

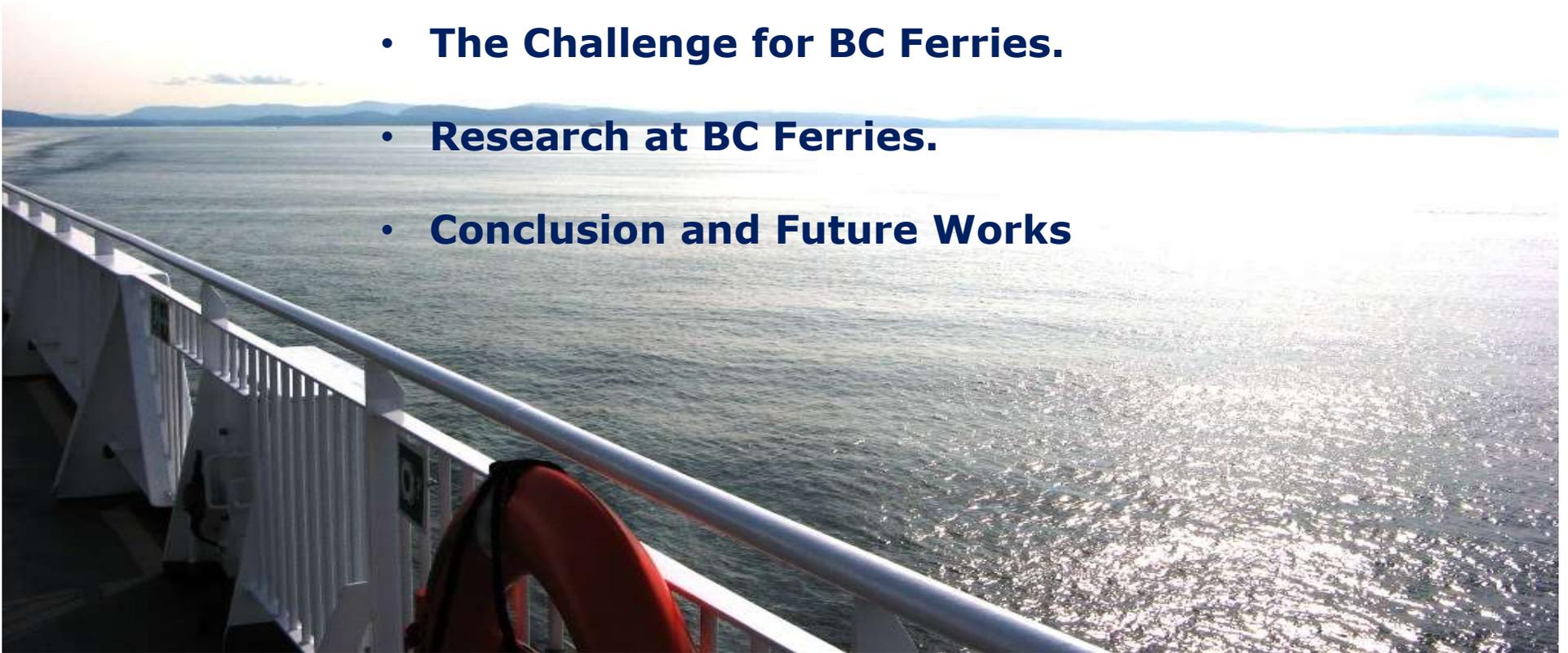
***Research Activities at BC Ferries
- URN and Air Emission Focused***

Chanwoo Bae, Fleet Technical Dept.  **BC Ferries**



Today's Topic

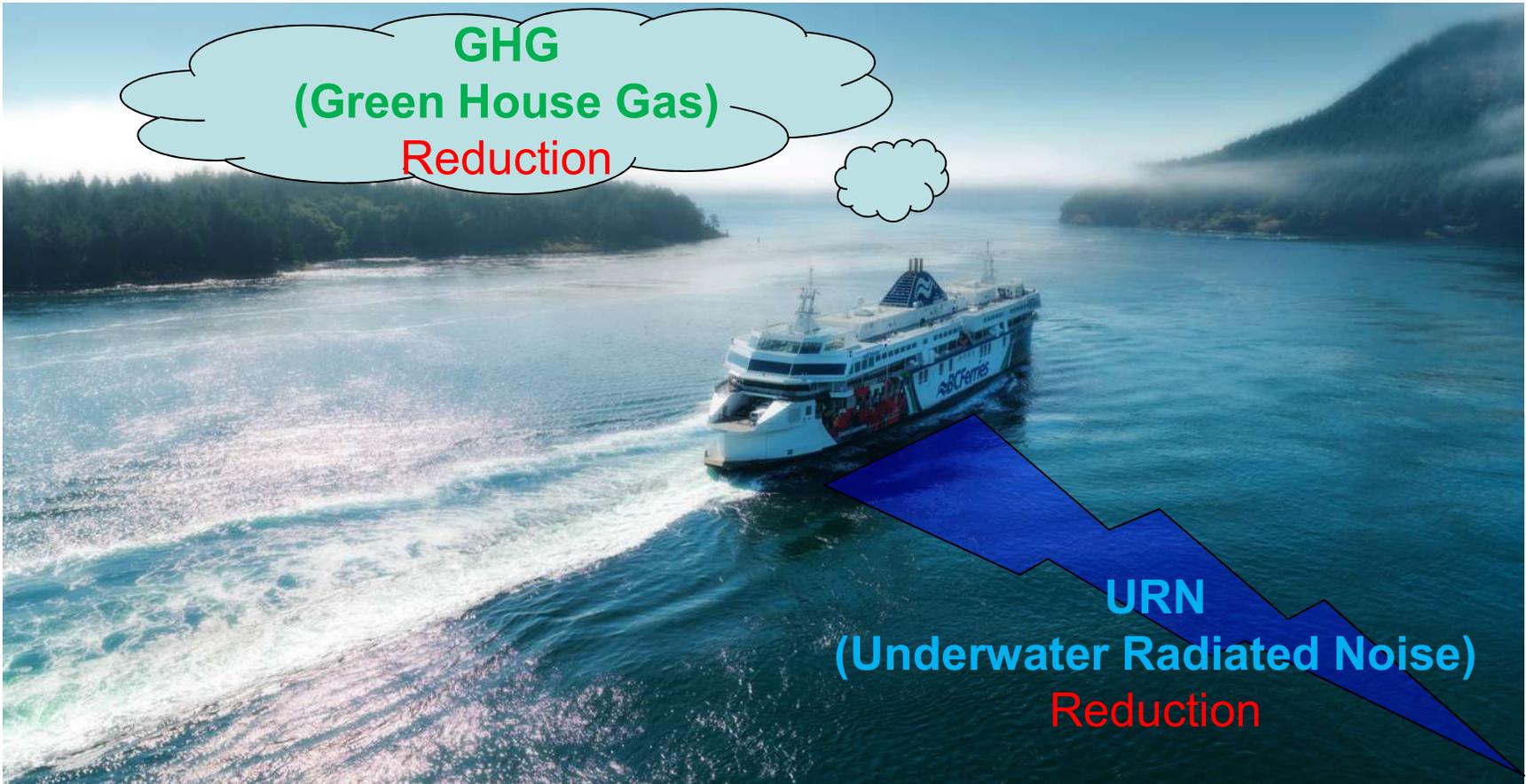
- **About BC Ferries**
- **The Challenge for BC Ferries.**
- **Research at BC Ferries.**
- **Conclusion and Future Works**



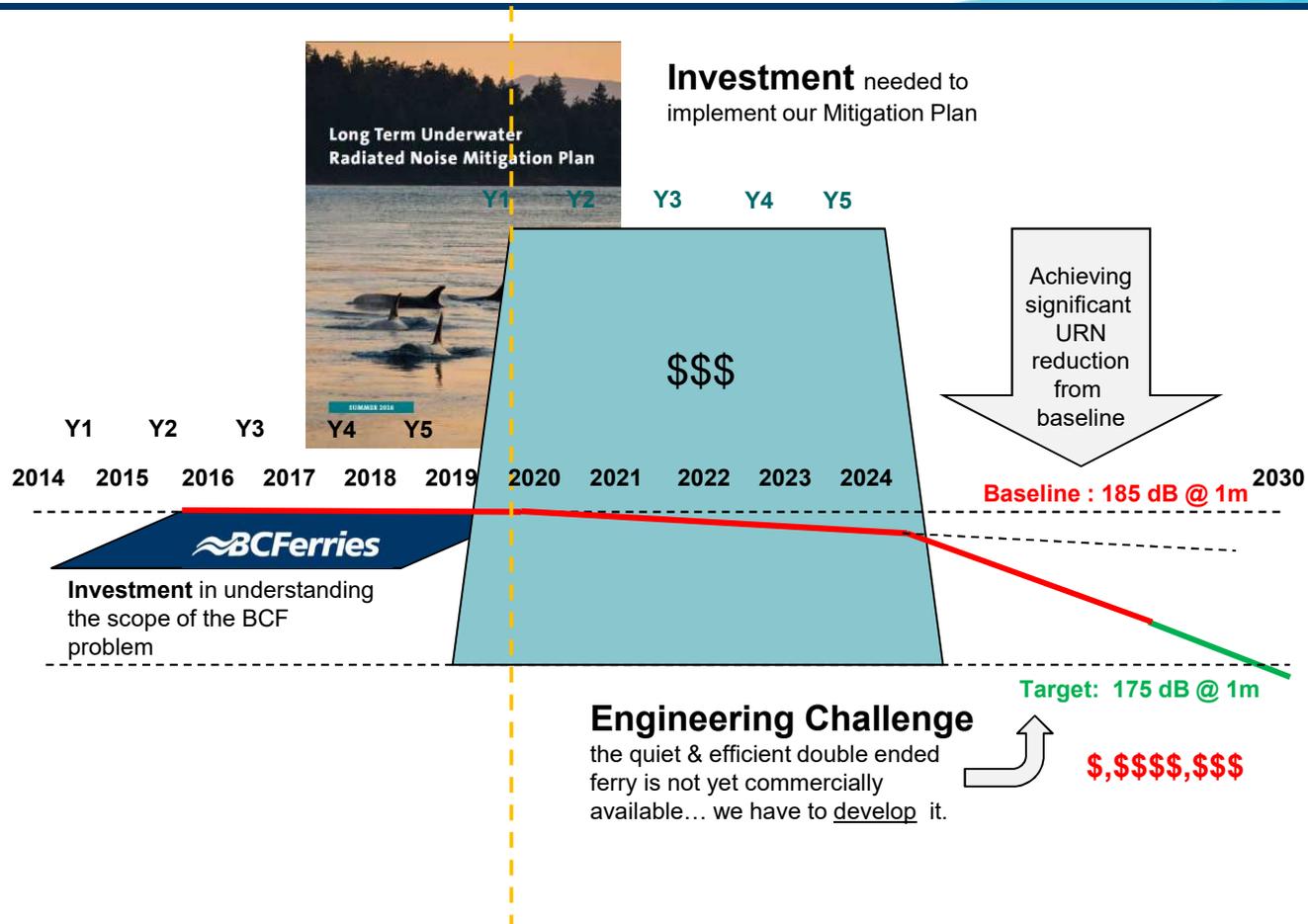
About BC Ferries



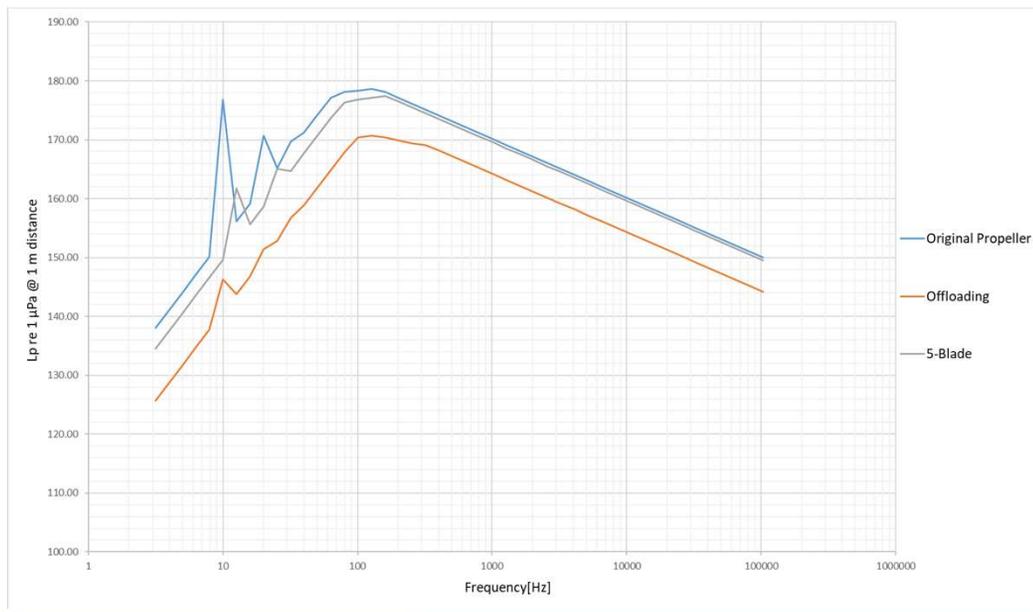
The Challenge for BC Ferries



The Challenge for BC Ferries



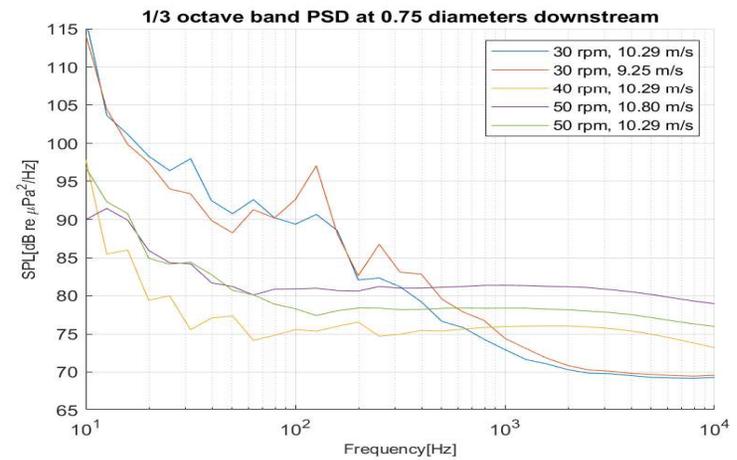
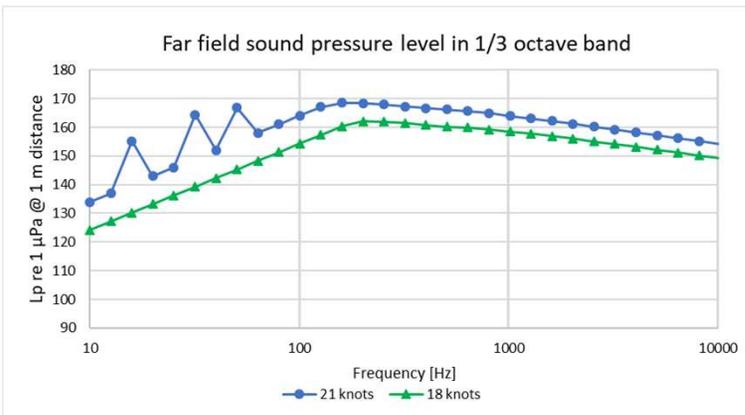
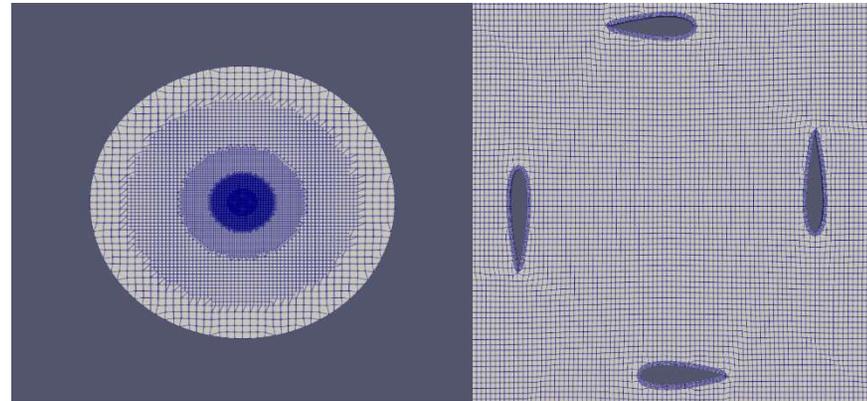
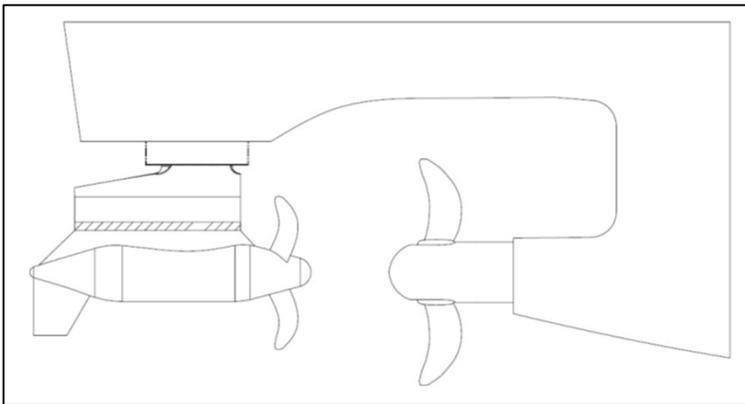
Research Activities at BC Ferries - Numerical Studies of URN



Problem:
A 9 dB reduction in URN results in a 5% decrease of propeller efficiency

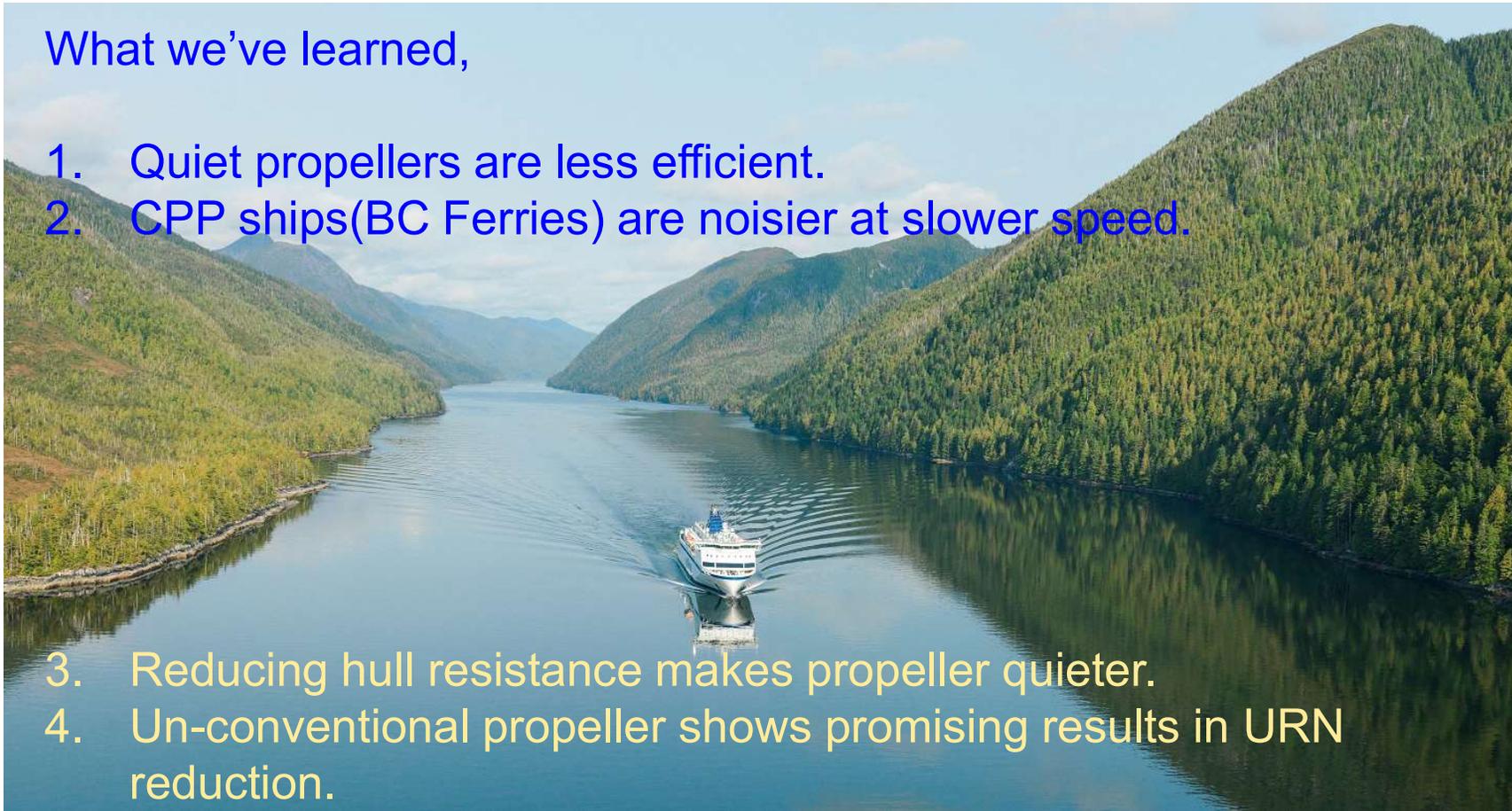
URN or GHG, what do we prioritize?

J	Kt	10Kq	η_o	Kt-Offloading	10Kq-Offloading	η_o -Offloading	Change, η_o
0.6	0.2797	0.4658	0.5736	0.2697	0.461	0.5587	97%
0.65	0.2574	0.4334	0.6146	0.2476	0.4312	0.5941	97%
0.7	0.2339	0.4044	0.6446	0.2248	0.4014	0.624	97%
0.75	0.21	0.3737	0.671	0.2011	0.3719	0.6457	96%
0.8	0.1858	0.3409	0.6939	0.1772	0.3404	0.6627	96%
0.85	0.1612	0.3059	0.7129	0.1529	0.3069	0.6739	95%
0.9	0.1363	0.2686	0.7269	0.1283	0.2714	0.6771	93%



What we've learned,

1. Quiet propellers are less efficient.
2. CPP ships(BC Ferries) are noisier at slower speed.
3. Reducing hull resistance makes propeller quieter.
4. Un-conventional propeller shows promising results in URN reduction.



Research Activities at BC Ferries

- The effect of new hull coating on fuel consumption and URN



- Quantify the impact of the new hull coating on the fuel consumption.
- Understand the relation between the hull coating condition and URN.

Queen of Oak Bay

Length:	139.3 m
Beam:	27.0 m
Draft:	5.9 m
Power:	11,860 kW
Speed:	20.5 Knots
Built:	1981
Propeller:	3.81m Dia. 4 Blade CPP



Research Activities at BC Ferries

- The effect of new hull coating on fuel consumption and URN

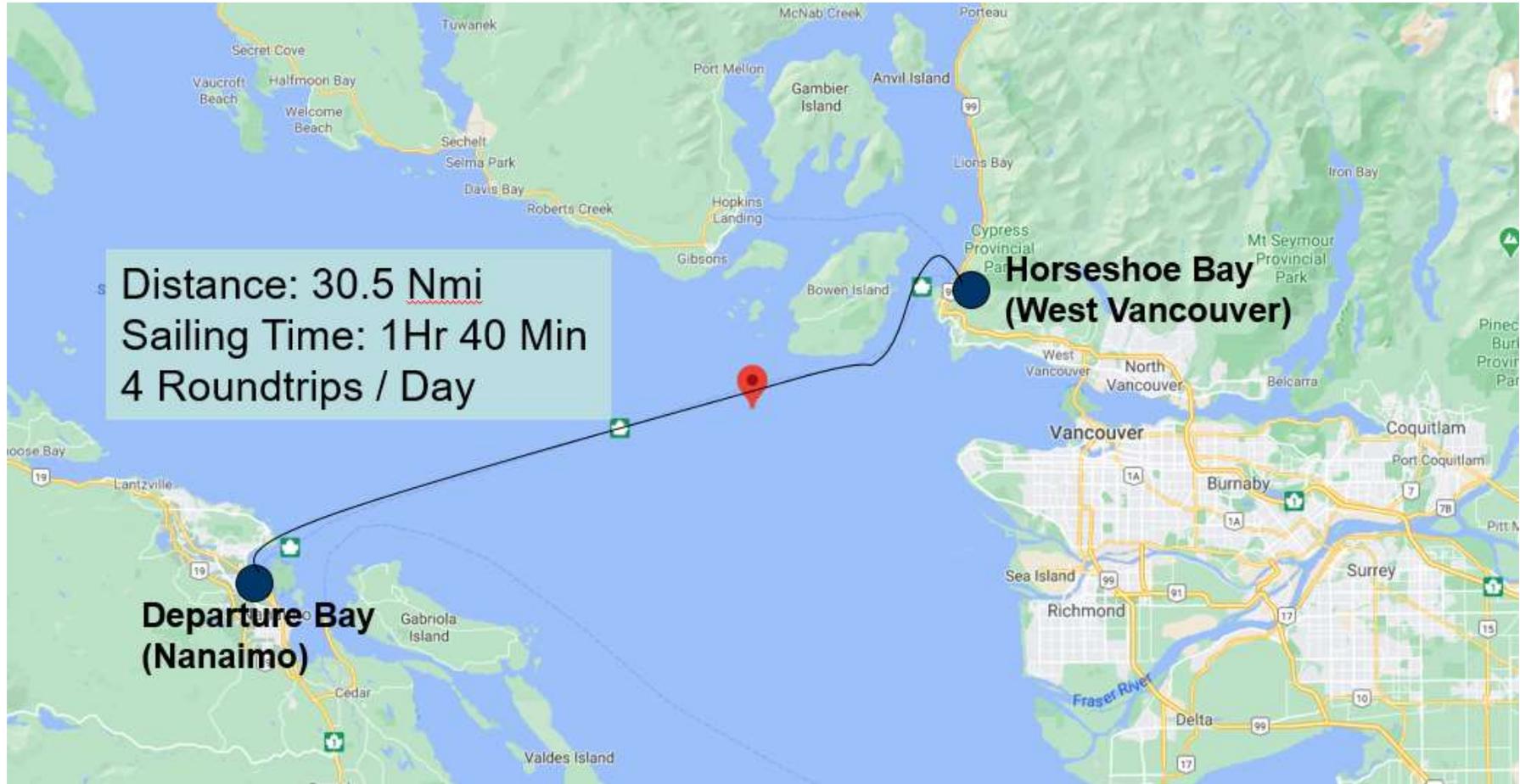


Year /Month	Event
2019 / 03	Installation of the performance monitoring system
2019 / 11	Underwater Sound Measurement System Installation
2019 / 12	Conduct URN Measurement
2020 / 1,2	Vessel in Drydock for Refit (New Coating)
2020 / 03	Conduct URN Measurement After the New Coating
2020 / 08	URN Measurement Report
2023 / Now	Data is still being recorded in the cloud.



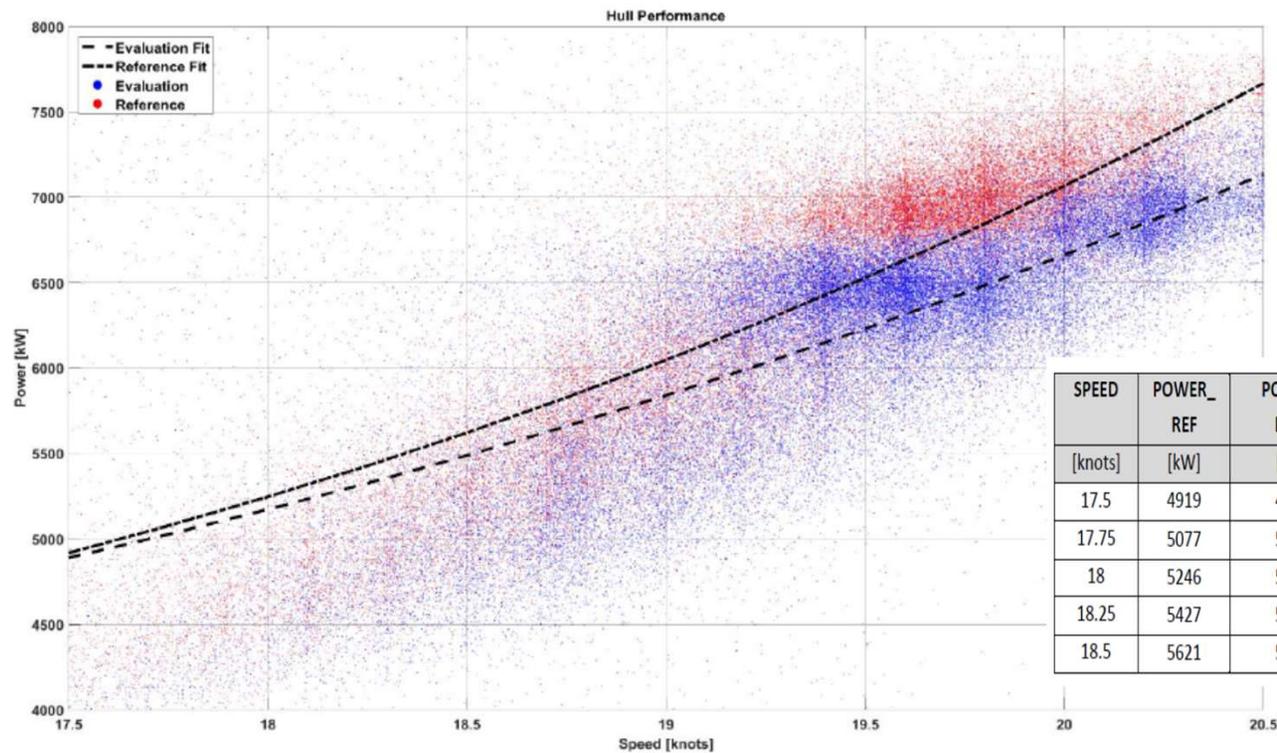
Research Activities at BC Ferries

- The effect of new hull coating on fuel consumption and URN

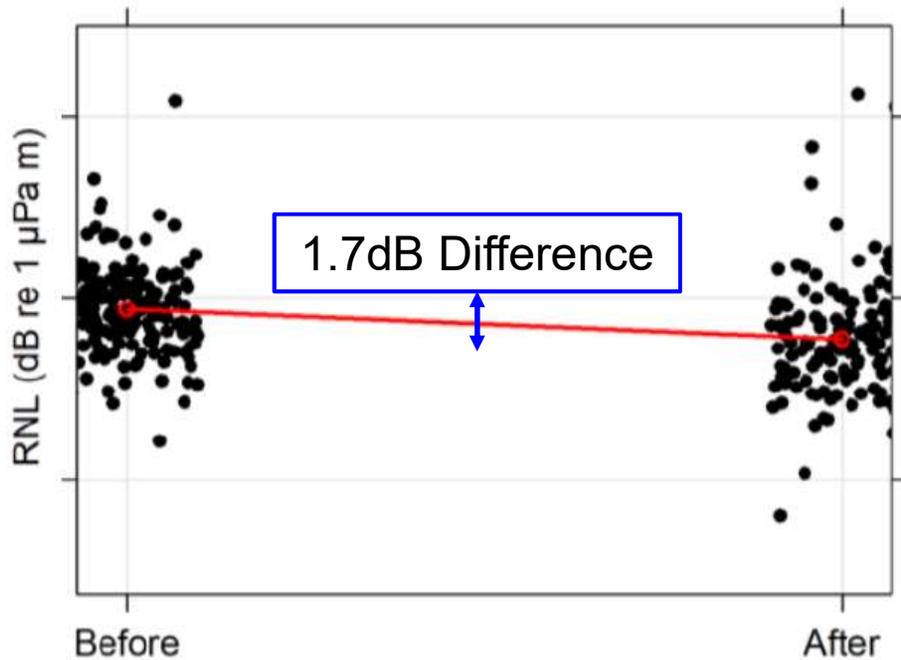


Research Activities at BC Ferries

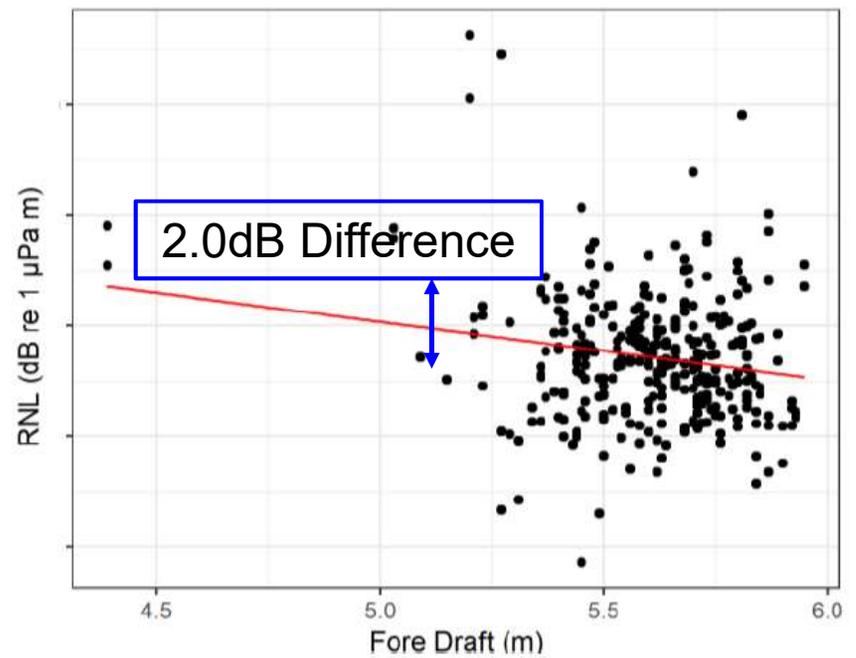
- The effect of new hull coating on fuel consumption and URN



SPEED	POWER_ REF	POWER_ EVAL	%POWER_ REDUCTION	FUEL_RATE REF	FUEL_RATE EVAL	% FUEL_RATE_ REDUCTION
[knots]	[kW]	[kW]	[%]	[kg/hr]	[kg/hr]	[%]
17.5	4919	4890	0.59	1064	1060	0.42
17.75	5077	5026	0.99	1097	1088	0.8
18	5246	5172	1.42	1131	1117	1.21
18.25	5427	5325	1.88	1168	1149	1.65
18.5	5621	5488	2.37	1207	1182	2.11



Hull Surface Effect on URN



Draft Effect on URN

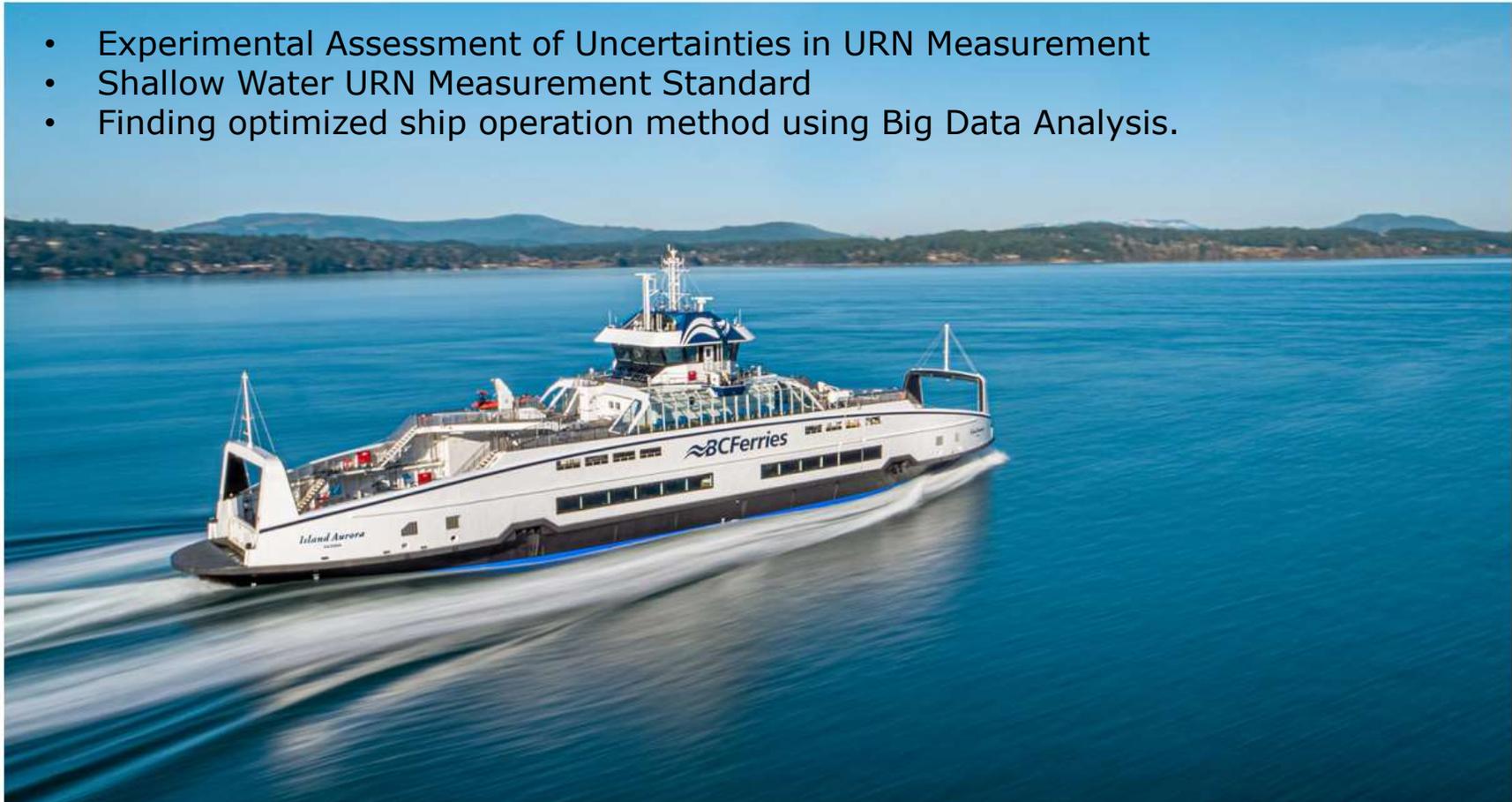
Research Activities at BC Ferries

- The effect of new hull coating on fuel consumption and URN



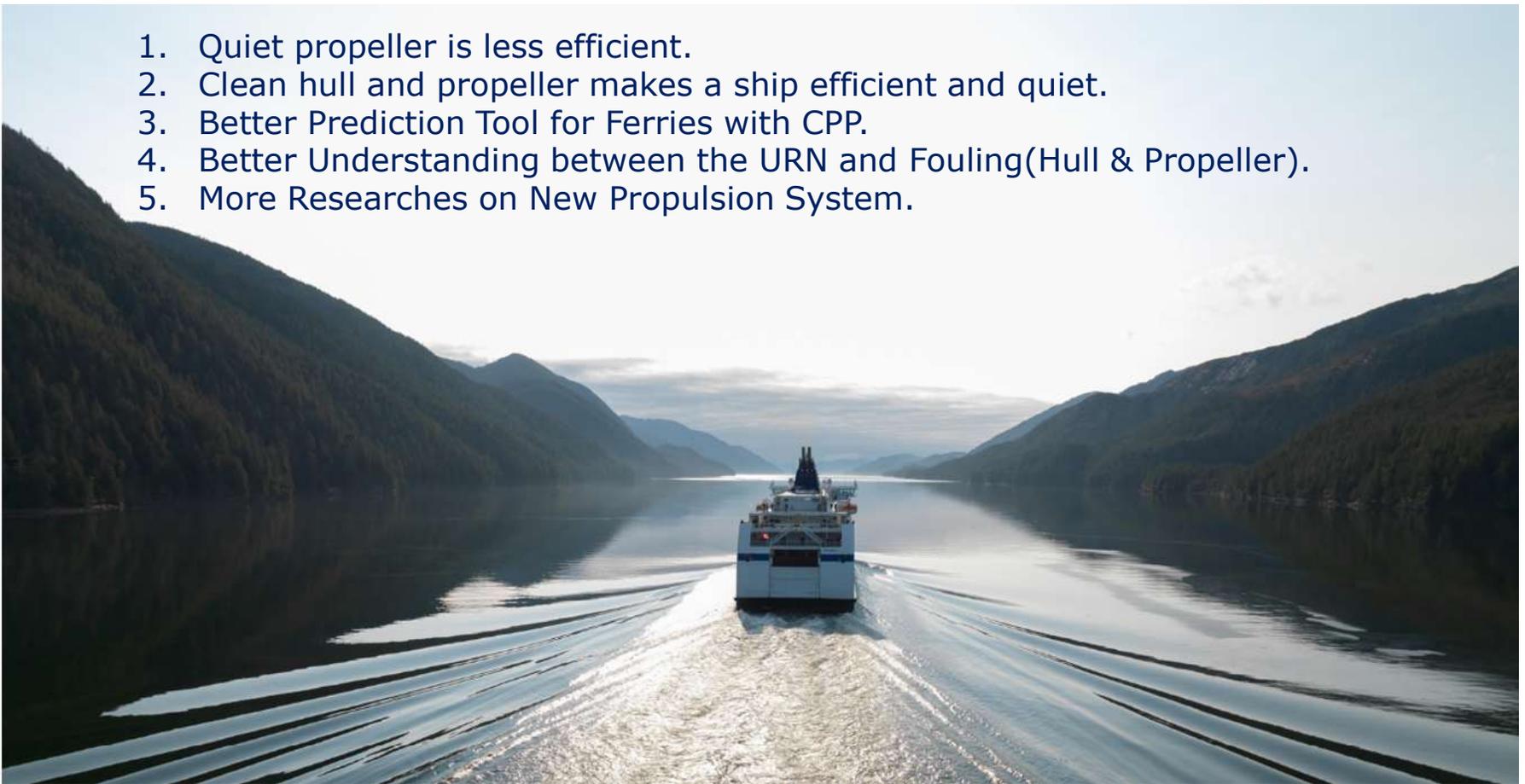
Cleaner underwater hull/propeller makes Better Fuel Efficiency and Quieter URN.

- Experimental Assessment of Uncertainties in URN Measurement
- Shallow Water URN Measurement Standard
- Finding optimized ship operation method using Big Data Analysis.



Conclusion and Future Work

1. Quiet propeller is less efficient.
2. Clean hull and propeller makes a ship efficient and quiet.
3. Better Prediction Tool for Ferries with CPP.
4. Better Understanding between the URN and Fouling(Hull & Propeller).
5. More Researches on New Propulsion System.



Thank you.

