

OFFICIAL RULES FOR 2016 JPL INVENTION CHALLENGE

The JPL Annual Invention Challenge is ready for its nineteenth year. The title for this year's contest is the **“Don't Waste a Drop Contest”**. The objective and rules are listed below. Questions related to this contest should be directed to: Paul MacNeal at work phone (818) 354-7824, M/S T1723, located in Building T1723-128, or e-mail to paul.d.macneal@jpl.nasa.gov.

OBJECTIVE: Create a device that can transport water in a plastic cup into the water vessel located 2 meters away in the fastest time without wasting a drop of water. The winner will be the team whose device accomplishes the task in the fastest time.

Rules:

ELIGIBILITY

- 1) The contest is open to all JPL employees, contractors, and immediate family members. The contest is also open to teams of students from Southern California middle schools and high schools providing that they have completed all required forms as outlined in rules 3 and 4 below.

REGISTRATION – JPL PERSONNEL

- 2) Applications for JPL employees, contractors, and immediate family members entering the contest (found on website) must be filled out and submitted to Public Services prior to midnight November 12, 2016. Completed entry forms should be directed to Public Services at FAX (818) 393-4641, or sent via email to Rhonda.M.Dash@jpl.nasa.gov. All entries will be time stamped based upon the time received. Only the first 20 JPL/contractor entries will be permitted to compete. Five alternates will be accepted in case some entries withdraw prior to the competition.

JPL employee family members and friends are welcome to watch the contest, but must be cleared through the security office prior to arrival. JPL employees must fill out the visitor request form: <https://gateway.jpl.nasa.gov/sites/JPL-ID/Pages/Default.aspx>

REGISTRATION – SCHOOLS

- 3) In order to make it easier to process badging at JPL, each team must email their completed, typed entry form (found on website) to Rhonda.M.Dash@jpl.nasa.gov. Additionally, to make the badging process flow smoothly each team must **mail** a printout of their completed student team entry form and the “Authorization and Release for Photos, Audio and/or Video Recordings of and/or Artwork” agreement form (found on website) for each person (student, guest, teacher, and chaperone) planning to attend the JPL contest. Each video release form must be completely filled out and signed. If the student is under 18 years of age, then use the appropriate form filled out and signed by their parent or guardian. **The emailed entry form and entire set of video release forms must be filled out and submitted to Public Services no earlier than August 29, 2016 and be postmarked no later than midnight October 1, 2016. Completed forms must be mailed to Public Services at Jet Propulsion Laboratory, M/S 186-113, 4800 Oak Grove Drive, Pasadena, CA 91109.** All entries will be time stamped based upon the time received. Student teams will be notified to verify their acceptance into the contest by October 6, 2016. Questions regarding the entry forms can be directed to Rhonda.M.Dash@jpl.nasa.gov in Public Services at (818)354-0112. Each school

is allowed no more than three teams. Internal school competitions are encouraged to select the top three teams if necessary.

Any foreign person, 18 or over, student or adult, will need to fill out a special form which is processed by the Public Services Office. The process takes nearly three weeks; therefore, if anyone plans on attending the contest at JPL, and they are a foreign national, it is important that they contact Public Services prior to November 6, 2016.

Additions or corrections to the registration forms and/or video release forms need to be mailed to the Public Services Office with a postmark no later than Wednesday, November 23, 2016. Faxed forms will not be accepted. Failure to send in the signed video release form by the requisite time will prevent participation and access to the JPL contest for those students that fail to comply with this request.

SPECIAL RULES FOR SCHOOL TEAMS

- 4) Only the first 90 student team entries will be permitted to compete at the regional competitions. Student teams will compete at a regional competition held on Saturday, November 19, 2016 at either Augusta Hawkins High School in Los Angeles or Chapman University in Orange. Details for the regional competitions will be sent to all registered teams. The top five teams with the fastest times from each regional competition will be invited to compete at the JPL contest held on Friday, December 2, 2016 (see Rule 5 below). In addition, the next 10 teams with the fastest times between both regional competitions will also be invited to compete at the JPL contest.

DEMONSTRATION EVENT AT SOCAL MAKER CONVENTION

- 5) There is an opportunity to demonstrate your device at the SoCal Maker Convention held on Saturday, November 5, 2016. It is located in Pomona at the Fairplex. Transportation to the event is not provided. The doors open at 9:00 AM and event is over at 5:00 PM. The JPL Invention Challenge demonstration will be held on stage at a specific time (approximately 12:00 PM to 1:00 PM). This opportunity would give your team a chance to operate your device in a realistic contest setting in advance of the regional or final contests. **Free admission (normally a \$20.00 value) is offered for every team member and chaperone.** More details will be made available in October. **If your team is interested in attending, please contact Paul MacNeal.**



LOGISTICS

- 6) The date and time for the final contest is Friday, December 2, 2016 between 11:30 AM and 1:00 PM. The contest is held at the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109. The contest area is located north of the fountain area, in front of the Administration Building (Bldg. 180) steps. In the event of heavy rain (more than mist), the contest will be held indoors. Check-in for the event will begin at 10:15 AM.

DEVICE RULES

- 7) The device must have the following characteristics:
- Be able to transport a plastic cup (described in Rule 7i), initially resting on the ground, filled with 250 grams [8.8 ounces] of water and a plastic goldfish (described in Rule 7e) from its starting location, transport the cup, and then cause all of the water and goldfish to move from the plastic cup into the water vessel (described in Rule 9). The water vessel centerline is 2.0 meters [78.74 inches] away from the starting location centerline of the plastic cup. The plastic cup may not be altered in any way. No adhesives or tapes are allowed to secure the plastic cup to the device. No outside water source can be used in the device.
 - At no time before, during, or after the task can the device or plastic cup touch the water vessel (plastic tube and wooden base). Violation of this rule will lead to a disqualification of the device.
 - At no time may the plastic cup or goldfish be cracked or broken. Violation of this rule will lead to disqualification of the device.
 - Be able to minimize the spillage or wasting of water during the completion of the task. Penalties for spilling water are described in Rule 10.
 - Ensure that the plastic goldfish ends up in the water vessel. The plastic goldfish is shown below and has approximate dimensions of 50 mm by 21 mm by 33 mm. The goldfish has a mass of 6 grams [0.2 ounces]. Violation of this rule will lead to disqualification of the device. For those teams wishing to “print” their own unofficial goldfish replica, an .STL file is loaded onto the JPL website located at <http://www.jpl.nasa.gov/events/inventionchallenge/>



- f. Only one attempt is allowed to complete the task.
- g. Be initiated by a single operation (cut a string, flick a switch, pull a pin, etc.) provided by the contestant. Only one contestant is allowed in the set up area at the initiation of the task. No human power may be used during the initiation of the device to add dynamic or potential energy to produce motion of the plastic cup. All stored energy systems must be energized prior to starting the task.
- h. The length and width of the device are limited to 3 meters long [9 feet 10 inches] and 2 meters wide [6 feet 6 inches]. The height is unlimited.
- i. The official clear plastic cup (shown below) is a 16 ounce cup with the “Up & Up” brand name. It is the “Entertaining Plastic Cup” and has SKU number 041165158557. It can be found at Target stores with a product code of 253050280. The mass of the cup is 15.4 grams [0.5 ounce]. The cup dimensions are as follows:
 - Outer rim diameter is 98 mm [3.85 inches]
 - Under lip diameter of cup is 95 mm [3.75 inches]
 - Inside diameter of lip is 90 mm [3.54 inches]
 - Height is 120 mm [4.72 inches]
 - Outer diameter at base is 62 mm [2.44 inches]



- j. Utilize safe energy sources. Examples of disallowed energy sources are chemical explosions, caustic gases, and rocket motors. High pressure gas systems and other questionable sources must be cleared through Paul MacNeal and the Safety Coordinator prior to performing at both the regional contest and the final contest. An electrical cord will be available for use.
- k. Be made from any materials as long as they are non-toxic and safe.
- l. Place the official entry number provided by the contest organizer (3” high numbers or larger) on at least two sides of the device for easy identification.
- m. Not use any clamps, tape, or any other means to attach to the ground. The device must only rest on the ground, however heavy weights may be used.
- n. Not use any remote control devices of any kind.

- o. Be able to adapt to non-level ground (see Rule 8).
- p. **SPECIAL RULE FOR SCHOOL TEAMS ONLY:** To avoid plagiarism, each team that competes at the regional contest will have photographs taken of their device. The basic concept of the device (energy source type, cup transport method, and size) must be maintained. Minor modifications to the device are allowed within these constraints.

CONTEST AREA DESCRIPTION

- 8) The contest site is located in front of the steps leading to Building 180. The site will contain two side-by-side areas for setting up and operating the device. The size of each set-up area is 4 meters by 2 meters. Each team will be randomly assigned to either operating area. The ground is concrete with a rough finish, potentially wet, and has a slight slope (approximately $1/2$ degrees across the width as shown in Figure 1). See Figure 1 for a description of the contest area.

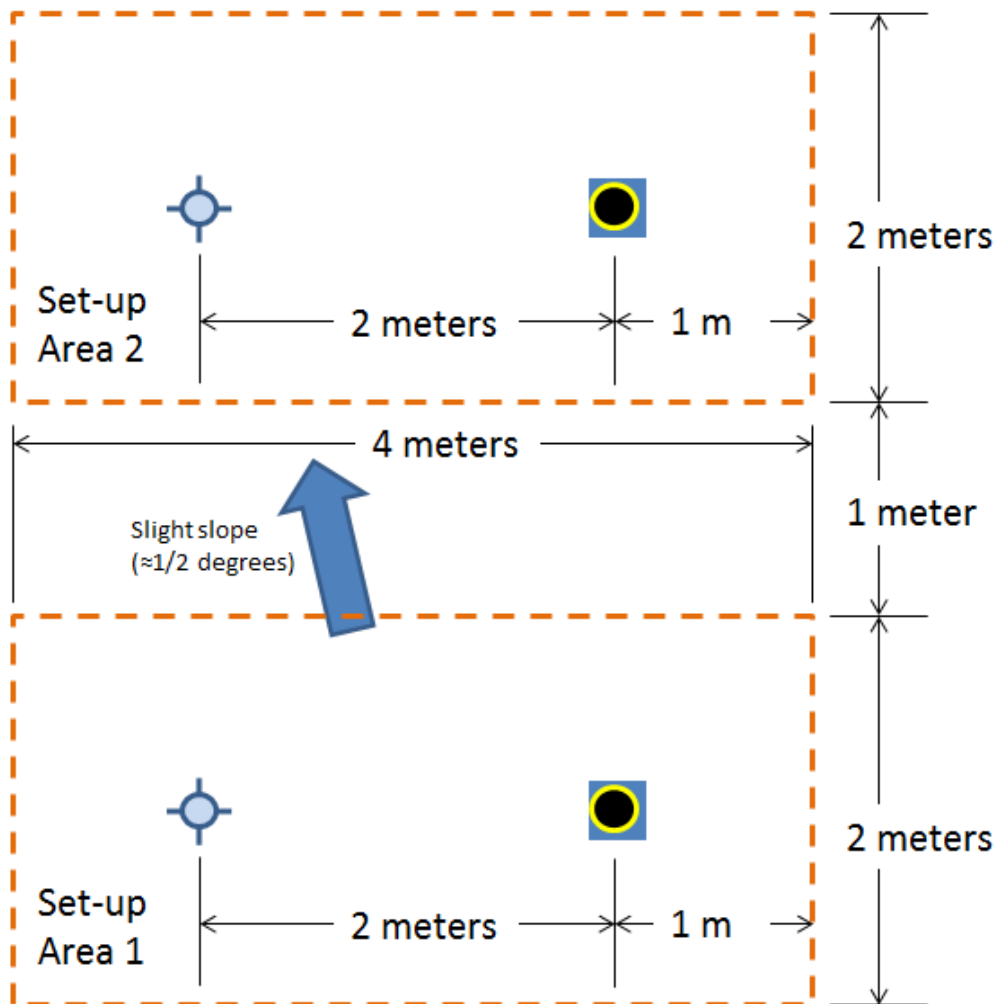


Figure 1. Contest Area – top view

WATER VESSEL DESCRIPTION

- 9) The water vessel includes a plastic tube and a wooden platform base and is described below.
- a) The rim has a 7.6 cm [3"] outer diameter and a 7.0 cm [2.75"] inner diameter.
 - b) The rim of the water vessel is located 30 cm [11.8"] above the ground and is level.
 - c) The platform supporting the plastic tube is secured to the ground and is 15.2 cm [6.0"] wide by 15.2 cm [6.0"] deep by 13.6 cm [5.38"] tall. The platform has a rim on it to help secure the plastic tube from sliding sideways.
 - d) A total of 150 grams [5.3 ounces] of water will be in the water vessel prior to the start of the task. The water amount will be weighed each time prior to the start of the task.
 - e) The centerline of the rim of the water vessel is located 2.0 meters [78.74"] away from the centerline of the starting location of the plastic cup.



PENALTIES

- 10) The task will be considered successful if the amount of water from the plastic cup ending up inside the water vessel is between 230 and 250 grams [8.1 and 8.8 ounces]. The plastic goldfish must also be inside the water vessel. Penalties will be awarded as described below.
- a. If the amount of water coming from the plastic cup and staying inside the water vessel is between 230 and 250 grams [8.1 and 8.8 ounces] then no penalties will be assessed.
 - b. If the amount of water coming from the plastic cup and staying inside the water vessel is between 200 and 230 grams [7.1 and 8.1 ounces] then a 5 second time penalty will be added to the task time.

- c. If the amount of water coming from the plastic cup and staying inside the water vessel is between 170 and 200 grams [6.0 and 7.1 ounces] then a 15 second penalty will be added to the task time.
- d. If the amount of water coming from the plastic cup and staying inside the water vessel is less than 170 grams [6.0 ounces] then the device will be disqualified from the contest.
- e. If the plastic goldfish does not end up inside the water vessel then the device will be disqualified from the contest.

CONTEST PROCEDURE

11) The order in which teams will participate is selected by a random process. The team will be given a three minute period of time to setup their device. Safety advisors will be observing the team during their setup time and will warn and potentially stop the team if any setup operations can lead to potential accidents. Strict time limits will be imposed to ensure that all contestants are able to operate their device. At the beginning of the setup time period each team will be handed the official plastic cup containing the water and plastic goldfish. The team is responsible for placing the plastic cup on the ground where indicated by the “X”. The team is responsible for ensuring that the water does not spill during the setup of their device.

Each team shall designate a speaker that is not involved with the device setup to talk about their team and their device during the setup period. The team will be asked if they are ready to proceed. The procedure for running the task and determining the official time for the task is as follows:

- a) The referee will give a countdown (3...2...1...GO!) for the start of operation for the device.
- b) The timers will start the time at the referee’s direction.
- c) The referee will determine when the water from the plastic cup has completed filling into the water vessel and the goldfish has entered the water vessel. The referee will yell an audible “STOP” when these tasks are complete.
- d) The timers will compare their times and the lead timer will write down the time it took to complete the task to the nearest 0.01 seconds on the scoresheet.
- e) The water vessel monitor will carefully remove the goldfish and attempt to make sure that all the water dripping off of the goldfish remains inside the water vessel.
- f) The water vessel monitor will calculate the weight of water that has been added to the water vessel by subtracting the original weight from the final weight. Based on Rule 10, the water vessel monitor may assess a time penalty which may lead to disqualification of the device.
- g) All decisions of the referee are final.

All teams will be asked to remove their device and place it back in their original waiting area. After the task is completed, the water vessel monitor will remove enough water to ensure that the starting weight of the water in the water vessel is 150 grams [5.3 ounces]. The water vessel monitor will also ensure that the plastic cup is filled with 250 grams [8.8 ounces] of water and place the goldfish into the cup prior to handing the plastic cup to the field judge.

The winning team will be the team whose device completed the task and had the shortest time of completion (including any time penalties). In the event of a tie, each team will be asked to setup their device and perform the task again to determine the winner.

AWARDS

- 12) Trophies will be divided into two categories: JPL employees/family/contractor entries and school team entries. Trophies will be given for first, second, and third place for each category at all contests (regional contests and the JPL contest). Certificates will be issued for the lightest, heaviest, most unusual, most artistic, and most creative designs.