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Physics of Surface Piercing Bodies

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Most Navy vehicles operate at or near the free surface in order to meet mission requirements. As such, it is important to be able to accurately model and understand the physics of surface piercing bodies to inform the Navy of the vehicle's performance during these operations. Continual advances in computing power and the ever-increasing availability of supercomputing resources have changed the way computational physics solvers are used in the Navy. However, even with modern High Performance Computing (HPC) resources, it is not currently feasible to directly simulate all of the relevant physics of Navy vehicles beneath, at, and above the free surface for necessary real-world time scales. Most modern computational physics codes address these shortcomings by resolving down to the smallest scales allowed by given computational resources and modeling phenomena that occur below the finest resolved scales. This work will discuss necessary physics of surface piercing bodies, current modeling techniques, and how they ultimately affect predictions which are used to inform the fleet.