

Abstract Submitted  
for the DFD12 Meeting of  
The American Physical Society

**Experimental Validation of Control Systems for a high Speed Supercavitating Vehicle** ROGER ARNDT, DAVID ESCOBAR, ELLISON KAWAKAMI, Saint Anthony Falls Laboratory - University of Minnesota, GARY BALAS, University of Minnesota — Testing of control systems for a high speed supercavitating vehicle (HSSV) is a challenge in terms of infrastructure and costs. An approach to the control validation of a supercavitating test vehicle is developed. The validation method, referred to as hybrid testing, combines simulation and experimental data in real-time to evaluate the HSSV control systems subject to perturbed flow in the high speed water tunnel at the Saint Anthony Falls Laboratory (Univ. of Minnesota). The test vehicle consists of a cylindrical body, two lateral wedge fins, a pitching disk cavitator used for control, and a ventilation system to insure a fully developed supercavity. A simulation computer uses measurements of the forces applied to the vehicle to compute the vehicle states utilized by the flight computer to control the vehicle simulated motion through the cavitator deflections, which in turn vary the forces applied to the test vehicle. The experimental results validate the suitability of the hybrid test platform, accuracy of the vehicle modeling and control design. as well as the effect of the perturbed flow on the closed-loop system performance. This research is supported by a grant from the Office of Naval Research.

Ellison Kawakami  
Saint Anthony Falls Laboratory - University of Minnesota

Date submitted: 03 Aug 2012

Electronic form version 1.4