Final Q&A Update February 6, 2022

Question 29:
The responses to many rules questions indicate that the water must be "poured", but it can be from any height. If we have a bucket that is open to atmospheric pressure, can we raise the bucket using a pulley and have a tube/hose that drains the bucket into our device?

Answer 29:
You can elevate your pouring system and connect tubing or hoses to it; however, the water must exit the fill system (either just a bucket, or the tubing connected to a bucket) and be flowing into the device at atmospheric pressure.

Question 28:
1. Our design incorporates a rectangular "flood gate" instead of a traditional drain valve. Can we open/close this manually since it acts as a drain valve? It will not extend beyond the 50 cm^3 volume.
2. Can water poured into the device drain onto the floor or into another container while in the loading area?
3. Can team members walk inside the arena if they don't touch the device? For example, could the driver walk alongside the robot to achieve a more stable wireless signal during trips?
4. If the device is carried back manually, can team members walk through the arena to return the device to the loading area?
5. Can you get the target bonus more than once? Say 10 trips are made. Would passing through the target bonus 10 times (once per trip) yield more points than only passing through the bonus once total in 15 minutes?
6. After the 15minutes is complete, can a pump with a flowmeter attached to it pump water out of our collection container as a more convenient way to measure mL of water delivered?

7. Can we have multiple containers to load water in the device? For example, ten 5-gallon buckets.
8. Can the container(s) used to pour water into the device be filled beforehand?
9. Will it be announced how many teams competed and what our standing was?
10. Will the videos/designs of the winning teams be available to view after the competition?
11. Can a hand-powered crank pump be used to manually load water into the device while in the loading area? There is no battery involved. The energy source is human muscle, it's simply being transferred through mechanical means.
12. We intend to setup our arena near a swimming pool so we can have easy access to a large body of water to scoop into buckets for loading. Is this permissible??
13. Can a faculty member participate on our team if they are an ASME member? They will not be designing our device, they will simply help us pour water manually.
14. Is having a playing field with drains a problem? We plan on using a swimming pool at our college and setting up our playing field right next to it, but the floor has areas with drains that create small dips in the level of the floor. There is no advantage whatsoever in having these dips in the floor (it's not going to help us drive down an incline). If we covered the drains with something to help flatten the dip, would that be acceptable?
15. Can we raise the height of our playing field? If the drains mentioned in #16 are a problem, we plan on creating a platform made of OSB and 2"x4"'s to keep the level flat. The arena will only be raised 1.5inches. We can also raise the height of our storage container to be 1.5 inches off the ground to be consistent.
16. Is using chlorinated pool water a problem? We will not use the chemical energy of chlorine in any way. We simply need access to a large body of water that we can scoop water out of to pour into our robot. The energy of this water will only be harnessed mechanically (pushing a propeller).
17. We have a rectangular "floodgate" instead of a traditional valve. In order to open/close it, we may need to attach a spring. Is this acceptable, since the potential energy of the spring is only harnessed to control our drain valve and does not provide locomotion to our device in any way?
18. Is the bonus still awarded if our device passes through it during a trip but does not finish the trip? For example, if our robot crosses the bonus area and runs out of energy/momentum, will we still get the bonus?
19. Can we measure the water from our storage container after 15 minutes?
20. Does our device need to start out empty or can we pre-fill it before the competition?

Answer 28:
1. A gate valve is allowed, and it may be manually operated.
2. Yes, see Q&A #4, only water transported to the Water Unloading Area is measured.
3. Yes
4. Yes
5. The Trip Score bonus must be earned for each trip and may only be earned once per trip (Rule #22)
6. No, that adds additional measurement uncertainty. Use either the method stated in Rule #7 or the method stated in Q&A #25.1. Also review Q&A #25.2 for allowable handling of water in the collection/measurement system.

7. No limit is given in the rules for the number of filling containers you use.
8. How water is provided for the demonstration is up to the team
9. Yes, the winners will be announced at E-Fest and the placement of every team will be given after that – usually approximately a week.
10. Some videos are made available by teams themselves, ASME will also sometimes make a competition summary video, but not specifically provide videos of teams.
11. No, water must be "manually poured into the device" Rule #5.
12. Yes
13. No, only undergraduate students may actively participate.
14. As long as the Water Loading Area and Water Unloading Area are at the same elevation that is allowable.
15. See response 28.14.
16. That is acceptable
17. Yes
18. A Target Bonus is earned for passing over the Target Bonus Area either going to the Water Unloading Area, or returning (not both). The Return Bonus is earned for returning to the Water Loading Area under device power.
19. Yes, see Q&A #27.1
20. Devices must start the 15-minute demonstration empty.

Question 27:
1. If the vehicle transports water and delivers it at the water unloading zone at exactly 15 minutes, will this water be counted in the team's total water transported if not measured within that timeframe? Is it allowed to measure the water for scoring after the 15-minute competition period has ended?
2. Is the robot allowed to work independently of the person measuring the water? For example, is the robot allowed to return to the start after depositing the water while the water is being measured?
3. The rules specify that we are allowed to manually open a valve to drain the vehicle. Are we allowed to manually scoop the water out of the vehicle?
4. Are we allowed to use an external device to hold the vehicle in place while unloading?

Answer 27:
1. All water that has been transported and removed from the device inside the Water Unloading Area within 15 minutes will count, even if the measuring of a final amount of water takes place after the 15-minute time limit. Teams must clearly show that draining of water from the device has stopped at the time limit, or the final volume may not be counted.
2. Yes, returning to the Water Loading Area may take place while water is being measured.
3. No, water must drain out through a valve.
4. No. The vehicle must stop itself (see Q&A #20 for one example).

Question 26:
My team and I were curious what the requirements are for measuring the water transported. The rules state that it must be measured using "an unaltered commercial measuring

container with clear volume markings in milliliters." In a Q&A update it seems to allow emptying and refilling of the same container for measurement. How should the count be recorded during the video?

Answer 26:

If a commercially labeled measuring container is used, and it will be reused several times during the 15-minute demonstration, teams can clearly record the amount of water collected in a single run, announce the amount collected, and then discard that water and repeat the process for future runs. Note Question 25.1 below for an alternative means of determining water transported.

Question 25:

1. Can the water transported by the device be weighed and the volume determined from the weight using the density of water instead of directly measuring volume?
2. Can our water collection device contain a water pump inside of it to automatically pump the water into a measuring container? Keep in mind the water will be removed from the device via gravity only using a drain. The pump will be within the water collection device itself, not affecting the transporting device.
3. Part of our device has the ability to change its shape with no external input. If we were to push this part of the device to fit inside of the sizing box, and this part then automatically returned to its original state once the box was removed would this be legal?
4. Our university's spring break is the week of March 18 and some of our group members may not be here. Will we be able to submit the final video before that week?

Answer 25:

1. That is a reasonable idea and will be allowed. Teams that measure the water mass, rather than volume, must provide video evidence of the calibration of their scale at the start of the competition video (show the scale reading with a calibrated amount of water on the scale)
2. Yes
3. Yes; stored energy is only forbidden when it is used to propel the device.
4. Detailed instructions for submitting each round of videos (due March 4, 11 and 18) will be sent to all registered teams approximately one week prior to the submission deadline. SDC judges will make every effort to evaluate the March 4th and March 11th videos as quickly as possible and send confirmation or required corrections (if any). If teams have non-ASME schedule issues, we would suggest that videos be submitted as quickly as possible, and not wait for the final deadlines.

Question 24:

Can we do some additional adjustments to the vehicle at the water loading area while loading water like lifting the back wheels of the vehicle?

Answer 24:

No.

Question 23:

Can we release a break/latch system by hand or does it need to be automated?

Answer 23:

Once the device has been placed in the Water Loading Area, it may only be filled manually. Control actions such as brakes/latches are control functions and must be done remotely. Only opening and closing water drain valves may be done manually (Rule #7)

Update December 28, 2021

Question 22:

Can I store water in a container in the water Loading area and power a vehicle run by potential energy stored in the water of that container which will be attached to it via a pipe and transport water in that way, and both of them assembled will fit inside 50x50x50 cm box?

Answer 22:

You don't have to store water in the loading area. You can have a reservoir of water that your team can use to fill your device within the Loading Area – you can attach via a pipe or can simply pour into your device. This water reservoir does not have to fit within the sizing box, only your device that will carry the water to the Unloading Area

Question 21:

1. Can a non-engineering student (physics) join my team and contribute, and if so do I have to register them as a participant?
2. Can you use predesigned parts or does 100% of the robot need to be built from scratch?

Answer 21:

1. Yes, they just must join ASME and register for the competition.
2. Your team may either use pre-fabricated components or may build from scratch.

Question 20:

Can we design the water unloading container any way we would like? We would like to use this container to help with return or be used to "catch" the vehicle (and therefore it would have a certain geometry and some robotic parts).

Answer 20:

The only function of the water unloading container is to assist in the collection and measurement of the water that is transported. It may not serve any other function in the competition, including helping with starting or stopping the device.

Question 19:

When unloading the water, can part of the vehicle be simultaneously in the loading and unloading area?

Answer 19:

No, see Question 7.1. Devices must be filled with water when within the Loading area, and water must be removed when the device is within the Unloading area. Components may not span the playing surface between the two areas during either water loading or unloading.

Question 18:
Are we able to load the water into a separate structure bigger than our 50cmX50cmX50cm constraint, which will then provide a mechanical force to our device which will charge it up (this would be a tension force applied to our device from this structure)? Or do these tension forces all need to be in the size constraints?

Answer 18:
Your device must fit in the original 50 cm cube sizing container; however, water collection systems may expand under device power during operation (Question 5.1), or due to the filling of water (Question 9.2). You may use the potential energy of the loaded water in either the original or an expanded container to propel your device to the unloading area however you wish. Be sure to review and comply with Rule #5 regarding initial stored energy.

Update November 10, 2021

Question 17:
1. In regards to expanding questions 2.1 about the terrain, are we allowed a track or rail system inside the 3*3 zone that the vehicle wheels can be placed on?
2. Since we are allowed to charge a battery with the water, can we use that battery to power a motor to move the car forward.

Answer 17:
1. No.
2. Yes.

Question 16:
When unloading and/or loading, does the entire robot need to be in the unloading and/or loading zones or can only part of it be in it?

Answer 16:
The device may not be touching the ground outside the Loading or Unloading Areas while adding/removing water.

Question 15:
Is it necessary to store the same water that is being used for propelling the vehicle?

Answer 15:
The water you transport to the Unloading Area does not have to be stored after measurement, or reused.

Question 14:

If we have a small tank in our device with stored water to use it to run the robot. Do we fill this tank by member's hand in the loading area and pour water from this small tank in the Unloading area?

Answer 14:

Water can be loaded manually and unloaded manually, see Question and Answer 1.2.

Question 13:
1. Does the robot have to fit inside the starting zone entirely or is overhanging outside the starting zone permitted?
2. Is a control function to expand the robot permitted to count as touching the bonus target zone?
3. Are springs allowed to be preloaded to prevent the robot from moving? They will return to the same state and there will be no way to harness the potential energy they do initially contain.
4. Is it required that the robot is able to be controlled remotely?

Answer 13:
1. Your device must fit inside initial sizing box, and if it expands, it must do so under its own power. Your device may not touch the ground outside the starting zone until it is going to the water unloading area, but may overhang the starting zone boundaries.
2. See Answer 10.2. A component of your device that contacts the ground during regular operation must touch within the Bonus Target area to count – not an extended arm.
3. Preloaded energy components are allowed as long as they finish the competition in the same energy state as they start.
4. To receive points for any water transported, a team may not manually touch their device after it has left the Loading Area and before it reaches the Unloading Area. How a team chooses to achieve this requirement is a design decision.

Update October 20, 2021

Question 12:

We are using the fact that water is very heavy as a means of propulsion. We plan on creating a spherical robot, in which the water reservoir is offset from the center of the sphere. This offset of the water will cause a rotation of the sphere and therefore be the means of propulsion. Two planes inside the sphere will position the water in a certain location to allow the rolling process to occur. These planes will be driven by motors, however will NOT propel the vehicle in any way, just reposition the location of the water reservoir inside the sphere. Are we able to have the motors and respective electronics components controlling this readjustment inside the sphere be fully charged at the start of the competition, as they are not propelling the vehicle directly?

Answer 12:

You cannot add electrical energy (motors) within the propulsion system. If you are using a motor to move a compartment within your system that is filled with water, then that is adding potential energy to your system and is not permitted.

Question 11:
Clarification regarding SDC Q&A Forum Question 8.2. Can we spend some of the allotted *fifteen* minutes in the loading zone passing flowing water through our robot to charge something before we fill our transport container and does the water that we pass through to be charged have to be transported or can we pass it through and pour it out in a different bucket.

Answer 11:
You can use water to "charge something" and all water does not have to be transported to the Unloading Area. However, water must be added manually, you cannot flow pressurized water through your system, it must be poured manually. (see questions 4 and 1)

Question 10:
1. Are we able to use heated water?
2. Can we get more clarification on the target bonuses: What does it mean by any part of the device needs to pass over?
3. Are there specific sizes for the water bins between active and passive (in use vs not in use)?

Answer 10:
1. No.
2. If any part of your device (presume it would be a wheel) touches the floor within the taped area of the Target Area that will be counted.
3. No.

Question 9:
1. How high can the water be poured into the machine from? Can we pour it from above the constrained size?
2. Can the device expand to larger than the constrained size if it is collapsible and expandable by the water deploying method?
3. Are there any limitations on the type of water collection container that is in the unload area?
4. Are there any limitations on the battery that can be used for steering and water deployment?

Answer 9:
1. Any height, as long as it is done manually. (see question 1)
2. Yes.
3. You can have a water collection container(s) and also a separate container that is used to measure the water volume. You may manually place, move and pour water from the collection to the measurement containers. (see question 10)

4. You control system battery for steering can have any battery you wish. Please be more specific what you mean about "water deployment." Water can be poured into the device and removed from the device manually. If you wish to have a remotely controlled valve that can be done with an electrical device, using the control system battery.

Update October 6, 2021

Question 8:
1. When filling our robot, are there limitations on how we can pour the water? Can we design an extended funnel to pour into our robot reservoir, and if we can, would we be limited to fitting the funnel within the rigid box with the robot?
2. While filling the robot, can we have an open valve that allows us to manually cycle water through our system while "charging" it up, before closing off the valve to hold water for transport?
3. How much of the robot needs to pass over the bonus areas to gain the bonus multiplier?
4. The competition rules state that no initial energy can be stored. If we use batteries, would they need to be fully discharged before the competition or can we implement some programming that sets the initial charge as effectively "empty", shutting the robot off if it reaches that level? We ask because fully discharging a battery ruins the battery, which would be very wasteful.

Answer 8:
1. See Answer 1.1. Only your device must fit within the rigid sizing box; external pouring or collecting systems do not have to fit in the box.
2. Yes.
3. If any portion of your device touches the ground within the Bonus Area that will count for the bonus points. It must be clear on the video that you record of your run.
4. See Answers 1.3 and 2.2.

Question 7:
1. Does the vehicle need to be completely inside the loading and unloading area to fill/empty?
2. Does the unloading tank need to stay within the unloading area, or can it be removed?
3. Can we have a barrier that blocks the "outside" of the play area? If so, what materials are acceptable?
4. Can the robot extend outside the Loading Area while the wheels are still inside the Loading Area.

Answer 7:
1. Yes. The device must not touch the ground outside the marked Loading and Unloading Areas.
2. The system for collecting and measuring water does not have to stay within the Unloading Area

3. Yes, if you wish. There is no explicit penalty for leaving the 3m x 3m playing area, if you wish to provide a barrier that is allowed. Any materials you wish are allowable.
4. Yes, see answer 7.1 above.

Question 6:
1. Does the battery have to be charged from the potential energy of the water at the start of the run, or can it have an initial full charge?
2. Are we allowed to pressurize the water in anyway?
3. Are we allowed to use the water in a hydraulics system as a source of actuation?
4. Are we able to modify the water in any way? For example, could our robot mix electrolytes into it?
5. Are we allowed to change the state of the water (create steam)?

Answer 6:
1. See Answer 1.3. Any battery used to propel the device must start fully discharged. Batteries used for device control can be fully charged at the start of the run.
2. See Answer 1.2. Only unpressurized water may be manually added. You may pressurize water within your device, but this must be done using the device power if it is being used to propel your device.
3. See 2 above.
4. No.
5. Only if this is done using the water power of the vehicle, not external electrical power.

Question 5:
1. Can frame parameter be exceeded during trip?
2. Is there a limit to how high we can dump water from?
3. Can the water be hot/ can it be ice or dry ice?
4. Can the robot be altered in the loading zone?
5. Can we extend the robot to get into the target zone?
6. Does our entire robot have to be in the loading and unloading zone during those periods?
7. Can we hit the target zone on the trip back?

Answer 5:
1. Devices must fit within the sizing box, and within the loading and unloading areas. They may expand under their own power during the runs.
2. No. See Answer 1.2.
3. Added water must be room temperature liquid.
4. Only if it is done by the device power, not manually by a team member.
5. To earn the bonus points for the Bonus Target Area, a portion of your device must touch the ground within the Bonus Area, you may not extend an arm to get to the target zone.
6. Yes, it must not touch the ground outside of these areas.
7. Yes you can enter the Bonus Target Zone either on the way to the Unloading Area, or on the way back if you are using water power to make the return trip.

Question 4:

Is all of the water that is poured into the device required to be transported to the water unloading area? Can water that is poured end up outside of the device? Can water be poured outside of the device?

Answer 4:

No. You can add excess water in the Loading Area that is not transported to the Unloading Area. This can be done in any way you wish as long as you satisfy Answer 1.1.

Question 3:

When the water propelled vehicle returns to the water loading area, are we allowed to pick up the vehicle, or reorient the vehicle?

Answer 3:

Yes.

Question 2:

1. Does the demonstration field have to be anything specific, are we allowed to choose any type of field like concrete, grass, wood floor, etc.?
2. Is the vehicle allowed to use the poured water to power a rechargeable battery, which can then be used to power motors, etc.? Or is it strictly to power a mechanical system?
3. To remotely return the vehicle back to the starting position, are we allowed to store some of the water we previously poured and use it to make the trip back? Or do we have to release all our water at the unloading area, then remotely move it back without any water??

Answer 2:

1. Yes.
2. Yes, see Answer 1.3.
3. Yes. If you chose to earn the return bonus, you can use some of the water to make this trip. Only the water you release in the Unloading/Measuring area counts towards your water total.

> **Commented [AS1]:** Consider clarifying if the answer is "yes, specific flooring is listed in the rules", or "yes, you many choose any floor available to you".

Question 1:

1. Are we able to construct a stand or fixture to allow for consistent pouring of water between runs?
2. Rule #23 states that the water can be manually or remotely removed from the device into the collection container as long as the device is not shifted or lifted during the process. Does this mean that we are able to remove the water via siphon or pump or other similar mechanical methods of removal?
3. Rule #5 states that there can be no initially stored energy of any kind, including electrical energy. Are we allowed to use rechargeable batteries as part of our drive system, and, if so, how should we show that the battery is discharged at the beginning of the run?

Answer 1:

1. Yes, as long as you manually pour water into whatever fixture you create. It is not allowed to provide water under pressure into your device, it must be poured into your device by a team member.
2. No, water must gravity drain from your device; you may create a collection container that facilitates this draining, and then pour the collected water into your measuring container manually.
3. Yes, but the battery must be fully drained at the start of your 15-minute run. Teams with battery systems will be required to prove that there is no charge in any batteries used to propel the system. (Electric power is permitted for all control operations. Batteries for this function are allowed.)