worldskills

Standards and Assessment Guide

Unmanned Aerial Systems

v1.0

Introduction

Welcome to the Standards and Assessment Guide (SAG), a comprehensive resource designed to support excellence in assessment practices for all skills competitions hosted at the WorldSkills Competition. A key component of the SAG is the commitment to continuous improvement through ongoing review, ensuring that these guides consistently reflect the latest industry innovations and high standards of assessment in an open and transparent manner.

Purpose

The primary purpose of this guide is to provide a structured framework for the consistent and fair assessment of each skill competition. It aims to ensure that all assessments are conducted with a high degree of accuracy, reliability, validity, and reflect global industry standards. By adhering to these guidelines, assessors can maintain the integrity of the competition and uphold the high standards associated with WorldSkills.

Note: this guide is not a replacement for the Marking Scheme and should only be used as a reference when required during the assessment process. Competitors are not allowed to have a copy of this SAG in the workshop in either digital or paper form.

Scope

This document covers general assessment practices applicable to a diverse range of industry sectors including:

- Manufacturing and Engineering Technology
- Information and Communication Technology
- Construction and Building Technology
- Transportation and Logistics
- Social and Personal Services
- Creative Arts and Fashion

Each skill competition has its unique requirements and benchmarks, which are detailed within sections of this guide. The consistency of assessment across each skill is the overarching principle, ensuring a unified approach to evaluating Competitor performance to the highest standards.

Key Components

The guide is structured into several key components, each addressing critical aspects of the assessment process:

Assessment Principles and Objectives

- Emphasis on fairness, transparency, and objectivity in assessments.
- Alignment with global industry standards and best practices.

Assessment Methods and Tools

- Description of various assessment methods in Measurement and Judgement.
- Guidance on the application of appropriate assessment tools and equipment (if applicable).

Criteria and Benchmarks

- Examples of assessment criteria and aspects for each skill, outlining the expected competencies and performance standards.
- Benchmarks for different levels of proficiency i.e. Judgement award range 0, 1, 2, 3 or Yes/No criteria alongside clear measurable descriptors.

Expert assessment requirements

- Completion of the Access Programme.
- Approved Curriculum Vitae (CV).
- Reaching 100% Expert preparedness.
- Full participation of online and in-person Mandatory Assessment Training (MAT).
- Completion of practical assessment testing at the Competition.

Quality Assurance and Improvement

- Monitoring and evaluation: Ensuring assessments are carried out correctly and produce reliable results.
- Continuous improvement: Using feedback from Experts and Skill Competition Managers to enhance future assessments.
- Periodic review: Regularly updating processes to reflect current industry and WorldSkills standards.

Implementation

For effective implementation, this guide should be used for guidance purposes only and in parallel with the Technical Description for each skill. Experts are encouraged to familiarize themselves thoroughly with both the general guidelines and the particular requirements of their respective skill areas. Collaborative efforts between the Skill Management Team, Experts, and Competitors are vital for achieving the ultimate goal of global skills development.

Conclusion

The Standards and Assessment Guide embodies the commitment of the WorldSkills movement to nurturing talent and promoting the highest standards of vocational education and training worldwide. By providing clear and comprehensive guidance, we aim to empower Experts to conduct marking and assessment practices that are not only rigorous and equitable but also inspiring and transformative for all participants.

Thank you for your dedication to upholding these standards and contributing to the success of the WorldSkills Competition. Together, we can continue to champion skills excellence and celebrate the achievements of talented individuals from around the globe.

How to Use This SAG

Assessment within this skill is divided into Measurement and Judgement.

The selection of assessment method is predefined in the Marking Scheme and implemented through the marking system (tablet interface). This ensures consistency, reduces subjectivity, and aligns assessment with the intended design of the Test Project.

Experts will be clearly guided for each aspect whether, Measurement or Judgement is required.

Experts must:

- Apply the assigned assessment method exactly as indicated
- Not substitute one method for another
- Not reinterpret a Measurement aspect as Judgement or vice versa

Use of Measurement

Measurement is used where performance can be objectively verified.

Experts are required to:

- Record outcomes as presented (e.g. YES/NO, count, time)
- Follow the Descriptor exactly
- Avoid interpretation beyond observable results

Use of Judgement

Judgement is used only where quality of execution cannot be measured objectively.

Experts are required to:

- Select the score (0–3) that best matches observed performance
- Use descriptors and supporting resources for calibration
- Ensure scoring differences between Experts do not exceed the allowed range

Key Principle

Experts do not determine the assessment method. The assessment method is defined by the Marking Scheme and must be applied as instructed.

Skill 64 – Unmanned Aerial Systems

Measurement

Measurement is used to assess accuracy, precision, and other performance that can be measured objectively. It is used where ambiguity must be avoided.

The total marks allocated to measurement marking may vary from competition to competition depending on the Test Project.

Assessment is recorded using YES/NO, count (0–N), or time where applicable.

Aspect	WSOS section as per TD	Descriptor
	1&2	**Work Organization, Management, and Communication (Continuous Assessment):** Performance is observed throughout all Test Project modules. Workspace is maintained in a safe and operational condition, tasks are executed within allocated time, and effective coordination between team members is demonstrated. Assessment is based on observable compliance with safe practices, task discipline, and cooperative behaviour across all modules, e.g. • Assembly of UAS completed withing allocated time • Compliance with the rules of work, otherwise, 0.5 marks are deducted for each violation. (If there were no violations of safety rules, competition rules, no misuse of equipment, and all timings were met) • Fulfilment of mission planning requirements. • Completion of planning forms for flight • Post-Repair and testing Report completed • Competitor work area left clean after task • Tasks completed within the allocated time

Aspect	WSOS section as per TD	Descriptor
A	3	**Assembling the UAS and Manual Flight Test (Module 1):** UAS is assembled as per industry practice. Assessment is based on the correct assembly and wiring, proper use of tools and procedures. Competitor successfully configures radio controls and upgrades the UAS's internal software by installing and updating firmware and software packages. Competitor also completes Initial Configuration and Calibration. Competitor performs manual flight tests, pilots drones to fulfil mission goals, and accurately executes emergency procedures, including simulated forced landings. • UAS Assembly • Configuration and Calibration • Flight controller firmware flashed to correct version • Motor direction configuration (CCW/CW per layout) • ESC calibration completed correctly • Radio receiver bound and all channels responding • Channel mapping correct (Throttle, Aileron, Elevator, Rudder) • Failsafe configured correctly • PID tuning values set within specified range • Accelerometer/Compass calibration completed • Telemetry/OSD configured and displaying correctly • External/Internal Sensor settings and calibration • Safety and Professional Practice • Manual Flight Testing

Aspect	WSOS section as per TD	Descriptor
B	1,2,3	**Drone diagnostics and repair (Module 2):** Competitor demonstrates the ability to diagnose and resolve system issues. Assessment is based on successful identification of faults, implementation of corrective actions, and restoration of system functionality within allocated time (count, YES/NO, and time), e.g. • Problem Identification and Diagnostic Process • Identify and Correct Mechanical Faults • Identified and Correct Electrical Faults • Verification and Testing After Repair • Safety and Best Practices • Documentation and Communication
C	1,2,6	**Autonomous Programming and Flight Planning (Module 3):** Competitor uses industry-standard software to write programs for autonomous flight. Assessment is based on the successful execution of flight test plans, data processing, and autopilot operation without human control. • Review Mission Requirements and Complete Initial Planning • Waypoint selectin and Flight Path Design • Mission Command and Flight Behaviours • Verification and Simulation Check • Document and Explain via Mission Planning Form

Aspect	WSOS section as per TD	Descriptor
D	1,4,6,7	**Advanced piloting and embedded vision (Module 4):** Competitor integrates advanced sensor systems (e.g., LiDAR, Cameras) and shows an understanding of onboard camera/sensor suites. The vision system combines onboard hardware (depth cameras connected via USB to a companion computer -Raspberry Pi) and involves software techniques such as object detection, marker/fiducial recognition (e.g., ArUco, April tags), optical flow, and visual odometry to give the aircraft situational awareness beyond GPS and IMU data. LiDAR is Commonly paired with vision systems rather than replacing them (LiDAR for distance/obstacle data, camera for object identification) • Install and test additional equipment • Complete updated UAS Configuration, Tuning and Flight Testing • Perform Vision based flight tasks and Scenarios
E	1,3	**Prototyping, Modelling and Mounting (Module 5):** Competitor designs and manufactures a drone replacement part, enhancement, or add-on for integration. Assessment is based on mechanical assembly and functional integration. • Part compliance with design rules • Design accounts for existing drone structure and functionality • Selection of Materials • Complete Drawings and Design Files • Perform Test to Ensure functionality

Aspect	WSOS section as per TD	Descriptor
F	1,7,9	**Operational Challenges (Modules 6):** Drone demonstrates integrated system performance in completing defined operational objectives under dynamic conditions. Assessment is based on successful task completion, accuracy, vision tasks, obstacle detection/avoidance, and system reliability. Flight is in a defined course that represents a real-world situation. • Core Flight Strategies • Demonstrates Basic Skills Sets • Flight Mode and Control Approach • Waypoint Accuracy • Altitude Control • Hold Position • Landing Accuracy • Integrates use of all Sensor systems • Time mark for finishing task within 300 seconds

Judgement

Judgement is used to assess the quality of performance about which there may be small differences of view when applying the external benchmarks.

The Resources column in the table below may include all kinds/formats of resources such as a link to a YouTube video, a website link, an illustration, a photo, a reference to a book, and so on. It needs to be as detailed as possible to show the differentiation between 0, 1, 2, 3.

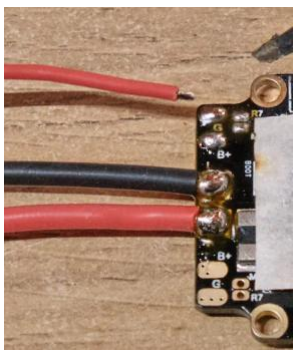
Generic rules

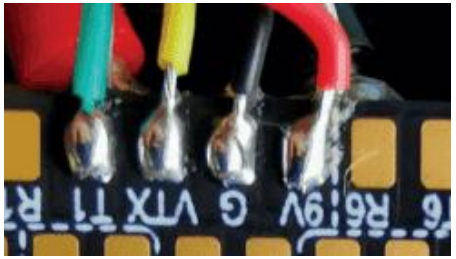
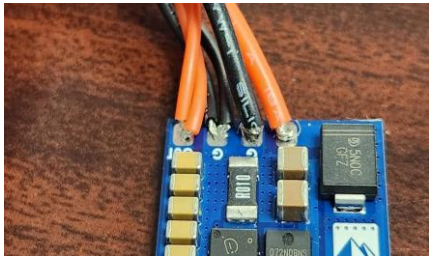
The assessment group comprises three Experts plus one Expert who acts as the supervisor. The supervising Expert will replace an Expert in the marking group to prevent compatriot marking.

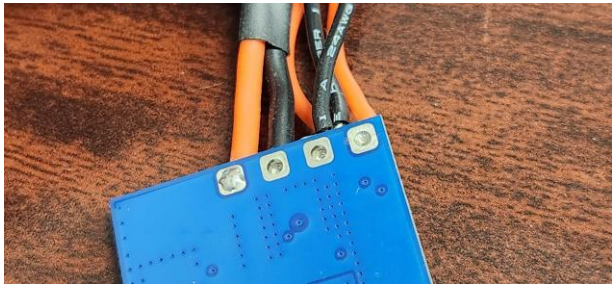
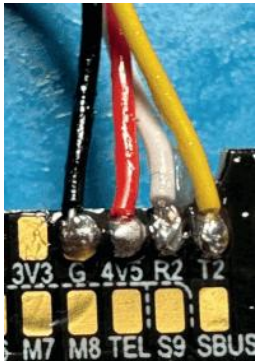
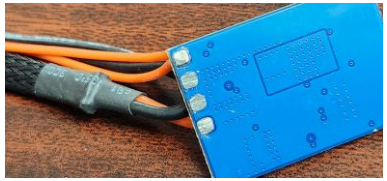
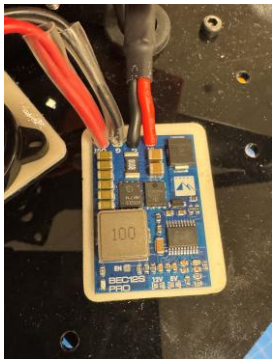
The difference of the three Experts' scores may not exceed 1. If this is the situation the Experts must re-score until there is a maximum difference of 1. As long as the three Experts judge within 1, the result can be entered into the CIS.

The total marks allocated to judgement marking may vary from competition to competition depending on the Test Project.

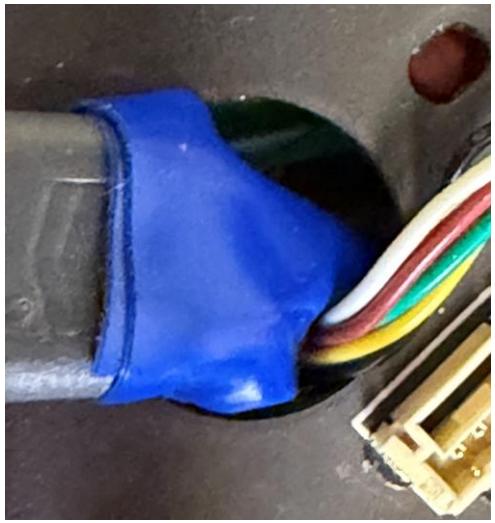
Electrical Assembly – Soldering Standard

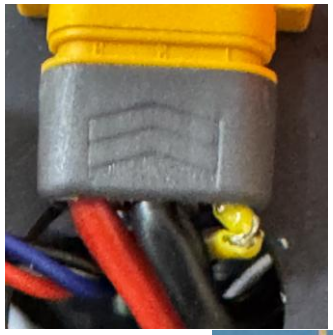
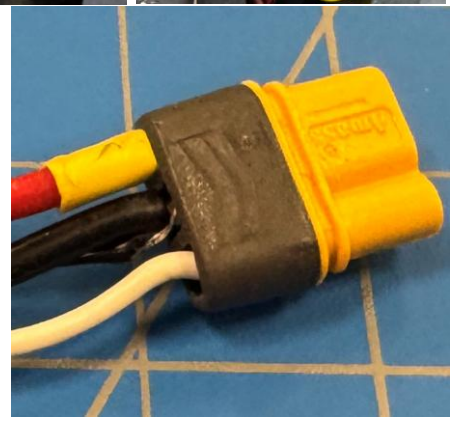
WSOS section as per TD	Score	Descriptor	Resource
3 (Assemble/repair)	0	• No wetting - solder sits on top of a bare or oxidized surface ("sat" solder) • Open joint - wire not making contact with pad/terminal at all • Cracked or fractured joint (visible fracture line, often from stress/vibration) • Lifted pad or damaged pad/trace • Bridging that shorts to an adjacent connection • Wire insulation melted into the joint or wire severed/nicked at the joint • Excessive heat damage (charring, discolored/lifted solder mask).	  

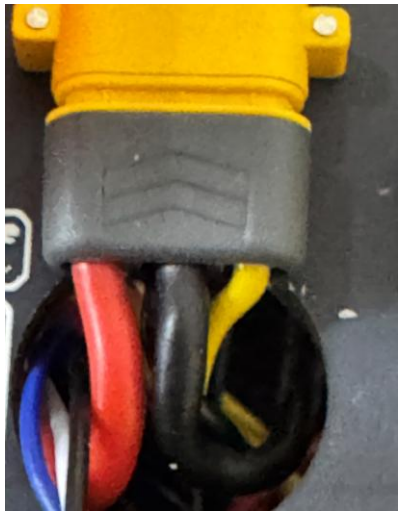
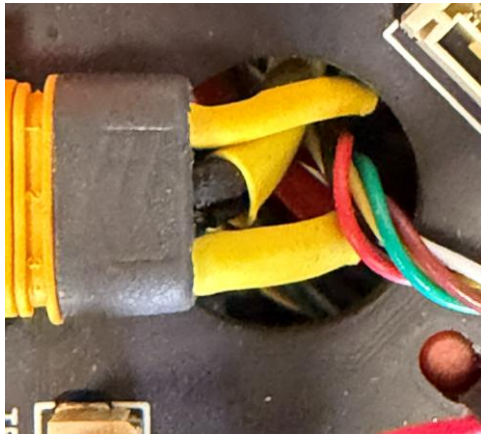
WSOS section as per TD	Score	Descriptor	Resource
	1	• Incomplete wetting on wire or pad (partial coverage, visible base metal) • Dull, grainy, or "cold joint" appearance suggesting poor thermal bonding • Insufficient solder (starved joint) - outline of wire/lead barely covered • Excess solder causing a blob that obscures joint geometry (can't verify wetting) • Minor bridging to an adjacent non-critical point • Wire pulled/lifted slightly from pad but still makes contact • Too much insulation removed from wires • Incomplete contact surfaces	   

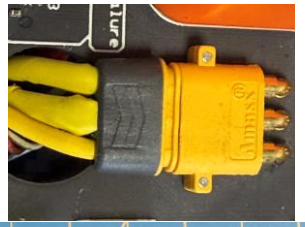
WSOS section as per TD	Score	Descriptor	Resource
	2	• Wetting is complete but fillet shape is imperfect (slightly convex, slightly uneven) • Minor discoloration from heat, but no damage to insulation or pad • Very minor solder ball or slight excess that doesn't bridge or affect function • Joint is mechanically and electrically sound - would pass functional test	 
	3	• Smooth, shiny (or appropriately matte for lead-free), concave fillet • Solder fully wets both the wire/lead and the pad/terminal • Wire or lead is not visible as a "ball" - solder flows into the joint, not just around it • No voids, no cold-joint dullness, no cracks • No excess solder bridging to adjacent pins/pads • Strain relief intact; wire insulation not melted back excessively	  

Electrical Assembly – Wiring

WSOS section as per TD	Score	Descriptor	Resource
3 (Assemble/repair)	0	• Wires tangled, crossing excessively, or under strain; • No bundling or securing; • Exposed conductors or loose connectors present a safety/reliability risk; • No discernible routing logic to core components.	

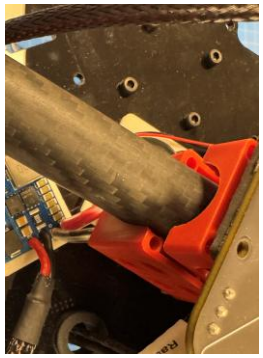
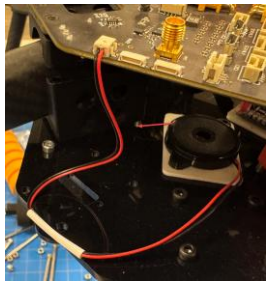
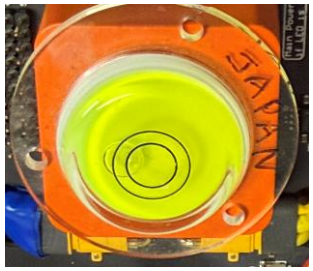
WSOS section as per TD	Score	Descriptor	Resource
	1	• Noticeable excess wire crossing or tangling; • Inconsistent slack (some too tight, some excessive); • Little to no bundling; • Connectors functional but loose or unsecured	  

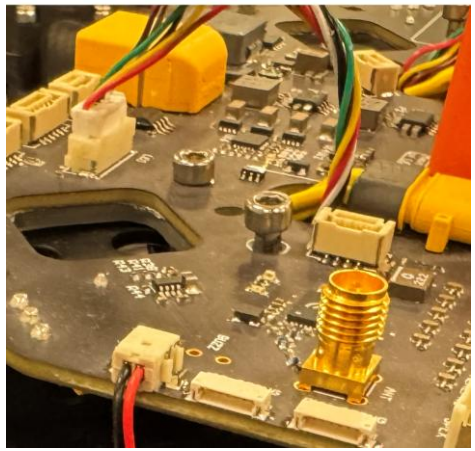
WSOS section as per TD	Score	Descriptor	Resource
	2	• Routing is mostly clean with a few unnecessary crossings; • Slack is mostly appropriate with 1–2 minor exceptions; • Some bundling present but inconsistent; • Connectors secure	 

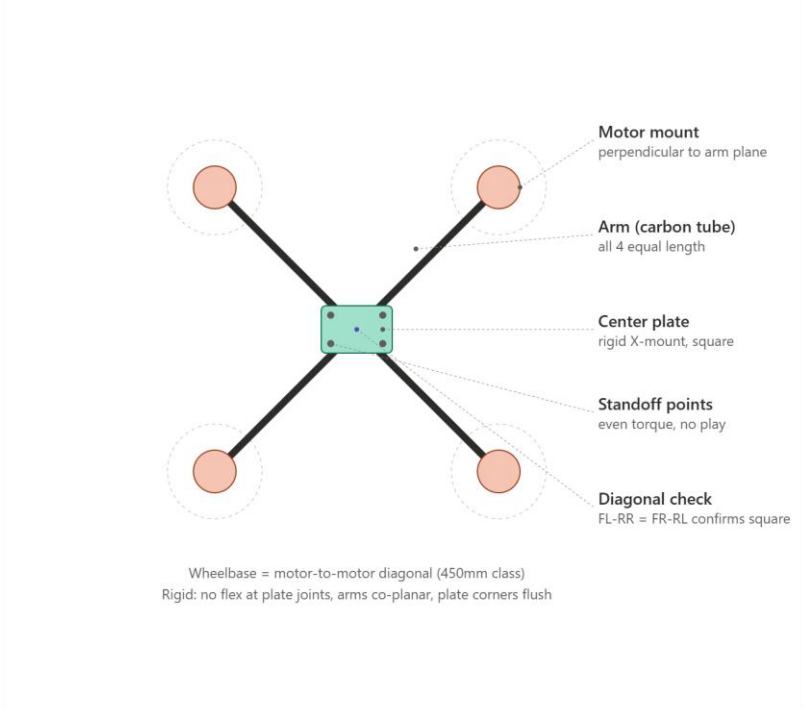
WSOS section as per TD	Score	Descriptor	Resource
	3	• Wires are routed cleanly with no crossing unless unavoidable; consistent, • Appropriate slack (no excess coiling or tautness); • Wires bundled/secured (zip ties, sleeving, or clips) where appropriate; • No exposed conductors • Connectors fully seated and strain-relieved;	 

Mechanical Assembly – UAS Frame Structure

WSOS section as per TD	Score	Descriptor	Resource
3 (Assemble/repair)	0	• Cracked, split, or delaminated frame arm or centre plate • Missing structural screws - frame is not mechanically sound • Motor mount loose or wobbling - unsafe to fly • Wires pinched/damaged, exposed conductor, or routed directly into prop arc • Frame significantly out of square/warped - arms not aligned • Stripped mounting holes with no fastener purchase • Wrong screw length used, causing damage or insufficient thread engagement • Any component that moves/shifts under light hand pressure that should be rigid.	

WSOS section as per TD	Score	Descriptor	Resource
	1	• Visible gap or misalignment at an arm-to-body joint (loose fit, can wiggle) • Wiring routed near moving parts (prop path) or pinched under a plate • One stripped screw head, still functional but compromised for future maintenance • Standoffs not fully seated (visible thread gap) • Frame geometry slightly out of square (measurable diagonal difference)	    

WSOS section as per TD	Score	Descriptor	Resource
	2	• Minor gaps at joints that don't affect rigidity • One or two screws slightly loose but still secure • Wiring mostly neat, one or two loose strands not yet tied down • Slight asymmetry in arm alignment, within tolerance, doesn't affect flight • Minor scuffing/scratches on frame material from assembly, no structural impact	. 

WSOS section as per TD	Score	Descriptor	Resource
	3	• All frame arms/plates seated flush with no gaps or warping at joints • All screws/bolts tight - snug and even, no stripped heads, no over-tightening cracks • Standoffs/spacers aligned straight (not canted), motor mounts perfectly perpendicular to arm plane • Wiring neatly routed, zip-tied or channeled, no wires pinched under standoffs or plates • Frame is symmetric - arm lengths/angles match design, X/H geometry is square when checked diagonally • No visible stress marks, cracks, or delamination in carbon fiber/plastic • All fasteners present (no missing screws), correct screw length used per mount point	

Quick Decision Checklist

1. **Rigidity** - does anything flex, wiggle, or shift that shouldn't?
2. **Alignment** - are arms, motor mounts, and standoffs square/perpendicular?
3. **Fastener integrity** - all present, correctly torqued, thread locker where needed?
4. **Wire routing** - clear of prop arc, not pinched, no exposed conductors?
5. **Structural integrity** - any cracks, delamination, or stripped holes?
6. **Symmetry** - does the frame match intended geometry (measure diagonals if X/H frame)?

Example Measurement Aspects – Work Organization and Management

Aspect	WSOS section as per the TS	
Work Organization and Management	1	**Compliance with the rules of work – assessed at each module** The following are noted as individual violations. **General** • Failed to meet timing • Violation of Competition Rules • Misuse of Equipment **Battery Charging and Storage** • Charging batteries unattended - especially LiPo, which can go into thermal runaway • Charging on flammable surfaces (wood desk, carpet, fabric) • No fireproof charging bag/box or fireproof container used for LiPo charging • Charging a damaged, swollen, or punctured battery • Charging at the wrong voltage/current setting for the battery's rating • Leaving batteries on charge overnight or beyond full charge without auto-cutoff • Storing batteries at full charge for extended periods (LiPo should be stored around storage voltage, typically ~3.8V/cell) • Storing swollen, punctured, or otherwise damaged batteries instead of disposing of them • Batteries stored loose in bags with metal objects (keys, tools) - short-circuit risk • Not using a fireproof storage container/bag for LiPo batteries

		Required PPE not in use • Safety Glasses and Gloves as Required **Soldering and Electrical Equipment** • Electrical Equipment not unplugged when not in use • Soldering without local fume extraction • Soldering iron left on and unattended • Iron stored tip-up or tip touching flammable material • Soldering near LiPo batteries or other flammable components without separation **Workbench Organization** • Cluttered bench - tools, wires, and components creating trip/fire hazards • No designated "hot zone" separating the iron from other materials • Solder wire, flux, and tools not stored properly between uses • Sharp tools (wire cutters, blades) left exposed or unsecured • No anti-static mat when handling ESD-sensitive components (not injury risk, but equipment risk) **Basic Flight Safety** ***Before Powering On*** • Props off during setup - never work on wiring, binding, or config with props attached • Prop guards installed • Battery check - no puffing, swelling, or damage; fully charged and secured (won't shift in flight) • Loose items cleared - no dangling straps, hair, scarves, or loose clothing near the flight area • Spin test on the ground first - arm motors briefly without lifting off to confirm all 4 spin correctly and nothing rattles loose

		Space Setup • Clear flight zone - no fragile items, glass, electronics, or breakables in the flight path • People at a safe distance - bystanders behind you or off to the side, never in the direct flight line ***After Flight*** • Props off before handling - even if you think it's powered down • Battery removed and stored properly - LiPo bags or fireproof containers, away from flammable materials **Method 1st Warnings No marks deducted.** • • When a warning / yellow card is given. The Competitor must be informed of what the violation was for. • • If a competitor makes a different H&S violation, then there is a new warning given. And again, they must be informed what the violation was. • • Mark deducted only if they repeat an H&S violation for which they have already been warned for.
1	Competitor work area left clean at end of task	Competitor must return any modules area to it original state after use.

Example Measurement Aspects: UAS Assembly

Aspect	WSOS section as per TD	Descriptor
Assembly	3	Propeller installation – correct pitch/direction, balanced, secured (check colours on motors, watch spin test)
Assembly	3	Landing gear is attached securely, aligned and flat.
Assembly	3	Battery Straps are installed and functional
Configuration and Calibration	3	Verify version 4.6.3 or 4.7
Configuration and Calibration	3	Channel mapping correct (Throttle, Aileron, Elevator, Rudder) – Verify during evaluation flight
Configuration and Calibration	3	Failsafe configured correctly (Land) – Verify in parameter file
Configuration and Calibration	3	PID tuning values set within specified range – compare via sample autotuned parameter file
Safety and Professional Practice	3	Pre-flight safety checks completed before arming – check items on provided checklist

Example Measurement Aspects: Autonomous Programming and Flight Planning.

Aspect	WSOS section as per TD	Descriptor
Mission Requirements and Planning	2	Mission objective/task clearly identified and understood before building the mission – shown by completing the planning form
Mission Requirements and Planning	2	Constraints considered up front (area boundaries, no-fly zones, altitude limits, time/battery budget)– shown by completing the planning form
Mission Command and Behaviours logic	6	All will be check by replaying the simulated mission
Parameters and Safety Configuration	6	All will be check by replaying the simulated mission
Documentation and Explanation	1	Mission design choices (commands, parameters, path) are clearly explained and justified – shown on the planning form
Safety and Professional Practice	3	Pre-flight safety checks completed before arming – check items on provided checklist

Example Measurement Aspects: Drone Diagnostics and Repair

Aspect	WSOS section as per TD	Descriptor
Problem Identification & Diagnostic Process	3	A systematic diagnostic approach is used (isolating variables), not random parts-swapping – competitor will follow the troubleshooting guide and checklist.
Repair Execution	3	Functionality X – replace damaged part number 1
Repair Execution	3	Functionality X – replace damaged part number 2
Repair Execution	3	Functionality X – replace damaged part number 2
Repair Execution	3	Align and Level Frame after replacement
Verification & Testing After Repair	3	Use supplied computer and Mission Planner to bench test
Documentation & Communication	2	Complete Repair Log with explanation of the process