

Testing and Analysis of Anti-Biofouling Coatings

NSRP All-Panel Meeting
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Presented by:
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Hepburn and Sons

Problem Overview

- Natural waterways contain microorganisms that attach, grow, and spread across surfaces
- This biofouling process can result in micro and macro issues including:
 - Clogged intakes and filters
 - Increased hull drag and corresponding performance decreases
 - Corrosion
- Mechanical removal is effective but can be time and labor intensive
- Legacy anti-fouling treatments often cause environmental damage

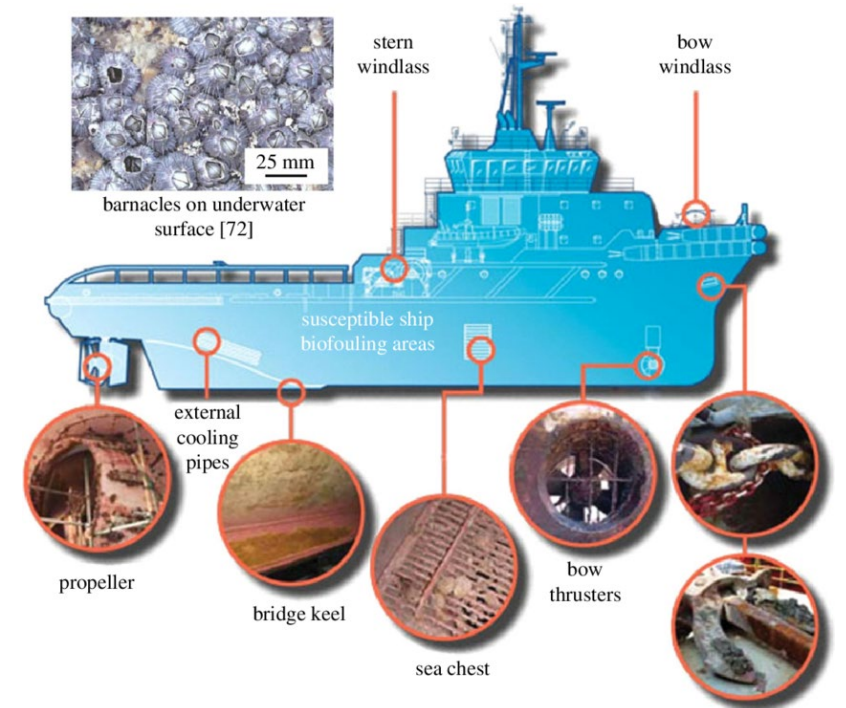
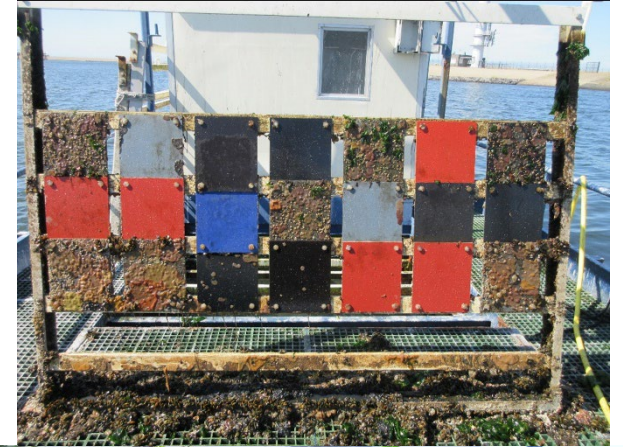


Image per Bixler "Biofouling: lessons from nature", 2015



Proposed Solution

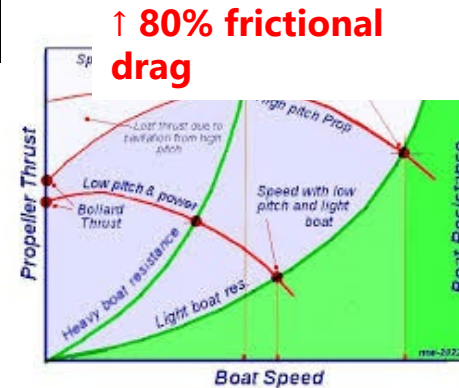
- Novel nano coating technologies have been developed with mission-specific optimization capabilities including:
 - Drag reduction
 - Corrosion prevention
 - Biofouling
- Thin coating layers are typically less than 0.001" and exhibit strong bonding strengths
- Incorporating nano coatings into ship maintenance can reduce cost and schedule while increasing efficiency



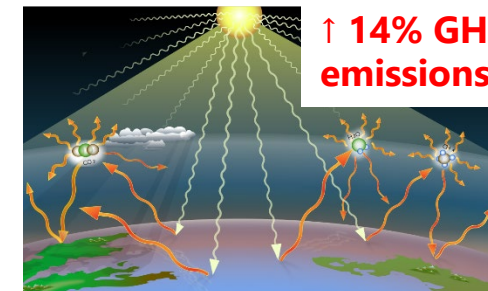
Images per Buitendijk "Tackling biofouling: Hull must be clean for shipping to be green", 2022

Expected Benefits

- Shipyards and Navy have additional options for mitigating biofouling supported by NRL produced data
- Extend maintenance intervals for subsea components and raw water operating equipment
- ROI evaluations for methods and applications of coatings established

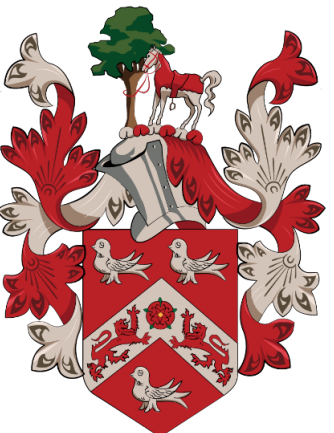
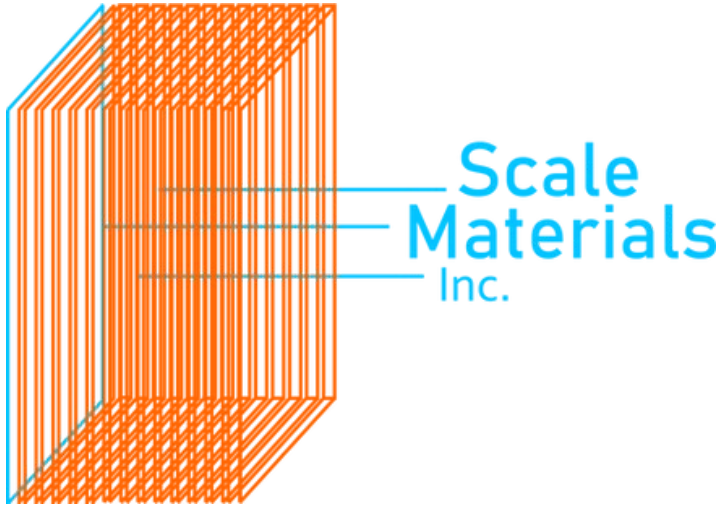


*Gordon, Atlas of marine-fouling... 1992



*Dobretsov, Expected effect of climate change on fouling ... 2009

Participants



Hepburn and Sons LLC



Newport News Shipbuilding
A Division of HII



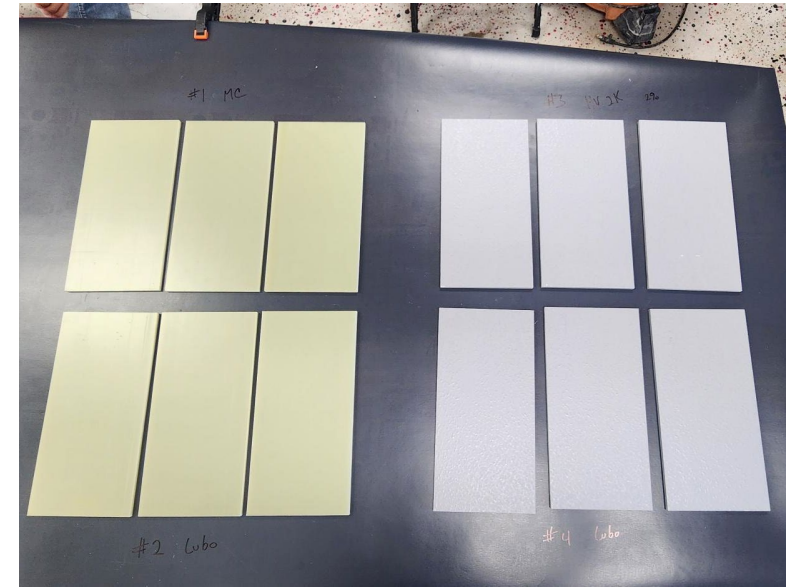
Evaluation Methods, Milestones and Schedule

- Develop test plan in combination with vendors and NRL
- Enable coating formulation optimization
- Evaluate performance using variation on MIL-PRF-24647E paragraph 4.4.1
- Expose panels for 6 months in horizontal orientation
- Flow-test to evaluate final fouling state

	FEB-APR 2024	MAY-JUL 2024	JUL-SEP 2024	OCT-DEC 2024	JAN-MAR 2025	APR-JUNE 2025	JUL-SEP 2025
Tasking	Test Plan Development	Coupon Procurement and Preparation	Coating and Curing	Shipping and Baseline Prep	Testing		Evaluation and Reporting
Engagement	△ Kick Off △ Test Plan	△ Coupons Delivered		△ Test Start △ Inspection	△ Inspection △ Inspection	△ Test End+Flow △ Inspection △ Test Report	△ Final Report

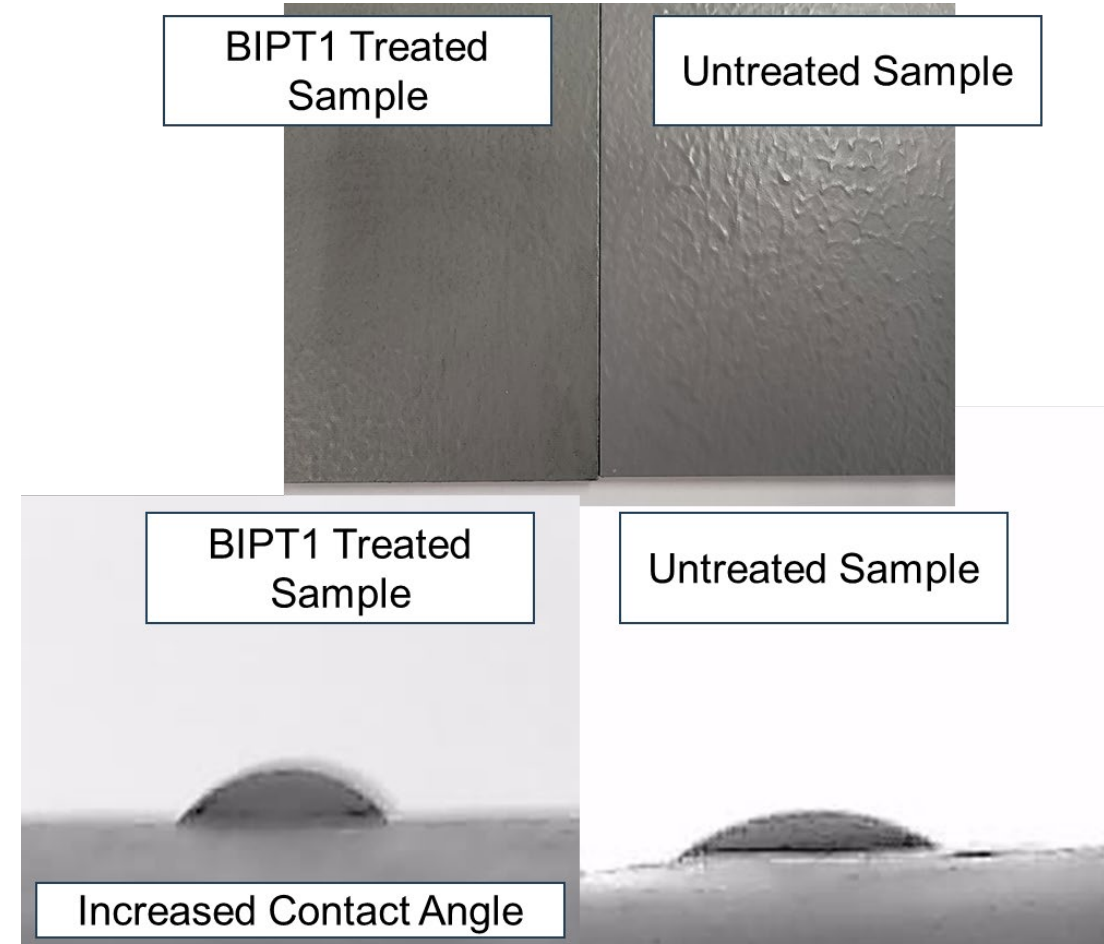
Test Overview

- Fiberglass panels for exposure (12"x6"x0.25")
- 12 panels per vendor
 - 3 panels per rack
 - Allowed up to 4 variations of coating
- Evaluated simultaneously against conventional MIL-PRF-24647 variants: Interspeed 640, Intersleek 1100SR
- Caged, horizontal submersion in Biscayne Bay
- Monthly inspections of status
- Flow testing at NRL Key West facility at conclusion



Approach

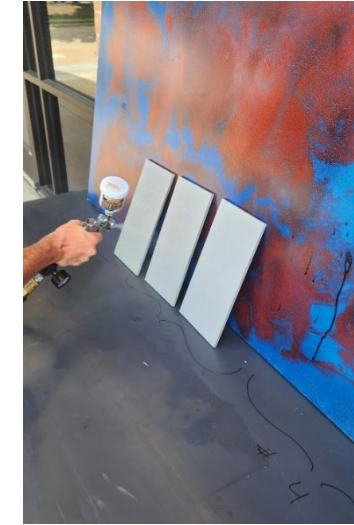
- Coval Technologies
 - Covalent bonding of polysiloxane
 - Hardness and durability of urethane
- BIOINTERPHASE
 - Bio-based polymer
 - Surface tension and biocatalysts
- Scale Materials
 - Zwitterions for AF
 - Customizable for targeted application



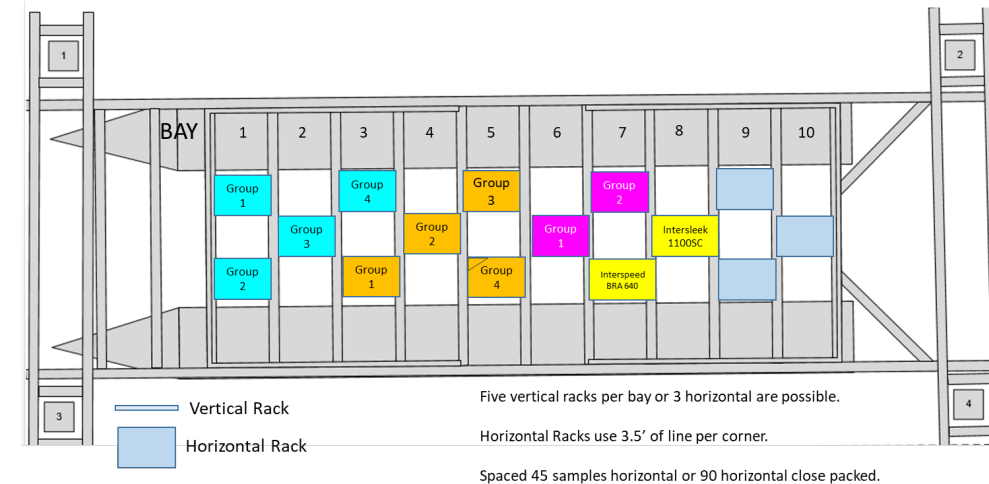
Evaluation of wetting contact surface angle alteration on panels by BIOINTERPHASE

Status

- Panels were installed in raft during week of 18 November 2024
- Inspections completed in December and January by NRL
- February inspection this week (24FEB2025) with low pressure rinse of panels
- At January inspection, all samples currently exhibit some growth on them with the exception of the control samples. Biofouling consists of mostly tunicates, soft corals and sponges



Application of coating to panels at Coval Technologies provided by Jason Dixon



Path Forward

- At conclusion of 6-month exposure, samples will be removed and transported in seawater to Key West for flow testing and evaluation
- Final report compiling the test results and interpretations will be submitted
- Additional application and validation opportunities for coatings will be explored based on findings

Questions?

