

## **RCJA - FAQ - Passive Ball**

Frequently asked questions about the introduction of the passive ball in Australia. *These FAQs only apply to the Open League.*

This document may be updated periodically.

- **Will the Standard League and Lightweight League use the passive orange ball?**  
No.
- **Why is the Open League using the orange ball instead of the infrared ball?**  
The aim of using the passive orange ball is to encourage advanced students to explore robotic vision, which has more practical applications in the real world. In recent years, camera technology has progressed to a point where they are accessible to students with no previous experience. Some cameras are also compatible with the LEGO EV3 kit.
- **How do I detect the passive orange ball?**  
Teams are highly recommended to use cameras to detect the ball. Infrared sensors will not work because the ball will not emit IR light.
- **Where can I get the passive orange ball?**  
There are two suggested suppliers:
  - <http://schweikert-shop.he-hosting.de/index.php?cat=2259&lang=ENG&product=93011>
  - <https://www.amazon.com/Mylec-Orange-Warm-Weather-Hockey/dp/B002LBDA30/>

The Schweikert ball is a matt finish and is preferable, as the Mylec might reflect light to some extent (for instance from camera flashes).

- **What kind of cameras could I use?**  
Cameras such as the Pixy Cam (CMUcam5) are commonly used in RoboCup competitions overseas. The Pixy Cam is also compatible with LEGO EV3 robots (teams programming with Mindstorms can even download the blocks to use in their program). Note that an adapter may be required to plug it in to the EV3 brick.

Other cameras are also available on the market - do your research to see what suits you.

Be sure to read the rules as there are certain limitations on the cameras you can use. For example, standard Pixy Cams or OpenMV Cams are fine, but you cannot use commercially made omnidirectional cameras or commercially made omnidirectional lenses. You are also limited to 1 camera per robot.

- **Can I make my own omnidirectional lens or omnidirectional camera?**  
Yes! As long as the construction of the omnidirectional lens or omnidirectional camera is primarily and substantially the original work of your team. For example, you can't buy an ultra-wide angle lens off the internet and attach it to your camera. You have to make it yourself.
- **Will it be difficult?**  
As with any new technology, it may be difficult to learn how to use it at first. The passive orange ball has been introduced this year because camera technology is now able to be implemented by students of school-level.

Teams who intend to build non-LEGO robots using electronic parts may find that there is a lot less wiring involved than with individual IR sensors.

- **Why will robots be allowed to go out of the white line?**

This refers to Rule 4.7.8.1 (Open League). This rule has been changed from 2017 to make it easier for teams to implement the introduction of a passive orange ball in the Open League. We want to make it simpler for teams wishing to try using the passive orange ball. Robots can still choose to stay inside the playing area if desired. This rule may change in 2019.

- **What happens if the ball goes out of the white line?**

There is no change to the '*Ball Out of Play*' rule. After the ball is considered out of play, it will typically be moved to the nearest neutral point.

- **I'm worried about the cost**

It is typically cheaper to buy the orange ball + camera, compared to the infrared ball + IR sensor. Teams who already have IR equipment in their inventory may wish to give these to new Standard League or Lightweight teams in their school or community.

- **Where do I start?**

Once you read the rules thoroughly, do your research. Collaborate with your team and your teachers to search the internet. There is already a lot of information out there about how to use cameras. There are also a tonne of YouTube videos of LEGO EV3s using cameras.

Check the tutorials and resources pages on the RoboCup website for links and other material you might find useful. More links and material will gradually be added.

- **Are drones allowed in Open soccer?**

Um... technically yes. You are reminded that:

- They cannot fly higher than the maximum height limit (22cm) throughout the game
- Ball capture zones still apply. The ball cannot be held underneath a drone, i.e. no part of a drone can protrude over more than 30mm of the ball's projected diameter
- This is probably not a good idea m8 :-)