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Experimental Evaluation of Control Algorithms for a Supercavitating Vehicle DAVID ESCOBAR SANABRIA, U niversity of Minnesota, ROGER ARNDT, GARY BALAS, University of Minnesota — High speed supercavitating vehicles offer significant challenges regarding control. Vehicles with actuated control surfaces, such as cavitators and fins, are of considerable interest for maneuverability and control. To study the interaction of control surfaces and the body dynamics of the vehicle, a new hardware and software infrastructure has been developed at Saint Anthony Falls Laboratory (SAFL-U of Minn). In addition, a new vehicle prototype that utilizes a cavitator disk and fins for control, a 6 degree-of-freedom force balance to measure forces and moments, and a ventilation system to insure a fully developed supercavity was designed and tested in the high-speed water tunnel at SAFL. Based on experiments in presence of a supercavity surrounding the vehicle, mathematical models that map cavitator and fins angles to pitch moment, drag force and lift force are obtained. These mathematical models and the new platform enable the use of closed-loop control to significantly reduce pitch moment oscillations induced by a gust flow. This achievement shows a promising path towards the experimental validation of control algorithms for high-speed supercavitating vehicles. The platform architecture, experimental design, mathematical models, and validation process are presented here.

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