

## “Mechanical Eye Challenge”

### OFFICIAL RULES

1. DESCRIPTION: The "Mechanical Eye" Challenge (the "Challenge") begins at 00:00 a.m. Eastern Time ("ET") on 00/00/18 and ends at 11:59:00 p.m. ET on 00/00/18 (the "Challenge Period"). The Challenge provides members of the public with the opportunity to design a mechanical eye system that follows specifications in section 4. By participating in the Challenge, each entrant (and, if a minor, his/her parent or legal guardian), unconditionally accepts and agrees to comply with and abide by these Official Rules and the decisions of the National Aeronautics and Space Administration (NASA Headquarters; 300 E Street SW; Washington DC 20024-3210) and the Jet Propulsion Laboratory/California Institute of Technology (4800 Oak Grove Drive; Pasadena, CA 91101) (collectively, the "Sponsors"), which shall be final and binding in all respects. By participating in this Challenge, each Entrant (and, if relevant, his/her parent or legal guardian) also unconditionally accepts and agrees to comply with and abide by the rules for prize provision set out in sections 6 and 7. If a team completes this challenge, then one selected member of the team must serve as the Entrant.

2. WHO CAN ENTER: The Challenge is open only to legal residents of the fifty (50) United States and U.S. Possessions over the age of thirteen. Entrants above the age of 13 and under the age of 18 must get a parent's or legal guardian's permission to enter. Entrants must provide parental consent in form and substance suitable to Sponsors, in Sponsors' sole discretion, in order to be confirmed as a prize winner. Employees of Sponsors and their affiliates (collectively, the "Challenge Entities") and their immediate family members and/or those living in the same household of each are not eligible to enter the Challenge or win a prize.

### 3. HOW TO ENTER:

ONLINE: Eligible entrants must follow the online instructions for uploading the following data (the "Submission") to <http://...> (the "Challenge Website"):

To submit an entry, participants must first submit a notice of intent due by (00/00/18, 11:59:00 PM PDST).

The entry must be submitted by the notice end date, and consists of:

- (a) a video of their mechanical camera working, per instructions in Section 4;

- (b) a full description of how the mechanical camera operates;
- (c) the transmitted reconstructed image;
- (d) the digital image of the same scene the mechanical camera was capturing;
- (e) details of how the signals were reconstructed into an image; and,
- (f) completion of the Official Entry Form (name of entrant, email, street address, city, state, zipcode, telephone number, and, if relevant, parent/guardian online permission).

All Submissions must be received during the Challenge Period. Limit one entry per person and/or team. No substitutions of new versions of a Submission will be accepted once the original Submission is submitted for consideration. All requested information must be completed to enter and to be eligible to win. Except as otherwise contemplated in these Official Rules, information collected in connection with this Challenge will be used by Sponsors in accordance with the privacy policy available at the Website. Any communication or information transmitted to Sponsors and/or the Website by electronic mail or otherwise is and will be treated as non-confidential and nonproprietary, except for personal information as protected by the Challenge privacy policy. Proof of submission is not considered proof of delivery to or receipt of such entry. Sponsors shall have no liability for any Submission that is lost, intercepted or not received by the Sponsors.

#### 4. SUBMISSION REQUIREMENTS

Each Submission that is entered into the Challenge must meet the following "Submission Requirements" (any Submission that, in Sponsors' sole and absolute discretion, fails to meet the following criteria will be disqualified):

- (a) The Submission must be the entrant's own, original, previously unpublished, and previously unproduced work;
- (b) The Submission must meet the following requirements.
  - the video must be submitted in in .mov, .wmv, or .mp4, be less than on 1GB in size. The video must fully explain how the system works, and illustrate the system working, and show how the data is received and translated, but must be no longer than 30 minutes.

- the video may be uploaded to YouTube.
- the images must be submitted in .jpg or .png format. Maximum size of all images is 50 MB.
- explanation as to how the signals were reconstructed into an image must be provided in a .pdf. Maximum size if 5 MB.
- the mechanical eye design model featured in the video must comply with the following specifications:
  - **Overarching:** The mechanical system must have a field of view 2 meter x 2 meter at 2.5 meters from the camera with a maximum pixel size of 10 mm x 10 mm (minimum resolution of 200 x 200 pixels, this is a FOV of roughly 60 degrees), and convert the image into an electrical or rotational signal. This electrical or rotational signal must be transmitted at least 1 meter to another location, and then used to reconstruct the image. The maximum amount of time allowed to take an image is 5 hours.
  - **Electronics:** Some simple electrical components are allowed. The allowed components include wires, inductors, capacitors, resistors, and **one** photo diode. (High temperature photodiodes are a realistic technology that many foresee on the near horizon. Hence, a hybrid electro/mechanical solution is likely possible, using very minimal electronics.)
  - **Size:** The entire mechanical camera must fit in a box 200 mm x 200 mm x 200 mm. (it is acceptable to have elements which extend or deploy outside of the box during operation). The box and limitations do not include the image reconstruction device our output shaft/electronic signal.
  - **Inputs:** The maximum number of inputs are one rotating shaft and two wires. The rotating shaft may be of any size, rotated at any speed, with any amount of torque desired (note, shaft can be connected to a motor outside of the box). The two wires are allowed, with one power wire and one ground. The maximum voltage difference across the wires may be 9 V, and a maximum current of 300 mA (i.e. essentially can be driven by a 9V battery).
  - **Outputs:**

The camera must provide outputs via either electrical signals or rotating shafts. The maximum number of outputs from the camera are 3 (i.e. 3 wires or 3 rotating shafts, or a combination of wires and rotational shafts). If wireless communication is used, there is no limit on the frequency range used.

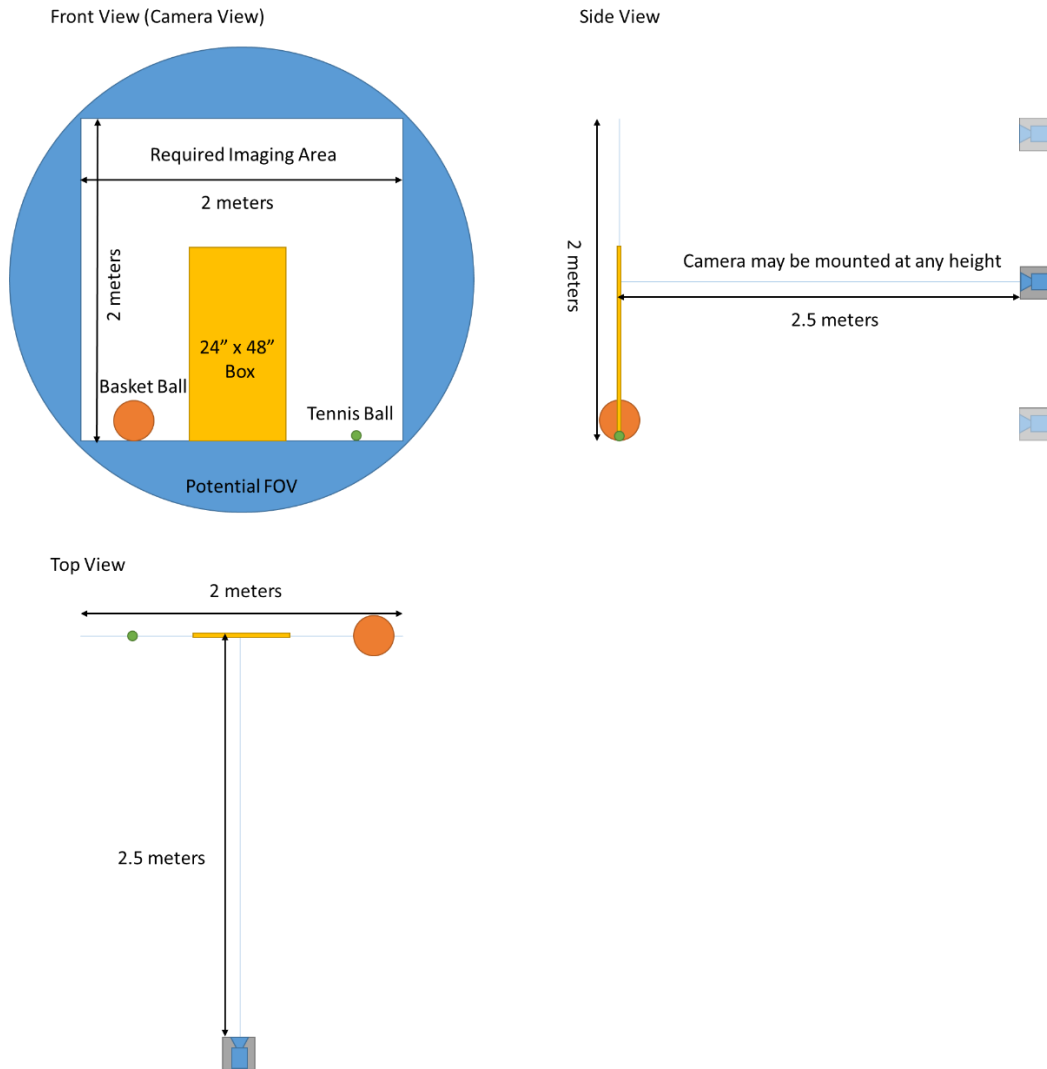
- **Products:**

The camera must take an image of a regulation size 7 basketball (9.4 to 9.55 inches in diameter) and an upright rectangular object (e.g. a wooden board) which is 24" by 48". A regulation size tennis ball must be in the imaging area (2.57 to 2.70 inches in diameter). Objects are to be aligned 2.5 meters from the camera imaging area (see graphic below).

Background can be any color users choice. Exact placement of the objects within the frame (side to side and height) are not critical, as long as objects are fully in the frame and in a plane 2.5 meters from the imager.

An image with a digital camera must be taken from the same vantage point as the mechanical camera. This image will be used to judge image accuracy.

## **REFERENCE IMAGE**



Neither YouTube nor any companies affiliated with it are a sponsor or otherwise an endorser of the Challenge

**5. CHALLENGE SUBMISSION AND WINNER SELECTION:** At the conclusion of the Challenge Period, and assuming a sufficient number of eligible entries are received, Sponsors or their designees will select a total of one (1) Finalist "Finalist" Submission and two (2) Semifinalist "Semifinalist" Submissions.

Judging criteria scoring divided into baseline and bonus points: The final score is calculated as follows:

**Final Score = (Baseline Score)\*(1.0 + Bonus Score)**

**Baseline Score = Points Per Objects Resolved/(Time to Take Image (in minutes)+10)**

- “Object Resolved” is defined as the contest judges being able to identify the object in the picture taken by the mechanical eye. The image taken with the mechanical camera will be compared with the digital camera image and objects must be in the same locations. For the object to be resolved, the object must also consume the following minimum number of pixels in the image.
  - 80 points are received for resolving the 24” by 48” box
    - Minimum of 6,000 pixels
  - 120 points are received for resolving the Basketball.
    - Minimum of 288 pixels
  - Tennis ball is not required to be resolved, but doing so will result in bonus points (see details below).
- **Time to take the Image:** the number of full minutes required to take the image and transmit it for reconstruction (but not necessarily the time to reconstruct the image).
- **Area Size Imaged:** More than a 2 meter by 2 meter area may be imaged, but this does not add any bonus.

**Bonus Score:**

Additional opportunities for points are available by accomplishing the following, with the Final score calculated as follows:

- **Bonus Score** = Detailed Image+ High Temperature + Wires Only + Color Image + Limited Information + Wireless Communication
- **Detailed Image:** You receive a bonus of 2.0 if your image can resolve the tennis ball, which has a minimum size of 20 pixels.
- **High Temperature:** You receive a bonus of 1.0 for high temperature if you can place your device in an oven on the “clean setting” (must be above 450 F) for two hours, and take the submitted image afterwards. You receive a bonus of 2.0 if you can place your device in an oven measured at 500C (likely a heat treat furnace) for two hours and take the submitted image afterwards.
- **Wires Only:** If you find a way of accomplishing the camera with only wires, a no other electrical components (i.e. no photo diodes, capacitors, etc.), you receive a bonus of 1.0.
- **Color Image:** You receive a bonus of 2.0 if your reconstructed image includes color, instead of grayscale.
- **Limited Information:** You receive a bonus of 1.0 if you only use two output devices. You receive a bonus of 2.0 if you only use one output device.

- **Wireless Communication:** You receive a bonus of 2.0 if you are able to wirelessly communicate image outputs.

In the event of a tie, tied entries will be re-judged in accordance with criteria listed above to determine the Finalist. The Finalist's and Semifinalists' Submissions will be posted on the Website. The Finalist (and Semifinalists) will be notified by telephone and/or e-mail using the contact information provided at the time of entry. Sponsors shall have no liability for any notification that is lost, intercepted or not received by the Finalist for any reason. If any potential Finalist or Semi-Finalist does not respond within the time required by Sponsors, or if the notification is returned as unclaimed or undeliverable to any potential Finalist or Semi-Finalists, such potential Finalist or Semi-Finalists will forfeit his or her prize and an alternate may be selected. If any potential Finalist or Semi-Finalists is found to be ineligible, or if he or she has not complied with these Official Rules or declines the prize for any reason, such potential Finalist or Semi-Finalists will be disqualified and the prize and/or status may be awarded to the next highest scoring Submission.

#### 6. PRIZES AND APPROXIMATE RETAIL VALUES:

The following prizes will be provided by Sponsors and awarded by Sponsors.

One (1) Finalist Prize: The Finalist Prize consists of a 2-day/1-night trip for winner related to a visit to the Jet Propulsion Laboratory and a demonstration of their design. The trip includes round-trip coach air transportation from gateway airport nearest the Finalist's home and hotel accommodations (1 room, single occupancy or 1 room, double occupancy in the case of a minor traveling with a parent/guardian). In lieu of the trip, the Finalist has the option shipping the hardware to JPL, which would procure it for \$1000. The hardware and related designs would become the property of JPL. See also section 8 for Grant of Rights. The Finalist will also receive a 3D-printed commemorative "Mechanical Maker Challenge coin." The approximate retail value ("ARV") of the Prize is \$1010. Maximum value of reimbursed travel is \$1,000. If a minor, the Finalist must travel with his or her parent or legal guardian or travel with the written permission of such parent or legal guardian in form and substance acceptable to Sponsors in their sole and absolute discretion. If accompanied, the Finalist and his or her travel

companion must travel together on the same itinerary and possess all required travel documents, including a valid photo ID, if and as applicable. Air transportation tickets are non-refundable/non-transferable and are not valid for upgrades and/or frequent flyer miles. All air transportation tickets are subject to the vagaries of flight variation, work stoppages and schedule or route changes. ARV for travel prizes may vary depending upon points of departure and destination and fare fluctuations. If the closest airport to a prize winner's home is in close enough proximity to prize destination city so that, as Sponsors may determine in their sole discretion, a flight is unnecessary, such prize winner will receive alternate transportation from the Sponsors with no further obligation to the winner. The Finalist will not receive cash or any other form of compensation if actual travel costs are less than the Grand Prize ARV in these Official Rules. Sponsors reserve the right to structure the travel route and select hotels in their sole discretion. In the event the Finalist (and, if a minor, his/her travel companion) engages in behavior that (as determined by Sponsors in their sole and absolute discretion) is obnoxious or threatening, illegal or that is intended to annoy, abuse, threaten or harass any other person, Sponsors reserve the right to terminate the trip or other applicable experience early, in whole or in part, and send the Finalist (and, in the case of a minor, his or her travel companion) home with no further compensation.

If the Finalist is unable to participate in the Prize trip during the dates set forth by Sponsors, the Prize will be forfeited in its entirety. In the event that the Prize trip does not or cannot take place as scheduled or at all, for reasons including, but not limited to, scheduling conflicts, cancellations, postponement, an event of force majeure, or for any other reason, then the Finalist will receive One Hundred Dollars (\$100), and such amount plus the remaining components, if any, of the Prize shall constitute full satisfaction of Sponsors prize obligation to the Prize Winner, and no other or additional compensation will be awarded. Excepting the preceding sentence, no cash alternative or prize substitutions will be allowed, except Sponsors reserve the right to substitute prize(s) of comparable value if a prize listed is unavailable for any reason.



One (1) Finalist Prize is available. Each Finalist Prize is valued at \$1010. Two (e) Semi-Finalist Prizes are available: Each Semi-Finalist Prize consists of a 3D-printed commemorative “Mechanical Maker Challenge coin” valued at \$10.00.

7. GENERAL RULES: Void where prohibited by law. All federal, state and local laws and regulations apply. Winners may make no substitution or transfer of prize. All federal, state and local taxes are the sole responsibility of winner. Not responsible for lost, late, misdirected, mutilated, incomplete or illegible entries.

The potential Prize Winner, must sign an Affidavit of Eligibility certifying that the Submission is the entrant's original work, that the entrant owns the right to the work, that the Submission has not previously won a prize in a national challenge nor has been previously published in a national publication, and that the entrant has followed the Official Rules of the challenge, along with an Affidavit/Release/Prize Acceptance Form, and their travel companion must sign a Travel Companion Liability/Publicity Release. (collectively, the "Prize Claim Documents"). At the Prize Provider's option, the applicable prize will either be awarded in the name of the parent or legal guardian of such winner or potential winner, or the parent or legal guardian of such potential winner will be required to ratify and sign the Prize Claim Documents. If a Prize winner or such winner's parent or legal guardian fails or refuses to sign and return all Prize Claim Documents within seven (7) days of prize notification (or a shorter time if required by exigencies), the Prize winner may be disqualified and an alternate winner may be selected. The Prize winner's travel companion(s) must execute a Travel Companion Liability/Publicity Release prior to ticketing. At the Prize Provider's sole discretion, the Finalist and Semi-Finalists and Finalists may also be required to sign Prize Claim Documents.

The Sponsor is not responsible if the ability to travel and visit the Jet Propulsion Laboratory is cancelled or delayed for any reason. NASA and JPL-Caltech are not responsible if prize provision is cancelled or delayed for any reason.

8. GRANT OF RIGHTS: Any information, know-how, data, results, and inventions, and associated intellectual property, that is made, discovered, created, invented or generated by the Entrant or its Affiliate in any activities or work under this Agreement shall be freely available to the Sponsor for future use without any limitations to the Sponsor, and without requiring any form of license. Each entrant who enters into the Challenge hereby irrevocably grants, transfers, sells, assigns and conveys to the Sponsors, their successors and assigns, all present and future right, title and interest of every kind and nature whatsoever, including, without limitation, all copyrights, and all rights incidental, subsidiary, ancillary or allied thereto (including, without limitation, all derivative rights) in and to the Submission for exploitation throughout the universe, in perpetuity, by means of any and all media and devices whether now known or hereafter devised. Sponsors shall have the right, in their sole discretion, to edit, composite, morph, scan, duplicate, or alter the Submission for any purpose which Sponsors and/ deem necessary or desirable, and each entrant irrevocably waives any and all so-called moral rights they may have therein. Each entrant hereby acknowledges that such entrant does not reserve any rights in or to the Submission.

9. PUBLICITY RELEASE: By participating in the Challenge, in addition to any other grants which may be granted in any other agreement entered into between Sponsors, and the Finalist and Semifinalists of the Challenge, each Finalist and Semi-finalist irrevocably grants the Promotion Entities and their respective successors, assigns and licensees, the right to use such entrant's Submission (with the exception of personally identified data identified in the Privacy Policy), in any and all media for any purpose, including without limitation, advertising and promotional purposes as well as in, on or in connection with the Submission, the Website, the Challenge or other promotions, and hereby releases the Promotion Entities, and their respective successors, assigns and licensees from any liability with respect thereto.

10. GENERAL LIABILITY RELEASE/FORCE MAJEURE: Entrants (and, in the case of minors, their parents or legal guardians) agree that the Sponsors (a) shall not be responsible or liable for any losses, damages or injuries of any kind resulting from

participation in the Challenge or any Challenge-related activity, or from entrants' acceptance, receipt, possession and/or use or misuse of the prize(s), and (b) have not made any warranty, representation or guarantee express or implied, in fact or in law, with respect to the prize(s), including, without limitation, to such prize's quality or fitness for a particular purpose.

Sponsors assume no responsibility for any damage to an entrant's computer system that is occasioned by accessing the Website or participating in the Challenge, or for any computer system, phone line, hardware, software or program malfunctions, or other errors, failures, delayed computer transmissions or network connections that are human or technical in nature caused by circumstances beyond its reasonable control. Without limiting the generality of the foregoing, Sponsors are not responsible for incomplete, illegible, misdirected, misprinted, late, lost, damaged, or stolen Submissions, Submission or prize notifications; or, for lost, interrupted, inaccessible or unavailable networks, servers, satellites, Internet Service Providers, websites, or other connections; or for miscommunications, failed, jumbled, scrambled, delayed, or misdirected computer, telephone or cable transmissions; or for any technical malfunctions, failures, difficulties or other errors of any kind or nature; or for the incorrect or inaccurate capture of information, or the failure to capture any information. Sponsors reserve the right in their sole discretion to disqualify any individual who is found to be tampering with the entry process or the operation of the Challenge or the Website, to be acting in violation of these Official Rules, or to be acting in an unsportsman-like or disruptive manner, or with the intent to disrupt or undermine the legitimate operation of the Challenge, or to annoy, abuse, threaten or harass any other person, and Sponsors reserve the right to seek damages and other remedies from any such person to the fullest extent permitted by law. In the event an insufficient number of eligible Submissions are received or Sponsors are prevented from awarding prize(s) or continuing with the Challenge as contemplated herein by any event beyond its control, including but not limited to fire, flood, natural or man-made epidemic, earthquake, explosion, labor dispute or strike, act of God or public enemy, satellite or equipment failure, riot or civil disturbance, terrorist threat or activity, war (declared or undeclared)

or any federal, state, provincial or local government law, order, or regulation, public health crisis (e.g. SARS), order of any court or jurisdiction, or other cause not reasonably within Sponsors' control (each a "Force Majeure" event or occurrence), Sponsors shall have the right to modify, suspend, extend or terminate the Challenge. If the Challenge is terminated for Force Majeure before the designated end date, Sponsors may (if possible) select the winners from all eligible, non-suspect submissions received as of the date of the event giving rise to the termination. These Official Rules cannot be modified or amended in any way except in a written document issued in accordance with the law by a duly authorized representative of Sponsors. The invalidity or unenforceability of any provision of these rules shall not affect the validity or enforceability of any other provision. In the event that any provision is determined to be invalid or otherwise unenforceable or illegal, these rules shall otherwise remain in effect and shall be construed in accordance with their terms as if the invalid or illegal provision were not contained herein.

#### 11. DATES & DEADLINES/ANTICIPATED NUMBER OF

ENTRANTS: Because of the unique nature and scope of the Challenge, Sponsors reserve the right, in addition to those other rights reserved herein, to modify any date(s) or deadline(s) set forth in these Official Rules or otherwise governing the Challenge.

Sponsors make no representation or prediction with respect to the number of entrants.

12. FURTHER DOCUMENTATION: If Sponsors shall desire to secure additional assignments, certificates of engagement for the Submission or other documents as Sponsors may reasonably require in the effect of the purposes and intents of these Official Rules, then each entrant agrees to sign the same upon Sponsors' request.

13. PRIVACY POLICY: All Submissions will be subject to the "Mechanical Eye" privacy policy, available on the Website.

14. GOVERNING LAW: All issues and questions concerning the construction, validity, interpretation and enforceability of these Official Rules or the rights and obligations as between entrant and the Promotion Entities in connection with the Challenge shall be governed by and construed in accordance with the internal laws of the United States and the State of California without giving effect to any choice of law or conflict of law

rules or provisions that would cause the application of any other state's, province's, country's or jurisdiction's laws.

15. WINNERS LIST/OFFICIAL RULES: To obtain a copy of any legally required winners list, send a self-addressed stamped envelope to: ATTN: Jonathan, Sauder "Mechanical Eye Challenge"; Jet Propulsion Laboratory MS 299-101; 4800 Oak Grove Drive, Pasadena, CA 91109-8099. All such requests must be received by four (4) weeks after the end of the Challenge Period. The winners' names will also be posted on <http://....> after Month 00, 2018. These Official Rules will be posted on the Website.