

# Evaluations of In-Water Cleaning & Capture Technologies: Facilitating Innovations in Environmental Protection & Business Development



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# Evaluations of In-Water Cleaning & Capture Technologies

- **2016 Workshop - Approaches to Quantifying Biofouling and Considerations of Hull Cleaning**
- **Third-Party Technology Evaluations**
- **Program and Initial IWCC Evaluations**



# Approaches to Quantify Biofouling and Considerations of Hull Cleaning

- August 2016, Smithsonian Environmental Research Center
- Consider approaches to characterize and quantify vessel biofouling
- Identify and discuss existing approaches used for in-water cleaning of vessels and quantifying cleaning efficacy
- 21 attendees, from 15 institutions, in Australia, Canada, New Zealand and USA
- Presentations and discussions on:
  - National and regional biofouling standards
  - Current and future research on quantifying fouling
  - Hull husbandry options, practices, and assessment efforts

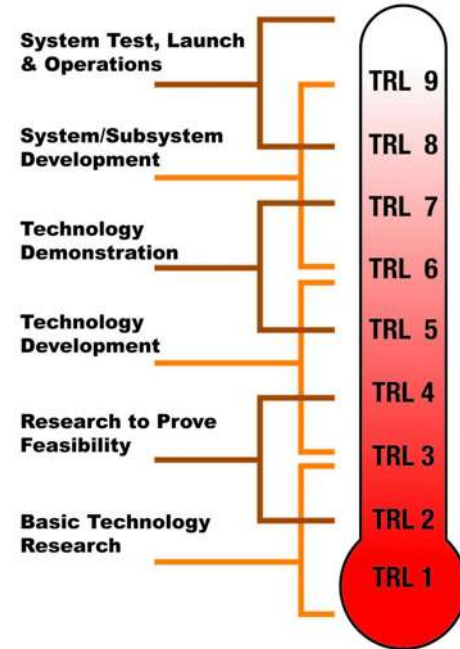


# Approaches to Quantify Biofouling and Considerations of Hull Cleaning

- **Conclusions and recommendations:**
  - **Similar gaps and needs exist across agencies, administrations and regions**
  - **Further consideration for live vs. all organisms (living + dead) in regulations is needed**
  - **Emphasis on quantifying and removal of fouling**
  - **Acceptable threshold for fouling and how it is measured is needed**
  - **Standardized procedures for quantifying fouling and for testing and approving cleaning are needed**
  - **Independent, third-party assessments are critical**
  - **This group should be expanded and meet annually to exchange information**
  - **A central data and information repository on current regulations, protocols, reports, etc. is needed**

# Independent Third-Party Technology Evaluations

- **Technology Users:**
  - Awareness and confidence
  - Identified needs and priorities
  - De-risk technologies
  - Reliable quantification of quality
  - Approvals/certifications
- **Technology Developers and Funders:**
  - Facilitate maturation and crossing the “valley of death”
  - Increase rate and probability of transition into operations
  - Build market / user awareness and confidence
  - Enhance return on investment
  - Approvals/certifications



Source: NASA

# Maritime Environmental Resource Center

- **Third-party testing of ballast water management systems to prevent invasive species and associated compliance monitoring tools**
  - **Type Approval Certification testing for US Coast Guard and other administrations (formerly)**
  - **Verification of ballast water compliance sensors**
- **Evaluations of vessel fouling and invasion risk, tests of power plant antifouling systems, and now in-water cleaning technologies**
- **Facilitating the development and adoption of Green Ship / Green Port innovations**



[www.maritime-enviro.org](http://www.maritime-enviro.org)

# Alliance for Coastal Technologies

- A third-party testbed for evaluating technologies – sensors and platforms for studying and monitoring aquatic environments
  - In partnership with NOAA, EPA, USCG, NRL, USGS, USDA, & NIST
  - Verifications of ballast water compliance sensors
  - Evaluations of sensor biofouling prevention approaches
- A forum for capacity and consensus building – technology workshops and training exercises
- An information clearinghouse for environmental technologies – searchable database of environmental technologies, reports and data



# Evaluations of IWCC and IWG Systems

- **Original Goals:**
  - Provide independent evaluations of technologies designed to support the maritime industry and to prevent the spread of invasive species
  - Facilitate the transition into routine operations and increased application of in-water cleaning technologies
  - Refine and standardize testing protocols
  - Provide rigorous, third-party data on the performance (removal and capture, hull and niche areas) of IWCC systems to support the approval of their commercial use
- **Evolution:**
  - Separate out and in-water cleaning and capture (IWCC) and in-water grooming (IWG) – distinct approach, technologies and test protocols
  - Almost all existing IWCC/IWG systems are focused hulls, not so much on niche areas
  - Early stages of technology and market development



# Evaluations of IWCC and IWG Systems

- **Steps:**
  - ✓ Update review of currently available in water cleaning technologies
  - ✓ Compile relevant regulatory and permitting requirements for in-water cleaning
  - ✓ Establish a Technical Advisory Committee (TAC) and begin to draft Test Protocols (Morrisey et al. 2015)
  - ✓ Release a Request for Technologies (RFT) that invites service providers to apply for evaluations
  - ✓ Accept IWCC providers into the evaluation
  - ✓ Finalize IWCC Test Protocols at a workshop – April 2018.
  - ✓ Conduct practice run of IWCC Test Protocols in Baltimore, MD – June 2018.
  - ✓ Conduct IWCC field test on MARAD vessel in Baltimore, MD – July 2018.
  - Conduct IWCC field test on MARAD vessel in Alameda, CA – October 2018.
  - First IWCC evaluation data analysis and report writing – Winter 2018
  - Workshop and peer-reviewed publication on evaluating IWCC/IWG systems – Spring 2019
  - IWG field tests on active commercial vessels – Spring through Fall 2019
  - Additional IWCC and IWG system testing – 2020, 2021...

# Evaluations of IWCC and IWG Systems

- **IWCC Technology/Service Providers:**

- CleanSubSea Envirocart
- ECOsubsea
- SGS EnviroHull
- SGS Whale Shark
- Sinku
- TechHullClean



- **IWG Technology/Service Providers:**

- HullWiper
- SeaRobotics HullBUG



- **Additional Requests for Technologies**

- 2019, 2020...

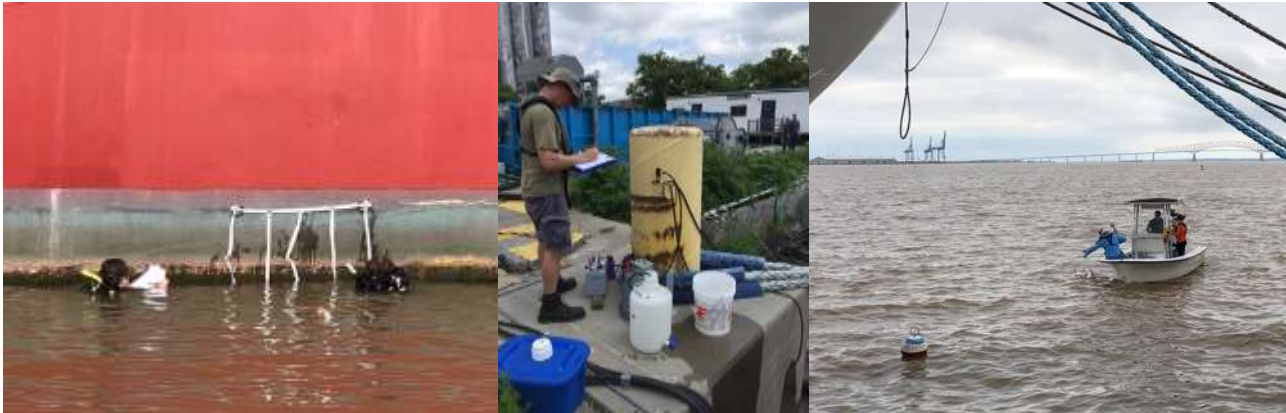
# Evaluations of IWCC Systems - Baltimore

- *NV Savannah* – last drydocking, March 2008, Copper SPC a/f coating
- Fouling ratings from initial ROV survey is FR50 and greater with fouling consistently distributed at 60 - 100% cover
- One service provider – Subsea Global Solutions (SGS)



# Evaluations of IWCC Systems - Baltimore

- Pre-cleaning sampling and dive surveys – low visibility (< 1 ft)
- Continuous, time-integrated and time point sampling
- Post-cleaning dive surveys – low visibility (< 1 ft)
- Primary data includes:
  - Biofouling percent cover and type
  - Total Suspended Solid
  - Copper, Zinc and Lead



# Evaluations of IWCC Systems - Alameda

- *MV Cape Orlando* – last drydocking October 2015, a CDP anti-fouling coating employing cuprous oxide and zinc oxide
- Fouling rating from initial ROV survey is FR40 with fouling distributed at 50 - 75% cover
- High visibility (> 2 m)
- One service provider – SGS Whale Shark



# Evaluations of IWCC and IWG Systems

- Provide the scientific foundation for the evolution of biofouling regulations
- Refine and standardize IWCC and IWG test protocols
- Provide rigorous, independent evaluations of IWCC and IWG system performance (removal & capture, hull & niche areas) to support their approval and commercial use
- Initial efforts suggest a promising suite of technologies/approaches that may be able address both vessel operation and biosecurity objectives



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