Official Rules for the International Aerial Robotics Competition
国际空中机器人大赛 官方规则 任务9
MISSION 9

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.

Mission 9 will build on past missions to demonstrate both enhanced Mission 8 behaviors as well as new aerial robotic behaviors unique to Mission 9.

TECHNOLOGIES TO BE DEMONSTRATED

Beyond those technologies and behaviors that have been demonstrated during past missions (full autonomy, obstacle avoidance, tracking, etc.) the following are emphasized:

1. Manipulation of large objects
2. Fast outdoor operations over long distance
3. Interaction with moving frames of reference
4. Aerial robotic repair of mobile platforms
5. Optical recognition
6. Navigation using GPS/Optical/Magnetic only (no other aids)
7. Use ONLY onboard computing (no data links except for kill switch and safety pilot override).

VENUES AND INTERNATIONAL TEAMS

SEE COVID ADDENDUM The International Aerial Robotics Competition Mission 9 will be conducted at two venues: The *American Venue*

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。

国际空中机器人大赛的第9代任务将基于之前的一系列任务，参赛机器人需要在任务9中展现出强于在任务8中的表现，同时需具备任务9所要求的独特性能。

将被验证的技术

除了在过去的任务（完全自主，避障，跟踪等）中已证明的技术和行为之外，还强调了以下内容：

1. 操纵大型物体
2. 长距离户外快速作业
3. 与移动参考系的相互作用
4. 移动平台的空中机器人维修
5. 光学识别
6. 仅使用GPS /光学/磁性导航（无其他帮助）
7. 仅使用机载计算（除一键关机和安全驾驶员超控外，无数据链接）。

赛区与国际赛队

国际空中机器人大赛（IARC）的第九代任务将分美国赛区和亚太赛区举办。各赛区具体地址将发布于国际空中机器人大赛（IARC）

and the *Asia/Pacific Venue*. The locations of these venues will be announced at the Official IARC website. Instructions about how to enter this competition are given later in these rules. Teams must designate at which of the two venues they wish to compete. Once a venue is selected, teams will continue to compete at the selected venue unless they choose to re-register and start over by paying the up-front one time Application Fee.

Each venue has visa and customs requirements that are dictated by the host country and are beyond the control of the IARC Organizer and Staff. It is recommended that international teams requiring visas, begin the visa acquisition process several months in advance of the IARC.

Check customs procedures and in some cases it may make more sense to ship equipment ahead by international courier than attempting to carry it as carry-on or checked baggage.

的官方网站，具体的报名方式将在后文中详述。各参赛队需要指定他们希望参加哪个赛区的比赛，赛区一旦选定，参赛队需要在该赛区内完成全部比赛项目，如要更换赛区，需重新注册并重新缴纳报名费。

参加比赛所需要的签证和其他海关要求将直接由主办国家给出要求，并在国际空中机器人大赛赛委会的控制范围之外。因此，建议参加比赛的国际队伍提前数月准备签证事宜。

同时请提前查阅海关的相应要求。请注意，在某些情况下，通过国际物流将比赛器材提前运达可能要好过乘机时随身携带或托运。

NARRATIVE

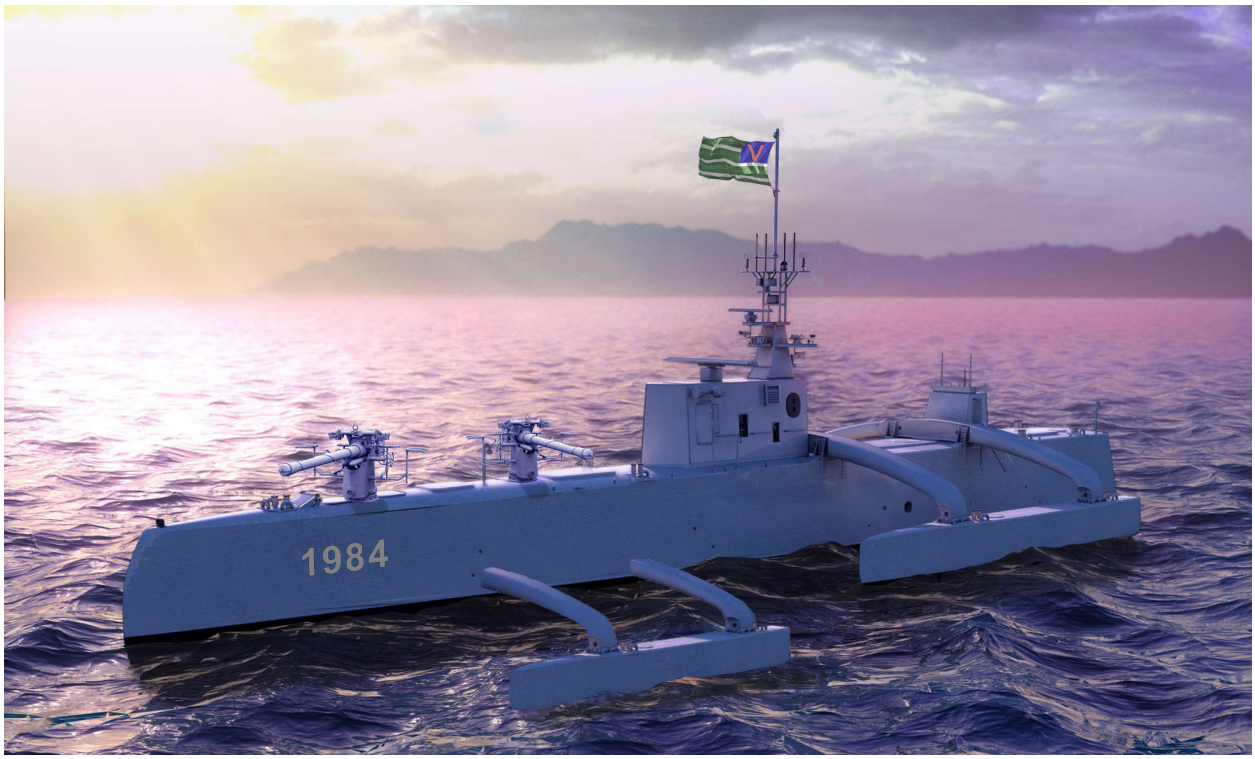
You live in a world controlled by artificial intelligence (AI). All super powers are now governed by machines for the benefit of mankind. The AI overlords maintain order in society without emotion, bias, or compassion. Robot armies enforce order and conformity. Humans who express opinions that are contrary to the State are eliminated. The only relatively free people in the world live in human-governed island nations without electronic surveillance--but many see the control of the super powers encroaching. It is only a matter of time before the AI overlords demand allegiance from these island nations.

Swift lethal ocean-going Hunter-Killer vessels able to traverse thousands of kilometers over open seas for months at a time, without a single crew member aboard, patrol the oceans to maintain control of shipping lanes and oceanic commerce.

任务背景

你生活在一个由人工智能(AI)控制的世界里。所有超级大国现在都为人类的利益而用机器治理。AI霸主在没有情感、偏见或同情的情况下维持社会的秩序。机器人军队执行命令和服从命令。表达与国家相反意见的人将被淘汰。世界上唯一相对自由的人民生活在没有电子监视的人类控制的岛国--但许多人看到超级大国的控制逐渐逼近。AI霸主要求这些岛国效忠只是时间问题。

快速致命的远洋猎杀船一次可以穿越公海数千公里在海上巡逻，以维持对航道和海洋商业的控制，但上面没有船员。



A group of island nations have secretly banded together to overthrow the AI overlords. A serious flaw has been discovered in the weapons systems used by the AI overlords to maintain control over humanity. A communications module has been developed that will disable all types of weapons systems by causing them to fail to function when commanded. A covert campaign has been instigated to replace as many AI overlord weapons systems with the new communications module as possible over the next 9 months. Unfortunately due to the autonomous nature of the weapons systems, the only way to gain control is to physically replace the communications module and its antenna.

Your team has developed a new communications module that is common to all AI overlord weapons platforms. If this module is surreptitiously replaced in any weapons platform, that platform will no longer respond to the AI overlords, but will instead come under the control of the International AI Rejection Coalition (IARC) of which your team is a member.

一群岛国秘密联合起来推翻AI霸主。他们在AI霸主用来控制人类的武器系统中发现了一个严重的缺陷。他们开发出一种通信模块，它可以使所有类型的武器系统在接到命令时无法工作，从而使其失效。在接下来的9个月里，一个秘密的行动已经开始，尽可能多的更换AI霸主的武器系统的通信模块。不幸的是，由于武器系统的自主性，制服它们的唯一方法是物理更换通信模块及其天线。

你的团队开发了一个新的通信模块，这是所有AI霸主武器平台的共用模块。如果这个模块被秘密地替换到任何武器平台上，那么这个平台将不再对AI霸主做出反应，而是由国际人工智能拒绝联盟（IARC）控制，你的团队正是这个IARC的成员。

你的团队位于一个小岛屿国家，经常观察到猎杀船在离岸2.5公里（1.6英里）的珊瑚礁外活动。你们的团队已经开发出一种自主的掠海式空中机器人，它可以追踪猎杀船 ，

Your team is located in a small island nation that frequently observes Hunter-Killer vessels operating outside the system of barrier reefs lying 2.5 km (1.6 miles) off the coast. Your team has developed an autonomous sea-skimming aerial robot than can track a Hunter-Killer vessel and rapidly approach it below its radar detection pattern (an altitude of less than 15 m (49 ft)). Once within 100m, the Hunter-Killer's sensors can not detect the presence of the aerial robot regardless of position due to range-gate limitations.

The critical module targeted by your design team is located on the main mast of the Hunter-Killer vessel. It can be removed and replaced with a "hot swappable" replacement module at which time, the Hunter-Killer vessel will come under the control of your team.

Your team has prepared a prototype aerial robot to perform this mission on the next Hunter-Killer vessel encountered. If successful, the IARC campaign to replace as many weapons systems communications modules as possible will begin.

并在低于其雷达探测波束下面快速接近它（海拔小于15米（49英尺））。一旦抵近到100米之内，猎杀船的传感器就无法检测到空中机器人的存在，而不管其位置是否位于位于探测门限内。

你的设计团队发现的关键模块位于猎杀船的主桅上。它可以 “热插拔”，被替换成新的模块，替换后，猎杀船将受到你的团队的控制。

你的团队已经在遇到下一艘猎杀船之前准备了一个空中机器人原型来执行这个任务，如果成功，IARC将开始尽可能多的更换武器系统通信模块的行动。

OBJECTIVE

Your autonomous aerial robot will receive as a payload, one replacement communications module. Upon command, your aerial robot will take off and fly at less than an altitude of 15 m (49 ft) to a distance of approximately 3 km (1.9 miles) to apprehend a Hunter-Killer vessel. The aerial robot will then remove the communications module from the Hunter-Killer (dropping it on site) and replace it with the communications module payload that it is carrying. Upon completion of the module swap, the your aerial robot will return to its point of origin and land.

目标

你的自主空中机器人将收到一个通信模块作为有效载荷。根据命令，你的空中机器人起飞后并在低于15米（49英尺）的高度飞行3公里（1.9英里）以接近一艘猎杀船。然后，空中机器人将把原通信模块从猎杀船上取下（扔在现场），并用携带的新通信模块有效载荷替换。完成模块交换后，您的空中机器人将返回其原点并着陆。

Speed is critical. Due to fuel and energy constraints, as well as the expected time that the Hunter-Killer vessel is within range, the entire mission must be completed in 9 minutes.

速度至关重要。由于燃料和能量的紧张，以及预期的猎杀船在射程内的时间，整个任务必须在9分钟内完成。

Your design team's task is to create an aerial robot that can:

1. Fly fully autonomously
2. Use ONLY onboard computing (no data links except for kill switch and safety pilot override)
3. Avoid obstacles including
   a. other aerial robots
   b. physical obstacles
4. Conduct the mission successfully (replace the module and return home) in under 9 minutes.

COMPETITION ADMINISTRATION

SEE COVID ADDENDUM During any competition year, each team will be allowed 3 attempts to demonstrate that it can perform the mission. Before attempts begin, each team must demonstrate that its vehicle can fly autonomously (including takeoff and landing), and can physically carry the designated payload. This is "qualification". Teams unable to meet this minimum qualification requirement, will not compete. Once a team has qualified, it will then be allowed to compete. The team conducting the mission successfully in the least time will be declared the winner.

The attempt will begin upon the signal of the Judges. Teams must be ready to begin their attempt when called. Each team will have one "pass" allowing them to move to the rear of the attempt queue. Teams that are absent or not ready when their turn in the attempt queue arrives, shall forfeit that attempt.

A monetary prize will be awarded to the team successfully performing the mission in the least amount of time. It is possible that no team will successfully complete the mission in the first year, in which case, the competition will start over in the following year and the prize money will be increased. More than one team may successfully perform the mission in a given year, but the one doing so in the least amount of time at either venue will win the grand prize.

您的设计团队的任务是创建一个空中机器人，可以：

1. 完全自主飞行
2. 仅使机载计算
（除安全飞行员超控一键关断指令外，没有其他数据链路）
3. 避障碍，包括
   a. 其他空中机器人
   b. 物理障碍
4. 成功执行任务
（更换模块并回家）9分钟内。

比赛管理

在每年的赛中，每个队将被允许3次尝试证明能完成任务。在正式比赛开始之前，每个团队必须证明它的飞行器可以自主飞行（包括起飞和着陆），并且可以物理地携带指定的有效载荷。这称为“资格”。不能达到最低资格要求的队伍将不参加正式比赛。一旦一支队伍合格，就可以参加比赛。在最短时间内成功完成任务的团队将被宣布为赢家。

比赛在裁判发出信号后开始。

参赛队在被呼叫比赛时必须做好开始比赛的准备。每个团队都有一次“轮空”机会，允许他们移动到每一轮比例的后面。当轮到比赛的队伍缺席或没有准备好，将失去本轮比赛。

将向在最短时间内成功执行任务的队伍颁发奖金。有可能在第一年没有队伍能完成任务，在这种情况下，比赛将在第二年继续，奖金也将增加。如果不止一支队伍在当年成功地完成任务，用最少时间完成任务的队伍将赢得大奖。

Since the American and Asia/Pacific Venues will be identical, whichever team at whichever venue can complete the entire mission successfully in the minimum time, will be the sole winner of the grand prize. Determination of the final winner will be announced once both the American and Asia/Pacific Venues have been completed in any competition year.

由于美国和亚/太赛区同步进行比赛，两个赛区用最短的时间内成功完成整个任务的队，将是大奖的唯一赢家。一旦美国和亚太赛区的任何一个队在当年完成任务，本次比赛任务将宣布最终获胜者。

The grand prize will begin at $10,000 and will increase by $10,000 for each year that the mission continues.

大奖将从1万美元开始，并将在任务持续期内每年增加1万美元。

AERIAL ROBOT DESIGN DETAILS

Your aerial robot must be fully autonomous and capable of performing all aspects of the mission without human intervention. The only control involving a human is to command the launch of the vehicle.

空中机器人设计要求

你的空中机器人必须是完全自主的，能够在没有人为干预的情况下完成任务的所有方面。唯一由人控制的是发送起飞指令。

The vehicle is to be self-contained (no off-board computing). The aerial robot must have an endurance exceeding the 9-minute run time.

空中机器人应具备全功能(无非机载计算）。续航时间必须超过9分钟。

Obstacle avoidance must be incorporated into the design. Obstacles could be physical items on the ground or other aerial robots operating in the arena.

设计中必须考虑避障。障碍物可以是地面上的物理物品，也可以是在在赛场上的其他空中机器人。

The aerial robots must be able to self-navigate using GPS, visual cues, or magnetic headings.

空中机器人必须能够自身导航，使用GPS、视觉或磁航向进行导航。

Your aerial robot can be of any configuration (rotary wing, fixed wing, lighter than air, etc.) and can be comprised of a “mother ship” and expendable air-launchable subvehicles if desired. Propulsion can be electric or fossil fuel, but rocket propulsion or ballistic propulsion is prohibited. The complete aerial robotic system must weigh less than 90 kg (198 lbs).

您的空中机器人可以是任何布局（旋翼，固定翼，比空气轻，等等），并且可以包括一个“母机”和可消耗的空中发射子机，如果需要的话。推进可以是电力或化学燃料，但火箭推进或弹道推进是被禁止的。整个空中机器人系统的重量必须小于90千克（198磅）。

The aerial robot must be able to find the module based on its bright blue color and the words, “**модули иртибот**” written above the module, grasp the existing module, replace it by pulling it off of its mount, and install the new

communications module on the same mounting point. Upon completing those tasks, the aerial robot must return to its launch point and land using its original 3km ingress path.

空中机器人必须能够根据模块上方的明亮蓝色和写着的“модули иртибот”文字，找到模块并抓住模块，将其从安装架上拔下进行更换，并将新的通信模块安装在同一个安装点上。完成任务后，空中机器人必须按3公里原路径返 回其发射点并着陆。

The module is located on a triangular tubular mast in proximity to a rotating radar antenna and various obstacles such as whip antennas and flags. General details of the mast are known to you, but everything will be moving semi-randomly as the ocean waves cause the Hunter-Killer vessel to pitch and roll. The Hunter-Killer vessel will be stationary in the water at the time your aerial robot arrives.

该模块位于靠近旋转雷达天线和各种障碍物（如鞭状天线和旗子）三角形的形管状桅杆上。桅杆的一般细节会让你知道，但所有部件将是半随机的移动，因为海浪导致猎杀船俯仰和滚转。当你的空中机器人到达时，猎杀船将停在水中。

A safety pilot can override the aerial robot's autonomous flight, but doing so will terminate the run. In addition, an independent "kill switch" must be supplied to the judges. Only a judge will decide when to terminate the flight (usually catastrophically), not a team member, although in less critical circumstances, the judge may call for the team's safety pilot to bring the vehicle down safely before resorting to the use of the kill switch as a last resort. The kill switch will be able to render the aerial robot completely ballistic (dropping from the air instantly). "Independent" means that the kill switch will have its own transmitter and not use the vehicle's onboard computer to process the kill command (therefore bypassing the flight computer should it fail). The kill switch will have to be demonstrated to the judging staff before teams are allowed to fly.

一个安全飞行员可以超控空中机器人的自主飞行，但这样做将终止比赛。此外，必须向裁判提供一个独立的“一键关机”。只有裁判才会决定何时终止飞行（通常是灾难性的），而不是团队成员，尽管在不太危急的情况下。裁判可能会要求团队的安全飞行员在采取“一键关机”最后手段之前将机器人安全降下。“一键关机”将能够使空中机器人完全呈弹道性（立即从空中坠落）。“独立”是指“一键关机”将有自己的发射器，而不使用飞行器的机载计算机来处理“一键关机”（因此，如果失败，将绕过飞行计算机）。在允许参赛队飞行之前，必须向裁判人员演示“一键关机”。

THE RUN

A run lasts 9 minutes. A run begins upon the command of a judge. A run ends when either:

(1) The module is successfully replaced and the aerial robot successfully lands at its starting point,
(2) When 9 minutes has expired,
(3) When there is a collision between the team's aerial robot and any other object,
(4) When a team's aerial robot lands in the arena,

比赛轮次

每轮持续9分钟。在裁判的命令下开始比赛。当下列情况之一发生时，本轮结束：

（1）模块已成功替换且空中机器人成功地降落在起点，
（2）9分钟时间到，
（3）当团队之间的空中机器人或与任何其他物体发生碰撞

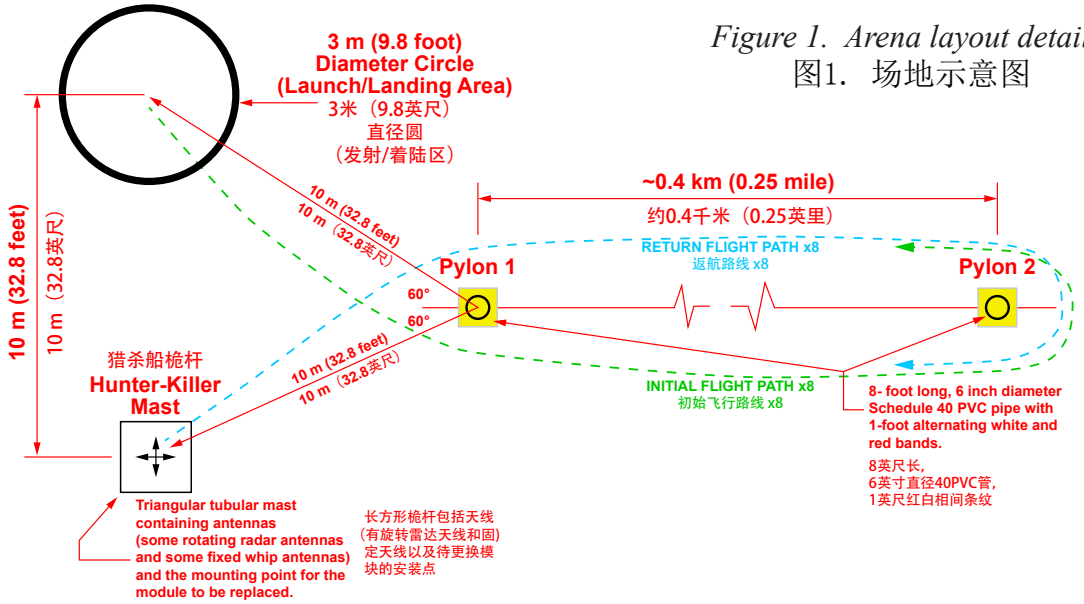


Figure 1. Arena layout details.
图1. 场地示意图

(5) When the judges call for the aerial robot to be manually controlled or the kill switch has been operated.

（4）当一个队的空中机器人降落在赛场，
（5）当裁判要求空中机器人手动控制或已操作“一键关机”。

THE ARENA

The arena will be large outdoor area of undefined length and width. Within the arena, there will be the communications/surveillance mast of the Hunter-Killer vessel, and upon that mast the communications module is mounted. See Figure 1.

赛场

赛场将是一个长宽不限的户外区域。在赛场内，将有猎杀船的通信/监视桅杆，在桅杆上安装通信模块。见图1。

The launch point will be a 3 m (9.8 foot) diameter white circle approximately 10 m (32.8 feet) to one side of the simulated Hunter-Killer mast.

发射点将是一个3米（9.8英尺）的白色圆圈，距离模拟的猎杀船桅杆一侧约10米（32.8英尺）。

To compress the linear distance of the arena, two pylons separated by approximately 0.4 km (0.25 mile) will serve as a “loop back” point. The approximate 3 km (1.9 mile) course will be broken into 8 trips between the two pylons. Figure 1 shows the configuration of the arena. Team aerial robots will takeoff near the Hunter-Killer mast, make 8 trips between the pylons, complete the communications module replacement at the Hunter-Killer mast, and return by making 8 trips between the pylons to land at the takeoff location.

为了压缩赛场的直线距离，设置两个相距约0.4公里（0.25英里）的塔架作为“回转”点。大约3公里（1.9英里）的航程是通过在这两个塔架间往复绕8圈来实现。图1示出了比赛场地的结构。空中机器人起飞点起飞后，绕两个塔架飞行8圈后在猎杀船处完成更换模块的任务，完成任务后同样再围绕塔架绕8圈回到起起飞点着陆。

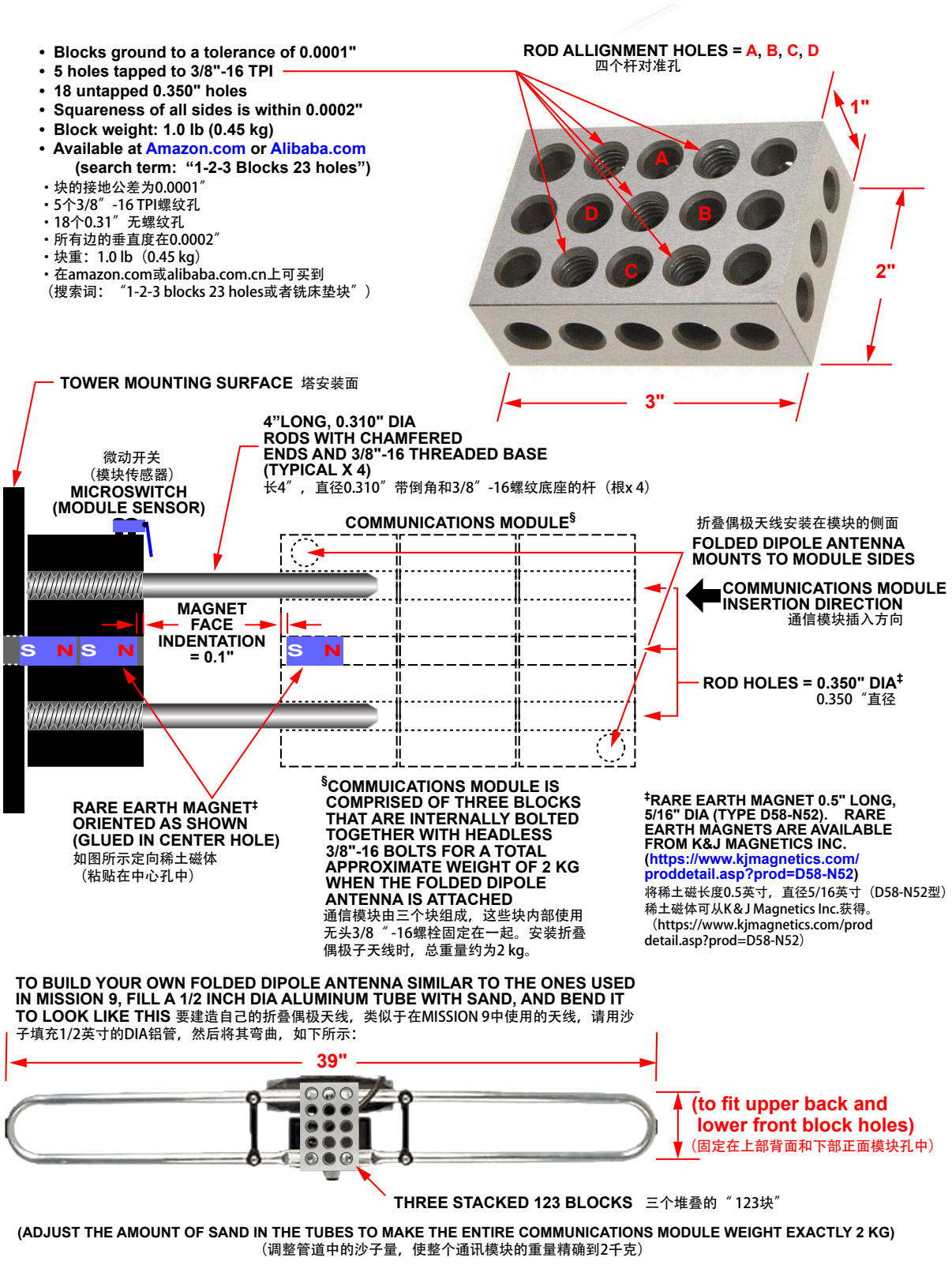


Figure 2. Communications Module interface specification.
图2. 通信模块接口定义

In Figure 1, dotted lines show the return path of the aerial robot from the launch area or the Hunter-Killer mast to pylon number 1.

图1中，虚线所示的路径是空中机器人从起飞（或者从猎杀船）到塔架1的路径。

The communication modules weigh approximately 2 kg (4.4 pounds) and are defined in Figure 2. The module installation location will have "**модули иртибот**" written above it.

处理模块的重量约为2千克（4.4磅），如图2所示。模块的安装位置应在其上方写上"модули иртибот"

ENTERING MISSION 9

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.

任务9报名指南

比赛官方网页提供有关比赛规则，解释和更新的所有信息。 官方规则和申请表可以从官方网站上获得，且并不会发送给潜在的竞争对手。如果您从其他来源收到这份规则的纸质版，请注意官方的信息可在以下网址找到：

http://www.aerialroboticscompetition.org/

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

电子申请表单可以在以下网址中获得：

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

All submissions must be in English. The completed application form is not considered an official entry until an Application Fee (1500 U.S. Dollars - American Venue, or 10,800 RMB - Asia/Pacific Venue) is received on or before June 1 of the current year for which a team officially enters the Competition and each subsequent year that the team participates (this fee is NON-REFUNDABLE if a team is either unable to attend or chooses not to attend).

所有提交的文件必须用英文撰写。每支队伍的比赛报名费用为1500美元（美国赛区）或10,800人民币（亚太赛区），且需要在当年的6月1日或之前缴纳 。（注意：如放弃参赛，报名费用不可退还）

On the final day of the competition, each team captain will receive a rebate (500 U.S. Dollars - American Venue, or 3,600 RMB - Asia/Pacific Venue). Teams failing to show up to the competition, or leaving prematurely, agree to forfeit their rebate.

在比赛的最后一天，每队队长可以收回500美元（美国赛区）或3,600人民币（亚太赛区）的退款，若未参加比赛或提前离开比赛，则视为放弃这部分退款。

Teams must be based at a university and must have an identified academic faculty advisor. Only one team per university unit is allowed to compete, and each team must have uniquely-developed aerial robotic hardware (no sharing of aerial robots).

每支比赛队伍必须来自于大学，且必须有一个确定的指导教师。每个大学的同一院系只能有一支队伍参赛（即每个大学可以有多个队），且每支队伍必须使用独立的比赛设备（即不能与其他队伍共享空中机器人）。

TEAM QUALIFICATION

参赛资格

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

参赛团队需要由学生，教师，行业合作伙伴或政府合作伙伴组成，学生可以是本科生或研究生。

Interdisciplinary 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.

组委会鼓励交叉学科团队（如团队成员分别来自电子信息工程，航空航天工程，机械工程等不同专业）。行业，政府机构或大学（就大学教师而言）的成员也可以参加，但每支团队必须有全日制大学生，参赛学生必须为团队作出足够的贡献，才能被认为是正式队员。只有每个团队的学生部分才有资格获得现金奖励。

Since Mission 9 of the International Aerial Robotics Competition will run until the mission is complete, 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 originally made application for Mission 9, is qualified to be a “student” team member.

由于国际空中机器人比赛的任务9将一直举办下去，直到任务被完成。因此在任务完成之前，对于某个学校而言，任何一名在当届比赛之前入学的学生，均有资格成为当届比赛的学生团队成员。

To qualify, a team must submit an acceptable Application Form and Application Fee. If upon arrival at the IARC and prior to the competition, the Judges determine that a team is NOT capable of demonstrating intelligent fully autonomous flight, the team will not be allowed to compete and the $500/3,600RMB rebate will not be refunded. The definition of “intelligent” autonomous flight will be the ability to avoid a 0.3m x 0.3m obstacle while in autonomous flight. Further, aerial robots that do not meet safety criteria or which have no remote mechanism for disabling the aerial robot, will not be

为了符合比赛资格，团队必须提交有效的申请表以及按要求缴纳申请费。如比赛开始之前，裁判认定某支队伍的机器人不足以满足比赛的智能自主飞行要求，该队将不被允许参加比赛，并且最终退款（500美元/3,600人民币）也不返还。“智能”自主飞行的定义是在自主飞行中避开0.3米×0.3米障碍的能力。此外，不符合安全标准的航空机器人或没有安装遥控关机开关的机器人也将不得参赛。

allowed to compete. Prior to the beginning of the IARC, the Judges will make these preliminary determinations. Those teams found to be in compliance will be allowed to compete in that competition year's event and will receive their rebate.

在IARC开始之前，裁判们将对以上情况做出初步判断。被认定符合条件的队伍将被允许参加本年度的比赛，并有资格获得最终退款（500美元/3,600人民币）。

MAINTAINING OFFICIAL COMPETITOR STATUS

To continue to be considered an Official IARC team, teams must submit an updated online Application and their Application Fee, a list of expected attendees, and submit a Journal Paper (see below). All of these items are due by June 1. To advertise your team, and as an aid to gaining sponsors, we recommend that each team maintain a website about their IARC team and its entry (this is not a requirement). Teams that do not comply with these requirements will lose official IARC team status and will be delisted on the IARC competitor web page, but can be reinstated in subsequent years of Mission 9 by meeting these requirements. Unofficial or delisted teams will not be allowed to compete until their status is restored.

维持正式参赛团队状态

若某支队伍想在某年比赛结束后，仍保留IARC参赛队伍身份参加下一年度的比赛，则须更新在线申请、缴纳新的报名费用、提交参赛名单，并提交论文（见下文）。这项均需要在每年6月1日前完成。 不符合这些要求的团队将失去IARC的官方团队身份，将在IARC竞争对手的网页上被除名，但可以在任务9的后续几年内通过重新满足这些要求而恢复。为了宣传您的团队，并获得赞助商的帮助，我们建议每个团队都建立一个关于他们的IARC团队的网站（非必需）。非正式队伍或已退出的队伍在重新报名更新参赛状态前不得参加比赛。

JOURNAL PAPER

Each team is required to submit a journal-quality paper (written in English) documenting its project. This paper will be ranked by the Judges on a scale of 0 to 100 points depending on technical quality (0 points minimum for submitting a credible paper or 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 competition year. Papers are to be uploaded by the due date via the website uploader.

学术论文要求

每个团队都需要一份期刊文章水平的论文（以英文撰写）。根据技术质量，本文将由评委以0至100分进行排名（提交论文的最低为0分、截止日期后提交的论文记 0分），论文限12页内（含图片与参考文献）。 论文格式应为单面、文本占用不大于9英寸高，6.5英寸宽的空间，每页居中。字体大小为12号衬线字体，行距14号。示例格式作为规则的附录提供，请参阅文件：论文格式。文章需包含的内容见文件：论文内容。您的论文的MS Word或pdf格式的文件(小于50MB)应在每年的6月1日前通过官方网站上传。

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. Just prior to the IARC performance days will be a symposium where selected teams will make a 10 minute PowerPoint presentation of their journal papers to the Judges and other assembled team members.

所有论文将成为该年度IARC研讨会的一部分，因此可以作为会议文章记录列入团队成员的简历中 。就在IARC比赛日之前，我们将举办一个研讨会，届时，选择的球队团队将向裁判和其他团队成员做10分钟的答辩。

COMPETITION DAYS

Upon arrival in the city hosting the American or Asia/Pacific Venues, teams must register their presence online (the IARC website will open a link to the registration page several days prior to the event at each venue). This registration is a final confirmation of a team's presence and notification of the team's contact information in case last minute change information needs to be relayed to the teams by the Organizers.

比赛日期

团队抵达举办城市后，须在网上完成报到。报到通道将在比赛前几天打开，该报到将成为团队抵达的最终确认，如团队联系方式有变动，此报到也将作为团队成员对变动信息的最终确认。

Since some teams travel great distances and must disassemble their equipment for shipping, a period will be announced when aerial robotic systems can be reassembled and aligned. This is NOT a "practice time", but is a time and place where teams can verify the correct operation of their reassembled systems. The location may or may not be the same as the IARC arena. Teams are expected to come 'ready to compete' and all 'practice' should have already occurred back at their respective universities.

若由于长途运输原因，某些团队的参赛设备必须拆卸来进行运输，则组委会会安排一段组装调整设备的时间。注意这并不是一段练习时间，而仅可用于设备的组装与调试 。调试地点可能与IARC比赛场地相同或不同，因此参赛团队需要确保在抵达前做好一切比赛准备。

SEE COVID ADDENDUM

For additional specific information, Teams are advised to consult the "MISSION 9 Arena Props Design Manual" found at the official IARC website under the Team Resources menu item
(TEAM RESOURCES > MISSION 9 ARENA INFORMATION)

其他具体信息， 请参考“MISSION 9 Arena Props Design Manual”。 该手册可在IARC网站 Team Resources 一页找到
(TEAM RESOURCES > MISSION 9 ARENA INFORMATION)

INTERPRETATIONS

You Are Responsible for knowing all of the information contained in the Official Rules. This page is provided as a place to find interpretations that may be added for clarity (nothing found here will be a change in the Official Rules, only clarifications or interpretations).
各参赛队有责任了解官方规则中的所有信息。本页所含信息仅为对官方规则的补充，解释。 本页不含任何对官方规则的修改信息

ABOUT THE AERIAL ROBOTS

Only one aerial robot (assumably the "mother ship" if carrying a second drone) needs to return by the 3 km path. The "mother ship" (if one is used) can proceed home while a deployed sub vehicle works on or around the mast. Catapult-launch takeoff methods are acceptable. No rocket launched or explosive means of propulsion (e.g. cannon launch) can be used. Pneumatic/hydraulic piston, sling-shot, electric rail gun, gravity-assisted launchers are all acceptable. Of course traditional takeoff methods are acceptable.

FLIGHT RULES IN CONTROLLED AIRSPACE

At the American Venue, teams must comply with FAA regulations; at the Asia/Pacific Venue other rules will apply and specific questions should be addressed to the organizer of the Asia/Pacific Venue using the IARC Website Inquiry form. At the American Venue, there is no requirement to use an aerial robot weighing in excess of 55lbs, however should a team decide to do so, it must register the vehicle accordingly. American Venue team vehicle operators should be FAA Part 107 licensed. It is recommended that all teams should have the knowledge and skills of an FAA Part 107 certified operator as well as all other visual line-of-sight crew normally required to maintain line-of-sight with the aerial robot for safety. For flight in FAA-controlled airspace, foreign-registered small unmanned aircraft are allowed to operate under part 107 if they satisfy the requirements of part 375. Also, until international standards are developed, foreign-certificated UAS pilots will be required to obtain an FAA-issued remote pilot certificate with a small UAS rating.

ABOUT THE SIMULATED HUNTER-KILLER MAST

The movement of the mast will simulate natural wave motion (≤ Sea State 3, being mostly sinusoidal in both pitch and roll). Neither heave (vertical component of motion) nor forward motion will not be implemented for simplicity. Nonetheless, noise will be introduced so that the pitch and roll are not entirely predictable. Putting a motion tracker (electronic or optical) on the mast is acceptable, but the follow are not acceptable: (1) to modify the mast (drill into it, paint it, or damage it in any way), (2) grab the mast to inhibit its motion, (3) collide with any part of the mast (as opposed to intelligently "docking with the mast"), (4) to adversely affect the movement of the mast by overpowering the motion table (for example, grappling a massive inertial load to the mast— like having a 90 kg aerial robot land on the mast). Though the Official Rules do not address this, it is expected that when the Communications Module is replaced, nothing substantial** is left on the mast. (Note: to protect the existing Communications Module after it is removed and discarded, that module will be attached to the mast with a bungee cord so that it does not fall to the ground (sustaining subsequent damage) as we need to be able to reuse it for future runs by other teams.). The mast's motion table will have to be able to handle not only the weight/inertia of the mast, but an additional 2kg Communications Module, insertion and extraction load forces, wind loads, and the weight of any vehicle (sub vehicle) landing on/grappling to the mast. Some of these loads are unknown (e.g., wind load), but for consistency across the teams and Venues, the mast-supported grappling weight limit allowed, shall be no greater than 10% of the maximum aerial robot weight, or 9kg (19.8lbs). Just like a ship at sea, the orientation of the mast could change from run to run. The orientation of the mast relative to North can be any angle and could even change between runs, so don't design for a specific orientation.

** "Substantial" means that nothing (beyond the replaced Communications Module) is to remain on the mast at the end of the run. The above reference to anything "substantial" remaining on the mast, is in the context of sub vehicles (if used) continuing to hang on the mast at the end of the run as well as any location/motion aids that might have been placed on the mast— these too should either be removed or self-jettison before the end of the run. Extra things remaining on the mast after the conclusion of the run, will invalidate the run.

ABOUT THE COMMUNICATIONS MODULE

Information has been provided at the Official IARC website showing teams how to make a Communications Module for testing at home. The actual Communications Modules to be used during the competition runs will be CNC machined to the specifications shown in the RESOURCES section of the Official IARC website. Note that the Communications Modules are part of the arena and will be issued to the teams for use during their runs. The existing communications module on the mast can be dropped after removal (it does not have to be returned to the launch point).

ABOUT INTELLIGENCE/COMPUTING

All aerial robotic intelligence for behavior and navigation must be carried by the aerial robot. Off-board telemetry-linked computing resources are not allowed. Aerial robots can release markers of beacons at the mast to aid in local positioning, but if used, those must be removed from the mast prior to the end of the run. Control data links are not allowed with the exception of a link to command launch of the aerial robot ("LAUNCH NOW" command). To keep the Venues equal in capability, GPS (or similar satellite systems) should be the only artificial navigation aid.

ABOUT PYLONS

The pylons are simply there for the Judges to use to determine that the aerial robot is completing the 3km course without taking a "short cut". The GPS locations of the pylons will be accessible to the teams so that they can be programmed into the aerial robots. Those GPS coordinates will be determined on the day of the competition.

说明

各参赛队有责任了解官方规则中的所有信息。本页所含信息仅为对官方规则的补充，解释。 本页不含任何对官方规则 的修改信息

关于空中机器人

只有一个空中机器人需要通过3公里的路径返回（如果参赛机器人还携带第二架无人机，“母舰”返航即可）。“母舰”可以在部署的“子无人机”在桅杆上或桅杆周围工作时就开始返航。弹射器发射的起飞方法是可以接受的。不能使用火箭发射或爆炸性推进方式（如大炮发射）。气动/液压活塞、吊枪、电动轨道炮、重力辅助发射器都是可以接受的。当然，传统的起飞方法也是可以接受的。

管制空域飞行规则

在美国赛区，参赛队必须遵守联邦航空管理局（FAA）的规定；而在亚太场馆，参赛队必须遵守另一套对应的规定，若有具体问题可以通过国际空中机器人大赛（IARC）官网上的垂询表向亚太赛区的组织者提出。在美国赛区，我们没有要求使用重量超过55磅的空中机器人，但是如果一个参赛队决定这样做，他们就必须相应地登记这个参赛机器人。美国赛区的无人机飞手需要持有联邦航空管理局（FAA）的Part 107无人机飞行员执照。建议所有参赛队都具备FAA Part 107无人机注册飞手的知识和技能，以及为了安全起见，通常需要其他的与空中机器人保持视野的视距队员。对于在联邦航空局（FAA）控制的空域里的飞行，外国注册的小型无人机如果满足FAA Part 375的要求，则允许其根据Part 107的规定进行飞行操作。此外，在通用的国际标准被制定出来之前，外国认证的无人机飞行员将需要获得联邦航空局（FAA）颁发的具有小型无人机等级的远程飞行员证书。

关于模拟的猎杀船桅杆

桅杆的运动将模拟自然的海浪运动（≤海况3，俯仰和横摇均为正弦）。为了简单起见，不会实现垂荡（运动的垂直分量）或前向运动。尽管如此，噪音还是会被引入，使得俯仰和侧倾不是完全可预测的。在桅杆上安装一个运动跟踪器（电子或光学）是可以接受的，但以下情况是不可接受的：（1）修改桅杆（钻洞、涂上油漆或以任何方式损坏它），（2）抓住桅杆以抑制其运动，（3）碰撞桅杆的任何部分（而不是智能地“与桅杆对接”），（4）通过压倒运动台对桅杆的运动产生不利影响（例如，让桅杆产生巨大的惯性负载——比如让一个90公斤的空中机器人降落在桅杆上）。尽管官方规则没有提及这一点，但希望大家在更换通信模块之后，桅杆上不会留下任何“实质性”**的剩余物。（注意：为了保护现有的通信模块，在它被移除和丢弃后，该模块将被我们用一根蹦极绳索绑到桅杆上，这样它就不会落到地上而坏掉；因为其他参赛队比赛时还需要用到它。）桅杆的运动台不仅要能够承受桅杆的重量/惯性，还要能够承受额外2kg重的通信模块、插入和拔出的力、风力以及任何降落在桅杆上/抓住桅杆的无人机（或“子无人机”）的重量。这些力中的一些力的大小是未知的（例如，风力），但是为保证各参赛队和各赛场的一致性，桅杆支撑的重量限制范围，不应大于最大空中机器人重量的10%，或是9KG（19.8磅）。就像海上的船一样，桅杆的方向也可能在不同次的比赛中不同。桅杆相对于北方的方向可以是任意角度，甚至可以在两次比赛之间发生变化，因此不要针对特定方向进行设计。

**“实质性”是指在比赛结束时（除了更换的通信模块外），桅杆上不留任何东西。上述提及桅杆上不留任何“实质性”剩余物的说法，是指在比赛结束时继续停留在桅杆上的子无人机（如有使用的话）以及那些可能已经被放置在桅杆上的位置/运动辅助装置——这些也应在比赛结束前移除或自动丢弃。比赛结束后，桅杆上还有多余的东西，会使比赛结果无效。

关于通信模块

国际空中机器人大赛（IARC）官方网站上已经公示了“通信模块”的制作方法，以便各队在队内进行测试。比赛期间实际使用的“通信模块”将按照IARC官方网站“参考资料（RESOURCES）”部分所示的规格进行数控加工。请注意，比赛时用的通讯模块是属于赛区的，我们将分发给各参赛队在比赛中使用。桅杆上的现有通信模块可以在拆卸后丢弃（不必带回起飞点）。

关于智能/计算

所有用于行为和导航的空中机器人智能设备必须由空中机器人携带。不允许使用非机载遥测连接的计算资源。空中机器人可以在桅杆上释放信标标记，以帮助进行局部定位；但如果使用标记，则必须在比赛结束前将这些标记从桅杆上移除。不允许使用控制数据链接，但空中机器人的启动命令链接除外（即“立即起飞”命令）。为了保持各赛区的比赛条件相等，GPS（或类似的卫星系统）应该是唯一的人工导航辅助设备。

关于塔架

塔架只是供评委使用，以确定空中机器人在不走“捷径”的情况下完成3公里的航程。我们将提供给各参赛队将塔架的GPS位置坐标，以便各队将其编入参赛的空中机器人中。这些GPS坐标将在比赛当天确定。

Procedural Changes to the 2021 International Aerial Robotics Competition
(COVID ADDENDUM)

Due to the ongoing COVD-19 situation, both IARC Venues have travel restrictions placed upon them regarding participation by international teams. This creates an unfair situation whereby U.S. and Chinese national teams can participate more freely than teams from other countries because teams residing in the U.S.A. and China are more free to attend the venues in their own countries than teams residing outside of the U.S.A. or China.

AMERICAN VENUE: At this time, the U.S.A. has restricted entry from the following countries: China, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Monaco, San Marino, Vatican City, England, Scotland, Wales, Northern Ireland, Republic of Ireland, Brazil, South Africa, and India.

ASIA/PACIFIC VENUE: At the same time, China has imposed restrictions on foreign travel for ALL non-citizens by requiring vaccination with only a vaccine produced in China, or if not vaccinated, a minimum 14-day quarantine at a location assigned by the government and paid for by the traveler. Depending upon the situation, quarantine may be longer and teams returning to their home countries may have additional quarantine periods imposed.

In an effort to allow teams to continue the development of their MISSION 9 aerial robotic systems, and to demonstrate their ability to successfully achieve MISSION 9 goals, the organizers have modified the procedures so that teams can compete from their home institutions if possible.

This document replaces conflicting sections of the Official MISSION 9 Rules. These changes affect the IARC administration and do not change the mission goals.

1. Without changing any performance parameters required in the Official Rules, official teams are permitted to set up their own arenas at (or near) their universities. Teams can fly the mission "at home" without the necessity for traveling to the American Venue or the Asia/Pacific Venue.

2. Arenas must conform to the exact standards set forth in the Official Rules and in documents found at the "Resources" section of the IARC website (http://www.aerialroboticscompetition.org/resources.php).

3. The deadline for Application for teams that thought that they would not be able to compete due to travel restrictions has been extended to 1 September, 2021. The due date for Journal Papers describing team entries has also been extended to 1 September 2021. The Competition performance period will be 12 months from Application deadline (ending 1 September 2022). Teams have this 12-month period to demonstrate the successful completion of MISSION 9. If, by 1 September 2022, no teams can demonstrate a winning performance, then the mission will be extended into 2023. Mission 9 will be conducted in this fashion until

completed. Depending upon the world travel situation, a future MISSION 10 could once again be an “in person” event at each Venue.

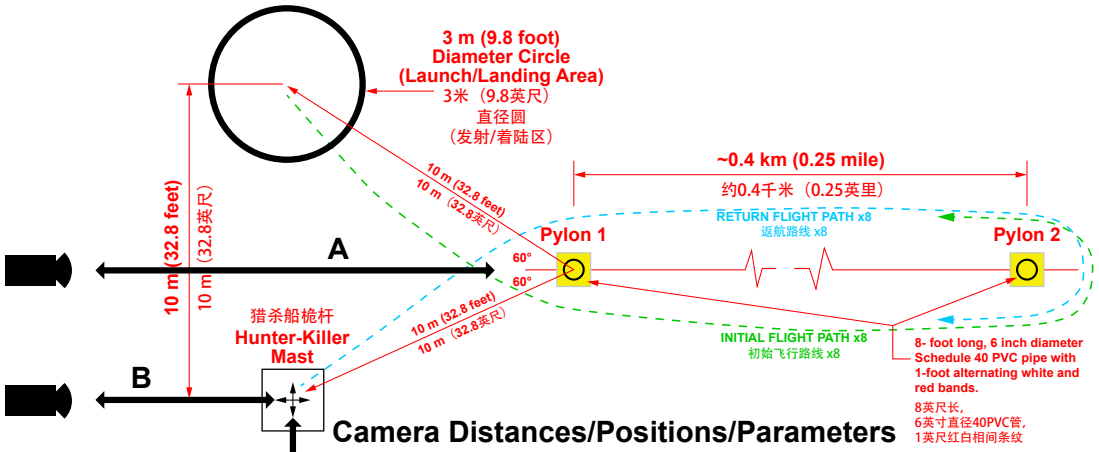
4. Since the teams will now have to create their own arena with a mast and a motion table, the Application Fee will no longer be required (teams that have already submitted their Application Fee can receive a refund by applying in writing to the Organizer with the banking information to which the refund can be wired). This, in addition to the savings realized by not having to travel, will help the teams fund their arena construction.

5. “Fairness” is a major concern. Teams must be able to validate their best performance in a way that will be credible not only to the Organizers, but also to the other participating teams. This will be achieved by requiring the following:

[1] Three independent witnesses will be obtained by each team to report team compliance to the IARC organizers. These independent witnesses shall be professional degreed engineers who are employed by any firm that is NEITHER a monetary sponsor of the team, nor affiliated with the team’s university. These witnesses will certify that the arena meets the specifications provided in the Official Rules and the Resources section of the IARC website (http://www.aerialroboticscompetition.org/resources.php). These witnesses will provide the Organizers with their credentials in the form of a printed or online resumé (in English) that has their company contact information so that their employment can be verified if necessary. A check list of important arena parameters will be supplied in the Resources section of the IARC website for use by the witnesses when determining arena compliance.

[2] The winning run for any team must be validated in terms of performance by two orthogonal video cameras at the mast/motion table, and a third camera along the ingress/egress path. As shown in the following figure.

Each of the cameras must be at least 1080p resolution and include a running time stamp to correlate views as a security measure to make faking of the final videos difficult.



Each camera must have an independent time code that will be recorded in the video frame. This time code will be used to determine the launch event and mission completion times.

Camera Distances/Positions/Parameters

A. In line with Pylon 1 and 2; 3m behind Mast/ Launch Circle centerline; Upward angle of 45°; 60° field of view, approximate focus at 5m.

B. Parallel to Camera A; On Ground 3m from Mast center; Upward angle of 45°; 60° field of view, approximate focus at 3m.

C. Orthogonal to Camera A and on centerline of Launch Circle–Mast center; On Ground 3m from Mast center; Upward angle of 45°; 60° field of view, approximate focus at 3m.