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BIOFOULING CONTROL SOLUTIONS FOR REDUCED ENERGY CONSUMPTION IN VESSELS

INTRODUCTION

All vessels operating in water will experience marine growth on the hull. The marine growth can be classified into macro biofouling (barnacles, seaweed, etc) and micro biofouling (slime or biofilm). Biofouling will increase the weight and surface roughness of the hull, increasing ship resistance (Haslbeck and Bohlander 1992) and thereby increasing fuel consumption (Schultz, Bendick et al. 2011).

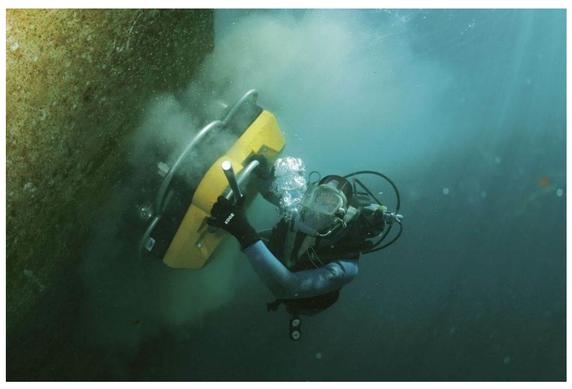


Table 1.2 Estimated effect of the choice of fouling control method on annual fuel consumption and CO_2 emissions. It is assumed that IMO estimations for 2020 correspond to a fleet featuring hydrodynamically smooth hulls. The increased shaft power as a function of the fouling degree is obtained from Schultz (2007) based on his calculations for an Oliver Hazard Perry class frigate sailing at 15 knots

	Additional shaft power %	Fuel savings 2020 million tonnes	ΔCO_2 emissions million tonnes	Money savings $billions
Freshly applied coating	0	0	0	0
Deteriorated coating or thin slime	9	44	134	22
Heavy slime	19	92	279	46
Small calcareous fouling or macroalgae	33	160	486	80
Medium calcareous fouling	52	253	768	127
Heavy calcareous fouling	84	408	1238	204

Hellio, C. and D. Yebra (2009)

RESEARCH PLAN

WP1: Drag characterisation of marine coatings and fouling

- Establishment of reliable drag evaluation method of hull coatings;
- Performance analysis of environmental impact of hull coatings & fouling

DESIGN AND MANUFACTURE OF COATING TESTING DEVICE

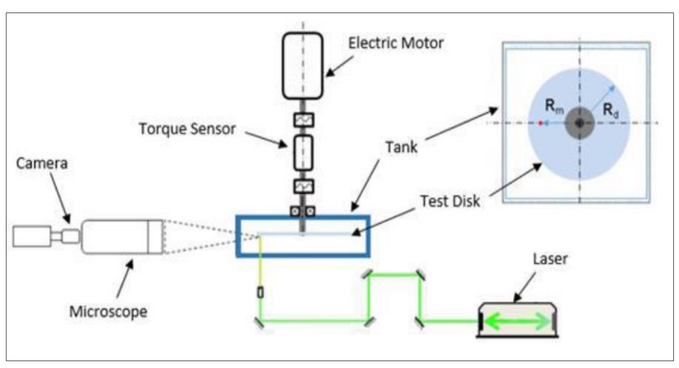
Herein, a new flow channel device is proposed with the aim of culturing biofouling (i.e. algae) in flow. The device will also allow testing of drag impact of fouling to assist for further research on novel fouling control solutions.

WP2: Study of different stages of algae fouling

- Characterization and modeling of different stages (e.g. microalgae-*diatoms* and green macroalgae-*Ulva sp*);
- Evaluation of roughness functions for soft fouling

WP3: Measurement of friction drag on small-scale rotating rig

- Collection of more drag data of different coatings using quick rotating disk tests



PROSPECTS

Experimental and Numerical computations will provide paint manufacturers and ship owners/charterers a possibility to account for the contribution of the coating resistance in the total resistance of a vessel, both directly out of dock and after some time in service (includes paint wear and fouling), so that the ship owners will be able to actively minimize the energy consumption of vessels.

REFERENCES

Haslbeck, E. G. and G. S. Bohlander (1992). Microbial Biofilm Effects on Drag-Lab and Field. Proc. SNAME Ship Production Symposium. New Orleans, Louisiana.

Hellio, C. and D. Yebra (2009). Advances in Marine Antifouling Coatings and Technologies. Abington Hall, Granta Park, Great Abington, Cambridge CB21 6AH, UK, Woodhead Publishing Ltd.

Schultz, M. P., J. A. Bendick, E. R. Holm and W. M. Hertel (2011). "Economic Impact of Biofouling On A Naval Surface Ship." Biofouling **27**(1): 87-98.