

Team America Rocketry Challenge

2013 Event Rules

July 20, 2012



1. **SAFETY:** All rockets must be built and flown in accordance with the Model Rocket Safety Code of the National Association of Rocketry (NAR), any applicable local fire regulations, and Federal Aviation Regulations. Rockets flown at the fly-off must have previously flown successfully. They will be inspected before launch and observed during flight by an event official, whose judgment on their compliance with the Safety Code and with these rules will be final. Teams are encouraged to consult with designated NAR officials who are running this event well before the fly-off to resolve any questions about design, the Safety Code, or these rules.
2. **TEAMS:** No more than five teams may be entered by any sponsoring organization. The application for a team must come from a single school or a single U.S. incorporated non-profit youth or educational organization (excluding the National Association of Rocketry, Tripoli Rocketry Association, or any other rocket club or organization). Team members must be students who are currently enrolled in grades 7 through 12 in a U.S. school or homeschool. Teams may have members from other schools or other organizations and may obtain financing from any source, not limited to their sponsoring organization. Teams must be supervised by an adult approved by the principal of the sponsoring school, or by an officially-appointed adult leader of their sponsoring organization. Minimum team size is three students and maximum is ten students. Each student member must make a significant contribution to the designing, building, and/or launching of the team's entry. No part of any of these may be done by any adult, by a company (except by the sale of standard off-the-shelf components available to the general public, but not kits or designs for the event), or by any person not a student on that team. No student may be on more than one team. The supervising teacher/adult may supervise more than one team. The Challenge is open to the first 1000 teams that submit a completed application, including payment, postmarked between September 4 and November 30, 2012.
3. **ROCKET REQUIREMENTS:** Rockets may be any size, but must not exceed 650 grams (23 ounces) gross weight at liftoff (Note: California state law has limitations on model rockets over 500 grams in that state). They may not be commercially-made kits designed to carry egg payloads with the only modification being the addition of an altimeter compartment. They must have only one stage. They must be powered only by commercially-made model rocket motors of "F" or lower power class that are listed on the TARC Certified Engine List posted on the TARC website and provided in the TARC Handbook. Any number of motors may be used, but the motors used must not contain a combined total of more than 80 Newton-seconds of total impulse based on the total impulse ratings in the TARC list. Rockets must not contain any pyrotechnic charges except those provided as part of the basic commercially-made rocket motor used for the flight, and these must be used in the manner prescribed in the instructions for that motor. The portion of the rocket containing the egg and altimeter must return to the ground using only one parachute of 15 inches (38 centimeters) diameter as its sole deployed recovery system. Every part of the outer edge of the canopy of this parachute must lie outside a circle of 14 inches diameter and inside a circle of 16 inches diameter. This canopy

measurement will be done with the parachute laid flat, or if the parachute is a shape that will not lay flat, then with discs that are compared to the base of the inflated canopy. The rest of the rocket may be attached to the portion of the rocket containing the egg, altimeter, and this parachute, or may return separately with a different recovery device of any size as long as it does so safely.

4. **PAYLOAD:** Rockets must contain and completely enclose one raw hen's egg of 57 to 63 grams weight and a length of 60 millimeters or less, and must return this from the flight without any cracks or other external damage. This egg must be placed in the rocket "on its back" with its long axis perpendicular to the rocket's intended direction of flight. The external diameter of the rocket at the point where the egg is placed must be no less than 60 millimeters. The egg will be issued to the teams by event officials during finals, but teams must provide their own egg for their qualifying flights. Rockets must be allowed to land at the end of flight without human intervention (catching) and will be disqualified if there is such intervention. The egg and altimeter must be removed from the rocket at the end of the flight in the presence of a designated NAR official observer and presented to that official, who will inspect the egg for damage and will read the altimeter score. All coatings, padding, or other materials used to protect the egg must be removed by the team prior to this inspection. Any external damage to the egg noted after flight is disqualifying.
5. **DURATION SCORING:** Scores shall be based on total flight duration of the portion of the rocket containing the egg and altimeter, measured from first motion at liftoff from the launch pad until the moment of landing or until the rocket can no longer be seen due to distance or to an obstacle. Times must be measured independently by two people not on the team, one of whom is the official NAR-member adult observer, using separate electronic stopwatches that are accurate to 0.01 seconds. The official duration will be the average of the two times, rounded to the nearest 0.01 second. If one stopwatch malfunctions, the remaining single time will be used. The flight duration goal is a range of 48 to 50 seconds. Flights with duration in the range of 48 to 50 seconds get a perfect duration score of zero. Duration scores for flights with duration below 48 seconds will be computed by taking the absolute difference between 48 seconds and the measured average flight duration to the nearest 1/100 second and multiplying this by 4. Duration scores for flights with durations above 50 seconds will be computed by taking the absolute difference between 50 seconds and the measured average flight duration to the nearest 1/100 second and multiplying this by 4. These duration scores are always a positive number or zero.
6. **ALTITUDE SCORING:** Rockets must contain one and only one electronic altimeter of the specific commercial types approved for use in the Team America event. These types are the Perfectflite APRA, or Pnut. The altimeter must be inspected by an NAR official both before and after the flight, and may not be modified in any manner. The altimeter must be confirmed by this official to not have been triggered and reading an altitude before flight. The altitude of the portion of the rocket containing the egg, as recorded by this altimeter, will be the sole basis for judging the altitude score and this altimeter may be used for no other purpose. The altitude score will be the absolute difference in feet between the 750 feet (229 meters) target altitude and the altimeter-reported actual flight altitude in feet (always a positive number or zero).

7. **FLIGHTS:** Team members cannot be changed after the first qualification flight. Only team members on record at Aerospace Industries Association (AIA) with valid parent consent forms are eligible to receive prizes. Only one flight is allowed per team at the final fly-off, except as specifically noted in these rules. In order to be eligible for the fly-off, a team is required to fly a qualifying flight observed in person by an adult (senior) member of the NAR (unrelated to any team members and not a paid employee of their school or member of their youth group) between September 4, 2012 and Sunday March 24, 2013. Each team may conduct a maximum of three qualification flights, and will be ranked based on the best of these three scores. No more than two of these qualification flights can be conducted after February 15, 2013. More than one qualification flight is not required if the team is satisfied with the results of their first flight. A qualification flight attempt must be declared to the NAR observer before the rocket's motor(s) are ignited. Once an attempt is declared, the results of that flight must be recorded and submitted to the AIA, even if the flight is unsuccessful. A rocket that departs the launch pad under rocket power is considered to have made a flight, even if all motors do not ignite. If a rocket experiences a rare "catastrophic" malfunction of a rocket motor (as determined by the NAR official observer), a replacement flight may be made, with a replacement vehicle if necessary. Flights which are otherwise fully safe and qualified but which result in no altimeter reading despite correct usage of the altimeter by the team, or that result in a reading of greater than zero but less than 50 feet despite a nominal flight will be counted as "no flight" and may be reflown without penalty. The results from qualification flight attempts must be faxed to and received at the offices of the AIA by 11:59 PM EST on Monday, March 25, 2013. Based on these qualification scores 100 teams will be selected on the basis of lowest scores, will be notified no later than 5 PM on Friday March 29, 2013, and will be invited to participate in the final fly-off to be held on May 11, 2013 (alternate date in case of inclement weather will be May 12, 2013).
8. **SAFE RECOVERY:** Each part of the rocket must either contain a recovery device or be designed to glide, tumble unstably, or otherwise return to earth at a velocity that presents no hazard. Any entry which has a major part (including but not limited to an expended engine casing) land without a recovery system (lightweight gliding/tumbling tube sections are considered to have a system), or at a velocity that is judged by an event official to be hazardous, due to recovery system absence, insufficiency, or malfunction, will be disqualified.
9. **RETURNS:** Return of the portion of the flight vehicle containing the egg and the altimeter is required by the deadline time established at the beginning of the day's flying. Entries whose egg and altimeter are not returned after flight may not be counted as a qualified flight. If this portion cannot be returned after an otherwise safe and stable flight because it landed in a spot from which recovery would be hazardous (as determined by an NAR official), a replacement vehicle may be substituted for a replacement flight. Return of the other portions of the rocket is required only if there is a question from the NAR official concerning the safe operation of the vehicle (e.g. a question as to whether the vehicle ejected a part that landed in an unsafe manner). An entry which has any such portion that is not returned when required shall be disqualified.

10. **LAUNCH SYSTEMS:** Teams may use the electrical launch system and the launch pads (with six-foot long, 1-inch rails or 1/4-inch diameter rods) provided by the event officials at the fly-off, or may provide their own system. Systems provided by teams for their own use must be inspected for safety by an NAR official before use, and must provide at least 6 feet of rigid guidance, including use of a rod diameter of at least 1/4 inch, if a rod is used. All launches will be controlled by the event Range Safety Officer and must occur from the ground.
11. **FLIGHT CONTROL:** Rockets may not use an externally-generated signal such as radio or computer control (except GPS navigation satellite signals) for any purpose after liftoff. They may use autonomous onboard control systems to control any aspect of flight as long as these do not involve the use of pyrotechnic charges. Any onboard flight-control electronics must use only commercially-made altitude and/or timing devices that are available to all TARC participants.
12. **PLACES:** Places in the final fly-off of the competition will be determined on the basis of the sum of the altitude and duration scores above. At the fly-offs, 24 teams will be invited to make a second flight at the last flight round of the day based on the results of their first flights. Prizes which are awarded to the top places will be awarded only to those teams that make a second flight. In this final round, rockets which have issues which would otherwise rate a replacement flight under TARC rules #7 or #9 will not receive a replacement flight. The top twenty final places will be ranked on the basis of the scores from the two qualified flights made at the fly-offs. Places twenty-one up to one hundred will be awarded to the remaining teams based on the scores from their first flight. Ties will result in pooling and even splitting of the prizes for the affected place(s) -- for example, a two-way tie for 4th place would result in a merger and even division of the prizes for 4th and 5th places. If there is a tie for one of the top three places, the teams involved in the tie will be required to make a third flight to determine final places. Aerospace Industries Association reserves the right to make all last and final contest determinations.