Technical Description技术说明

Robot Systems Integration

机器人系统集成

Manufacturing and Engineering Technology制造及工程技术

worldskills

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.

世界技能国际大赛通过竞赛委员会决议，根据《世界技能大赛章程》、《常备规则》和《竞赛规则》，对世界技能大赛该项技能的最低要求如下。

The Technical Description consists of the following::

技术说明包括以下内容:

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1 INTRODUCTION介绍

1.1 NAME AND DESCRIPTION OF THE SKILL COMPETITION技能竞赛名称及描述

1.1.1 The name of the skill competition is Robot Systems Integration

技能竞赛的名称是机器人系统集成

1.1.2 Description of the associated work role(s) or occupation(s).相关工作角色或职业的描述。

Within the last eight years the number of robots installed in the world has increased by a factor of 6.5. In 2017, 387,000 robots were installed worldwide; in 2019, 520,000 are scheduled to be installed (source: IFR: International Federation of Robotics). This requires both the capacity to manufacture these robots, and the skilled human resources to install them.

在过去的八年里，世界上安装的机器人数量增加了6.5倍。2017年，全球共安装机器人38.7万台;2019年，计划安装52万台机器人(来源:IFR:国际机器人联合会)。这既需要制造这些机器人的能力，也需要熟练的人力资源来安装它们。

To be useful, the robot needs to be integrated within an overall process that will benefit from its availability. According to the robot application: pick and place, load and unload, palletization, welding, and so on, the role of the robot integrator is to think about and decide: what is the most appropriate type of robot to use; how to organize the parts flow; how best to program the robot; how to make the robot cell safe, etcetera. These are considerations for the robot manufacturer, the system integrator, and sometimes the end user.

为了发挥机器人的作用，需要一个将其集成（组装）到整体的过程，从而发挥其有效性。根据机器人的应用:取放、装卸、堆垛、焊接等，机器人集成商的作用是思考和决定:用哪种机器人最合适;如何组织零件流程;如何最好地为机器人编程;如何使机器人细胞（单位/模块）安全等等。这些都是机器人制造商、系统集成商，有时甚至是最终用户需要考虑的问题。

The robot system integrator must provide technical solutions to the robotization of all or part of a system by机器人系统集成商必须为整个或部分系统的自动化提供技术解决方案

incorporating a multi-articulating arm, together with the associated handling tools or special processes (such as handling, machining, painting and welding), to increase competitiveness and采用多关节臂，配合相关的搬运工具或特殊工序(如搬运、机械加工、油漆及焊接)，以提高竞争力及

supporting the ergonomics, health and safety of the users and people around them.

支持人机工程学，用户和周围的人的健康和安全。

Through additional devices the robot can acquire several “senses”, such as sight and touch, in order to

perform complex and precise tasks.通过额外的设备，机器人可以获得几个“感觉”，如视觉和

触觉，以便完成复杂而精确的任务。

The robot system integrator must be aware of technological developments in the manufacturing process, control systems, multi-articulated arm and the evolution of regulations for robotization. Preliminary study, implementation, electrical connection for power and other automated systems, integration of peripheral equipment, and programming, as well as

documentation, maintenance and troubleshooting, are all essential tasks.

机器人系统集成商必须了解制造过程、控制系统、多关节手臂的技术发展以及机器人化规则的演变。初步研究、实现、电力和其他自动化系统的电气连接、外围设备的集成、编程以及文档编制、维护和故障排除都是必不可少的任务。

Across the globe, small and medium-sized enterprises (SMEs) outnumber large corporations. Collectively, they employ more people. SMEs represent the majority of businesses that have yet to realize the advantages of automation and robotics, as the big companies like the automobile industry have already done. SMEs can automate by investing in “custom” or “hard” automation, where the automation is designed and built for a specific purpose, or in flexible robot systems. Robot automation offers advantages of increased flexibility for meeting changing production requirements typically found in SMEs as well as lower investment through the use of standard industrial robots.

在全球范围内，中小型企业的数量超过了大型企业。总的来说，他们雇佣了更多的人。中小型企业代表了大多数尚未实现自动化和机器人优势的企业，就像汽车行业这样的大公司已经实现了（机器人自动化）。中小型企业可以通过投资于“定制”或“刚性”自动化来实现自动化，其中自动化是为特定目的而设计和构建的，或者在灵活的机器人系统中。机器人自动化提供了更多的灵活性，以满足中小型企业不断变化的生产需求，并通过使用标准工业机器人降低了投资成本。

All in all, robot system integration represents a new, growing, and universal opportunity for skilled and committed technicians.

总而言之，对熟练而敬业的技术人员而言，机器人系统集成代表了一个新的、不断增长的普遍机会。

1.1.3 Number of Competitors per team每队参赛人数

Robot Systems Integration is a team skill with two Competitors per team.

机器人系统集成是一个团队技能，每个团队有两名参赛选手。

1.1.4 Age limit of Competitors参赛者年龄限制

The Competitors must not be older than 25 years in the year of the Competition.

参赛者的年龄不得超过25岁。

1.2 THE RELEVANCE AND SIGNIFICANCE OF THIS DOCUMENT

本文件的相关性和重要性

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.

本文件包含有关这项技能比赛所需的标准，以及管理比赛的评审原则、方法和程序的资料。

每个专家和参赛选手竞争对手都必须知道并理解这项技术描述。

如果技术说明的不同语言之间发生冲突，以英文版本为准。

1.3 ASSOCIATED DOCUMENTS相关的文档

Since this Technical Description contains only skill-specific information it must be used in association with the following:由于本技术说明只包含特定技能的信息，因此必须与下列内容结合使用:

- WSI – Competition Rules竞赛规则
- WSI – WorldSkills Standards Specification framework WSI - 世界技能大赛标准规范框架
- WSI – WorldSkills Assessment Strategy 世界技能大赛评估策略
- WSI Online resources as indicated in this document WSI在线资源，如本文档所示
- WorldSkills Health, Safety, and Environment Policy and Regulations. 世技健康、安全和环境政策法规

2 THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

WORLDSKILLS标准规范(WSSS)

2.1 GENERAL NOTES ON THE WSSS 世赛的一般说明(WSSS)

The WSSS 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/WSSS).

WSSS指定了技术和职业绩效国际最佳实践的知识基础、理解和特定技能支撑体系。它应该反映出全球对相关工作角色或职业代表工业和商业的共同理解(www.worldskills.org/wsss)。

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification is therefore a guide to the required training and preparation for the skill competition.

技能竞赛旨在反映WSSS所描述的国际最佳实践，并在一定程度上能够反映国际最佳实践。因此，该标准规范是技能竞赛所需培训和准备的指南。

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.

在技能竞赛中，知识和理解的评估将通过绩效评估来进行。只有在有压倒性理由的情况下，才会有单独的知识和理解测试。

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

标准规范分为不同的部分，并添加了标题和参考编号。

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards Specification. This is often referred to as the “weighting”. The sum of all the percentage marks is 100.

每个部分在总分中分配一个百分比，以表明其在标准规范中的相对重要性。这通常被称为“权重”。所有百分数之和为100。

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

评分计划及测试项目只会评估标准规格书所载的技能。它们将在技能竞赛的限制范围内尽可能全面地反映标准规范。

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

评分计划和测试项目将尽可能遵循标准规格内的评分分配。允许5%的变化，前提是这不会扭曲标准规范指定的权重。

2.2 WORLDSKILLS STANDARDS SPECIFICATION标准规范

SECTION组成部分		RELATIVE IMPORTANCE (%)占比
1	**Work organization and management工作组织和管理**	**10**
	The individual needs to know and understand个人需要知道和理解: • principles and methods of safe work execution安全执行工作的原则和方法 • the purposes, uses, care and maintenance of all equipment together with their safety implications所有设备的用途、用途、保养和保养及其安全影响 • environmental and safety principles and applications with regard to good housekeeping in the work area工作区域内良好的内务管理的环境和安全原则及应用 • principles of effective communication有效沟通原则 • principles of effective collaboration有效合作原则 • the scope and limits of one's own and others' roles, responsibilities and duties, both individually and collectively个人和集体的角色、职责和职责的范围和限制 • parameters within which activities must be planned必须规划活动中的参数 • principles and techniques for time management.时间管理的原则和技巧	百分之十
	The individual shall be able to个人应当能够: • prepare and maintain a safe, tidy and efficient work area准备和维护一个安全、整洁和高效的工作区域 • prepare self for the tasks in hand, including full regard to health, safety, and environment为手头的工作做好准备，包括充分考虑健康、安全和环境 • schedule work to maximize efficiency and minimize disruption安排工作以最大限度地提高效率，减少干扰 • select and use all equipment and materials safely and in compliance with manufacturers' instructions选择和使用所有的设备和材料，确保安全，符合制造商的指示和要求 • apply or exceed the health and safety standards applying to the environment, equipment, and materials符合或超出环境、设备和材料的健康和安全标准 • restore the work area to an appropriate state and condition将工作区环境恢复到适当的状态 • contribute to team performance both broadly and specifically广泛而具体地为团队绩效做出贡献 • give and take feedback and support.给予和接受反馈和支持	
2	**Communication and interpersonal skills沟通及人际交往技巧**	**10**

	The individual needs to know and understand:个人需要知道和理解: • organizational cultures and behaviours within business and industry企业和行业内的组织文化和行业惯例 • the purposes and range of required documentation in paper and electronic forms以纸张及电子形式提交所需文件的目的及范围 • the technical language associated with the occupation and sector与职业和部门有关的技术用语 • the standards required for routine and exception reporting in oral, written, and electronic form口头、书面和电子形式的例行报告和例外报告所需的标准 • good practice in communication with clients, team members, and others良好的与客户、团队成员及他人沟通的习惯 • the purposes and techniques for generating, maintaining, and presenting records for one's own and others' uses.生成、维护和为自己和他人的使用提供记录的目的和技术	
	The individual shall be able to:个人应能够: • interact with a range of business and industry, modelling professional conduct at all times与各种商业和行业互动，随时为专业行为建模 • communicate by oral, written, and electronic means to ensure clarity, effectiveness and efficiency通过口头、书面和电子方式进行沟通，以确保清晰、有效和高效 • use a standard range of communication technologies使用一系列标准的通信技术 • discuss complex technical principles and applications with others与他人讨论复杂的技术原理和应用	

	• use active listening and questioning techniques使用积极的倾听和提问技巧 • read, interpret, and extract technical data and instructions from documentation in any available format从任何可用格式的文档中读取、解释和提取技术数据和说明 • complete reports and respond to issues and questions arising完成报告并对出现的问题作出回应 • respond to clients' and personnel's needs face to face and indirectly面对面和间接地回应客户和员工的需求 • gather information and prepare documentation as required by the client and other individuals and groups.根据客户或其他个人和团体的要求收集信息并准备文件	
3	**Layout and design布局和设计**	**15**

	The individual needs to know and understand:个人需要知道和理解:
	• the principles and relevant applications of computing and electronics计算机和电子学的原理和相关应用
	• the relevant practical applications of engineering science and technology工程科学与技术的相关实际应用
	• the relevant practical implications of physical principles and interrelationships物理原理和相互关系的相关实际含义
	• the principles and relevant applications of electrical engineering and pneumatics 电气工程与气动的原理及相关应用
	• the design, uses, repair and maintenance needs of relevant machinery and tools相关机械和工具的设计、使用、维修和保养需要
	• the principles and applications of robots, robotic tools and equipment mounted on robots and in robotic cells机器人的原理和应用，安装在机器人和机器人单元（模块？）上的机器人工具和设备
	• principles and methods of systems analysis to determine how conditions, operations and the environment will affect outcomes系统分析的原则和方法，以确定条件、操作和环境将如何影响结果
	• principles and applications for incorporating and integrating robots within industrial systems, such as:在工业系统内整合及整合机器人的原理及应用，例如:
	  • payload settings负载设置
	  • reach studies达到研究？？？
	  • motion optimisation运动优化
	principles of CAD and offline simulation tools used for layout and design of robot systems用于机器人系统布局和设计的CAD原理和离线仿真工具	

	The individual shall be able to:个人应能够:
	• acquire and check instructions and guidance for given assignments获取并检查指定任务的指示和指导
	• identify and resolve areas of uncertainty within the parameters of the brief确定并解决概要参数中的不确定性区域
	• carry out initial systems design for given industrial applications对给定的工业应用进行初步的系统设计
	• inspect installation sites or use alternative methods to test the applicability of initial systems design检查安装地点或使用其他方法来测试初始系统设计的适用性
	• optimise systems designs within the parameters of the given industrial applications在给定的工业应用参数范围内优化系统设计
	• incorporate the dimensioning of electrical and pneumatic systems结合电气和气动系统的尺寸？？
	• determine the role of pneumatic engineering in the choice and connection of controls and activators确定气动工程在控制和活化剂的选择和连接中的作用
	• carry out systems analyses for risk assessment进行风险评估的系统分析
	• itemize the requirements and implications of installation and integration in relation to详细说明与之相关的安装和集成的需求和含义
	  • robots, ancillary equipment and tools机器人、辅助设备和工具
	  • human resources and time人力资源及时间
	  • estimated impacts on production during installation估安装过程中对生产的影响
	  • estimated impacts on production following installation估计安装后对生产的影响
	  • operating parameters and risk management经营参数及风险管理
	• present proposals for consideration and approval, and adjust as required. 提出建议供审议和批准，并根据需要作出调整	

4	Installation and connectivity安装与连接	13
	The individual needs to know and understand:个人需要知道和理解: • the norms and cultures of the receiving industrial sites接收工业现场的规范和文化 • principles and methods for the safe receipt and ongoing management of equipment, tools and materials安全接收和持续管理设备、工具和材料的原则和方法 • principles underlying the physical installation of robotics into production systems在生产系统中物理安装机器人的基本原则 • principles and methods for assembling pre-manufactured robots in their positions for use在其位置上装配并使用预加工机器人的原理和方法 • principles and methods for assembling and fixing tools and equipment to the robots为装配机器人及固定工具和设备的原理和方法 • principles underlying the positioning, connection and use of electrical power电力的定位、连接和使用的基本原则 • principles underlying the positioning, connection and use of pneumatics.基本原则的定位，连接和使用的气动 • Principles underlying the correct foundations and fixing methods required for installation of industrial robots and peripheral equipment工业机器人和外围设备安装所需的正确基础和固定方法的基本原理	
	The individual shall be able to:个人应能够: • check that all items have been delivered according to specification, and follow up as required检查所有产品是否符合规格要求，并按要求跟进 • organize the safe storage of all items, together with arrangements for their checking in and out组织所有物品的安全存放，并安排物品的进出 • check that the pre-manufactured robot has been delivered ready to run, and follow up as required检查预制机器人是否已交付准备运行，并按要求进行跟踪 • connect robot system components according to instructions and documentation根据指令和文件连接机器人系统组件 • assemble, position and fix robotic tools and equipment according to instructions and documentation根据说明书和文件组装、定位和安装机器人工具和设备 • align, fit or assemble components, using hand tools, power tools, fixtures, or templates, according to specification根据规格使用手动工具、电动工具、夹具或模板对齐、安装或组装组件 • liaise with specialists for the correct electrical, pneumatic and mechanical installation of robots and peripheral equipment与专家保持联系，正确安装机器人和外围设备的电气、气动和机械设备 • connect Input/Output (I/O) control signals between robot and peripheral equipment, either low voltage (24V) or Ethernet / Bus systems.连接机器人和外围设备(低压(24V)或以太网/总线系统)之间的输入/输出(I/O)控制信号 • perform tests during the installation process to ensure functionality在安装过程中执行测试以确保功能 • identify installation issues, consider alternative solutions, and implement selected solution(s) to resolve the issues确定安装问题，考虑其他解决方案，并执行选定的解决方案来解决问题	

	respect and take account of the receiving sites' requirements and characteristics, within the bounds of safe working, active risk management, and professionalism.在安全工作、积极的风险管理和专业精神的范围内，尊重并考虑接收站点的要求和特性。 •	
5	**Automation and programming自动化及编程**	**20**

	The individual needs to know and understand:个人需要知道和理解:
	• computer capabilities and symbolic logic计算机能力和符号逻辑
	• principles governing the purposes and functions of computer hardware and software控制计算机硬件和软件的目的和功能的原则
	• principles and options for原则及选择
	  • manipulating robot coordinate frames, for robot, cell and tooling
	  • 操作机器人坐标系，用于机器人、单元（模块？）和工具
	  • controlling robot motion控制机器人运动
	  • controlling robot input/output (I/O) functions控制机器人输入/输出(I/O)功能
	  • optimizing the user interface and优化用户界面和
	  • enabling re-programming and adjustment启用重新编程和调整
	• the principles, reasons or facts that provide the basis for breaking down information or data into separate parts
	• 将信息或数据分类提供的基础原则、理由或事实
	• methods for obtaining information and data from all relevant sources
	• 从所有相关来源获取信息和数据的方法
	• principles and methods for processing information and data
	• 处理资料和数据的原则和方法
	• the software in use正在使用的软件
	  • sensor integration.传感器集成	

	The individual shall be able to:个人应能够: • consult with client/ personnel to clarify program intent • 与客户/其他人员协商，明确项目意图 • develop diagrams or flow charts of systems operations • 开发系统操作图表或流程图 • write, analyse, review and rewrite programs, using flow charts and diagrams使用流程图和图表编写、分析、审查和重写程序 • create application software programs that are easy to document, understand and maintain • 创建易于记录、理解和维护的应用软件程序 • conduct trial runs of programs and software applications to ensure they will produce the desired robot and cell performance进行程序和软件应用程序的试运行，以确保它们将生产出所需的机器人和电池性能 • write, update and maintain computer programs or software packages to handle specific jobs • 编写、更新和维护计算机程序或软件包来处理特定的工作 • optimise robot motion performance and I/O handling to minimise cycle time / maximise throughput while retaining reliable operation • 优化机器人的运动性能和I/O处理，以最小化循环时间/最大化吞吐量，同时保持可靠的运行 • correct errors by making appropriate changes and rechecking the program to ensure that the desired results are produced • 通过进行适当的更改和重新检查程序来纠正错误，以确保产生所需的结果	

	• consult with other personnel to identify problems and suggest changes.与其他人员协商，找出问题并提出改进建议 • implement new additional software and hardware options based on standard functionality.基于标准功能实现新的附加软件和硬件选项	
6	**Commissioning, maintenance, and troubleshooting** **调试、维护和故障排除**	**20**
	The individual needs to know and understand:个人需要知道和理解: • the formal requirements for successful site acceptance tests • 成功的站点验收测试的正式要求 • the scope and limits of the technologies, methods operational environment技术的范围和限制，方法的操作环境 • criteria and methods for testing equipment and systems • 测试设备和系统的标准和方法 • strategies for fault finding, problem solving and optimization • 故障发现、问题解决和优化策略 • techniques and options for replacements and repairs • 选择更换或修理的技术 • principles and techniques for generating creative and innovative solutions产生创造性和创新性解决方案的原则和技术 • principles and options for establishing and maintaining production maintenance regimes建立和维护生产维护制度的原则和选择	
	The individual shall be able to:个人应能够: • investigate whether the robot and its peripheral equipment are responding to the programs' instructions 检查机器人及其周边设备是否正常响应程序的指令 • revise, repair or expand existing programs to increase operational efficiency or adapt to new requirements • 修改、修复或扩展现有的程序，以提高运行效率或适应新的需求 • repair or replace components as required根据需要维修或更换部件 • develop Human-Machine-Interface (HMI) applications for the users of the robot system, using HTML or other web technologies使用HTML或其他web技术为机器人系统的用户开发人机界面(HMI)应用程序 advise on maintenance regimes to maximize efficiency and minimize disruption. • 就维护制度提供建议，以最大限度地提高效率和减少中断	
7	**Documentation, briefing, and reporting文档、简报和报告**	**12**
	The individual needs to know and understand: 个人需要知道和理解: • the role and importance of maintaining records of each stage of activity • 保存每个活动阶段的记录的作用和重要性 • the required media and formats of records and reports to ensure compliance with contracts, regulations and legislation, verification and audit • 记录和报告的必要媒体和格式，以确保遵守合同、条例和立法、核查和审计	

	• the needs of users and specialists for information, guidance and instructions in suitable forms (media, content, language, format and presentation) • 用户和专家对适当形式(媒体、内容、语言、格式和演示)的信息、指导和说明的需要的性能。 • clients' specific information needs客户的具体信息需求 • basic principles and techniques for briefing and training non-specialist end users介绍和培训非专业最终用户的基本原则和技术 • principles and techniques for critical review of own and others' • performance.对自己和他人做评论的原则和技巧 • principles of common PC / Office software常用PC / Office软件原理	

	The individual shall be able to:个人应能够:
	• liaise with other personnel or departments for project integration
	• 与其他人员或部门联系，进行项目整合
	• document design and development procedures according to requirements根据要求设计开发文件
	• compile and write documentation of program development and subsequent revisions, inserting comments in the coded instructions so that others can understand the computer programs
	• 编写程序开发和后续修订的文档，在编码指令中插入注释，以便其他人能够理解计算机程序
	• present and provide test results from the commissioning process
	• 提供调试过程中的测试结果
	• design or contribute to instructions and guidance to guide end users, with an emphasis on clarity and ease of use
	• 设计或帮助、指导最终用户，强调清晰和易于使用
	• provide the end user with a set of documentation in appropriate formats, including all necessary robot data such as:向最终用户提供一套适当格式的文件，包括所有必要的机器人数据，例如:
	  • operating instructions操作规程
	  • application specific fault messages - I/O Listings
	  • 特定于应用程序的错误消息- I/O清单
	  • user adjustable parameter (register) descriptions
	  • 用户可调参数(寄存器)说明
	• review each part of the process of design, fabrication and assembly, and operation, against established criteria, including accuracy, consistency, time and cost
	• 根据既定的标准，包括准确性、一致性、时间和成本，评审设计、制造、装配和操作过程的每个部分
	• contribute to individual and collective quality and contract review, responding to questions and challenges appropriately.为个人和集体的质量和合同评审做出贡献，适当地回应问题和挑战	

	Total共计	**100**

3 THE ASSESSMENT STRATEGY AND SPECIFICATION评估策略和规范

3.1 GENERAL GUIDANCE总体指导

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

评估由WorldSkills评估策略管理。该策略确立了世界技能评估和评分必须遵循的原则和技术。

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).

专家评估实践是世界技能大赛的核心。因此，它是持续专业发展和审查的主题。评核专业知识的增长，将会为世界技能大赛所用的主要评核工具:评分制度、测试项目及比赛资讯系统(CIS)，提供未来使用的指引。

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.世界技能大赛的评估分为两大类:测量和判断。对于这两种类型的评估，使用明确的基准来评估每个方面对于保证质量是至关重要的。

The Marking Scheme must follow the weightings within the Standards Specification. The Test Project is the assessment vehicle for the skill competition, and also follows the Standards Specification. The CIS enables the timely and accurate recording of marks, and has expanding supportive capacity.评分方案必须符合标准规格的权重。测试项目是技能竞赛的评估工具，同时也遵循标准规范。CIS能够及时准确地记录标记，并具有不断扩大的支持能力。

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed and developed through an iterative process, to ensure that both together optimize their relationship with the Standards Specification and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards Specification.评分方案在大纲中将主导测试项目的设计过程。在此之后，评分方案和测试项目将通过一个迭代过程进行设计和开发，以确保两者共同优化与标准规范和评估策略的关系。为了证明其质量和符合标准规范，将由专家同意并一起提交WSI批准。

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

评分计划及测试项目将于提交WSI（世赛国际组织）评核前，与WSI（世赛国际组织）技能顾问联络，以善用比赛资讯系统(CIS)的功能。

4 THE MARKING SCHEME评分制度

4.1 GENERAL GUIDANCE一般性指导

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.本节介绍评分计划的任务和地点，专家将如何通过测试项目评估参赛选手的工作，以及评分的程序和要求。

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standards that represent the skill. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards Specification.评分制度是世界技能大赛的关键工具，因为它将评估与代表技能的标准挂钩。它的设计目的是根据标准规范中的权重为每个评估的性能方面分配分数。

By reflecting the weightings in the Standards Specification, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill 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.通过反映标准规范中的权重，评分方案为测试项目的设计确定了参数。视乎技能的性质及评估需要而定，我们可先制定更详细的评分计划，作为测试项目设计的指引。或者，最初的测试项目设计可以基于大纲评分方案。由即日起，评核计划及测试项目应一并制订。

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards Specification, if there is no practicable alternative.上文第2.1条指出，如没有切实可行的替代办法，评分制及测试项目可能与标准规格书所载的权重比例有多大程度的偏离。

The Marking Scheme and Test Project may be developed by one person, or several, or by all Experts. The detailed and final Marking Scheme and Test Project must be approved by the whole Expert Jury prior to submission for independent quality assurance. The exception to this process is for those skill competitions which use an independent designer for the development of the Marking Scheme and Test Project. Please see the Rules for further details.评分方案和测试项目可由一人、数人或所有专家制定。详细和最终的评分方案和测试项目必须在提交独立的质量保证之前得到整个专家评审团的批准。这个过程的例外是那些使用独立设计师开发评分方案和测试项目的技能竞赛。详情请参阅规则。

Experts and independent designers are required to submit their Marking Schemes and Test Projects for comment and provisional approval well in advance of completion, in order to avoid disappointment or setbacks at a late stage. They are also advised to work with the CIS Team at this intermediate stage, in order to take full advantage of the possibilities of the CIS.为了避免后期的失望和挫折，专家和独立设计人员必须提前提交评分方案和测试项目，征求意见和临时批准。还建议它们在这个中间阶段与比赛资讯系统(CIS)小组合作，以便充分利用比赛资讯系统(CIS)的各种可能性。

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition using the CIS standard spreadsheet or other agreed methods.在所有情况下，必须在比赛前至少八周，使用比赛资讯系统(CIS)标准电子表格或其他商定的方法，向比赛资讯系统(CIS)提交一份评分方案草案。

4.2 ASSESSMENT CRITERIA

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived in conjunction with the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards Specification; in others they may be totally 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 Specification.评分制的主要标题是评核准则。这些标题是与测试项目一起派生的。在某些技能比赛中，评审准则可能与标准规格书的章节标题相似; 在另一些情况下，它们可能完全不同。通常会有5至9项评核准则。不论标题是否相符，评分制作为一个整体必须反映标准规格书的权重。

Assessment Criteria are created by the person(s) developing the Marking Scheme, who are free to define 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). It is advisable not to specify either the Assessment Criteria, or the allocation of marks, or the assessment methods, within this Technical Description.评核准则由制定评核计划的人员订立，他们可自由界定他们认为最适合评核及评核测试项目的准则。每个评估标准由一个字母(a - i)定义。建议不要在本技术说明内指明评审准则、分数分配或评审方法。

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

由比赛资讯系统(CIS)编制的分数摘要表格将包括一份评审准则清单。

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.

分配给每个标准的分数将由比赛资讯系统(CIS)计算。这些将是该评价标准内各方面所获分数的累积和。

4.3 SUB CRITERIA子标准

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.每个评估标准被划分为一个或多个子标准。每个子标准都成为WorldSkills（世赛）标记表单的标题。每个评分形式(子标准)都包含需要通过测量或判断，或测量和判断同时进行评估和标记的方面。

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

每个评卷表格(子标准)都指定了评卷的日期和评卷小组的身份。

4.4 ASPECTS各方面指标

Each Aspect defines, in detail, a single item to be assessed and marked together with the marks, or instructions for how the marks are to be awarded. Aspects are assessed either by measurement or judgement.每个方面都详细地定义了一个单独的项目，与这些标识一起评估和打分，或者指示如何授予这些分数。各方面可以通过测量或判断来评估。

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 skill in the Standards Specification. 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)

标记表单详细列出了要标记的每个方面以及分配给它的分数/标识。分配给每个方面的分数总和必须在标准规范中为技能的该部分指定的分数范围内。在C-8周评核评核成绩计划时，有关成绩会以下列格式显示在CIS的成绩分配表内。(4.1节)

		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	30.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 ASSESSMENT AND MARKING评估和打分

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, in all circumstances. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (See 4.6.)无论是通过判断、测量或两者同时进行评估和评分，每个子标准都有一个评分小组。同一个评分团队必须在任何情况下对所有参赛选手进行评估和打分。必须分好打分小组，以确保在任何情况下没有同胞给自己的团队打分。(参见4.6)。

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

4.7 评价和打分使用判断

判断使用0-3的量表。要严格和一致地适用该量表，必须使用下列方法作出判断:

- 各方面详细指引的基准(准则)(以文字、图像、艺术品或个别指引说明的形式)
- 0-3表示:
  - 0:性能低于行业标准
  - 1:性能符合行业标准
  - 2:业绩达到并在具体方面超过行业标准
  - 3:性能完全超过行业标准，被评为优秀

Three Experts will judge each Aspect, with a fourth to coordinate the marking and acting as a judge to prevent compatriot marking.

各方面由三名专家评判，第四名负责协调评分，并担任评委，防止同胞打分。

4.8 ASSESSMENT AND MARKING USING MEASUREMENT 评估和标记使用测量

Three Experts will be used to assess each aspect. 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.

三个专家将被用来评估每个方面。除非另有说明，否则只会给予最高分或零分。使用时，将在各方面中清楚地定义授予部分分数的基准。

4.9 THE USE OF MEASUREMENT AND JUDGEMENT 测量和判断的应用原则

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

比赛将透过评分制及测试项目，在设计比赛时决定比赛准则及评审方法。

4.10 COMPLETION OF SKILL ASSESSMENT SPECIFICATION

The Competition Information System (CIS) will perform the calculations required for the allocation of time points.

Competitors may not modify cell components in any way during the competition. Exceptions will be announced by the Skill Management Team.

The Sponsor support team provides spare and replacement parts to Competitors only during competition time. Exceptions will be announced by the Skill Management Team.

完成技能评估规范

比赛资讯系统(CIS)会进行所需的时间点分配计算。

参赛者不得在比赛期间以任何方式修改电池组件。如有例外情况，以技能管理团队宣布为准。

赞助商支持团队只在比赛期间为参赛者提供备件和替换件。如有例外情况，以技能管理团队宣布为准。

4.11 SKILL ASSESSMENT PROCEDURES

Assessment “best practices and procedures” are described in the Guidelines for Assessment for Robot System Integration.

Both Competitors being assessed have to be present during the entire assessment procedure.

技能评定程序

《机器人系统集成评估指南》中描述了“最佳实践和程序”。

在整个评估过程中，被评估的两名选手必须在场。

5 THE TEST PROJECT测试项目

5.1 GENERAL NOTES一般说明

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.第3节和第4节管理测试项目的开发。这些注释是补充说明。

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the skills in each section of the WSSS.无论是单个实体，还是一系列独立或连接的模块，测试项目都将支持对WSSS的每个部分的技能进行评估。

The purpose of the Test Project is to provide full, balanced and authentic opportunities for assessment and marking across the Standards Specification, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme and Standards Specification will be a key indicator of quality, as will be its relationship with actual work performance.测试项目的目的是结合评分方案，为跨标准规范的评估和评分提供全面、平衡和真实的机会。测试项目、评分方案和标准规范之间的关系，以及它们与实际工作绩效之间的关系，将是衡量质量的一个关键指标。

The Test Project will not cover areas outside the Standards Specification, or affect the balance of marks within the Standards Specification other than in the circumstances indicated by Section 2.测试项目不包括标准规范之外的区域，也不影响标准规范中除第2节所述情况外的其他标记的平衡。

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work.测试项目将使知识和理解能够通过其在实际工作中的应用进行评估。

The Test Project will not assess knowledge of WorldSkills rules and regulations.测试项目不评估WorldSkills规则和规章的知识。

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 Specification. Section 2.1 refers.本技术说明将说明影响测试项目全部支持能力的任何问题，与标准规范相关的评估范围。详见2.1节。

5.2 FORMAT/STRUCTURE OF THE TEST PROJECT 测试项目的格式/结构

Completion of a Robot System Integration project, through all steps from planning through implementation to documentation will use a realistic Test Project based on the FANUC Education Cell.

The Test Project will be presented to the Competitors in the form of a project specification from an Industrial Customer.

完成一个机器人系统集成项目，通过从计划到实现到文档的所有步骤，将使用一个基于FANUC教育单元的现实测试项目。

测试项目将以来自工业客户的项目规范的形式呈现给参赛选手。

5.3 TEST PROJECT DESIGN REQUIREMENTS测试项目设计要求

Overall the Test Project must:

- Be modular, consisting of linked tasks to create a basic project and with additional tasks / modules which will result in an excellent project if completed during the Competition;
- Be accompanied by a marking scale that will be finalized at the Competition in accordance with section three;
- Be validated according to section 5.5;
- The Test Project may include software or hardware functions which have not been disclosed to the Experts or Competitors in advance, to test the ability of Competitors to understand and use these under pressure.
- Be supplied with documentation clarifying the operation of special or new robot hardware or software functions for the Experts and Competitors, as well as the standard robot reference manuals.

总体测试项目必须:

- 模块化，包括创建一个基本项目的链接任务和额外的任务/模块，如果在比赛期间完成，将产生一个优秀的项目;
- 附有评分表，评分表将于比赛时根据第三节的规定定稿;
- 根据第5.5条进行验证;
- 测试项目可以包括事先未向专家或参赛选手披露的软件或硬件功能，以测试参赛选手在压力下理解和使用这些功能的能力。
- 为专家和参赛选手提供文件，阐明特殊或新的机器人硬件或软件功能的操作，以及标准的机器人参考手册。

5.4 TEST PROJECT DEVELOPMENT

测试项目的开发

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.

测试项目必须使用WorldSkills International提供的模板提交(www.worldskills.org/expertcentre)。文本文档使用Word模板，绘图使用DWG模板。

5.4.1 Who develops the Test Project or modules谁开发测试项目或模块

The Test Project/modules are developed by an Independent Test Project designer/team, in collaboration with the Skill Competition Manager. The designer/team may be from a Global Partner.测试项目/模块由独立的测试项目设计师/团队与技能竞赛经理合作开发。设计师/团队可能来自全球合作伙伴

5.4.2 How and where is the Test Project or modules developed

测试项目如何以及在哪里开发

The Test Project is designed independently.测试项目是独立设计的

5.4.3 When is the Test Project developed什么时候开发测试项目

The Test Project is developed according to the following timeline:测试项目按照以下时间线开发

TIME时间	ACTIVITY活动内容
C-6 months6个月	Details of the latest version of the FANUC Education Cell itself will be released (not the actual Test project)FANUC发布教育单元最新版本的细节(不是实际的测试项目)
C-3 months3个月	The documentation for all software and hardware options used in the Test Projects will be released发布测试项目中使用的所有软件和硬件选项的文档
During competition比赛期间	If undisclosed software or hardware is included in the test project as part of the competition, the relevant documentation will be supplied to competitors to use during competition 如果未披露的软件或硬件包含在测试项目中作为竞赛的一部分，相关文档将提供给参赛选手在竞赛期间使用

5.5 TEST PROJECT VALIDATION测试项目验证

It must be demonstrated that the Test Project can be completed within the material, equipment, knowledge and time constraints. This will be demonstrated by the Independent Test Project designer/team.必须证明测试项目能够在材料、设备、知识和时间的限制下完成。这将由独立的测试项目设计人员/团队进行演示。

The assembly and testing of the Test Project must be done before the Competition.

测试项目的组装和测试必须在比赛前完成。

5.6 TEST PROJECT SELECTION测试项目的选择

Not applicable – refer to 5.4.1 不适用-请参阅5.4.1

5.7 TEST PROJECT CIRCULATION测试项目发布

The Test Project is circulated via the website as follows:测试项目通过以下网站发布:

The Test Project is not circulated in advance of the competition.测试项目不会在比赛前发布。

5.8 TEST PROJECT COORDINATION (PREPARATION FOR COMPETITION)测试项目协调(竞赛准备)

Coordination of the Test Project will be undertaken by the Skill Competition Manager and the Independent Test Project designer/team.

测试项目的协调工作将由技能竞赛经理和独立的测试项目设计师/团队负责。

5.9 TEST PROJECT CHANGE AT THE COMPETITION

在竞赛中测试项目变更

There is no change at the competition – see section 5.4.1. 比赛不会有任何变化-见5.4.1节。

5.10 MATERIAL OR MANUFACTURER SPECIFICATIONS

材料或制造商规格

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and the Global Partner.

The Global Partner will supply all necessary documentation, manuals etc. in electronic form.

参赛者完成测试项目所需的特定材料和/或制造商规格将由竞赛组织者和全球合作伙伴提供。

全球合作伙伴将以电子形式提供所有必要的文件、手册等

6 SKILL MANAGEMENT AND COMMUNICATION技能管理与沟通

6.1 DISCUSSION FORUM论坛

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (http://forums.worldskills.org). 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

在比赛之前，所有关于技能竞赛的讨论、交流、协作和决策都必须在技能特定论坛(http://forums.worldskills.org)上进行。与技能相关的决策和沟通只有在论坛上进行时才有效。首席专家(或由首席专家提名的专家)将担任本次论坛的主持人。交流时间表及竞赛发展要求参照竞赛规则。

6.2 COMPETITOR INFORMATION参赛选手信息

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

所有注册选手的信息均可从选手中心获得(www.worldskills.org/competitive torcentre)。

这些信息包括:

竞争规则

技术描述

评分摘要表格(如适用)

测试项目(如适用)

基础设施列表

世技健康、安全和环境政策法规

其他指一整套信息

6.3 TEST PROJECTS [AND MARKING SCHEMES]测试项目〔及评分计划

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).测试项目的发布将从www.worldskills.org/testprojects和参赛选手中心(www.worldskills.org/competitive torcentre)获得。

6.4 DAY-TO-DAY MANAGEMENT日常管理

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 progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).比赛期间技能的日常管理由技能竞赛经理领导的技能管理团队制定的技能管理计划中规定。技能管理团队由技能竞赛经理、首席专家、副首席专家组成。技能管理计划在比赛前六个月逐步制定，并经专家同意在比赛中定稿。技能管理计划可以在专家中心(www.worldskills.org/expertcentre)查看。

7 SKILL-SPECIFIC SAFETY REQUIREMENTS

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

- It is not foreseen that the test project will include any electrical or mechanical assembly activities which require specific safety requirements.
- Safe robot operating procedures must be followed. These must be reviewed with the Experts and Competitors at the start of the competition.
- The Experts are responsible for making sure that the Competitors follow the safe operating procedures.
- The design of the Education Cell ensures that the robot can only be operated in Automatic (100% speed) mode when the robot cell door is closed.
- The robot must be operated only in T1 (reduced speed) mode when the robot cell door is open.
- The use of T2 (100% speed with door open) mode is prohibited.
- The method of ensuring this must be agreed with the Skill Competition Manager before the Competition, for instance:
- By indicating clearly by additional label on the robot controller.
- By giving the Experts the Auto/T1/T2 key
- 7专项技能安全要求
- 有关东道国或地区的卫生、安全和环境政策法规，请参阅WorldSkills。
- 预计测试项目将不包括任何需要特定安全要求的电气或机械装配活动。
- 必须遵守安全的机器人操作规程。这些必须在比赛开始时与专家和参赛者一起评审。
- 专家负责确保参赛选手遵守安全操作规程。
- 教育单元的设计确保了机器人只能在关闭机器人单元门时以自动(100%速度)模式运行。
- 当机器人电池门打开时，机器人只能在T1(减速)模式下运行。
- 禁止使用T2(100%速度带门开启)模式。
- 确保这一点的方法必须在比赛前得到技能竞赛经理的同意，例如:
- 通过在机器人控制器上附加标签清楚地指示。
- 通过给专家自动/T1/T2键

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 Experts for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Items supplied by the Competition Organizer are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts 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.

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

The Competitors do not need to bring a toolbox. All necessary tools will be supplied by FANUC. Correct use of the tools will be reviewed with the competitors during the Familiarization day.

Assessment of the correct use and organization of the tools should be included in the marking scheme.

8.3 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY COMPETITORS IN THEIR TOOLBOX

Refer to section 8.2

8.4 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY EXPERTS

The Global Partner will supply all necessary equipment related to the Test Project for Experts

8.5 MATERIALS AND EQUIPMENT PROHIBITED IN THE SKILL AREA

Use of any additional equipment is prohibited.

8材料和设备

8.1基础设施列表

基础设施清单详细列明比赛主办机构提供的所有设备、材料及设施。

基础设施列表可以在www.worldskills.org/infrastructure上找到。

基础设施清单指定了专家们为下一届比赛所要求的项目和数量。竞赛组织者将逐步更新基础设施清单，说明项目的实际数量、类型、品牌和型号。比赛主办机构提供的项目列于另一栏。

在每一场比赛中，专家必须审查和更新基础设施清单，为下一次比赛做准备。专家必须就空间和/或设备的任何增加向技能竞赛主任提出建议。

在每场比赛中，技术观察员必须审核在该比赛中使用的基础设施清单。

基础设施清单不包括参赛选手和/或专家必须携带的物品，也不包括参赛选手不允许携带的物品。

8.2参赛选手的工具箱

参赛者不需要携带工具箱。所有必要的工具将由FANUC提供。在熟悉日期间，将与参赛者一起检查工具的正确使用。

评核工具的正确使用和组织方法，应纳入评核计划内。

8.3竞争者在其工具箱中提供的材料、设备和工具

请参阅第8.2节

8.4由专家提供的材料、设备和工具

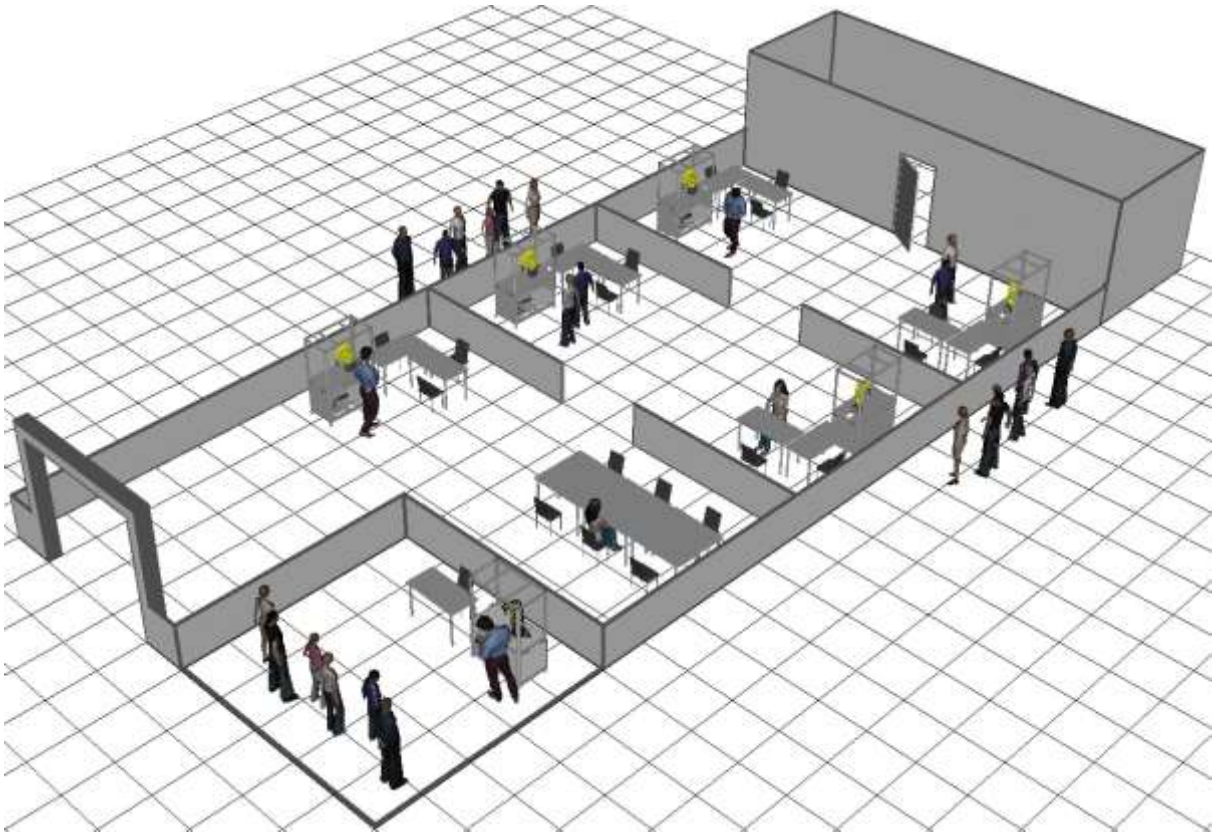
全球合作伙伴将为专家提供与测试项目相关的所有必要设备

8.5禁止使用技术区域内的材料和设备

禁止使用任何附加设备。

8.6 PROPOSED WORKSHOP AND WORKSTATION LAYOUTS建议的车间和工作站布局

Example workshop layout for 5 teams competing:8.6　　5支参赛队伍工作坊布局示例:



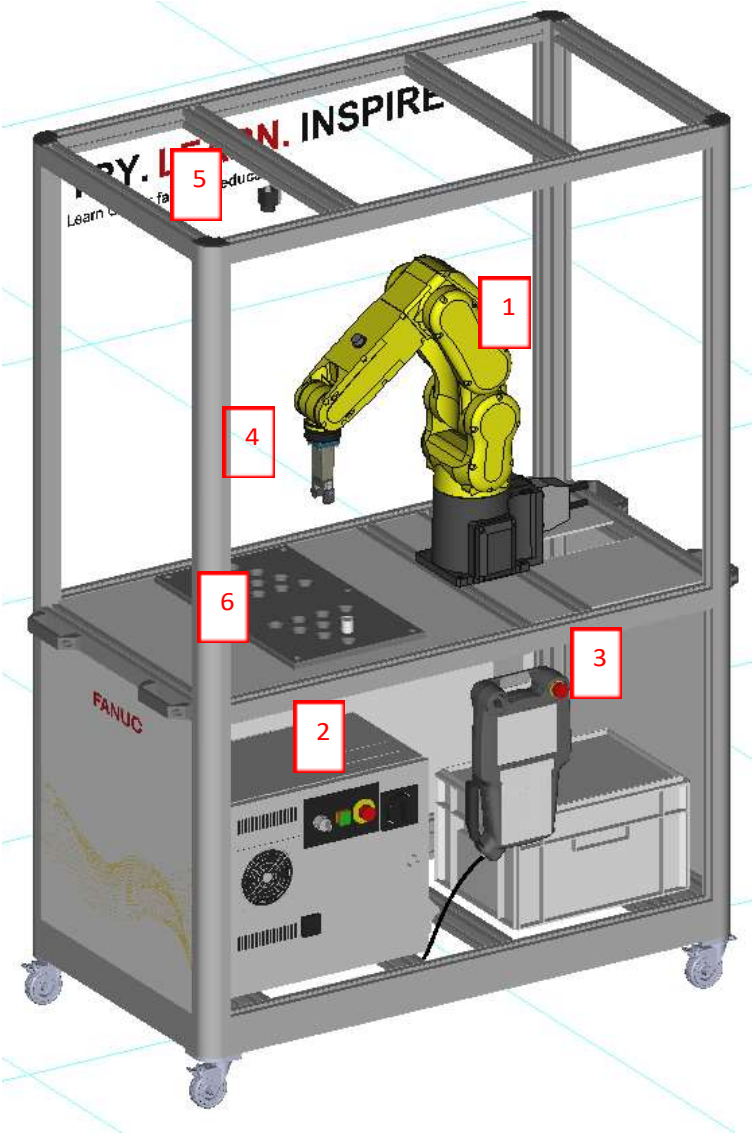
1	5 complete sets of competition equipment as shown in section above. Each team has a space of approx. 4m x 5m to provide some separation between the teams. 五套以上所示竞赛设备。 每个团队大约有一个空间。4米x 5米，让团队之间有一定的距离。
2	Public exhibition / engagement area where skill can be demonstrated to public and other interested parties公众展览/参与区，向公众及其他有关人士展示技能
3	Judges/experts area 法官/专家领域
4	Booth is surrounded by low wall. Since each robot cell is self-contained and guarded, there is no need for special protection for spectators, so they can get close up to the competition cells. The cells have large transparent rear window allowing clear view for spectators.摊位四周都是矮墙。由于每个机器人单元都是独立的，并且是有保护的，所以观众不需要特殊的保护，所以他们可以接近比赛单元。牢房有一个大的透明后窗，让观众可以清楚地看到。
5	Storage, Expert and Competitor Rooms, if required.如有需要，提供储藏室、专家室和竞赛室。

Total area shown approx. 10 m x 23 m)

显示的总面积约为。10米x23米)

8.6.1 Standard FANUC Education Cell 8.6.1标准发那科教育单元

The Competition will use the well tried and tested FANUC Europe Education Cell as the basic platform for the test project.比赛将使用经过测试的FANUC欧洲教育单元作为测试项目的基本平台。



1	FANUC LR-Mate 200 id 机器人
2	R-30iB Mate Plus控制器
3	iPendant示教器
4	Schunk EGP40电动夹持器
5	iRVision摄像头
6	Standard cell is equipped with pick and place application配备了拣选和放置应用的标准单元模块

The cell uses the FANUC LR-Mate 200iD together with the latest generation R-30iB Mate Plus controller. The robot is equipped with integrated iRVision 2D camera system, and a Schunk EGP40 gripper.

The standard cell comes with full instructions and exercises which the competitors can use to prepare themselves for the competition. The cell also comes with a running 'pick and place' application which will be replaced for the competition.

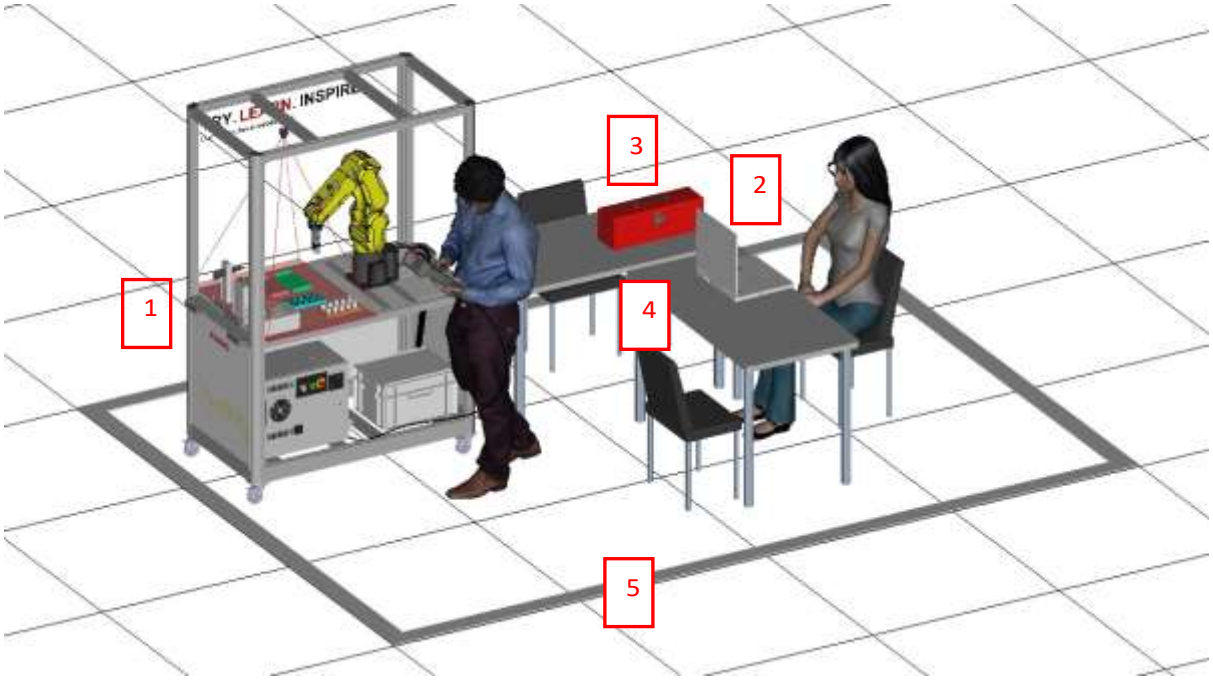
该单元使用FANUC LR-Mate 200iD和最新一代R-30iB Mate Plus控制器。该机器人配备了集成的iRVision 2D摄像系统和一个Schunk EGP40夹持器。

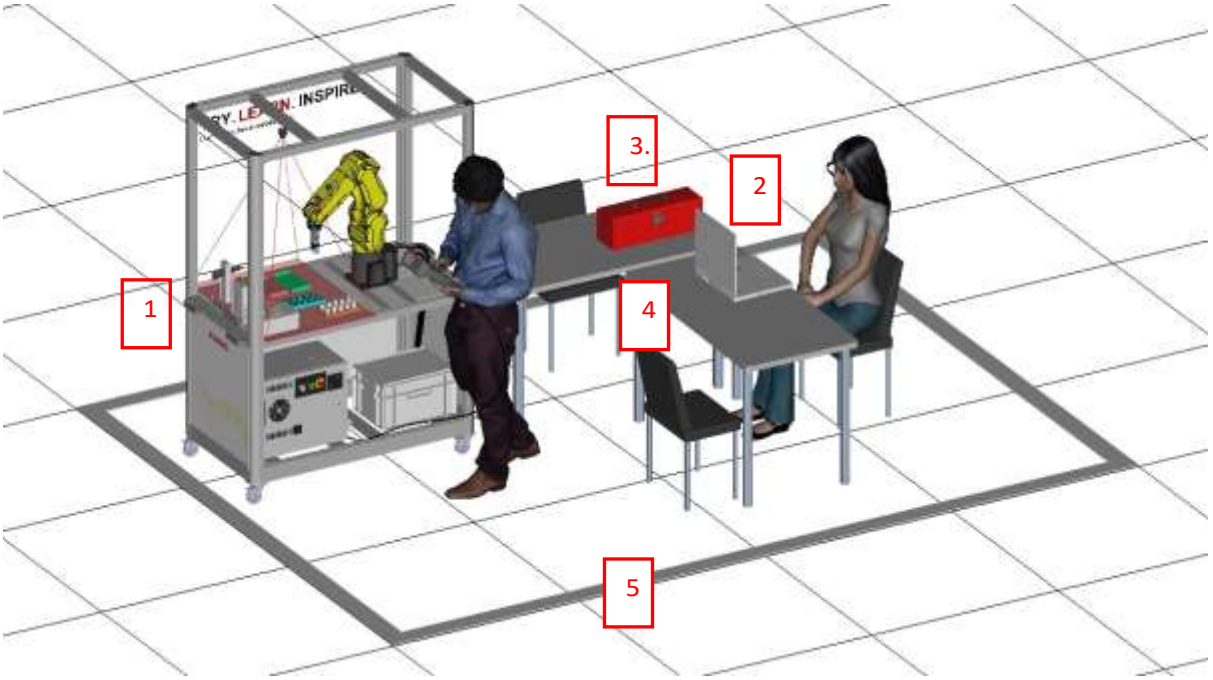
标准单元配有完整的指导和练习，参赛者可以使用这些指导和练习为比赛做准备。这款手机还配有一个正在运行的“挑选地点”应用程序，将在比赛中被取代。

8.6.2 Additional Equipment额外的设备

In addition to the FANUC Education Cell, some additional equipment is needed as shown below:

除 FANUC单元模块外，还需要一些额外的设备，如下所示:





1	FANUC Education Cell, modified to support a Competition-specific Test 教育单元模块，修改为支持比赛的特制测试项目

2	Laptop with pre-installed software: Roboguide / Sharepoint designer / Office etc 预装软件的笔记本电脑:Roboguide / Sharepoint designer / Office等
3	Simple toolkit. No special tools should be required for the competition – no soldering / crimping etc. (Electrical connections will be made by simple push-in cage-clamp terminals) So only simple tools will be required - screwdrivers, pliers, allen keys, ruler / vernier measuring equipment etc. Support staff should have additional tools to repair any accidental damage. 简单的工具包。 比赛不需要特殊的工具-不需要焊接/卷曲等(电气连接将通过简单的推入笼夹终端进行) 因此，只需要简单的工具-螺丝刀，钳子，艾伦内六角扳手，尺子/游标测量设备等。 支持人员应该有额外的工具来修复任何意外损坏。
4	Tables and chairs for the competitors为参赛者准备桌椅
5	Minimum space per team is 3m x 4m每队最少场地3米x4米

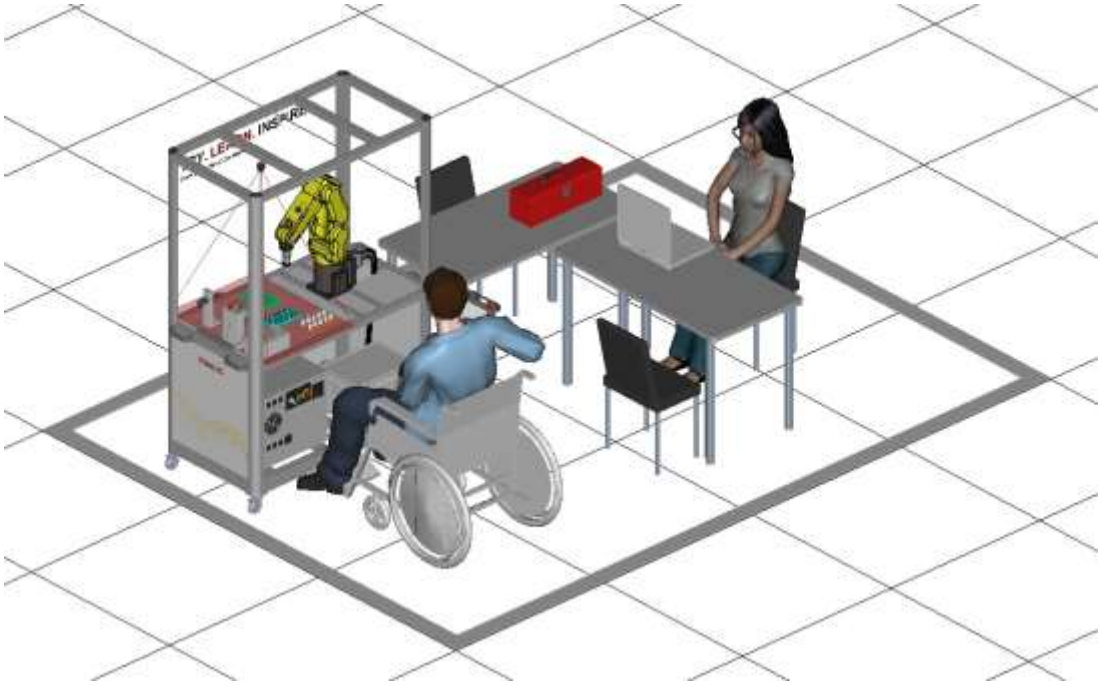
8.6.3 Wheelchair Users轮椅使用者

Most, but not all of the tasks can be carried out by competitors in wheelchairs, for instance:

大多数但不是所有的任务都可以由坐在轮椅上的参赛者完成，例如:

Simulation / Offline programming模拟/离线编程
Robot / Vision System setup & programming ocumentation
机器人/视觉系统设置和编程文档

Some of the Electrical connections
一些电气连接



But other tasks such as mechanical installation inside the cell cannot be done from a wheelchair, so one team member could be in a wheelchair, but not both.

但是其他的任务，如在单元模块内的机械安装不能从轮椅上完成，所以一个团队成员可以坐在轮椅上，但不能都坐在轮椅上。

9 SKILL-SPECIFIC RULES专项技能规则

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 work flow, and documentation management and distribution.特定技能规则不能与比赛规则相抵触或优先于比赛规则。它们确实提供了具体的细节和清晰的领域，这些领域可能因技能比赛而异。这包括但不限于个人IT设备、数据存储设备、internet访问、流程和工作流程，以及文档管理和分发。

TOPIC/TASK主题/任务	SKILL-SPECIFIC RULE专项技能规则
Use of technology – USB, memory sticks使用技术-USB，记忆棒（应该是U盘吧）	Competitors are only allowed to use memory sticks provided by the Competition Organizer. 参赛者只可使用比赛主办机构提供的记忆棒。 Memory sticks or any other portable memory devices cannot be taken outside the workshop. 记忆棒或其他便携式记忆设备不能带出车间。 Memory sticks or other portable memory devices are to be submitted to the Chief Expert or to the Deputy Chief Expert at the end of each day for safe keeping.记忆棒或其他便携式存储设备应在每天结束时交首席专家或副首席专家保管。
Use of technology – personal laptops, tablets and mobile phones科技的使用-个人笔记本电脑，平板电脑和手机	Experts and Interpreters are allowed to use personal laptops, tablets and mobile phones in the Expert room only.专家和口译员只能在专家室使用个人笔记本电脑、平板电脑和手机。 Competitors are not allowed to bring personal laptops, tablets or mobile phones into the workshop.参赛者不得携带个人手提电脑、平板电脑或手提电话进入工作坊。
Use of technology – personal cameras使用科技-个人相机	Competitors, Experts, and Interpreters are allowed to use personal photo and video taking devices in the workshop at the conclusion of the competition only.参赛者、专家及翻译人员只可于比赛结束时在工作坊内使用个人摄影及录影器材。

10 VISITOR AND MEDIA ENGAGEMENT

The following ideas may be considered to maximize visitor and media engagement:

- Display screens - some web cams could be dispatched on the Competition area and show details of the task to the public and on a website;
- Test Project descriptions;
- Enhanced understanding of Competitor activity;
- Competitor profiles - For each Competitor team provide a sticker with the national flag, the name of the Competitor and a brief description of their studies;
- Daily reporting of Competition status;
- Do it yourself workshop - in the Robot System Integration workshop provide an area where young people and public can work with a Robot System – for instance a standard Education Cell. This activity could be managed by a students of from the Host Country/Region.
- Display videos of typical Robot Systems and Applications.
- Large Industrial Robot could be installed as an eye-catching static display

The back side of the FANUC Education Cell, opposite to the opening side where the Competitors work, is a full-size plexiglass window – see below.

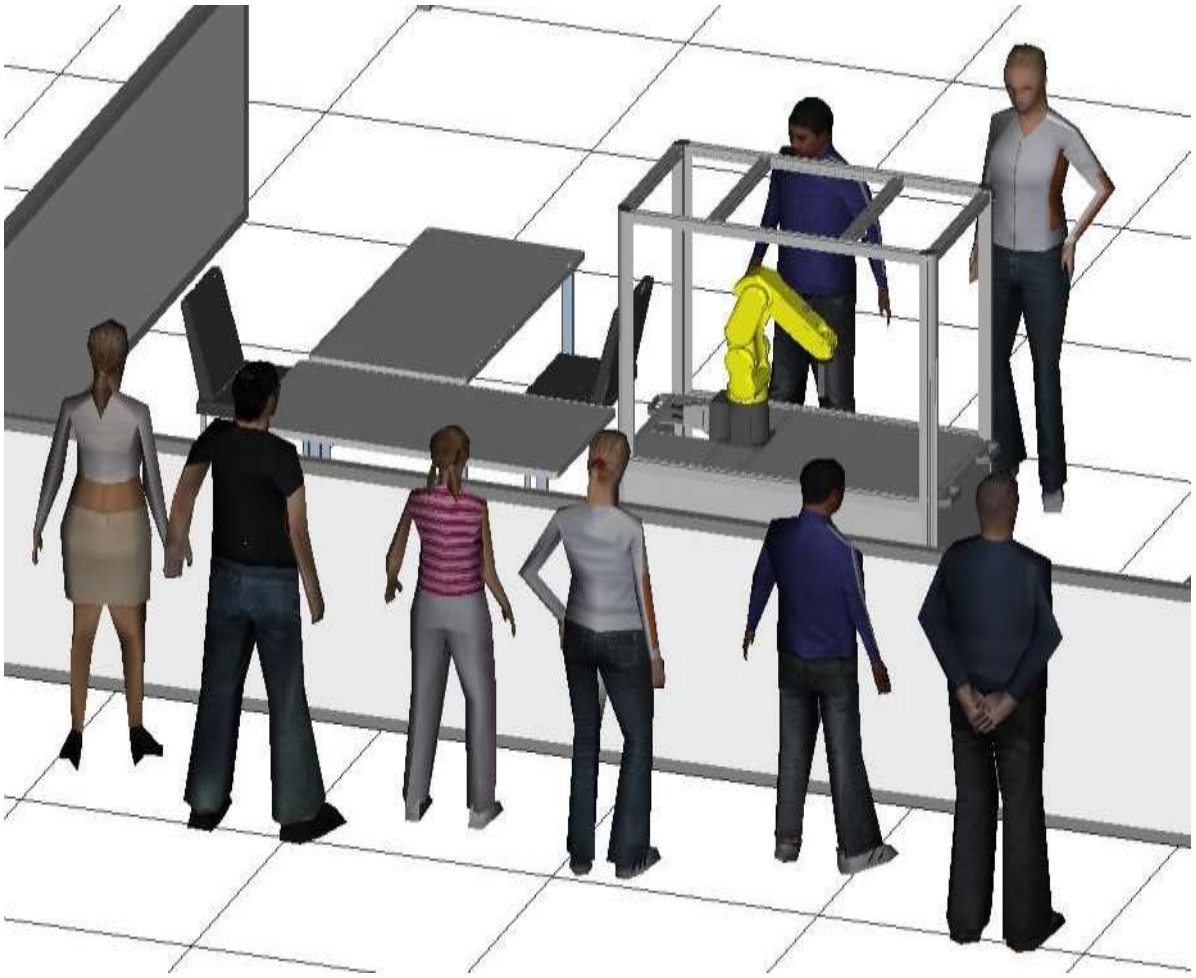
This allows spectators a complete view of the robot application, without any safety issues.

11 访客及传媒参与

以下的想法可以被认为是最大限度地提高访问者和媒体的参与度:

- 显示屏-可在比赛场地安装一些网络摄影机，向公众及网站展示比赛详情;
- 测试项目描述;
- 加强对参赛选手活动的了解;
- 参赛队伍简介-每队提供国旗贴纸、参赛队员姓名及学习情况简介;
- 每日汇报比赛情况;
- 自己动手工作坊-在机器人系统集成工作坊提供一个区域，让年轻人和公众可以使用机器人系统-例如一个标准的教育单元。这项活动可由东道国/区域的学生管理。
- 展示典型机器人系统和应用的视频。
- 大型工业机器人可以作为一种引人注目的静态显示器安装

FANUC单元模块的背面，与参赛选手工作的开放侧相对，是一个全尺寸的有机玻璃窗户——见下图。这允许观众完整地查看机人应用程序，而不存在任何安全问题。



12 SUSTAINABILITY

This skill competition will focus on the sustainable practices below:

- Recycling;
- Use of “green” materials;
- Test Project, Robot and equipment manuals etc. provided in electronic rather than paper form
- 11可持续发展
- 这项技能比赛的重点是以下可持续发展的做法:
- 回收;
- 使用“环保”材料;
- 测试项目、机器人及设备手册等以电子形式而非纸质形式提供

13 REFERENCES FOR INDUSTRY CONSULTATION

WorldSkills is committed to ensuring that the WorldSkills Standards Specifications 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 Standards Specification 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.**oneto**nline.org/)

This WSSS (Section 2) appears most closely to reflect 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

14 行业咨询参考资料

WorldSkills致力于确保WorldSkills标准规范充分反映国际公认的工业和商业最佳实践的活力。为了做到这一点，WorldSkills与世界各地的许多组织进行了接触，这些组织可以在两年的周期内就相关角色的描述草案和WorldSkills标准规范提供反馈。

与此同时，WSI咨询了三个国际职业分类和数据库:

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

这个WSSS(第2节)最接近地反映了机器人技术人员:
https://www.onetonline.org/link/summary/17-3024.01

机器人工程技术人员:http://data.europa。http://data.europa.eu/esco/occupation/7833d5cd-873d-4fdd- b2f8-9762d68494a7