Official Rules for the International Aerial Robotics Competition
国际空中机器人大赛 官方规则 任务7

MISSION 7

INTRODUCTION

The primary purpose of the International Aerial Robotics Competition (IARC) has been to "move the state-of-the-art in aerial robotics forward" through the creation of significant and useful mission challenges that are 'impossible' at the time they are proposed, with the idea that when the aerial robotic behaviors called for in the mission are eventually demonstrated, the technology will have been advanced for the benefit of the world.

简介

国际空中机器人大赛（IARC）的根本目标是通过设置具有挑战性的、实用而有意义的比赛任务推进空中机器人最先进技术的进步。这些任务在提出时是几乎不可能实现的，而当其最终被空中机器人完成时，世界将受益于因此所得到的技术进步。

As such, the International Aerial Robotics Competition has not been a "spectator sport", but rather a "technology sport." Since its inception, over twenty two years has passed with six successful missions having been accomplished. Each time a mission was accomplished, some aspect of the state-of-the-art in aerial robotics was advanced beyond that which had previously been demonstrated.

所以，IARC不是一个“观赏比赛”而更是一个“技术比赛”。大赛自创始，经历22年，已经成功完成了六次任务。每一次任务的完成都将空中机器人某些先进技术的水平提到了新的高度。

During Mission 1, the ability to fully autonomously fly and navigate without inertial systems was demonstrated using a triad of carrier wave GPS antennas/receivers, as was the ability to pick up objects in one location and deposit them in another.

第一次任务时，空中机器人使用了三合一GPS载波天线/接收机，验证了全自主飞行能力和不依赖惯性系统导航能力以及两点物体搬运能力。

During Mission 2, autonomous aerial mapping, millimeter target identification, and object retrieval was demonstrated using differential GPS technology for navigation.

第二次任务时，空中机器人使用差分GPS导航技术，验证了自主空中测绘、毫米级目标识别和目标获取的能力。

During Mission 3, the ability to perform an autonomous search and rescue mission was demonstrated, incorporating location and discrimination between injured survivors and the dead, avoidance of real threats to the aerial robot (15 meter flames, water geysers) in a cluttered, smoke obscured environment, and mapping of a disaster scene.

第三次任务时，空中机器人验证了自主搜索和营救的能力。该次任务结合了定位和区分灾害中生还者和死者的能力，在混乱、烟雾和昏暗环境中对各种威胁的规避能力（15米高的火焰、间歇的水柱），以及描绘灾害场景的能力。

During Mission 4, autonomous aerial robots demonstrated the ability to fly long distances (3 km), find a village, find a specific building in that village, identify all of the valid openings (open windows/doors) in that building, and insert an autonomous sub-robot into that opening.

第四次任务时，空中机器人验证了长距离自主飞行的能力（3千米）。其需发现一个村庄及其中的一间特定房屋，识别房屋所有的入口（开着的窗户/门），并派遣辅助机器人进入入口。

During Mission 5, the Mission 4 goals were extended to assume that the autonomous sub-robot was able to fly, and that it needed to map the interior of the building and locate an object. SLAM (simultaneous localization and mapping) techniques were used to achieve this mission.

第五次任务是第四次任务的延伸。第四次任务中的辅助机器人使用SLAM技术完成自主飞行，绘制室内地图及定位一个目标。

During Mission 6, the autonomous indoor flight scenario was further refined and completed by requiring a fully autonomous aerial robot to map the unknown interior of a building, avoid or defeat security measures, read and interpret printed directions on the walls (written in Arabic) to locate a specific room and remove a small object while replacing it with another like object before rapidly exiting the building as part of a simulated espionage mission. These mission goals were demonstrated during August of 2013 through the use of SLAM techniques and object recognition.

第六次任务中，室内飞行场景更加复杂。空中机器人需能够自主地绘制建筑物的未知室内地图，躲避或摧毁安防措施，发现并理解墙上的文字指引信息（阿拉伯文），进而找到放置机密物品的房间。空中机器人需进入房间取走机密物，放入替代品，并快速地退出建筑物。利用SLAM和目标识别技术，该次任务在2013年8月被完成。

MISSION 7

It is not the intent that the IARC repeat prior technology demonstrations, but to push new areas of aerial robotic behavior. Picking up and moving objects has been amply demonstrated over the first six missions. The use of GPS and SLAM techniques to navigate has likewise been well established over the past six missions. So what new behaviors are yet to be demonstrated in a fully autonomous aerial robot?

任务7

IARC的目的不是重复先前已实现的技术，而是开辟空中机器人技术的新领域。拾取和移动物体的能力已经在前六次任务中得到展示，使用GPS和SLAM技术进行导航亦被很好地验证。那么，自主飞行空中机器人还需展示什么样的新行为？

Mission 7 will challenge teams to demonstrate three new behaviors that have never been attempted in any of the past six IARC missions. First, “interaction between aerial robots and moving objects (specifically, autonomous

任务7将有三个新行为挑战参赛队。这三个行为在前六次IARC任务中从未被尝试过。第一，空中机器人与地面移动物体（具体而言是地面自主机器人）的交互行为。第二，在一个开敞环境中的导航行为。该环境中无外界导航辅助，GPS或墙壁等静止点。第三，与其他竞争空中机器人的博弈行为。

ground robots). Second, navigation in a sterile environment with no external navigation aids such as GPS or large stationary points of reference such as walls. Third, interaction between competing autonomous air vehicles.

Incorporating these three behaviors and capabilities into a single mission is a challenge in and of itself, but after analysis of comments from many experts in the field of aerial robotics, machine vision, and cognitive sciences, as well as a review of the pertinent literature, a manageable and fair test of these behaviors is a reasonable expected outcome from the mission described below.

将这三个行为和能力集成在一个任务中本身就是一个挑战，但是，经过分析许多空中机器人、机器视觉和认知科学等领域专家的建议，并参考了相关文献，测试这些行为的合理可行的方案可从下述任务看到。

Before enumerating the details and the administration of Mission 7, consider the envisioned implementation of the mission through an example approach to each of the three behaviors required.

在列举任务7的细节之前，通过对三个行为的举例来形象地说明如何实现比赛任务。

Interaction between Aerial Robots and Ground Robots: During Missions 1 through 6, IARC aerial robots have been required to interact with, and manipulate, stationary ground objects... however never before has the IARC required teams to develop the capability to track randomly moving objects and interact physically with them. Mission 7 incorporates this new behavior. This behavior has application to the use of aerial robots from moving platforms such as ships, trucks, or even other air vehicles.

空中机器人与地面机器人的互动:
在第一至第六次任务中，IARC空中机器人虽需与地面静止目标互动，但从未被要求具有跟踪随机运动的地面目标且进行物理接触的能力。任务7则加入了这一新行为，这种行为可以使空中机器人用于舰船、卡车等移动平台，甚至其他空中平台。

Mission 7 will use off-the-shelf ground robots that are available to all teams for testing back in their laboratories. The ground robots to be used are inexpensive (under $150) iRobot Create® Programmable Robots which are available to any team for testing. The IARC will provide the robots used in the competition at both venues, and it will also make the programming source code that will be used in the IARC available to all the teams so that they can conduct tests with

任务7将使用商业成品地面机器人，以方便所有参赛队购买并在实验室进行测试。所用的地面机器人为价格并不昂贵（低于150美元）的iRobot Create®可编程机器人。IARC将为两个赛区提供这种地面机器人。其在比赛中使用的程序源代码也将提供给个参赛队，以便各参赛队在测试时能得到地面机器人在比赛时的相似行为。

ground robots that exhibit the same behaviors to be encountered in the arena. Details about the iRobot Create® Programmable Robot can be found here: http://www.irobot.com/About-iRobot/STEM/Create-2.aspx

iRobot Create®的详细信息可以在这里找到：http://www.irobot.com/About-iRobot/STEM/Create-2.aspx

Navigation without External Navigation Aids: The use of GPS, and to a lesser extent, SLAM, has become prevalent in the world of aerial robotics. Many of the same missions that have been flown with these navigation aids over the past 22 years could have been conducted by a trained animal or human without the use of GPS or SLAM. So why should our aerial robots be dependent on these external navigation aids, especially when working in a confined space? Mission 7 eliminates these off-the-shelf navigation solutions by being conducted in a GPS-free indoor environment that is devoid of obvious physical cues. Teams will be encouraged to devise other methods for stability and control, as well as navigation in the same way that a living organism might have to solve the problem.

无外界辅助导航：
GPS、激光测距和SLAM在空中机器人中广泛使用。在过去的22年中，许多使用类似导航辅助飞行的任务设置可以由经过训练的动物或人来完成，而不需要GPS或SLAM。因此，为什么我们的空中机器人需要依赖这些外部导航辅助呢，尤其是工作在狭窄的空间？任务7设置在既没有GPS亦没有明显物理提示物的室内环境中，要求各参赛队不使用这些现成的导航手段，而是探索生物体面对类似问题的解决方案，以满足稳定、控制以及导航的要求。

An example of a technique that could be used to solve the navigation problem in Mission 7 would be “optical flow.” It has been demonstrated in the laboratory that honeybees and other flying creatures use optical flow to assess speed, altitude, and drift when navigating. There is no reason why our autonomous aerial robots should not similarly be able to leverage such passive navigation techniques.

任务7可用一种称为“光流”的技术来解决导航问题。有研究已在实验室中证明，蜜蜂和其他的飞行生物使用光流来感知用于导航的速度、高度和偏移。我们的自主空中机器人没有理由不使用相似的被动导航技术。

Interaction between Multiple Aerial Robots: Reliable interaction between unmanned aerial systems and manned or unmanned aircraft is an essential capability that is necessary before civil aviation authorities will allow unmanned aerial vehicles to operate in manned airspace for civilian applications. The requirement is referred to as "sense and avoid". Air vehicles must be able to sense the presence of fixed and moving obstacles to avoid collision. Presently, the state-of-the-art in sense and avoid technology for unmanned aerial vehicles is in its infancy, and has never been reliably demonstrated in a fully autonomous aerial robot. This aerial robotic behavior, once demonstrated, rates very high on the state-of-the-art importance scale.

与其他空中机器人的互动：
无人机系统与有人或无人机间的可靠交互是无人机进入有人机空域或者取得民用资质所必须具备的能力，这种能力被称为“感知和规避”。空中机器人必须具有感知固定或移动障碍物并规避的能力。目前，无人机感知和规避的技术尚处于幼年时期，而且从未在自主空中机器人上得到可靠的验证。空中机器人这种自主规避的行为一旦得到验证，将在最先进的技术领域得到高度的认可。

Concerns by teams that their aerial robotic vehicle investment may be jeopardized by collisions of vehicles should drive their designers toward more robust designs. The IARC scoring formulas will also reward robust "crash-proof" air vehicle designs. For example, the design shown in this YouTube video (Robust Robot) is highly robust and would survive most any collision that might occur during the IARC.

参赛队需考虑到其空中机器人可能由于碰撞而带来损伤，应为对空中机器人采用更加坚固的设计方案。IARC的评分规则里也将增加关于抗撞击的设计评分。例如，该鲁棒机器人就是一种非常坚固的，可在比赛发生的碰撞中顽强生存的空中机器人。

MISSION 7 OVERVIEW

The seventh mission of the IARC will ultimately involve a head-to-head competition between aerial robots that will incorporate the three new behaviors described in the previous section of these rules. Before teams will be invited to compete head-to-head, they will be required to demonstrate that their design can perform the required behaviors necessary for a fair and meaningful head-to-head competition. This is referred to as "Mission 7a". Only those teams capable of demonstrating the behaviors of Mission 7a will ultimately be invited to compete head-to-head for an additional "super prize". This head-to-head competition is referred to as "Mission 7b". Mission 7b will involve two teams' aerial robots competing against each other in the same arena simultaneously.

任务7概览

IARC任务7最终将会是空中机器人之间关于上述三个新行为的头对头的比赛。各参赛队在被邀请进入头对头比赛之前，必须首先完成先前任务，以验证其设计具备可完成公平而有意义的头对头比赛的行为能力。验证这个能力的任务称为“任务7a”。只有在任务7a中验证了具有这样行为能力的参赛队方可被邀请参加最后的头对头比赛，竞争额外的“超级大奖”。头对头比赛被称为“任务7b”。在任务7b中，两个队的空中机器人将在同一个场地同时进行互相博弈的比赛。

The ultimate winner of the initial IARC Mission 7a will be based on the highest numerical score (see the section on SCORING) after inducing at least 4 ground robots to cross the green boundary. The winning team will receive a $30,000 prize. Soon thereafter, the IARC Judges will select the "best of the best" to be invited to go head-to-head for the even larger "super prize" in Mission 7b. (NOTE: All teams will get one last chance to qualify for 7b immediately prior to beginning 7b) Mission 7a can be thought of as the "Qualifier" for Mission 7b. Both Missions 7a and 7b will have an independent large monetary prize awarded to the best team based on its final numerical score.

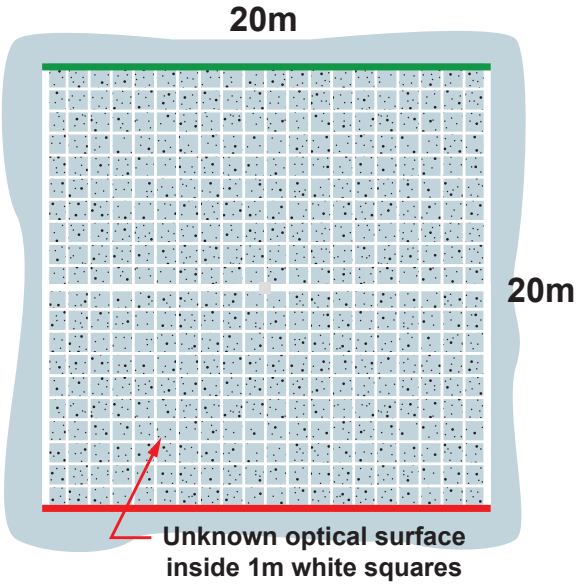
在任务7a中成功导引不少于4个地面目标机器人通过绿色边界，并获得最高分(见评分一节)的参赛队为最终获胜者，可获得3万美元的奖金。此后，IARC裁判将优中选优，选取参加头对头任务7b的参赛队，竞争更大的“超级大奖”（请注意：在任务7b正式开始前，所有参赛队都将获得竞争任务7b参赛资格的最后一次机会）。任务7a可以认为是任务7b的资格赛。任务7a和任务7b都为最好的参赛队设置了独立的大额奖金。奖金的获得依据各参赛队的最后得分。

Mission 7 Aerial Robotic Behavioral Demonstration

1. A square arena is marked on the ground in an indoor GPS-free arena. This square arena will be 20 meters on each side. The boundary shall consist of wide white lines bounding the sides of the square arena, with a wide red line on one end, and a wide green line on the other end as shown in the figure.

任务7的空中机器人行为验证

1. 在无室内GPS的区域划定一个每边为20米的正方形区域，如下图所示，正方形的一边为绿色，相对的另一边为红色，其他为白色。在白边的中点连接一条白线作为场地中心线。



2. Ten (10) iRobot Create® programmable ground robots will be placed at the center of the arena. The orientation of the ground robots will be such that they will initially move in all directions of the arena. The aerial robot will launch from a white side of the arena.

2. 十个iRobot Create®可编程地面目标机器人被放置在场地中心线附近,其初始朝使地面目标机器人向场地各个方向运动。空中机器人则可从场地两侧的任一白边起飞。

3. When the run begins, the ground robots begin to move toward the boundaries of the arena, but as collisions occur, they will reorient themselves to move in different directions or, after about 20 seconds of travel, they will redirect themselves. Eventually when a ground robot reaches any edge of the square arena, it is permanently removed from the arena.

3. 每轮比赛开始，地面目标机器人首先向场地周边运动。当发生碰撞或连续移动20秒后，目标机器人将改变运动方向。目标机器人移动到赛场边缘后将被永久移除。

4. Each robot has a tactile switch on the top. If an aerial robot comes close enough to just “touch the top” of the ground robot, the ground robot will change its direction of movement by 45 degrees (clockwise).

4. 每个地面目标机器人的顶部都有一个磁传感器。当空中机器人与目标机器人顶部足够接近，并“触碰了顶部”，目标机器人将以45度角(顺时针)改变运动方向。

5. It is the job of the autonomous aerial robot to redirect the ground robots and herd them toward the green side of the arena such that as many as possible cross over the green line. This is achieved by descending onto the top of a ground robot, the effect of which will be to cause the ground robot to change its direction by 45 degrees (clockwise). For example, descending upon the same ground robot twice will result in the robot’s direction changing 90 degrees (clockwise). Landing in front of a ground robot to induce a collision which will also cause the robot to change its direction of movement, but by 180 degrees. Ground robots that happen to collide will likewise change direction by 180 degrees.

5. 自主空中机器人的任务就是改变目标机器人的运动方向，并尽量多地将目标机器人赶往场地的绿边。这可通过下降至目标机器人顶部来实现。每一次下降，将引起目标机器人顺时针旋转45度角。例如，下降至同一个机器人上部2次，将使目标机器人顺时针旋转90度。在一个目标机器人前方降落，导致一次碰撞，将使目标机器人旋转180度而向相反的方向运动。目标机器人相互碰撞也同样可以导致180度转向。

6. In addition to the 10 ground robots that need to be herded toward the green end of the arena, there will be 4 robots with

6. 除了需要被赶往绿色边界的10个地面目标机器人外，还有4个上部带有柱状物（高度最多2米）的地面障碍机器人。

tall cylinders extending vertically from their upper surface (up to two meters maximum). These special ground robots will be preprogrammed to circle within the arena and to serve two functions. The first function is as a source to help randomize the motion of the other 10 target robots by periodically causing collisions that reorient those robots. The second function is to provide moving vertical obstacles that must be avoided by the aerial robot as it uses its sense and avoid technologies. Should more than two impacts occur between the aerial robot and one of the cylindrical obstacles, the run will be terminated.

这些特殊的地面障碍机器人将在场地中循环绕圈，执行两个功能。一是充当其他10个目标机器人可产生随机运动的导因，可通过间歇地引起碰撞从而改变目标机器人的方向。二是提供移动的垂直障碍物。空中机器人必须使用感知和规避技术来躲避这些障碍物。一旦空中机器人与柱状障碍物发生多余两次（不包含）的相碰，该轮比赛将被终止。

7. The autonomous aerial robot must analyze the directions of the various ground robots and redirect them toward the green end of the arena while avoiding the four obstacle robots. Aerial robots must stay within the boundaries of the arena, but are allowed to go up to approximately two meters outside the boundary momentarily (for up to 5 seconds). Aerial robots must not exceed an altitude of three meters above the floor, and they are allowed to land inside the arena.

7. 自主空中机器人必须分析地面目标机器人的不同运动方向，并引导其到场地绿边，同时躲避四个障碍机器人。空中机器人只能在场地内运动，但允许短暂地超出边界约2米（最多5秒钟），其飞行高度不能超出地面3米。允许空中机器人在场地内降落。

8. Strategies involved would be to redirect robots that are closer to the red or white edges of the arena before contending with robots that are either still close to the center of the arena, or which are generally on track toward the green end of the arena.

8. 涉及的策略是要及时改变已经接近比赛场地红边或白边的机器人的方向，而可以暂缓处理在中心附近或已经向场地绿边运动的机器人。

9. All of the robots are autonomous (both ground and air). When the run begins, the aerial robot should do everything that it can get the ground robots to the green edge of the arena while avoiding the obstacle robots. The run will be over when all of the ground robots either reach the green edge of the arena, or go out of bounds on either of the white edges or the red edge. In any event, assuming that there are still active (non obstacle) ground robots in the arena, the run will be terminated after 10 minutes, and any

9. 所有机器人必须是自主的（包括地面和空中的）。当比赛开始，空中机器人必须自主将目标机器人围堵到场地绿边，并且躲避障碍机器人。当所有的地面机器人或到达场地绿边，或从白边或红边出去，该轮比赛将结束。在任何情况下，只要10分钟的比赛时间到，即使仍然有活动的地面机器人在场地中（不包括障碍机器人），本轮比赛结束。此时，任何未达到绿边的地面机器人将被视为超出场地(译者注：从红边/白边)而被计负分。每轮比赛的比赛时间将作为决定最终大奖获得者的一个因素。

robots not yet over the green line will be considered to have gone out of bounds for the purposes of scoring. Completing a run in less time is a determining factor in the selection of the final grand prize winner.

10. To diminish the effects of bad "luck," each team will be allowed to perform a total of three times, and the one best performance out of the three attempts will be used as the final score for that team. The team with the highest score at the end of Mission 7a will be declared the winner.

10. 为了减少“运气”成分的影响，每个队可以进行3轮比赛，其中最好的一次得分作为该队的最终得分。在任务7a结束时，最高得分的队为任务7a的胜利者。

11. Mission 7a design strategies and capabilities will include speed, energy endurance, object recognition, air vehicle/ground vehicle interaction, tracking moving targets, maneuvering to land (momentarily) on (or in front of) a moving target, target identification, target prioritization, knowledge of the progress of ALL targets, obstacle avoidance, and the ability to navigate without external cues such as GPS or beacons. All of these must be demonstrated during Mission 7a in order to be eligible for Mission 7b.

11. 任务7a所需要的策略和能力包括速度、续航、目标识别、空中/地面机器人的互动、跟踪移动物体、在移动目标上方或前方短时降落、目标识别和目标排序，以及感知所有目标的进程、威胁规避和不依赖如GPS等外部导航信息的导航能力。参赛队只有在任务7a中验证这些能力后，才可进入任务7b的比赛。

GENERAL RULES GOVERNING ENTRIES

参赛的基本要求

1. Vehicles must be unmanned and autonomous. They must compete based on their ability to sense the unstructured environment of the competition arena. The size of any aerial robot shall be limited to 1.25 meters in any dimension. There is no weight limit. Only a single air vehicle can be deployed during a run.

1. 空中机器人必须是无人的和自主的,必须具有感知比赛场地的非结构化环境的能力。空中机器人在任何维度的尺寸不得超过1.25米。没有重量限制。 每一轮仅可使用一个空中机器人。

2. Computational power need not be carried by the air vehicle. Computers operating from standard commercial power may be set up outside the Competition arena boundary and uni- or bi-directional data may be transmitted to/from the vehicle in the arena, however there shall be no human intervention with any ground-based systems necessary for autonomous operation (computers, navigation equipment, links, antennas, etc.).

2. 所需的计算能力不必一定由机载计算机完成。可选用地面计算机置于比赛场地外面，可采用单向或双向数据链与场地中的空中机器人进行通信，但不允许人员与任何自主空中机器人的地面设备接触（计算机、导航设备、链路、天线等）。

3. Data links will be by means of radio frequencies in any legal band for the location of the arena.

3. 数据链的频率可以是比赛当地允许的任何无线电频段。

4. The air vehicle must be free-flying, autonomous, and have no entangling encumbrances such as tethers. The air vehicle can be of any type. During flight, the maximum dimension of the air vehicle can not exceed 1.25 meters. The vehicle must be powered by means of an electric motor using a battery, capacitor, or fuel cell as a source of energy. The vehicle must be equipped with a method of manually-activated remote override of the primary propulsion system.

4. 空中机器人可以是任何形式，但必须是自主、自由的，且不能有任何牵绊物，如绳索等。飞行中，空中机器人的最大尺寸不得超过1.25米。其动力必须是以电池、电容或燃料电池为能源的电动机。空中机器人必须装备可由人工切断其动力的安全开关。

5. Upon entering the arena under autonomous control, aerial robots must remain within the bounds of the arena or the attempt will end. The exception to this is any brief excursion of no more than 2 meters beyond any boundary line for less than 5 seconds Vehicles leaving the arena or in the Judges' opinion, are about to leave the arena at a high rate of speed, will have their flight terminated by a Judge. Flight termination actuation will be controlled by a Judge, not the team. Each team will supply the designated Judge with its manually-actuated safety shutdown control as they enter the arena prior to their attempt, and must demonstrate that the safety shutdown device is functional for the Judge.

5. 空中机器人在自主控制下进入场地比赛，并且保持在场地边界以内，允许短暂地飞出边界外(少于5秒)不超过2米，否则比赛将被终止。若空中机器人飞出了比赛区域，或者在裁判看来将要以很高的速度离开场地，裁判有权终止飞行。终止飞行由裁判实施而不是由参赛队实施。每个队在进入场地开始比赛前，必须向指定裁判提供可人工操作的安全开关，并且向裁判演示安全开关可以正常工作。

6. The ground station equipment and safety shutdown device, must be portable such that it can be setup and removed from the arena quickly.

6. 地面站和安全开关必须是便携式的，可以在赛场快速布置和移除。

THE IARC COMMON SAFETY SWITCH

Safety has always been a primary concern of the International Aerial Robotics Competition and an effective "safety switch" has always

IARC比赛通用安全开关

安全性永远是IARC大赛首要考虑的问题，有效的"安全开关"永远是比赛要求的一部分。

been a part of the Competition requirements. Often teams arrive at the IARC with safety switch solutions that are not independent of the onboard computer, or are in other ways inadequate. Teams without acceptable safety switch mechanisms are NOT allowed to fly.

需要指出的是，曾有参赛队使用依赖于机载计算机的安全开关，或者是其他不适当的方式。没有有效安全开关的参赛队将不允许飞行。

A simple and effective means of killing power to the motors of a small air vehicle through the use of a separate radio control receiver has been developed by a member of the IARC Judging staff so that teams can be assured that their safety switch will be acceptable to the Judges on the day of the Competition. This design can be copied and built as is, or used as a reference design for teams to implement into their own vehicle. This design is considered the standard design by which other safety switch mechanisms will be judged. Teams are not required to use this design, but are encouraged to do so. The details of the design can be downloaded as a .zip file by going to: Safety Switch.

一个简单而有效的关断发动机动力能源的方法是通过使用独立的无线电接收机。这个装置已经由IARC的一位裁判员开发出来，因此参赛队可以保证其安全开关在比赛当天可被裁判接受。这个设计可以提供给各参赛队直接使用，或者作为参考由各参赛队自行设计。这个设计可以认为是一个标准的设计，用以判别其他的安全开关机制。并不要求但鼓励各参赛队使用这个设计。该设计方案的细节可以到下面的网址下载 http://www.aerialroboticscompetition.org/downloads/killswitch.zip。

ARENA SPECIFICS

A square arena will be marked on the ground in an indoor GPS-free area. This square arena will be 20 meters on each side. The boundary shall consist of approximately 8 cm wide white lines bounding the sides of the square arena, and an 8 cm wide red line on one end, and an 8 cm wide green line on the other end of the square arena. An approximately 8 cm wide white line will bisect the arena in a direction parallel to the red and green ends. The floor space inside the arena will be optically textured with an unknown random or regular pattern. The arena will be two-dimensional, having no vertical dimension. Lighting in the arena will be an unknown, though it will likely be what would be encountered in a gymnasium.

场地说明

方形比赛场地将设在没有GPS的室内。该方形区域是20米 ×20米的正方形。其两个相对边为宽约8厘米的白边，另两个边一端为绿色，另一端为红色，均为约8厘米宽。另一个8厘米宽的白线与红边和绿边平行，将场地一分为二。场地中的地面具有随机或规则的光学纹理。场地为2维，没有垂直边框。场地中的光线是未知的，大体上如体育馆中的光线。

OPERATIONS

Teams will be given three (3) flight attempts. Each team will be given 10 minutes to setup their system and adjust parameters. If the team is unable to launch an aerial robot within the 10 minute window, one attempt is forfeited. Each team is granted one (1) pass. Once a set of attempts has been completed by a given team, the entire team will be required to leave the arena. No hardware may be left in place.

比赛

每队有3轮飞行的机会，每轮飞行前有10分钟的准备时间。如果10分钟结束时，参赛队仍不能使空中机器人起飞，该轮尝试失败。每队可允许一次轮空。每轮比赛完成后，参赛队必须离开比赛场地，不得遗留任何硬件。

During the static inspection of the aerial robot by the Judges, the aerial robot will be measured to verify the 1.25 meter maximum dimension constraint. The aerial robot size measurement will be made with appendages, rotors, propellers, etc. in the widest orientation. The aerial robot will also be examined to assure that all safety shutdown switch functions are fully operational prior to flight.

在静态检查时，裁判将测量空中机器人的尺寸，确认其是否满足1.25米最大尺寸的限制。空中机器人的尺寸测量包括附件、旋翼和螺旋桨等，均在其最大尺度方向。空中机器人的安全开关也将在飞行前被检查，以确保其工作有效。

MAKING APPLICATION TO ENTER

The official web pages for the competition are your source for all information concerning rules, interpretations, and information updates regarding the competition. In anticipation of the upcoming event, the official rules and application form will be obtained from the official web pages and will *not* be mailed to potential competitors. If you have received these rules as a hard copy from some other source, be advised that the official source of information can be found at:

http://www.aerialroboticscompetition.org/

The application form is available electronically at:

http://www.aerialroboticscompetition.org/entryform.php

All submissions must be in English. The completed application form is not considered an official entry until a check or money order

报名参赛

比赛官网是比赛信息的唯一来源，包括规则、解释以及与比赛相关的最新消息。对新一代比赛任务，比赛规则和申请表格需从官网下载，而不会通过邮件发送给可能的参赛队。如果从其他途径得到本规则的纸质版本，建议到以下官网进行信息查询。

http://www.aerialroboticscompetition.org/

报名表可在以下地址获得：

http://www.aerialroboticscompetition.org/entryform.php

所有报名必须为英文。报名表的提交只能视为报名意向。只有在5月1日(含)前通过支票或者现金交付1000美元报名费的参赛队，方可被接受为正式报名。（报名费在每次任务中只需交付一次）。

for 1000 U.S. Dollars is received by mail on or before May 1, of the current year for which a team officially enters the Competition (this is a one-time application fee).

For the American Venue, the application fee should be sent to the attention of the Competition organizer, Robert Michelson, P.O. Box 4261, Canton, Georgia 30114, U.S.A. The application fee should be made out as follows: SEPDAC Inc.† Checks or money orders made out to any name other than "SEPDAC Inc." will be returned. Credit cards can now be accepted.

美国赛区的报名费需交付到：
Robert Michelson, P.O. Box 4261, Canton, Georgia 30114, U.S.A. The application fee should be made out as follows: SEPDAC Inc.† Checks or money orders made out to any name other than "SEPDAC Inc." will be returned. Credit cards can now be accepted.

For the Asia/Pacific Venue:

亚太赛区的报名费交付到：

Use one of these two methods for electronic wire transfer—

ROUTE1：

SWIFT FORMAT		FOR REMITTER
56：	INTERMEDIARY BANKER'S NAME	JPMORGAN CHASE BANK, NEW YORK
	SWIFT CODE	CHASUS33
57：	BENE BANKER'S A/C NO.	001043718
	BENEFICIARY BANKER'S NAME	INDUSTRIAL AND COMMERCIAL BANK OF CHINA，BEIJING MUNICIPAL BRANCH, BEIJING, PRC
	SWIFT CODE	ICBKCNBJBJM
59：	BENEFICIARY'S NAME	CHINESE SOCIETY OF AERONAUTICS AND ASTRONAUTICS
	BENEFICIARY'ACCOUNT NO.	0200001109089123894
	BENEFICIARY'ADDRESS	NO.2 BEIYUAN ANDINGMENWAI CHAOYANG DISTRICT, BEIJING
	BENEFICIARY'PHONE NO.	+86(10)84924387/+86(10)84934114

ROUTE 2：

SWIFT FORMAT		FOR REMITTER
56：	INTERMEDIARY BANKER'S NAME	INDUSTRIAL AND COMMERCIAL BANK OF CHINA, SEOUL BRANCH
	SWIFT CODE	ICBKKRSE
57：	BENEFICIARY BANKER'S NAME	INDUSTRIAL AND COMMERCIAL BANK OF CHINA，BEIJING MUNICIPAL BRANCH, BEIJING, PRC
	SWIFT CODE	ICBKCNBJBJM
59：	BENEFICIARY'S NAME	CHINESE SOCIETY OF AERONAUTICS AND ASTRONAUTICS
	BENEFICIARY'ACCOUNT NO.	0200001109089123894
	BENEFICIARY'ADDRESS	NO.2 BEIYUAN ANDINGMENWAI CHAOYANG DISTRICT, BEIJING
	BENEFICIARY'PHONE NO.	+86(10)84924387/+86(10)84934114

This application fee covers all of the events for Mission 7a and 7b until it is achieved. Teams entering for the first time subsequent to 2014 are still liable for the application fee. (This fee has been instituted to discourage teams from applying that are not serious competitors).

报名费涵盖了任务7a和任务7b的所有活动，直至任务被完成。2014年以后进入任务7的参赛队也需缴纳报名费。（设置报名费的目的是鼓励参赛队报名后能认真准备参赛）。

Upon receipt of the one-time application fee, your team will become "official" and will get listed on the official web site (this helps you to gain sponsorship grants), and co-sponsors offering special promotions will be notified that your team is eligible for these offers (see offer details as they become available at: http://www.aerialroboticscompetition.org/).

一旦收到一次性的报名费，该队即成为"正式参赛队"而被列入比赛官网（这将有助于参赛队获得赞助），同时享受大赛协办方提供的各类赞助项目（见赞助详细信息网站：http://www.aerialroboticscompetition.org/).

† SEPDAC Inc. is a 501c3 tax exempt Georgia corporation established in part, to support the goals and missions of the International Aerial Robotics Competition.

A brief concept outline describing the air vehicle must be submitted for safety review by the Judges (the application form provides space for this). The Judges will either confirm that the submitting team design concept is acceptable, or will suggest safety improvements that must be implemented in order to participate.

为了便于裁判审核安全性，各参赛队需提交其空中机器人的设计概述（报名表中设置了相应项目）。裁判将或接受参赛队提交的设计概念，或给出增进安全性的建议。参赛队必须根据给出建议进行修改，以便顺利参赛。

A web page showing a picture of your primary aerial robot flying either autonomously or under remote human pilot control must be posted/ updated by June 1 of each year to continue to be considered as a serious entry. The web page should also include sections describing the major components of your system, a description of your entry's features, the responsibilities of each of your team members, and recognition for your sponsors. At least one picture of your vehicle flying is required, though additional photographs of the other components comprising the system are desirable. People accessing your page should be able to learn something about your system from the pages. Web pages that are deemed adequate will be listed with a link from the official Competition web site.

每年的6月1日前，各参赛队必须建立或更新一个网页，包含所用空中机器人自主飞行或者由人遥控的照片，以表明仍在准备参赛。网页中也应介绍空中机器人系统的组成，参赛队员名单及其分工，以及赞助商的标识。希望组成系统的更多地照片被展示，但至少应该包含一张飞行中的照片。浏览网页的人可以通过网页了解各参赛队的系统。被认可的网页将被在比赛官方网站中列出链接。

A research paper describing your entry will be due by the date shown at the bottom of these pages. The paper should be submitted electronically in .pdf, .docx, or .doc format via the upload feature at the Official IARC website (no hard copy is required). This paper will be presented as part of the annual Symposium to be conducted in concert with the IARC. Presentation at the Symposium is mandatory for all competing teams and is part of the static inspection process. Teams should augment their presentations with Keynote or PowerPoint presentations. Each team paper will be posted at the Official IARC web site after the event.

各参赛队在本规则底部显示的截止日期前提交一份描述参赛作品的研究报告。报告以电子形式提交，可以是pdf或docx或doc格式，通过IARC网站上传（不需纸质版）。报告可以作为在与IARC同时举办的学术年会中交流展示的一部分。报告交流作为静态检查程序的一部分，每个参赛队必须参加。报告时可以使用KEYNOTE 或 PPT。每队的报告将在比赛结束后在IARC官网发布。

Teams may be comprised of a combination of students, faculty, industrial partners, or government partners. Students may be undergraduate and/or graduate students.

参赛队可以由学生、教师、工业或政府的人员混合组成。学生可以是本科和/或研究生。鼓励多学科交叉的参赛队（如电子工程，结构工程，机械工程等）。

Inter-disciplinary teams are encouraged (EE, AE, ME, etc.). Members from industry, government agencies (or universities, in the case of faculty) may participate, however full-time students must be associated with each team. The student members of a joint team must make significant contributions to the development of their entry. Only the student component of each team will be eligible for the cash awards.

来自工业和政府机构的人员（或者是学校的教职工）可以参赛，但必须有全日制学生与其联合。联合队的学生队员必须对参赛作品具有明显的贡献。只有学生队员具有获得奖金的资格。

Since Mission 7 of the International Aerial Robotics Competition was announced in AD2013 and will run until the mission is completed (at least three competition cycles), anyone who is enrolled in a college or university as a full-time student (as defined by their university) any time during or after the calendar year that the team first made application for Mission 7a, is qualified to be a "student" team member.

因为IARC第七代任务在2013年发布，且持续到任务完成（可能至少需要3年），每个队第一次申请注册时在学院或大学注册的全日制学生（按各大学的注册规定），在此后的比赛中可一直被认为是“学生”队员身份。

LOGISTICS

Each team will be given three attempts during the total time allotted for performance judging. Within these three attempts the team shall demonstrate as much as it can. Due to the fact that the competition is not schedule driven, no team will be able to choose what time of day it will be making its attempt(s). The Judges will announce the starting order. After an attempt has been made, the team can choose to continue and make an additional attempt (within 10 minutes) or leave the arena and reenter the performance sequence. If a team is not ready to make an attempt when in sequence, it is allowed one "free pass" but must be prepared the next time or the lose one attempt. Each team will be allotted 10 minutes to start an attempt. The team captain will declare to the Judges the start of an attempt. If in the opinion of the Judges an attempt fails due to a situation beyond the team's control, it will not count against the team's remaining allotment of attempts.

比赛流程

在规定的正式比赛时间内，每个队有三轮尝试的机会。在这三轮尝试中，参赛队可充分地验证其机器人的性能。由于比赛难以严格遵循时间表，各参赛队不能选择某天具体的某个时刻进行比赛。裁判将公布比赛开始顺序。完成一轮尝试后，参赛队可以选择继续进行下一次尝试（在10分钟内做出），或者离开比赛场地重新排队。如果轮到某队出场但该队尚未准备好，允许该队使用一次“自由轮空”，但必须准备好下一轮比赛，否则将失去一轮尝试。每队在每一轮尝试中将有10分钟准备时间。由队长向裁判示意每轮尝试的开始。 如果裁判认为由于非参赛队因素导致了该轮尝试的结束，该轮尝试将不计入该参赛队的总共3轮尝试中。

The launch location is within any of the four corner 1m-by-1m squares. Air vehicles can only land within the arena for 30 seconds or less without terminating the run.

起飞区为场地四角四个1米× 1米的四方区域中的一个。比赛时，飞行器被允许着陆在场地中不多于30秒，否则将停止当轮比赛。

A specified "*Staging Area*." will be located outside of the competition arena. There will be a specified "*Contestant Area*." During the performance, the vehicle operator interface and vehicle operators, with the exception of the safety pilot, will be stationed in the *Contestant Area*. The team that is next in the competition sequence shall begin staging their equipment in the *Staging Area*. If the next team is planning to "pass" then at least one member of the team shall be present in the *Staging Area*. Once the currently performing team has finished and vacated the *Contestant Area*, the team currently occupying the *Staging Area* shall move its equipment into the *Contestant Area*. In the special case where at the end of a performance, the next team in the queue is not present or unrepresented in the *Staging Area*, one (1) attempt will be forfeited by that team and the Judges will call for the next team in the queue to move into the *Staging Area* where they will have 10 minutes to prepare prior to moving forward into the *Contestant Area*.

在比赛区外设置“等待区”，在比赛场边设置“选手区”。比赛时，除了安全操纵员，其他人员及设备必须位于“选手区”内。下一个参赛队需在“等待区”布置和准备其设备。即使这个队准备“轮空”，也至少应该有一名队员在“等待区”。一旦当前的比赛队完成当轮尝试并离开“选手区”，在“等待区”的参赛队将其设备移至“选手区”。一种特殊情况，当一个队比赛结束时，下一个参赛队未在“等待区”，则该队将丧失一次尝试机会，裁判将叫队列中的再下一支参赛队进入“等待区”，这支队在移入“选手区”前将有10分钟的准备时间。

Points will be used to determine team rankings and any progress awards apart from the grand prize. Judges will score each valid attempt, with the highest score being used to determine the final ranking score.

比分将用来决定比赛名次以及大奖以外的任何奖项。裁判将对每轮有效的尝试打分。3轮尝试中的最高分将用来决定最终名次。

Teams may have no more than one entry, though that entry may be comprised of any number of backup vehicles. Only one team may be affiliated with any particular university unit (though different universities may band together to form a single team) and each team must have a different Faculty Advisor. If several teams wish to enter from a single university unit, a decision must be made by the university (not the IARC) as to which team will represent that school's unit. This may be done as a result of an engineering analysis of each team's design and progress, or it may be as a result of an actual demonstration of hardware. The determination should be by a panel of impartial evaluators not directly affiliated with either team or their unit. Notification (prior to the journal paper submission) of which university entry is the "official" one must be provided in writing by someone equivalent to the "Dean of Engineering" since various departments or units from the same university may be vying for the honor of representing the university.

每个队只能有一个参赛作品，但该作品可以由几个备用飞机组成。一所大学中的每个学院只能有一个代表队（即使不同的大学可能联合组队）。且每个代表队需有各自不同的指导老师。如果一个学院有多个队想参赛，该大学（不是IARC）必须决定由哪个队代表该学院。该决定可以根据每个队的设计和进展决定，或者根据硬件的实际验证结果确定。决定应由一组与各参赛队无关的公平公正的专家做出。由于不同的院系都愿意竞争代表学校的荣誉，该最终决定必须由相当于“工程院院长”的人员签署，且于提交研究报告前给出。

It is hoped that teams will join together to offer their best ideas for the benefit of a single unified team, while being willing to compromise and defer to team members with specific training and skills. The most successful teams are interdisciplinary groups of dedicated engineers and scientists with backing from their university administration and industrial partners. Having a strong, involved Faculty Advisor has proven beneficial to all winners in the past.

各参赛队员都应该团结努力，集思广益，从团队的利益出发，为团队提供最好的想法，而不是仅依赖于几个有一定技能的队员。最成功的队往往是由来自学校或工业部门的有经验的工程师和科学家组成的多学科交叉联队。过去的比赛证明，具有强有力的，密切的指导教师的参赛队往往可以取胜。

To discourage multiple entries from the same university, each team vying to represent the university from a different unit must submit its individual applications in accordance with the schedule shown at the bottom of these pages, along with a nonrefundable 1000 U.S. Dollar application fee. No application will be considered valid without the accompanying fee being received. It is therefore in the interest of all potential competitors from a single university to form their team without the need for arbitration prior to submission of an application.

为了不鼓励相同学院的多支代表队参赛，同一学校不同学院的各代表队必须在下述截止日期前提交各自的申请表，并支付1000美元的报名费。报名费不退还。未支付报名费的申请将视为无效。因此一个大学有兴趣参加的所有潜在参赛者不用等待学校的裁决即可先行组队报名。

SCORING

Grand Prize Eligibility: Scoring will be based on performance of particular autonomous behaviors. Only those demonstrating the Mission 7a behaviors as defined above, are eligible to receive the grand prize cash award. In addition to the demonstrated behaviors described above, the journal quality paper describing the team's entry (defined below) must be submitted by the designated date.

评分

大奖资格：各参赛队的得分将根据其空中机器人的自主行为性能给出。只有那些验证了上述任务7a行为的参赛队有资格获得大奖。除了验证上述行为以外，描述参赛队作品（按下面的定义）的研究报告必须在指定日期前提交。

Who will be Declared the Winner of the Grand Prize: The team receiving the highest numerical score when the *minimum mission* is achieved, will win the AUVSI Foundation grand prize money and be declared the winner of the entire Mission 7a competition if no other teams are able to perform equally well in any given year. The minimum mission is defined as getting at least 4 ground robots that were "interacted with" by the aerial robot, to go across the green boundary before the end of the run. Other factors in the scoring formula (below) will determine the final score. In the event that multiple teams execute

谁将赢得大奖：在没有其他队可以做的同样好的情况下，完成最小任务且获得最高分的队可以获得AUVSI基金大奖奖金，并被授予任务7a的获胜者。最小任务定义：在每轮比赛结束前，至少有4个地面目标机器人被空中机器人"引导"且从绿边通过边界。得分公式（见下面）中的其他因素也会决定最终比分。如果多个队完成最小任务且总分相同，用时最少的队（±1分钟）将被认定为最终获胜者。

the *minimum mission* with the same aggregate score, the team performing in the least amount of time (±1 minute) will be deemed the winner.

A team's score will be based on a number of factors as follows:

每队的得分将按以下的因素计算：

Effectiveness Measures:
Points allotted for the following:

1. An initial credit to all teams to make scores positive (+12000 points)
2. Points for each ground robot crossing the green line **(B)** (+2000 points).
3. Points for each ground robot *not* crossing the green boundary line **(C)** (-1000 points).
4. Per minute penalty until the end of the run **(D)** (-100 points/minute to compete a run).
5. Fully autonomous operation **(z)** is required (+1), else (0).
6. Mission failure due to >2 obstacle collisions **(x)** (+1 for success), else (0 for failure).

实效得分：
得分按如下分配：

1. 预设每队的初始积分为+12000，以免出现负分数。
2. 每个通过绿边的地面目标机器人 (B) (+2000 分)。
3. 每一未越过绿色边界线的地面机器人分数为（C）(-1000)
4. 每分钟罚分直至比赛结束 (D) (-100 分/分钟，至比赛结束)。
5. 全自主飞行(z)(+1)，否则 (0)。
6. 由于与障碍碰撞两次以上（不包含两次）导致任务失败 (x) (+1 成功)，否则(0 失败)。

Subjective Measures:

1. Elegance of design and craftsmanship (E) (up to +1500 points).
1.1 Component integration (0 to +250).
1.2 Craftsmanship (0 to +250).
1.3 Durability/Robustness (0 to +1000).

主观评分：

1. 设计与工艺精巧性(E) (最高+1500 分)。
1.1 集成性(0至 +250)。
1.2 工艺性 (0至+250)。
1.3 耐久性/鲁棒性(0 至 +1000)。

2. Innovation in air vehicle design (F) (up to +1500 points).
2.1 Primary propulsion mechanisms (0 to +300).
2.2 Attitude/heading adjustment schemes (0 to +300).
2.3 Navigation techniques (0 to +300).
2.4 Target identification techniques (0 to +300).
2.5 Threat avoidance schemes (0 to +300).

2. 空中机器人创新性 (F) (最高+1500分)。
2.1 主推进系统机制 (0至+300)。
2.2 姿态/航向调节算法(0至+300)。
2.3 导航技术(0至+300)。
2.4 目标识别技术(0至+300)。
2.5 威胁规避算法(0至 +300)。

3. Safety of design to bystanders (G) (up to +1750 points).
3.1 Isolation/shielding of propulsors (0 to +1000).
3.2 Energy source stability/safety (0 to +250).
3.3 Crashworthiness (0 to +500).

3. 安全性设计 (G) (up to +1750 points).
3.1 螺旋桨的隔/保护 (0至+1000)。
3.2 能源的稳定性/安全性 (0至 +250)。
3.3 适毁性 (0至+500)。

4. ***Journal Paper.*** Each team is required to submit a journal-quality paper (written in English) documenting its project. This paper **(H)** is worth between -1000 and +1000 points depending on technical quality (0 points minimum for submitting a credible paper, and -1000 points for those not submitting a paper by the deadline). Papers are limited to 12 pages (including figures and references, if any). The format shall be single-sided with text occupying a space no greater than 9 inches tall by 6.5 inches wide centered on each page. Font size shall be 12 point (serif font) with 14 point leading. The example format is provided as an addendum to the rules (see: paper format). Topics to be covered are detailed in a printable document found at: paper content. A file (<50 MB in size) in .pdf format of your paper is due by June 1 of each qualifier year. Papers are to be uploaded via the website upload facility by the due date. All papers will become part of the IARC Symposium proceedings for that year and will therefore serve as a publication reference on team member resumés.

4. 研究报告。每队要求提交高质量的报告（用英文撰写）。报告分 (H)在-1000分 至+1000分之间，取决于报告的技术质量（提交可信报告的最少0分，在截止日期未提交报告的得-1000分）。报告限定在12页内（包括图和参考文献）。报告格式为单栏，居中，高9英寸，宽6.5英寸。字体为12磅印刷字体，行间距14磅。报告格式样例请见(报告格式）。报告的主题可在下述PDF文件中找到具体信息：报告内容。各参赛队的研究报告需以pdf的格式（<50MB）在每年的6月1日前提交。所有的报告将成为IARC会议论文的一部分。因此各参赛队员可在其简历中引用该报告。

5. ***Best team T-Shirt*** **(I)** (500 points to the best, 100 points to others having team Tee Shirts, and -100 points to those not having team Tee Shirts).

5. 最佳队服奖(I)（最好的队为500分，有队服的为100分，没有队服的为-100分）。

The teams will be rank-ordered by the judges based on score. Scores for a given round will be totaled according to the following formula:

裁判根据分数确定大赛名词。每轮得分按如下公式：

SCORE = x (12000 + B + C + D + E + F + G + H + I) z

得分 = x (12000 + B + C + D + E + F + G + H + I) z

The highest score accumulated by a given entry after all runs have been completed in any event year will be considered that team's current ranking for that year.

每个参赛队3轮尝试后的最高分将被视为该队的最后得分，成为确定名次的依据。

AIR VEHICLE DEFINITION AND ATTRIBUTES

1. "Air Vehicles" are considered to be those capable of sustained flight out of ground effect while requiring the earth's atmosphere as a medium of interaction to achieve lift (as such, pogo sticks and similar momentary ground-contact vehicles are not considered to be flying air vehicles). The scoring formula and arena have been carefully designed to normalize advantages inherent to a given class of air vehicles such that all may compete fairly to perform the same tasks. Prospective teams must decide how best to allocate resources to maximize their potential score in light of the constraints imposed by the arena, the task, and the scoring algorithm.

2. Air vehicles may only land within the arena while fully autonomous except when overridden by the safety pilot (which terminates the attempt). Initial launch must be autonomous and without human assistance other than to issue the launch command via a switch, voice control, or other electronic interface. Vehicles crossing no-fly boundaries, or which seem to be going away from a logical path leading to the target zone, will be brought back under safety pilot control or terminated by the Judges.

3. Each air vehicle must be equipped with an independently-controlled, non-pyrotechnic termination mechanism that can render the vehicle ballistic upon command of the Judges. This termination mechanism must be demonstrated to the Judges prior to each round of each event. Air vehicles may land under manual control of a safety pilot in the event of an emergency, but credit for that run will be forfeited unless manual control is exercised AFTER the mission has been completed in full. Both autonomous and manually-assisted landings must occur within the boundaries of the Competition arena or starting area.

空中机器人的定义和属性

1. "空中机器人"被认为是那些需要地球大气作为产生升力作用的媒介，可以脱离地效持续飞行的机器，（因此，弹簧棍和相似的短时地面接触的机器不能被认为是空中机器人）。场地设计和评分标准的制定充分考虑了各类飞行器的特点和优势，确保各类飞行器可公平地完成相同的任务。各参赛队必须决定怎样最好地分配资源，在场地、任务和得分算法的约束下，最大化其得分。

2. 空中机器人全自主飞行时只能落在场地内，除非被安全操纵手操控（此时比赛将终止）。除了用开关、语音控制或其他电器接口发出起飞命令，初始起飞必须是自主的而不能由人辅助。。飞行器若超过了场地的边界，或者离开飞往目标区的预定轨迹，必须由安全操纵员控制回来或由裁判终止飞行。

3. 每个飞行器必须配备一个独立控制的，非火工品的安全开关，以便需要时由裁判终止飞行。这个安全开关必须在每轮比赛前由裁判验证有效。飞行器在应急状态下应由安全操纵员人工控制着陆，但该轮成绩将失效，除非人工遥控是在完成全部任务后。自主和人工辅助着陆必须发生在比赛区域内部或者在起飞区。

SUMMARY OF ROBOT, ARENA, AND MISSION PARAMETERS

Target Ground Robots††

1. Trajectory Noise Occurs = 5 second interval
2. Amplitude of Trajectory Noise = 0° ≤ noise ≤ 20°
3. Period of Trajectory Reversal = 20 seconds
4. Direction of Trajectory Reversal = 180° ("clockwise")
5. Rotation of Trajectory for Collision = 180° ("clockwise")
6. Rotation of Trajectory for "Top Touch" = 45° ("clockwise")
7. Speed = 0.33 m/s
8. Initial Radius of Mission Robots (all facing outward, equally spaced) = 1 m

Obstacle Ground Robots

1. Trajectory Noise Occurs = Never
2. Amplitude of Trajectory Noise = 0°
3. Period of Trajectory Reversal = Never
4. Direction of Trajectory Reversal = 0°
5. Rotation of Trajectory for Collision = 0°
6. Rotation of Trajectory for "Top Touch" = 0°
7. Speed = 0.33 m/s
8. Initial Radius of Obstacle Robots = 5 m
9. Initial Direction = "clockwise"
10. Trajectory = 10 m diameter circle (centered on arena)

Arena Dimensions

1. 20 m x 20 m Square
2. Red boundary at one Edge
3. Green Boundary at Opposite Edge
4. White Boundaries on either Side
5. White Center Line Bisecting Square and Parallel with Green and Red Edges
6. White 1 m Circle at Geometric Center of Arena to Facilitate Initial Robot Placement
7. Four White Dots to Mark starting Location for Obstacle Robots.
8. Boundary Line Width = ~8 cm (two-dimensional tape or paint on ground)

机器人、场地和任务参数汇总

地面目标机器人 ††

1. 轨迹噪声频率=每5秒间隔
2. 轨迹噪声幅度=0° ≤噪声≤ 20°
3. 轨迹转向间隔=20秒
4. 轨迹转向角度=180°（顺时针）
5. 碰撞后轨迹旋转角度=180°（顺时针）
6. "顶部接触"后轨迹旋转角度=45°（顺时针）
7. 速度=0.33m/s
8. 目标机器人初始半径（均面向场地外，等间距）=1米

地面障碍机器人

1. 轨迹噪声=从不
2. 轨迹噪声幅度=0°
3. 轨迹转向间隔=从不
4. 轨迹转向角度=0°
5. 碰撞后轨迹旋转角度=0°
6. "顶部接触"后轨迹旋转角度=0°
7. 速度=0.33m/s
8. 初始半径=5米
9. 初始方向=顺时针
10. 轨迹=10米直径圆（场地中央）

场地尺寸

1. 20米×20米正方形
2. 一端为红边
3. 与其相对的边为绿边
4. 其他两边为白色
5. 中间白线平行于绿边和红边将场地平分为两部分
6. 直径为1米的白色圆在场地中心，用于初始放置地面机器人
7. 4个白色圆点标识障碍机器人的起始点
8. 边界线宽≈8厘米（2维胶带或者在地上施画）

Mission Parameters

Duration <= 10 minutes

Mission Robots that Remain in Arena after 10 minutes or at the end of the run = Eliminated (Negative Score)

Mission Robots that Cross Green Edge in under 10 minutes = Eliminated (Positive Score)

Mission Robots that Fail During Run = Eliminated (No Affect on Score) and are Left in Arena as Static Obstacles

Obstacle Robots that Fail During Run = Left in Arena as Static Obstacles

Obstacle Robots that Leave Arena = Eliminated as Obstacles

Aerial Robots that Leave Arena for more than 5 seconds or more than 2 m Beyond Boundary = Run Terminated (No Score)

Aerial Robots that Collide with Obstacles more than twice (other than Ground or Mission Robots) = Run Terminated (No Score)

Aerial Robots that Return to Manual (Piloted) Control before the End of Run = Run Terminated (No Score)

Aerial Robot Flight that must be Terminated by Judge for Safety Reasons = Run Terminated (No Score)

†† These specifications are "typical", and are provided so that teams can test realistically at home. During the IARC runs, initial conditions may vary to induce more random behavior in the ground robots. The ground robot source code will be provided to officially-registered teams, as will any modifications to the iRobot Create® Programmable Robots so that teams can work with the same equipment that will be provided in the arena.

Judging

A team of three or five judges (per venue) will determine compliance with all rules. Official times and measures will be determined by the Judges. Team papers will have been reviewed by the Judges in advance of the flight performance.

任务参数

持续时间≤10分钟

每轮结束后或10分钟后仍留在比赛区域的任务机器人将会被移除（负分数）。

在10分钟内越过绿边的目标机器人=移除(正分)

每轮中故障的目标机器人=移除(不影响分数)

每轮中故障的目标机器人=留在场地作为静态障碍

每轮中故障的障碍机器人=留在场地作为静态障碍

离开场地的障碍机器人=移除

空中机器人离开场地大于5秒或超出边界2米=本轮结束(该轮0分)

空中机器人与障碍(不是场地地面或目标机器人)相撞两次以上（不包含两次）=本轮结束(该轮0分)

空中机器人在本轮结束前被人工控制返回=本轮结束(该轮0分)

空中机器人被裁判以安全原因终止飞行=本轮结束(该轮0分)

††这些说明是“理想”的，提供给参赛队实现自行测试。在IARC实际比赛中，初始条件可能会变化，从而对地面机器人引入更多的随机行为。地面机器人iRobot Create®的源代码将提供给正式注册的参赛队，以便各队可以用与比赛场地相同的设备进行测试。

裁判

由3人或5人组成的裁判组（每个赛区）遵照规则裁决。比赛时间和分数将由裁判决定。研究报告须在比赛飞行前由裁判审阅。

Prize Awards

The following benefits accrue to the teams participating in, and winning the International Aerial Robotics Competition:

1. As an incentive, all Mission 7a teams demonstrating the essential behaviors required to be invited to Mission 7b, will receive a one-time $1,000 award when they attend either the American or Asia/Pacific Venue. The ultimate winner of the initial IARC Mission 7a will be based on the highest numerical score (see the section on SCORING). The winning team will receive a $30,000 prize. Soon thereafter, the IARC Judges will select the "best of the best" to be invited to go head-to-head for the even larger "super prize" in Mission 7b. The organizers reserve the right to increase the prize amount at any time. Mission 7a can be thought of as the "Qualifier" for Mission 7b.
2. Any other awards prior to the completion of the full mission, shall be distributed at the discretion of the Judges.
3. International recognition for the winning students' university.
4. International recognition through AUVSI for the winning team's sponsors.
5. Free full-page advertisement in Unmanned Systems magazine for the winning team and its sponsors.
6. Free one year membership for all team members to the Association for Unmanned Vehicle Systems International.

Summary of Transition from 7a to 7b

1. Interact with 4 or more ground robots to influence them to cross the green boundary in under 10 minutes.
2. Conduct the entire mission fully autonomously from launch to final landing.

奖项

所有参加国际空中机器人大赛的参赛队都将有机会获得以下奖项：

1. 作为鼓励，美国和亚太赛区所有在任务7a中验证其具有参加任务7b能力的参赛队都将获得1000美元的一次性奖励。IARC任务7a的最终获胜者将是得分最高者（请见评分部分）。获胜队将获得30,000美元奖金。此后，IARC裁判将“优中选优”，邀请进入任务7b头对头比赛，角逐更大金额的奖金。大赛组织者保留在任何时候增加奖金额的权利。任务7a可以被认为是任务7b的资格赛。
2. 任何在完成所有任务前的其他奖励，将由裁判裁决和分配。
3. 提高获胜学生所在大学的知名度
4. 提升获胜队赞助商的国际知名度
5. 在《无人系统杂志》为获胜队及其赞助商提供一整版免费广告。
6. 所有参赛队员免费一年的国际无人机系统协会会员资格。

7a到7b任务升级汇总

1. 10分钟内，引导不少于4个地面目标机器人通过绿色边界；
2. 从起飞到最终着陆，需全程自主完成任务。

2017 SCHEDULE

	American	Asia/Pacific
REMEMBER THESE IMPORTANT 2017 DATES:		
2017 Application Deadline (*for teams new to Mission 7a*)	**May 1**	**May 1**
Current Team web page on line	**June 1**	**June 1**
Journal quality paper (all teams)	**June 1**	**June 1**
***Having flown the Mission 7a at home twice**	**June 1**	**June 1**
(Recommended strongly*)**		
Other Actions:		
Final Attendee List	**(*via E-MAIL*)**	
Team Check-in/Registration	**(*done online*)**	
Subjective Measures Judging	**(*by appointment*)**	
2017 Symposium on Indoor Flight Issues	***(day before competition day)***	
Performance Judging (*visitors welcome*)	**(*competition day*)**	
Awards Banquet	**(*time announced upon arrival*)**	

NOTE: "Practice times" for American Venue teams to align their systems near or in the Arena, will be on the day before competition day (but not during the Symposium hours).