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THE HYDRODYNAMIC IMPACT OF MARINE FOULING

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ABSTRACT

Surfaces submerged in the marine environment are often fouled by bacteria, algae, or macro-organisms. It is well established today that fouling on ships increases the hull roughness, causing increased frictional resistance and fuel consumption, as well as decreased top speed and range[1]. It has been estimated that the US alone spends more than $5B annually to prevent and control marine biofouling. Antifouling (AF) coatings have been widely used to control the problem, but they contain biocides which are toxic to marine organisms, resulting in a worldwide ban. As research on non-toxic alternatives is ongoing there is a pressing need to assess the impact of various types of fouling and coverage level on the frictional resistance of naval vessels to make cost/efficient hull cleaning decisions. In turbulent boundary layers over rough surfaces the equivalent sandgrain roughness, k_s, is used as a common currency to estimate hydrodynamic resistance[2]. For biofouled surfaces, however, estimating k_s, via correlations based on datasets from generic rough surfaces leads to significant errors because biofouling has unique surface properties (i.e. high skewness, low effective slope, ES < 0.16 etc). The objective of this session is to bring together experts with diverse backgrounds, including biology, material science, experimental and computational fluid dynamics to provide a snapshot of the state-of-the-art, and identify future needs and research directions in the field.

REFERENCES

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[2] I.K. Kaminaris, E. Balaras, M. P. Schultz, and Volino R.J. Secondary flows in turbulent boundary layers developing over truncated cone surfaces. J. Fluid Mech., 961:A23, 2023.