

Advanced Glider Concepts for Missions Beyond Oceanographic Vertical Profiling

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Abstract: Undersea Gliders have primarily been used in oceanography applications where the glider flies vertical profiles from the surface to depths up to 1,000 meters collecting CTD data. Speeds are typically very low 0.25 to 1 knot.

The US Navy is currently studying the performance characteristics for a variety of glider platforms and system concepts beyond those used today for oceanographic data gathering.

ONR is currently investigating other missions for undersea gliders that may require size increases on the order of 10x, 100x and even up to 1,000x the size of current legacy gliders. Some missions require long endurance at optimum lift-to-drag (L/D) ratios while others require maximum over the ground speed to overcome ocean currents.

Several new concepts are currently being explored to meet these requirements. This paper will explore the performance capabilities and issues for three configurations: (1) Slocum glider wing and control fin

configurations that can achieve either maximum L/D ratio, maximum over the ground speed, or an in between performance (2) circular disk configuration that will make a bottom sitting glider trawler proof and (3) a flying wing that utilizes a low Reynolds No., 28% thick airfoil shape that has been optimized to reduce its drag rise with thickness increase.

VCT Tools was used to develop and integrate the glider hydrodynamic models used in this study. A particular concern to the glider designer is the drag characteristics that are quite nonlinear with Reynolds No. for the speeds of interest. This effect is accounted for in the glider models used for the study. Also, the effect of the additional drag from fins, wing, and externally mounted sensors that can double the glider hull-drag is discussed.

Static performance measures consisting of classical C_L/C_D , C_L/C_D and $(C_L^{2/3})/C_D$ plots as a function of angle-of-attack and glide angle are reported along with glide polar performance plots for the advanced concepts. Results from in water tests scheduled for summer 2003 will be included.