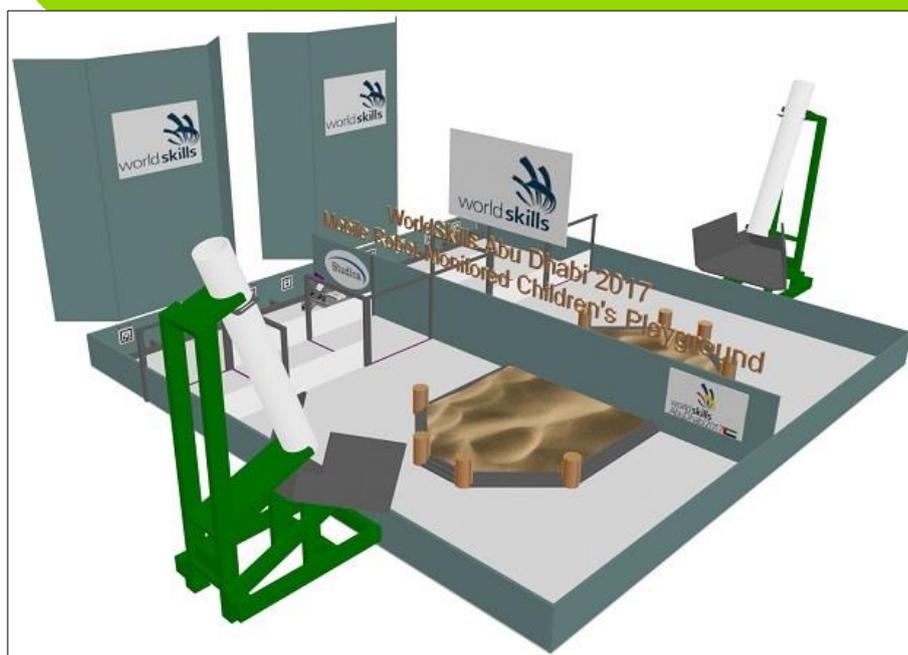


TEST PROJECT MOBILE ROBOTICS

COMPETITOR INFORMATION DOCUMENT

Playground Monitor Robot

场地检测机器人 选手比赛信息文件 机器人试题



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1. INTRODUCTION

Mobile Robots are used in a variety of applications to:

移动机器人广泛应用于如下情形:

- Move between known in advance locations in prescribed in advance movement patterns
- 按照指定模式在已知指定位置间移动
- Interact with known objects positioned in known in advance locations and move these known objects to known in advance new locations
- 与在已知位置的已知物体互动，并将之移动到已知的新位置
- Interact with known objects positioned in unknown in advance locations and move these known objects to unknown in advance locations
- 与在不明位置的已知物体互动，并将之移动到未知的新位置
- Distinguish in a group of similar objects between those that are objects of interest and those that are not of interest
- 在感兴趣和不敢兴趣的对象之间做出区分
- Interpret and respond to specific features found in the robot's performance environment to manage overall mobility and the robot's object management system autonomously
- 对所处的环境特征作出理解和反应，并自动进行移动行为管理和任务对象管理
- Support the involvement of a remotely positioned tele-operator to manage the robot's object management system in situations where the tele-operator has or does not have direct line of sight access to the robot
- 在操作者可以或者不可以直视机器人的情况下，支持远程操作以进行对象管理

The role of the WorldSkills Mobile Robotics Task is to provide a structure which enables the Mobile Robotics Technician Competitors to showcase their knowledge, skills and talents during the Competition Days and within the bounds of the Competition Space.

世界技能大赛移动机器人项目比赛提供了一种范式，这种范式可以让移动机器人专业技术人员在竞赛日和特定比赛空间内展示他们的知识，技能和才能。

The '**Playground Monitor Robot**' task concept reflects a **FUTURE** Vendor Driven Mobile Robot application. The premise is that in the future a playground monitor robot would have performance capabilities similar to the Dubai Robot Police Officer shown below scheduled to be introduced in 2017.

“场地监控机器人”任务概念来源于机器人供应商的未来移动机器人应用。前提的假设是，未来的场地监控机器人将具备机器人警察类似的功能，这种机器人警察计划于2017年在迪拜推出。



Computing Capability 计算能力

- Artificial Intelligence supported by IBM's supercomputer Watson
- 超级计算机支持的人工智能

Communication Performance Capability 通讯性能

- Ability to maintain a communications link with a Home Base Computer可以与主机保持通讯
- Virtual Assistant System supporting the ability to interact directly with parents and children through an on the robot touch screen computer as well as through audio虚拟协助系统可以通过机器人触摸屏和语音，与父母和儿童进行互动

Mobility Performance Capability 移动性能

Able to move in autonomous or tele-operation control mode: 能够以自动或者远程遥控模式移动

- On carpeted or hard flat surfaces在地毯或者硬平面上移动
- Can 'See' it's surrounding environment and can interpret / recognize / respond appropriately to environmental features when moving在移动的时候可以看到并认知、理解周边环境并做出合适的反应
- Able to move in response to voice commands能够根据声控命令移动



Interactive Performance Capability

- Can utilize Facial Recognition to identify children at a distance up to 20 meters能够在20米内利用人脸识别系统进行儿童辨认
- Can reach out verbally to children可以音控接近儿童
- Can motion / wave arms and hands plus bend down towards children to communicate可以挥动手臂、手并弯腰与儿童沟通
- Can hold hands with and gently lead children to a pre-determined location能够握住儿童的手并轻轻地将其领到事先指定的地点
- Can recognize the correct parent to ensure the child is safely returned to their own family能够识别正确的父母来确保儿童回到自己的家庭

2. COMPETITOR ROBOTS 竞赛机器人

The 'Competitor's Playground Monitor Robots' are based on [Current Generation](#) Mobile Robot Technology with lower performance thresholds than the Dubai Community Police Robots.

选手的场地监控机器人基于当代机器人技术，其性能略逊于迪拜的社区警察机器人。

Competitors Design / Fabricate / Manage (Program) a Competitor Designed / Built Robot capable of moving in [Autonomous and Teleoperation Control Mode](#) within the 2 by 4 metre Competition Performance Environment Court while conducting a 'Search for Designated Children'. Once a Robot has taken Full Control of a Designated Child the Robot returns to the Reception Area, locates the Parent of the Child and returns the Child to the Correct Family.

参赛选手设计/制造/管理(计划)/构建的机器人能够在2×4米的场地按照“自主控制模式”和远程控制模式搜索指定儿童。一旦机器人完全控制了指定的孩子，机器人带其返回到接待区，在找到孩子的父母后，将孩子送回到正确的家庭。



Competitors Design / Fabricate / Manage a Competitor Designed / Built Object Management System that is capable of functioning in **ALL Three** of the following **Control Modes**:

选手设计制作的机器人应当完全胜任以下三种控制模式

Object Management System Option One: The Competitor's Object Management System can function in **Autonomous Control Mode** and is capable of taking control of ONE Child at a time.

目标对象管理系统选项一：目标对象管理系统在自主控制模式下一次控制一个小孩

Object Management System Option Two: The Competitor's Object Management System is capable of taking control of ONE Child at a time under the control of a Tele-operator who **HAS Direct Line of Sight Access to their Robot and Object Management System**.

目标对象管理系统选项二：目标对象管理系统在第三视角的远程操控模式下一次控制一个小孩

Object Management System Option Three: The Competitor's Object Management System is capable of taking control of ONE Child at a time under the control of a Tele-operator who **DOES NOT HAVE Direct Line of Sight Access to their Robot and Object Management System**. In this control mode Competitors must rely on the 'Robot's Eye View': A live video sent from the robot to the Competitor's Lap Top.

目标对象管理系统选项三：目标对象管理系统在第一视角的远程操控模式下一次控制一个小孩。（通过机器人摄像头传输到笔记本或者平板的画面来看）

3. MOBILE ROBOTICS TECHNICIAN'S JOURNAL 移动机器人工程日志

Competitors **MUST** create a 'Mobile Robotics Technician's Journal' describing their Robot's Development to: 选手必须创建一个“移动机器人工程日志”，来描述机器人的创建过程，可用于以下方面：

- Serve as a resource for the Competitors when they are assembling their robot, and, 作为组装机器人时的技术文本资源
- Serve as a resource for the Competitors when / if they are asked questions by an Evaluating Expert Panel during some of their evaluation experiences 在评价环节中，作为用来回答裁判提出问题的资源

Competitors **MUST** create two copies of their 'Mobile Robotics Technician's Journal' One with English Text and the other in a language of the Competitor's choosing. 选手必须创建 2 份工程日志，一份为英语，另一份语种自选。

A printed copy and a PDF file version of the English Text Mobile Robotics Technician's Journal **MUST** both be handed in to the Expert's Jury Panel on C-1 the Competition Familiarization Day. 移动机器人工程日志的打印版和 pdf 文档各 1 份都必须于场地熟悉日即 C-1 日提交到专家裁判团

The Mobile Robotics Technician's Journal is expected to include content in the following areas: 工程日志应当包括以下 5 个方面

- 1) The Frame / Structural Elements Organization / Strategy 框架、结构要素组织、策略
- 2) The Wiring System Organization / Strategy 布线系统组织、策略
- 3) The Mobility Management System Organization / Strategy 移动管理系统组织、策略
- 4) The Object Management System Organization / Strategy 目标对象管理系统、策略
- 5) The Computer Programming Organization / Strategy 计算机编程组织、策略

4. COMPONENT COLLECTION: ALLOWABLE ADDITIONAL COMPONENTS

组件套件：允许的额外组件



Following the start of February Competition Preparation Week Meetings the Skill Management Team will publish the guideline that will apply in the following areas:二月初竞赛准备周会议后，技能管理团队将发布应用于以下方面的大纲指南

- A) The maximum allowable \$ amount with respect to Team spending on additional components.使用额外组件允许的最大花费金额
- B) The response that will be applied if a Team is deemed to have exceeded the allowable \$ amount.使用额外组件花费超过要求的处理措施

Competitors **MUST** use the WSI 2017 Abu Dhabi Component Collection as the Primary Source for components when building / assembling / operating their mobile robot. 在组建和操作机器人时，选手必须将2017年世赛阿布扎比提供的组建作为主要来源

Competitors **MUST** use their Mobile Robotics Technician's Journal to provide the rationale on which the decision to purchase **EACH** additional component was made. 选手必须以移动机器人工程日志为依据，来说明购买每个额外组件的理由。

Competitors **CANNOT** purchase components as direct replacement / upgrades to the provided components. **Example:** Four Encoder Motors are provided and teams must use these motors. 选手不能购买组件来直接更换/升级已提供的组件。例如：组委会提供四个编码器，每个参赛队都必须使用这些编码器。

The following constraints that will affect the design and production of the robot must be adhered to.

以下影响机器人设计和制作的要求必须遵守：

1. The system **MUST** be designed to include the MyRIO as the main or only processing unit. 系统设计必须将MyRIO作为唯一或者主要的处理单元。
2. Programming **MUST** be accomplished in LabVIEW. 必须在LabVIEW中完成编程
3. Competitors **MUST** use the components provided in the 2017 WSI Mobile Robotics Component Collection as the Core Elements of their Competition Robot's Frame and Base Structure. 选手必须使用2017年世赛提供的套件组件作为竞赛机器人框架和基座结构的核心要件。
4. Teams **CANNOT** use any hydraulic pressure or barometric pressure.不能应用气压或者液压
5. Teams **CAN** use any sensors of their choice – provided they do not exceed the core capability of those provided in the component collection. Additional sensors must be accounted for in the allowed additional spending \$XXX 参赛队伍可以使用自选传感器——只要他们不超过组委会提供的传感器的核心性能。额外的传感器花费将计入到可允许花费的经费中
6. Teams can use any additional electrical motors and servos of their choice – no restrictions on brand or number of motors and servos used however teams must use the supplied motor control boards and motors cannot be more powerful than those supplied. Additional purchased control items will be accounted for in the allowed additional spending \$XXX. 选手团队可以使用自选的电动机和伺服，没有品牌和数量的限制，但是必须使用提供的电机控制板，并且电机不能超过组委会提供的电机的功率，这些额外的花费也将计入到允许的花费金额总数内。
7. Competitors are **NOT** to use Commercial, Off the Shelf, Straight Out of the Box Ready to Use Robot Components such as pre-assembled grippers and drive systems. 选手不能使用商用的、开箱即可使用的机器人组件，例如预装好的夹具和驱动系统。
8. Teams **MUST** use the supplied batteries 参赛团队必须使用供应的电池
8. All the parts for the robot **MUST** be disassembled and in their initial state (not pre-built) when the “assemble” time starts. For example, a tire cannot be put on a wheel until assembly time begins. 在比赛日“装配”时间开始之前，机器人的所有部件必须是拆卸并处于最原始状态的（不能提前组装）。例如，轮胎在组装时间开始之前不能安装在车轮上。



10. Teams should prepare and bring all the equipment, software and portable computers, they need during the competition 赛队伍必须准备和携带比赛所需要的设备、软件和笔记本电脑。



<p>All components / elements / parts that are structural in nature, their contribution is to hold / secure in place functional elements of the robot do NOT need to be accounted for in the listing of additional \$ spent to enhance the robot's performance capabilities. 所有部件/元件/部件在结构上是自然状态的，用于保持/固定机器人的功能元件，不需要纳入为了增强机器人的性能而购置组件清单的限制性预算中。（简单说就是无功能提升的原始组件不算钱）</p> <p>Example: Neither a purchased nor a competitor fabricated bracket with the functional purpose of holding a Linear Actuator in position needs to be accounted for in the listing of additional \$ spent to enhance the robot's performance capabilities. 例如：不管是购买的还是选手制造的具有线性制动器功能的支架，都被要求纳入用于增强机器人性能的额外花费中。（简单说就是有增强功能作用的组件要算钱）</p>				
<p>The following components are considered to be structural items and will not be counted in the \$XXX spending limit: 以下结构性的组件（非功能性的）不算钱</p>				
Channel and Tubing 通道和管道	Extrusions /压出胶 Beams 横梁	Gussets 三角形撑料	Linkages 连杆机构	Tank Tread 踏板
Plates and Brackets 板和托架	Clamping Mounts 夹紧座	Attachment Pieces 小附件	Stand offs and Spacers 支座和垫片	Wheels / Axles / Wheel Hubs 轮子/轮轴/轮毂
Mounting Hardware 安装用的硬件	Belting and Pulleys 皮带和滑轮	Linear slide systems 线性滑动系统	Fasteners 紧固件	Gears, Sprockets, and Chain 齿轮，链轮和链条
<p>All components / elements / parts that make a direct contribution to expanding the functional capabilities of the robot beyond that supported by the provided components MUST be accounted for in the listing of additional \$ spent to enhance the robot's performance capabilities. 任何不在已提供组件功能范围内且直接用于拓展机器人功能的组件，必须列入增强机器人的组件及花费清单中</p> <p>Example: A Linear Actuator provides a functional capability to reach forward and back again and as such must be accounted for in the allowed additional items account listing. 线性致动器提供了前进和后退的功能，因此必须在允许的附加项目列表中进行说明。（做一个额外功能性组件的费用清单）</p>				
<p>The following are NOT considered structural items and must be included in the \$XXX 以下组件不算结构性的（就是功能性的）需要纳入限额中</p>				
Motor and Servo Controllers 电机和伺服控制器	Additional Batteries 备用电池	Linear Actuators 线性致动器	Signal Modifiers 信号修改器	Speed Controls 速度控制器
Micro Controllers 微控制器	Single Board Computers 单板计算机	Additional Sensors 备用传感器	Additional Motors 备用电机	Gripper 夹具
<p>The following items will NOT be counted in the \$XXX spending limit: 以下项目不受额外开支额度限制</p>				
Cables, Wires, and Connectors 电缆，电线和连接器	Safety Switch 安全开关	Voltage Regulators 稳压器	Electrical Connectors 电气连接器	Relays 继电器
Switches 开关	Electronics Mounts 电子安装器	Breadboards 面板	Competitor manufactured items 选手制造的工具	Lead Screws 铅螺丝
Wheels 轮子	Competitor manufactured Sensor Interface Board 选手制造的传感器接口板		Competitor Supplied Remote for Tele-operation 选手提供的远程操控设备	

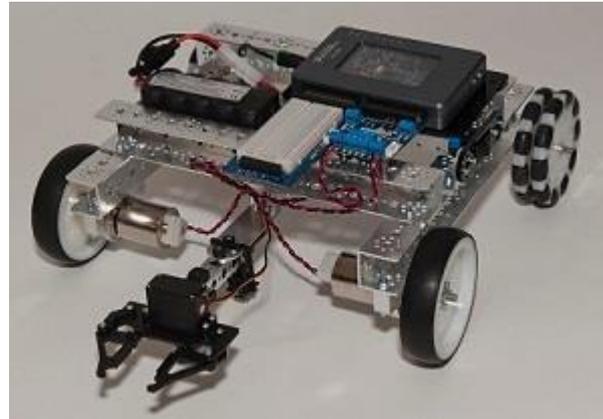


Computing Capability 计算能力

- Labview / NI MyRIO

5. COMMUNICATION PERFORMANCE CAPABILITY

- Ability to maintain a video communication link with an FPV Camera Receiver. 能够与 FPV 摄像机接收器保持视频通信
- No ability to support interactive communication with people other than its' assigned Home Station Operator 不是指与人互动的能力，而是指机器人支持与特定主机操作员的通讯能力



6. VISION PERFORMANCE CAPABILITY

Able to recognize Designated Parent Objects (Black and White Grid Patterns) as well as being able to identify Designated Children Objects (Solid and Striped American 2.25 inch Billiard Balls plus an All White Cue Ball)



能够识别指定的父母目标（黑白网格图），还能识别指定的小孩目标（2.25 英尺的美式落袋台球中的全色球、半色球和白球）

7. MOBILITY PERFORMANCE CAPABILITY 移动性能

Able to move in autonomous and teleoperation control mode:能够在自主控制和远程操作下移动

- **Compulsory Mobility Capability** involves movement on hard flat surface 必须要求完成的移动能力：在硬平坦表面上的运动
- Mobility in relationship to the structures within the 2 by 4 metre Exclusive Use Competition Court Performance Environment Space 在 2×4 米专用比赛区内的移动（结构性的空间，就是有挡板）
- Mobility within a Maximum Robot Occupancy Space that is 600 by 600 by 500 mm. 在机器人最大占用 600×600×500mm 的立体空间内的移动（可以伸出机械臂超出空间限制，但是不做抓取动作收缩机械臂不超过限制空间即可）
- **Optional Mobility Capability** involves movement **UP / DOWN** a set of steps, **INTO / Out Of** and **AROUND IN** a floor area covered with a minimum 57 mm deep layer of sand. 可选的（非要求的）移动能力展示：上下台阶，进入/退出至少覆盖 57 毫米沙层的区域并旋转。



8. TARGET OBJECT MANAGEMENT CAPABILITY 目标对象管理能力



A set of American Billiard Balls, diameter 2.25 inches, will fill the role of 'Children' in the Playground Monitor Robot Task. 一套直径为2.25英寸美国的桌球，在机器人场地活动任务中扮演“儿童”的角色。

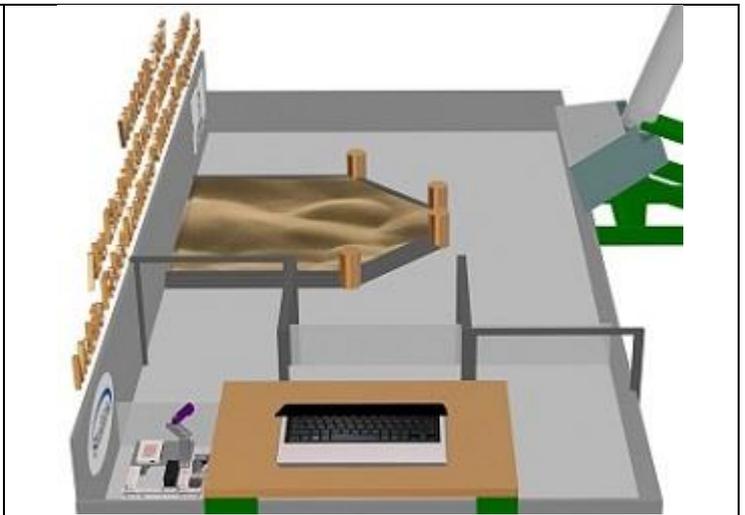
Competitors will Design / Fabricate and Operate an Object Management System with the following capabilities: 目标对象管理系统具备下列能力

- Can be managed / operated autonomously **and** through a Teleoperation Based Control System 在自主控制模式和远程操控模式下运行
- Can function when the Teleoperator either **HAS** or **DOES NOT HAVE** Direct Line of Sight Access to their Robot / Robot's Object Management System 能够在第一视角和第三视角下运行

The Object Management System and the Robot in combination can be in possession of a **Maximum of ONE Child** at a time. 移动机器人的目标对象管理系统一次最多控制一个小孩



In the **NO Direct Line of Sight** situation the Object Management System Tele-operator's Courtside Workstation includes both their Lap Top and their FPV Camera Receiver. The Robot's video signal is sent **ONLY** to the FPV Camera Receiver. 不可直视的情况下（第一视角），目标管理系统遥控操作员的场边工作站有笔记本电脑和 FPV 摄像接收器。机器人的视频信号只输送至 FPV 摄像接收器。



In the **Autonomous and Direct Line of Sight** situations the Object Management System Tele-operator is positioned in a fixed location behind their computer table and can see the Full Performance Evaluation Space but cannot see their Lowered Lap Top computer screen. 在自主控制模式和可以直视机器人及目标对象下（第三视角），操作员在电脑桌后的位置固定，可以看到演示测评场地空间的全貌，但不允许看笔记本屏幕。

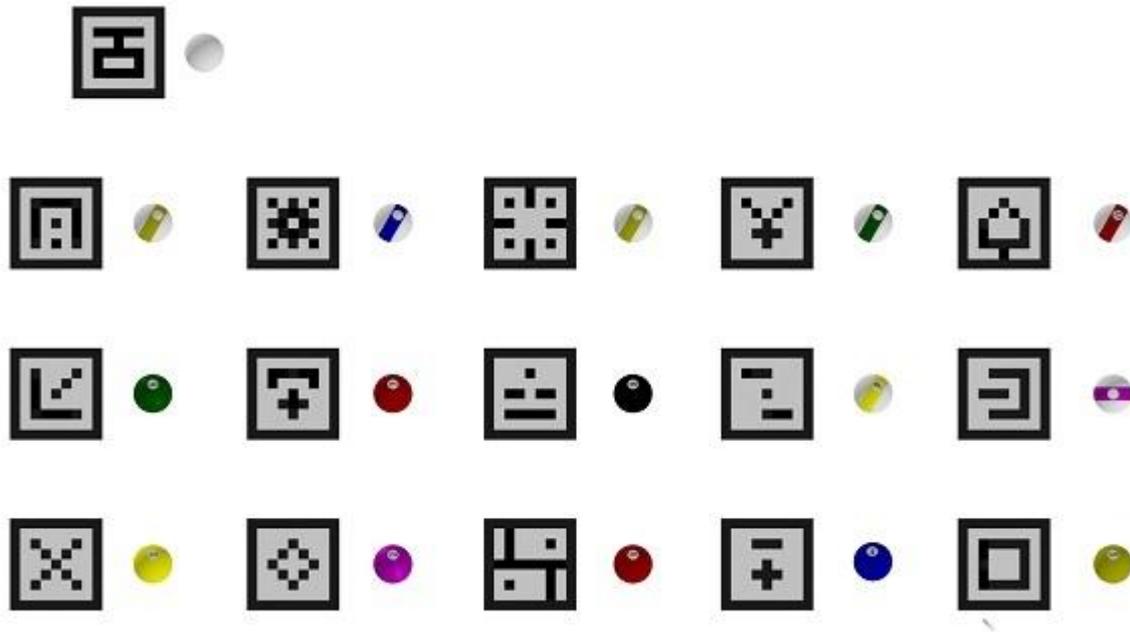
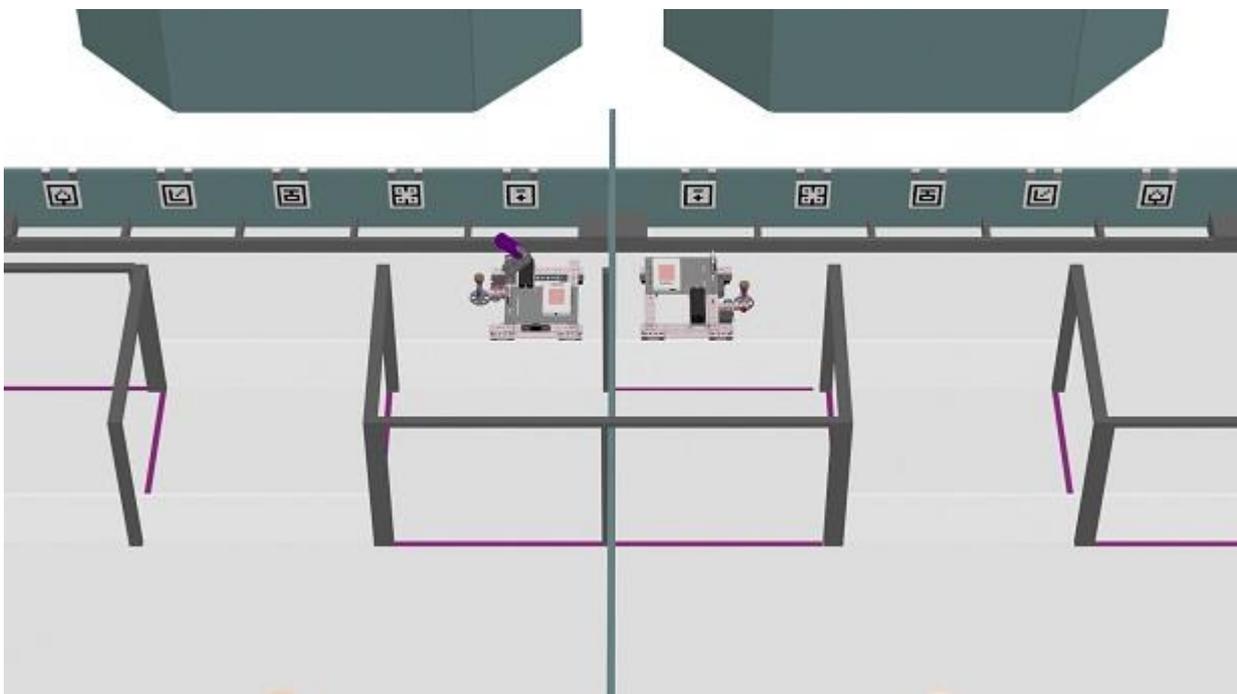


IMAGE: The image above displays the Full Complement of the “Task Families”

图像：以上展示的是“任务家庭”中的全部图像（网格是指家庭，台球是指小孩，比赛现场将指定对应关系）



ALL Teams **MUST** prepare their Robot to be able to execute Evaluated Task Runs when at the Start of the run the Parent Booths are EITHER on the Right OR the Left side of the Robot.所以参赛团队都必须要为在比赛场地左侧或者右侧执行被评价的任务（不知道被分配到左侧还是右侧，所以需要为两种可能做准备）



9. A TWO CAMERA DIRECT LINE OF SIGHT / TELE-OPERATED OBJECT MANAGEMENT SYSTEM SOLUTION

两个摄像头直视下远程操控目标对象管理系统方式

The Two Camera Solution is intended to: 2 部摄像头的作用

- a) Internalizes Camera Management to the on the Robot MyRIO which will support Autonomous Mode Mobility and Object Management Functionality Free from any potential competition space signal interference issues. 内置的摄像头管理系统嵌入至 MyRIO 中，可以使机器人在自主控制模式下运行，免收场地潜在信号的干扰
- b) Enable the Tele-operation mode to take place with the Tele-operator NOT Having Direct Line of Sight contact with their Robot which is the most realistic Tele-operating arrangement. 可以在操作者看不见机器人的情况下实施远程操控，这也是远程操控管理最有现实意义的地方。

THE SEARCH CAMERA 搜索摄像头

- This camera is managed exclusively by Labview and all images are analysed on the robot through MyRIO. This camera does NOT send any images to an 'Off the Robot Device'. This is the camera directly involved in the process of identifying Children (Billiard Balls), Parents (Black and White Grid patterns) plus any additional movement management responsibilities Competitors choose to assign to the camera. 摄像头只能用 Labview 操控，所有的图片都通过 MyRIO 进行分析。摄像头不会发送图片至任何不安装在机器人上的设备。这台摄像头直接参与辨认儿童（台球）及父母（黑白网格），以及完成其他选手分配给摄像头的运动管理任务。
- This puts Labview and MyRIO in full control of managing the processing resources committed to the major vision task elements involved in the search process without the burden of sending a constant live video signal to an off the robot lap top. 这就使得 Labview 和 MyRIO 充分控制和管理任务过程中视角任务搜索出来的资源，从而无需将持续的视频信号发送至机器人外部笔记本。
-

THE TELE-OPERATION CAMERA 远程操控摄像头

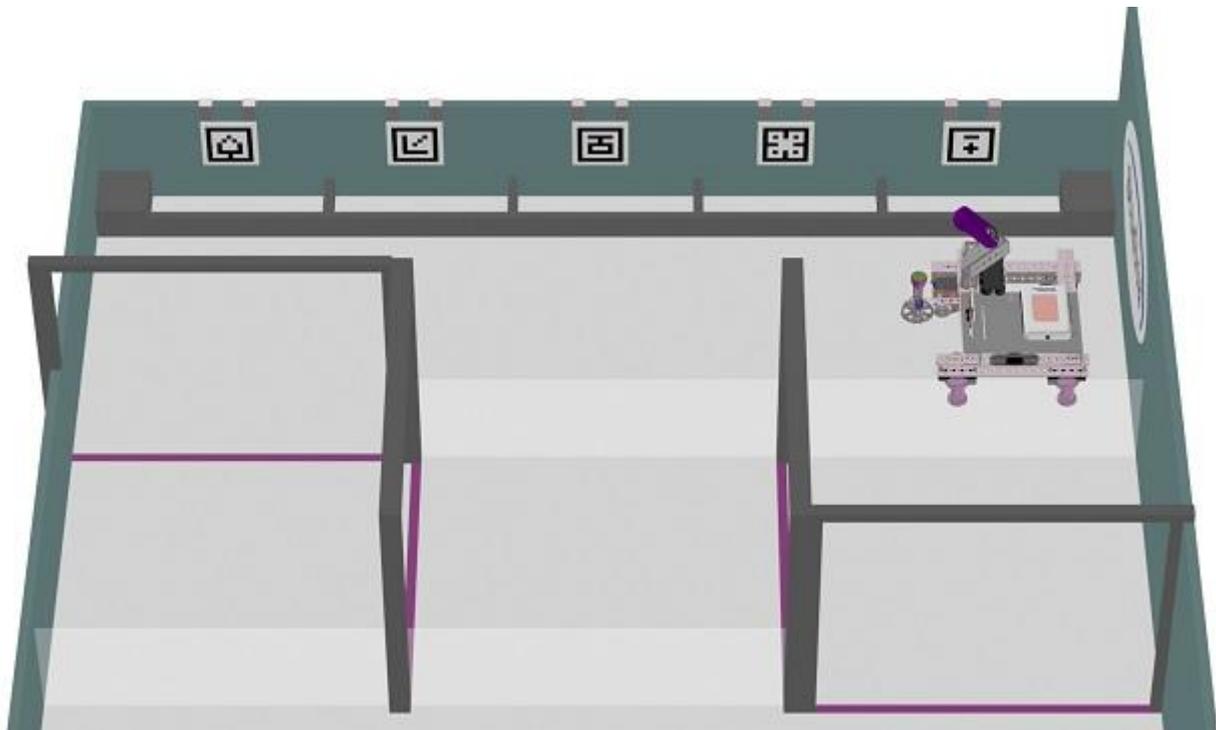
- Competitors will be provided with a separate FPV Camera, a 5.8Ghz transmitter and a small 4.3" monitor/receiver for use during their competition preparation experiences to support the teleoperation of their Object Management System having NO Direct Line of Sight Access to their Robot or Object Management System. 选手在比赛准备过程中会得到一台 FPV 摄像头，一个 5.8 千兆赫的发射器及 4.3 寸的监测器，用来在第一视角下远程操控目标对象管理系统。
- At the competition Competitors will be provided with larger HD 7" LCD receivers. These will also have HDMI out so that they can be wired to large screens for viewing by the audience. 比赛时，选手拿到更大的 HD 7 寸的 LCD 接收器。有 HDMI 输出，所以可以连接到更大的屏幕以便观众观看。
- Competitors will have to decide how to power these cameras. 选手需要决定/考虑机器人如何给摄像头充电
- These cameras will have NO interaction with the Competitor's Lap Tops, or MyRIO. 这些摄像头与选手的笔记本或 MyRIO 没有连接。
- These cameras provide the video image the Tele-operator will use when they are operating their Object Management System. 这些摄像头提供远程操控者在操作目标对象管理系统时需要用到的视频图像
- ALL Teams will be required to position a light on their Robot where this light is always in the Field of View of the Tele-operation Camera. Robots will need to be programmed to Turn this Light ON at the end all Autonomous Performance Sequences. This will alert the Tele-operator that it is time for them to take control and operate the Object Management System to retrieve or deliver a Child (Billiard Ball). 所有参赛队都将被要求在机器人上装灯，这盏灯会一直在遥控摄像头的视野之内。需要编程实现在自动演示序列（就



是自主控制模式下任务的完成)结束时亮灯。这会提示遥控操作员去操作目标管理系统中重新寻找或运送一名儿童(台球)。

- When the Tele-operator has completed their task, they will use their Tele-operation Device to signal the Robot to move forward with its' next Autonomous Performance Sequence. 遥控操作员完成任务后, 发送信号给机器人, 使其开始下一个自主控制模式下的任务。

In Abu Dhabi, the Performance of the Tele-operation Cameras will be monitored to confirm their in the Competition Space functional reliability during Competition Days 1, 2 and 3 when they have no role in the marking experiences. The goal is to have Competition Day 4 involve Tele-operation with No Direct Line of Sight Access to the Robots given this is the most realistic tele-operation application format. However, **IF our Competition Days 1, 2 and 3 experiences demonstrate the presence of IN the Competition Space signal problems with the Tele-operation Camera / HD 7" LCD receiver pairings then C4 will be made a Tele-operation Day WITH Direct Line of Sight Access to the Robot.** 在阿布扎比比赛前三天遥控摄像头没有参与评分任务的情况下, 对遥控摄像头的性能进行观测, 评价其稳定性, 目标是让其在比赛第四天实现不直视机器人情况下的遥控功能——这是最真实的遥控应用形式。但是, 如果比赛前三天的经历表明赛场遥控摄像头与 HD 7" LCD 接收器发生信号配对问题, 那么第四天在可以直视机器人的条件下来进行遥控。



THE PLAYGROUND RECEPTION AREA 场地接待区

The Playground Reception Area is comprised of: 场地接待区由以下组成:

- An Entry Passageway with Clear Plastic Side Walls 200 mm Tall and providing a 600 mm wide travel space with a maximum overhead clearance allowance of 500 mm. 入口通道侧面有 200mm 高的干净的塑料墙面, 还有 600mm 宽的通行空间, 允许的最高高度为 500mm
- A Row of Parent Booths, with 100 mm tall front walls, along the longest wall of the Reception Area • 一排有高 100mm 前壁的父母区, 父母区沿着接待区域最长的墙体
- The Parent Grid Patterns will be mounted on Thin, Flat Plates that have either Velcro Tape on the Back of the Plates or Hooks. The Back Wall of the Parent Booths will also have Velcro Tape or support for the hooks which will allow for easily changing the Position of Parent Patterns between Task Runs necessary



to support the True Search Element of the overall task. 父母网格将被安装在轻薄平坦的板子上，板子背后有 Velcro 胶条或有钩子。父母区所在隔间的后墙也有 Velcro 胶条或可以支撑钩子，这样就可以随意改变父母网格位置，体现整体任务设计中的真实搜索要求。

- The Designated Robot Starting Position is Inside a 600 by 600 mm Tape Line Square at the end of the reception area farthest from the Reception Area Entry. 指定的机器人的开始位置在 600*600mm 的胶条方块内，位于接待区域入口远端。
- ALL of the Performance Environments physical features will be put in place on Familiarization Day and will remain unchanged throughout the Four Competition Days. 所有演示环境的外在特征都会在熟悉日摆放到位，在四天的比赛时间内不予改变。

PLAYGROUND ENTRY SLIDE 场地入口滑道

- The 16 Children (Billiard Balls) will be placed in the Top of the Entry Slide prior to the Start of each Evaluated Task Run 每次打分任务开始前，16个儿童（台球）会被放置在入口滑道的顶部。

The order the balls are placed in the slides will be identical for ALL courts. This is intended to bring a suitable degree of equity to the otherwise Random Placement of the Children (Target Objects) in the multiple courts running Evaluated Task Runs at the same time. 台球放置在滑道内的顺序（即台球编号放置顺序一致）对于所有场地都是一样的。这将在一定程度上保障在不同场地同时随机放置儿童（目标物）开展测评任务的公平性。

Note:注意

Random Placement of the Target Objects in NOT Known to the Competitors in advance positions is essential to enable a 'True Search for the Designated Five Children' element to be part of the task experience. 目标球的随机放置，使选手无法提前得知其具体位置。这是任务过程体现真实搜索的关键。

Note:

If a Ball lands either Outside the Playground Entirely or On Top of a Sand Area Pillar then the following procedure will be followed: 如果一个球完全落在场地之外或是在沙地柱子上面，那么处理程序如下：

- The Ball will be picked up by a Court Area Supervising Expert 此球由监视专家捡起来
- The Ball will be placed in the Entry Slide 此球放置入滑道
- The Entry Slide Procedure will be repeated for this Single Ball 此球重新发球。







PLAYGROUND 场地

The 16 Children (Billiard Balls) will tumble out of the Entry Slide Chute into a Playground consisting of: 16个儿童（台球）将通过进入滑道的斜槽进入场地

- A U-shaped open / hard / smooth surface floor area 一个 U 形开阔/坚硬/平滑的地面
- A Central 57 mm deep 1100 by 1257 mm Sand Filled Area with a perimeter frame consisting of step sections each with 3 steps having a 19 mm Rise and 25 mm Run per step 中间 57mm 深，1100*1257mm 的沙区，沙区外围是边框式结构架，结构架有 3 级阶梯，每级垂直高度为 19mm，宽度为 25mm.
- Four Dia. 100 mm 180 mm tall Cylindrical Pillars 4 个直径 100mm，高 180mm 的圆柱
- A 600 mm wide 500 mm tall archway entry / exit opening 一个 600mm 宽，500mm 高的拱门入口/出口。

10. DESCRIPTION OF THE PROJECT AND TASKS 项目与任务

描述

The Competitor Built Robots Task is to travel from the Playground Reception Area into the Playground and retrieve, one at a time, the Designated 'Children of Interest' then return to the Playground Reception Area and deliver each of the Children to the Correct Parent. 选手制作机器人任务就是从场地接待区域行进到场地中，然后一次一个地搜索并抓取指定的“目标儿童”，然后回到场地接待区域并将每个孩子交予正确的父母。

The number of 'Children of Interest' Teams will need to manage in each of their 10 minute Evaluated Task Runs will be 5 Children per task run. 每轮 10 分钟内完成 5 个小孩的检索运送。

The number of Children of Interest per Task Run will be finalized by the Experts Jury Panel during their in Abu Dhabi pre-competition meetings. However, ALL Teams need to prepare to have their Robot ready to manage 3, 4 or 5 Children per 10 Minute Evaluated Task Runs in ALL Object Management System Control Modes. 每次任务运行中“目标儿童”的数量最终由迪拜赛前会议中由专家评审团确定。可是，所有参赛队都应在各种目标管理系统控制模式中（自主、第一视角、第三视角）让机器人能够在 10 分钟的任务运行评价中完成 3、4 或 5 个孩子的检索运送。

Prior to coming to Abu Dhabi Competitors will: 来阿布扎比之前:

- Design and Build a Prototype Mobile Robot capable of managing its' mobility within the Performance Evaluation Environment in **BOTH** 100% Autonomous Control Mode and 100% Teleoperation Control Mode. 设计并制作一个原型移动机器人，在 100% 自动控制模式和 100% 远程控制模式下，使其在演示评估环境中能够管理和完成移动；
- Design and Build a Prototype Object Management System capable of functioning in a variety of control formats: 在各种控制模式下运行
 - a) In Autonomous Control Mode 自主控制模式
 - b) In Tele-operation Control Mode based on the Tele-operator **NOT** having Direct Line of Sight access to their robot and Object Management System. 第一视角远程控制模式
 - c) In Tele-operation Control Mode based on the Tele-operator having Direct Line of Sight access to their robot and Object Management System. 第三视角远程控制模式
- Competitors need to be prepared to demonstrate in Abu Dhabi their understanding of the structural, mechanical, electrical, and control systems they have included in the design of their robot and object management systems including the rationale behind their design decisions. 选手需要准备在阿布扎比展示他们在机器人和目标管理系统设计过程中对于结构、机械、电气及控制系统的理解并且说明设计背后的



理由。（主要就是工程日志）

- Competitors are required to dis-assemble their proto-type robot and prototype object management system prior to shipping them to Abu Dhabi. 要求选手在将原型机器人及目标管理机构（系统）拆解后方可运送至阿布扎比前。

NOTE:

Dis-assembled is defined as follows:未组装的定义

- All motors, sensors and electrical components must be in their 'Straight out of their delivery box statuses. 所有的发动机、传感器、电子元件必须如“直接从送货箱拿出的状态”（就是世赛赞助商发货给你收到的状态）
- All structural and mechanical components secured to one another by competitor installed mechanical means (nuts and bolts / screws) must have these connecting elements removed resulting in the structural and mechanical components being totally separated from one another. 所有选手用来固定结构、机械零件的机械方式（螺丝螺帽和螺栓）必须被分离，所有结构、机械零件需要完全分离。
ALL competitor installed wiring connections to components must be removed. 所有选手安装好的接至零件上的电缆接头必须被移走。
- Competitors will be required to build their competition robot on-site in the competition space on Competition Day 1 which has been assigned as the Robot Build / Setup Day. 在比赛日第一天，选手需要在场地内制作组装比赛机器人
- Competitors **will be allowed** to use Program Files created during their Pre-competition Preparation Experiences when conducting their On-site Evaluation Experiences. 允许选手比赛中直接使用 完成好的程序文件。
- Familiarization Day (C-1) can **NOT** be used to assemble the Mobile Robot. This day is only intended for Competitors to check whether all components, assembly parts, wires and tools are available and to check whether individual parts (like motors, sensors, and control unit) are still functioning after shipping. 熟悉日（C-1）不能组装机器人。选手只能在这天检查所有的零件、组装件、电线、工具是否可用，并且还有些独立部件（如发动机、传感器及控制单元）运输后仍然可以发挥作用
- Competition Day Two will involve Competitor Evaluation Experiences in (a) the Design, (b) the Fabrication and Assembly and (c) Core Programming, Testing and Adjustment evaluation categories. 比赛第二天会就设计、制作、组装、核心编程、测试及调整评估模块方面对选手进行评估。
- Competition Days Three and Four will involve Evaluation Task Runs that will take place in the provided Performance Evaluation Environments. 比赛第三天、第四天会在提供的演示评估环境中对任务运行打分。
- Each Court provides Two Side by Side Independent Playgrounds. 每一个赛场提供对侧的2个比赛场地
- 4 to 6 Teams of Competitors will share the pair of Playgrounds in each court during "Work Periods". 工作期间4至6队共用一个赛场的2个比赛地。

11. EVALUATION CRITERIA AND PROCESS

	Category	Value
1	Work organization and management	10
2	Communication and interpersonal skills	10
3	Design	25
4	Fabrication and assembly	5
5	Core Programming, Testing and Adjustment	20
6	Performance Review and Commissioning	30
	Total	100

- In category 1, the Evaluation Process will be conducted each of the Four Competition Days 评分项目 1,4 天比赛日都进行评价
- In categories 2, 3, 4 and 5 the Evaluation Process will be conducted on Competition Day 2 based on the requirements defined in the Computer Information System Assessment document file. 评分项目 2/3/4/5, 根据 CIS 系统在第二条进行
- In category 6 the Evaluation Process will be conducted on Competition Days 3 and 4 评分项



目 6 在第三第四天进行。

12. COMPETITOR'S MOBILE ROBOTICS TECHNICIAN'S JOURNAL USE AND EVALUATION 工程日志的使用和评价

Competitors are required to maintain a Mobile Robotics Technician's Journal during their competition preparation activities. 选手需要在比赛准备过程中完成好工程日志。

The Mobile Robotics Technician's Journal will serve the following purposes: 工程日志用于以下目的:

- Provide an insight into the competitor's thinking throughout their Mobile Robot / Task Specific Solutions Development across the full spectrum of content areas associated with the development of Mobile Robot / Task Specific Solutions. 可以查看选手在移动机器人/特定任务解决方案制定过程中的与之有关的全部内容（策略、路径、方法）
- Highlight the Competitors thinking relative to their robot design, program file structure, overall task strategy and Team Organization during item 3, 4 and 5 evaluation experiences. 在第三、四、五项 的评价过程中，可以用来考察选手对机器人设计、编程结构、整体任务策略及团队组织有关的想法。
- Serve as an 'In the Competition Space Competitor Resource' available to the Competitors to consult while at their workbench and during Expert Jury Panel Interview Experiences. 选手在工作时候可以参考的资源以及作为回答专家裁判团询问的资源
- Evaluation of the Mobile Robotics Technician's Journal will comprise the marking content for the Communication and Interpersonal Skills CIS section and will this evaluation will be done by an Expert Jury Panel. The Journals will be examined relative to the quality, appropriateness and organization of the Journal content. 移动机器人日志的评价会作为CIS系统沟通及交际能力的评分项，由专家评审团打分。这本日志的质量、合适度及日志内容的组织会成为检查项目。

Competitors will be required to include the following Five Content Areas in their Mobile Robotics Technician's Journal and each of these areas will carry a value of 2 marks in the CIS file. 选手的移动机器人工程日志应该包含以下五方面内容，每方面都在 CIS 程序内有 2 分。

- Frame / Structural 框架结构
- Wiring 布线
- Mobility Management 移动管理
- Object Management 目标对象管理
- Computer Programming 计算机编程

In all of these areas the Expert Jury Panel evaluating the Engineering Journal will be looking for: 裁判团关注点:

- Appropriate use of content area specific drawings / diagrams / schematics 图纸/图表/原理图在内容中的合理应用（该用到的地方就得用到，三类图的使用可以清晰展示/取代文字内容）
- Clarity in which the Competitors understanding of the area specific theories are evident in the design decisions the Competitors have made during the development of their Mobile Robot / Task Specific Solutions. 阐述/澄清选手在移动机器人/特定任务解决方案制定中做出设计决定时对于特定理论的理解。（你为什么作出这样的决策，基于什么理论/理由）

13. COMPETITION SCHEDULE 比赛日程计划



C-2	<p>Familiarization Day: 熟悉赛场</p> <ul style="list-style-type: none"> Competitors unpack their tools and robot components 选手打开工具及机器人零部件 Competitors examine their tools and robot components to confirm they have not been damaged during shipping to the competition site 选手检查工具及零部件，确保运输过程中没有损坏 NO Robot or component assembly takes place on C-1 C-1这天不可进行机器人或零部件的组装 Competitors hand in to the Expert Jury Panel a printed copy and a PDF file of the English Text version of their Mobile Robotics Technician's Journal 选手将机器人工程日志的英文打印版及PDF电子版交给专家评审组
C1	<p>Competition Day One: 比赛日第一天</p> <ul style="list-style-type: none"> Competitors have the Full Competition Day to Build / Assemble their Competition Robot 选手有一整天的时间去制作/组装比赛机器人 Competitors have Shared Access to their Assigned Performance Evaluation Spaces (Playground Courts) on an Unscheduled Basis All Day 选手可以进入演示空间（场地），没有指定的安排（也就是大家共享场地，没有谁先谁后，但是不能长时间霸占场地或者生抢场地）
C2	<p>Competition Day Two: 比赛日第二天</p> <ul style="list-style-type: none"> Competitors continue Building / Assembling / Preparing their Competition Robot 选手继续制作/安装/准备比赛机器人 Competitors have Shared Access to their Assigned Performance Evaluation Spaces (Playground Courts) on an Unscheduled Basis dependent on court availability. Note: Court Access Priority will be given to conducting marked evaluation experiences. 只要场地可用，没有在进行打分评价时，选手就可以进入演示空间（场地），没有指定的时间和顺序的安排（也就是只要场地没有在进行打分项目的演示，大家就共享场地，没有谁先谁后，但是不能长时间霸占场地或者生抢场地） Competitors will complete the following Evaluation Experiences on a by Competitor Request Schedule Basis with the restriction that ALL Teams MUST complete these Evaluation Experiences by the End of C2 选手应以日程表为基础，完成以下评分过程，所有的队伍必须在C2结束时完成以下评分项目演示。 <ul style="list-style-type: none"> a) Robot Development Journal Review, 机器人构建的工程日志检查评价 b) Design Evaluation Experiences, 设计评价 c) Fabrication and Assembly Inspection 组装评价 and d) Core Programming, Testing and Adjustment Experiences 核心编程及测试调整评价
C3	<p>Competition Day Three: 比赛日三</p> <ul style="list-style-type: none"> During the AM Orientation Meeting the Specific Parent Grid Patterns and Child Objects will be identified and this set of Parent and Child objects will be used in ALL Evaluated Task Runs on Competition Day 3 早会中确定父母网格和小孩（的对应关系），这套对应关系将在全天中使用 Competitors have Shared Access to their Assigned Performance Evaluation Spaces during the 30 minutes following the AM Orientation Meeting 会后30分钟各队共享场地空间进行测试 Competitors will have TWO Exclusive Use 20 Minute Access to their Assigned performance Evaluation Spaces 选手有2次各20分钟的专用时间到指定场地测试 Competitors will have THREE Autonomous Control Mode Mobility and Autonomous Control Mode Object Management Control System Evaluated Task Run Experiences involving: 选手有3次自主模式下的移动和对象目标管理评价任务： <ul style="list-style-type: none"> a) A 5 Minute Final on the court Robot Adjustment Time Block 1个5分钟的不评分的调试任务



	<p>时间段</p> <p>b) A Ten Minute actual Evaluated Task Run Time Block 1个10分钟的实际评分任务的时间段</p> <p>A 5 Minute POST Evaluated Task Run Time Block used by the Competitors to confirm the results of their Evaluated Task Run have been recorded correctly and to remove their Robot from the Performance Evaluation Environment 1个5分钟用于确认成绩被正确记录并将机器人移出场地的时间段。(5+10+5 每个队每次20分钟)</p>
C4	<p>Competition Day Four:比赛日第四天</p> <ul style="list-style-type: none"> • During the AM Orientation Meeting the Specific Parent Grid Patterns and Child Objects will be identified and this set of Parent and Child objects will be used in ALL Evaluated Task Runs on Competition Day 4早会中确定父母网格和小孩（的对应关系），这套对应关系将在全天中使用 • Competitors have Shared Access to their Assigned Performance Evaluation Spaces during the 30 minutes following the AM Orientation Meeting会后30分钟各队共享场地空间进行测试 • Competitors will have TWO Exclusive Use 20 Minute Access to their Assigned performance Evaluation Spaces选手有2次各20分钟的专用时间到指定场地测试 • Competitors will have THREE Teleoperation Control Mode Mobility WITH NO Direct Line of Sight Access Tele-operation Control Mode Object Management Control System Evaluated Task Run Experiences选手有3次第一视角远程控制模式下的移动和目标对象管理任务 <p>Note: IF On-site Robot to Lap Top communication testing conducted over Competition Days 1, 2 and 3 indicates the presence of any Robot to Lap Top communication irregularities then the Day 4 Task format will be changed to: THREE Teleoperation Control Mode Mobility WITH Direct Line of Sight Access Tele-operation Control Mode Object Management Control System Evaluated Task Run Experiences注意：如果前三天发现第一视角不可用，那就改为第三视角。</p> <ul style="list-style-type: none"> • A final 5 Minute Final on the court Robot Adjustment Time Block 1个5分钟的测试调整时间段 • A Ten Minute actual Evaluated Task Run Time Block 1个10分钟的实际评分任务时间段 <p>A 5 Minute POST Evaluated Task Run Time Block used by the Competitors to confirm the results of their Evaluated Task Run have been recorded correctly and to remove their Robot from the Performance Evaluation Environment1个5分钟进行确认成绩是否被准确记录并移出机器人的时间段（5+10+5 每队每次20分钟，全天一个小时）</p>

14. MAINTAINING EQUITY WHILE REQUIRING TRUE SEARCH EVALUATION EXPERIENCES 在真正的打分过程中保证公平性

It takes Three Task Runs involving Two Teams at a time per court to complete an Overall Single Evaluated Task Run experience. It is essential that neither a real advantage nor a perceived advantage is associated with a Team being in the First, Second or Third Pair of Teams. 为完成全部的评分任务，每块场地每次有两个队进行三次任务。无论是第几对选手出场，都不应出现真实或者可察觉的优势，这点非常重要。

The following Evaluation Task Organization is intended to ensure NO Advantage exists based on a Team's placement in the First, Second or Third Pair of Teams scheduled to execute the Task sequence. 下列的举措将确保每队的比赛顺序不产生优势

The Entry Slide is intended to introduce a Mechanical Based Process to managing the entry of the children into the Playground. Balls will be placed in ALL Entry Slide in the same order. 所有滑道的台球都按照相同的顺序放置进去并且按照基于机械过程的方式划入赛场。



If a Ball lands outside the court or On Top of a Sand Area Pillar an Expert will retrieve the Ball, put it in the Entry Slide and before the Evaluated Task Run starts repeat the Slide Experience for this Ball only. 如果一个球掉到了沙滩柱子上，这个球就在比赛开始前捡回来重新发。

- There will be Three Evaluated Task Runs per Day C3 and C4 比赛日第三第四天，每天都有3轮任务。
- The AM Exclusive Use Court Access Time Blocks will be scheduled in the same sequence as the Task Evaluation Runs ensuring the time between each Team's final preparation Time Block and their Evaluated Time Block is equal. 进入赛场的专用时间按照相同顺序进行排列，确保每队的准备时间和真实展示的时间一致
- The Designated Task Parents and Children will be **set in the AM and NOT change ALL Day**. 早会定的父母网格与小孩的对号关系全天不变。
- The Final Positions of the Children based on tumbling Out of the Entry Slide is by default a Random Task Element. 小孩最终的位置由滑道滑出的随机性决定。

15. SAMPLE SINGLE DAY FAMILY GROUP 家庭组样例（1天1变）

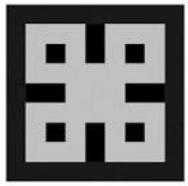
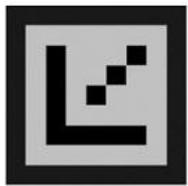
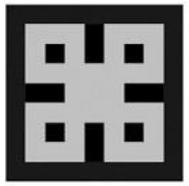
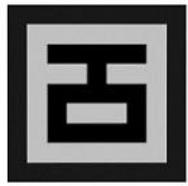
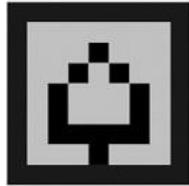
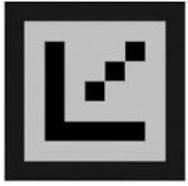
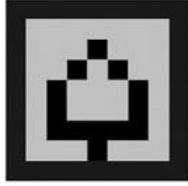
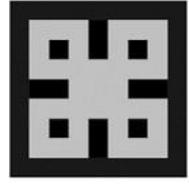


- The Positions of the Five Designated Parents in the Reception Area will be a **NOT** Known in advance by the Competitors Detail. 选手提前不知道5组制定的父母网格在接待区的位置（早会后定）
- The Parent Grid Patterns for each Task Evaluation Run will be **IDENTIFIED AFTER** the Competitors have placed their Robots in the Performance Environment Court and ALL Task Preparation Activity has been completed. 选手将机器人放置场内并完成所有准备工作后，机器人将去辨认父母网格。
- The images in the table below are intended to provide an explanation how the Parent Grid True Search Performance Element will be organized to ensure an equitable experience for all teams. 下表中的图像旨在说明如何组织父母网格真实搜索性能元素，以确保所有团队的公平体验。
- The sample below has 3 Parent Grid Sets but using 6 Parent Grid Sets is a possibility. 下面的样例有3套父母网格，6套也是有可能的。
- Each Parent Grid Set will be assigned number values: 每一套父母网格都被赋值
Set A = 1 or 2, Set B = 3 or 4 and Set C = 5 or 6. A套=1或者2，B套=3或者4，C套=5或者6
- **AFTER ALL Teams** involved in the Task Evaluation Run indicate they are ready, a Die will be rolled to identify which Parent Grid Set would be used for that Task Evaluation Run and then the Parent Grids would be placed in the Designated Reception Area Booths. 所有要进行任务运行评分的队伍准备好后，就会掷骰子决定使用哪套代表父母的网格，之后这套网格就会被放置在指定接待区域。（比如掷骰子，显示3，那就是下面图形中的第二套）

Note: If an error is made in placing the Grid Patterns on a single court the Task Runs will **NOT** be stopped given All Robots must deliver a Child to ALL 5 Parent Booths and the position of the Children of Interest is unknown the error would not generate any measurable advantage to the Team. 如果在某一个场地将网格图案贴错了，运行任务并不会因此停止。因为机器人必须把儿童带到有五对父母区，而儿童的位置是未知的，因此一个错误并不会造成某个参赛队的评分优势。



16. SAMPLE TASK EVALUATION RUN PARENT GRID SETS

 <p>Parent 5 Reception Area Parent Booth 1</p>	 <p>Parent 1 Reception Area Parent Booth 2</p>	 <p>Parent 4 Reception Area Parent Booth 3</p>	 <p>Parent 2 Reception Area Parent Booth 4</p>	 <p>Parent 3 Reception Area Parent Booth 5</p>
<p>Sample Parent Grid Pattern Position Set A = Die Values 1 or 2 固定值1或者2</p>				
 <p>Parent 2 Reception Area Parent Booth 1</p>	 <p>Parent 4 Reception Area Parent Booth 2</p>	 <p>Parent 5 Reception Area Parent Booth 3</p>	 <p>Parent 3 Reception Area Parent Booth 4</p>	 <p>Parent 1 Reception Area Parent Booth 5</p>
<p>Sample Parent Grid Pattern Position Set B = Die Values 3 or 4</p>				
 <p>Parent 3 Reception Area Parent Booth 1</p>	 <p>Parent 5 Reception Area Parent Booth 2</p>	 <p>Parent 2 Reception Area Parent Booth 3</p>	 <p>Parent 1 Reception Area Parent Booth 4</p>	 <p>Parent 4 Reception Area Parent Booth 5</p>
<p>Sample Parent Grid Pattern Position Set C = Die Values 5 or 6</p>				

17. SINGLE TASK EVALUATION RUN / MARKING PROCEDURE: MAXIMUM VALUE 5 MARKS 单个运行任务评分/评分过程: 最大值为5分

- Each court hosting two side by side Teams in Exclusive Use Performance Evaluation Environments will be monitored by a group of Three Experts.每块赛场分为2个专用相对的比赛区,由3个专家进行监视。
- Marking will take place at the conclusion of the 10 minute Task Run in compliance with Worldskills Rules indicating Groups of Three Experts must be involved in each Mark Assignment Experience.10分钟的单任务评价由专家组按照世赛规则进行打分,三位专家都必须参与打分。



18. SINGLE TASK EVALUATION RUN AND MARKING PATTERN 单一任务的打分模式

- Teams will be awarded 0.8 Marks for each Child successfully delivered to the Correct Parent Booth. Maximum Value: 4.0 Marks 每完成一个小孩的运送到正确的父母区就得 0.8 分，最大值 4 分。
- Teams will be awarded 0.6 Marks for Children delivered into the Playground Reception Area but **NOT** delivered to the Correct Parent Booth.将小孩运送到接待区但不是正确的父母区得 0.6 分
- Teams delivering **ALL Five of the Designated Children to the Correct Five Parent Booths** before the End of a Task Run Buzzer Sounds will qualify for a Time Mark with a Maximum Value of 1.0 Mark.在时间到的提醒声前完成将 5 个指定的小孩送到正确的父母区，可以根据实际完成时间得到时间奖励分。最多 1 分。
- Time Mark Calculation will be based on the following formulae:时间分的计算公式

(Fastest Qualifying Team's Time / Individual Qualifying Team's Time) X 1.0 = Time Mark Awarded
(最快完成队的完成时间/本队完成时间) X 1.0 =时间分

19. BILL OF MATERIALS 材料清单

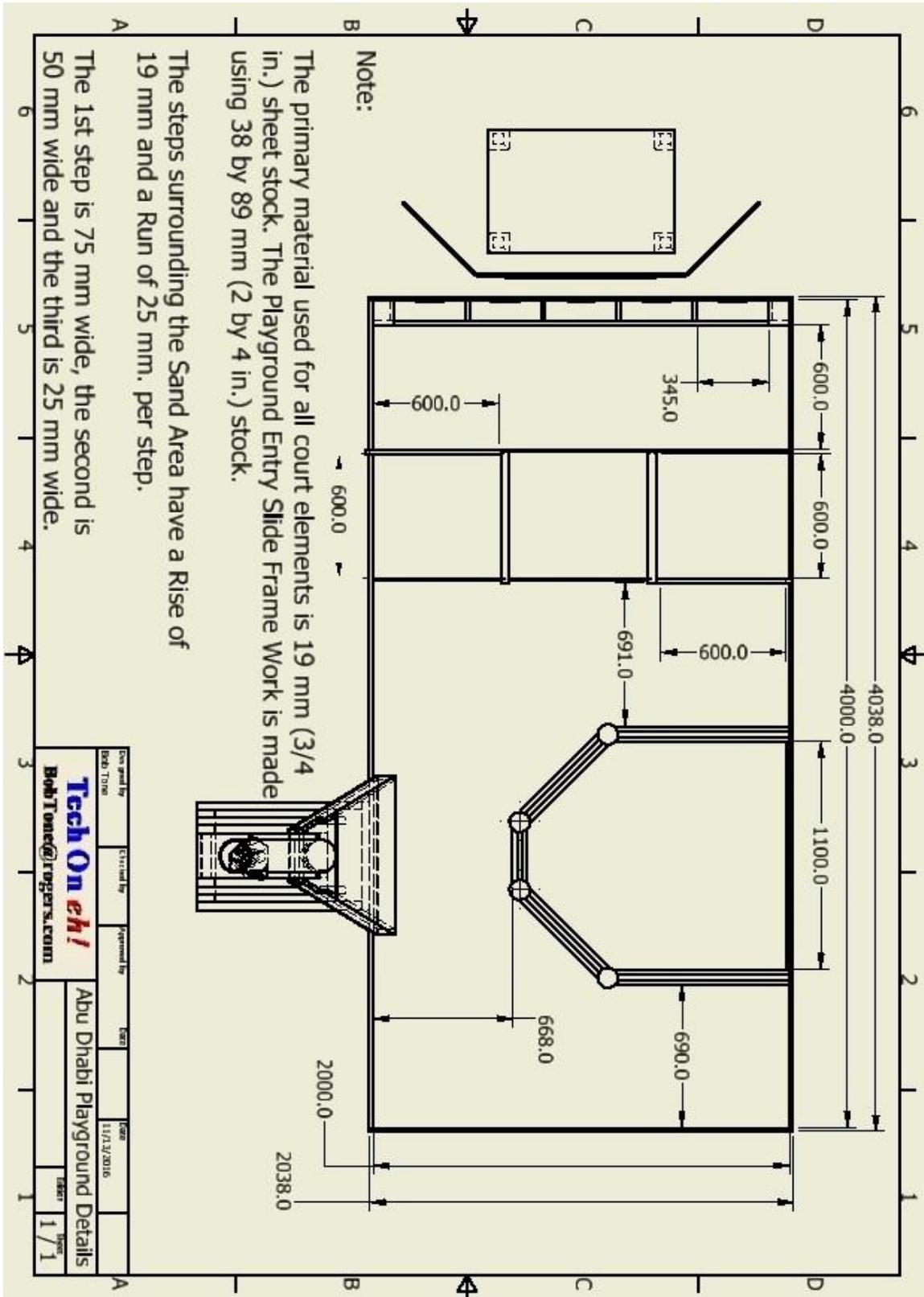
- 2 sheets of ¾ in. by 4 ft. by 8 ft. rough stock of your choice. I recommend Good 2 Sides Birch Plywood
2 块 ¾ 英寸厚、4 英尺宽、8 英尺宽的原材料薄板。推荐上好的两面的桦木胶合板
- 4 pieces of 2 by 4 in. by 8 ft. boards
四块 2*4 英寸*8 英尺的板子
- 2 pieces of clear plastic measuring:
2 块透明干净的塑料板
- Piece One: 1362 by 200 by 6 mm
第一块 1362*200*6mm
- Piece Two: 1381 by 200 by 6 mm
第二块 1381*200*6mm
- 1 PVC Drainage Pipe or SONO Tube Concrete Forming Tube Dia. 6 in. and 48 in. Long
1 根直径 6 英寸和 48 英寸长的 PVC 排水管或 SONO 管混凝土成型管，
- 1 PVC Drainage Pipe or SONO Tube Concrete Forming Tube Dia. 3.5 in. and 32 in. Long
1 个直径 3.5 英寸和 32 英寸长的 PVC 排水管或 SONO 管混凝土成型管，
- 1 sheet of white Hardboard ¼ in. by 2 ft. by 4ft.
1 张¼英寸×2 英尺×4 英尺的白色硬纸板
- Two Metal Hooks made from thin / flat metal strapping for each Parent Grid Plate 父母网格的两个金属挂钩由薄/扁平金属捆扎制成

The rest of this document has drawings presenting the cutting patterns and individual parts dimensions required by teams to build a Court for use during their Competition Preparation Activities.再下面就是建造比赛场需要的图纸。

Note: The Entry Slide is primarily required to bring equity to the Ball Distribution when multiple courts are running Evaluation Task Runs at the same time. Teams could decide not to build an Entry Slide and choose to use alternate methods of distributing the balls in the Play Ground.所有赛区会同时发球以确保公平性。各队可以不必要建造发球装置，用其他方式发球练习即可。

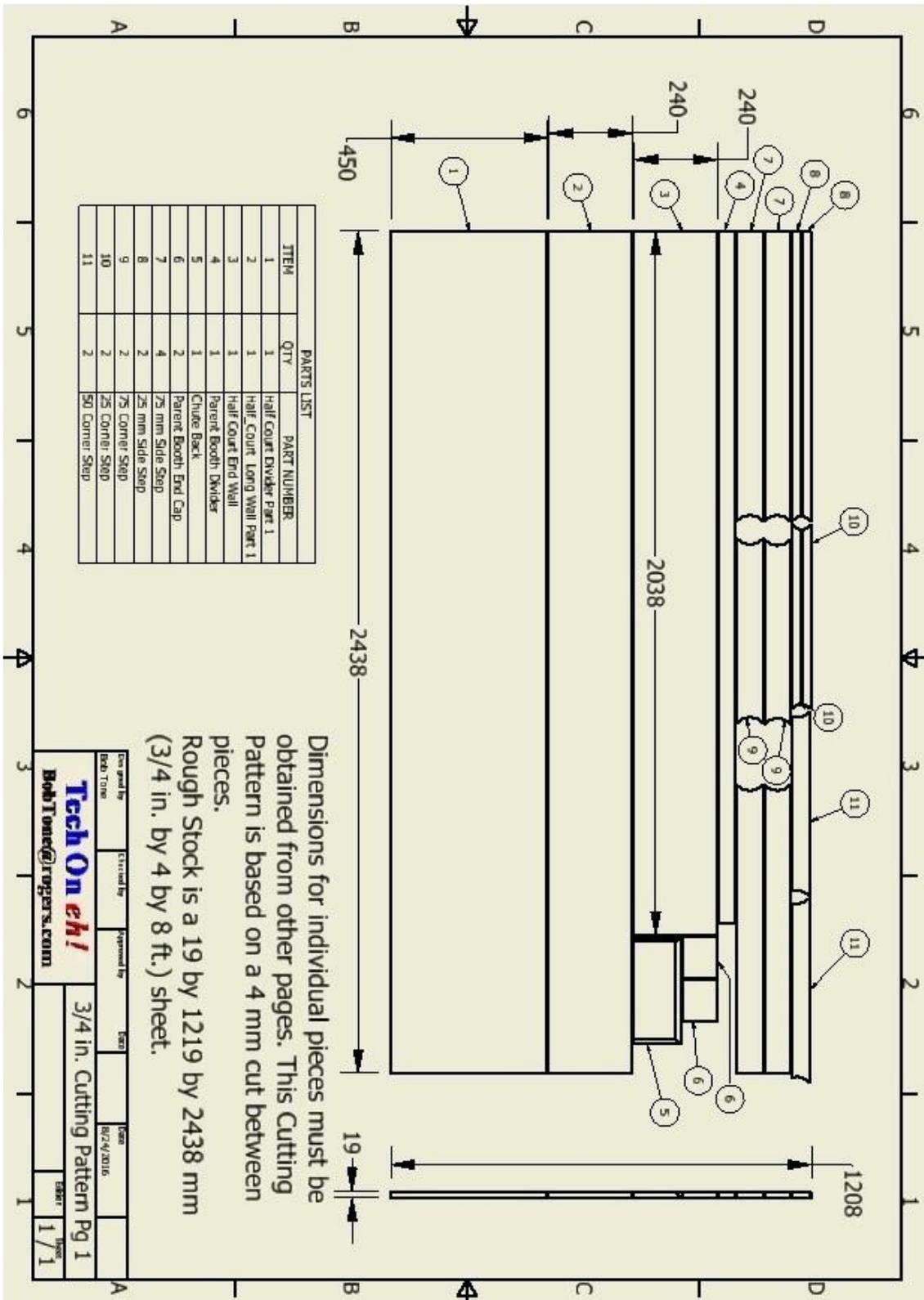


20. OVERALL PERFORMANCE ENVIRONMENT DETAILS



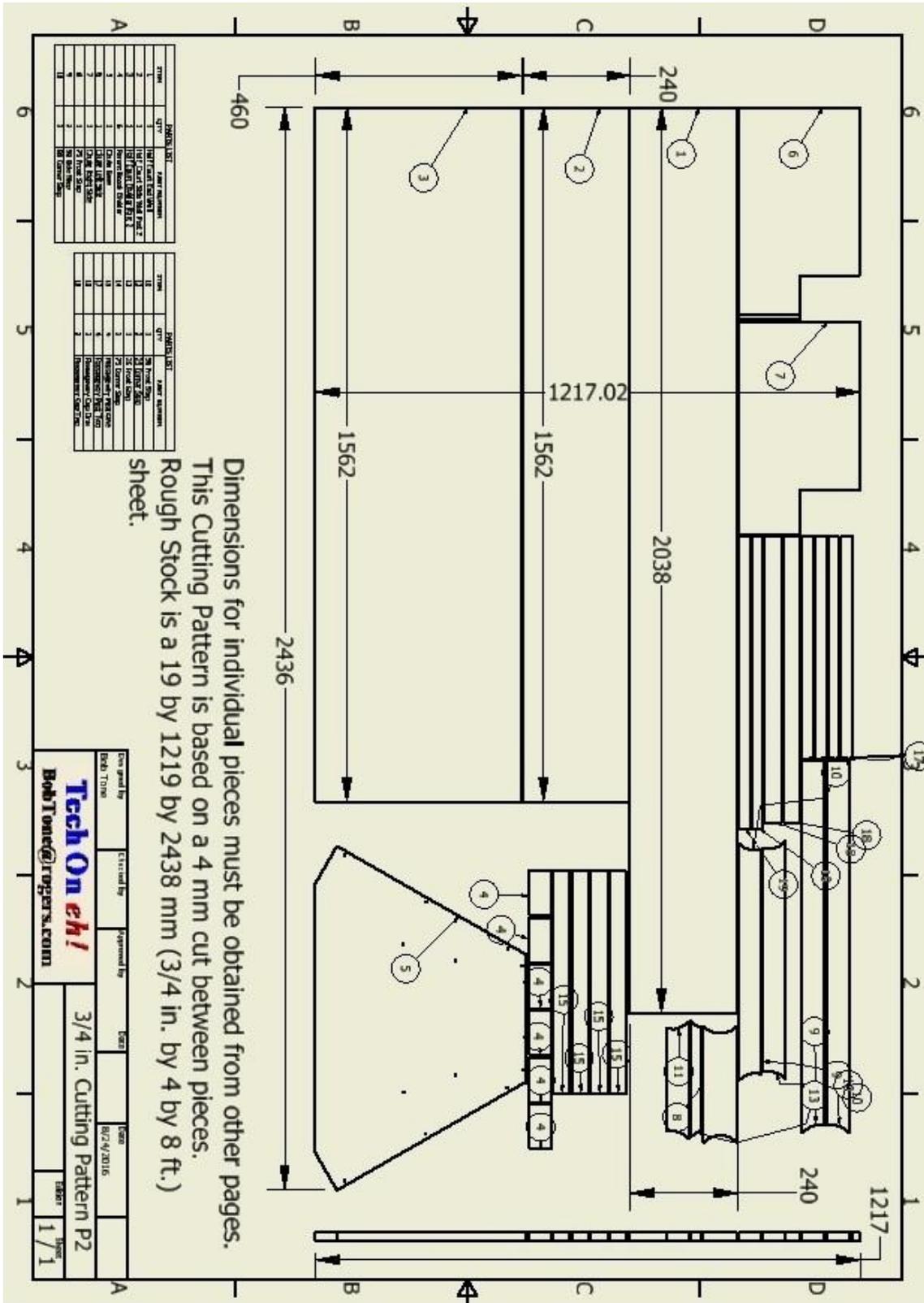


38 MM (3 / 4 IN.) ROUGH STOCK CUTTING PATTERN PAGE 1



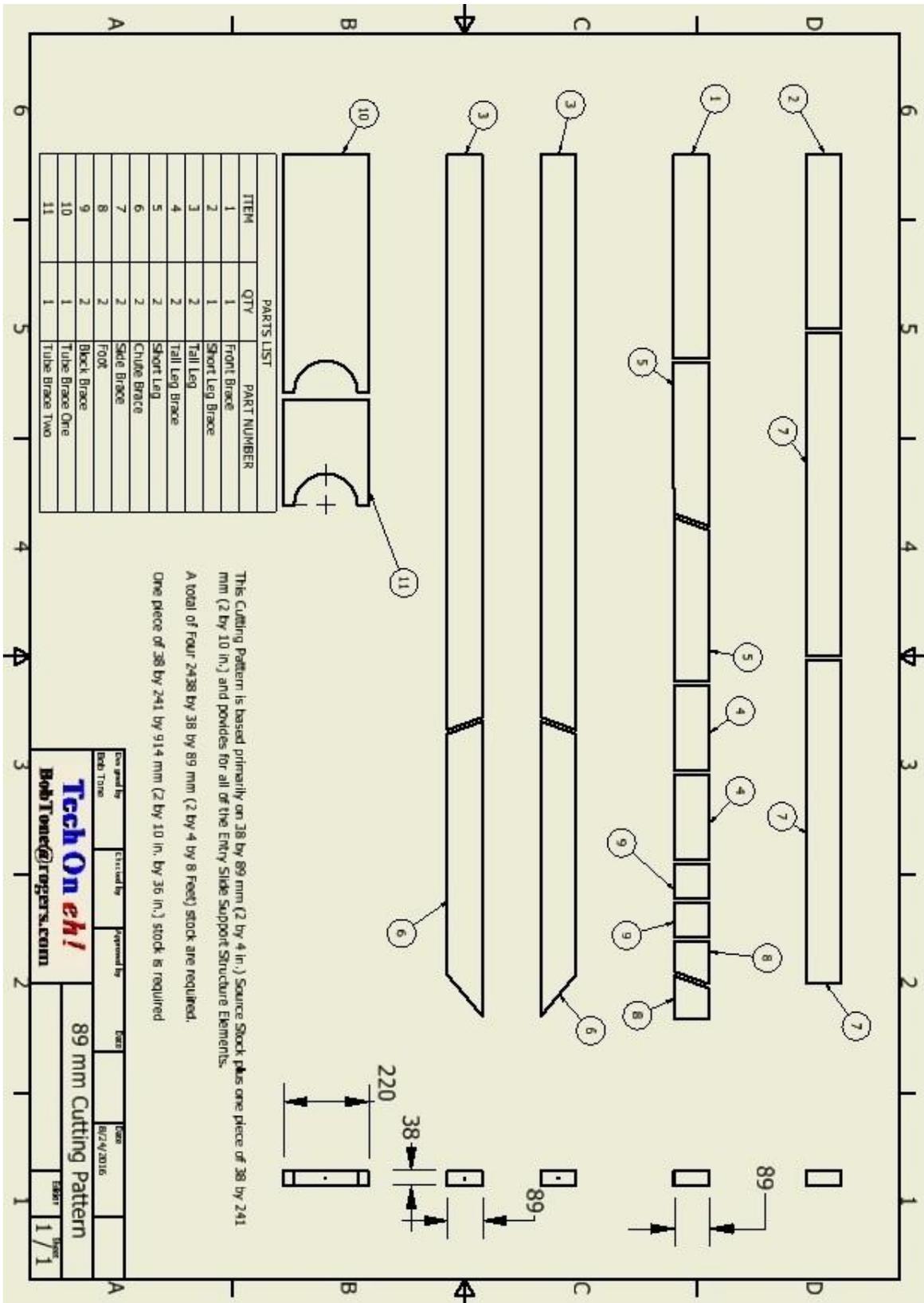


38 MM (3 / 4 IN.) ROUGH STOCK CUTTING PATTERN PAGE 2



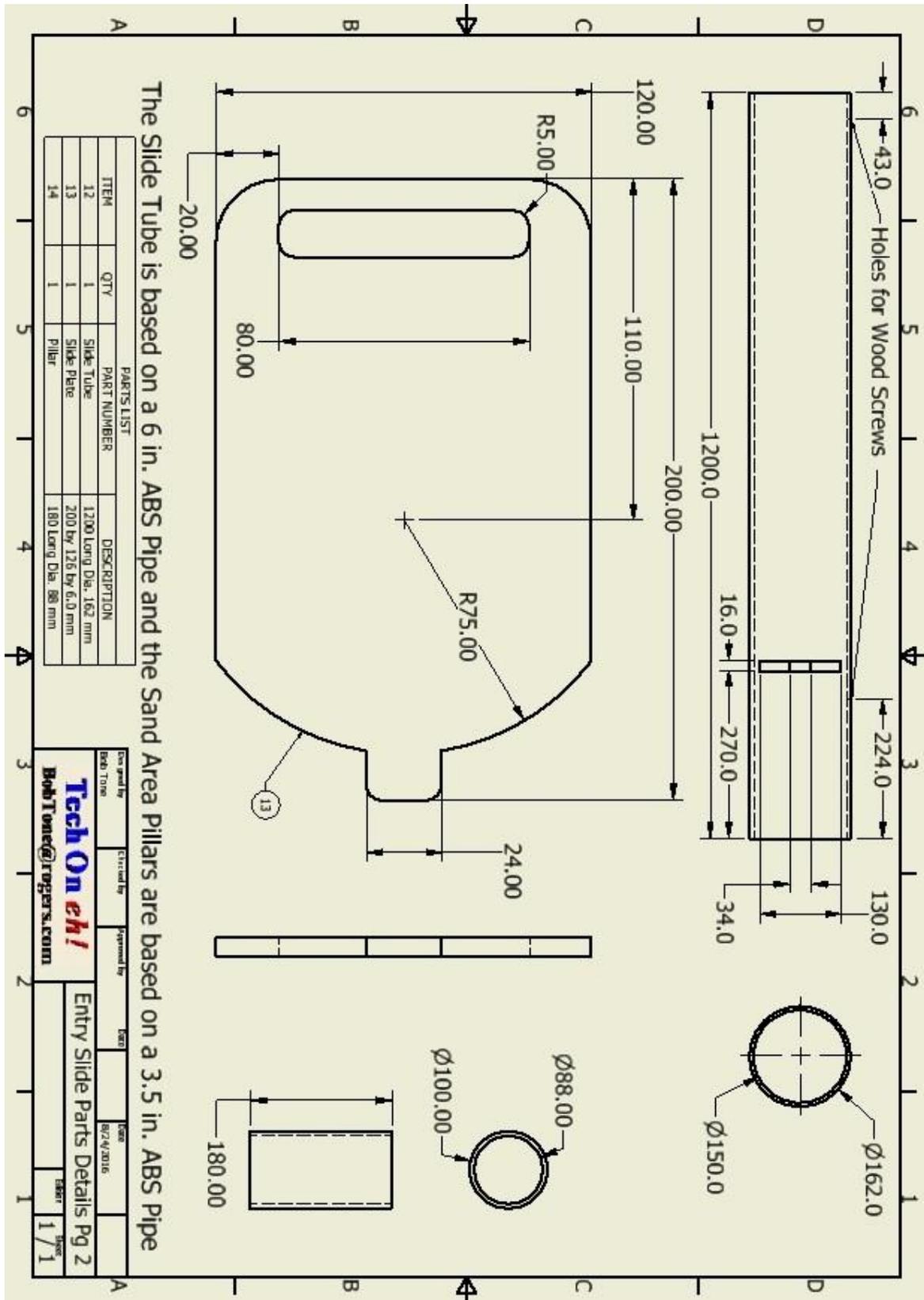


89 MM (2 BY 4 IN.) ROUGH STOCK CUTTING PATTERN PAGE



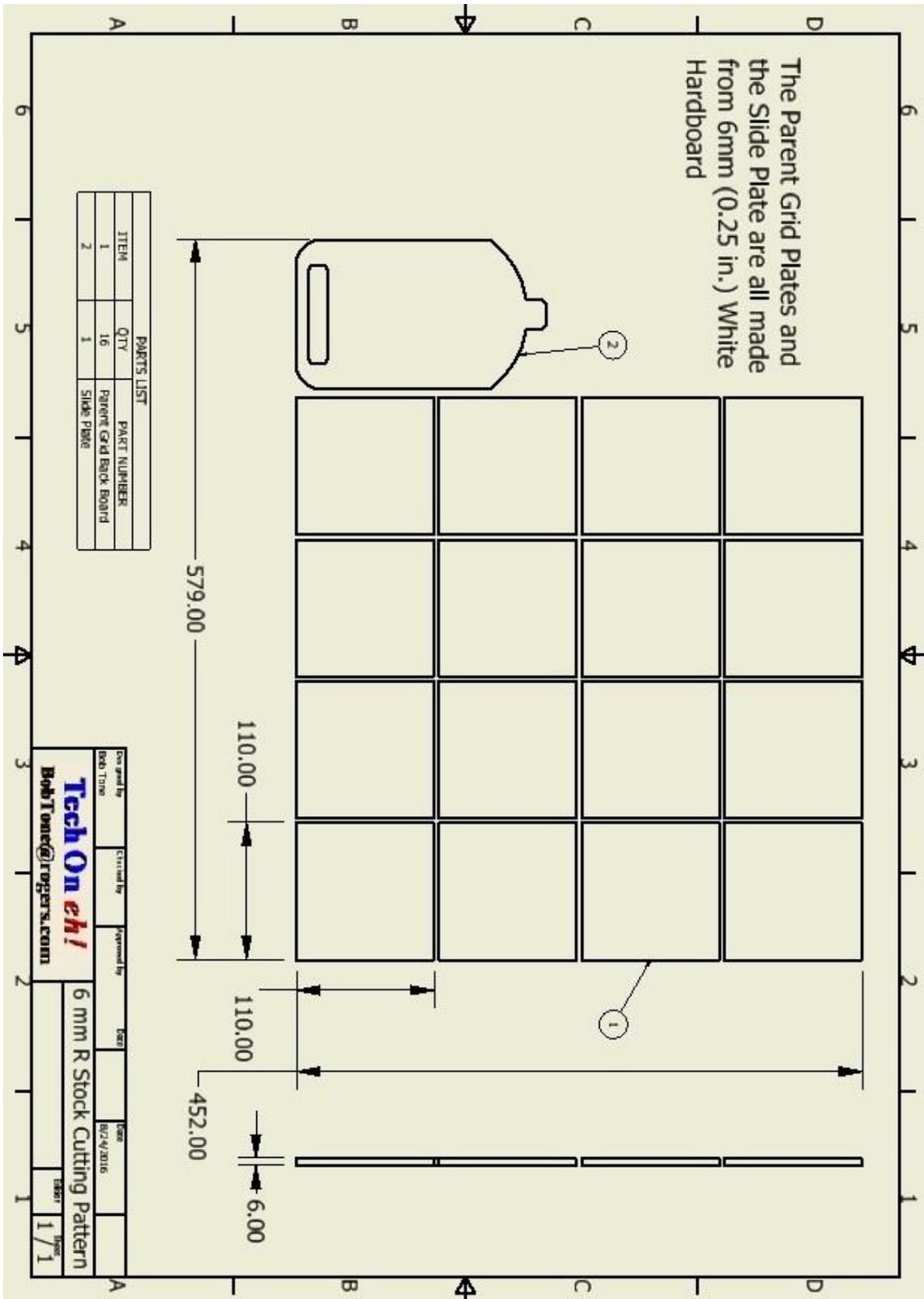


ENTRY SLIDE PARTS DETAILS PAGE 2



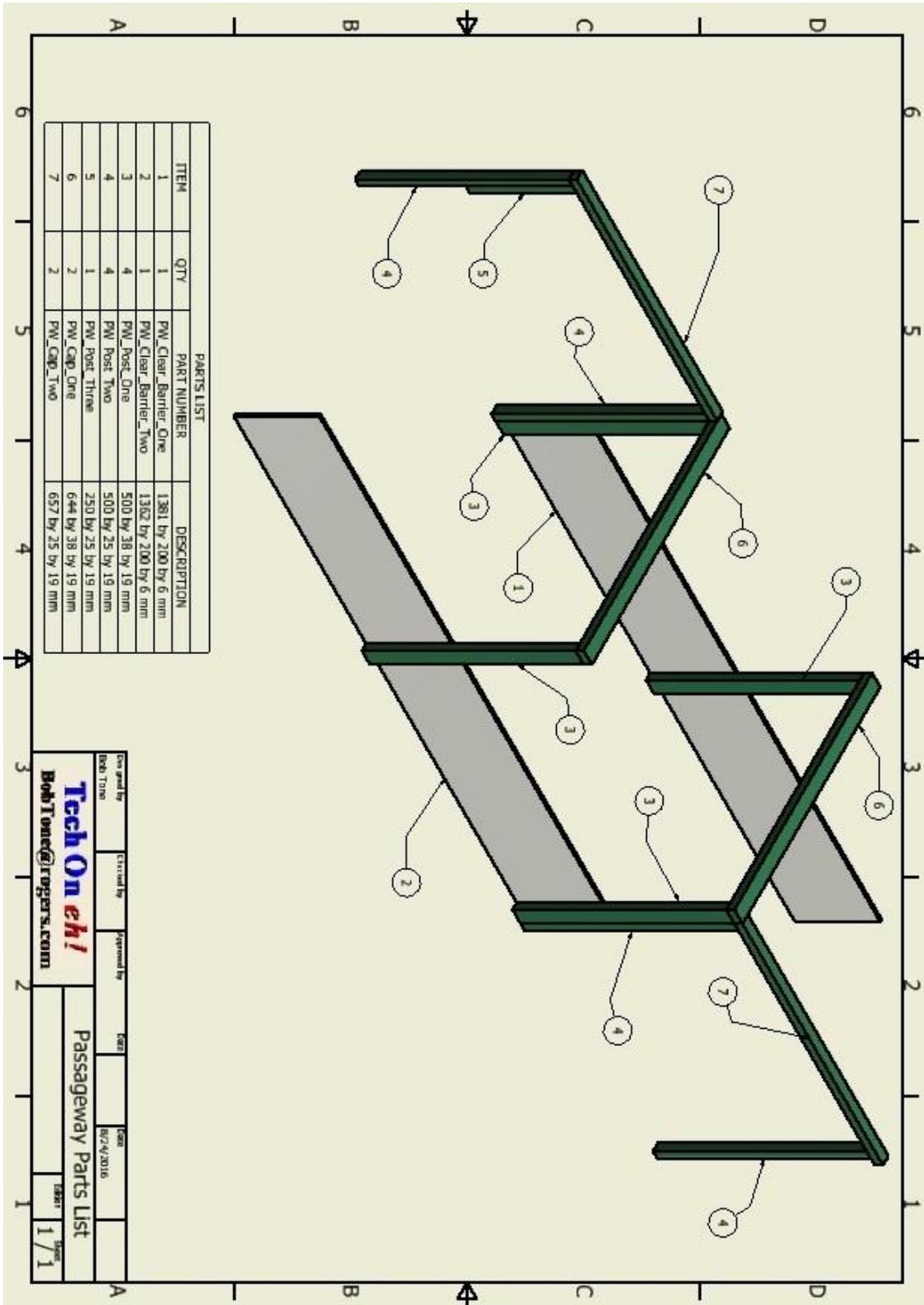


6 MM (1 / 4 IN.) ROUGH STOCK CUTTING PATTERN



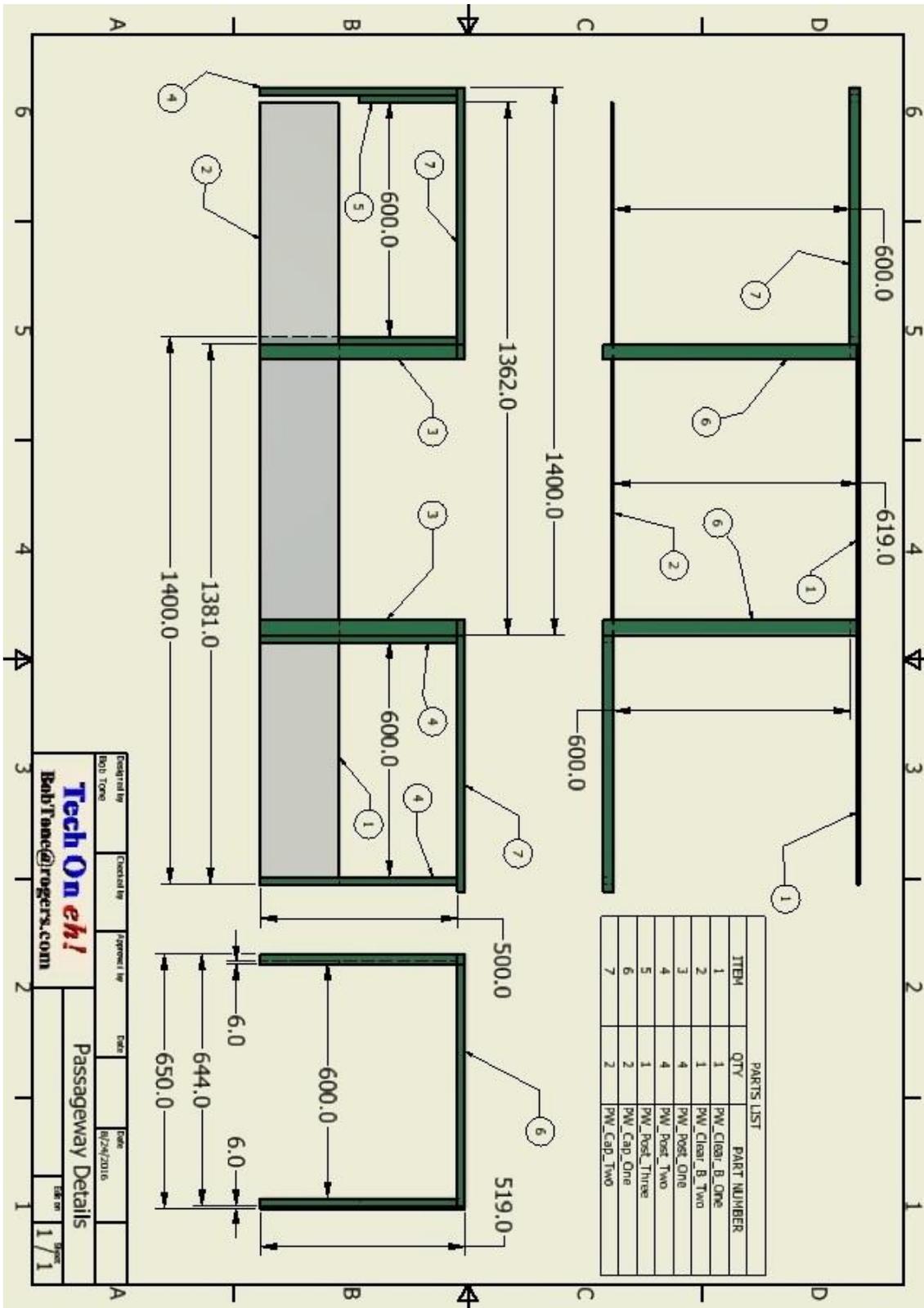


PASSAGEWAY PARTS LIST





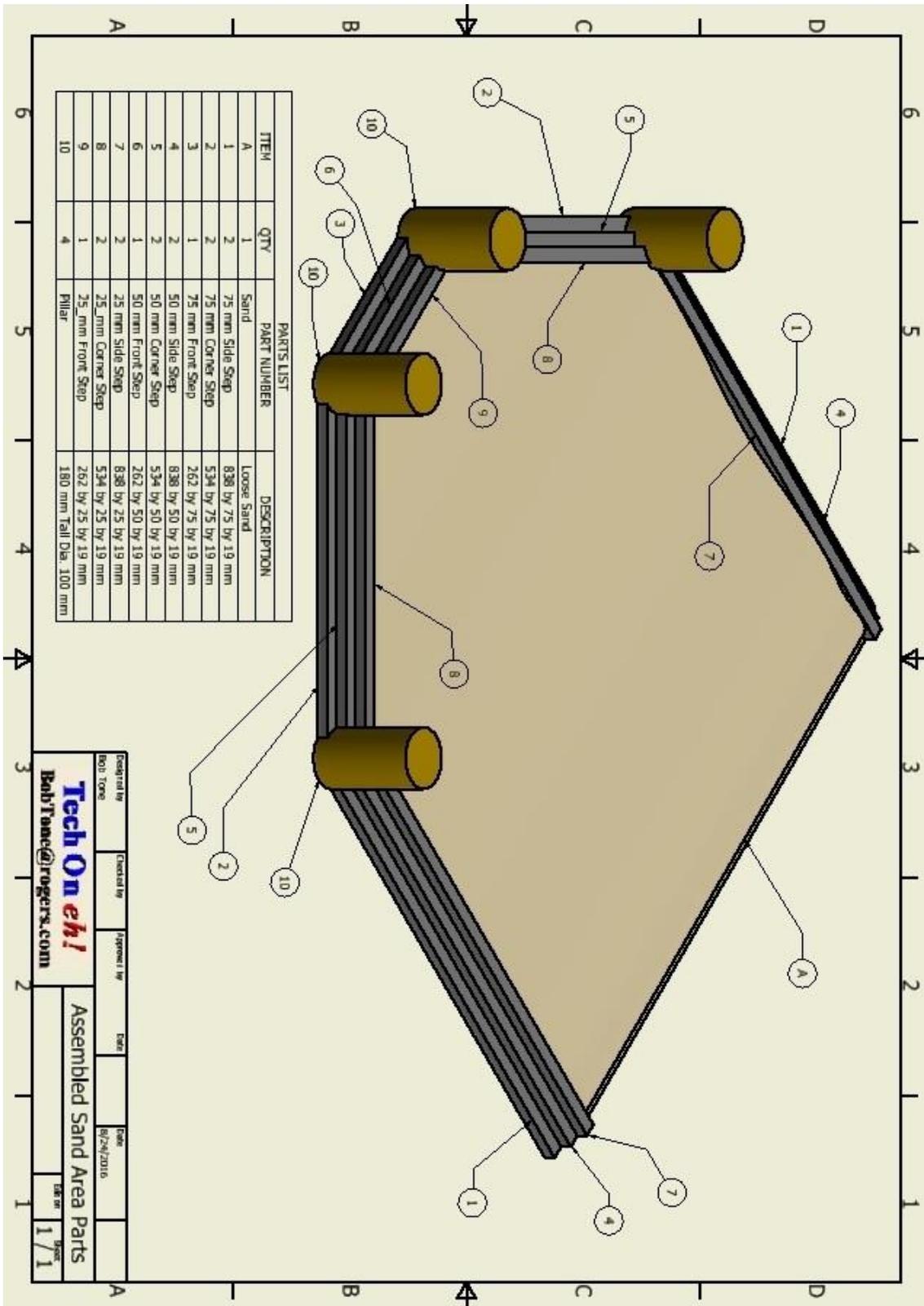
PASSAGEWAY DETAILS



Created by: Bob Tope
 Checked by:
 Approved by:
 Date: 8/24/2016
Tech On eh!
 Bob Tope@rogers.com
Passageway Details
 Date: 11/1



SAND AREA PARTS





PARENT BOOTHS DETAILS

