CISMaRT 2020
November 25th

Workshop on Underwater
Radiated Noise from Ships

Today's Presentation

- **The Project Challenge**

- **How we got "Here"**

- **The Data**

- **Data Analysis Thoughts**

The Challenge

Transport Canada is seeking to identify technologies that result in both efficiency improvements and Underwater Radiated Noise (URN) reduction, conduct testing and validation of the technologies, in order to quantify linkages between efficiency improvement and/or emission reductions (GHG and/or CAC) and URN reduction.

GIT is a leading advanced materials engineering firm focused on providing innovative and smart coating solutions in the ocean industry.

GIT and LR

Introduction

- Graphite Innovation and Technologies (GIT) partnered with Lloyd's Register (LR)

- A joint work plan was developed to meet TC Stream 3 Call for Proposals (URN and GHG)

- Contract awarded July 2020

GIT and LR

Introduction

The two-year project will examine means and ways to reduce both Underwater Radiated Noise (URN) and Green House Gas (GHG) Emissions via a systematic framework for measuring, monitoring and understanding these areas within Canada's Inshore Fishing Craft.

The end goal is to **extract practical and economically feasible changes** that lead to reductions in URN and GHG emissions.

Four areas:

1. Development of Coating
2. Baseline Studies
3. Post-Hull Coating/Refit Studies
4. Awareness Program

Project Phases

Nov 2020 →

Phase 1
- Testing Methodology Completed And Approved
- Initial Awareness Program Approved
- Six Boats Selected

Phase 2
- Instrumentation Installed / Formal Testing Begun
- Awareness Program Delivered To Boat's Crew
- Preliminary Data Analysis To Ensure Data Integrity

Phase 3
- Continue Measurements
- Grow The Data Sets
- Continue to Expand The Awareness Program

Phases 4 And 5
- Refinish Hulls
- Repeat Trials and Comparative Analysis
- Final Report, Awareness Programs, Presentation For TC

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Objectives

| Quantify	Quantify	Create	Deliverable
Quantify the underwater noise pollution of the inshore fishing craft.	Quantify the GHG emissions of the inshore fishing craft.	Create an awareness program to both educate and coach boat captains on how their actions impact URN and GHG emissions.	The developed program will serve as part of an awareness "kit" that can be distributed and implemented into small fishing communities across Canada.

Summer Intern

GIT and LR

Meet the Captains & the Team

GH and EK

Sea Trial & Hull Cleaning Sites
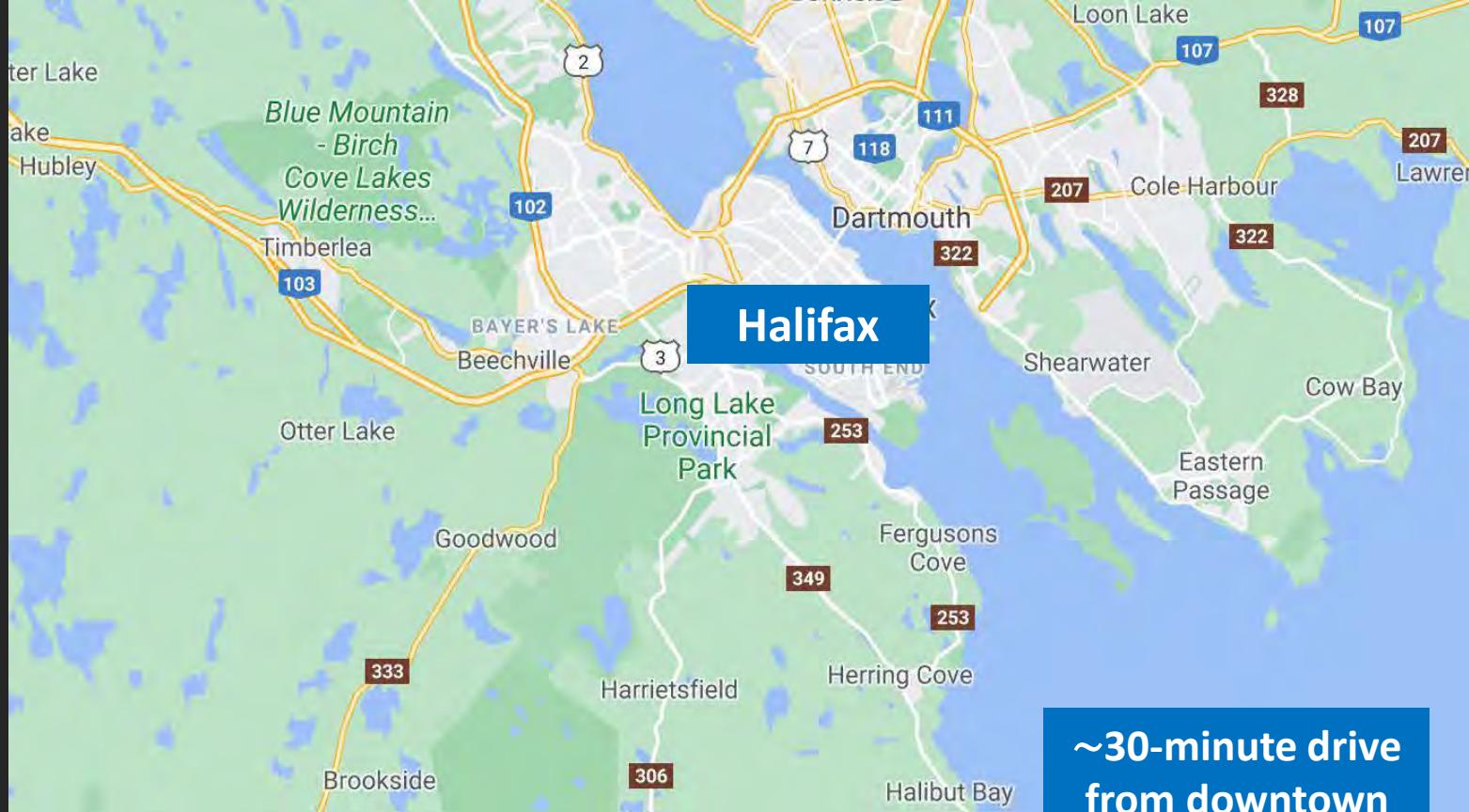
Halifax

~30-minute drive from downtown Halifax
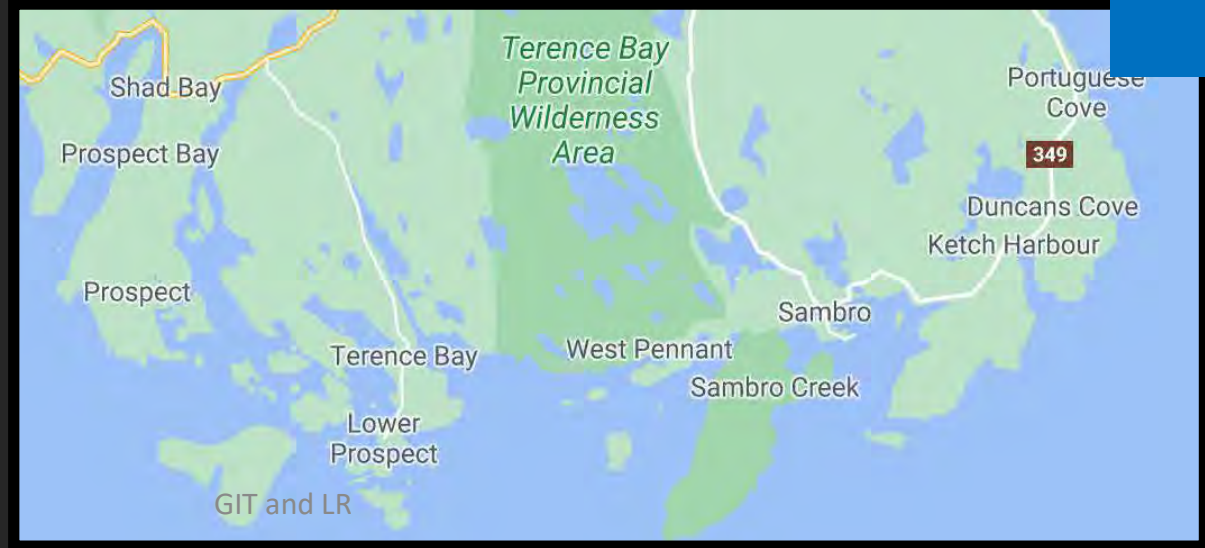
Hull Inspections Completed Fall 2020

Boats Can Be Readily Drydocked
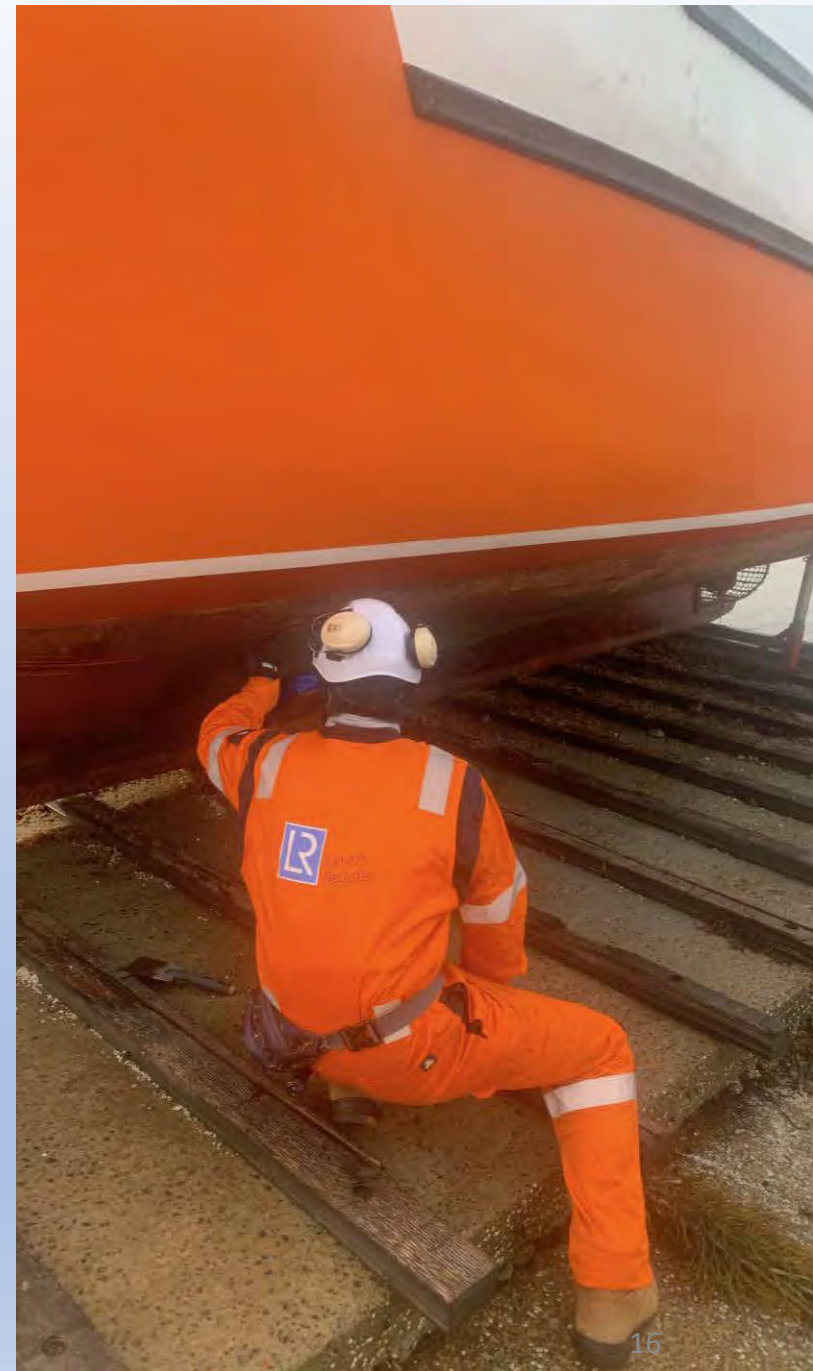
Quantifying Hull Roughness

Bait'em & Crate'em

Nicholas "R"

GHG Emissions Probe

Carbon Filters Dirty vs. Clean


Strain Gauge for Torque Measurement

Measuring **G**reenhouse **G**as **E**missions (**GHG**)

- Combustion Gas Analyzer System Installed

- Conducted Sea Trials at Various RPM

Comments from working with Boat Captains

- Open discussions about possible incoming regulations and restrictions with regards to URN & GHG emissions

- Some have already noted a significant difference in engine efficiency between a dirty hull and a clean hull

- Identified a need for a hull coating that can last multiple seasons and can be easily cleaned during drydock
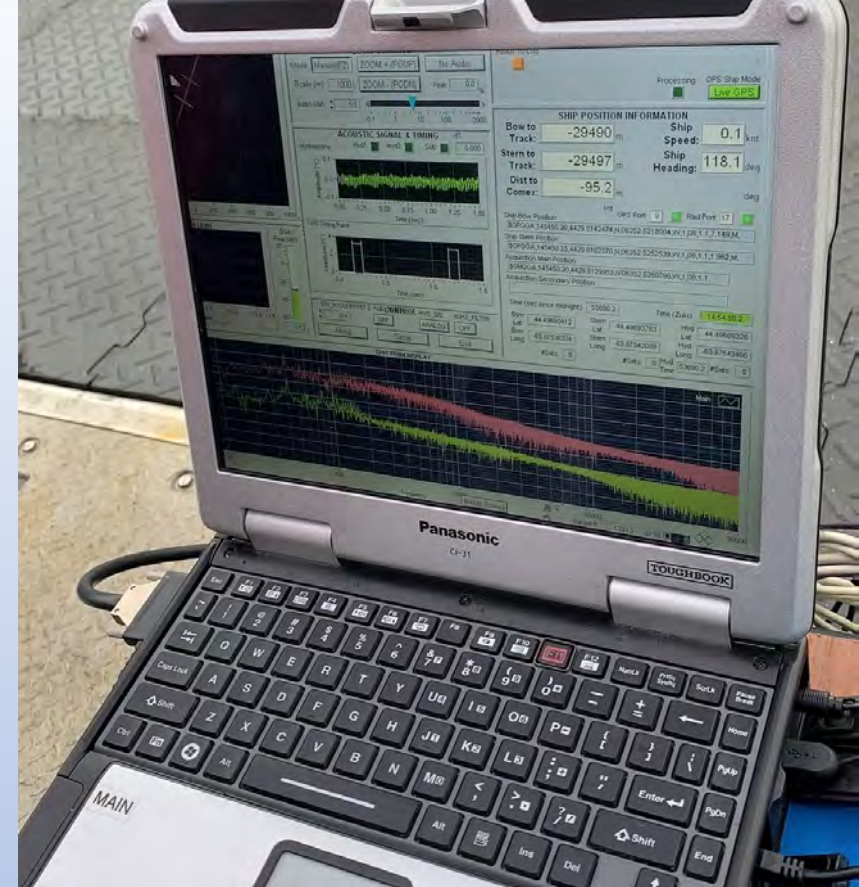
Measuring **U**nderwater **R**adiated **N**oise (**URN**)

- Digital & Analog Hydrophone Measurements

- Conducted Stationary & Dynamic Sea Trials

The Data

Boat
- The Transport Canada Data Sets consists of many time referenced measurements
- Engine performance measurements including RPM, fuel consumption, torque, particulate matter, GHG, AIS or GPS track data.
- Hull condition via inspection.

Environmental
- Underwater radiated noise (hydrophone data) measured with two different systems
- Meteorological data (wind, waves …) is recorded via buoys, weather monitoring stations, and captain's logs.

Analysis
- Data sets will need to be correlated, quality assured
- Multi-variate Analysis and
- Machine learning/AI approach applied to see if we can tease out hidden inter-relationships.
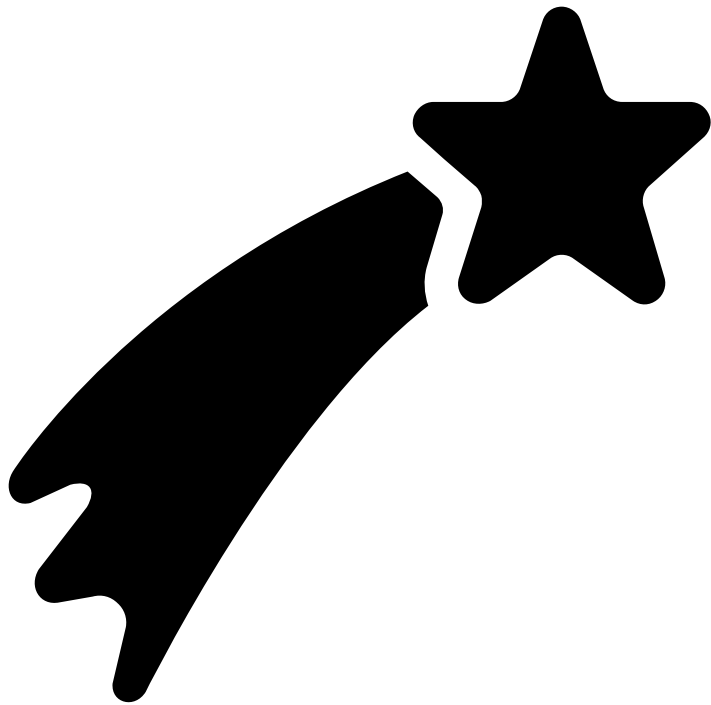
The Final Word

Captains are excited:

1. Outcomes of this project

2. Talk of the dinner table

3. Friendly competition to rank boats

   (fuel efficiency)

GIT and LR