11 Propulsion Systems

- T2.11.1 Only electric motors shall be permitted for propulsion.
- T2.11.2 Propellers, rotors, ducted fans or other mechanical means of converting power from the electric motors to thrust are allowable.

Note: Points are awarded for novel solutions.

T2.12 Land away recovery

- T2.12.1 If the air vehicle lands (controlled or otherwise) away from the runway, it shall make an audible and visual alert.
- T2.12.2 The aircraft will be flying above farmland. At least 25% of the upper, lower and side surfaces of the air vehicle shall be coloured to contrast with landscape which will consist of greens, browns & yellows – for example:



T3 PLATFORM ENERGY STORAGE

T3.1 Batteries

- T3.1.1 Only 6s 6000 mAh Li-Po batteries with XT90 anti-spark connectors are permitted to be used on the air vehicle.
- T3.1.2 Teams may use multiple batteries.
- T3.1.3 Batteries shall be positively secured to prevent movement in flight.
- T3.1.4 Batteries shall be located such that there is some impact protection in the event of a crash.
- T3.1.5 Batteries shall be easily accessible and removable without the use of tools. Teams will be required to demonstrate that the batteries can be removed from the aircraft within 60 seconds.
- T3.1.6 Any electrical power / battery architecture deemed a high risk in the opinion of the scrutineering team at the fly off event will be prevented from flying.
- T3.1.7 All teams shall note legal requirements on transport of hazardous materials.

T3.2 Power Safety Links

- T3.2.1 The air vehicle shall have two clearly identified and accessible, externally removable XT-90 anti-spark power links. Failure to comply with these rules will result in the aircraft not

being permitted to fly at the fly-off until this has been rectified. Examples shown below.(image courtesy of: <https://www.spiderbatterysystems.ca/>)



T3.2.2 1 of the links is required to isolate power to the whole air vehicle.

Note: this is a requirement so that in the event your aircraft lands away from the runway and requires the recovery team to retrieve it, they can immediately cut off all power from the batteries to the aircraft.

T3.2.3 1 of the links is required to isolate power to all motors.

Note: this is a requirement so that the team may power on the air vehicle, minimising risk to the team, whilst work is done on the aircraft prior to flight.

T3.2.4 Both safety links shall be positioned away from any propellers so that there is minimum risk of injury when making safe the aircraft.

T4 RADIO EQUIPMENT & CONTROL

T4.1 Manual/autonomous control

T4.1.1 The air vehicle shall be capable of flying fully automatically from initiation of take-off to a full stop landing, including navigation and payload operation without input from the competition pilot or team.

T4.1.2 It shall be possible for the competition pilot to revert to manual control at any point in the flight. Any manual intervention during an automatic flight will result in loss of points.

T4.1.3 It shall be possible for the competition pilot to manually trigger a Flight Termination System at any point in the flight.

T4.1.4 The air vehicle shall be capable of flying a circuit manually by the competition pilot.

T4.2 Controller/Handset/Transmitter

T4.2.1 The controller for manual flight shall be set up to operate in Mode 2 configuration: yaw and throttle on left stick and roll and pitch on the right stick.

Note: the competition pilot(s) will be flying a lot of aircraft. It is to your benefit to make it easy for them to identify the controls necessary for your UAS.

T4.2.2 The throttle must not be spring loaded.

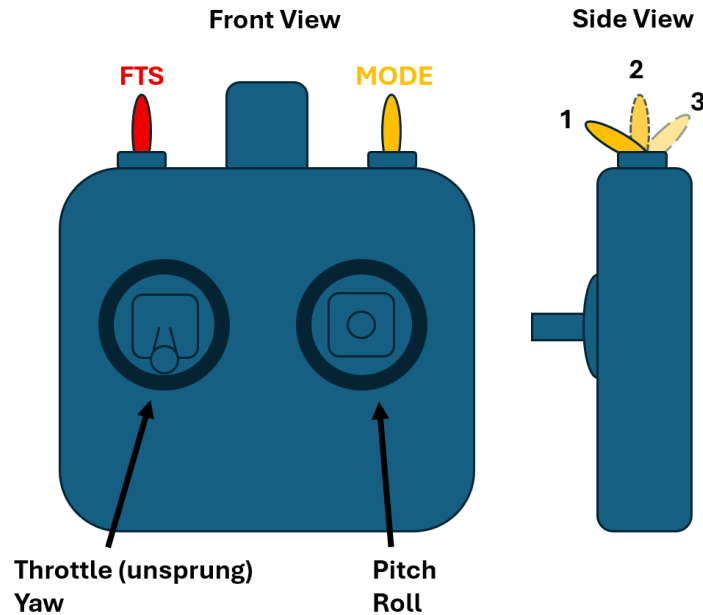
T4.2.3 The flight control mode switch must be set on a single three-way switch, with three clear flight modes marked visibly in yellow on the right hand side of the handset. The flight control mode switch modes must be set up as:

- Fixed wing:
 - 1. Full-auto – switch forward
 - 2. Fly-by-wire (stabilised) – switch centred
 - 3. Manual - switch is set to the back position
- VTOL
 - 1. Full auto – switch forward
 - 2. Horizontal mode – switch is centred
 - 3. Vertical mode – switch set to the back position

T4.2.4 The FTS manual trigger must be by a single switch only, marked visibly in red, on the left hand side of the handset.

T4.2.5 Other controls, flaps, landing gear, payload release etc must be easy to explain to the competition pilot. The suggestion is that you should keep these controls away from transition or FTS switches.

T4.2.6 Example control setup shown below:



Note: if you are unsure how to set your controller up like this, ask us.

T4.3 Flight Termination System (FTS)

T4.3.1 An FTS shall be incorporated as part of the design and demonstration of the functionality is a mandatory requirement to achieve a Permit to Fly.

Note: the purpose of the FTS is to bring the air vehicle down as quickly as possible within the shortest horizontal distance from initiation, to ensure the safety of people. It does not necessarily mean the aircraft will be undamaged.

T4.3.2 The FTS shall bring down the air vehicle as soon as possible after initiation.

T4.3.3 The FTS shall immediately set all motors to off/disarm – this must happen, regardless of the throttle stick position.

T4.3.4 For air vehicles in fixed wing flight, the FTS shall be set to

- Pitch: full nose up
- Roll: full right
- Yaw: full right
- Any other moveable surfaces (flaps/spoilers etc): full deflection
- Deployment of any other additional recovery means, for example parachute.

T4.3.5 For hybrid VTOL aircraft operating in a powered lift flight, the FTS shall not trigger a transition.

T4.3.6 The FTS must not trigger a “return to home” function.

T4.3.7 The FTS shall be triggered automatically by:

- Breach of geo-fence
- After 3 seconds of RC signal loss

T4.3.8 After no more than 10 seconds of data link loss with the GCS the air vehicle may enter a loiter mode so long as the aircraft remains within the geo-fence and doesn't contravene any other competition rules. This is to allow for the competition pilot to subsequently take manual control of the aircraft.

Note: the FTS functionality identified above is required for the fly-off event as part of this competition. Teams may require different failure management controls whilst undertaking flight testing in their local environment. It is always the team leader's responsibility to ensure that the air vehicle is operated safely and within the law.

T4.4 Ground Control Station

T4.4.1 The UAS shall include a GCS which shall display the following information to be visible to the Operators, Flight Safety Officer and Judges during the mission flight:

- Current air vehicle position on a map
- Local Airspace, including the geo-fence flying zone
- Height AGL (QFE) (ft)
- Ground speed (kts)
- Indicated airspeed (kts)

T4.4.2 A display screen on the handheld transmitter is not an acceptable alternative to a dedicated GCS screen.

T4.4.3 The air vehicle shall have a suitable port for a wired connection to the GCS to enable data transfer and mission programming without the need to transmit RF.

T4.5 Radio Equipment

T4.5.1 All radio equipment shall comply with Ofcom regulations for Licence Exempt Short Range Devices, permitted for airborne use:

<https://www.ofcom.org.uk/spectrum/radio-equipment/short-range-devices>

T4.5.2 Radio equipment providing control of the air vehicle and FTS shall be "Spread Spectrum" compliant on the 2.4 GHz band.

- IR2030/7/1 - 2400 – 2483.5 MHz - ≤100 mW e.i.r.p. frequency hopping

T4.5.3 For telemetry radios.

- IR2030/1/10 - 433.05 – 434.79 MHz - ≤10 mW e.r.p. (10% duty cycle limit)
- IR2030/1/14 - 865 – 868 MHz - ≤25 mW e.r.p.

- IR2030/1/23 - 5725 – 5875 MHz - ≤25 mW e.i.r.p.

T4.5.4 The Radio equipment must have sufficient range to ensure the aircraft remains under control throughout the live flying activities.

At BMFA Buckminster the air vehicle will not operate at ranges greater than 500m from the competition pilot.

T4.5.5 Evidence of compliance shall be presented in deliverables.

T4.5.6 Teams may be required to operate on specific channels within their radio equipment's operating range, which may be defined at the fly-off event.

T4.6 Additional Competition Equipment

T4.6.1 The air vehicle must provide space and payload capacity to carry two additional devices which will be provided by the competition officials at the fly-off event. These are: a GPS tracker, which is used to record the flight path of the air vehicle for scoring purposes, and an RF locator which is required to aid in locating the air vehicle in the event of a fly-away. Both devices are provided per flight and must be removed between flights.

T4.6.2 Both devices shall be positioned on the upper surface of the air vehicle and must have a non-conductive, RF transparent cover over them.

T4.6.3 The RF locator is 60mm x 34mm x 18mm and weighs 30g.



T4.6.4 The GPS tracker is 78mm x 28mm x 18mm and weighs 32g.



T4.6.5 Both devices will be activated by the competition officials but will be fitted to the aircraft by the team.

T5 MISSION PAYLOAD

T5.1 Payload Description

- T5.1.1 The aircraft is required to carry and release water.
- T5.1.2 The water may be dyed by the challenge flight line volunteers (TBD).
- T5.1.3 The team may utilise any means to contain the water in their air vehicle.
- T5.1.4 The payload container(s) may be filled whilst in the aircraft.
- T5.1.5 The payload must be loaded from above the aircraft with the aircraft sat upright on the ground.
- T5.1.6 It must be possible to load the payload without the use of tools.
- T5.1.7 The person loading must be able load the payload whilst keeping all parts of their body free of the swept arc of any propeller or rotor.

T5.2 Payload Delivery

- T5.2.1 Only water shall be released during flight.
- T5.2.2 Payload release will happen at no greater than 20ft AGL.

Note: the flying site at BMFA Buckminster slopes, care should be taken when planning the drop.

- T5.2.3 The air vehicle shall not hover for payload release.

T6 STORAGE & RE-ASSEMBLY REQUIREMENTS

T6.1 Container

- T6.1.1 The teams shall design and make a storage container to safely transport their UAS and spare parts. No score will be awarded for COTS storage containers without modification or justification.
- T6.1.2 This should be as small as practical, but the external dimension shall not exceed 1500mm x 600mm x 600mm.

Note: these are the external dimensions.

Note: these external dimensions are for the whole container. Any items, including but not limited to, hinges, handles, casters, or other protrusions must also remain inside these dimensions.

- T6.1.3 The container should allow for the air vehicle and its components to be secured in place.

Note: innovation is encouraged. The Storage Container may also be designed with additional functionality.

Note: for teams outside of the UK the container may be split down into smaller containers so long as the total container dimensions do not exceed the dimensions identified above.

T6.1.4 The container must also include storage for all spare parts that the team wish to have available for the competition. This does not include consumables like, fasteners, tape, solder, adhesives, etc or raw materials like spare fabric, wood, metal etc.

T6.2 Re-Assembly

T6.2.1 The teams shall design the UAS for routine assembly without the use of any tools.

T6.2.2 The only exception to this rule is propellers and rotors, which shall be fitted and torqued according to their specs.

T6.2.3 Major subassembly component connections (e.g. wing to fuselage) shall have a secondary retention mechanism (e.g. cotter pins, pip pins, locking wire, etc). These will be items of inspection by scrutineering. If scrutineers do not believe that suitably safe and robust connections are in place, the aircraft will not be permitted to fly.

During assembly the team will likely have to reconnect various electrical and/or mechanical connections. Teams should consider how they design these connections to physically prevent incorrect configurations.

SECTION D – DELIVERABLES

D1 INTRODUCTION

D1.1 All Deliverables

D1.1.1 Over the academic year, the team will prepare and deliver the following documents:

- Concept Paper
- X-Plane Model and Flight Test Report (FTR)
- Design and Development Specification (DDS)
- Flight Readiness Review (FRR) meeting minutes
- Academic lead sign off

D1.1.2 Teams are reminded to review the plagiarism rules set out in A4.2

D1.1.3 All deliverables must be uploaded to Mashoom by the scheduled dates, or they will incur a late penalty, see A6.3.

D1.1.4 All documents must be in .pdf format, A4 page size in portrait, with a Arial 10pt font, 1.15 line spacing, 2.54cm margins, and text must be single column.

D1.1.5 Each document must have a cover page with the following information

- Team number, university name, team name
- A perspective image of your proposed vehicle against a plain white background
- A list of team members, their courses and years
- Name(s) of supervisor
- Signature of person compiling the document (usually the team leader)
- Signature of person authorising its issue (usually the academic lead)
- Sponsor logos (if applicable)

D1.1.6 A page or word limit is provided for some deliverables. Some individual sections of deliverables will also have a page limit. Where there is a word limit, titles, equations, drawings, diagrams and annotations are not counted. Any part of the deliverable that is outside of these limits will not be scored. Annexes/appendices to documents must not be added – they will not be scored and may attract penalties.

D1.1.7 All files uploaded to Mashoom must have their file name in the following format:

Team number. University name – Team name – Deliverable Name

For example: 17. Daystrom Institute – Phoenix – Concept Paper.pdf

D1.1.8 Failure to comply with the file naming convention may result in a score penalty being applied.

Note: these deliverables will add to the overall competition score as well as some of the individual prizes.

D1.2 Deliverables' due dates

Deliverable	Date
Concept Paper	20 th November 2026
X-Plane FTR	12 th February 2027
Design & Development Specification	29 th March 2027
Flight Readiness Certificate – Form 701	4 th June 2027
Academic Lead Sign-off	25 th June 2027

D1.2.1 In addition to the documents, the team will prepare the following to bring to the fly-off:

- A0 poster – to be displayed above your bench in the hangar
- Business Case presentation

D2 CONCEPT PAPER

D2.1 Background

D2.1.1 The first step in meeting a new customer requirement, in this case the UAS Challenge mission, is to fully understand the requirement and to undertake trade studies to compare various configuration options to determine which would best to undertake the mission. This should take into account the team's knowledge, experience, access to manufacturing and test facilities, and affordability.

Note: the Challenge fosters, encourages, and rewards new thinking and new patentable solutions to address the UAS Challenge's various design and engineering problems. The judges will track your innovative concepts through to the fly-off.

D2.2 Description

D2.2.1 The concept paper shall describe the team's chosen concept to meet the requirements of the UAS Challenge and the programme that will be followed to deliver it.

- This is worth 100 points

D2.3 Content

D2.3.1 The report is limited to 8 pages and shall contain:

- A cover page (D1.1.5)
- No more than 5 pages of text
- 1 page of drawings/sketches – with labels
- 1 page graphical project plan

D2.3.2 It must provide enough information to illustrate the key design features, scaling and innovation. It must cover the following aspects and explain why your choices will address the UAS Challenge mission:

- Air vehicle configuration
- Propulsion system
- Control system
- Payload system

D2.3.3 The drawing must include a 3-view dimensioned and labelled sketch of the aircraft, showing the location of the payload, undercarriage and motors.

Note: at this point you don't have to have the finalised design, but you should have a reasonably close estimate

D2.3.4 The project plan shall be a simplified Gantt or similar chart showing the major steps in your design and development process and the competition project deliverables covered in section D.

Note: it would be wise to allow plenty of time for manufacturing, testing and contingencies. Test subsystems as early as possible – initial testing can be carried out before integration. Make allowances for things going wrong – you may break things, shipping may be delayed, team members may be unavailable – and exams happen.

Note: this will be the customer's (judges') first impression of your aircraft design and your delivery project. It is worth spending some time to finesse the concept paper.

D3 SIMULATION ACTIVITY

D3.1 Background

D3.1.1 Simulation is a critical tool to support the design of an aircraft, assess its effectiveness, and optimise its performance. Simulation results are used to refine and optimise a design. Simulation is not just CFD and FEA. Simplified whole aircraft models can be used to rapidly iterate designs and get a feel for the performance impacts/improvements that can be achieved.

D3.2 Description

D3.2.1 An X-Plane model shall be created by teams following the completion of their concept paper and be further developed through the design lifecycle. The Flight Test Report (FTR) shall describe this development and, in particular, detail how X-Plane has been used to test the design parameters of the aircraft.

- This is worth 100 points

D3.3 X-Plane Model

- D3.3.1 Teams shall create their X-Plane model using the X-Plane 11 Plane Maker toolset, and shall do flight testing within X-Plane 11. It is possible to use the free version of X-Plane 11 to build the aircraft and the demo time will allow you to complete some flight test activity.

Note: every year we have teams who use X-Plane 12 instead of 11, and who score no points for their X-Plane model, don't let this be you!

Note: if your aircraft has some peculiar handling or specialised procedures to fly it correctly, a short Pilot Operating Handbook will help the judges to effectively score your aircraft. This is not to be included directly within the FTR and it will not attract a score in itself.

- D3.3.2 The model will be assessed against the requirements for take-off, handling, payload release, energy efficiency and landing.

Note: X-Plane is not a CAD tool, you cannot get the same precision as you would from CAD, don't try. Build a simplified but representative model of your aircraft.

Note: X-Plane is remarkably flexible but can also be remarkably opaque. If you are struggling with x-plane, please ask for help.

- D3.3.3 The X-Plane 11 model required for submission is only the final version of the aircraft design. The model shall be submitted onto Mashoom in a single zip file containing all the required data. The zipped folder shall follow the naming convention for all deliverables (D1.1.7)

- D3.3.4 If the submitted model throws an error on loading, the judges will not attempt to rectify the issue. You will score 0 for the model.

Note: teams are strongly advised to load their model into a completely fresh install of X-Plane to confirm that they've packaged everything correctly. Every year we have teams who don't and score no points for their X-Plane model, don't let this be you!

D3.4 Flight Test Report (FTR), 15 pages (50 points)

- D3.4.1 The FTR is a document created by the team to showcase their design iteration process in their aircraft development phase using X-Plane. The document will have the following sections:

- D3.4.2 **Coversheet** (D1.1.5)

- D3.4.3 **Overview of Initial X-Plane model**, 1 page.

- D3.4.4 **Test Plan**

- Sufficiently detailed to allow the team to assess the key characteristics of their aircraft design within X-Plane

D3.4.5 **Test Results**

- Results for each test run
- Assessment of the design based on the tests
- Subsequent design modifications (if any) based on the results
- Optionally any additional simulation activities used to inform the finalised design of the aircraft

D3.4.6 **Design Limitations**

- Detailed description of any design limitations encountered with the creation of the team's aircraft model in X-Plane.

Note: this is not a section to complain about the simulator

D3.4.7 **Conclusion, 2 pages**

- A conclusion section detailing the key design features of the team's final X-Plane model e.g. wingspan and chord, tail size and moment arm, motor power, battery size, propeller size, weight, payload mass and C of G, etc.

D3.4.8 The FTR must be uploaded to Mashoom as a pdf, like the other deliverables, and following the file naming convention specified in D1.1.7

D4 DESIGN & DEVELOPMENT SPECIFICATION

D4.1 Background

D4.1.1 A design specification defines the technical, functional and performance requirements of a product, the UAS, and is produced so that all the stakeholders, engineers, project managers and the customer have a shared understanding of what is being built and how it should perform and to specify any limitations. This would normally be produced early in the design and development lifecycle.

D4.2 Description

D4.2.1 The DDS shall describe the technical, functional and performance parameters of your design but, for the purpose of the UAS Challenge, we also want to understand how the team arrived at the final design of the UAS and how it will be manufactured, tested and supported. This document is a description of the design and its development, including diagrams, tables and charts. This document must demonstrate that all the mandatory requirements will be met and that the UAS will be safe to fly.

- This is worth 200 points

D4.3 Content

D4.3.1 The document shall be structured as described below and each section has either a page or a word limit and must be started on a new page.

D4.3.2 **Coversheet** (D1.1.5)

D4.3.3 **Design Summary**, 1 page (10 points).

- A description of the proposed design including the intended scale.
- Any significant changes since the Concept Paper and their reasons.
- Any contributions from sponsors.
- A table listing the key features/parameters of the design and must include (but is not limited to): configuration, wingspan, overall length, radio transmitter frequencies and powers, MTOW, number of motors, number of batteries, stall speed (if applicable), cruise speed, and payload weight.

D4.3.4 **Project Management**, (10 points).

- A statement on progress against plan, with details of any delays/setbacks and amendments to ensure a fully tested UAS is on schedule for the demonstration event. (350 words max).
- A table summarising the project risks and their mitigations. (e.g. resourcing, skills, procurement, manufacturing etc.) (1/2 page max)

Note: project risks are not safety risks and vice versa.

- An updated Gantt style programme chart from Concept Paper to Fly-off and showing completed activities, 1 page.

D4.3.5 **Requirement Review**, 3 pages (10 points).

- A table of all technical requirements and how they are being met, for example:

Rule ID	Requirement	Response
TX.X.X	All up mass ≤ 10 kg	A detailed weight budget has been produced with a 10% contingency allowance.
TX.X.X	Limit of 40kts IAS / 200 ft AGL	The autopilot, with inputs from air data probe, on board barometer, and GPS, enforces airspeed and altitude limits. The remote pilot will monitor for any exceedances.

D4.3.6 **Design Description**, 10 pages (90 points). This is the principal area where the team shall provide the evidence and justification for all your design decisions. For each section, explain how the design decision addresses the mission requirements and highlight any innovative features (technical or process). Where software tools are used for calculations they must be backed up by hand calculations for verification. All sections

should include informative illustrations and diagrams (noting that they do not count towards the word count limits). Don't forget to highlight (but also justify) novel features of your design.

- Aircraft Configuration (600 words max, 10 points)
 - A description of the overall UA configuration and how the design addresses the mission requirements.
- Aerodynamic design and performance (600 words max, 10 points)
 - Aerofoil selection (for wings or rotors)
 - Control surface sizing/control authority estimation
 - Aerodynamic performance
- Flight Control System (600 words max, 10 points)
 - Description
 - Control laws
 - Stability analysis
 - Autonomous and manual control
- Flight termination System (600 words max, 10 points)
 - Implementation and operation
 - Expected post initiation aircraft response
- Navigation and Mission Control (600 words max, 10 points)
 - Mission planning
 - Sensors
 - Ground Control Station
- Propulsion System and Energy Management (600 words max, 10 points)
 - Motor selection
 - Battery system
 - Energy management
- Structural design and performance (600 words max, 10 points)
 - Material selection
 - Structural analysis and performance against expected loads (not just in flight)
 - Undercarriage
 - Manufacturability

- Payload System (600 words max, 10 points)
 - Container
 - Loading
 - Release system
- Mass estimation and CG (1 page, 10 points)
 - Approach to mass management
 - Table of subsystem/component mass and locations

D4.3.7 System Architecture Diagram, (1 page, 10 points).

- Diagram showing the system interconnections and data and power flows, including the two removable safety links.

D4.3.8 3-view Drawing, (1 page, 10 points).

- A dimensioned and labelled 3-view scale drawing including the control surfaces, motors, undercarriage, payload, battery, systems and position of the CG

D4.3.9 Safety, (2 pages, 20 points).

- A description of the approach to safety and airworthiness (airworthiness - the ability of an Air System to be operated in flight and on the ground without significant Hazard to Aircrew).
- A risk assessment table listing potential hazards during manufacturing, testing and operating the UAS and how they will be mitigated, using the severity and probability definitions shown below. Both pre- and post-mitigation levels shall be shown.

Note: damage to your UAS is not considered a high severity event but injury to people is! Teams get this wrong every year, don't let that be you.

Severity	Definition
Marginal	Irreparable damage or loss of the UAS
Minor	Minor injury to participant. Damage to public property
Major	Single major injury to a participant. Single injury to a member of the public
Catastrophic	Multiple injuries. Death of any participant

Probability	Definition
Frequent	Likely to occur frequently during UAS Challenge
Occasional	May occur occasionally during UAS Challenge
Remote	Remote possibility of occurring during UAS Challenge
Improbable	Highly unlikely to occur during UAS Challenge

D4.3.10 Manufacturing, (600 words max, 10 points).

- The proposed manufacturing process and construction techniques to be used, including any safety and environmental issues and how they will be addressed
- Justification of material selections with special attention to environmental impact.
- Any special equipment required.
- Any outsourcing of major subsystems with a justification.

Note: failure to identify outsourced manufacturing may be later deemed to be plagiarism at which point, you will receive a penalty

D4.3.11 Support, (2 pages, 10 points).

- The design for the storage container for transporting the UAS, including a sketch or drawing of how your aircraft and spares/equipment will fit in it.
- An outline for the proposed assembly instructions and operations manual for your aircraft.
- The support equipment, handling and storage fixtures necessary for the development flight trials and prototype customer demonstration at BMFA Buckminster.

D4.3.12 Qualification Test Plan, (2 pages, 10 points).

- A description or illustration of a structured approach to testing from ground based sub-systems to full flight testing, supported by a table summarising planned ground and flight tests indicating how each performance and safety requirement will be verified. So far as possible it should include numerical values for objectives and success criteria and test results or date results expected. Examples in the table below:

ID	Objective	Method	Success Criteria	Test results and date
QTP X	Structural integrity	Sandbag wing spar with 2x expected flight load	No permanent deflection	No deflection 25/03
QTP Y	MTOW of 10.0kg	Weigh fully loaded aircraft using scales	≤10.0kg	10.0 kg with 1.5kg of payload 15/04
QTP Z	Land within 20m box	Measure aircraft landing run when at MTOW	≤ 20m	Awaiting flight test phase expected 20/05

D4.3.13 Cost Breakdown, (1 page, 10 points).

- A table listing all items and materials with their actual or estimated costs, including local taxes (e.g. VAT). Any costs incurred from outsourcing manufacturing or parts/services donated by sponsors must be included.
- Any cost above £1,800 must be fully justified.

D4.4 *Guidance on how the DDS will be assessed*

D4.4.1 *The judges will be looking for several factors, including:*

- *Demonstration of a sound systems engineering approach to meeting the design requirements.*
- *Soundness of the air vehicle's design.*
- *A structured design process adopted by the team, and how the derived performance requirements are developed for each of the sub-systems such as wing (or rotor), airframe, propulsion, control, navigation, payload handling etc.*
- *Extent of innovation and incorporation of novel design.*
- *Adherence to the rules.*
- *Depth and extent of underpinning engineering analysis.*
- *Design and planning to meet safety and airworthiness requirements.*
- *Evidence of sound project management, planning, budgeting.*
- *Overall quality of the submission.*

D5 **FLIGHT READINESS REVIEW CERTIFICATE – FORM 701 (F701)**

D5.1 **Background**

D5.1.1 In order to establish that all regulations and mandatory requirements for legal and safe flying at the Fly-off event at BMFA Buckminster, a signed certificate is required. The IMechE's F701 is a tailored and simplified version of the UK Ministry of Defence F701. This is a real-world document that is used as part of aircraft safety and airworthiness management.

D5.2 **Description**

D5.2.1 The form must be fully completed and signed off by both the team leader and academic supervisor, or equivalent.

D5.2.2 This is worth 50 points.

D5.2.3 This is also a condition for being permitted to fly at BMFA Buckminster.

D5.3 **Content**

D5.3.1 The content of the form is a summary of evidence used in support of the airworthiness assessment of your UAS by the scrutineering team.

D5.3.2 The proforma, which must be used, will be posted on the IMechE UAS Challenge website.

D6 ACADEMIC LEAD SIGN OFF

D6.1 Background

- D6.1.1 Before the first flight of a prototype or development aircraft a Flight Readiness Review must be undertaken and, if successful, the authorisation to fly is signed off by the licensed authority in the organisation. For the purposes of the UAS Challenge, this will be your academic lead or equivalent Chartered Engineer.
- D6.1.2 A copy of the signed document must be uploaded to Mashoom by the date shown in D1.2, the file naming convention must comply with D1.1.7.
- D6.1.3 This is not worth any points, but is a condition of being permitted to fly at BMFA Buckminster.

D6.2 Content

- D6.2.1 The signatures are to confirm that the items below have been addressed.
- All Corrective Actions required by the judges from the Design & Development Specification have been fully addressed.
 - The UAS is compliant with the requirements noted in the UAS Challenge Competition Rules.
 - The design and build quality is satisfactory.
 - Safety and Airworthiness aspects have been addressed satisfactorily, with appropriate fail safe mechanisms and a risk register completed.
 - The system has been tested, both by modelling, ground and flight demonstration to evaluate its performance and reliability.
 - The team members preparing and operating the UAS are suitably competent to ensure safe operations.

D7 BUSINESS PRESENTATION

D7.1 Background

- D7.1.1 The UAS design is to address a specific customer requirement, the mission. The design has to be attractive to potential customers both technically and commercially. This is the team's opportunity to sell their full scale concept to potential customers.

D7.2 Description

- D7.2.1 The Business Presentation given at the fly-off event and consists of 10 minutes to present your business proposition to a panel of judges, followed by 5 minutes of questioning.
- This is worth 50 points.

D7.3 Content

D7.3.1 The Business Presentation should include:

- A well-articulated understanding of the market that your UAS will be competing in.
- Production set up.
- An estimate of your sales projection, your costs and the selling price of the production system and operational costs.
- Considerations of support model.
- Discussion of how your design minimises its environmental impact in production and operation.

D8 A0 POSTER

D8.1 Background

D8.1.1 Showcasing your concept is an important step in marketing and at the fly-off event it's a good way to start conversations with other teams, sponsors, volunteers and visitors.

D8.2 Content

D8.2.1 The A0 poster is for display beside the team's workstation at the fly-off event to showcase your UAS. It should cover elements of the following in an easily accessible and attractive form:

- Design
- Development
- Manufacturing
- Testing
- Innovations
- Safety and environmental issues

SECTION F – LIVE FLY-OFF EVENT

F1 OVERVIEW

F1.1 Outline Timings

F1.1.1 The following are not strict timelines and are provided as a guide for what teams should expect at the fly off event. Specific timings will be promulgated closer to the fly-off.

F1.1.2 The fly-off event will run from Monday through to Thursday.

- Monday
 - Teams' arrival and registration in the morning from 0900 (time TBC).
 - The Hangar tent will be open for teams to unload their aircraft and set up their pit from 1000 (time TBC).
 - There will be a mandatory safety brief for all participants in the morning.
 - Scrutineering and unboxing start.
 - Once an aircraft has been scrutineered it may conduct a manual handling flight.
 - Business presentations start.
- Tuesday
 - Mandatory team leader briefing in the morning.
 - Flight line opens – “mission 1” day.
 - Business presentations continue.
 - Scrutineering and unboxing continues.
- Wednesday
 - Mandatory team leader briefing in the morning.
 - Flying continues – “mission 2” day.
 - Business presentations continue.
 - Scrutineering and unboxing available if required.
- Thursday
 - Mandatory team leader briefing in the morning.
 - Scrutineering and unboxing available if required.
 - Business presentations continue.
 - Competition flying finishes in the early afternoon – “manual handling” day.
 - Hangar pits tidy.
 - Competition awards presentation.

F1.2 Business Presentations

- F1.2.1 Teams will be given a business presentation slot; you will not be able to choose when you do your presentation. It is the team leader's responsibility to ensure that the presentation team are available at the allotted time.
- F1.2.2 If you are able to mutually agree to a time swap with another team you may do so. You must inform the head judge, or their representative, of the swap. Only swaps where both slots are in the future are permitted.

Note: it is recommended that the presentation team are not required to be present for flying the UAS in the event of a schedule overlap.

F2 GENERAL RULES

F2.1 Removing the UAS from the Hangar

- F2.1.1 At the live fly-off event, teams must not remove their UAS or parts thereof, except for laptops, from the Hangar tent. Any team found doing so will be penalised 25 points.
- F2.1.2 Teams must not move their aircraft from the Hangar to the flight line until they are instructed to do so by the flight scheduling team.
- F2.1.3 Teams must have permission from the repair tent team to bring their aircraft, or parts to the repair tent.

F2.2 Multiple Airframes

- F2.2.1 Only one air vehicle per team will go through the scrutineering process and so only one air vehicle will be permitted to be flown at the fly off event.

F2.3 Safety Briefing

- F2.3.1 At the life fly-off event, all team members from all teams must attend any announced or scheduled safety briefings. Teams failing to attend may be prevented from flying.
- F2.3.2 There may be additional briefings announced throughout the competition. These will principally be for team leaders. If your team leader is not available, you shall send another team representative and back brief your team.

F2.4 Moving Around on Site

- F2.4.1 Participants and challenge staff must not run on site. This includes the flight line, hangar and spectator areas.

Note: repeat offenders may have points deducted from their team and may be barred from the flight line.

F2.5 Propellers/Rotors

F2.5.1 Propellers and rotors shall not be fitted to the UAS unless instructed to do so by challenge officials.

F2.5.2 In any event, propellers and rotors shall never be fitted whilst in the hangar tent.

F2.6 Dirty Work

F2.6.1 Any work on the aircraft that produces swarf, dust or fumes must not be carried out in the hangar tent.

F2.6.2 Such activities must be conducted in the repair tent with permission and under the supervision of the repair tent officials.

F2.7 Repairs

F2.7.1 Repairs may include replacement of systems and airframe components with spare parts.

F2.7.2 Only those spare parts that are carried within the aircraft storage container will be permitted to be used for repairs. Raw materials and consumables do not need to fit within the aircraft storage container.

F2.7.3 Any repair work must be subsequently reviewed by the scrutineering team to confirm that it does not invalidate the airworthiness of the UAS.

F2.8 Battery Charging

F2.8.1 This must only happen on the designated battery charging station.

F2.8.2 There must be at least one person (from any team) present at the battery charging station whilst batteries are being charged.

F2.8.3 If the officials discover unsupervised batteries charging, they will be disconnected from their charger and may be confiscated until the responsible team requests their return.

F3 FLY-OFF PROCESS

F3.1 Flying Days

F3.1.1 This year each team will be limited to 1 flight per day and the missions for the day will be proscribed.

- First half day will have the option of manual handling
- First full day flights will be mission 1.
- Second full day flights will be mission 2.
- Third day flights will be the last chance for manual handling.

F3.1.2 All flights are limited to 10 minutes.

F3.1.3 If an aircraft exceeds the mission time limit, the competition pilot will take manual control, bring the aircraft back and land the aircraft. No points will be awarded for any flying after 10 minutes.

F3.2 Scheduling

F3.2.1 To manage the competition a flight schedule is utilised. This tracks the team's progress through scrutineering and judging towards flight and manages the flying programme. For this system to work, teams will need to communicate their readiness at each stage with the flight scheduling team.

F3.2.2 If a team report that they are ready but cannot progress when called, they will be moved to the back of the queue for whatever stage they are at. Repeat offenders may be penalised.

F3.3 Scrutineering

F3.3.1 To be allowed to fly, each team will need to complete scrutineering and demonstrate to the satisfaction of the scrutineering team, that their UAS is airworthy.

F3.3.2 This process consists of the following activities:

- F700 inspection
- Aircraft visual inspection and discussion with scrutineers
- Unboxing demonstration
- Battery removal demonstration

F3.3.3 On completion of scrutineering the team may report their readiness to fly.

F3.3.4 If a team fails scrutineering, they will be given guidance on how to rectify the faults.

F3.3.5 If an aircraft is modified or requires repairs, the scrutineering team will need to review the changes before the aircraft is permitted to fly again.

F3.4 Flight Line

F3.4.1 The flight line is the demarcation between the ground activities and the flying activities. There will be a physical barrier – typically a rope fence. Access to the flight line is controlled by the flight line staff. No-one is allowed to cross the flight line without permission of the flight line staff.

Note: Team members behaviour at the competition is always being noted. However, on the flight line this is especially critical. Unsafe or otherwise unprofessional behaviour will be noted. Depending on the perceived severity: you may lose points for your team, individually be requested to leave the flight line, your team not be permitted to fly or your team disqualified.

F3.4.2 The schedulers will call teams individually, as they reach the front of the queue, to take their UAS to the flight line.

Note: it is always the team leader's responsibility to decide whether, or not, to fly their UAS.

F3.4.3 The team will report to the flight line with their UAS and their completed F700 and wait for the flight line staff to call them through the flight line fence. The team should take all items necessary to fly their UAS.

F3.4.4 No tools – apart from those required for fitment of propellers/rotors are permitted on the flight line.

F3.4.5 If a team is deemed to be not ready for flight, the flight line staff are authorised to return the team to the hangar and the back of the flight queue.

F3.4.6 Only 4 team members will be permitted on the flight line. They shall be identified as having specific roles – example:

- Flight lead – in charge of the flying activity. Will brief the competition pilot on the operation of their UAS manual controls.
- Mission planner – responsible to the flight lead for the GCS. Will brief the flight line staff on their GCS, indicating their waypoints, geofence and flight instruments.
- Payload – responsible to the flight lead for the mission payload.
- Aircraft handler – responsible to the flight lead for moving and positioning the aircraft on the ground (with the assistance of other team members as required).

Note: it is possible to switch team members on the flight line, with the permission of the flight line staff. However, this should be kept to a minimum and will not be permitted when the aircraft is being/has moved to the runway.

F3.4.7 The team will be asked to prove their quick disconnects, FTS, and demonstrate that their controls are functioning correctly.

F3.4.8 Once this has been satisfactorily completed the team will be allowed to fit their propellers/rotors.

F3.4.9 The team will then join the queue moving to the runway.

F3.4.10 When it is your turn to fly, you will be invited to position your aircraft on the runway, brief the competition pilot and, once they are content, fly the day's mission.

F3.4.11 Once a team has been brought to the runway, you will have 5 minutes to brief the pilot, set up your aircraft and launch. The competition pilot may return any teams exceeding this time to the back of the flight queue at their discretion.

SECTION S – SCORING SUMMARY & PRIZES

S1 SUMMARY TABLE

S1.1.1 Pre-fly-off event scores are described in Section D

	Activity	Section Score	Score
Pre-Fly-off Event	Design and Development		450
	Concept Paper	100	
	X-Plane Model	100	
	Design and Development Specification	200	
	Flight Readiness Review	50	
Fly-off Event	Storage & Re-assembly		50
	Scrutineering		50
	Mission Flight # 1		200
	Automatic Take-off	20	
	Navigation	120	
	Automatic Landing	60	
	Mission Flight # 2		400
	Automatic Take-off	20	
	Navigation to Payload Delivery	120	
	Payload Delivery	120	
	Return Navigation	20	
	Automatic Landing	60	
	Energy Efficiency	60	
	Manual Flying Quality Assessment		50
	Design implementation		25
	Conduct and Professionalism		50
	Business Case		50
Total			1325

S2 FLYOFF SCORES

S2.1 Innovation Scoring

S2.1.1 The challenge aims to encourage innovation and novel solutions. Based on the Concept Paper, X-Plane model and Design & Description Specification, the judges will identify 4 teams who have been assessed as having the most innovative designs in one of 4 categories (they will only be awarded points for a single category). These teams will receive a 1.1 times score multiplier for all the Fly-off Event scores. The multiplier does not allow the score for an individual aspect to exceed maximum points. The categories are:

- Aerodynamic/configuration
- Material/manufacturing process
- Payload integration/release mechanism
- Aircraft systems/GCS

Example: Team with a multiplier scores 300 points on Mission #2, with multiplier, they are awarded $300 \times 1.1 = 330$ points. On the manual flying, they score 48 points, 48×1.1 exceeds maximum score and so they are capped at the maximum 50 points.

S2.2 Scrutineering (50 points)

S2.2.1 Scored by the Scrutineers on the quality and preparedness of the UAS being presented for scrutineering.

S2.3 Storage & Re-assembly (50 points)

S2.3.1 Packaging and storage. Maximum 30 points based on size, novel features, security and protection of components.

S2.3.2 Re-assembly. 20 points for time ≤ 8 minutes. Time to assemble and ready UAS for flight, starting with the UAS packaged in the closed Storage container. Includes the installation of batteries, an empty payload and performing all control function and other pre-flight checks to the satisfaction of the Scrutineering Official. Propellers/rotors must not be fitted.

S2.4 Design Implementation (25 points)

S2.4.1 Scored by the judges on how well the UAS design described in the team's Design & Development Specification has been taken through to the final manufactured product.

S2.5 Conduct & Professionalism (50 points)

S2.5.1 Scored by the IMechE challenge staff and volunteers on the overall conduct and approach to the competition of each team, as individuals and all together.

S2.6 Mission 1 (200 points)

S2.6.1 As described in M3.2

S2.7 Mission 2 (400 points)

S2.7.1 As described in M3.3

S2.8 Manual Handling Assessment (50 points)

S2.8.1 As described in M3.4

S3 PRIZES AND AWARDS

S3.1.1 The prizes and awards list is being overhauled this year and the full, revised list will be published at a later date.

Prize	Award Criteria	Notes
Grand Champion	Highest aggregate score from the Design & Development documents, X-Plane Simulation, and the Pre-Mission and Flight Demonstration. All elements of the Challenge, including the Business Presentation must be completed to be eligible.	Scoring as per Error! Reference source not found.
Runner Up	2 nd highest aggregate score from the Design & Development, X-Plane Simulation and the Pre-Mission and Flight Demonstration. All elements of the Challenge, including the Business Presentation must be completed to be eligible.	Scoring as per Error! Reference source not found.
3 rd Place	3 rd highest aggregate score from the Design & Development, X-Plane Simulation and the Pre-Mission and Flight Demonstration. All elements of the Challenge, including the Business Presentation must be completed to be eligible.	Scoring as per Error! Reference source not found.
Innovation	The most innovative concept taken through to flight demonstration. This could include an innovative layout of propulsion and flying surfaces, aerodynamics, structures, use of materials, and manufacturing methods.	Assessed from the Design Reports, confirmed at the demonstration event.
Simulation	For the entrant with the highest overall score achieved for their X-Plane Simulation Model. This will include likeness to their proposed design and submitted documentation.	Assessed from the X-Plane submission and design reports.

Prize	Award Criteria	Notes
Scrutineering	The best presented UAS that is fully compliant with the competition rules and meets the technical, build quality and supportability objectives of the competition.	Judged by the scrutineers at the Demonstration event.
Safety	For the entrant developing the best combination of a well-articulated safety case, with evidence that safety has been considered throughout the design and development stages and demonstrating safe operation and team behaviour.	Judged from the Design Report and from the Flight Demonstration Event.
Environmental	For the air vehicle demonstrating the most environmentally sustainable design in materials, noise and energy usage.	Assessment of materials selection, and flight energy efficiency score.
Pilot's Award	For the best flying aircraft as judged by the competition pilot.	Judged by competition pilot
Airworthiness	For the entrant demonstrating the best approach to airworthiness, through design, well-engineered features, use of sound engineering practice and attention to the aircraft's suitability for flight.	Judged by the scrutineers at the Demonstration event.
Operational Supportability	For the team who can most quickly and professionally go from a fully stowed to flight-ready UAS safely, whilst demonstrating the best team-working.	Judged by scrutineers during the pre-flight inspections.
Project Management	For the team who deliver an aircraft, which has flown prior to the event and who have demonstrated good project management techniques through their documentation.	Judged by documentation scores and aircraft at the fly-off
Business Proposition	For the entrant with the most promising business and marketing case presented to a panel of sponsors, reflecting a well-articulated understanding of the market and good alignment of the UAS capabilities and cost projections with the target market.	Judged by a panel of the event sponsors at the Flight Demonstration event.
Value for Money	The team who achieved the highest score/price ratio.	Calculated based on declared cost and overall competition score.

Prize	Award Criteria	Notes
Most Promise	For the entrant which couldn't quite make it all work on the day, but where the team showed most ingenuity, teamwork, resilience in the face of adversity, and a promising design for next year's competition.	This could either be a team that failed to make it to the Flight Line, or one that did not reach its full promise during the flight trials/simulation.
Advancement Award	Highest scores for a university that has not previously taken part or has excelled compared to previous years' entries.	
STEM Engagement	For the team which engages most effectively with schools, and social media, encouraging STEM Outreach Programmes, to promote participation and engagement with the Challenge.	This is assessed from the evidence of a team's STEM activities. Please use #UASC2026 and tag the UASC in whichever platform(s) you are using.
Teams' Team	An award voted on entirely by the competition entrants. It is intended to recognise the team which best represents the spirit of the competition.	There is 1 vote per team at the fly-off for any-other team.
Chair's Award	An award given by the Challenge Chair to recognise a team or individual's outstanding achievement not otherwise recognised.	Not necessarily delivered each year.
Commendation: Innovation-Aerodynamics	Recognition of the team who were awarded the innovation score multiplier for aerodynamics/configuration.	Judges panel at the flyoff
Commendation: Innovation-Structures & Manufacturing	Recognition of the team who were awarded the innovation score multiplier for structures and manufacturing processes.	Judges panel at the flyoff
Commendation: Innovation-Payload Integration	Recognition of the team who were awarded the innovation score multiplier for payload integration.	Judges panel at the flyoff
Commendation: Innovation-Systems, avionics, GCS	Recognition of the team who were awarded the innovation score multiplier for systems/avionics/GCS.	Judges panel at the flyoff
Commendation: First past the post	Recognition of the team who were the first to fly at the event.	First aircraft to fly