



QUIET VESSEL INITIATIVE PROGRAM TO ADDRESS DISTURBANCES FROM VESSEL TRAFFIC

Active underwater noise cancellation system for vessels

File No. 7075-132-4-5-22

SUMMARY REPORT – MARCH 11, 2024

Background - The goal of this project was to demonstrate an active underwater noise cancellation system based on airborne systems in everyday use. Rising Tide BioAcoustics completed initial development and in-water testing of a cancellation prototype that used a game changing family of underwater speakers/transducers that can produce sound in the very low frequency (VLF) band, which is the band most harmful to the marine environment. Up until recently, VLF transducers were prohibitively large and their use was restricted. These new speakers/transducers, called C-BASS, were developed as a result of a multi-million dollar investment by Rising Tide's partner GeoSpectrum and a marine seismic customer as well as the Government of Canada. The size reduction is impressive and considered game changing. As a case in point, one customer is utilizing the largest version of these transducers – (1 m diameter) to replace units that were the size of a small automobile.

Major activities included obtaining acoustic measurements of the noise generated by several vessels, data analysis signal processing/emulation development, and a dockside demonstration where one C-BASS transducer was used to emulate a vessel's noise signature, with a 2nd C-BASS used to play cancelling sounds.

Theory and Results - The attached slide deck summarizes the theory behind the cancellation concept, test results, and plans for further development. In-water tests provided the viability of the concept and showed that simulated ship noises could be reduced by a factor of more than 100 (>20 dB). We have met the project goals of demonstrating and determining the frequency band at which cancellation can occur.

In-water demonstrations were conducted on October 5 at COVE in Dartmouth; a morning demonstration for TC and DFO, and an afternoon demonstration for the Royal Canadian Navy and DRDC.

Since the demonstration we have been focused in applying for funding, and contacting a large number of potential customers, stakeholders, and partners. Other applications have been identified, including offshore wind turbines and some types of pile driving.

Outside of the scope of this project, we have also discovered that:

- 1) one of the benefits of this technology appears to be a reduction in hull fouling, transfer of invasive species and GHG emissions according to research done in New Zealand (see link below) and anecdotal evidence that ships have more hull fouling near the propellor, engine room and generator room.

<https://oceanandairtechnology.wordpress.com/2012/01/30/research-noisy-ships-attracting-more-hull-fouling/>

- 2) there is a use case for cancelling ship generator noise while in port, and once additional funding is secured, we plan to test a portable dock mounted version of the noise canceller for applications where there is insufficient shore power.
- 3) It may be possible to cancel some components of a ship cavitation signature.

Other contributions - In-kind contributions shown in Table C2 below were provided by Allswater Marine (who advised on ship integration) and Ocean Environmental (loan of hardware).

Other in-kind contributions included:

- acoustic hardware on loan from GeoSpectrum Technologies at an estimated value of \$70,000
- we were able to leverage a vessel noise simulator under development by GeoSpectrum, Hines Ocean Science and Technology, and Seamount Analytics for the Canadian Navy. Estimated value is \$20,000.
- in-water tests were completed at the COVE floating dock, with the dry end hardware set up at the Stella Maris operations center. We were also able to access Stella Maris hydrophone data to provide independent far field measurements of the cancellation system performance. Although we did pay rent to use the Stella Maris and its ops center, the amount charged was minimal and access to this infrastructure greatly contributed to the success of the project.

C.2 : OTHER CONTRIBUTORS				
Contributor 1 (Allswater)				
Cash	\$0		\$0	\$0
In-Kind Contribution	\$400		\$200	\$200
Contributor 2 (Ocean Environmental)				
Cash	\$0		\$0	\$0
In-Kind Contribution	\$5,000		\$2,500	\$2,500
SUBTOTAL C.2: TOTAL FROM THIRD PARTY CONTRIBUTORS	\$5,400		\$2,700	\$2,700
SUBTOTAL C.3: MAXIMUM CANADA CONTRIBUTION	\$149,500		\$58,750	\$90,750
TOTAL C: TOTAL FUNDING FOR THE PROJECT (C1+C2+C3)	\$222,500		\$87,650	\$134,850