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Wind tunnel testing of hybrid buoyant aerial vehicle

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Abstract

Purpose - Realistic data bank of aerodynamic and stability derivatives is still missing for hybrid buoyant aerial vehicles. Such vehicles take-off and land similar to an aircraft with their partial weight balanced by the aerostatic lift. The purpose of this paper is to use wind tunnel testing for a better understanding of the aerodynamic and static stability behavior of such vehicles.

Design/methodology/approach - The effect of wing on the aerodynamic and static stability characteristics of a clean configuration hybrid buoyant is analyzed. The free stream velocity is 20 m/s, and ranges of angle of attack and side slip angle are from -8 degrees to 12 degrees and -16 degrees, respectively. Data are corrected to account for the effect of strut interference and zero load condition. The maximum blockage of the model with respect to the cross-section area of the test section is about 2.7 per cent.

Findings - A hybrid model manufactured by using wood and metal is an optimum solution with less number of parts. The vehicle is statically, longitudinally and directionally stable. Wings designed to fulfill the partial requirement of lift contribute significantly to counter the huge moment generated by the voluminous hull for centre of gravity location ahead of the leading edge of the wing.

Research limitations/implications - There are number of manufacturing constraints for scaling down a model of a hybrid buoyant aerial vehicle configuration. Specially, the thickness of the wing limits the testing envelop of angle of attack and free stream velocity.

Practical implications - The data presented here are a preliminary guide for further work on larger size models. The data may also be used to build and perform flight tests on small full-scale instrumented models and to obtain flight dynamics data.

Originality/value - The estimated aerodynamic and stability derivatives and slopes can be utilized in future for multidisciplinary design.

Keywords

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