
DTU

Investigating the Impact of In-Water Cleaning on Coating Performance and Cleaning Efficiency Using a Lab-Scale System

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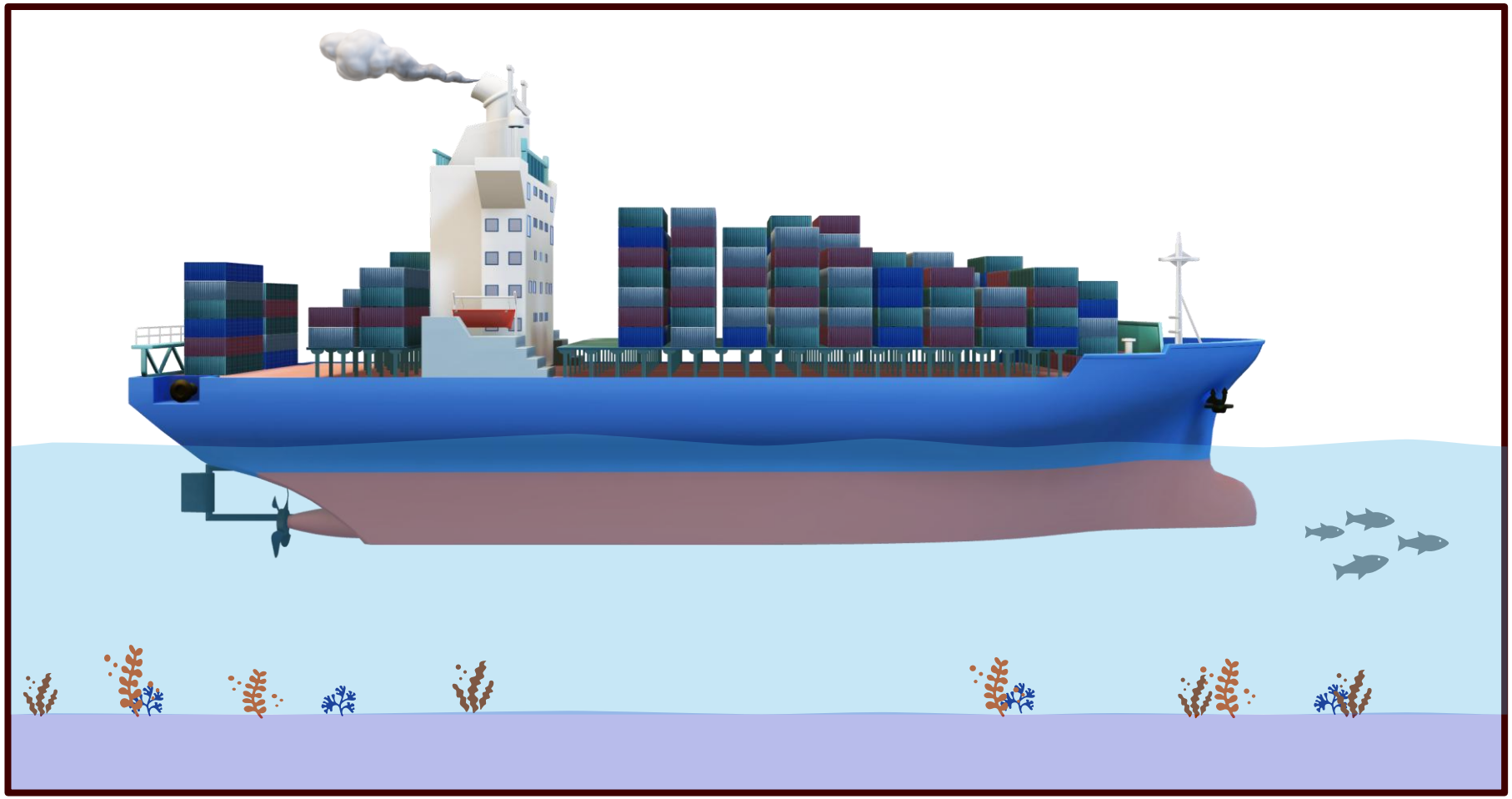
Beyond Clean: What is actually happening?



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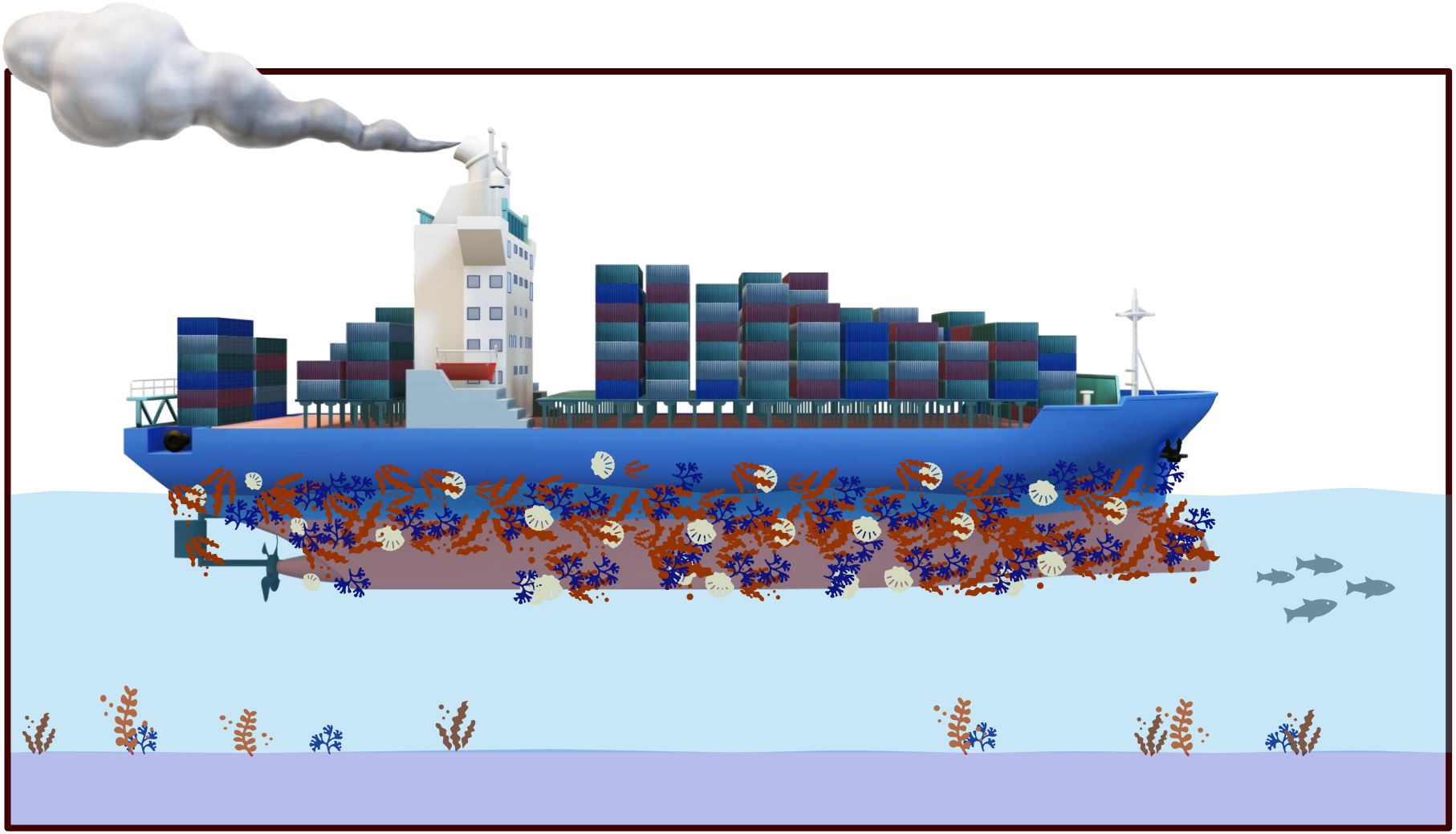
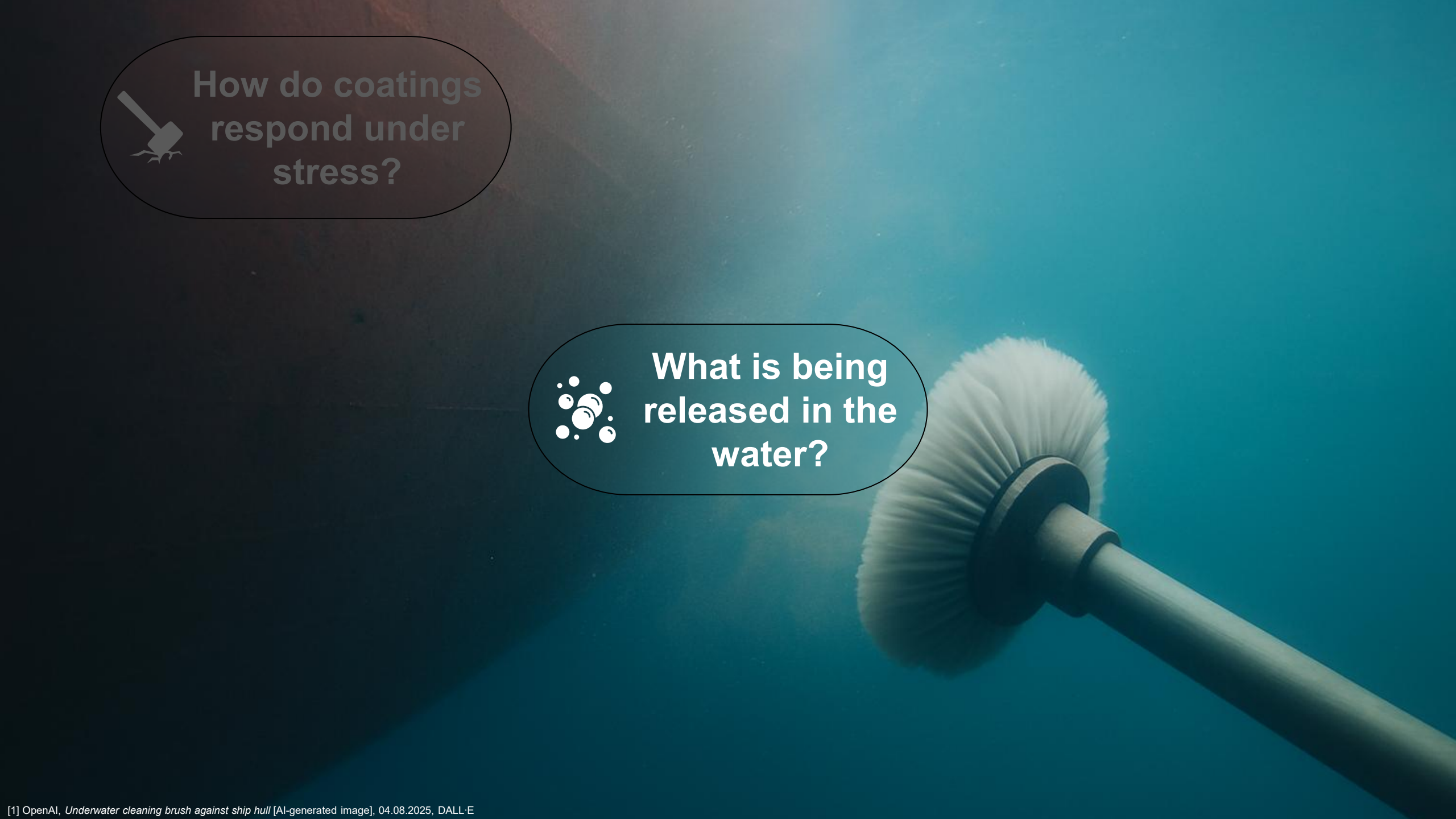


How do coatings respond under stress?

[1] OpenAI, *Underwater cleaning brush against ship hull* [AI-generated image], 04.08.2025, DALL·E



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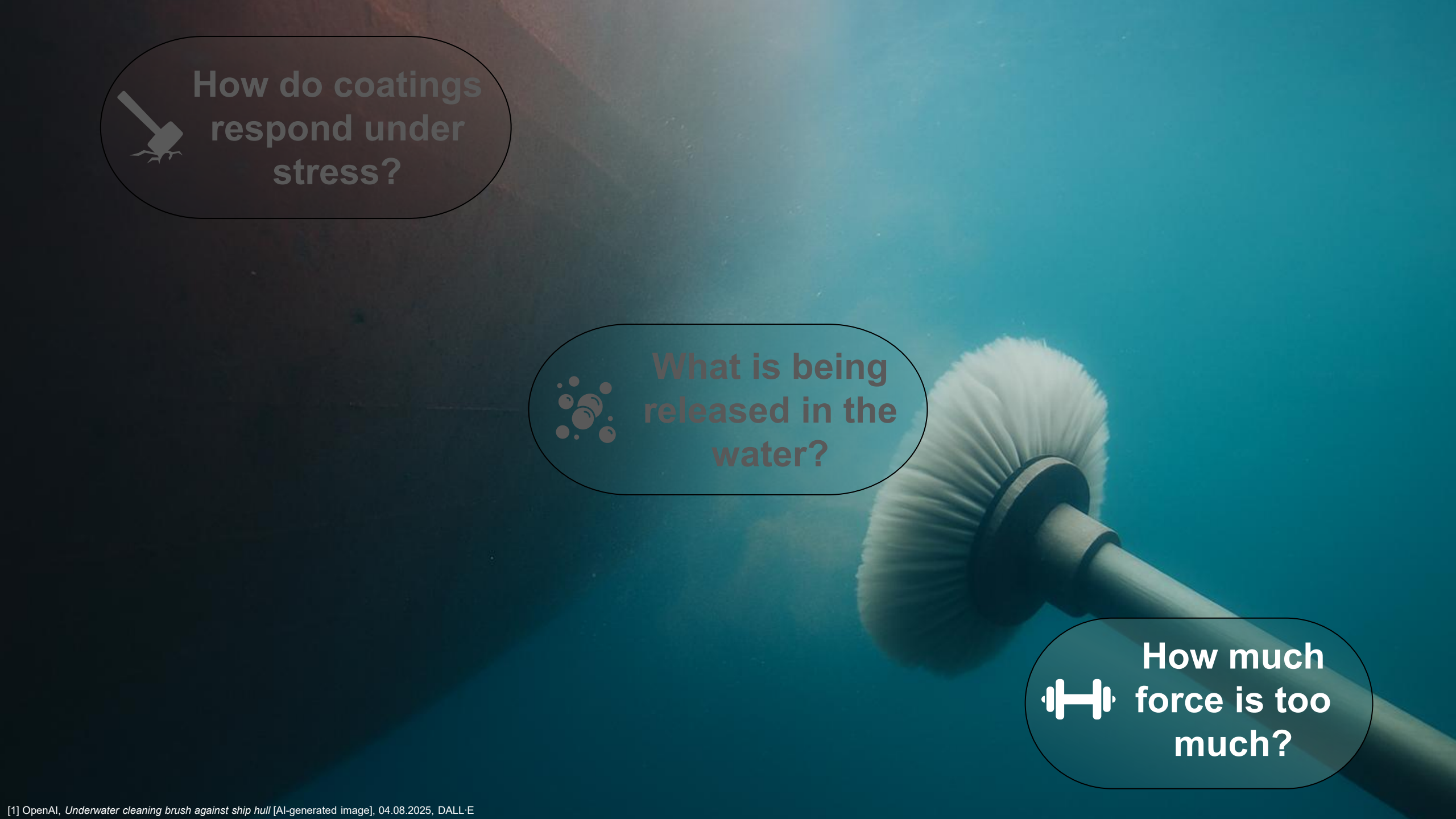

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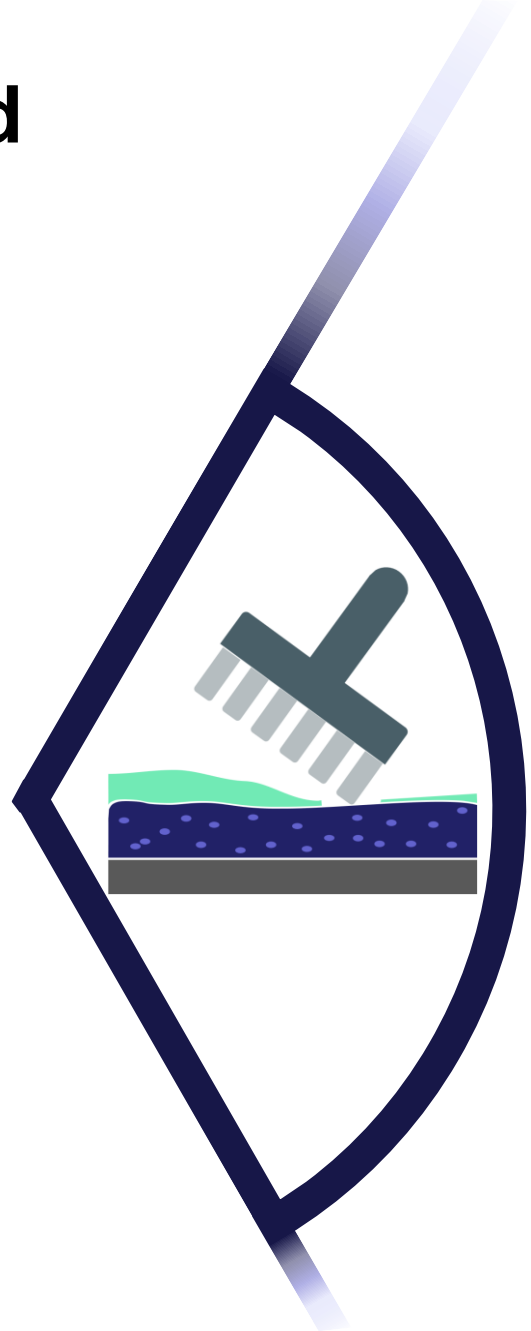
2. Designing a Controlled Cleaning Study



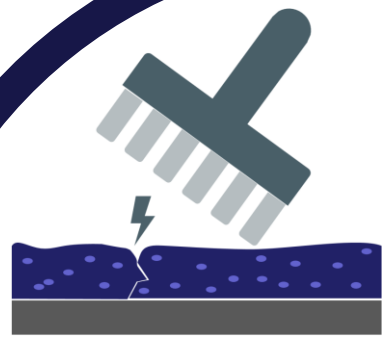
Performance evaluation

- Simulate in-water cleaning under lab conditions

2. Designing a Controlled Cleaning Study

Damage analysis

- Surface degradation
- Compatibility coating – cleaning



Performance evaluation

- Simulate in-water cleaning under lab conditions

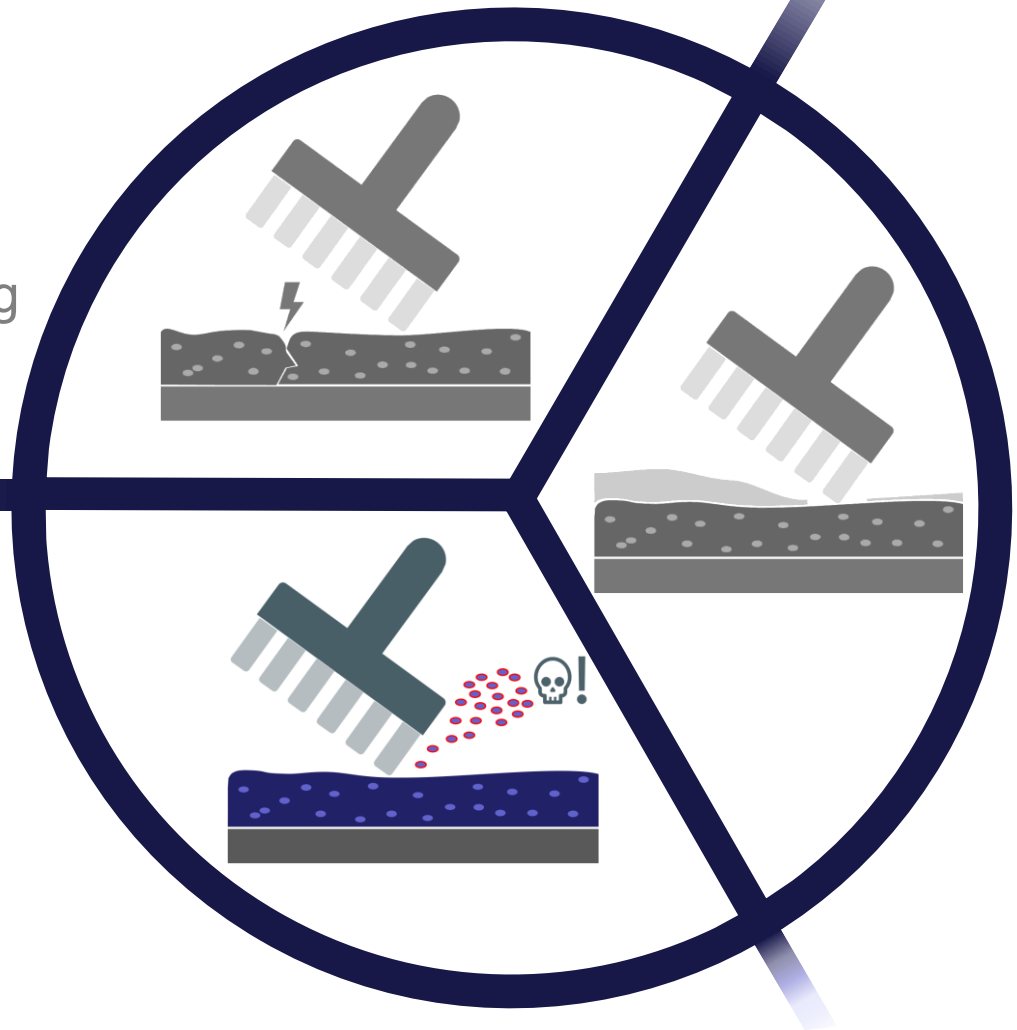
2. Designing a Controlled Cleaning Study

Damage analysis

- Surface degradation
- Compatibility coating – cleaning

Release analysis

- Biocides
- Microplastic



Performance evaluation

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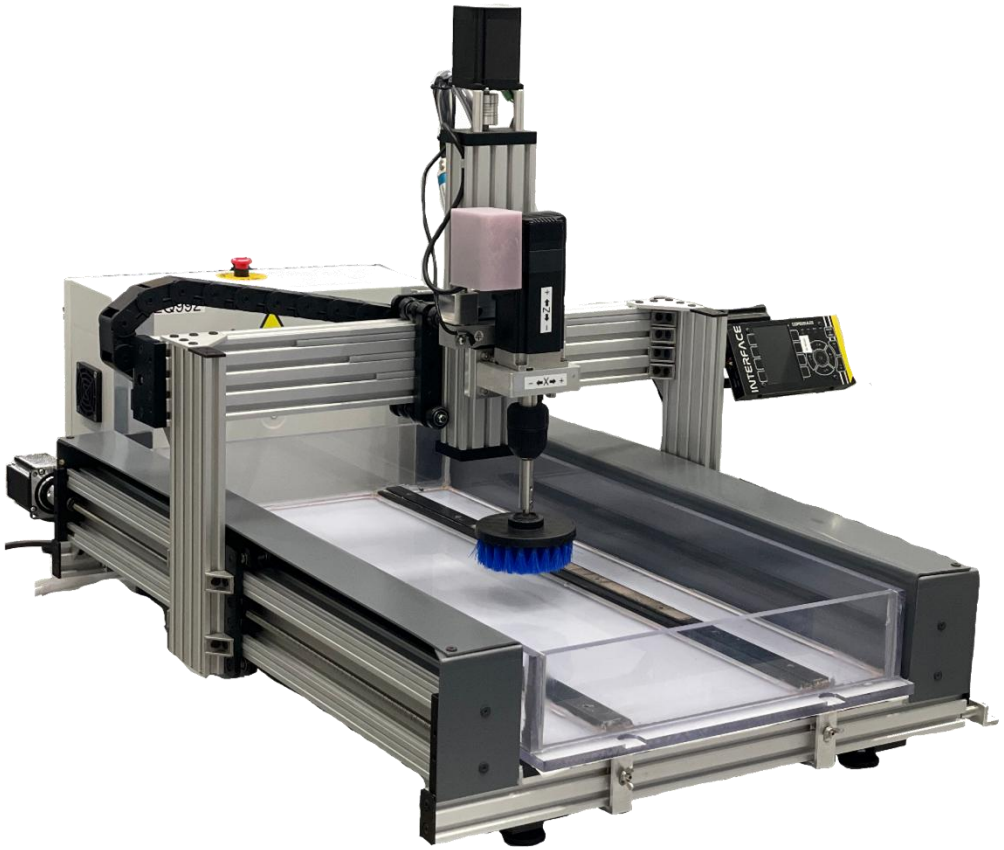
Automated Underwater Cleaning System (AUCS) – brush cleaning



3-axis gantry for controlled brush movement

Cleaning tank with sample fixation

3. From Ship Hulls to Benchtop: Our Test Systems

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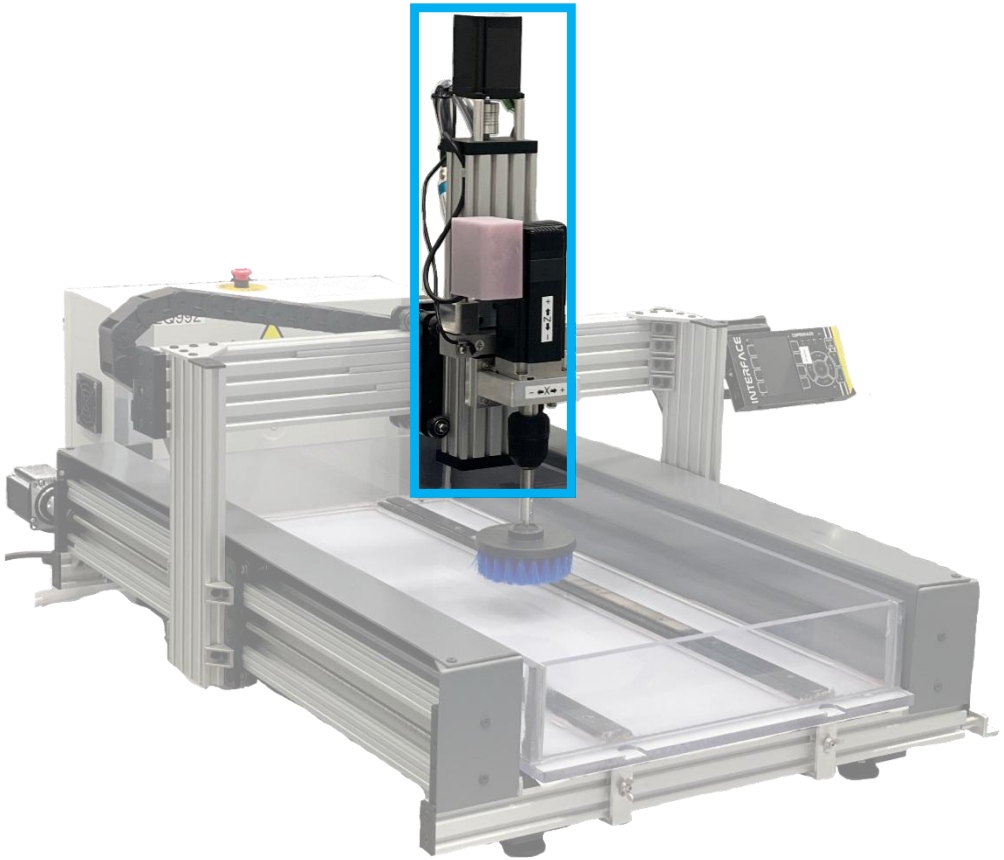

Adjustable rotation speed

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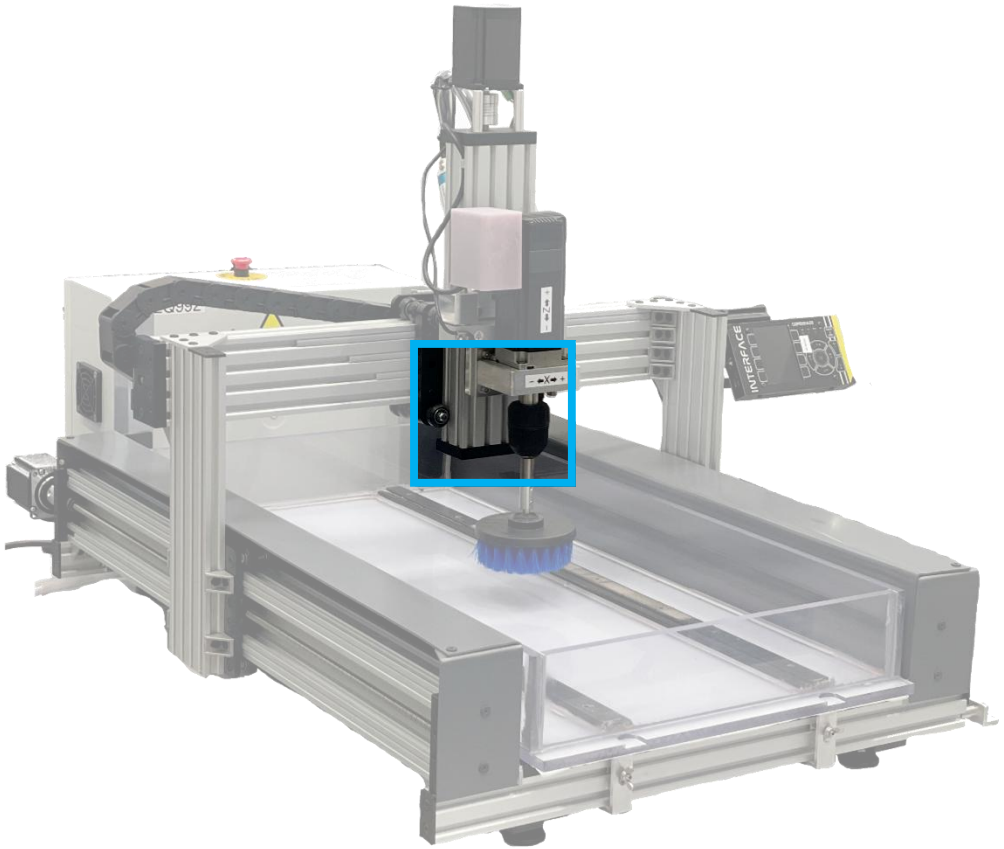

Force sensor

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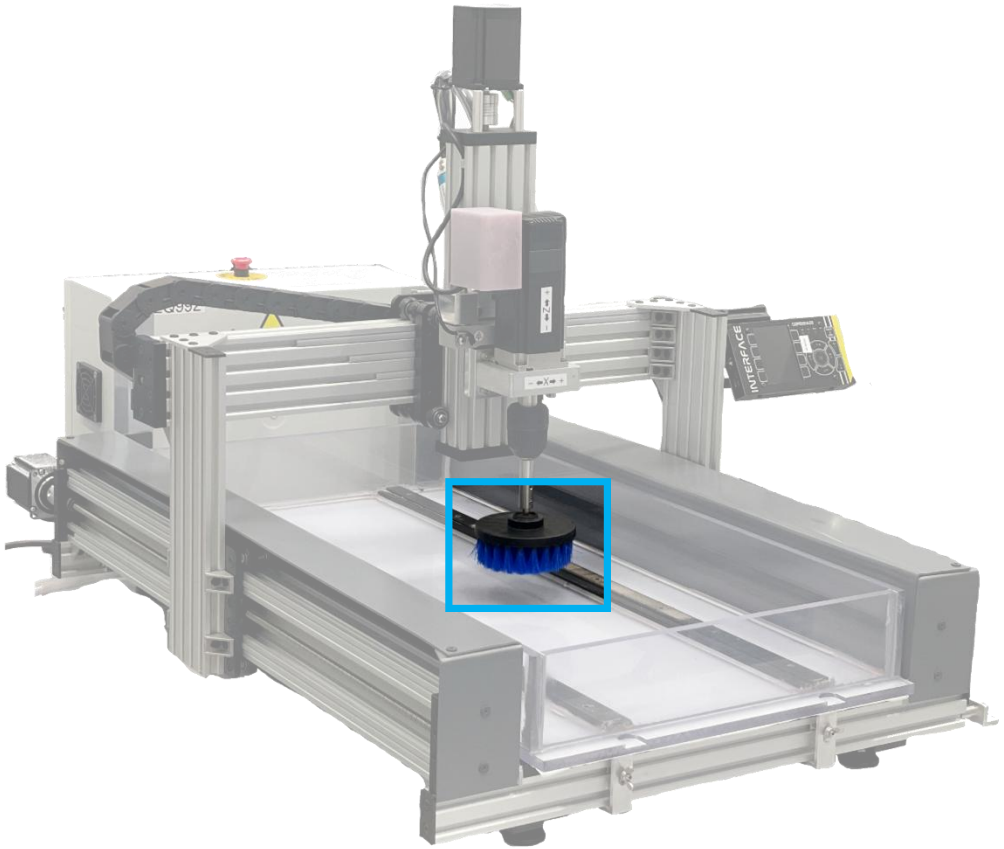
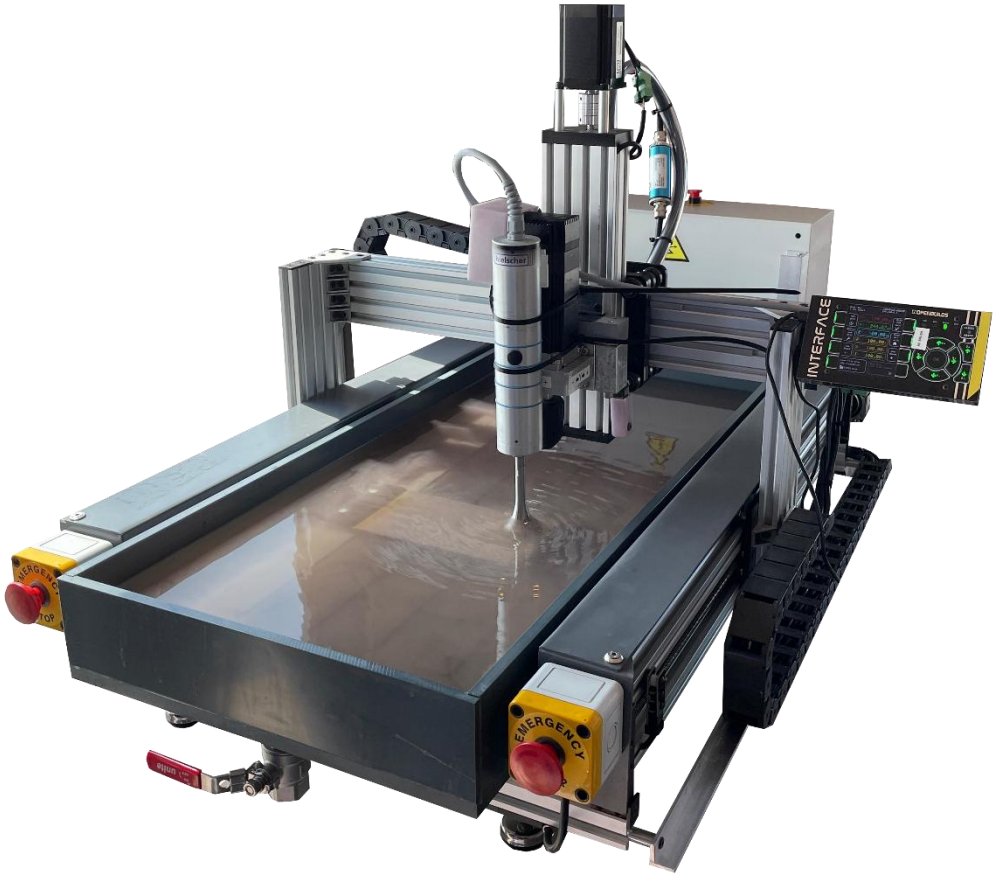
Automated Underwater Cleaning System (AUCS) – brush cleaning



Variable cleaning brushes

3. From Ship Hulls to Benchtop: Our Test Systems

Automated Underwater Cleaning System (AUCS) – Ultrasonic cleaning



3-axis gantry for controlled brush movement

Cleaning tank with sample fixation

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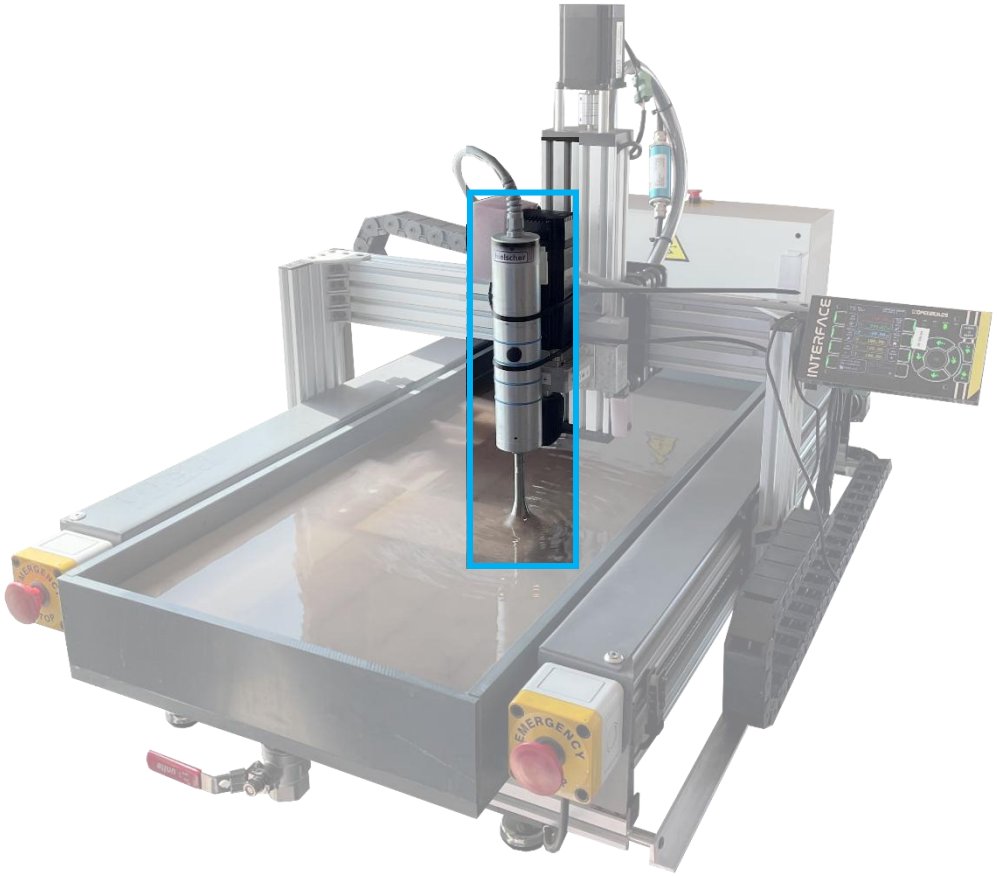

Ultrasonic source + variable sonotrodes

3. From Ship Hulls to Benchtop: Our Test Systems

Underwater Water-jet Cleaning System

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Underwater Water-jet Cleaning System

Cleaning tank with overflow system

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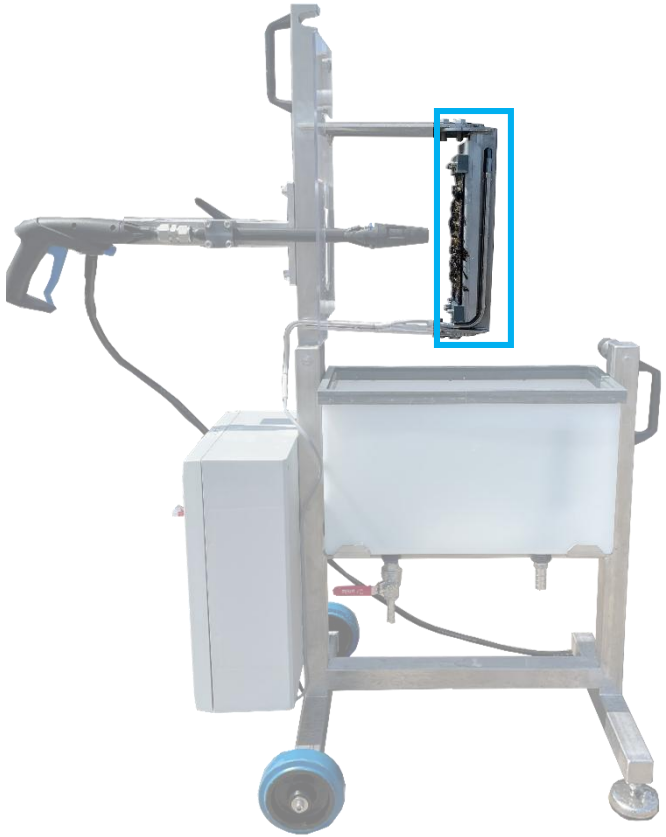
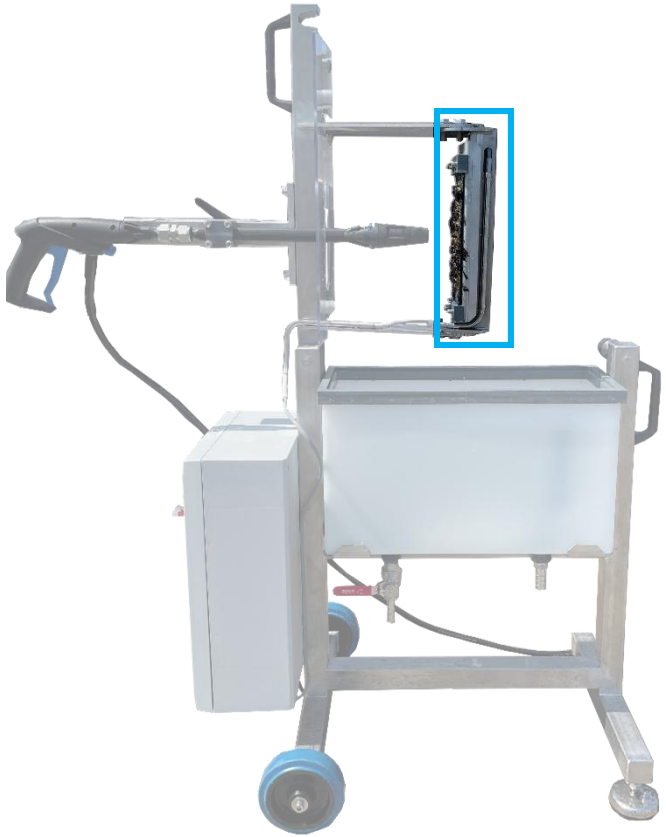
Underwater Water-jet Cleaning System



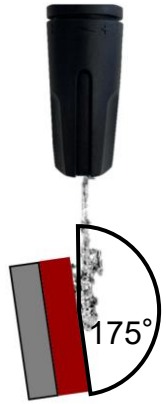
Sample holder with integrated force sensor

3. From Ship Hulls to Benchtop: Our Test Systems

Underwater Water-jet Cleaning System



Adjustable angle nozzle - substrate



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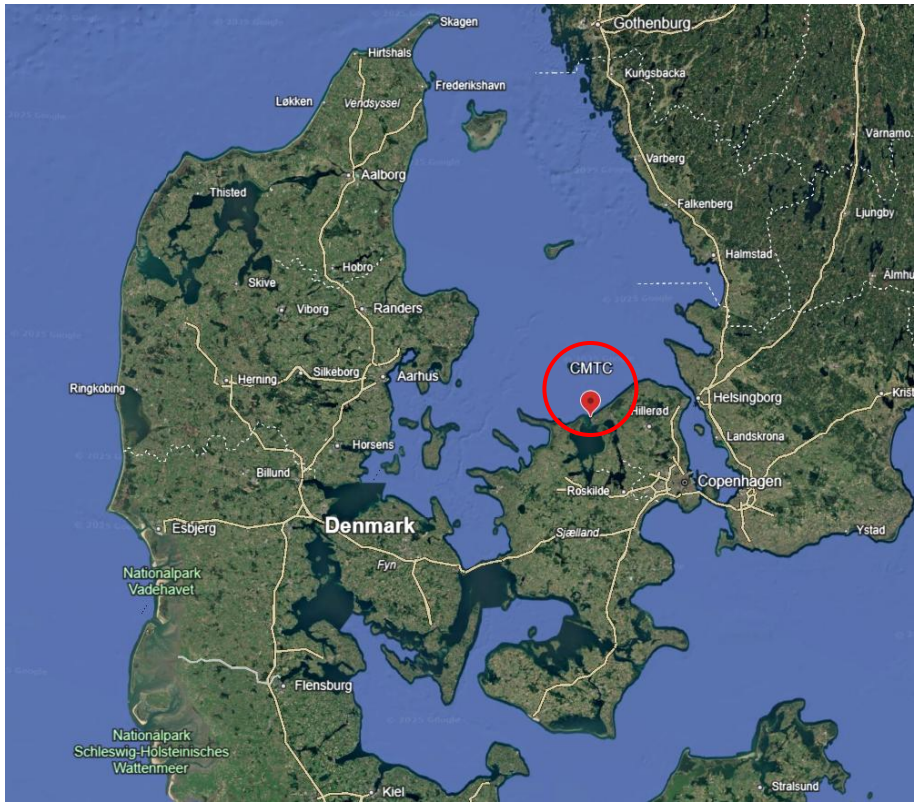
Underwater Water-jet Cleaning System

Water-jet with exchangeable nozzle

3. From Ship Hulls to Benchtop: Our Test Systems

Sample exposure



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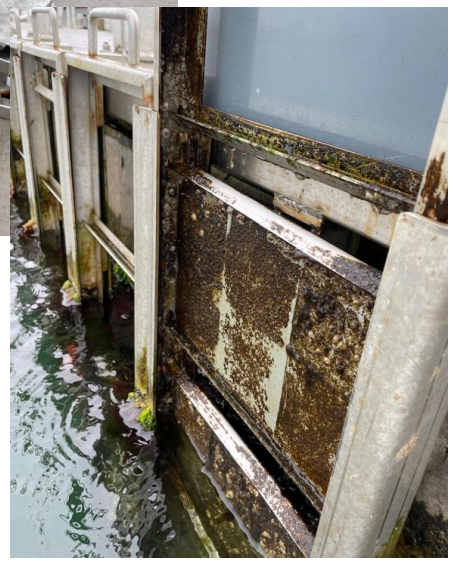
Sample exposure



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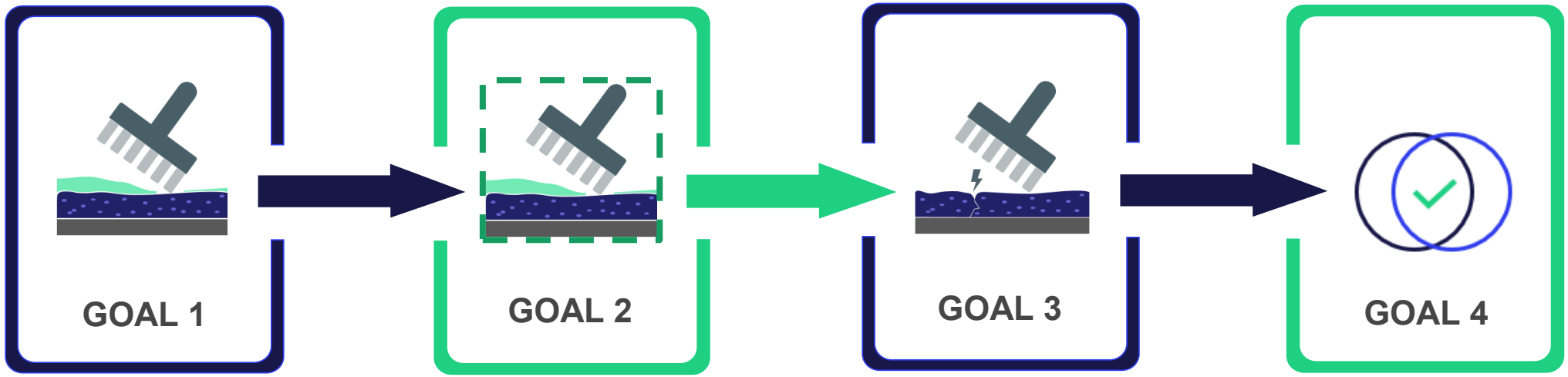

In-water cleaning simulation

Realistic process control of in-water cleaning

Framework for operational limitation

Lower limit: Effective removal

Upper limit: Coating damage

Coating Response

Assessing Coating Damage from Cleaning

Compatibility

Coating–Cleaning Compatibility

Thank you very much for your attention!

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