

Research on Vessel Underwater Radiated Noise & Efficiency



Abigail Fyfe, Research Development Officer, Innovation Centre, Transport Canada



Transport
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Reduction of Emissions and URN

Canadian projects can be described in 2 categories:

1. Projects that examine the **CORRELATION** between vessel emissions/efficiency and URN
2. Projects that examine the **CO-BENEFITS** – emissions/efficiency and URN – associated with making a change to a vessel or its operation

Examining Correlation

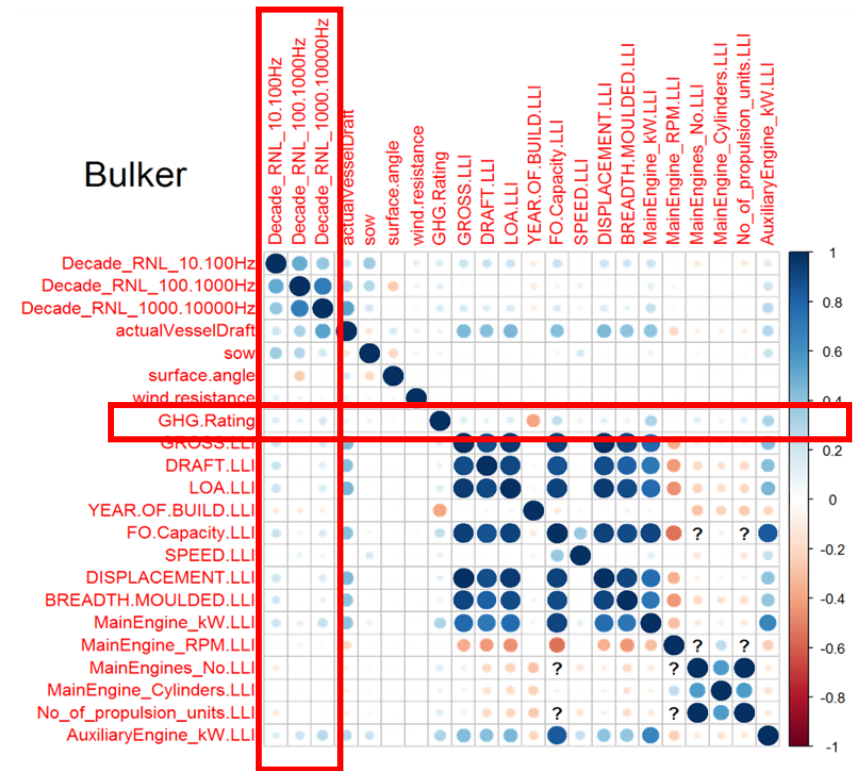
Vessel Correlations Study

JASCO Applied Sciences (Canada) Ltd, ERM Consultants Canada Ltd, Acentech, ECHO Program

Objective –to determine which vessel design and operational parameters influence URN

Method – statistical analysis of databases of vessel noise measurements and design and operational characteristics

Key Result - GHG Emissions Rating exhibited weak correlation with URN



Source: JASCO Applied Sciences and Vancouver Fraser Port Authority

Examining Correlation

URN and Vessel Efficiency

JASCO Applied Sciences (Canada) Ltd, DW ShipConsult

Objective – to determine whether a vessel's URN can be reduced without compromising efficiency

Method – analysis of tanker & containership designs, EEDI and URN; propeller design, efficiency and cavitation; market factors

Key Result – achieving EEDI by speed reduction is favoured and URN reduction may result, but overall impact may be limited if propellers are re-designed for efficiency at the reduced speed



Source: DW Ship Consult

Examining Co-Benefits – Hull Cleaning

M/V Cygnus Trials

National Research Council Canada, JASCO Applied Sciences (Canada) Ltd, ECHO Program

Objective – to evaluate the effects of hull and propeller cleaning on efficiency and URN of a Canadian Coast Guard patrol vessel

Method – full scale trials to measure performance and URN before and after hull and propeller cleaning

Key Result – Average 5% reduction in required propulsion power; no impact on URN; recommendations to improve experimental controls and improve confidence in results



Source: MarineTraffic.com



Source: National Research Council Canada

Examining Co-Benefits – Hull Coating

BC Ferry Vessel Trials

National Research Council Canada, JASCO
Applied Sciences (Canada) Ltd, ECHO
Program

Objective – to evaluate the effects of new hull coating on efficiency and URN of a BC Ferry vessel

Method – full scale trials to measure performance and URN before and after application of a new hull coating

Key Result – data is being analyzed; preliminary results indicate modest reductions in required power and URN at service speeds



Source: BC Ferries

Examining Co-Benefits – Hull Coating

URN and GHG Reduction for Fishing Vessels

Graphite Innovation and Technologies and Lloyd's Register Advanced Technology Group

Objective – to develop a new graphene-based coating and evaluate its impact on efficiency and URN of small fishing vessels

Method – full scale trials to measure performance and URN before and after application of a new hull coating on 6 vessels

Key Result – project is underway; baseline data has been collected and is being analyzed



Source: Graphite Innovation and Technologies

Examining Co-Benefits – Electric Propulsion

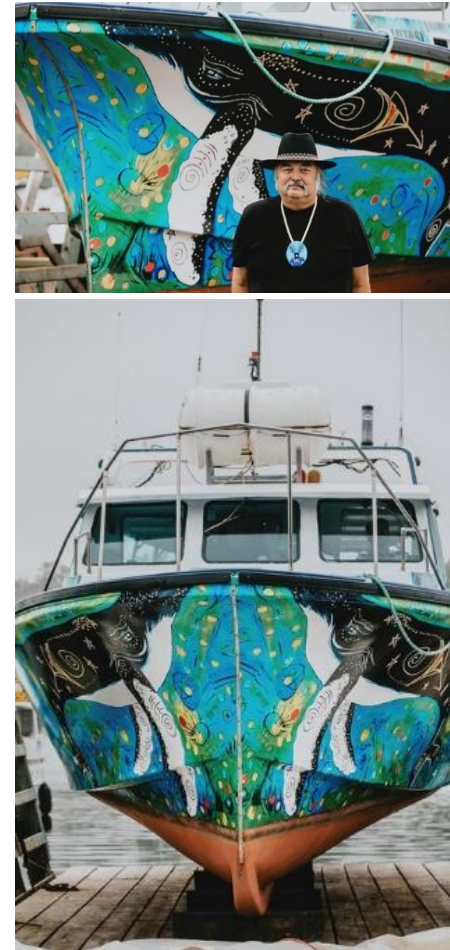
Electric Propulsion for Small Vessels

Glas Ocean Electric

Objective – to demonstrate emissions and URN benefits of a side-by-side diesel and battery-electric propulsion system

Method – full scale trials to measure emissions and URN; analysis of impact from using electric system for low speed operations typical for small fishing vessel fleet

Key Result – project is underway; data has been collected and is being analyzed



Source: Glas Ocean Electric

Examining Co-Benefits – Propeller Design

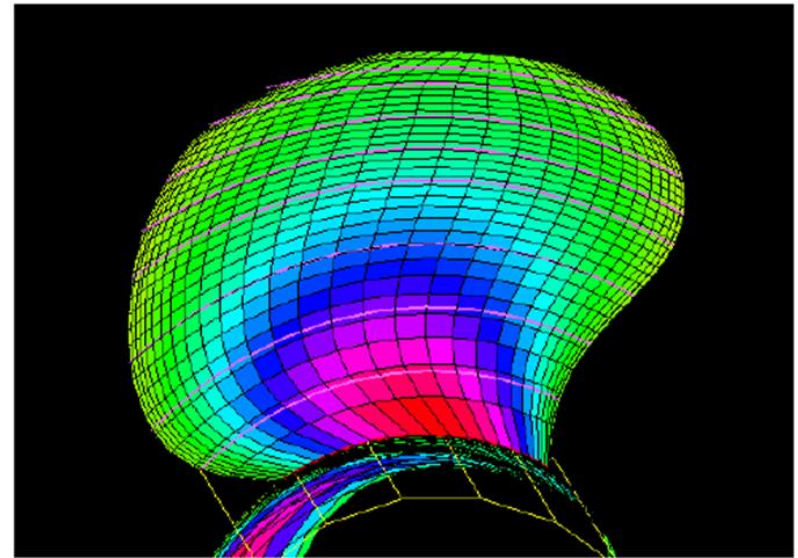
Parametric Propeller Noise Study

BC Ferries and DNV

Objective – to evaluate the effect of varying propeller design parameters and operational conditions on URN and efficiency

Method – numerical simulations of existing BC Ferry hull forms and propeller designs and operating points, and comparison with predictions for modified propeller geometries and off-design conditions

Key Result – project is underway; preliminary results indicate that tip-offloading improves URN, but with efficiency loss



Source: BC Ferries

Examining Co-Benefits – Propeller Design

Propeller Re-design and Optimization

Defence Research and Development Canada,
Lloyd's Register Applied Technology Group,
MARIN

Objective – to re-design the propeller, optimizing for improved cavitation inception and efficiency

Method – computation and model tests of existing and newly designed and optimized propeller

Key Result – improvements in cavitation inception without loss of efficiency; improvements being made to computational methods



Source: DRDC

Underwater Radiated Noise Monitoring

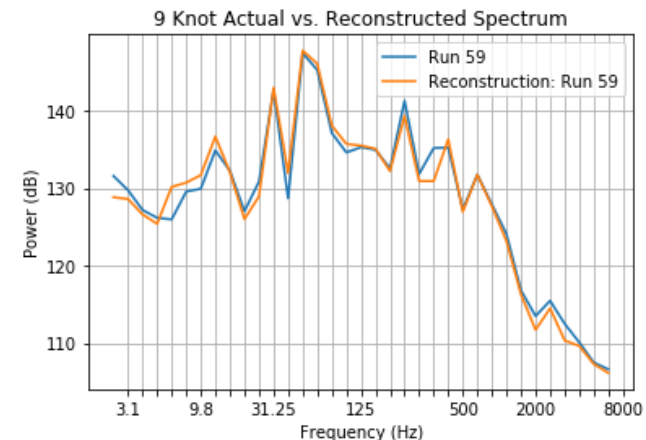
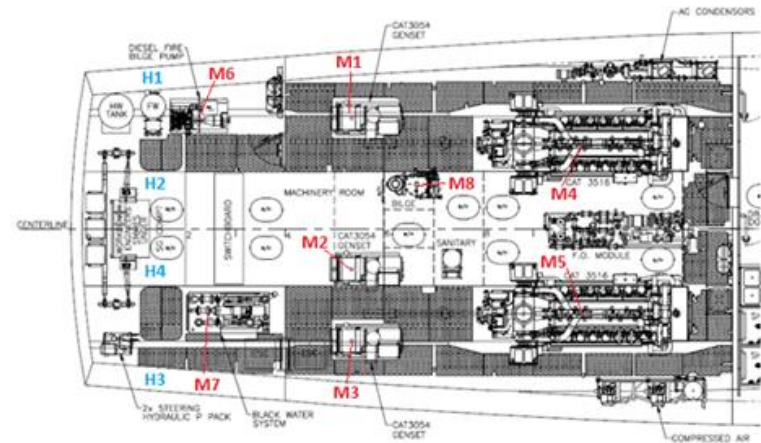
On-board/Off-board Noise Correlation

Defence Research and Development
Canada

Objective – to test a methodology for real-time estimation of vessel underwater radiated noise

Method – full scale trials to measure on-board vibrations and off-board noise; application of transfer function to re-construct off-board noise spectrum

Key Result – it is possible to re-construct the URN spectrum and cavitation state of the propeller using a few hull and machine-mounted accelerometers



Source: DRDC

Report Status and Links

Vessel Correlations Study

Phase 1 report: <https://www.portvancouver.com/wp-content/uploads/2020/05/2020-05-26-ECHO-Program-Vessel-Noise-Correlations-Study.pdf>

Phase 2 report: https://www.portvancouver.com/wp-content/uploads/2021/01/2021-01-29-Vessel-Noise-Correlations_Phase-2_Final.pdf

URN and Vessel Efficiency

Report complete; link not yet available

M/V Cygnus – URN and Efficiency after Hull Cleaning

Efficiency report: <https://nrc-publications.canada.ca/eng/view/object/?id=1c84eae1-f574-4330-b0bc-771e280030d3>

URN report: https://tcdocs.ingeniumcanada.org/sites/default/files/2020-01/COAST_GUARD_CYGNUS_NOISE_ANALYSIS_TRANSPORT.pdf

Queen of Oak Bay Trials

Report not yet complete

URN and GHG Reduction for Fishing Vessels

Report not yet complete

Electric Propulsion for Small Vessels

Report not yet complete

Parametric Propeller Noise Study

Report not yet complete

Propeller Re-design and Optimization

Report complete; link not yet available

On-board/Off-board Noise Correlation

https://cradpdf.drdc-rddc.gc.ca/PDFS/unc351/p812595_A1b.pdf



QUESTIONS