# Introduction

## What is a High Altitude Balloon?

A high altitude balloon, or HAB, is a balloon, often made of latex or foil, that is launched up into the atmosphere, often to collect scientific data. They offer a cheap means to get scientific equipment, such as temperature sensors, into the lower, and sometimes upper, atmosphere.

## How do they work?

A HAB is normally paired with a payload and parachute. The payload is an insulated box usually containing electronics, such as a radio transmitter, GPS and electrical equipment used to record data such as temperature and humidity. The parachute ensures the payload doesn’t fall too quickly, which could be dangerous.

The balloon itself can be filled with two gasses: Helium or Hydrogen. Both of these gasses are lighter than air, allowing them to lift the balloon off the ground. Helium is used more often because Hydrogen can be potentially dangerous, although it is cheaper and more effective. We decided to use Helium because it was easily obtainable, and much safer.

There are two main types of balloon: Latex and Foil. Latex balloons are most commonly used and simply go up and come down again, as described below. Foil balloons rise to a certain altitude and then float around at this altitude for a number of days (normally 5-6) before popping and returning to earth. Foil balloons often travel vast distances before popping, which means that the payload is very rarely recovered. Ideally, we would like to recover our payload, which means we have to use the more common Latex balloons.

Balloons come in a range of sizes from 50g to up to 2000g. Each size has its advantages and disadvantages. Smaller balloons require less helium and are cheaper but don’t travel as high (or far) and carry smaller payloads. Bigger balloons travel much higher and can carry much heavier equipment but require more helium and often require a license to launch. We chose a relatively light 200g balloon that will reach an altitude of approximately 20km before bursting and falling to earth. It also requires less helium and doesn’t travel as far, making it both cost effective and easier to recover.

When the balloon is released, it begins to rise. As the balloon gets higher, the pressure around the balloon decreases, and the balloon expands. The form of latex used in balloons is incredibly stretchy, which allows the balloon to reach high altitudes, but, eventually, the balloon will burst. Now the payload begins to fall to the earth, pulled by gravity. This is were the parachute comes in. When the payload starts falling, the parachute opens up and slows the descent to earth.

During the flight, we need a way of tracking the balloon. This is where the tracker comes in.

Throughout the flight, a GPS module sends the balloons location to a microcontroller, such as an Arduino. The microcontroller reads the information and, through a radio module, transmits the location back to earth. There are a number of methods for tracking the balloon, as explained in the document titled ‘Tracking the Balloon’.