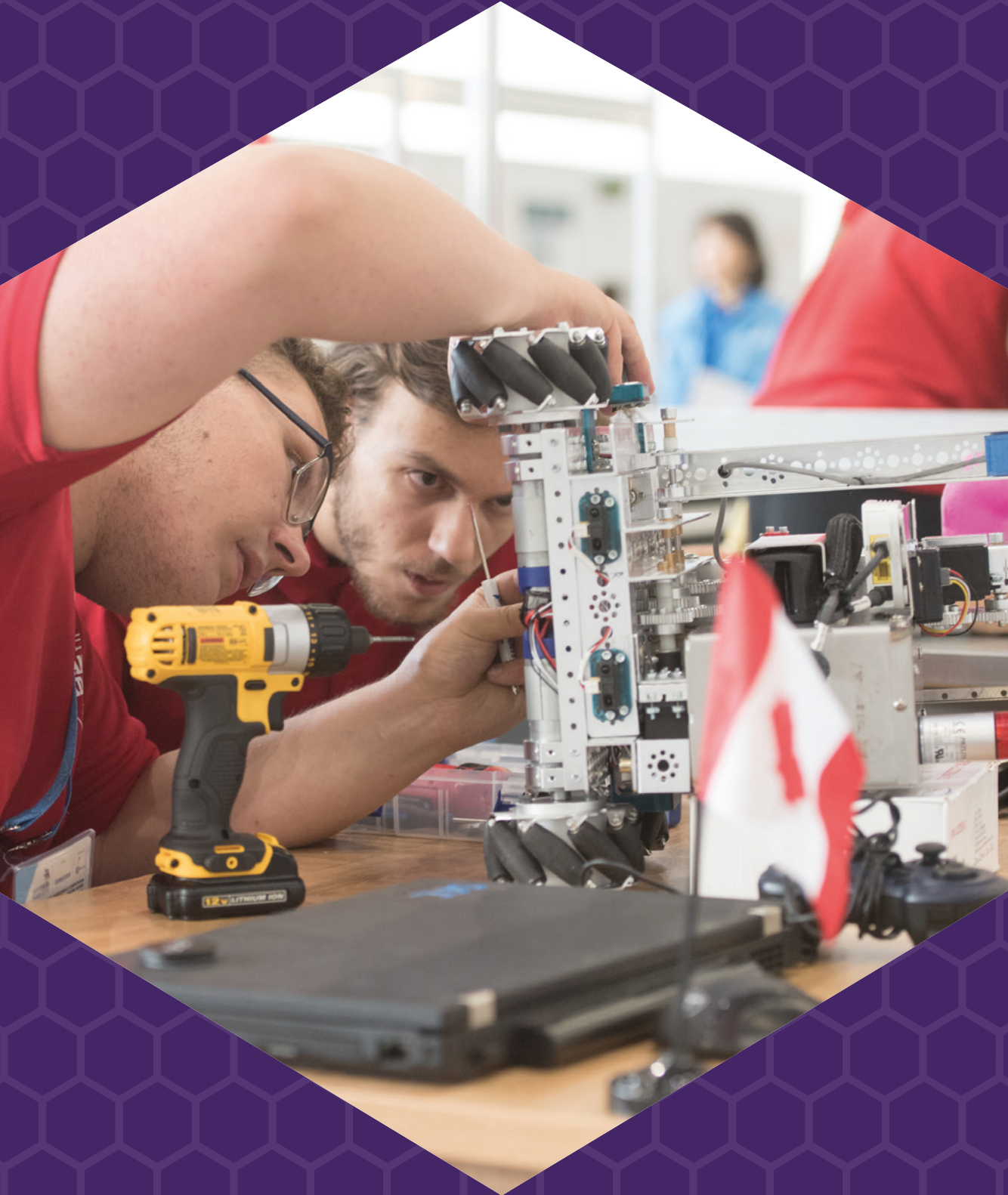


MANUFACTURING AND ENGINEERING TECHNOLOGY

Mobile Robotics



WorldSkills Occupational Standards

WorldSkills Occupational Standards (WSOS)

Occupation description and WSOS

The name of the occupation is

Mobile Robotics

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

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.

WorldSkills Occupational Standards

Section	Relative importance (%)
1 Work organization and management	10

The individual needs to know and understand:

- Principles and applications of safe working generally and in relation to manufacturing
- The purposes, uses, care, and maintenance of all equipment and materials, together with their safety implications
- Environmental and safety principles and their application to good housekeeping in the work environment
- Principles of team working and their applications
- Personal skills, strengths, and needs relative to the roles, responsibilities, and duties of others individually and collectively
- The parameters within which activities need to be scheduled

The individual shall be able to:

- Prepare and maintain a safe, tidy, and efficient work area
- Prepare self for the tasks in hand, including full regard to health and safety
- Schedule work to maximize efficiency and minimize disruption
- Take account of the rules and regulations in force for robotics technician/engineering
- Select and use all equipment and materials safely and in compliance with manufacturers' instructions
- Apply or exceed the health and safety standards applying to the environment, equipment and materials
- Restore the work area to an appropriate state and condition
- Contribute to team performance both broadly and specifically
- Give and take feedback and support

2 Communication and interpersonal skills	10
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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

Section	Relative importance (%)
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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

3 Design	15
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The individual needs to know and understand:

- 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

Section	Relative importance (%)
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The individual shall be able to:

- 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

4	Prototyping	10
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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 (%)
5 Programming, testing, and adjustment	15

The individual needs to know and understand:

- Manufacturers' control software
- 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
- 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 a process and operation using software
- Use the manufacturer provided control software to assert effective autonomous control over manufacturer provided object management systems
- Use industrial standard programming software to assert effective autonomous control over robots' 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 navigation strategies
- Install and make physical settings adjustments to sensors
- Install cameras on robots 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

6 Performance Review and Commissioning	40
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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

Section	Relative importance (%)
<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Test each part of a mobile robot against agreed operating criteria • 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 • 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 • Finalize and present portfolios to clients, the portfolios to include all essential documentation required in business transactions • Present mobile robots and portfolios to clients and respond to questions 	
Total	100

References for industry consultation

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/>) ILO 3119
- ESCO: (<https://ec.europa.eu/esco/portal/home>)
- O*NET OnLine (www.onetonline.org/)

Your competition appears to relate closely to *Robotics Technician*:

<https://www.onetonline.org/link/summary/17-3024.01>

and *Robotics Engineering Technician*:

<http://data.europa.eu/esco/occupation/7833d5cd-873d-4fdd-b2f8-9762d68494a7>

Adjacent occupations can also be explored through these links.

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2022.

Organization	Contact name
Studica	Frank Nanfara