

EFFECTS OF APPENDAGES ON UNDERWATER VEHICLES

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Depending on mission requirements, underwater vehicles are designed and configured with a number of appendages. These include appendages for stability and manoeuvring control, sensors, propulsion, payloads, equipment, etc. The collective arrangement of these appendages is generally detrimental to the drag of the vehicle, and in many cases, can result in out-of-plane forces that can affect the trajectory and attitude of the vehicle, that in turn can affect its operational capability and safety. Therefore, when designing underwater vehicles, it is important to identify and quantify the effects from these appendages, and design the vehicle and the appendage configuration to minimize the detrimental effects from these surfaces. Care should also be taken during operations, as the operator should be aware of these effects on the behaviour of the vehicle, especially in non-standard and off-design operational conditions. These include the location of the forward and aft control surfaces on its manoeuvring and propulsion characteristics, effects of the sail on the flow structure around the vehicle, effects of the flow on sensors, etc. Thus, the location and sizing of the appendages are important, although the final configuration is not totally dependent on the hydrodynamic characteristics. This presentation provides some guidance on the sizing, locations, and shapes of common appendages on a typical underwater vehicle.