

FREQUENTLY ASKED QUESTIONS (FAQs)

UAS CHALLENGE

A: TEAM COMPOSITION

- 1. If we want to add an additional member to the team (more than 10 people + supervisor) is this possible?**

You can add up to 5 additional team members to make up a maximum of 15 participants per team. Please note any team member above the initial 10 will need to be paid for separately as per the Entry Form.

- 2. Team supervisor: Can this just be anyone (for instance someone from the team) or does this have to be someone more official, such as a university lecturer?**

The Team Supervisor should be a university staff member.

B: FUNDING

- 1. Is it possible for IMechE to help our team financially in order to cut down costs?**

IMechE is not able to sponsor any teams but you are eligible to apply for a Group Project Award <http://www.imeche.org/careers-education/scholarships-and-awards/group-project-award>

- 2. If we acquire backup components for the build that may not be used in the final system during the flight missions, should we include it in the budget/ cost declaration?**

No, you need not declare backup components in your cost budget but you may want to mention that you have taken the precaution of buying some as a risk mitigation.

- 3. We have a sponsor who will be helping us fabricate our frame. If we have to, how do we declare the costs associated with this?**

You need to clearly state what work your sponsor is doing for you. Please take particular note of the words in sections 2.6 and 3.1.13 (particularly 4th paragraph) of the Rules. The idea of the competition is that this should be your own airframe and control system design

and aside from off-the-shelf components (e.g. autopilots, batteries, motors, etc.) should largely be manufactured and assembled by yourselves. If it is a specialised component/assembly from your sponsor then it should be included in the COTS budget. If the sponsor is helping with specialised manufacturing equipment then it need not but should be acknowledged.

C: AIRFRAMES

1. Are we allowed to use ready-made frames/structures for our unmanned aircraft or do we make it from scratch?

The rules are quite clear that airframe kits are not permissible – para 3.1.13 “The UAS airframe and control systems shall be designed from scratch, and not based upon commercially available kits or systems.” The airframe and control systems design should be your own and not a copy of a commercial UAS. We are looking for innovative ideas.

D: COTS

1. Does the camera count as an off shelf component that is part of the suggested budget?

Yes, the camera counts as a COTS item and should be included in your COTS budget.

2. 3.1.13 Limits on use of COTS Items

The UAS airframe and control systems shall be designed from scratch, and not based upon commercially available kits or systems. This is a qualifying rule, meaning that an entrant based on a commercially available system will not be eligible for consideration.

We would like to buy a flight controller which has many integrated systems. Are we allowed to use such commercially available set of hardware?

The Note in para 3.1.13 lists the type of stock components that are permissible as COTS items. We want you to design your own airframe but you are permitted to use off-the-shelf autopilots.

3. The COTS products budget is set at £1000. I am aware this includes off the shelf components such as motors and batteries etc. Does this also include all material and manufacturing costs too? Is the cost of either the sandwich panel itself or the associated manufacturing costs included in this COTS budget?

The rules state that the *guideline* maximum value of COTS is £1,000; it is not a limit but we are looking for the best value for money (competitiveness) of the UAS. COTS, in this context, is for bought in finished components (e.g. motors, batteries, servos, control boards, etc.). Materials that the team will be using in the manufacturing of the UAS would not be included in COTS.

E: DELIVERABLE DOCUMENTS

1. Annex D specifies the structure and content of the deliverable documents. Is this mandatory or guidance on how to cover the subject matter?

A: The structure, word and page counts are mandatory. The sections will be split up for assessment by different judges and, therefore, it is important that you clearly follow the individual section content, including the information required on the cover page.

2. According to the competition rules it must contain a section "Verification and Validation Register". What does that mean/is that section supposed to contain?

It is a table to show how you will verify that your design meets all the requirements that IMechE has stated in the rules – in other words what you plan to do. Validation is the evidence that you have met the requirement. Wikipedia is a great help, https://en.wikipedia.org/wiki/Verification_and_validation.

A suggested format:

Requirement	Verification method	Validation method
Mass <6.9kg	Table of component weights	Calibrated weighing scales

3. I had some questions regarding the 'Functional Description' section in the PDR.

- What is the expected description of autonomy? Is it for instance the 'level' of autonomy per the levels 1-5 scale or is it a verbal description of the autonomous capability of the system?**

We are looking for you to describe how you have approached the challenge of flying your UAS from take-off to landing fully automatically and your reason for selecting the system that you have designed. We are not looking for a description of autonomy.

- **What is expected to be described in the control system? We will be using an off the shelf autopilot and flight controller in the UAS, and will be innovating mainly in the autonomy. Do we then describe the functioning of these off-the-shelf autopilot and flight controller?**

You do not need to describe in detail the operation of off-the-shelf systems or components but you should describe your overall systems architecture and the role of each sub-system. You should also explain why you have selected the off-the-shelf systems and any modifications or software changes that you are making. We are interested in innovative applications of off-the-shelf systems.

F: FLIGHT DEMONSTRATION

- 1. In the competition document it says that the aircraft should operate on grass OR hard runway surfaces. Does this mean we get to choose whether we want to launch/land on grass or asphalt runway?**

You are required to be able to do either but the take-off and landing site will be chosen and designated by the Flight Safety Officer at the start of the flight demonstration event.

- 2. Is it allowed to use Dronekit for the path planning?**

Yes, but it will need to be accounted for in the COTS budget and do not forget that there are points for innovation.

- 3. What is the maximum flight time to score points? The rule book states that after 10 minutes from take-off the mission ends. Further into the rules under General Points, it quotes a limit of 25 minutes for each team on the runway.**

For the scoring of points, the 10 minutes from the start of take-off to the full stop landing is the critical maximum time. If you exceed the 5 minutes from being given the go ahead to take-off to starting your take-off, the FSO may direct you to retire and request another mission slot, which may be granted if time allows later. Points may be deducted at the discretion of the judges if the team fails to recover their UA and then pack up and clear the flight line (5 minutes allowed) within the overall 25 minutes allocated.

- 4. Could you please provide a full list of all PPE that the team will require to be compliant with your risk assessment?**

The PPE requirement will vary for each team (depending on what tooling they bring with them to use at the event), therefore, no specification will be provided by the IMechE (if we did it would state "all PPE required for the tasks to be performed"). Teams should be advised to consult the Health and Safety Executives (HSE) guidance for PPE at work

(<http://www.hse.gov.uk/pubns/indg174.pdf>) and demonstrate to the IMechE that they have selected suitable PPE for the maintenance/manufacturing tasks they will be performing (as part of their own Safety Assessment/Risk Assessment as part of the Concept Paper, CDR and FRR deliverables and through volunteer observation of PPE usage at the event).

- 5. While the brief does provide a good idea of what the targets will look like, it is possible that the physical manifestation of these could differ on the day. Are any photos of previous targets available for reference?**

The dimensions will be adhered to but the exact formation of the letter may vary. Unfortunately there are no photographs of previous year's targets but these would not necessarily be helpful.

- 6. I assume that the characters will be hand-painted so will not be of a particular 'font'. That said, can you confirm that they will be similar to standard sans-serif fonts such as that used in the brief?**

They will be handmade but will be as near as possible to the font shown in Figure A1.

- 7. Could you post an example picture of the actual target? (Knowing the material and character font would allow us to fine tune the object detection system. I'm sure all the teams would benefit from having this).**

No, you are only being given the approximate dimensions in the rules.

- 8. Regarding the video downlink, is the 1km range a strict requirement even if the video downlink is not essential in the operation of the UAS? Telemetry and RC will of course comply with the 1km range.**

No, you do not have to achieve a 1 km range for the video downlink if it is not critical to the operation of the UAS but it must comply with EU directives and be licensed for use in the UK. All a/c are flown within Visual Line Of Sight (VLOS) rules i.a.w CAP722/CAP393, therefore, any video imagery is not essential for Safety of operation.

- 9. Does the touch and go require the full UAVs landing gear to make contact with the ground or is it acceptable for the UAV to for example, approach the ground and the rear wheel to make contact whereas the front part of the landing gear to remain in air?**

The UAV simply has to touch the ground within the 30 m x 30 m square.

- 10. Does the failsafe system need to remove power to the motors or can the failsafe system simply remove the control signals to the electronic speed controller which**

in turn shall prevent the motor using power (both ways will bring the motors to a standstill and the UAV to a safe glide to ground)?

The means by which you achieve the engine shut down is up to you but as this is a key safety issue you should satisfy yourself that your design is of high integrity and will operate immediately that the FTS system has been triggered either through loss of the link or commanded by the Flight Safety Officer.

11.The rule states: "The accuracy of the marker placement shall be within 30m of nominal course".

- **Does this mean that the marker shall be within a 30m bound total or 30m either side of the UAV flight path?**

It is not clear what you mean by "a bound total" but the rules clearly state that the Ground Markers will lie on a straight line between waypoints within a placement accuracy within 30 m either side of this straight line.

- **Will the placement of the marker be on a straight within the two waypoint or can the marker be placed a point where the UAV is required to bank?**

See above but they will not be placed so close to a waypoint that your vehicle will still be turning if it is following the correct course.