Assessment of engine's power budget for hydrogen powered hybrid buoyant aircraft

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Abstract

It is well known that hydrogen has less undesirable exhaust emissions as compared with other types of liquid fuels. It can be used as an alternative fuel for a hybrid buoyant aircraft in which half of the gross takeoff weight is balanced by the aerostatic lift. In the present study, weight advantage of liquid hydrogen as an ideal fuel has been explored for its further utilization in such aircraft. Existing relationships for the estimation of zero lift drag of airship is discussed with special focus on the utilization of such analytical relationships for the aircraft whose fuselage resembles with the hull of an airship. Taking the analytical relationship of aircraft and airship design as a reference, existing relationships for estimation of power budget are systematically re-derived for defined constraints of rate of climb, maximum velocity and takeoff ground roll. It is perceived that when the propulsion sizing for liquid hydrogen is required, then the presented framework for estimation of its power budget will provide a starting point for the analysis. An example for estimation of the power requirement is also presented as a test case. (C) 2016 National Laboratory for Aeronautics and Astronautics. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http//creativecommons.org/by-nc-nd/4.0/).

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