worldskills

Technical Description

Unmanned Aerial Systems

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Unmanned Aerial Systems (UAS)

1.1.2 Description of the associated work role(s) or occupation(s)

Unmanned Aerial Systems (UASs) are emerging into prominence in multifaceted environments and applications, including military, societal, agricultural, and environmental purposes, disaster recovery, infrastructure assessment, and wildlife monitoring. Their industrial applications are growing rapidly.

Within design and development frameworks and applications led by engineers, the UAS Technician builds, installs, tests, and maintains robot equipment. For this they may use a combination of mechanical, electronic, and computer engineering knowledge and skills. In detail, the UAS Technician

- performs troubleshooting and maintenance tasks on unmanned aerial vehicles. They test different electronic components, circuits, and boards used in a UAS to find faulty parts by using various instruments and equipment. They replace faulty boards and components and perform essential surface mounted device (SMD) and de-soldering. They disassemble and assemble different parts of the system for testing and repair.
- works with the different batteries used for the systems' power supplies, with different specifications, and with the different sensors used in various applications. They test
  - different motors, such as Brushless Direct Current (BLDC) motors, Electronic Speed Controller cards, and their connectivity with the motors
  - the flight controller, transmitter and receiver communication, and calibration
  - landing gear, GPS Modules and other sensors.
  - the transmitter, the control box to a receiver of the UAS, and the communication link.
  - all device controllers and their programming.
- works on the system's internal software by installing and updating firmware and software packages and completing custom programming of systems
- is responsible for decision-making, path planning, and executing piloted and autonomous flight tasks.

The individual in this job identifies different applications and occupations in agriculture, mapping, surveillance, photography and videography, firefighting and emergency operations, various inspection tasks, surveying and construction, public safety and security. However, a UAS can be used in many more fields and emerging applications.

In summary, the UAS Technician has tremendous potential to work within a range of business models that will create many career opportunities for development and progression.

1.1.3 Number of Competitors per team

Unmanned Aerial Systems (UAS) is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The competitors must not be older than 22 years in the year of the competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods, and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, to the extent that it can. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills and capabilities that are set out in the WorldSkills Occupational Standards. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**8**
	The individual needs to know and understand: • How to maintain a healthy, safe and secure working environment • How to perform assigned work within timelines and with defined quality • Techniques of work planning and scheduling to support efficiency and meet customer deadlines/productivity targets • The stages of a quality assurance process • Principles and practices of team working • Reporting methods using each organisation's standards and methods • Effective waste management/recycling practices	

Section		Relative importance (%)
	• The importance of personal protective equipment (PPE) for tasks and work environments • Importance of work ethics and workplace etiquette • The importance of maintaining one's own professional development.	
	The individual shall be able to: • Give and take feedback and support • Conduct organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials • Prioritize, re-prioritize, and plan work to achieve goals and targets • Process information and identify solutions to problems and challenges effectively • Lead fire safety practices • Identify, select, and apply different types of UASs, UAS rules and regulations, drone applications, and essential safety precautions • Explain to team members the importance of following safety procedures • Explain to team members the importance of quality standards • Keep up to date with trends and developments in the industry • Apply support and servicing workflows and Standard Operating Procedures.	
2	**Communication and interpersonal skills**	**8**
	The individual needs to know and understand: • The principles and requirements underpinning flight plans, including checks for any sign of potential flight hazards and coordinating airspace • The various types of UASs and their respective applications • How to collect information about clients' requirements and issues • The range and purposes of electronic documentation and publications • The technical language associated with the occupation and its associated technology • The range and methods of communication including body language • The required standards for communicating with clients, team members and others.	
	The individual shall be able to: • Exchange information, instructions, and advice with colleagues, and seek clarifications and feedback as necessary • Read, interpret, and extract technical data and instructions from documentation in any available format • Communicate by oral and written means to ensure clarity, effectiveness and efficiency	

Section		Relative importance (%)
	• Use a standard range of communication technologies • Conduct pre-mission planning meetings with clients • Create, contribute to, and maintain knowledge base content and training materials • Update and organise design documentation such as schematics, wiring • diagrams, and bills of material.	
3	**Assemble/Repair, and maintain an unmanned aerial system (UAS/RPAS)**	**12**
	The individual needs to know and understand: • The use of various electronic components such as resistors, capacitors, coils, diodes, transistors, and integrated circuits (IC) • The fundamental concept of a UAS • The functions of various drone components including: fan, propeller, electric motor, camera, and GPS • The range of tools and equipment required for the repair and maintenance of a drone • The range of replaceable parts based on Standard Operating Procedures • Principles and methods for analysing and responding to clients' feedback and complaints • Recommended practices for starting and shutting down drones safely • The range of diagnostic tests for hardware and software systems, their applications, strengths, and limitations • The basic principles governing Alternating Current (AC), Direct Current (DC) and electronic circuits • How to avoid damage to components due to negligence in electrostatic discharge (ESD) procedures.	
	The individual shall be able to: • Select relevant troubleshooting instruction sheets, tools, equipment and verified fields • Perform preliminary check-up of UASs • Identify electronic components that are malfunctioning and need to be repaired/replaced • Review standard work practices to disassemble defective components • Inspect functional components of drones thoroughly by connecting to an external power source, and using multimeters • Repair defective components as per company-specified maintenance guidelines • Install repaired/fresh electronic components using appropriate tools and components • Complete post-maintenance tests	

Section		Relative importance (%)
	• Prepare maintenance reports using the required systems and methods.	
4	**Setup, program, and operate the UAS**	**12**
	The individual needs to know and understand: • How to perform diagnostic tests on hardware and software systems • Different types of law and regulations regarding UAS technology and Rules • Airspace Structure for UAS technology • Basic principles of flight • Air Traffic Control (ATC) procedures & Radio Telephony (non-FRTOL)/ ATC procedures • Different types of UAS systems • Weather and meteorology for UAS technology • Risk assessment and analysis, including safety management/ emergency procedures.	
	The individual shall be able to: • Assess the UAS is working effectively by undertaking checks • Assemble/Disassemble the UAS components as per industry practice • Assemble complex sensor systems through mechanical assembly, soldering circuit boards, and building complex wiring harnesses • Demonstrate the functionality of the UAS to ensure customer satisfaction • Perform hands-on mechanical and electrical integration of new hardware components • Upgrade the UAS's internal software by installing and updating firmware and software packages.	
5	**Manual flight demonstration and emergency procedures**	**16**
	The individual needs to know and understand: • How to collect information about the clients' requirements and challenges • How to design customised UAS and payload solutions according to needs • How to troubleshoot in case of crashes using flight data and other sources of data • How to use simulation techniques to understand design limitations and take corrective measures • The emergency procedures that apply to the Remote Pilot Aerial Systems (RPAS)/UAS	

Section		Relative importance (%)
	• The procedure for reporting a flyaway drone or loss of command and control.	
	The individual shall be able to: • Perform preliminary checks of UASs • Perform preflight checks as per common Standard Operating Procedures • Demonstrate drones to ensure their proper functioning • Modify drones' designs to add cameras and other devices • Configure radio controls for use with new devices • Perform simple and standard flying exercises • Perform abnormal/emergency procedures • Complete emergency procedures checklists • Perform practical forced landings • Pilot drones to fulfil the goals of each mission • Select and use relevant troubleshooting-instruction sheets, tools, equipment and verified fields.	
6	**Autonomous flight planning and demonstration**	**20**
	The individual needs to know and understand: • The individual needs to know and understand: • How to collect information about the customer's requirements, challenges, and issues • How to conduct pre-mission planning meetings with clients • How to develop flight plans, including checking for any signs of potential flight hazards and coordinating airspace • The basis for selecting and using relevant troubleshooting-instruction sheet, tools, equipment and verification • Basic programming knowledge • Basic software development tasks and sensor integration • Data capture and processing techniques • The operation of an autopilot system in relation to: ◦ software and hardware that process sensor data ◦ the execution of flight plans, and ◦ the basis for making autonomous decisions.	
	The individual shall be able to: • Use autopilot systems that allow UASs to operate without constant human control • Create computer programs that allow UASs to run sophisticated algorithms and process large amounts of data in real time • Perform preliminary check-up of the UASs • Plan and execute flight test plans for new software features, electronics, sensors, and payloads • Use industry-standard software to write program for autonomous flight	

Section		Relative importance (%)
7	**UAS Advanced Piloting and Embedded Vision**	**24**
	The individual needs to know and understand: • A foundational understanding of photography and camera systems • Utilization of software tools to create basic imagery products • GPS module and positioning data • Additional sensors beyond the basic ones found in non-autonomous drones, such as obstacle avoidance sensors (such as ultrasonic or Light Detection and ranging LiDAR sensors) ◦ optical sensors for visual recognition and mapping, and ◦ other specialized sensors, depending on each UAS's intended application.	
	The individual shall be able to: • Perform preliminary check-ups of UASs • Integrate advanced sensor systems such as Light Detection and Ranging (LiDAR) and 3D Sensing Cameras • Collect photography, videography and LiDAR data • Implement filters (including histogram, Kalman, and particle filters) to localize moving objects whose locations are subject to noise • Implement Proportional integration Derivative (PID) controls to correct autonomous flights smoothly • Implement Simultaneous Localisation and Mapping (SLAM) algorithms for flight navigation • Assist in the development of simulation experiences for real-world scenarios • Develop 3D models using LiDAR data • Use software to process and analyse geographical or photo/video data collected during drone operations • Perform Infrared Thermography inspections to identify temperature anomalies in industrial equipment and infrastructure • Utilize drones for external asset inspections, including flare stacks, tanks, and bridges.	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: Measurement and Judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 The Marking Scheme

4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more Independent Test Project Designer(s) with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Competition Rules for further details.

Experts and Independent Test Project Designers are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). **The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment**

methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by Measurement or Judgement, or both Measurement and Judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by Measurement or by Judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

		CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
STANDARDS SPECIFICATION SECTION		A	B	C	D	E	F	G	H			
	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by Judgement, Measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using Judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, Judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts, or separate guidance notes). This is documented in the Standards and Assessment Guide.
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

4.7 Assessment and marking using Measurement

Normally three Experts will be used to assess each Aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of Measurement and Judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 Skill assessment strategy and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

Performance/Quality

The quality and results of the performance task are evaluated according to the accuracy, efficiency, reliability, and repeatability.

Time to complete

Time taken can be a factor when two Competitors both successfully complete a task. Competitor taking less time can be deemed more efficient and marked accordingly.

5 The Test Project

5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects and Marking Schemes are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Designer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a series of 6 standalone modules.

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

The Test Project enables the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS. The sections of the WSOS will be used to develop several modules to be tested throughout the competition.

To provide context to the modules, the Test Project is associated with a real-world application scenario that will be referenced throughout the competition.

Module 1: Assembling the UAS and Manual Flight Test – building and testing a quadcopter UAS using the provided kit

Module 2: Drone Diagnostics and Repair – solve industry-based problems and prove competency in troubleshooting and recommending corrective repairs

Module 3: Autonomous Programming and Flight Planning – complete the planning and execution of all aspects of a flight and provide documentation showing calculations and decision-making strategies.

Module 4: Advanced Piloting and Vision Skills – incorporate advanced sensor systems and use vision technology

Module 5: Drone Prototyping, Modelling and Mounting – design and manufacture a drone replacement part, part enhancement or a new add-on for use in one of the other modules

Module 6: Operational Challenges – showcase UAS skills with actual flight scenarios based on real-world applications

5.4 Test Project coordination and development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules will be undertaken by the Skill Competition Manager.

5.4.2 Who develops the Test Project/modules

The Test Project/modules are developed by an Independent Test Project Designer (ITPD) in collaboration with the Skill Competition Manager.

5.4.3 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Action
Six (6) months prior to the Competition	Competition Information Document (CID) is circulated on the WorldSkills website without any technical or detailed information.
No later than 3 months prior to the Competition	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C-4	The Test Project/modules are presented to the Experts.
At the Competition on C-2	The Test/Project modules are presented to the Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations.

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer (ITPD) is expected to identify one or more independent

expert(s), and trusted individuals initially to review the Independent Test Project Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project circulation

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts on C-4 and to Competitors on C-2.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and according to infrastructure limitations.

5.9 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

All Competitors will be provided with a competition UAS kit on Familiarization Day.

The manufacturer/sponsor will support sufficient spare parts during the competition but will NOT be responsible for servicing the UAS in case of malfunction or breakdown. This is the Competitors responsibility.

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the WorldSkills skill-specific Discussion Forum. (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the WorldSkills Discussion Forum. The Chief Expert (or an Expert Lead appointed by the Skill Management Team) will be the moderator for this Discussion Forum. Refer to the Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Equipment failure	• The Sponsor will provide replacement parts for items contained in the provided UAS kit that fail during the competition. • Competitors are responsible for the failure of all components they introduce/provide to supplement the originally provided UAS kit.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

Refer to WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

Task	Safety glasses with side protection	Cut protection gloves (without breakage)	Sturdy shoes with closed toe and heel	Hearing protection	Dust mask
General PPE for safe areas			√		
Drilling	√	√ (optional for material removal only)	√	√	
Grinding	√	√ (optional for material removal only)	√	√	√
General work at workstation			√		
Flying UAS	√		√		

8 Materials and equipment

8.1 Infrastructure List

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition for the upcoming WorldSkills Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 Competitors toolbox

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for Competitors to bring materials, equipment, and tools to the Competition.

However, Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Experts are responsible that Interpreters bring their PPE.

8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout

As this is a new skill competition there is no example workshop layout from previous Competitions.

The workshop area is estimated at 32m x 18m for 10-12 Competitors.

9 Skill-specific rules

9.1 General notes

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

9.2 Skill-specific rules

Topic/task	skill-specific rule
Use of technology – USB, memory sticks	• The Test Project will indicate if competitors are allowed to bring USB memory stick(s) per Competitor into the workshop on the Familiarization Day. During competition days, the USB memory devices cannot leave the competition floor and must be kept in a closed envelope with the Workshop Manager to be used only in exceptional cases to recover a critical state. It can be removed from the workshop at the end of the competition on C4 only. • Experts, and Interpreters are not allowed to bring USB memory devices into the workshop. • The Skill Competition Manager and Chief Expert can bring USB memory devices for competition organization purposes only. They can be removed from the workshop at the end of the competition on C4 only.
Use of technology – personal laptops, tablets, and mobile phones	• Competitors are not allowed to bring any laptop or tablets into the workstation. • Competitors can only use allocated laptops by organization during test runs. • The number of laptops allowed per Competitor will match the Test Project (TP) and the specific task. • Experts are not allowed to bring laptops or tablets into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at the end of the day. The Skill Competition Manager and Chief Expert are exempt from this rule. • Interpreters are allowed to use laptops or tablets during translation of textual information only. • Competitors are not allowed to bring mobile phones into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at lunch time and at the end of the day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring mobile phones into the workshop and they can remain in their pocket, but shouldn't be used in public except for emergencies.

Topic/task	skill-specific rule
Use of technology – personal photo and video taking devices	• Competitors are not allowed to bring any laptop or tablets into the workstation. • Competitors can only use allocated laptops by organization during test runs. • The number of laptops allowed per Competitor will match the Test Project (TP) and the specific task. • Experts are not allowed to bring laptops or tablets into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at the end of the day. The Skill Competition Manager and Chief Expert are exempt from this rule. • Interpreters are allowed to use laptops or tablets during translation of textual information only. • Competitors are not allowed to bring mobile phones into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at lunch time and at the end of the day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring mobile phones into the workshop and they can remain in their pocket, but shouldn't be used in public except for emergencies.
Drawings, recording information	• Competitors are not allowed to bring any laptop or tablets into the workstation. • Competitors can only use allocated laptops by organization during test runs. • The number of laptops allowed per Competitor will match the Test Project (TP) and the specific task. • Experts are not allowed to bring laptops or tablets into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at the end of the day. The Skill Competition Manager and Chief Expert are exempt from this rule. • Interpreters are allowed to use laptops or tablets during translation of textual information only. • Competitors are not allowed to bring mobile phones into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at lunch time and at the end of the day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring mobile phones into the workshop and they can remain in their pocket, but shouldn't be used in public except for emergencies.
Templates, aids, etc.	• Competitors are not allowed to bring any laptop or tablets into the workstation. • Competitors can only use allocated laptops by organization during test runs. • The number of laptops allowed per Competitor will match the Test Project (TP) and the specific task. • Experts are not allowed to bring laptops or tablets into the workshop. If these items are brought, they must be locked in the personal locker

Topic/task	skill-specific rule
	and can only be removed at the end of the day. The Skill Competition Manager and Chief Expert are exempt from this rule. • Interpreters are allowed to use laptops or tablets during translation of textual information only. • Competitors are not allowed to bring mobile phones into the workshop. If these items are brought, they must be locked in the personal locker and can only be removed at lunch time and at the end of the day. • Skill Competition Manager, Chief Expert, Experts, and Interpreters are allowed to bring mobile phones into the workshop and they can remain in their pocket, but shouldn't be used in public except for emergencies.

10 Visitor and media engagement

10.1 Engagement methods

Following is a list of possible ways to maximize visitor and media engagement:

A UAS makes an indelible impression, mainly due to its novelty and the stunning visual experience it offers. Audiences often marvel at the flight and capabilities. The main Test Project requires the Competitors to be inventive and original in their solutions to the tasks, engaging on their own as it will focus on current real-world issues.

Both autonomous and controlled flight sections provide an exciting spectacle. Precision piloting and piloting with cargo modules, for example, are very appealing. Visitors can also get a chance to watch the flight modules from the UAS's perspective using FPV goggles.

The spectacle is projected onto a big screen, which can be especially effective and engaging.

Visitors to the competition can participate in master class lectures and get a chance to pilot a UAS in a designated location.

The Try-A-Skill area can provide:

- a live demonstration to showcase various drone operations
- interactive displays – both through flight simulation and actual flights in a controlled environment
- Social Media Campaign involving Skills partners and how they use this technology
- a chance to pilot a UAS in a designated location.

Drones can drop promotional items or samples to attendees, participate in games, or even serve as floating photo booths. By incorporating these interactive elements, we are not just entertaining visitors but we are giving them a unique opportunity to interact with technology in a fun and memorable way. This level of engagement can significantly enhance the overall event experience and leave a lasting impression.

11 Sustainability

11.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

This skill competition will challenge the participant to make careful use of resources. It will limit the amount of on-site equipment while reducing the waste competitors produce.

All equipment to be used will be sourced from the local industry to reduce the shipping footprints and the required packaging. Competitors will be provided with all resources and will not be required to travel with toolboxes or equipment.

Many of the UAS designs and components will use recyclable materials for components, and proper recycling and the avoidance of single-use components will be emphasized to keep waste and materials to a minimum.

The equipment designed and implemented by the Competitors will be donated to local organizations to support the chosen operational challenges used in the Test Project.

For the repair/maintenance section, Competitors will follow the principle of eco-design by considering factors such as the amount of energy and materials consumed in production or how the product and its manufacturing byproducts may affect biodiversity. To minimize their impact, Competitors will be assessed on investigating alternative processes, systems, and materials. The focus will be on:

1. Reuse – make use of scrap materials; fix/upgrade old equipment rather than purchasing new.
2. Recycle – use products and materials made from recycled materials; recycle metals, paper, and plastics; avoid hazardous substances; and opt for nontoxic products.

This also involves the reclamation of used, durable materials, such as steel shafts, bearings, and other products that can be reused.

12 References for industry consultation

12.1 General notes

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

12.2 References

This WSOS is classified within ISCO-08 Unit Group 3119: 3119: Physical and Engineering Science Technicians Not Elsewhere Classified. P.174

In greater detail, as an interdisciplinary occupation it most closely relates to O*NET 49-2094: Electrical and Electronic Repairers, Commercial and Industrial Equipment. https://www.onetonline.org/link/summary/49-2094.00 and 17-3024.01: Robotics Technicians https://www.onetonline.org/link/summary/17-3024.01,

It also relates to ESCO 3119.2.1: Robotics Engineering Technician: https://data.europa.eu/esco/occupation/7833d5cd-873d-4fdd-b2f8-9762d68494a7

These links also enable adjacent occupations to be explored.

There were no responses to the requests for feedback this cycle.

13 Appendix

13.1 Appendix information