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## Defining Reference Area for Prediction of Aerodynamic Coefficients of a Biologically Inspired Hybrid Buoyant Vehicle (Article)

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### Abstract

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Geometric and volumetric quantities are usually used to define the reference area for the prediction of aerodynamic coefficients of various aquatic mammals, airships and unmanned vehicle. However, reference area does not have a unique definition, especially for a hybrid buoyant aerial vehicle having hybrid lifting hull which resembles a Steller sea lion. The term square cube root of volume is traditionally used as reference area to nondimensionalize the aerodynamic forces for conventional as well as unconventional airships. Published experimental data are usually available for complete configuration at low speed and in nondimensionalized form. So, a generic model of an aircraft's fuselage was first tested in a wind tunnel as a test case to first determine the lift force and then the influence of different choices of reference area on the lift. A hybrid lifting hull was numerically simulated for the prediction of lift as well as drag coefficients and their ratio. It was found that the volumetric term has undefined correlation with aerodynamic forces in both cases. Changes in aerodynamic coefficients are not prominent when using the wetted area as the reference area. Based on the predicted trends of aerodynamic coefficients and a deep literature survey, the projected planform area is proposed as the best option for reference area of a Steller sea lion as well as for hybrid lifting hull of a hybrid buoyant vehicle. © 2017 World Scientific Publishing Company.

### Author keywords

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