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A Numerical Study on Effect of Change in Longitudinal Centre of Gravity on Planing Capability of a Coastal Patrol Craft: A Case Study, Sri Lanka Navy

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The pressure that acts on the wetted surface area of coastal petrol craft always maintains the equilibrium with the weight of the vessel. The acting pressure comprises of two elements, i.e. hydrostatic which relates to buoyancy and hydrodynamic which relates to speed of the vessel. The authors were involved in planning a novel design of a monohull Coastal Patrol Craft with unknown capabilities of dynamic behaviour with planning at initial stage. The research objectives were to estimate the total weight, compare resistance for different LCG positions, and the dynamic wetted area comparison for different LCG positions, Effective power demand comparison for different LCG positions, dynamic trim comparison for different LCG positions, and Planning capabilities for different LCG positions. Five different LCG positions were considered during the study to realize the craft's behaviour. According to the numerical approach, craft's behaviours explored with the change in LCG positions and anticipated effect on the resistance, effective power demand, dynamic trim, and Planning capabilities. Based on the results, a small initial trim angle is required for the CPC to display optimal performance at speeds in the upper range of the planing regime. On the other hand, an initial trim by aft would increase the performance of the CPC at speeds lower than the planing region but would adversely affect the performance at higher speeds as the trim further increases due to dynamic behaviour. Further, this increase in trim at higher speeds would result in dynamic instability and be detrimental to the performance of the craft.

Keywords: *longitudinal centre of gravity, planing, hydrodynamic forces*