

## Innovative Solutions Canada (ISC)

*Quantifiable Escort Tug URN Mitigation with Quiet Propeller, Machinery and Operations Design*

Focus: escort tugs

**Underwater Noise  
Measurement**

**Quantifying Underwater  
Radiated Noise Emissions**

**TugEm Analysis Tool**

## Quiet Vessel Initiative (QVI)

*Quantifying Underwater Noise Reductions from Environmentally Friendly Tugs*

Focus: battery-electric tug



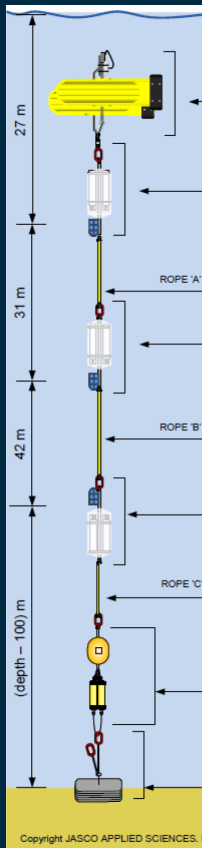
## Measurements of URN

- Sea trials
  - Held in Fall 2023
  - URN measurement
  - Onboard N&V measurements
- URN trial type:
  - Transits at constant speed
  - Bollard pull
  - Baseline stationary

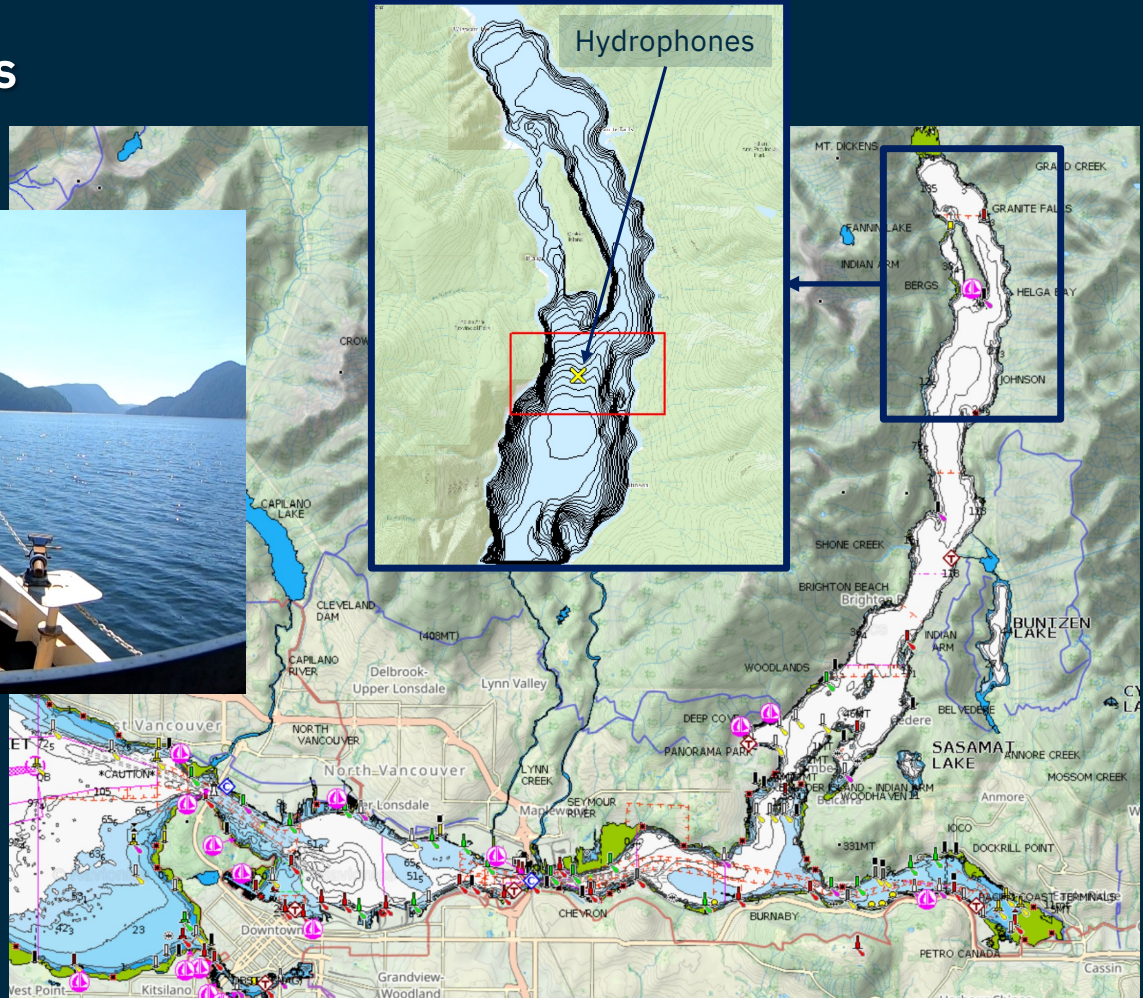


# Underwater Noise Measurements

## JASCO Hydrophone deployment

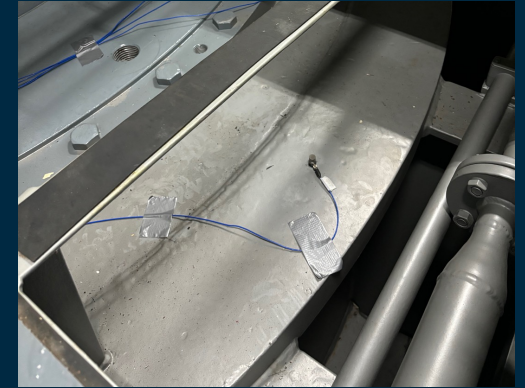


JASCO Applied Sciences photo



## Onboard Equipment

- 15 x accelerometers
- 2 x microphones
- N&V DAQ system
- Vessel State DAQ



## URN Results

- Tug noise is generally lower than the assisted ships for transits
- However, BP generated noise is comparable to assisted ships (VLCC)
- Diesel propulsion > battery propulsion transits
- Diesel propulsion comparable to battery in BP
- Diesel-electric mode is comparable to battery-electric mode

Trial Type	RNL Levels (dB re 1µPa)				
	VLCC Average	Diesel Tug 1 28 m LOA	Diesel Tug 2 28 m LOA	HaiSea Wamis Genset Mode (DE)	HaiSea Wamis Battery Mode (BE)
Transit 5~6 kn	187	180	170	164	159
Transit 7.5~8 kn		181	174	165	162
Transit 10.0 kn		184	177	170	169
Bollard Pull ~25% Power	187	177	171	179	178
Bollard Pull ~50% Power		180	176	183	182
Bollard Pull ~100% Power		188	189	N/A	191



## Work ongoing at RAL and next steps

- Use measurement data to:
  - Validate prediction models
  - Enhance *TugEm* prediction tool
    - SRKW impact metrics
    - Machinery noise module
    - Propeller noise module
- Explore design solutions to reduce critical URN contributors
  - Propeller selection
  - Resilient mount characterization
  - Acoustic and damping treatment
  - ???