# PRESENTATION OUTLINE

| 01 | Overview of CSL |
| 02 | Ferbec |
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We are The CSL Group Inc., a world class provider of complex marine solutions with a history that dates back to 1845. We are the world’s largest owner and operator of self-unloading vessels, the third largest cement carrier, and a leader in high-efficiency transhipment solutions.

- 1,500 employees
- 97 vessels
- 50+ types of dry bulk commodities shipped globally
- 85+ customers worldwide
SHIP OVERVIEW

• Geared Bulk Carrier
• 49,502 dwt
• Slow speed 2-stroke ME
• Single screw, fixed pitch propeller
• 3 Gen sets
FERBEC PROJECT

SCOPE

• Evaluate the possibility of a cavitation monitoring system
• Establish a baseline trial at various speeds

PROJECT OVERVIEW

• Installed 3 pressure sensors, an accelerometer and data collection system onboard
• Installed vertical line array
• Passed the array at 7,9,11 and 13 kts
FERBEC RESULTS

RESULTS

• Evaluated the possibility of a cavitation monitoring system
• Establish a baseline trial at various speeds
• Cavitation onset at ~6kts
• Cavitation status light integrated into bridge display
NUKUMI OVERVIEW

SHIP OVERVIEW

• Self Unloading Bulk Carrier
• 31,600 dwt
• Diesel electric
• Twin podded design
• CPP
• 4x medium speed, 4 stroke engines
• URN-M Notation
NUKUMI URN-M
NUKUMI SUMMARY

URN RESULTS

Measured during sea trials for URN-M notation

- 50% MCR
- 12kts
- 190dB maximum at 12Hz
- Challenges:
  - Higher than desired background noise, 130 dB
  - Shallow water depth of 54m (ship LOA is 225m)
MARS SUMMARY

MARS (MARINE ACOUSTIC RESEARCH STATION)

The MARS Project is an applied research venture whose purpose is to measure the underwater noise radiated by ships, to understand its origins, and to propose relevant methods for its reduction in collaboration with Canadian navigation professionals and regulators.

Objective 1: design and deployment of instrumentation in the St. Lawrence Estuary near Rimouski

Objective 2: measure and provide information in near real time on the acoustic signatures of partnerships following the ANSI/ASA S12/64-2009 standard and then to study links between radiated noise, environmental parameters, and ship operating conditions

Objective 3: carry out vibration and acoustic diagnostics on board ships to identify and prioritize sources generating underwater noise within the ship.

Objective 4: assemble the knowledge produced by the three previous objectives to propose and test methods to reduce radiated noise that are compatible with ship operational constraints.
TRILLIUM CLASS

SHIP OVERVIEW

• Self Unloading Bulk Carrier
• 34,490 dwt
• Single screw
• Controllable Pitch Propeller
• 3 Gen sets
## TRILLIUM VS NUKUMI

### SHIP OVERVIEW

<table>
<thead>
<tr>
<th></th>
<th>TRILLIUM</th>
<th>NUKUMI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHIP TYPE</strong></td>
<td>Self-Unloading Bulk Carrier</td>
<td>Self-Unloading Bulk Carrier</td>
</tr>
<tr>
<td><strong>DWT (T)</strong></td>
<td>~34,500</td>
<td>31,600</td>
</tr>
<tr>
<td><strong>MAIN ENGINE(‘s)</strong></td>
<td>Slow-Speed 2-Stroke, 8750kW</td>
<td>4x Medium Speed, 6000kW Total</td>
</tr>
<tr>
<td><strong>PROPULSION</strong></td>
<td>Direct Drive</td>
<td>Diesel Electric, Podded Design</td>
</tr>
<tr>
<td><strong>PROPELLER</strong></td>
<td>4 Blade, Controllable Pitch</td>
<td>4 Blade, Controllable Pitch</td>
</tr>
<tr>
<td><strong>RUDDER</strong></td>
<td>Steering Nozzle</td>
<td>2 x High Lift Rudder</td>
</tr>
<tr>
<td><strong>GENERATOR ENGINE</strong></td>
<td>3 x Medium Speed, 4-Stroke</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>FUEL CONSUMPTION AT 12KTS (MT/D)</strong></td>
<td>20.6</td>
<td>18.3</td>
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</tbody>
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TRILLIUM VS NUKUMI

Trillium

Nukumi
NUKUMI PROPULSION
TRILLIUM VS NUKUMI

Points of measurement on Trillium Class

Points of measurement on Nukumi
TRILLIUM VS NUKUMI
TRILLIUM VS NUKUMI

Thunder Bay – Passage #2

Nukumi – Passage #2
Conclusions
CONCLUSIONS

• Sea Trial URN measurements are challenging

• It is possible to measure the onset of cavitation

• It is possible to measure different sources of ship noise

• It is possible to reduce noise and GHG through design