

2017 Showcase Showdown

Rocket Launch

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Wyoming 4-H Team Rocketry Contest

PURPOSE. The team rocketry challenge is modeled after the Team America Rocketry Challenge (TARC) 2017. All information referencing to TARC lists or handbooks, may be found on the TARC website at:

<http://www.rocketcontest.org>

ENTRIES. Any Wyoming 4-H member currently enrolled in the Aerospace project may enter. Each team entered into the challenge will be required to give a 1-3 minute oral presentation/demonstration on the construction of their rocket.

1. **SAFETY.** All rockets must be built and flown in accordance with the Model Rocket Safety Code of the National Association of Rocketry, any applicable local fire regulations, and Federal Aviation Regulations. Rockets flown at this event must have been previously flown successfully by the teams. 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 event officials who are running this event well before the fly-off to resolve any questions about design or flight safety, about the Safety Code, or about these rules.

2. **TEAMS.** Each county may enter as many teams as desired. Teams may be comprised of a minimum of three and maximum of five currently enrolled 4-H members. Teams may be made up of individuals in different 4-H age groups. Teams must be supervised by an enrolled Wyoming Volunteer 4-H leader and/or Extension 4-H educator. Each team 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 solely 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 member on that team.

3. ROCKET REQUIREMENTS.

Rockets must not exceed 650 grams gross weight at liftoff. They must use body tubes of two different diameters for their exterior structure. The smaller-diameter of the two must be used for the lower (motor and fin) end of the rocket and must not be greater than 42 millimeters (1.65 inches, corresponding to body tubes generally called BT-60) in diameter, and the larger one must be large enough to contain the egg (which may be up to 45 millimeters) plus padding and altimeter. Each tube must have no less than 150 millimeters (5.91 inches) of exposed length, and the overall length of the rocket must be no less than 650 millimeters (25.6 inches) as measured from the lowest to the highest points of the airframe structure in launch configuration. Rockets 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 only in the manner prescribed in the instructions for that motor. The rocket must separate into at least two pieces for recovery, with one piece containing the egg payload and the altimeter and not the expended rocket motor. This piece must be recovered by a single parachute and must not be connected in any manner to the other piece or pieces of the rocket during recovery. The rest of the rocket may use any safe means of recovery. All rockets flown at the Finals must have a surface finish with a different color or colors than

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the basic construction materials of the rocket which has been applied over all or most of the outer surface of the rocket's nose, body, and fins by means such as paint, ink, adhesive wraps, etc.

4. PAYLOAD.

Rockets must contain and completely enclose one raw hen's egg of 55 to 61 grams weight and a diameter of 45 millimeters or less; and must return it from the flight without any cracks or other external damage. The egg will be issued to the teams by event officials during the finals, but teams must provide their own egg for their qualifying flights. The egg and altimeter must be removed from the rocket at the end of the flight in the presence of a designated official and presented to that official, who will inspect the egg for damage after their removal 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 its flight and removal from the rocket by the team is disqualifying.

5. DURATION SCORING.

The duration score for each flight 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 that the first part of that portion of the rocket touches the ground (or a tree) or until it 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, with .005 seconds being rounded up to the next highest 0.01 seconds. If one stopwatch malfunctions, the remaining single time will be used. The flight duration goal is a range of 41 to 43 seconds. Flights with duration in the range of 41 to 43 seconds get a perfect duration score of zero. Duration scores for flights with duration below 41 seconds will be computed by taking the absolute difference between 41 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 43 seconds will be computed by taking the absolute difference between 43 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. For those teams at the Finals that are invited to make a second flight based on their first-flight performance, the target duration for the second flight at that event will be 42 to 44 seconds and scoring for flights with durations above or below this range will be aligned to match the procedures for the 41-43 second range.

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 Perfectlite APRA, Pnut, or Firefly. 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 before flight to not have been triggered and to be ready for flight. The peak altitude of the rocket as recorded by this altimeter and sounded or flashed out on its audible or visible light transmission post-flight will be the sole basis for judging the altitude score and this altimeter may be used for no other purpose. Other altimeters of other types may be used for flight control or other purposes. The altitude score for every qualification flight and for the first flight at the Finals will be the absolute difference in feet between the 775 feet (236 meters) target altitude and the altimeter-reported actual flight altitude in feet (always a positive number or zero). For those teams at the Finals that are invited to make a second flight based on their first-flight performance, the target altitude for the second flight at that event will be 800 feet (244 meters).

7. **FLIGHTS.** Only one flight is allowed per team at the fly-off, except as specifically noted in these rules. In order to be eligible for the fly-off, the team leader (adult volunteer) must confirm that the rocket has been flown safely at

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least once previously by signature on team entry form. 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 event 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 an altimeter reading of greater than zero but less than 50 feet will be counted as "no flight" due to false triggering of the altimeter and may be re-flown without penalty.

8. SAFE RECOVERY.

Return of the portion of the rocket containing the egg and altimeter is required by the deadline time on that same day that was established at the beginning of the day's flying. If the rocket cannot be returned after an otherwise safe and stable flight because it cannot be located or because it landed in a spot from which recovery would be hazardous (as determined by an official), a replacement vehicle may be substituted for a replacement flight. Once the official has declared that a rocket has landed in a place from which recovery would be hazardous, the results from that rocket's flight may not subsequently be used even if it is recovered.

9. RETURNS.

Return of the portion of the rocket containing the egg and altimeter is required by the deadline time on that same day that was established at the beginning of the day's flying. If the rocket cannot be returned after an otherwise safe and stable flight because it cannot be located or because it landed in a spot from which recovery would be hazardous (as determined by an official), a replacement vehicle may be substituted for a replacement flight. Once the official has declared that a rocket has landed in a place from which recovery would be hazardous, the results from that rocket's flight may not subsequently be used even if it is recovered.

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 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.

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.

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Wyoming 4-H Individual Open Rocketry Demonstration

ENTRIES. Any Wyoming 4-H member currently enrolled in the aerospace project may enter. Each individual entered into the open demonstration will be required to give a 2-5 minute oral presentation/demonstration on their rocketry project.

1. **SAFETY.** All rockets must be built and flown in accordance with the Model Rocket Safety Code of the National Association of Rocketry, any applicable local fire regulations, and Federal Aviation Regulations. Rockets flown at this event must have been previously flown successfully by the individual. 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. Individuals are encouraged to consult with designated event officials who are running this event well before the fly-off to resolve any questions about design or flight safety, about the Safety Code, or about these rules.

2. **ROCKET REQUIREMENTS.** This is intended to be an event where contestants can demonstrate their individual rocketry skills, but has no specific objective (ie. height, payload or other requirements). Individuals in the junior and intermediate age categories may fly commercially prepared rockets or rockets constructed from commercially available kits. Individuals in the senior division will be required to fly rockets constructed solely by the individual from components commercially available and may not fly retail purchased rockets. Loose black powder, separate from the certified rocket motors and their as-designed ejection charges, may not be used in rockets as its use requires a federal license not available to minors.

3. **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) landing 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.

4. **LAUNCH SYSTEMS.** Teams may use the electrical launch system and the launch pads (with six-foot long, 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 event 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.

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5. **FREE FLIGHT.** Rockets may not use an externally-generated signal such as radio or computer control (except GPS navigation satellite signals) for any purpose, including flight termination, after liftoff. They may use autonomous onboard control systems to control any aspect of flight.

6. **AWARDS.** There will be awards given to each age group for most innovative (design is challenging and requires problem solving beyond just assembling a rocket kit) and best presentation.