WorldSkills Asia Online Skills 2022

(MOBILE ROBOTICS)

TECHNICAL DESCRIPTION

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Version: 1.0

1 Introduction

1.1 NAME AND DESCRIPTION OF THE SKILL COMPETITION

1.1.1 The Name of the skill competition is

Mobile Robotics

1.1.2 Description of the associated work role(s) or occupations(s).

Mobile Robotics is a fast evolving, solutions orientated, industry within which the robotics/technologist is a significant and growing work role. Mobile robotics is an important part of the future, with applications in everyday life, diverse industries, including autonomous vehicles, manufacturing, agriculture, aerospace, mining, and medicine.

A robotics technologist works in offices, manufacturing plants or laboratories; he or she designs, maintains, develops new applications, and conducts research to expand the potential for robots. The role begins with a strong focus on a specific business problem, in a particular sector. For example, in manufacturing there may be a need to increase capacity by creating robots for tasks that can be automated. Mobile robots may also be designed to explore areas that are inaccessible or dangerous for human beings.

Careful, deep client consultation is required, resulting in an accurate specification. The design phase follows, and a prototype is assembled. The robot is then programmed and tested to ensure high, consistent performance. At the heart of every robot is a robotics technologist who thinks about what a robot needs to do and works with several disciplines to design and put together the optimal piece of equipment, demonstrating a commitment to attention to detail. In this instance the robotics technologist uses existing technologies to create solutions to new challenges.

Robotics technologists must be familiar with logic, microprocessors, computer programming, mechanical, electrical, and control system so that they can design and prototype the right robot for each application. They must also prepare specifications for the robot's capabilities as they relate to the everyday life. In addition, robotics technologists are responsible for cost efficient design, cost-price calculations, and quality-control.

Integral to the role of the high performing robotics technologist are a range of skills related to work organization and self-management. Excellent communication and interpersonal skills, with a particular strength in working well in a team, are equally important. An ability to be innovative and creative in resolving technological challenges and generating solutions is also essential.

Working across sectors internationally and being able to transfer analytical skills is a feature of the excellent robotics technologist, together with a commitment to continuing specialist, and professional development and a determination to resolve problems through experimenting and risk taking within self-managed boundaries. In an increasingly global industry, which is 'breaking new ground' and altering the way we live and work, there are significant opportunities for sustainable careers in robotics. The opportunities carry with them the need to work with diverse cultures, industries and fast paced technological change. The diversity of skills associated with robotics technologists is likely to expand.
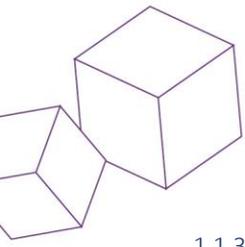
1.1.3 Number of Competitors per team

Mobile Robotics is a team skill competition with two Competitors per team.

1.1.4 Age limit of Competitors

The Competitors must not be older than 25 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.
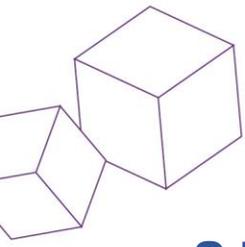
2 The WorldSkills Occupational Standards (WSOS)

2.1 GENERAL NOTES ON THE WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It 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, and to the extent that it is able to. 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 that are set out in the Standards Specification. 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, provided that this does not distort the weightings assigned by the Standards.

There is some adjustment to the WSOS for the online competition format.

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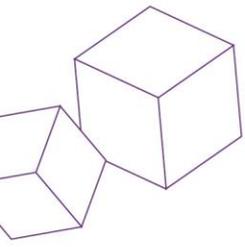
2.2 WORLDSKILLS OCCUPATIONAL STANDARDS

| Section	Relative importance (%)
1 Communication and Design (Technical Journal)	10

The individual needs to know and understand:

- The range and purposes of documentation and publications in electronic forms
- The technical language associated with the skill and technology
- The standards required for routine and exception reporting in oral and electronic form
- The required standards for communicating with clients, team members and others
- The purposes and techniques for maintaining and presenting records, including financial records
- The principles and applications of project design
- The nature and formats of project specifications
- The bases on which the manufactured item will be appraised
- Design parameters including the following:
- Options appraisal
    - Selection of components, materials, and work processes
    - Prototype development
    - Manufacture
    - Assembly
    - Refinement
    - Commissioning

- Principles and applications for:
    - Designing, assembling, and commissioning mobile robotics systems
    - The components and functions of electrical and electronic systems
    - The components and applications of add-ons
    - The components and applications of mobile robotics systems
- Principles and applications of design and assembly of mechanical, electrical, and electronic systems, their standards, and their documentation
- Principles and methods for work organization, control, and management in relation to the product
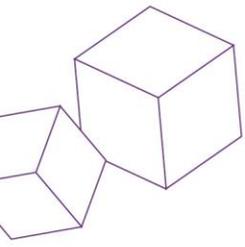
The individual shall be able to:

- Read, interpret, and extract technical data and instructions from documentation in any available format
- Use research for problem solving and continuing professional development
- Communicate by oral, written, and electronic means to ensure clarity, effectiveness, and efficiency
- Use a standard range of communication technologies
- Discuss complex technical principles and applications with others
- Explain complex technical principles and applications to non-Experts
- Complete reports and respond to issues and questions arising
- Respond to clients' needs face to face and indirectly
- Arrange to gather information and prepare documentation as required by the client
- Complete reports and respond to issues and questions arising
- Analyse the briefs or specifications to identify the required performance characteristics of mobile robots
- Identify and resolve areas of uncertainty within the briefs or specifications
- Identify the characteristics of the environment in which the mobile robots are required to operate
- Identify hardware requirements to support the mobile robots' performance
- Generate designs for the manufacture of a functioning item within given timescales
- Generate designs for tele-operation control systems independent of the base unit
- Develop strategies to solve mobile robotics tasks including navigation and orientation
- Generate innovative solutions to design challenges
- Identify and appraise options for selection, purchase and manufacture of materials, components, and equipment
- Record decisions on the basis of business principles and other essential factors such as health and safety
- Prepare documentation for work management and control
- Complete the design stage within given limits of purpose, cost, and time
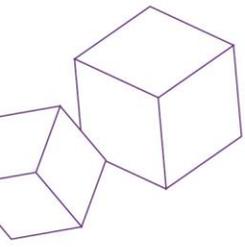
Section	Relative importance (%)
2 Robot Inspection (Design, Fabrication and Assembly)	**8**

The individual needs to know and understand:

- Basic principles of mechanical, electrical and electronics technician/engineering
- Principles of fabrication and assembly
- Principles and practices of safe manufacture and operation

The individual shall be able to:

- Fabricate frame parts of mobile robots
- Integrate the structural and mechanical parts of mobile robots
- Integrate the electronic control circuits
- Install, set up and make all necessary physical and software related adjustments required for effective use
- Install, set up and make all necessary adjustments to mechanical, electrical and sensor systems
- Install, set up and make all necessary adjustments required for effective tele-operation of mobile robots
- Integrate sensors to gain control of the required tasks
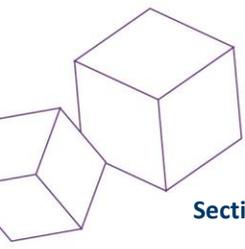
Section	Relative importance (%)
3 Core Robot and Object Management System Evaluation	**10**

The individual needs to know and understand:

- **Manufacturers' control software**
- **How to program using standard industrial software**
- **How a software program relates to the action of machinery and systems**
- **Principles and applications of wireless communications**
- **Robot navigation by orientation and mapping**
- **Sensor integration**
- **Analytical techniques for fault finding**
- **Techniques and options for making adjustments and repairs**
- **Strategies for problem solving**
- **Principles and techniques for generating creative and innovative solutions**

The individual shall be able to:

- **Visualize the process and operation using software**
- **Use the manufacturer provided control software to assert effective autonomous control over the manufacturer provided object management systems**
- **Use industrial standard programming software to assert effective autonomous control over the robot's movement**
- **Use tele-operation to assert effective control over systems**
- **Implement programming methodologies to the control systems**
- **Assert robot movement by implementing orientation and mapping capabilities**
- **Implement a navigation strategy**
- **Install and make physical settings adjustments to sensors**
- **Install cameras on the robot and make appropriate adjustments**
- **Test run individual applications and full functionality**
- **Find and document faults using appropriate analytical techniques**
- **Demonstrate basic IT knowledge**
- **Repair or change components efficiently**
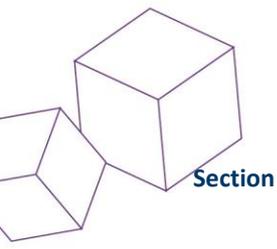
Section	Relative importance (%)
3 Performance Review and Commissioning	72

The individual needs to know and understand:

- Criteria and methods for testing equipment and systems
- Criteria and methods for operating test runs
- The scope and limits of the technologies and methods used
- Strategies for thinking creatively and generating innovation
- The possibilities and options for making incremental and/or radical changes
- How to program using standard industrial software
- How software programs relate to the action of machinery and systems
- Principles and applications of wireless communications
- Robot navigation by orientation and mapping
- Analytical techniques for fault finding
- Techniques and options for making adjustments and repairs
- Strategies for problem solving
- Principles and techniques for generating creative and innovative solutions

The individual shall be able to:

- Test mobile robots' overall performance against agreed operating criteria
- Optimize the operation of each part of systems, and the systems as a whole, through analysis, problem solving and refinement
- Visualize a process and operation using software
- Use industrial standard programming software to assert effective autonomous control over robots' movement and object management systems
- Use tele-operation to assert effective control over systems
- Implement programming methodologies to the control systems
- Assert robot movement by implementing orientation and mapping capabilities
- Implement navigation strategies
- Install and make physical settings adjustments to sensors and cameras
- Find and document faults using appropriate analytical techniques
- Demonstrate basic IT knowledge
- Repair or change components efficiently
- Undertake final test runs to commission systems
- Review each part of the process of design, fabrication and assembly, and operation, against established criteria, including accuracy, consistency, time, and cost
- Ensure that all aspects of a design stage meet the required industry standards
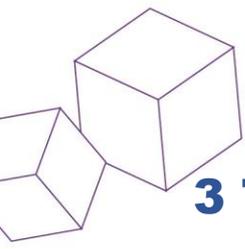
3 The Assessment Strategy and Specification

3.1 GENERAL GUIDANCE

Assessment is governed by the WorldSkills Asia 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 Asia 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 Asia 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.
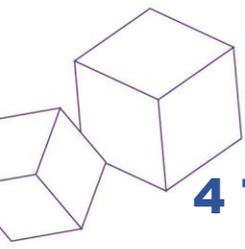
4 The Marking Scheme

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 Asia 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 people 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 Rules for further details
.
Experts and Independent Assessors 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.

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.
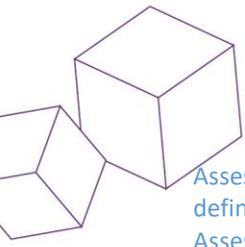
Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). *The Assessment Criteria, the allocation 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 Asia 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. (Section 4.1 refers.)

		A	B	C	D	E	F	G	H	TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
STANDARDS SPECIFICATION SECTION	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
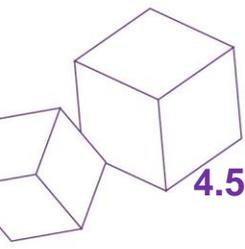
4.5 ASSESSMENT AND MARKING

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)
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.
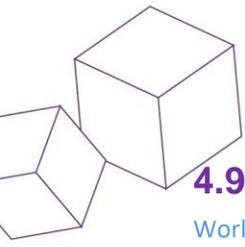
4.9 SKILL ASSESSMENT STRATEGY

WorldSkills Asia is committed to continuous improvement. This particularly applies to assessment. The SMT is expected to learn from past and alternative practice and build on the validity and quality of assessment and marking.

Detailed Evaluation Criteria are included in the final criterion descriptions provided to the Competitors at the Competition.

Competitors can expect marks will be awarded for the following type of items:

Successfully following the prescribed path;
Successfully locating the designated target object;
Successfully interacting with the target object when it has been found;
Successfully delivering the target object to a designated location;
Successfully fault finding and repairing;
Successfully using technical documents;
Successfully improving a given robot;

Time taken can be a factor in particular when two Competitors and robots both successfully complete the task. Competitors or robot taking less time can be deemed more efficient and marked accordingly.

4.10 SKILL ASSESSMENT PROCEDURES

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

Final overall standing is based on the total points scored by a team over the four WorldSkills Competition days combined.

Performance/Quality

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

Time to complete

Time taken to complete the task is one of the components used to evaluate Mobile Robot/Competitor performance.

The degree to which a Mobile Robot/Competitor is able to complete the various competition tasks taking into consideration pre-set performance efficiency standards as the core evaluation criteria.

Marking is to be entered after each section has been completed.

A sample marking scale and instructions for referees is to be included in each module.
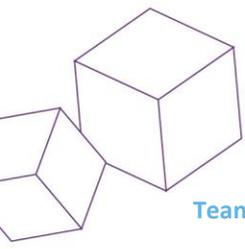
Team competition

Mobile Robotics is a team competition consisting of two Competitors from each country/region. The rules for all modules will require all Competitors to focus on maximizing their own score.

Teams may not act in a supportive partnership with an opponent.

Entering marks into the CIS

Marks are entered as soon as available.

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 Developer, 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.
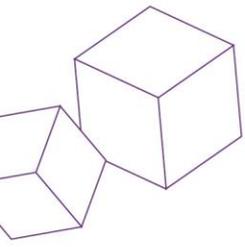
5.2 FORMAT/STRUCTURE OF THE TEST PROJECT

The Test Project is a series of Three (3) separately assessed modules. It consists of customer demanded mobile robot tasks.

The Test Project describes:

- A short introduction of the identified customer and their products and/or services;
- A detailed description of the tasks the customer wants to be solved;
- All specifications needed about environment, objects to be handled, accuracy, repeatability, efficiency, prescribed use of components where applicable, etc.;
- Criteria for assessment and the allocation of marks for each criterion;
- Specifications about the conduction and presentation of the solutions.

5.3 TEST PROJECT DESIGN REQUIREMENTS

The criteria are presented through descriptive document packages that:

- None of the test runs allow destructive robot behaviour;
- The Test Project must have at least two independent modules that should be evenly distributed;
- Define the various operational environments in which the competition robots must function;
- Define the nature of the relationship between the Competitors and their competition robot when it is performing in the Mobile Robotics Test Court;
- Define the rules of assessment and marking criteria for each aspect clearly;
- During the execution of the task the robot must preferably be autonomous.
- Any instructions to Competitors are provided through the Test Project document.

The teams of Competitors are required to assemble, maintain, repair, and operate Mobile Robots.

The Competition robots are required to complete customer defined modules explained in the Test Project document.

Competitors must generate all programmes required by their Mobile Robots.

Each session will comprise:

- Robot assembly, programming, troubleshooting, maintenance work, and robot performance.

Details defining the particular rules of the test court and marking pattern for each criterion are presented in the Test Project document.
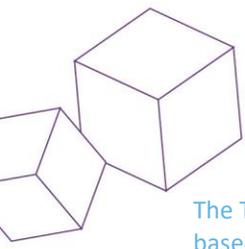
The Test Project details are developed by the Independent Test Project Designer prior to the Competition based on the following format:

- A *Competitor Pre-Competition Information Package* is developed by the Independent Test Project Designer.
- *The Competitor Pre-Competition Information Package* will provide generic descriptions defining the broad range of robot/Competitor performance capabilities that Competitors will need to execute at the Competition.

5.4 TEST PROJECT DEVELOPMENT

The Test Project MUST be submitted using the templates provided by WorldSkills Asia. Use the Word template for text documents and DWG template for drawings.

5.4.1 Who develops the Test Project or modules

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

The Mobile Robotics criteria is developed by a customer whose company will ideally be in the Host Country.

The Customer's cooperation involves:

• Contribution to the specification of the Mobile Robotic task to perform;
• A meeting during Competition Preparation Week.

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 Asia, the Independent Test Project Designer is expected to identify one or more independent, expert, and trusted individuals initially to review the 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.
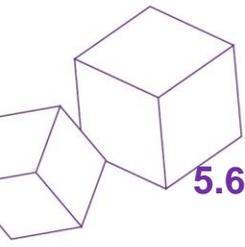
5.6 TEST PROJECT VALIDATION

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

The Skill Management Team will be responsible for ensuring that:

The guidelines for the Test Project is published prior to the Competition;
There are no criteria requirements that cannot be completed;
The Test Project criteria can be completed in the prescribed time;
Proper function is achievable;
The material/equipment list is accurate;
Hardware and software used at the competition are available to all teams prior to the Competition;
There will be no changes to the content of guideline prior to the Competition;

Competitor instructions are kept to a minimum of text, and that they do not exceed the available space permitted on the approved instruction sheet for any one module.

5.7 TEST PROJECT SELECTION

The Test Project/modules are selected by the Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.8 TEST PROJECT CIRCULATION

The Test Project is circulated via the website as follows:

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Competitors every morning of each competition day.

The *Competitor Pre-Competition Information Package* is circulated prior to the competition. No detailed information is circulated.

The Mobile Robotic criteria and Test Project descriptions will be disclosed to the Competitors at the start of the Competition.
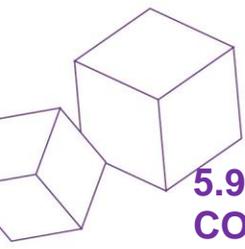
5.9 TEST PROJECT COORDINATION (PREPARATION FOR COMPETITION)

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

5.10 TEST PROJECT CHANGE

The Independent Test Project Designer shall develop changes to the Test Project as required by WorldSkills Asia. This change in the Test Project documents is presented to the Competitors prior to Compatriot Communication each competition day.

5.11 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. 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 such items may include those for fault finding modules or modules not circulated.

Sponsorship, specifications, supply, and support for the selected hardware and software are co-ordinated by the Workshop Manager and the Skill Competition Manager.

The Mobile Robotic Component Kit must provide all components needed to design and assemble a Mobile Robotic System able to run the Mobility Aspects of the Test Project robot programmes in self-contained independent mobile robotic functioning.

The supplier/sponsor makes a commitment to comply with the approved timelines.
The manufacturer/sponsor will support sufficient spare parts during competition but will NOT be responsible for servicing the robot systems in case of malfunction or breakdown. This is the Competitors responsibility.
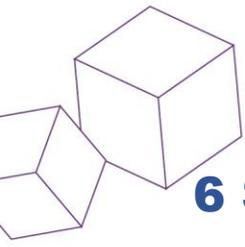
6 Skill management and communication

6.1 DISCUSSION FORUM

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (https://wsrforum.studica.com). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to 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.

This information includes:

Competition Rules
Technical Descriptions
Mark Summary Form (where applicable)
Test Projects (where applicable)
Infrastructure List
Other Competition-related information

6.3 TEST PROJECTS [AND MARKING SCHEMES]

Circulated Test Projects will be available from WorldSkills Asia.
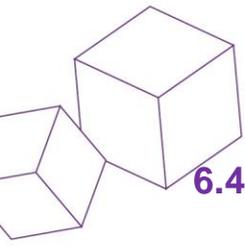
6.4 DAY-TO-DAY MANAGEMENT

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and Deputy Chief Expert. The Skill Management Plan is developed prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan will be distributed to all registered teams.

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 solution
Equipment failure contained in	Competitors are responsible for replacement parts for items that fail during the competition.
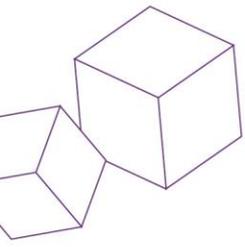
7 Competition Format

The primary goal is to create an Online Competition Experience that as much as possible mirrors a traditional WorldSkills Asia competition experience. Local time schedules will be provided in advance of the competition. These will include a Start of the day Competitor Information / Question and Answer Session / Competitor and Compatriot Expert Communication Session. The competition committee will try to adhere to the following based up

Sample Competitor Schedule Example (Competitor Group 1 – UTC +8)

NOTE: All assessment experiences are done at the same time. This is to introduce the HazMat cube locations right before the assessment. Running at the same time will prevent any advantages to a team not running at the same time.

Competitor Information / Question and Answer Session 1	8:00am – 8:15am
Competitor and Compatriot Expert Communication Session 1	8:15am – 8:30am
Local Court Time and Task Preparation/Practice Session 1	8:30am – 11:30am
Assessment Experience Window Session 1	11:30 – 11:45 am

NOTE: While this is a 15 minute window the maximum time allocated for complete test run is 10 minutes.

Upload of Test run video complete Session 1	12:30 pm
Break	12:30 pm – 1:00 pm
Competitor Information / Question and Answer Session 2	1:00 pm – 1:15 pm
Competitor and Compatriot Expert Communication Session 2	1:15 pm – 1:30 pm
Local Court Time and Task Preparation/Practice Session 2	1:30 pm – 4:30 pm
Assessment Experience Window Session 2	4:30 pm – 4:45 pm

NOTE: While this is a 15 minute window the maximum time allocated for complete test run is 10 minutes.

Upload of Test run video complete Session 2	5:30 pm

Competition Day 1 Session 1: Competitors have their robot complete Core Performance Evaluation Elements based on a completely known in advance court layout. Competitors will be provided with ONE evaluation experience for each of the Core Performance Aspects being marked.

> o Competitor Technician Journals are submitted for evaluation
> o Competitor Robots Inspection Videos are submitted and are Inspected / Evaluated

Competition Day 1 Session 2: Competitors have their robot complete Evaluated Test Project Run Experience based on a completely known in advance court layout and a set of randomly assigned variables

Competition Day 2 Session 1: Competitors have their robot complete Evaluated Test Project Run Experience based on a completely known in advance court layout and a set of randomly assigned variables

Competition Day 2 Session 2: Competitors have their robot complete Evaluated Test Project Run Experience based on a completely known in advance court layout and a set of randomly assigned variables
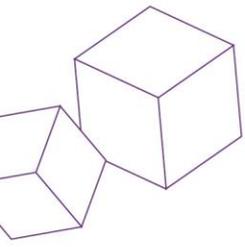
7.1 EVALUATED TEST PROJECT EXPERIENCES

Evaluated Test Project Experiences will take place between August 10th and August 11th, 2022 using scheduled streamed experiences witnessed and marked by an Assigned Team of Experts. These streamed experiences will be saved for review and uploaded to a secure Dropbox file hosting service folder to confirm marking.

o The Mobile Robotics CE and DCE will create Regional Teams of 4 Experts, based on shared time zones, who will mark an assigned set of Competitor Team's Evaluated Test Project Experiences

o Each Team's Own Compatriot Expert will manage their actual Onsite Evaluated Test Project Experiences.

o Compatriot Experts will have NO Role in the Evaluation (CIS) Process

o Compatriot Experts will:

- Ensure a Performance Court and all required Test Project Elements are available, and are in competition appropriate condition
- Ensure their Competitors and their Robot are available at their assigned Evaluated Test Project Experience Time

7.1.1 Competitor monitoring and evaluation

Competitor monitoring and evaluation will involve the use **o**f an Online platform (ZOOM) for competitor monitoring and assessment

- Evaluated Test Project Experiences viewing, and monitoring will be setup as 'Zoom Meetings' hosted by the Compatriot Expert with the Evaluation Panel of Four Experts participating as 'Invited Meeting Participants'.

- Note: Both the court, and the competitor's workstation area MUST ALL remain IN the camera or camera's field of views while the competitors are working and preparing for a schedules assessment run.

7.1.2 Robot Inspection Video

Robot Inspection Videos are submitted by a team on Day 1, the video should clearly allow the experts marking the ability to assess the following robot features.

Robot is presented at inspection with all mechanisms (including all components of each mechanism), configurations, and add-ons that will be used on the Robot during the competition.

Using a measuring device show the Robot in all its unique starting (pre-match setup) configurations. The Robot must fit within the 600mm x 600mm x 600mm requirement.
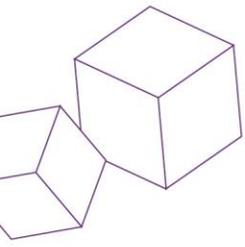
Electrical Wiring:

Wiring installation meets Industry Standards for secure / safe installation Examination of the Robot's Wiring (secure wire placement, efficient wire organization, quality of connections, protection from Abrasion, inclusion of appropriate fusing and master safety switch)

Show that:

- The Main Power Switch and Estop are installed properly, labeled, readily accessible, and visible to competition personnel.
- All batteries of the correct type, are securely attached to the Robot and are properly connected
- Show all fuses, fuses must not be replaced with fuses of higher rating than originally installed
- Allowed electronic devices are powered by power ports on the Titan Controller/ ADC and Servo Power Module.
- Robot contains no more than eight (8) DC motors of the allowed models.
- Show that the wiring connections are of good quality, there is protection from abrasion, wires are routed correctly and are not tangled and are easy to follow. Wire marking should be clear and evident.
- Show and verify that power, motor control, servo and sensor wires are the correct size.
- Robot contains only allowed sensors

Robot Base:

Frame Assembly meets Industry Standards for fit and alignment of components Examination of the Robot Frame's Structural Integrity (fit between connected components, accuracy of component alignment angles, sizes etc.)

Show that:

- All components on the Robot are from allowable raw materials and supplied channel
- Show the structural Integrity of the Robot Base
- Verify all views of the robot, show proper fixing of all elements, accuracy of component alignment

Object Management System:

Object Management System meets Industry Standards for fit and alignment of components Examination of the Object Management System's Structural Integrity (fit between connected components, accuracy of component alignment angles, sizes etc.)

Show that:

- All components on the Robot are from allowable raw materials and supplied channel
- Show the structural Integrity of the OMS and its relationship to the Robot Base
- Verify all views of the robot, show proper fixing of all elements, accuracy of component alignment
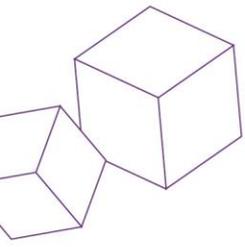
7.1.3 Recording Evaluated Test Project Experiences

The Compatriot Expert will also provide a volunteer dedicated to the task of filming the Evaluated Test Project Experiences separately to ensure that all assessment requirements are clearly seen. One camera is permissible if it can view the whole field as well as move around the field via the SCM instructions. Otherwise, additional cameras are needed to accomplish these tasks.

The filming must be staged to ensure the following Once Teams download their code to the robot:

The Robot must be on the court, in its' starting position with the only remaining Competitor action required being to press the Robot's Start Button or initializing the start of the robot via shuffleboard/ gamepad control.

- A second clock showing the current date / time must be on video during the entire test run.
- Test runs should follow a standard procedure, done and shown on one video without any "cuts" or edits, in the following order:

  - The Team shows on video a closeup view of the Starting space to provide video evidence that the Robot is in a legal starting position.
  - The Team says out loud and writes on paper or whiteboard if they are attempting a task.
  - The Team starts a run when Robot is started, and the clock begins.
  - After the run (either the Robot has successfully completed the entire Evaluated Test Project Experience or the Maximum Allowed Time Limit of 10 Minutes has expired), the Team must move the camera to show that the robot has returned to the end space and then show each of the client targets the robot will send a text report back to the competitor laptop confirming that is has completed a successful run.
  - The video recording can now be stopped.

Teams will need to upload their video to the provided URL per the instructions provided. Videos must be uploaded within 45 minutes of a run completion

7.2 TIME ALLOCATED

19 hours over 2 days of competition

8 Skill-specific safety requirements

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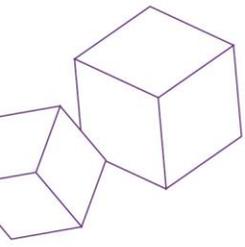
9 Materials and equipment

9.1 INFRASTRUCTURE LIST

The Infrastructure List details all equipment, materials, and facilities are provided by the local Host Competitors Organization.

Local Skill organizations will be required to build the court as required.

Challenge elements as required will be provide by Studica

The Infrastructure List can be confirmed with WorldSkills Asia.

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.

9.2 COMPETITORS TOOLBOX

As required within local restrictions

9.3 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY COMPETITORS

Teams should have access to small tools for assembly and service of their Mobile Robot System

- Competitors are required to supply their own Personal Protective Equipment as required

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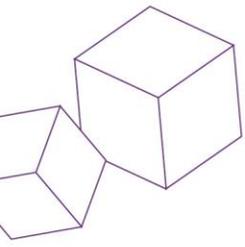
9.4 PROPOSED CAMERA AND COMPETITOR WORKSTATION LAYOUTS

Institute must provide the facilities required. The diagram below can be used as a reference on how to setup the facility.
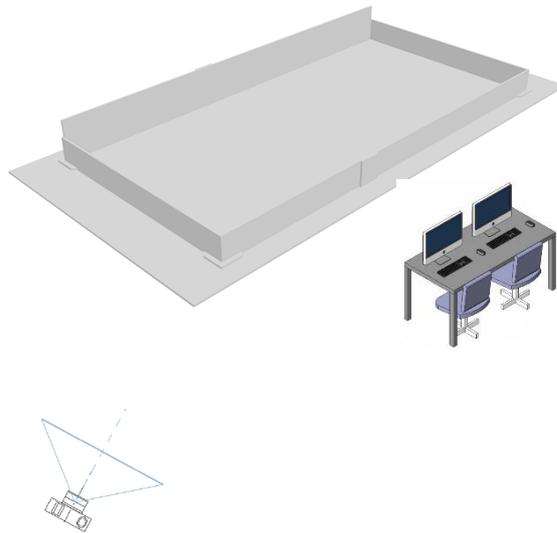
9.5 VIDEO FORMAT AND PROCEDURES

To aid in both the upload and viewing of video files, teams should use a compressed video format such as the following when submitting test run video.

MP4, MOV,WMV, MTS

Videos should be named as follows and uploaded to the supled secure drobox location.

Sample Filename: Competition Day C1 Test Run Video China

A free DropBox account will provide you with up to 2GB of storage. It is suggested that you setup a separate account if required so that you do not have issues with your personal storage.

https://www.dropbox.com/basic
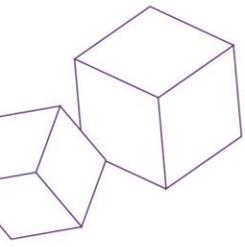
10 Skill-specific rules

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.

Use of technology – personal laptops, tablets, and mobile phones

- Competitors are allowed to bring one laptop per Competitor into the workstation.
- Competitors are allowed one laptop per team during test runs.

Templates, aids, etc.

- Competitors are allowed to bring and use aids for positioning their robot.
- Competitors are allowed to bring and use manipulator tools to hold the robot during assembly and wiring.

Version: 1.0