



WATER ROCKET CHALLENGE

RULEBOOK



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1.0 Competition Overview

The TechnoXian Water Rocket Challenge is one of the most exciting challenges in the World Robotics Championship series. Teams must design and build a water rocket according to the specified dimensions, strong enough to withstand pressure and achieve the maximum altitude above ground level when launched from the launch platform. The team with the longest flight time will be declared the winner.

2.0 The Team

Tournament teams and their members are subject to the following:

2.1.0 Team Name

All team names must be approved by TechnoXian. The team name must be unique and must not be identical or very similar to the name of a previously registered team. It must also not be identical or very similar to any commercial brand name. TechnoXian reserves the right to require any team to change its name if it is considered inappropriate, offensive, or conflicting. Once a team has been accepted to participate in the tournament, its name cannot be changed unless written permission is obtained from TechnoXian.

2.2.0 Team Members

A team must consist of a minimum of two people, with at least one member who is not a minor (under 18 years of age). There is no specific maximum limit on the number of people who may be part of a team. However, limits apply to the number and age of team members who may be included in the pit crew. No person may be a member of more than one team.

2.3.0 Team Technical Experience

One team member, or a combination of team members, must have knowledge and understanding of all technical aspects of the water rocket.

3.0 Competition Field

3.1.0 Field Dimensions

The Water Rocket Tournament field will measure approximately 100 metres × 100 metres. A fixed location for the launch platform will be marked within the competition field. The penalty area will be marked with white lines. A rocket will receive a penalty if it lands outside the designated area.

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4.0 The Rocket

The team must safely design its own water rockets (minimum of two) and launch platforms. Commercial water rocket kits and launch platforms will not be permitted. The following specifications and rules address many well-known safety concerns related to water rockets; however, they are not intended to cover every possible design. Teams must carefully evaluate their designs, use common sense, and keep in mind that, on the day of the competition, the inspection team will examine and assess whether the rockets meet all safety requirements.

4.1.0. The rocket material

The weight of the empty rocket with an empty fuel tank must not exceed 0.5 kg (1 pound), and the maximum permitted overall height of the rocket is 76.0 cm. The rocket must be constructed from low-density materials such as paper, plastic, adhesive tape, and glue. The use of metal, ceramic, and other high-density materials is prohibited. The rocket must not be too compact; in other words, its overall density—the ratio between its total mass and total volume—must be low enough for the rocket to “float” slightly during descent. A handmade parachute may be used to slow the rocket’s descent and allow it to land gently. When designing a rocket for landing accuracy, the team should prioritise safety by building the rocket “larger and lighter” rather than “smaller and heavier.”

A rocket must be designed for stable flight. It must have sufficiently sized stabilising fins at the rear to position the Centre of Drag (COD) behind the Centre of Mass (COM), also known as the Centre of Gravity (COG). One way to test stability is to swing the empty rocket, with its fuel tank empty, in a circle using a string attached to the rocket’s COM. When the rocket is aerodynamically stable, it will automatically orient itself nose-first in the direction of movement. The stabilising fins must be firmly attached to the rocket and must not have any sharp edges or points.

4.2.0. Rocket nose shape

Although a sharper nose improves aerodynamics and accuracy, for safety reasons the nose must be slightly rounded and made from a soft, flexible material. It must not form a hard or sharp point. The nose must not be capable of breaking a windscreen or injuring anyone.

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4.3.0 Fuel Tank

The water-fuel tank must be a plastic soft drink bottle, not a water bottle, with a maximum capacity of 2.5 litres. A soft drink bottle is an ideal fuel tank for a water rocket because it is strong, lightweight, and designed to withstand pressure. The bottle must be in perfect condition, with no cracks, dents, wrinkles, scratches, or other defects that could weaken it and cause it to burst during pressurisation or launch. Although not strictly required, participants should consider wrapping the bottle with adhesive tape or a similar material, or enclosing it inside a cardboard tube, to reduce fragmentation and limit the spread of debris in the event of an explosion.

4.4.0 Fuel

The rocket's fuel must be water, propelled by pressurised air to produce thrust. Water and air are non-toxic, non-combustible, and readily available. The air pressure must not exceed 70 psi, which is approximately half the burst pressure of standard soft drink bottles.

4.5.0 Launch Platform

The launch platform must be constructed strongly enough to ensure a repeatable and predictable launch direction. It may optionally include a blast shield that disperses the rocket's high-velocity water exhaust into a harmless spray. This helps protect participants and spectators and prevents mud from splashing from the field's soil surface. A launch guide rod must be used to help direct the rocket along its intended launch path. The launch platform must not be secured to the ground using spikes driven into the soil. This restriction is intended to protect the field's underground sprinkler system. However, small-diameter rods, such as wooden dowels or metal rods used as guide posts, may be pushed into the ground by hand to a depth of several inches.

5.0.0 Competition Structure

During the official competition, several key roles must be filled.

Each competition round is controlled by the referee, who has full authority to enforce the rules of the competition to which they have been assigned. Referees observe and supervise competitors before, during, and after the challenges, award the final score, and make decisions. The referee is encouraged to use the designated area to walk alongside the...

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...field. The referee's decisions regarding facts related to the competition are final.

The referee may change a decision only upon realising that it is incorrect or, at their discretion, on the advice of an assistant referee, provided that the competition has not been restarted. The referee is not responsible for any injury suffered by an official or spectator, any damage to property, or any other loss suffered by an individual, club, organisation, institution, or other body.

The team captain is the only team member permitted to speak with the referee.

Duties

1. The referees' general duties include starting the competition, stopping it early, declaring a winner, announcing and managing time-outs, and monitoring safety violations. The referee ensures a safe competition for all participants and rockets and guarantees that the competition is conducted fairly according to the rules.
2. The referee ensures that there is no interference from unauthorised individuals or team members.
3. If, at any time before or during a competition, a referee observes disruptive or inappropriate behaviour from any operator or team support person in or around the competition area, the referee has the authority to require that person to leave the area immediately.

5.1.0 Assistant Referee

The assistant referee supports the referee whenever possible. The assistant referee is encouraged to use the designated area to walk in front of the referee. No team member may speak with the assistant referee.

Duties

The assistant referee indicates when misconduct or any other incident occurs outside the referee's view.

The assistant referee discusses unclear situations with the referee.

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5.2.0 Rocket Handler

Before the competition begins, each team must appoint its rocket handlers, air-pressure pump operators, and team captain.

Duties

- The team captain may request a time-out from the referee when necessary.
- The rocket handler may replace a rocket during the competition.
- The rocket handler must ask the referee for permission to replace a rocket at the next stoppage. If the referee approves, the rocket may be replaced.

5.3.0. Competition Preparation

Before the competition begins, each team must appoint its rocket handlers, air-pressure pump operators, and team captain.

- All individuals playing a role in the competition must be ready at least 10 minutes before the start of the competition to allow the referee to carry out the following preparations:
 - Competition score sheet: The referee obtains a competition score sheet along with the ball from the organizing committee. After the competition, the referee fills in the final score, collects the required signatures, and submits the sheet to the organizing committee.
 - Choice of team colors: The referee asks the team captains for their preferred team color (either blue or yellow). Teams will be given a sticker of the same color to place on their rocket.
 - Start of the game: The schedule for the teams playing will be announced on Day 1 of the competition. Teams must be available according to the scheduled time.
 - Rocket designation: The referee asks both captains which rocket they will use. The team can change the rocket at any time during the game with the referee's permission.

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6.0.0 Launch Coordination

Before the start of a Competition, the launch pad and rockets must be available in the designated area. Specifically, The launches will be coordinated by a team captain. To begin, a team will hoist a "pressurization in progress" flag and fuel and pressurize their rocket, which will allow a launch inspector to verify the launch pressure if requested. When a team is ready to launch, they will hoist a "ready to launch" flag and, if necessary, the team captain will notify the referee in person. When the referee gives permission to launch, the team will hoist a "launch" flag, announce the launch to everyone present (spectators, participants, and staff), either by sounding a horn or shouting a launch sequence, for example, "Launch in T minus 5, 4, 3,...", and will proceed with the launch. The launch announcements must be loud enough to be heard by the referee,

6.1.0. Countdown to Start

The referees will determine when each team is ready to start, at which point an operator from each team will display a green card to indicate that their team is ready to start the competition.

6.2.2. Foul

If a Referee or Judge notices premature actions or any other violation of the start procedure, they can declare a Foul and require a Restart.

6.3.2. Timeouts

Any referee can call a timeout to stop the competition. The team must immediately stop movement. Subsequent actions by the Referees and TechnoXian Officials will depend on the circumstances that gave rise to the Timeout.

7.0. Winning the Challenge

The maximum allocated time (play time) for a team to set up and launch the rocket is 10 minutes. Otherwise, it will result in the team's disqualification.

Each team will have three opportunities to launch the rocket and achieve the maximum air time.

The referee will record the rocket's air time for each attempt, the time of...

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maximum air time will be chosen from all attempts and will be declared as the official air time of the rocket.

The rocket with the maximum air time will be nominated as the winner.

The referee's decisions regarding the outcome of a challenge are final and binding for all Competitors. The referees' decisions are not subject to challenge or appeal.

8.0. General Tournament Rules

8.1.0. Prohibited Activities

TechnoXian expects all Competitors to act in a safe and legal manner. The actions of a single Team member can be grounds for Disqualification or Expulsion of the entire Team. The following activities are prohibited; Violation of any of these terms may result in the disqualification of the competitor and/or the team, as determined by TechnoXian and/or Producer in their sole and absolute discretion.

- Unruly behavior: Fighting, belligerence, the threat of physical violence, or other unruly behavior, including abusive physical contact with any TechnoXian Official, will not be tolerated and may result in the immediate expulsion from the Tournament of the entire Team of the offending member.
- Vehicles in Pit Areas: Scooters, bicycles, skateboards, roller skates, and similar vehicles may not be used in any of the Pit Areas. In addition, motorized vehicles such as Segways, hoverboards, or electric scooters may not be used or stored in the Pit Zones. The only exceptions are wheelchairs (manual and electric) occupied by disabled persons and vehicles used by authorized personnel for Tournament operations.
- Running and playing: Running is not permitted in the pit area, except in an emergency. Running while carrying a charged pneumatic tank, or any sharp or dangerous part, may result in the revocation of the offender's pit pass. It is also not permitted to engage in roughhousing, throw balls or other items, or operate remote control vehicles or equipment in the pit area.
- Team property: no team member may touch, tamper with, or deliberately come into contact with any rocket, parts,

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...tools or other equipment that belongs to another team, without the explicit verbal authorization of a member of the other team.

- **Smoking:** The use of tobacco products, nicotine vapor devices (e-cigarettes), or similar non-nicotine devices is specifically prohibited in any of the pit areas and in any other nearby indoor or outdoor area that is marked as "No smoking".
- **Alcohol consumption:** No team member may consume alcohol during the tournament at any time. Furthermore, alcoholic beverages will not be allowed to enter any of the pit areas. A Team member under the influence of alcohol is not permitted in any of the Pit Areas and may not participate in any activity involving the preparation, transport, or operation of any Rocket in the Tournament.
- **Illegal drugs:** The possession of illegal drugs or other substances or the use of them at any time or place during the entire production, on or off camera, will not be tolerated. The penalty is the immediate expulsion of the offender's entire Team from the Competition and the Program.
- **Firearms and explosives:** No Competitor or any other person other than authorized law enforcement personnel may possess or bring to any Tournament location firearms, explosives, or other dangerous items or materials of any kind.
- **Lasers:** Deliberately pointing any laser at any other person at the Tournament will not be tolerated and may result in the immediate expulsion of the offending member's entire Team from the Tournament.
- **No Pets:** Pets of any kind are not allowed anywhere in the Tournament. The only exception is a certified service dog that is used to assist a disabled person.

8.3.0. Rule changes during the competition

Rule changes between years can have unforeseen consequences. If it is determined that a rule causes a significant negative impact on the competition, the rules may be adapted under the following conditions:

- Only between phases of the competition.
- Only for major problems, as a last resort.
- The change must be approved by all team leaders (by unanimous vote).

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8.4.0. Final Authority:

The TechnoXian organizer will have final authority over the interpretation and application of all Rules, and decisions regarding the Rules will be made by TechnoXian at its sole and absolute discretion. TechnoXian's decisions regarding the interpretation and application of the Rules, the Tournament, and the Program will be final and not subject to challenge or appeal.

Notice:

These Design Rules may change at any time with or without specific prior notice. Any change made to these rules will be noted in a revised Design Rules document with a higher revision number. You acknowledge and agree that it is your responsibility to read, understand, and comply with each and every rule provided here or by TechnoXian. We strongly recommend that you consult these Design Rules frequently to detect any changes that may affect your design, construction, and/or ability to compete in the Tournament. TechnoXian reserves the right to remove any Team from the Tournament at any time and for any reason (including, but not limited to, failure to meet technical and/or safety requirements) at its sole and absolute discretion.