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Impact of Diatomaceous Biofilms on the Frictional Drag of Ship Hull Coatings[1] MICHAEL SCHULTZ, U.S. Naval Academy, JESSICA WALKER, University of Tasmania, CECILY STEPPE, KAREN FLACK, U.S. Naval Academy
— Skin-friction results are presented for three commercial ship hull coatings in the unexposed, clean condition and after dynamic exposure to diatomaceous biofilms for 3 and 6 months. The experiments were conducted in a fully-developed turbulent channel flow facility spanning a wide Reynolds number range. Results show that the clean coatings tested are hydraulically-smooth over much of the Reynolds number range. Biofilms, however, result in an increase in skin-friction of up to 70%. The roughness functions for the biofilm-covered surfaces do not display universal behavior. The effect of the biofilm is observed to scale with its mean thickness and the square root of the percent coverage. Boundary layer similarity-law scaling is used to predict the impact of these biofilms on the required shaft power for a mid-sized naval surface combatant at cruising speed. The increase in power is estimated to be between 1.5% and 10.1% depending on the biofilm thickness and percent coverage.

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