

WORKSHOP: A DISCUSSION OF BALLAST WATER SAMPLING APPROACHES AND RECOMMENDATIONS

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Ballast Water Sampling Workshop

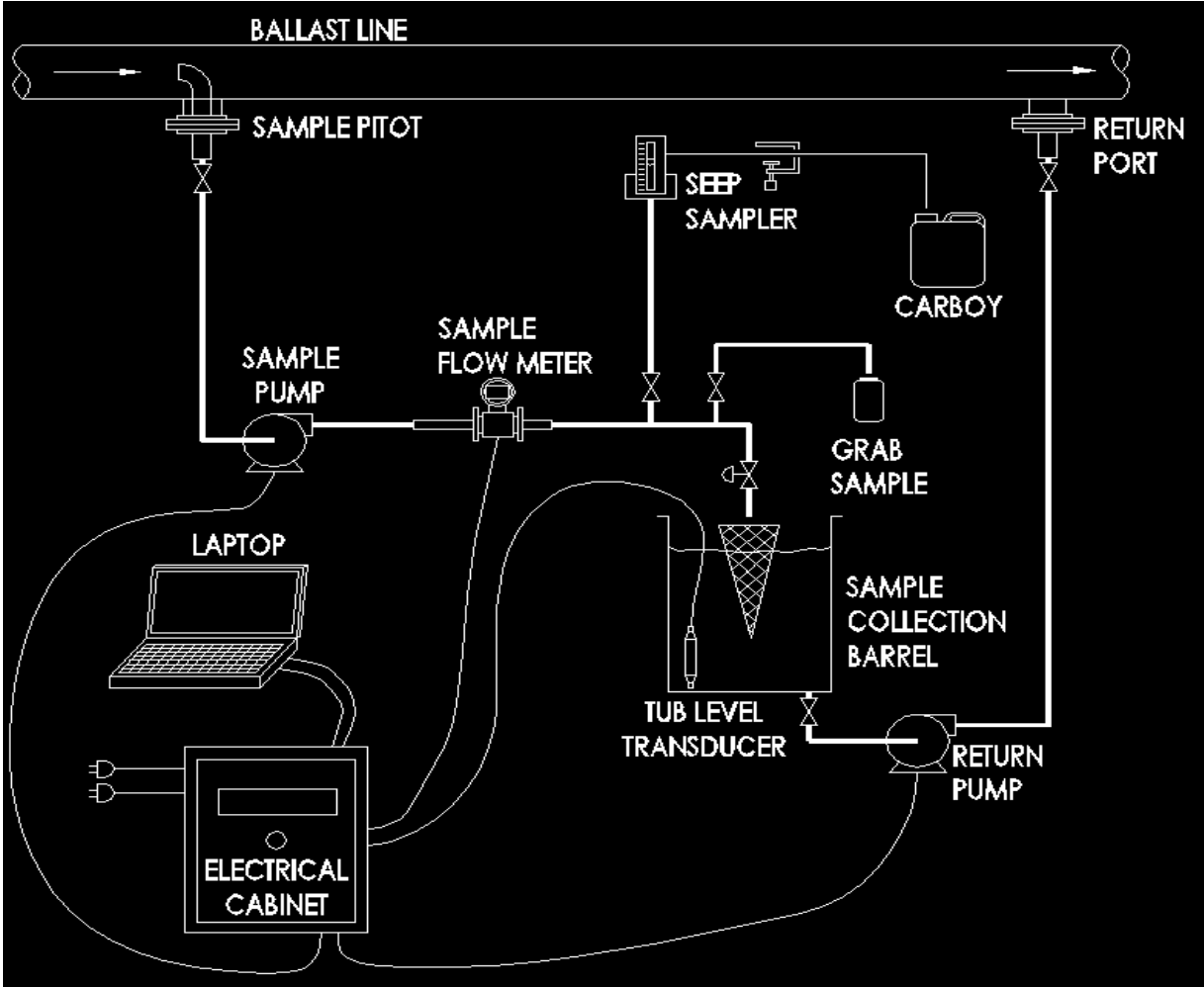
- Sponsored by USCG to examine available approaches to shipboard sample collection
- Occurred 10-11 June 2015 in Washington DC
- Invited attendees
 - Government agencies (USCG, EPA, MARAD, CSLC)
 - R&D, test, and engineering organizations (GSI, SGS, Glostten Associates, NRL)

Workshop Agenda

- Review available sample collection systems and approaches
 - Each group presents their sampling approach and associated equipment
 - 3 are portable to support one-time sampling
 - 1 is a skid for long-term shipboard testing
 - Identify capabilities necessary to achieve accurate and comparable data
- Discuss sampling methodology and statistical requirements to measure rare populations in ballast discharge
- Compare needs between type approval (verification) and Port State Control (compliance) tests
- Review the ISO 11711 ballast water sampling and analysis standard
 - Identify updates to Part 1 – Sample Ports
 - Consider input for Part 2 – Sample Collection Devices
 - Did not address Part 3 – Analytical Methods

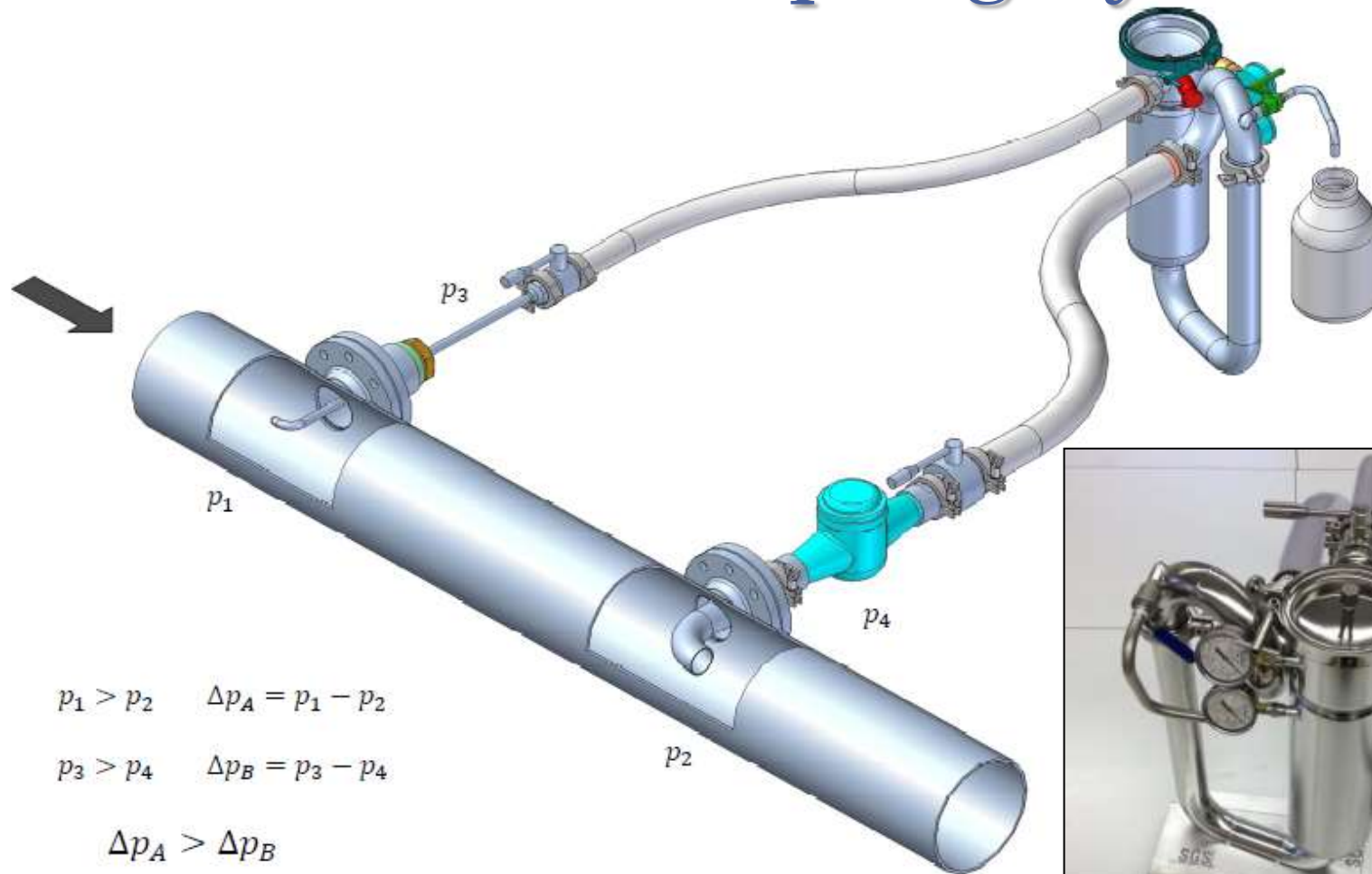
GSI Ballast Sampling System

Components on pack frames for transport



Plankton nets for sample collection

SGS Ballast Sampling System



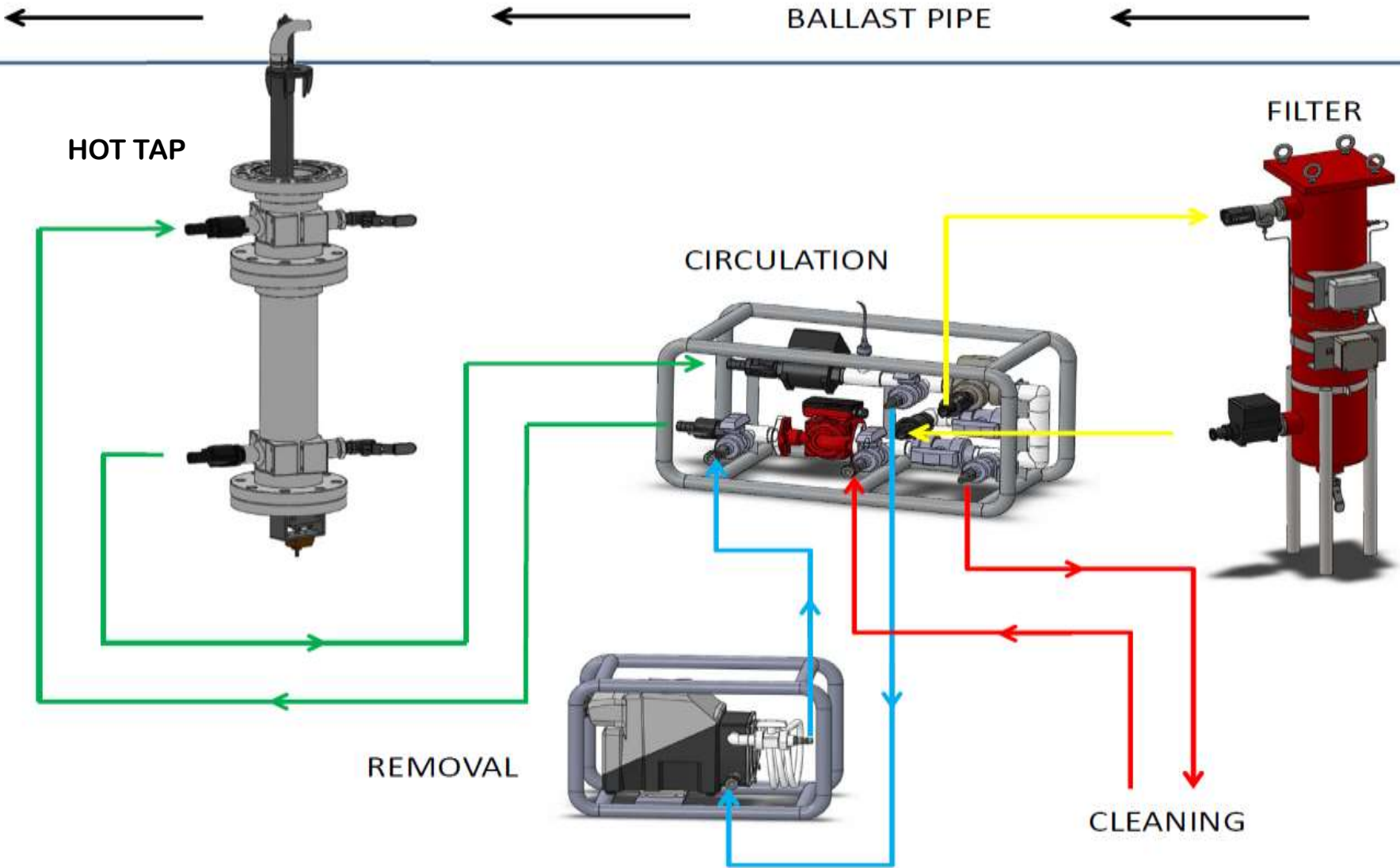
$$p_1 > p_2 \quad \Delta p_A = p_1 - p_2$$

$$p_3 > p_4 \quad \Delta p_B = p_3 - p_4$$

$$\Delta p_A > \Delta p_B$$

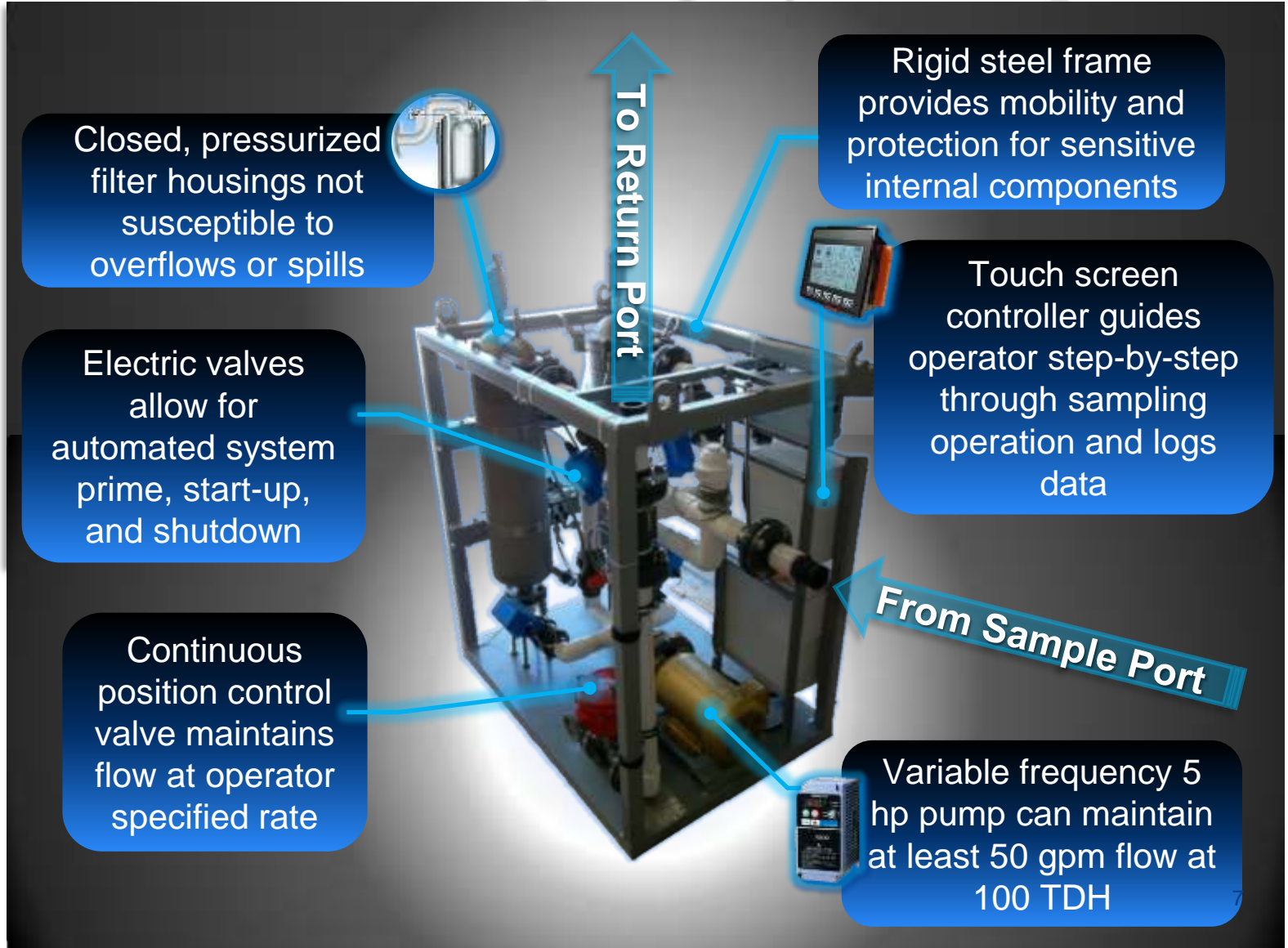


Glosten Ballast Sampling System



Figures from The Glosten Associates

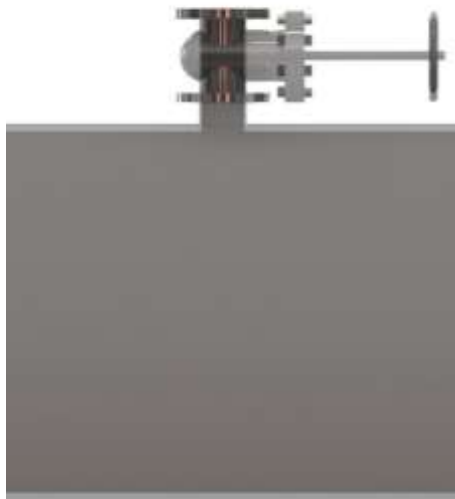
NRL Ballast Sampling System (p3SFS*)



*Third prototype filter skid

Discussion – ISO 11711-1 Updates

- Standardize **fitting arrangements and terminology**
 - **Ports** with DIN 100 (4”) flange and fully ported valve (part of ship)
 - **Probes** distinct from port (sized per sampling criteria)



Sample Port
and Valve



Sample Probe



Port with
Probe Installed

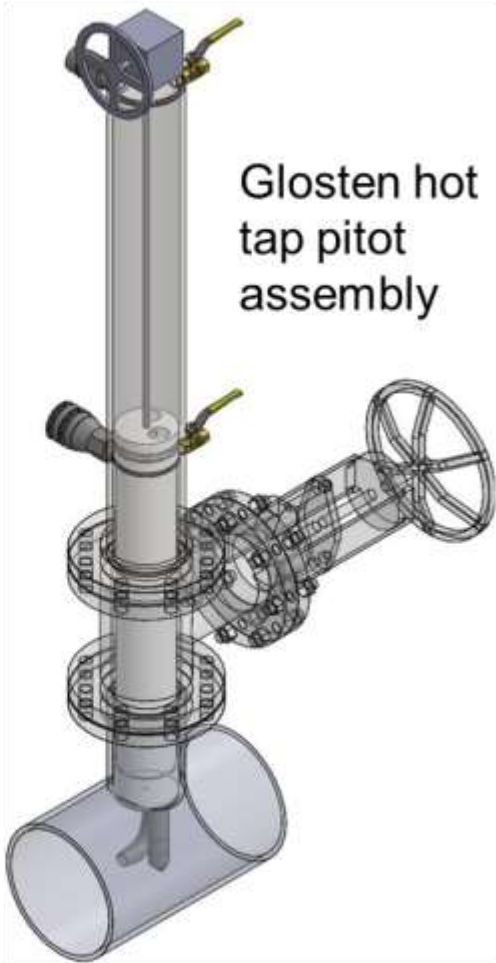
Sample Probe Design Variations



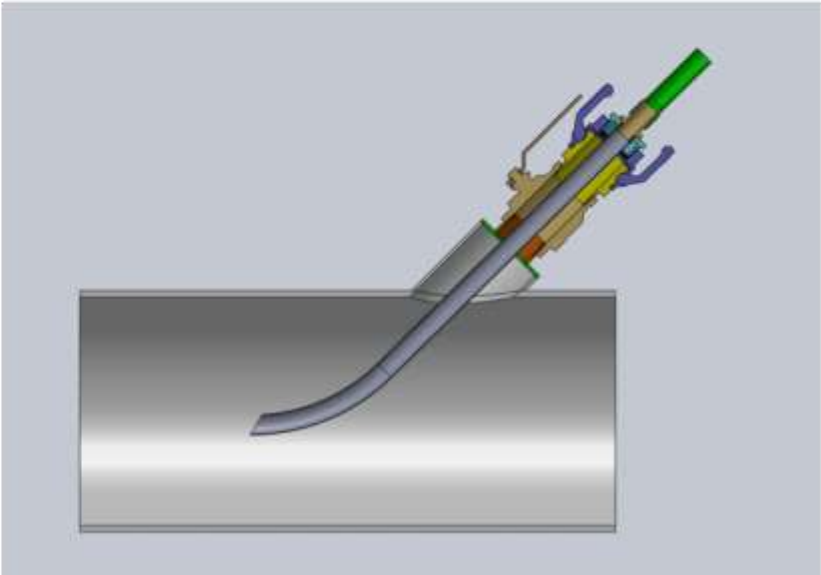
SGS "port bend"
or straight probe



Indiana Harbor
elbow sample
probe



Glostien hot
tap pitot
assembly



CDM Smith
removable 45°
sample port &
probe

Discussion – Measurements

- Measurement confidence intervals and detection limits associated with collecting and counting sparse organism populations
 - Poisson statistics require a **representative sample** of the volume of interest
 - Sample and analytical volumes directly affect the **confidence intervals** of the measurement
 - Software tools are useful for assessing sample volume tradeoffs (e.g., USCG ballast water STEP 2010 page)

Discussion – Measurements

- **Compliance** (Port State Control, PSC) vs. **verification** (type approval, TA) testing
 - Compliance officers have limited time as they have many items to check on a ship
 - TA testing is performed at both land-based test facilities and on board ships over extended periods of time
- Both **currently require** a method detection limit (MDL) at or better than the regulated discharge limit
 - Several labs are evaluating handheld compliance tools that may provide the ability to indicate gross exceedance of the discharge standard, but do not measure directly to the standard (proxy measures)
 - These may be a future alternative for PSC and ship operators to provide a quick assessment without sampling of large volumes

Discussion – ISO 11711-2

- What parameters are needed to specify the sample collection device?
 - **Operational** capabilities (e.g., flow rates, sample volumes, sample collection time)
 - **Measurement** capabilities (e.g., core ETV parameters, parameters that could affect mortality, such as differential pressure)
 - **Control functions and data logging** (e.g., alarms, proportional flow control, flows, volumes)
 - **Standard operating procedure** (requirements to achieve a MDL of ≤ 10 live org mL⁻¹ or m⁻³ with statistical probability of $p < 0.05$)

Conclusions

- Achieved consensus on **recommendations to update Part 1 guidance**, including:
 - Terminology to clarify:
 - Sample port
 - Sample probe
 - Sample collection device
 - Additional guidance to optimize the location of a sample port in ballast piping
 - Port, flange, valve and probe configurations
 - Requirements for access and clearance

Conclusions

- **Identified many of the capabilities to be specified in ISO 11711 Part 2 guidance**
 - Operational ranges for capabilities are still undefined
 - Will need to discriminate between required capabilities and features for sample collection systems
- Report to USCG documents findings

Looking Ahead – Next Steps

- Guidance for sampling device validation
 - All sample probe designs had been **modeled and empirically validated**
 - This is good engineering practice – should it be required in ISO 11711?
 - A test protocol for sample collection device evaluation and comparison would be useful
- Draft text for ISO 11711-2
 - ID minimum required **capabilities vs. features**
 - Specify **validation requirements** for the sampling SOP
- Conduct a study with multiple devices over a range of organism concentrations and locations

Acknowledgements

This work was funded by the US Coast Guard,
agreement HSCG23-14-X-MMS010

This work does not represent the official position of the
US Coast Guard.

We appreciate the advice and programmatic support of
Richard Everett and Regina Bergner

This work was supported by Diane Lysogorski, Section
Head of NRL Code 6136 and Director of the Center for
Corrosion Science and Engineering - Key West, Florida