How to Build a GEV: A Computational and Experimental Approach to the Design of Ground Effect Vehicles in the Modern World

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Ground Effect Vehicles (GEV) provide a hybrid between ships and airplanes for transcontinental transportation. By flying close to the surface, lift is increased and drag is decreased. This means that the payload can be increased compared to airplanes, while a higher rate of travel is possible compared to ships. This decrease in cost without sacrificing speed fills a gap in modern shipping models. However, the close ground distance limits GEV operation to water and coastlines due to obstructions on land. In order to investigate possible configurations for GEVs, historic, modern, and theoretic examples were analysed in a virtual wind tunnel using Computational Fluid Dynamics. Promising models were then created in an experimental setting in order to correlate the computations to real world results. Early iterations suffered a misalignment of the center of lift and mass, causing instability, and was fixed by using 2 main wings. As the GEV pitches, the wing farther from the ground generates less lift, correcting the pitch. Later revisions had problems with roll stability- by pitching the wings up, the wing closer to the ground during roll produces a righting force, eliminating the roll. During waterborne takeoff, a large pressure wave is formed at the bow, significantly increasing drag and demanding thrust beyond what is required for cruising. By using hydrofoils to assist in launch, less power is needed, lowering associated cost. The configuration of GEVs described in this project has significant advantages over current methods of travel, providing a useful asset for modern transportation.