Test Project

Module 6 – Operational Challenge

5 hours

Unmanned Aerial Systems

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WSC2026_TP64_en

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1 Introduction

A magnitude 6.2 earthquake has damaged an office building. Structural engineers have deemed it unsafe for human entry. Competitors must autonomously fly their UAS through the structure to locate objects (survivors, and hazards) and indicate what has been located using the onboard LEDs — without physical contact with any objects or walls.

The competitor UAS is required to be able to autonomously navigate the environment and provide information using only onboard sensors, which facilitate efficiency in missions such as environmental monitoring, emergency rescue, etc.

The initial operational requirements are defined as follows:

COLOUR	OPERATIONAL AREA	FUNCTION
Red	Injured Person	Change LEDs to all Red
Green	Injured Person	Change LEDs to all Green
Blue	Injured Person	Change LEDs to all Blue
Yellow	Hazard	Flash all LEDS Yellow
Orange	Fire	Flash LEDS Orange
Purple	Unknown Issue	Flash LEDS Purple

2 Description of project and tasks

2.1 Required Components

The list of required components to complete the task.

- Competitor completed UAS built on C1 with components added in module 4

2.1 Flight Mode

Competitors are required to complete this module as an **Autonomous Flight**.

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2.2 Schedule

There is a total time block of 5 hours. Below is a chart to help the competitor manage their time.

TIME	TASK
00:00 – 04:00	Prep-Time
04:00 – 05:00	Evaluation time

Competitors should refer to the official competition schedule to determine the start and finish time of their allocated session. Before the end of the time block, competitors must:

- Arrive at the Flight Area
- Prepare the UAS and complete pre-flight inspection
- Complete the Task;
- Complete post-flight Steps;
- Safely store the Drone and Battery; and
- Wait in the designated briefing area until released by the Chief Expert.

During the evaluation period, competitors are **not permitted** to modify the UAS or perform any additional work.

The total time allocated for the Operational Challenge is 5 hours, this includes assessment.

2.4 Assessment Criteria

Module 6 will be scored by Experts during the Competition. Information about specific tasks and required tests will be provided to Competitors in the morning briefing.

Competitors should complete all tasks independently within the time allocated to the Module.

First, prepare according to requirements.

Second, complete the tasks listed below

Note: During operations, strictly adhere to the operation safety rules and carry out the tasks in order.

Workplace safety procedures and protocols must be always demonstrated.

If you are advised of a safety infraction during this module, there will be a percentage of marks deducted for each infraction. On the 3rd infraction, the Competitor will be stopped, and the evaluation will be based on work already completed.

Experts will not intervene unless there is a safety concern.

2.5 Module Task

2.5.1 Core Task Objectives

Competitors shall complete the UAS programming and debugging (including assessment within 5 hours to enable the UAS to have the capabilities of autonomous obstacle avoidance, object detection, and path planning;

The UAS shall independently complete the full process of operations.

Competitors can conduct flight tests and debugging using a sample flight scenario before being scored.

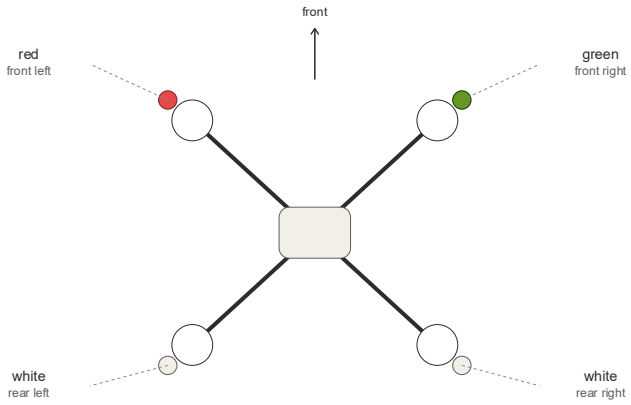
Before an evaluation run, the roll of the die determines the target color for each of the six locations where the UAS must detect and avoid the object.

The layout of the area will not change only what object is at each location, changes, the start point, court boundaries and end point will not change.

The target time to complete a run is 240 Seconds. Competitors who complete a run within this time will receive full-time marks. A percentage of the time mark will be deducted for each 120 second interval after the 240. No time mark will be given for 600+ seconds.

2.5.2 Specific Task Requirements

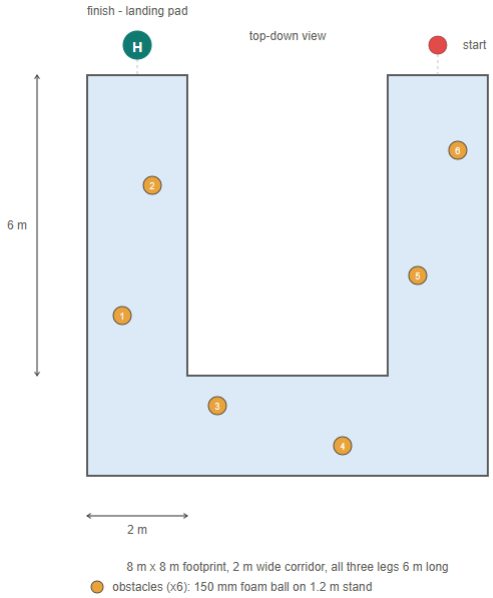
1. Autonomous take-off, the indicator lights turn on in the state of navigation lights as follows:



Red = front left, green = front right, white = both rear — this mirrors the aviation port/starboard convention

2. The flight altitude is 1m~1.5m.
3. Autonomous obstacle avoidance and object detection: The UAS plans the route autonomously locates each object while avoiding contact with any wall, object or stand. The passage is 2 meters wide. At each object the UAS must wait 5 seconds and execute the correct light sequence. At all other times the standard navigation lights must be maintained.

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BALL COLOUR	FUNCTION
Red	Change LEDs to all Red
Green	Change LEDs to all Green
Blue	Change LEDs to all Blue
Yellow	Flash all LEDS Yellow
Orange	Flash LEDS Orange
Purple	Flash LEDS Purple

The UAS shall avoid obstacles autonomously during the crossing process with no collision and stable flight.

4. The UAS shall land in the indicated landing grid area.

3 Instructions to the Competitor

3.1 Competition Requirements

Each competitor will use the following for this module:

1 X WS500 UAV Quadcopter Kit

Instructions

1. Competitors should not bring any device irrelevant to the Competition to the workstation.
2. Tools, electrical components and materials for the Skill are all provided at the workstation or in the shared work area for Competitor access.
3. During the Competition, for matters irrelevant to the Competition contents, such as use of the washroom, or report of equipment, facilities, tooling, or tool faults, Competitors can seek help from the Experts.
4. Competitors may refer to the reference documents for the Skill provided.

Operation Safety Rules

1. Put on proper personal protective equipment according to operation requirements;
2. Take site safety protection measures and confirm them;
3. Before performing operations with power off, confirm that the power is off and batteries are disconnected;
4. Before performing operations with power on, turn on the power after confirming that no safety hazards exist;
5. Do not operate in a violent or an unsafe manner, including but not limited to forcibly pulling, dragging, smashing, throwing, and other violent behaviors, as well as behaviors that may cause personnel injuries or damage to equipment;
6. All the tools or materials used during operations should be stored correctly.

Note: If a competitor fails to comply with the operation safety rules and is considered to have operated in a dangerous manner or have caused a safety hazard in the workplace, or equipment damage or personal injuries, marks will be reduced until his/her right to participate in the Competition is cancelled.

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4 Equipment, Machinery, Installations, and Materials Required.

4.1 Equipment Provided by the Competition Organizer

One laptop installed with core programming tools including but not limited to:

- Mission Planner
- Rasperry PI Imager
- VS Code
- Drone OS Image

All equipment, tools, and materials listed in the Infrastructure List –see the WorldSkills Forum and Technical Description;

Personal Protective Equipment (PPE) and tools must be provided by Competitors.

Objects required for identification during the performance and testing.

Test arena for the performance evaluation tasks

4.2 Equipment and Materials not Permitted

Personal Laptops or portable computers.

Tablets, such as Android, IPAQ, etc.

Memory sticks/Music players/digital storage devices.

Portable radios/CD players.

Electronic organizers/diaries.

Wireless communication devices, including mobile phones.

Any power tools.

Any other software not provided by the Competition Organizer without the approval of Experts.

Pre-programmed Raspberry Pi images not approved; teams will be required to delete any images under the supervision of Experts during the familiarization period and will then receive a pre-approved version.

Equipment that is similar or operates similarly to the equipment provided. For example – if the Competition Organizer provides a metal-cutting saw, no team may bring their own metal-cutting saw.

All raw materials, components, parts, purchased items, tools, and equipment not permitted in the Technical Description and the List of Material Allowed and Not Allowed of the skill.

During the Competition, no tools, equipment, stationery, components, parts, raw materials, manuals, drawings, electrical devices, or digital storage devices may be taken out of or brought into the Competition venue without the approval of the Skill Compeition Manager.

4.3 Items to be Provided by Teams

Each team must provide and wear team identification indicating their region. These must be always worn during the Competition.