

RULES and INFORMATION



NPL Water Rocket Challenge 2024

Date: Wednesday 26 June 2024

Venue: Bushy Park Sports Club Field, TW11 0EL (**what3words: shed.farm.energetic**)

The Challenge

The aim is to launch a rocket powered by water/air pressure and land it in designated target zones, whilst trying to earn additional bonus points by time of flight. Your score will be your time in the air plus bonus seconds gained from landing in target zones. People have tried using parachutes to achieve long flight times and whilst

	Equipment check from	Launch starts	Round duration	Awards	End
Schools Only	10:00	12:00	30 mins	14:30	15:00
Open competition*	17:00	18:30	23 mins	20:15	20:30

there will be a prize for the longest time in the air; these rockets tend to get caught by the wind and land outside the scoring zone resulting in a null score.

*Open for families, friends, colleges, universities, apprentices, youth clubs, NPL staff or anyone wishing to enter.

Registration will be online at www.npl.co.uk/wrc

- Teams are limited to 6 people; an adult **must** accompany and is responsible for each team, **no under 6's allowed in teams and launch bays.**
- Space permitting, more than one team may be allowed per school, though with the high demand for places, schools often run an internal selection competition.
- Eggstra-challenge: fire and land your rocket with an egg payload (provided by NPL) intact within the 3rd round.

Entry Fees: £35 per team payable on registration with proceeds going to local Scouts groups.

Awards: First, second & third awards will be awarded with no age categories. Several additional awards will be awarded for things like: Best Engineered Launcher, Most Interesting Rocket, Best Team Uniform, Best Team Banner (to be no more than 2 m wide), Best Engineering, etc.

Refreshments: For the afternoon event food and drinks are not provided, so bring your own packed lunches as there are no nearby shops.

Water rockets are fun and easy to make.

For construction details, examples of launchers, photographs, scores and videos from previous years, and more information check out our web site: www.npl.co.uk/wrc

Weather?

Unpredictability of weather means launch decisions may be left until the launch hour! If you arrive and strong winds, heavy rain or lightning impede launching, we have storm shelter.

Who may attend?

For child protection reasons no parent spectators other than team helpers are permitted in the afternoon. Spectators are welcome at the evening open competition (£2 entry fee for adults) and all money raised goes towards our chosen charity – local Scouts groups. **Site rules mean dogs are not permitted onto the location.**

Clothing

We welcome team themed dress and recommend weather appropriate attire.



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Rules are to keep everyone safe, but not prevent innovative and imaginative solutions.

Changes to previous year are marked in red.

The Challenge

Your mission is to launch and land your rocket 70 m from the firing line (competing against other teams), three times. Afternoon rounds last 30 minutes, in the evening they are 23 minute each (with about 12 minutes between rounds). If you cannot launch within the time allocated for a round, your score for that round will be zero. Your team must operate within the following constraints:

Your Equipment

- Competitors bring their own rockets, launchers and team. NPL provides no equipment! Teams often bring many rockets of identical (or differing) design to enable range-finding, though note that the first rocket launched in each round is the scoring one!
- All energy given to the rocket must only come from the water/air pressure combination. No other source of energy is allowed. You can only compress air manually, with a foot or bicycle pump.
- No external metal parts are allowed on the rocket but are allowed on the launch mechanism.
- You are only allowed to use plastic bottles specifically designed for holding pressure, or that have been pressure tested (for example carbonated drink bottles). Please do not re-use bottles from previous competitions as they are likely to explode.
- Your launch apparatus must be secure and must be able to robustly control the rocket's flight direction.
- No glass or sharp objects to be used in/on the rocket.
- Particular care must be taken so that the rocket's launch direction is not changed when the launch mechanism is released. This means, that handheld launches, systems requiring human support, or launches guided by flexible wire rods will not be allowed.
- In previous years some people just relied on a simple wire loop to align their launch. These cannot control launch direction so will not be permitted.
- You will need a launcher capable of launching a rocket at a variable vertical angle of up to 60° to the horizontal. The maximum launch angle will be decided on the day. You may launch at angles less than the maximum.
- If your rocket has fixed wings then a maximum variable launch angle of 30° to the horizontal is allowed. The maximum launch angle will be decided on the day.
- Multistage rockets are permitted, so long as the 'scoring' part is labelled prior to launch.
- No free-standing laboratory clamp stands allowed for supporting launchers.
- If you are not sure your rocket or launcher will pass the safety inspection, please contact us in advance at waterrockets@npl.co.uk

The Competition Day

- No under 6's allowed in the launch bays.
- When you arrive and have checked in at the registration tent, your launch apparatus and all rockets will be safety checked. Judges can disqualify any equipment considered unsafe.
- You **must** use all safety equipment provided on the day (eyewear and ear protectors).
- There will be three rounds. You may bring more than three rockets, but only the **first** rocket launched in each round will count towards your total score.
- You must ensure labels provided by NPL on the day are attached to all your rockets so they return to you at the end of each round. Labels designating scoring rockets are critical for awarding bonus seconds according to the zone they land in.
- Your team will be assigned a marshal who will inform you of the correct launching elevation angle and permissible directions of flight. When you are ready to launch your scoring rocket, alert your marshal and they will tell you if it is safe. When your rocket leaves the launcher, the marshal will start a stopwatch, then stop it when the labelled part of the rocket touches the ground, a tree, a building or goes out of sight. The Marshall's timing is the official value. You will not be disqualified if small parts of the rocket come off and land outside the landing zone, but it will be at the marshal's discretion to decide which is the largest part of the rocket.
- Rockets shall be launched from the firing line towards the landing zone. The landing zone is a large grassed area 200 m by 200 m, adjacent to the firing line containing bonus zones. For your safety please



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do not walk into this area unless it has been announced that it is safe to do so.

- For safety's sake any fast falling rockets **must** land in the landing zone or you will get no points for that round. If soft-landing rockets (e.g. rockets with parachutes) land outside the landing zone their time will be counted for the *longest time in the air* award.

Bonus seconds will be awarded according to this table:

Zone	Bonus seconds	* Distance from firing line /m	Depth of zone /m	* So (e.g.) zone A starts 50 m and ends 65 m from the firing line.
A	15	50	15	
B	30	65	10	
C	20	75	15	

The following map isn't necessarily to scale.



Tips

Download our water rockets and launcher designs booklet in the resources section of www.npl.co.uk/wrc.

Increase team engagement by designating roles like chief engineer, head designer, safety adviser etc.

Bring more than just one rocket, and/or means of carrying out running repairs – you may have to repair rockets between rounds.

Test rockets before you come to the event, there is nothing more disappointing than finding your rocket doesn't work on the day. You might want to have several designs to try out. You can use a different scoring rocket for each round if you wish. Remember it could be windy, this might be an advantage, but **remember you must fire away from the crowd and land in the landing zone.**

Do not use glass bottles or plastic bottles designed for still water.

Do not use bottles more than 6 months old (previous year's rockets have exploded!).

We recommend that you only use plastic bottles and containers designed to store carbonated drinks; these will be able to withstand the pressure.

Be careful that in building your rocket you don't weaken the plastic bottle with glues, solvents, paints etc.

Pressure test your rocket full of water, this means if it fails you only get wet!

We recommend not exceeding 70-90 psi (5-6 bar) which should enable the 70 m range. We have tested new carbonated drinks bottles up to 120 psi (7 bar) and found failure unlikely but still possible, so eye and ear protection are advisable.