

## UKRoC Rules 2019

- 1. SAFETY:** All rockets must be built and flown in accordance with the UKRoC Best Practices document. Rockets flown at the National Finals must have previously flown safely and successfully. Rockets will be inspected before launch and observed during flight by a UKRoC official, whose judgment about the safety of the flight and with these rules will be final. Teams are encouraged to consult with designated UKRoC officials well before the fly-off to resolve any questions about design, safety, or these rules.
- 2. TEAMS:** The application for a team must come from a single school or a single non-profit youth or educational organization. There is no limit to the number of teams that may be entered from any single school or organization, but no more than three teams containing students who attend the same school or who are members of the same organization, regardless of whether the teams are sponsored by that school or organization, can be invited to attend the National Finals. Team members must be students who are aged 11 to 18. 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 head 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 activities for a rocket used in a qualification flight or at the Finals 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.
- 3. ROCKET REQUIREMENTS:** Rockets must not exceed 650 grams gross weight at lift off. The egg payload portion of the rocket tube must be large enough to contain an egg of up to 45 millimetres in diameter. The overall length of the rocket must be no less than 650 millimetres as measured from the lowest to the highest points of the airframe structure in launch configuration. The portion of the rocket containing the egg payload and the altimeter must separate from the rest of the rocket in the air and must descend separately under at least two parachutes that are the same shape and are within 50 millimetres (2.0 inches) of the same diameter. The rest of the rocket must recover safely under any deployed recovery system. 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 UKRoC Approved Motor List posted on the UKRoC website. 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 UKRoC list. Motors must be retained in the rocket during flight and at ejection by a positive mechanical means (clip, hook, screw-on cap, etc.) and not retained simply by friction fit in the motor mounting tube. 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.

4. **PAYLOAD:** Rockets must contain and completely enclose one raw hen's egg of 55 to 61 grams weight and a diameter of 45 millimetres or less; and must return them from the flight without any cracks or other external damage. The egg will be issued to the teams by event officials, but teams must provide their own eggs for their qualifying flights. The egg and altimeter must be removed from the rocket at the end of a qualification or finals flight in the presence of a designated UKRoC official and presented to that official, who will inspect the egg for damage after 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 and in the presence of a designated UKRoC official. Any external damage to the egg noted after the 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, measured from first motion at lift off from the launch pad until the moment that the first part 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 UKRoC approved observers 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 43 to 46 seconds. Flights with duration in the range of 43 to 46 seconds get a perfect duration score of zero. Duration scores for flights with duration below 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. Duration scores for flights with durations above 46 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 National 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 1 second less or 1 second more (determined by a coin toss at the student team pre-flight briefing at the Finals) and scoring for flights with durations above or below this revised range will be aligned to match the procedures for the 43-46 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 Perfectflite APRA, Pnut, or Firefly. The altimeter must be inspected by officials 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 performance goal is 856 feet. The altitude score for every qualification flight and for the first flight at the National Finals will be the absolute difference in feet between the 856 feet (261 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, with one exception as noted below for the National Final. Only team members on record with valid parent consent forms are eligible to receive prizes. A team may make a maximum of three qualification flights, and will be ranked based on the sum of the best two qualified flights. More than two qualification flights are not required if the team is satisfied with the results of their first two flights. A qualification flight attempt must be declared to the UKRoC 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 ADS, 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 UKRoC 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 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 or scanned and e-mailed to and received at the offices of ADS by the closing date for submissions detailed on the UKRoC website.

Based on the scores from qualification flight attempts the organizers will select 20 teams (with a limit of no more than the best three made up of students from any single school or organization) for the UK National Final. Teams will be selected on the basis of lowest combined scores for their best two flights. If a school has more than three teams whose flight score is better than the cut-off score for UK National Finals selection, they may adjust the membership of the three best teams invited to attend the UK National Finals to include students from other teams with scores that met the UK National Finals cut-off, up to a limit of ten students on any single team. Teams will be notified by ADS of these results and will be invited to participate in the UK National Final to be held the week of 6 May 2019, subject to weather and other considerations.

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 official observer), a replacement flight may be made, with a replacement vehicle if necessary.

8. **SAFE RECOVERY:** Every portion of the rocket must return to earth safely, and at a velocity that presents no hazard. An entry which has any structural part or an expended engine casing separate from the rest and fall to earth will be disqualified. The rocket must be recovered intact and allowed to land at the end of flight without human intervention (catching) and the flight will be disqualified if there is such intervention.
9. **RETURNS:** Return of the entire rocket 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 a UKRoC official), a replacement vehicle may be substituted for

a replacement flight without penalty. Once the UKRoC 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 at least four feet six inch long, ¼ inch rods) provided by the event officials or may provide their own rail or tower system as long as it provides at least four feet six inches of rigid guidance. All launches will be controlled by the event Range Safety Officer.
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 lift off. They may use autonomous on board control systems to control any aspect of flight as long as these do not involve the use of pyrotechnic charges. Any on board flight-control electronics must use only commercially-made altitude and/or timing devices that are available to all participants.
12. **QUALIFICATION PROCESS:** Qualifying at a regional event will be an option across the UK, regional events will be delivered based on demand in all regions. Teams will be entitled to complete test and qualification flights during the one-day regional events, the number of test and / or qualification flights are not limited but will be dictated by the time available to teams on the day.

Self-Qualification can be conducted by any team to allow them to complete a UKRoC qualification flight. In order to self-qualify, qualification flights must take place at a rocketry club or other UKRoC approved event within the UK. The organisers of these events will be responsible for rocketry safety.

An independent and experienced rocketeer must witness the qualification flights and must be the individual who times the flight duration and records the reading from the altimeter. The scores of the self-qualification will then need to be sent to ADS ahead of the self-qualification deadline (advertised on the ADS website) to allow the qualification flight to be eligible.

13. **PLACES:** Places in the UK National Final will be determined on the basis of the sum of the altitude and duration scores. Each regional winner will be awarded a place at the National Final. At the UK National Final, the top 3 teams will be invited to make a second flight based on the results of their first flights. In these second flights, rockets that have issues which would otherwise rate a replacement flight will not receive a replacement flight. Prizes awarded to the top places will be awarded only to those teams that make a second flight.

The top final places will be ranked on the basis of the scores from the two qualified flights made at the UK National Final. Remaining places will be awarded based on the scores from the 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. ADS reserves the right to make all last and final contest determinations.

**14: ADVERSE WEATHER CONTINGENCY AT THE NATIONAL FINALS:** in the event of adverse weather each team at the National Finals must give a presentation of 10 minutes and compile a Log book to underpin their presentations. The presentation will be used to determine winners and placings if flights cannot be made and in those circumstances scores from the Regional events will be taken into account and amount to 60% of the final score. An example of a log and other information will be made available on the 2019 UKRoC website. The team will be marked for content of the presentation and scoring will be;

**0-4 points** for participation of team members in the presentation; maximum score of 4 points will be awarded if each team member actively participates in presentation and answering questions; teams are encouraged to have all members participate at the same level during the presentation

**0-10 points** for design; maximum of 10 points will be awarded if the team explains one or more design features unique to their rocket and can confidently answer questions from the judges about the design. The number of design features explained is not a judging criterion (i.e., the judges will not score higher for teams solely based on presenting multiple design features).

**0-6 points** for lessons learned; a maximum of 6 points will be awarded if the team explains one or more lessons learned about their rocketry challenge experience and can confidently answer questions from the judges.

Each judge will ask at least one question to the team.

**Note, International Final:** the winning UK team at the National Finals will be eligible to go to the International Final in Paris on Friday 21 June 2019, and will involve modifying or building a new model using a single motor and with the capacity to house three eggs. Advice will be given to the winning team by UKRoC officials after the National Finals.

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Questions and enquiries can be made to [ukroc@adsgroup.org.uk](mailto:ukroc@adsgroup.org.uk).