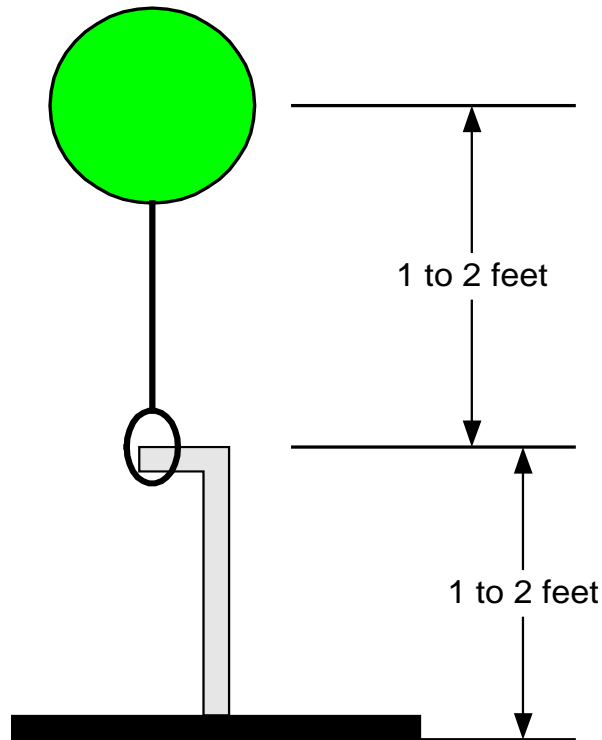


Buoy Challenge Basics

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One of the challenges in the upcoming competition is to detect and release two tethered buoys so that they float to the surface. The buoys can be detected by recognizing a colored light flashing at a specified frequency. The information on the tethering is as follows:

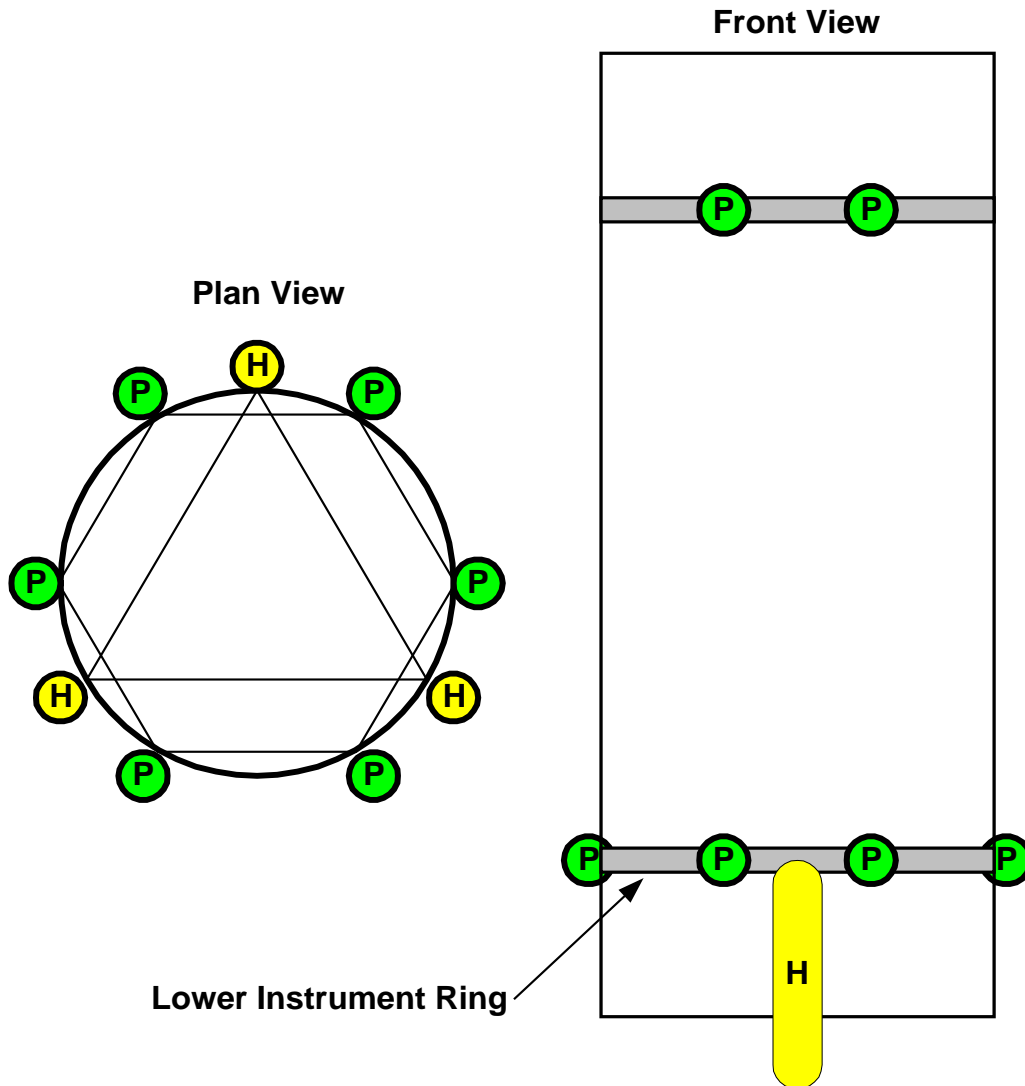


The base (black) sits on the floor of the competition arena (depth 16 feet). Attached to the base is a pole, one to two feet long, with a simple hook on the end. The buoy has a tether (rope?), one to two feet long, with a ring on the end that slips over the hook. The challenge is to run into the rope or buoy and push it so that the ring comes off the hook. The buoy will then float to the surface by itself.

The first thing to note about this challenge is that the sub must be able to descend to the depth of the buoy, approximately 12 to 14 feet.

One approach to solving this problem is to use a color camera to find the light and then maneuver appropriately. The problems with this approach are first the cost of the camera and then the difficulty of getting it pointed in the right direction to see the light. Note that the competition is expected to take place in bright sunlight, so the ambient light levels will be fairly high.

The alternative approach, used by one of the teams in the 2006 competition, is to use a set of photoreceptors covered by translucent filters. These devices are very low cost, so a number of them can be used without breaking anybody's budget. The following diagram illustrates how this approach can be adapted to our vehicle:



Six photoreceptors (green circles) are attached to the external lower equipment ring along with the hydrophones (yellow). These photoreceptors are arranged in a hexagonal pattern as shown. In addition, there are two more photoreceptors attached to the upper equipment ring as shown in the front view above. All of the photoreceptors are ac-coupled to the analog inputs of the processor board. The software simply looks for a signal at the given frequency and then compares amplitudes to determine the direction to the light; this is similar to the hydrophone algorithms for determining the direction to the pinger. The purpose of the upper photoreceptors is to determine when the sub is at the right depth.