



## ASME IAM3D Competition 2021 Rules

### **ATTENTION E-FESTERS! Please read this important announcement about ASME E-Fests® in 2021**

ASME is excited to host an E-Fest Digital event in April 2021. E-Fest Digital will include career and professional development content, digital competitions (including the Human Powered Vehicle Challenge, the Student Design Competition, the Innovative Additive Manufacturing 3D Competition, the Oral Competition and the Elevator Pitch Competition) and much more! Additional details will be available soon. Questions may be directed to [efests@asme.org](mailto:efests@asme.org).

We encourage students, competitors, and faculty members to take advantage of the learning experiences provided by both our competitions and other digital offerings throughout the year. Questions may be directed to [efests@asme.org](mailto:efests@asme.org) and a digital calendar will be posted on <http://efests.asme.org> with lots of information.

All ASME conferences, meetings and events scheduled through December 2021 are being planned as virtual only, enabling everyone to enjoy the full benefits of participation via our virtual event solutions with no physical presence required. ASME will not have any physical or in-person events during this time but will continue to deliver the insights and expertise that our community depends upon. For more information about ASME's virtual approach to events and meetings, visit <https://www.asme.org/anywhere>.

Students are encouraged to download E-Fest competitions rules at <https://efests.asme.org/competitions> for our 2021 Digital events.

Additionally, ASME will be hosting a series of year-long digital events including a [Student & Early Career Town Hall](#) (Sept. 17, 8:00 pm – 9:15 pm EDT), E-Fest Careers 2020 (November 7), webinars and other competitions. Please visit <http://efests.asme.org> for more details.

Teams who participated in the 2020 virtual competition will be allowed to reuse their design in the 2021 U.A.R.C.V. Hopefully with awesome upgrades!

**[Watch the IAM3D Facebook page for updates!](#)**

## 2021 ASME IAM3D Competition Rules - U.A.R.C.V.

Do you have the need for speed? The 2021 ASME IAM3D Unmanned Aerial Racing Cargo Vehicle (U.A.R.C.V.) competition tasks university students to use additive manufacturing and an iterative design process to create an unmanned aerial racing vehicle capable of picking up and dropping off a payload on each lap. One document submission, a design report showing your team's design process and detailed drawing will be required prior to participating in the physical obstacle course. \*\*Be sure to pay special attention to the Competition Safety Requirements & Safety Equipment portion of the rules. All teams must be in compliance with safety in order to compete. If in person events are not feasible we will move to a second set of rules with the same competition where teams can build a course at their university to compete through a set of demonstration videos. The course has been designed for ease of setup and materials that can be found at most universities for little to no cost.

**Objective** The objective is to design and manufacture a U.A.R.C.V. using additive manufacturing and an iterative design process that will race in five team flights for five laps through an obstacle course picking up and delivering one payload per lap.

**E-Fest Registration** Formal "E-Fest registration" is required to participate in the in person event. Two registrations for the E-Fest Event must be completed. One for each team's vehicle AND one for each individual that plans to participate in the competition. Registrations must be entered and paid for through the E-Fest website. To ensure proper Formal E-Fest registration please register through the E-Fest website at least 2 months before your applicable E-Fest.

Example: If the E-Fest you are attending occurs February 3rd-5th vehicle registrations should be completed by December 3rd.

**Late registrations may be accepted but are not guaranteed.**

**Eligibility** Every participant must be a student member of ASME who is enrolled as an undergraduate in a baccalaureate or associate engineering/engineering technology degree program or was enrolled in one of those programs within one year of the competition date (must still be a dues paying member). Special considerations will be made for students that could not participate in the 2020 IAM3D event. All competitors agree to abide by the [ASME Engineering Code of Ethics](https://www.asme.org/wwwasmeorg/media/resourcefiles/aboutasme/get%20involved/advocacy/policy-publications/p-15-7-ethics.pdf).

<https://www.asme.org/wwwasmeorg/media/resourcefiles/aboutasme/get%20involved/advocacy/policy-publications/p-15-7-ethics.pdf>

**Competition Safety Requirements & Safety Equipment** All teams/team members must wear safety glasses while assembling and working on vehicles and while on the course. Teams will not be allowed to compete without safety glasses. Teams are required to provide their own safety glasses. It is suggested to bring comfortable

safety glasses as you will be wearing them all day. Additional personal protection equipment (PPE) is recommended.

**Design Report** The design report should address at a minimum the following points:

- Individual CAD drawings for every part created using additive manufacturing
- Exploded CAD assembly drawing of all parts created using additive manufacturing
- Analyses: Expected vehicle performance, part specifications, and structural simulations •  
Design for manufacture and assembly analysis (DFMA) <https://en.wikipedia.org/wiki/DFMA>
- Design for additive manufacturing analysis (DFAM)  
[https://en.wikipedia.org/wiki/Design\\_for\\_additive\\_manufacturing](https://en.wikipedia.org/wiki/Design_for_additive_manufacturing)
- Design Iterations and physical testing information

There are no paper length or format requirements but design reports should be professional and contain sufficient detail to describe the design and function of the vehicle. The design report will be due two months before the start of your applicable E-Fest. Date examples can be found in the registration section. Design report scores will be provided publicly at the start of the competition. Late report submissions will be accepted but a 6 point per day penalty will be incurred based on the number of days after the target submission date that the report email is received. Due to time constraints scoring of late submissions will be attempted but are not guaranteed.

**Submission of Design Report** To officially submit your design report, email your document in PDF format along with team information to [IAM3D@asme.org](mailto:IAM3D@asme.org) . In the email body

include the following team information:

- University /Project name / Vehicle name
- Team captain contact information (Email address, phone number, physical location)
- Number of students on the build team
- Number of students that intend to participate at E-Fest with your team

**Use of Additive Manufactured Parts** This competition strives to provide experience in additive manufacturing and an iterative design process. To ensure the spirit of the competition, scoring will be heavily weighted on what percentage of parts on your team's vehicle were produced using additive manufacturing. Teams will be required to design and construct their vehicle's airframe using additive manufacturing. All designs of additive manufactured parts must be original, designed, and created by the competing team. The use of preexisting designs will be grounds for disqualification. If an unnecessary number of additive parts are used to serve one function, it would be left under the judges discretion to reduce the number of parts counted for the additive manufacturing score.

Additive manufacturing through any traditional form of line fed or powder-based process will be allowed. Any form of commercially available additive manufacturing material/process will be allowed. Alternative forms of additive production that are found to reduce structural

integrity enough to be considered unsafe may be disqualified and will be left to the judge's discretion.

**Required Commercially Purchased Parts** Safety is a criterion that nearly every engineering design considers. For this reason, some parts of this competition will require commercially purchased parts and are considered to be exceptions to the use of additive manufacturing parts score. Exceptions include: All electronics (example: flight controllers, cameras, FPV, electrical wire, electric Motors, propellers, batteries, fasteners/bolts/nuts

Other parts may be deemed exceptions to the use of additive manufacturing parts score and will be left to the judge's discretion.

**Payload** The payload will be a 3D printed (PLA) one-inch( $\pm 1/4$  inch) cube with 30% infill and four outer shells. A ferromagnetic metal (steel) washer smaller than one inch and larger than one half inch diameter will be attached to the top of each payload. The payload will weigh 25 grams ( $\pm 5$  grams). All competition payloads are identical except for color and will be provided by ASME.

**Vehicle & Vehicle Size Constraints** The vehicle size constraints are as follows:

- 33 cm measured diagonally from motor center to motor center
- 25 cm height

A judge will measure dimensions to ensure that your vehicle dimensions are compliant. This does not include the device controller, FPV equipment, or payload. Vehicles are allowed to transform to any dimensions as long as it does so while on the course and only by doing so on its own and under its own power. Keep in mind the course and obstacle dimensions!

## Vehicle Safety Provisions

- A safety briefing will be held during the first day of the competition. All team members are required to attend.
- Vehicles must pass an airworthiness/wiring inspection. Once vehicles are inspected, they may not be altered without re-inspection.
- No one will be allowed on the course during the race for any reason.
- Race viewing will only be allowed from outside the netted course area and will require the use of safety glasses.
- All pilots must have an arming switch feature on their controller.

- Vehicles must have a physical kill switch located on the vehicle and controller.
- Pilots will not be allowed to power up video or controller transmitters or vehicles outside of the course unless instructed to do so by a Judge or race official.
- Pilots must use FPV to pilot the vehicle. Goggles and ground stations are allowed.
- Pilots will not be allowed to fly outside of the designated competition area. Flying outside of the designated competition area is STRICTLY prohibited and will result in immediate disqualification.
- All batteries must be stored in a LiPo safe bag or an approved fire-resistant container.
- Vehicles may not fly higher than 15 feet. Warnings will be provided at 10 feet Any breach of this will result in immediate disqualification.

Failure to adhere to the above provisions constitutes a possible disqualification. Disqualifications will be at the discretion of the Judging team.

**Energy Sources** All electrical energy for the device must be provided by commercially produced rechargeable batteries. Student designed and manufactured energy sources will not be allowed. Maximum battery specs:

- 4S
- 4.2 Volts per cell

Springs may be used with the following static size constraints.

- 1/2 Inch diameter maximum.
- 2-inch length maximum.

**Controls** Devices may be controlled via remote control through a transmitter/receiver radio link. As an exception to the rechargeable battery rule, a radio transmitter may have its own batteries and these batteries do not have to be rechargeable. The transmitter/receiver radio link may be any commercially available model controller. All radio controllers will be impounded and shut off during the competition, except during the team's race. Umbilical controls may not be used. Each team must have the ability to switch controller and FPV frequencies. There will be a "planned team frequency" per race board that students will be required to fill in. Each vehicle must have its own distinct frequency per race to avoid interference between vehicles. Any attempt to impede another competitors frequency will result in disqualification.

**First Person Visual (FPV)** No one will be allowed on the physical course while vehicles are in flight. Due to this requirement, FPV is required for all vehicles/pilots. Please be prepared to record your flights and provide your flight videos to the judging staff. FPV video

may be used to settle race disputes. Providing your video to the judging staff will signify your permission for ASME and IAM3D to use all provided videos for advertisement purposes. If you do not wish to have your videos used please inform the judges at the competition before submitting your videos.

**Course** Each team will be given 5 minutes to ready their vehicle. Vehicles will fly 5 laps. On the first lap, the vehicle will be staged on the ground in their respective lane. The vehicle will be required to pick up a payload from a section of the same lane before entering the obstacle course. After clearing the last obstacle, the vehicle must deposit the payload in the staging lane. The remaining four laps will start with payload pickup, obstacle course and payload drop off in the same fashion as the first lap but will not be required to land. The final lap will stop when the vehicle comes to rest on the empty payload lane. Any race that results in a tie for first place will be settled in a two lap face off. Payload deposit is required for the lap to count in face offs. If a race results in a tie for second place both teams will receive a score for second place and third place will not be awarded. On the final race day, a maximum of 20 teams with the highest scores will participate in an additional semi-final race. The top 5 team scores after the semi-finals will participate in a final race.

Day 1: Practice laps and lane selection races – No race scoring

Day 2: Initial race round for score and vehicle reduction rounds

Day 3: Semi-final races and final race.

If complications arise Judges reserve the right to make adjustments to the rules or scoring structure.

**There will be many races involved. It is suggested to make your vehicle modular and bring backups to everything. Crashes are inevitable and rebuilt/backup vehicles will be permitted to race.**

Course dimensions and obstacle descriptions can be found in Appendix 1.

**Scoring** Practice runs will be organized on the first day of competitions. There will be three

ways to score points.

- Design Report - 2500 Points possible
- Use of Additive Manufacture Parts - 5000 Points possible
- Obstacle course - 2000 points possible from payload score and placing score (below)
  - Payload Score: 200 points per successfully deposited payload (1000 points possible)
  - 1st place - 1000 points ○ 2nd place - 500 points ○ 3rd place - 250 points

Pilots that prematurely start, or miss going through an obstacle will be required to run one additional lap per occurrence. Missed obstacles will only be penalized if the vehicle completes a lap without going back to complete the missed obstacle.

In the event that a payload is dropped, the penalty will be not receiving the payload score for that individual payload. Payloads may not be recovered if it falls outside of the designated pickup area. Teams that fail to meet the following requirements will receive an obstacle course score of zero but will keep design report and use of additive manufacture parts scores.

- Teams must be physically present at the time of their scheduled race.
- Finish all 5 laps in under 15 minutes.
- Vehicles must stay within the outer course boundary and under an altitude of 10 feet.
- Intentional vehicle collisions are prohibited. Pilots can resume the race if they are able to fly without physical intervention. The pilot not at fault may be granted a makeup run. Make-up runs should not be expected and are at the discretion of the Judging team.

#### Competition Prizes

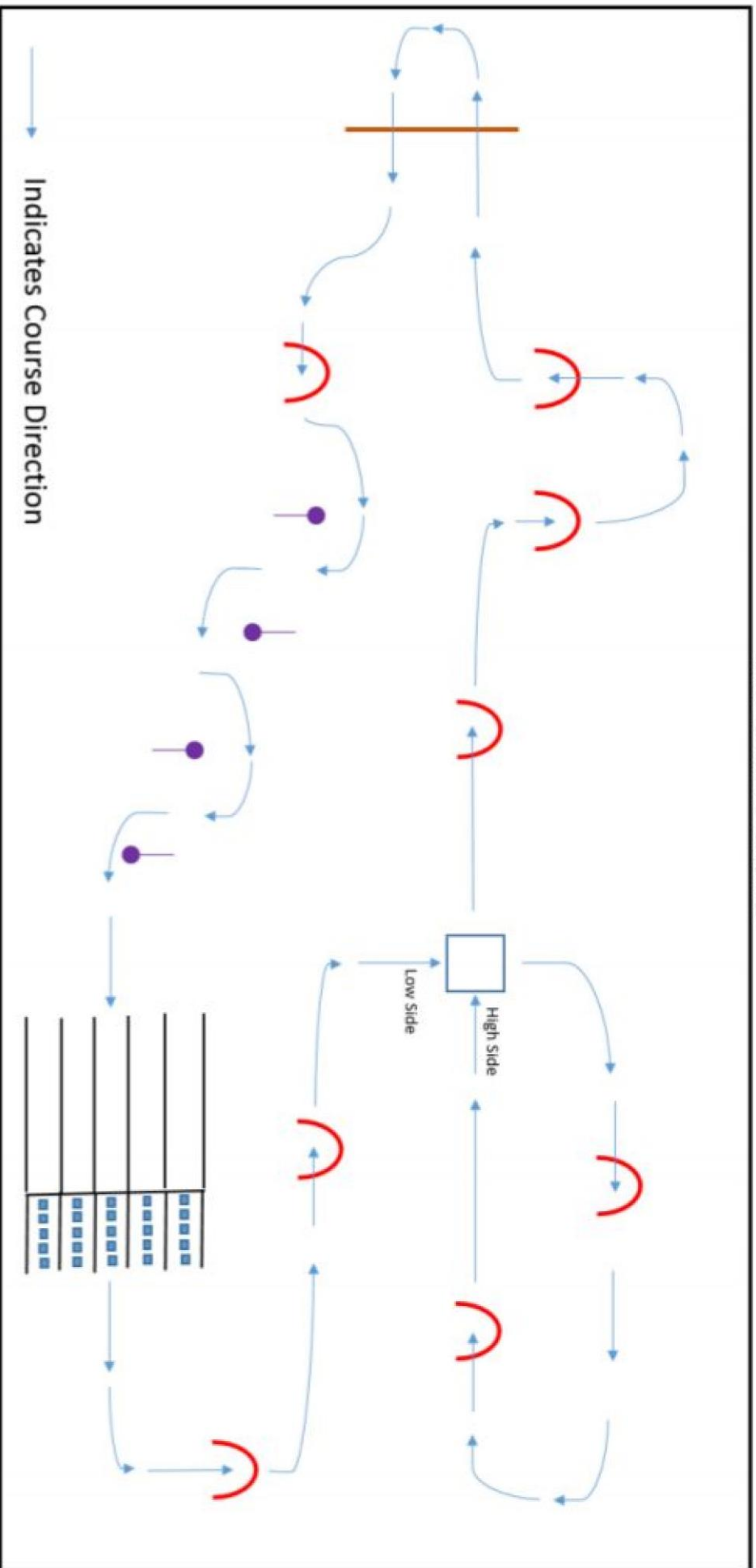
IAM3D Competition - 1st place	\$250.00
IAM3D Competition - 2nd place	\$150.00
IAM3D Competition - 3rd place	\$75.00

Any additional questions may be emailed to [IAM3D@asme.org](mailto:IAM3D@asme.org)

# Appendix 1: Competition Course / Obstacle Dimensions & Course Legend



# IAM3D 2020 Course



\*Course outer dimension is 100 X 50 feet. Obstacles are not shown to scale. Obstacle placement may vary and is not to scale. Course Legend is on Following Pages. Obstacles may be lit with LED lighting.

# Course Legend



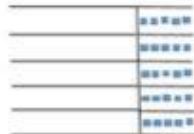
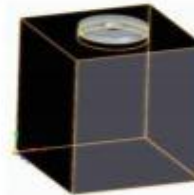
Race Gate



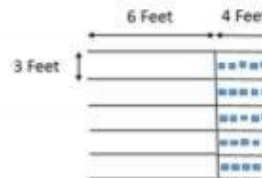
Turn Flag



1 Inch Cubed  
Competition  
Payload



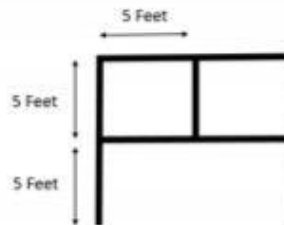
Payload  
Pickup/Drop off  
Lane



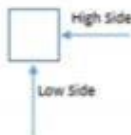
All Dimensions are approximate



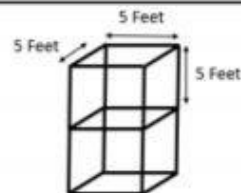
Field Goal  
Obstacle



Constructed of PVC Pipe



High/Low  
Cube



Constructed of PVC Pipe

**E-Fest Digital Rules - Read Page 1**



## **ASME IAM3D Virtual Competition Submission Guidelines**

\*This set of rules will be used for E-Fest Digital (Virtual Event)\*

### **Objective**

The objective is to design and manufacture a U.A.R.C.V. using additive manufacturing and an iterative design process that will perform tasks in five laps through an obstacle course picking up and delivering one payload per lap. This year's competition will be held by proxy video submission.

### **Registration**

Teams will be formally registered once all submissions are made.

### **Eligibility**

Every participant must be a student member of ASME who is enrolled as an undergraduate in a baccalaureate or associate engineering/engineering technology degree program or was enrolled in one of those programs within one year of the competition date (must still be a dues paying member). All competitors agree to abide by the ASME Engineering Code of Ethics.

### **Competition Safety Requirements & Safety Equipment**

All teams/team members must wear safety glasses while assembling and working on or flying their vehicles. Teams will not be allowed to compete without safety glasses. Teams are required to provide their own safety glasses. Additional personal protection equipment (PPE) is recommended but not required. Teams with video submissions showing dangerous actions may be disqualified at the judging committee's discretion.

### **Design Report**

The design report should address at a minimum the following points:

- Individual CAD drawings for every part created using additive manufacturing
- Exploded CAD assembly drawing of all parts created using additive manufacturing
- Analyses: Expected vehicle performance, part specifications, and structural simulations
- Design for manufacture and assembly analysis(DFMA)  
<https://en.wikipedia.org/wiki/DFMA>

- Design for additive manufacturing analysis (DFAM)  
[https://en.wikipedia.org/wiki/Design\\_for\\_additive\\_manufacturing](https://en.wikipedia.org/wiki/Design_for_additive_manufacturing) ● Design Iterations and physical testing information

There are no paper length or format requirements but design reports should be professional and contain sufficient detail to describe the design and function of the vehicle. The design report should be included with your team's submission package.

Late report submissions will not be accepted.

### **Use of Additive Manufactured Parts**

This competition strives to provide experience in additive manufacturing and an iterative design process. To ensure the spirit of the competition, scoring will be heavily weighted on what percentage of parts on your team's vehicle were produced using additive manufacturing. Teams will be required to design and construct their vehicle's airframe using additive manufacturing. All designs of additive manufactured parts must be original, designed, and created by the competing team. The use of pre existing designs will be grounds for disqualification. If an unnecessary number of additive parts are used to serve one function, it would be left under the judge's discretion to reduce the number of parts counted for the additive manufacturing score. Additive manufacturing through any traditional form of line fed or powder-based process will be allowed. Any form of commercially available additive manufacturing material/process will be allowed.

A short video detailing your vehicle's number of additive parts used shall be included with your submission.

### **Required Commercially Purchased Parts**

Safety is a criterion that nearly every engineering design considers. For this reason, some parts of this competition will require commercially purchased parts and are considered to be exceptions to the use of additive manufacturing parts score.

- All Electronics (example: flight controllers, cameras, FPV...)
- Wire
- Electric Motors
- Propellers
- Batteries
- Fasteners/Bolts/Nuts

Other parts may be deemed exceptions to the use of additive manufacturing parts score and will be left to the judge's discretion.

### **Payload**

The payload will be five (5) 3D printed (PLA) one-inch cube with 30% infill and four outer shells. A ferromagnetic metal (steel) washer smaller than one inch and larger than one half inch diameter will be attached to the top of each payload (super glue). All competition payloads need to be identical and will be provided by each individual team.

## **Vehicle & Vehicle Size Constraints**

The vehicle size constraints are as follows:

33 cm measured diagonally from motor center to motor center

25 cm height

This does not include the device controller, FPV equipment, or payload. Vehicles are allowed to transform to any dimensions as long as it does so while on the course and only by doing so on its own and under its own power. Keep in mind the course and obstacle dimensions!

A portion of the video submission will need to show your team measuring the dimensions to ensure that your vehicle dimensions are compliant.

## **Vehicle Safety Provisions**

All teams shall hold a safety briefing prior to arming their vehicle for any reason during the creation of your team's video submission. All team members that will be attending the physical demonstration are required to attend. No one will be allowed on the course during the demonstration. Race viewing will only be allowed from outside the obstacle course at a safe viewing distance and everyone including spectators must have safety glasses on.

All pilots must have an arming switch feature on their controller. Pilots must use FPV to pilot the vehicle. Goggles and ground stations are allowed. FAA and all other country, state, and local regulations must be followed when testing and filming your vehicle. If you are flying or testing your vehicle on university grounds, please ensure that you connect with your faculty advisor or university administrators to secure appropriate permissions before doing so

Failure to adhere to the above provisions constitutes a possible disqualification.

Disqualifications will be at the discretion of the judging team.

All video submissions will be scrutinized for safety. Any infractions of the above tasks will be subject to penalty score and will be at the discretion of the judging team.

## **Energy Sources**

All electrical energy for the device must be provided by commercially produced rechargeable batteries. Student designed and manufactured energy sources will not be allowed.

Maximum battery specs:

4S

4.2 Volts per cell

Springs may be used with the following static size constraints.

½ Inch diameter maximum

2-inch length maximum

Controls:

Devices may be controlled via remote control through a transmitter/receiver radio link. As an exception to the rechargeable battery rule, a radio transmitter may have its own batteries and these batteries do not have to be rechargeable. The transmitter/receiver radio link may be any commercially available model controller. Umbilical controls may not be used.

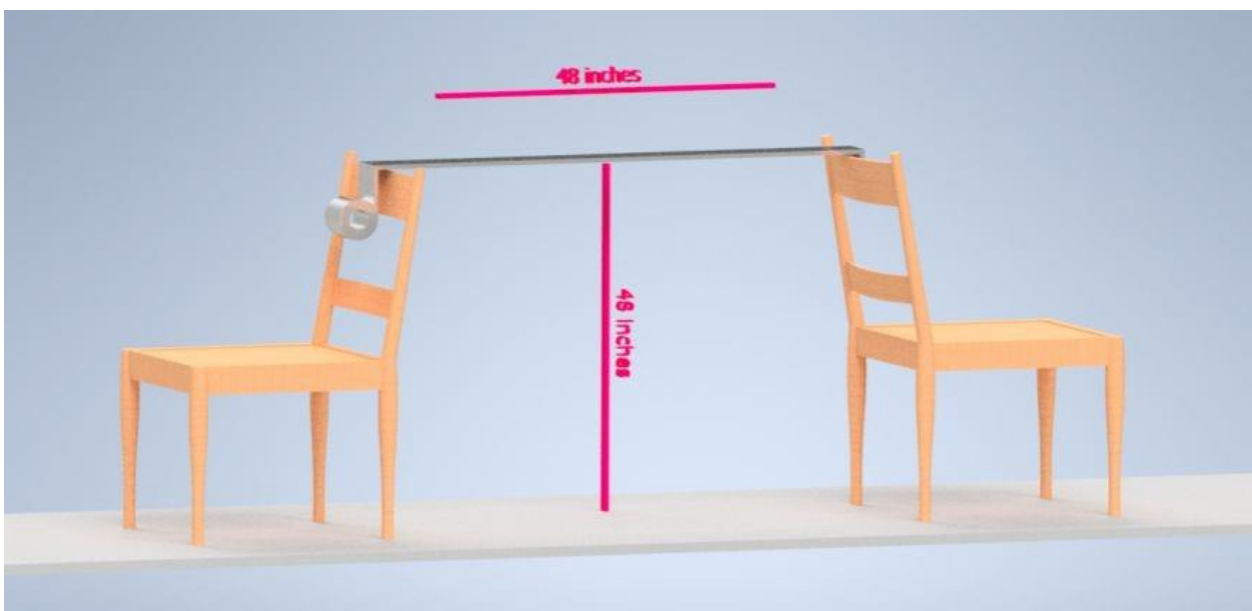
## **First Person Visual (FPV)**

No one will be allowed on the physical course while vehicles are in flight. Due to this requirement, FPV is required for all vehicles/pilots. Please be prepared to record your flights and provide your flight videos to the judging staff. Providing your video to the judging staff will signify your permission for ASME and IAM3D to use all provided videos for advertisement purposes. We intend to place all provided videos to showcase your teams on our ASME IAM3D Youtube channel and some team highlights on Facebook/Instagram. If you do not wish to have your videos available for public viewing please include your request as a formal written attachment to the email with your submission package. You can also designate which videos you will allow to be used and which ones specifically you do not wish to have used.

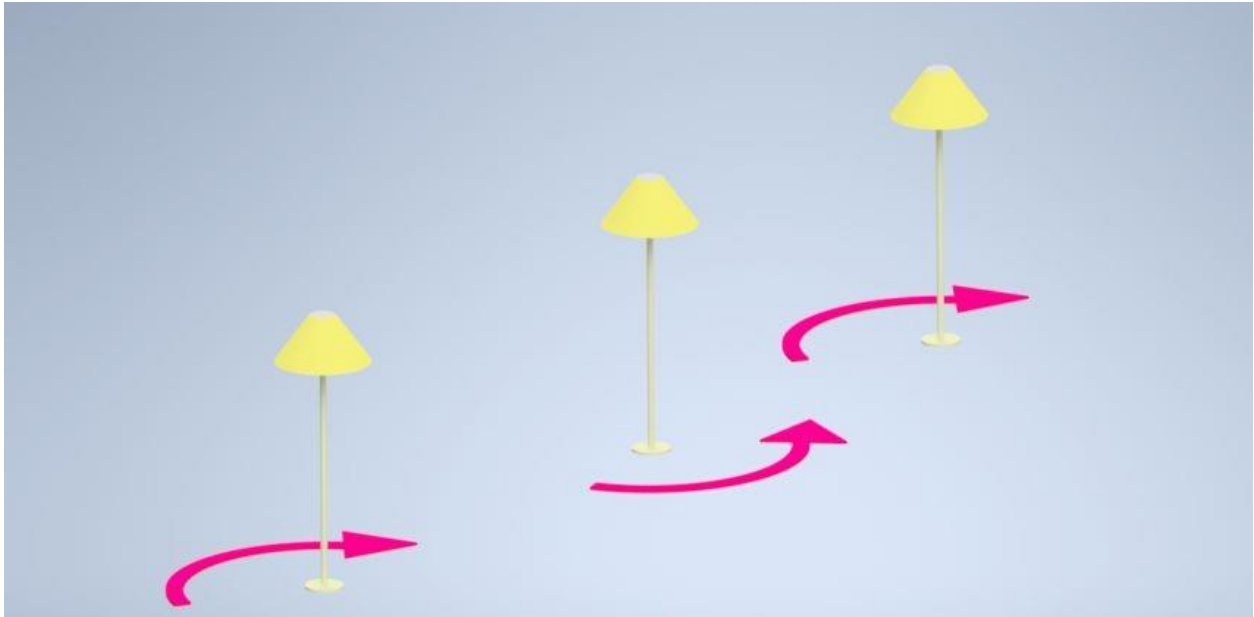
## **Course**

On the first lap, the vehicle will be staged on the ground in the empty area. Launch stands will be allowed. The vehicle will be required to lift off of the ground and move to the second half of the bay in front of them to pick up the first payload. After clearing the last obstacle, the vehicle must deposit the payload in the area where it initially lifted off the ground from. The first four laps will start with payload pickup, obstacle course and payload drop off in the same fashion as the first lap but will not be required to land. The final lap will stop when the vehicle comes to rest on the empty payload bay after depositing the last payload.

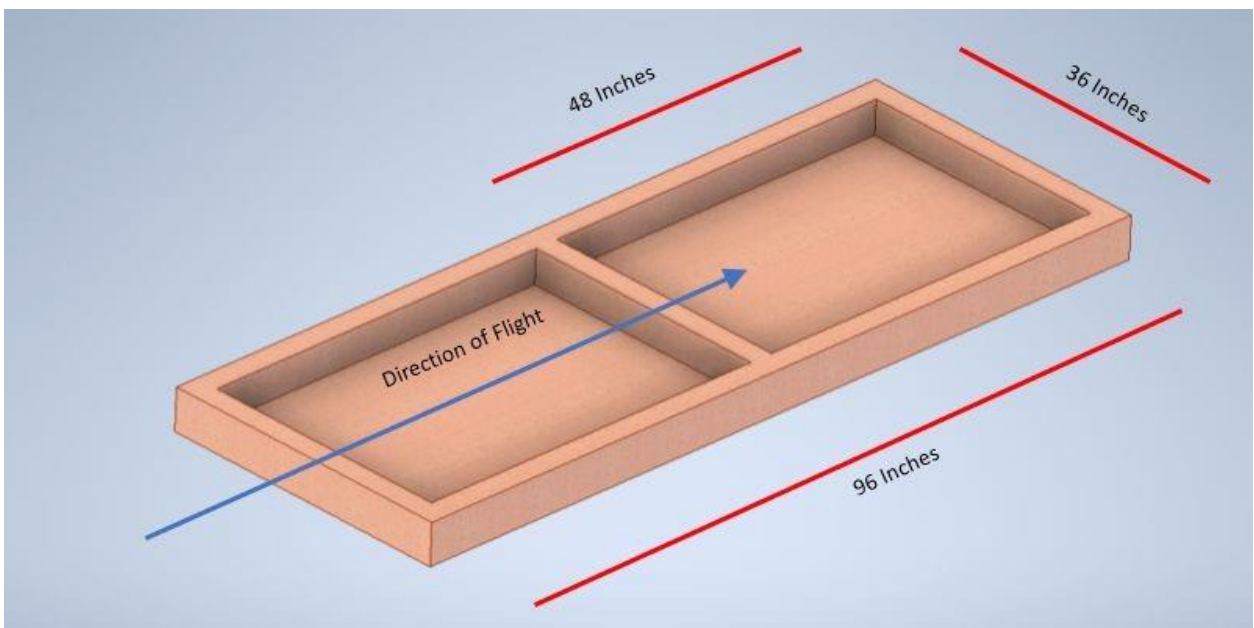
As the competition is forced to be by proxy at this time a truncated course layout will be used and must be constructed by the competing team at a local venue that meets FAA guidelines for public UAV flight. We understand that resources may be hard to come by so course materials are intentionally not specified. We encourage the creative use of “whatever is around” materials. Only dimensions matter for the construction of the course. Here are examples for the arch, slalom, and payload bay obstacles.



Arch obstacles are limited to 48 inch wide and 48 inch high area. Smaller obstacles are allowed as this increases difficulty. Any shape (arch/square) is ok but the “fly through” area needs to be equal to or less than the 48 inch squared dimensions.

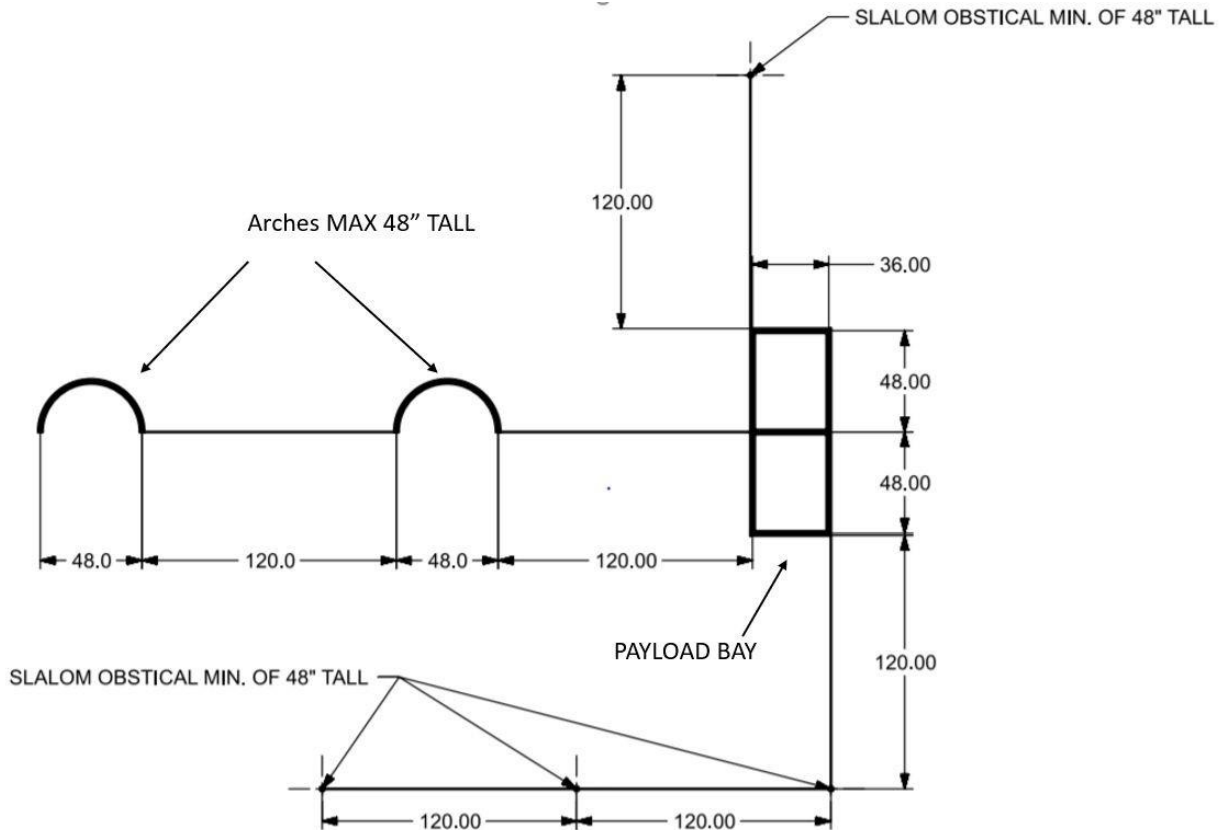


The slalom obstacles must be at least 48 inches tall at a minimum. This is so we can properly see that the vehicle has indeed correctly traversed the obstacle.



Payload bay obstacle dimensions are two connected 36in by 48 in rectangles making an 8 foot by 3 foot rectangle. Walls can be up to 4 inches high. The floor of the structure can be closed as shown in the photograph or just the ground. 2x4's would work nicely here but are not required. Tape on the floor is acceptable.





The course layout is in inches and all angles are 90°.

A virtual flight of the course can be found at

<https://drive.google.com/open?id=19swwDQzC3K-HL9SWXx5hVGj9N1-4Af3z>

Watch our ASME IAM3D Facebook page for possible future versions of that video.

We understand that people have the option to run the race video as many times as it takes to get it perfect. For this reason we are allowing it and there will be no time score, only ability scores. Speed, agility, and the ability to efficiently fly through the obstacles will be considered for the ability scoring. The ability score will be subjective and up to the discretion of the judging panel. There will be a minimum of four judges on the panel to even out variability.

## **Scoring**

There will be four ways to score points.

**Eligibility Video** - Required - No associated points

- Vehicle Dimensions
- Course Dimensions
- Advisor stating that they verified all dimensions

**Design Report** - 2500 Points possible

**Use of Additive Manufacture Parts Video** - 5000 Points possible

**Video Submission of obstacle course** - 5,000 points possible

- Correct Set up of course - 1000 points
- Ability to traverse course - 3000 points

- Payload Score: 200 points per successfully deposited payload

**Team Video** - 1500 points possible

- Team / school showcase - 500 Points
- Design / Technical explanation - 1000 Points

## **Video Guidelines**

Eligibility Video - **This video will not be shared on any media site by IAM3D**

- Physically show the measurements of your vehicle - Make sure to show that you meet all size constraints.
- Physically show the measurements of your course - Make sure you show that you meet all required dimensions.
- At the end of this video record your advisor saying that they have witnessed all measurements and verify that everything is true/correct. Use of additive video-5 minute video limit
- Do a runthrough video of your assembled vehicle. Point out all of the parts of your vehicle including non additive manufactured parts. Obstacle Course Video - 10 minute video limit
- Do not put dimension verification of your obstacle course in this video
- Include a video of the 5 lap performance of your vehicle. Make sure that judges can clearly see you completing all the necessary tasks. Team Video -5 minute video limit
- Showcase your team. Show us all the hard work you have done and how awesome your university is.
- Include technical design discussion - why you chose your design and how you came to the final design through an iterative design process.
- Also include any design features you deem as “nifty”. We would like to see how you included creative design features.

## **Video Submission**

To submit your videos please “Google drive” share all your videos to IAM3D@ASME.ORG - The gmail part is important so pay attention. After all of your videos are shared include the links in your submission email.

**Submission Email** - Please use this as a form (Next Page)

Fill out the following form and email it to IAM3D@ASME.ORG with your design report as an attachment.

### Competition Prizes

IAM3D Competition - 1st place	\$250.00
IAM3D Competition - 2nd place	\$150.00
IAM3D Competition - 3rd place	\$75.00

IAM3D Staff,

MM/DD/YYYY

This mail is the University of ( yours here ) formal submission to compete in the 2021 IAM3D U.A.R.C.V. Virtual competition.

#### Basic Information

- University /Project name / Vehicle name  
University of Hard Knocks / Blades of steel
- Chapter advisor name and contact information  
John/Jane Doe  
[Advisorname@school.gov](mailto:Advisorname@school.gov)  
(555) 555-5555
- Chapter president's name and contact information  
Awesomemember#1 Doe  
[Awesomemember#1@school.gov](mailto:Awesomemember#1@school.gov)  
(555) 555-5555
- Number of students on the competition team 42
- Number of students that participated on your team  
12

#### Video Submissions

##### Eligibility Video

[https://docs.google.com/\\_stuffandthings](https://docs.google.com/_stuffandthings)

##### Use of Additive Video

[https://docs.google.com/\\_stuffandthings](https://docs.google.com/_stuffandthings)

##### Obstacle Course Video

[https://docs.google.com/\\_stuffandthings](https://docs.google.com/_stuffandthings)

Team Video

[https://docs.google.com/\\_stuffandthings](https://docs.google.com/_stuffandthings)

Any Additional Videos (FPV ECT) [https://docs.google.com/\\_stuffandthings](https://docs.google.com/_stuffandthings)

**Make sure to Attach your Design Report!!!!!!**