

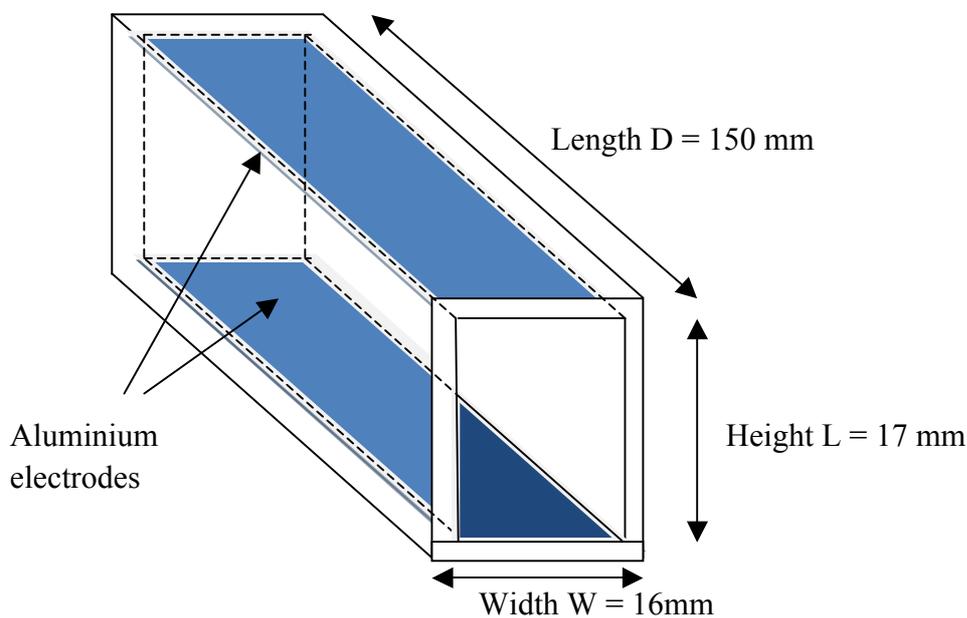
### 3. EXPERIMENTAL METHOD

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The method of this project was divided into two sections epitomised by the construction of the two MHD propelled vessels and the investigations into the MHD engine's properties.

Firstly, the two MHD prototypes consisted of a long single propulsion engine and a vessel with shorter twin engines inspired by the design<sup>4</sup> of the *Yamato I*. Both models were constructed using a similar method, which can be illustrated using the example of the single engine craft. In order to accelerate salt water under the influence of a current and a magnetic field, we used a hollow, rectangular plastic channel with the following dimensions(see Fig. 3):

**Figure 3: Water channel for MHD propulsion**



The length  $D$  of the channel was dependent on the length of the plastic box intended for the hull of the craft. As illustrated above, Aluminium electrodes were attached to the top and bottom surface on the channel's inside in order to transport the current vertically within the channel. Despite its susceptibility to corrosion, this metal was chosen because it could be easily made into electrodes by rolling Aluminium foil around a thin wooden rod before pressing the resulting cylindrical shell into a light, thin, rigid sheet of metal. Several of these electrodes were produced as a replacement once pairs of anode and cathode have corroded. Potential alternatives to Aluminium included Copper sheets, which were even more vulnerable to corrosion, and Brass sheets, which were more resistant to corrosion but also impractically heavy. Gold leaf was also considered as a light, non-corroding and highly conducting substitute to Brass and Copper, but unfortunately it was so thin that it detached itself from the electrodes during operation.

The magnetic field was produced by 18 permanent neodymium cylindrical magnets with a magnetic field strength of **0.34 Tesla** on each face. These magnets were attached on two opposite sides of the channel to create an approximately uniform magnetic field

<sup>4</sup> See Appendix 1 for pictures of the two different MHD engines and the Yamato 1