INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
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Agenda item 17

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ANY OTHER BUSINESS

Quieting ships to protect the marine environment workshop summary report

Submitted by Canada

SUMMARY	
Executive summary:	This document highlights the recommendations and outcomes from a recent international technical workshop on underwater vessel noise, titled Quieting Ships to Protect the Marine Environment
Strategic direction, if applicable:	4
Output:	Not applicable
Action to be taken:	Paragraph 4
Related documents:	MEPC 71/16/5; MEPC 72/16/5; MEPC 73/18/4, MEPC 73/INF.23 and MEPC 74/17/2

1 At MEPC 73, the chair of MEPC asked Canada to report back on the Quieting Ships to Protect the Marine Environment Technical Workshop it was hosting from 30 January to 1 February 2019 at IMO Headquarters.

2 Attached in the annex are key excerpts from the final report, including the Executive Summary, Recommendations and Conclusions of the workshop.

3 IMO Member States, intergovernmental, and non-governmental organizations interested in reviewing the full workshop report, which includes a full summary of the technical discussions held during breakout and plenary sessions, can request a copy through Transport Canada at: TC.QuietShips-Navieressilencieux.TC@tc.gc.ca

Action requested of the Committee

4 The Committee is invited to note the information in this document.

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ANNEX

KEY EXCERPTS FROM THE "QUIETING SHIPS TO PROTECT THE MARINE ENVIRONMENT WORKSHOP FINAL REPORT", PREPARED BY ACENTECH FOR TRANSPORT CANADA

Executive Summary

1 In late January of 2019, Transport Canada hosted a technical workshop entitled "Quieting Ships to Protect the Marine Environment". The workshop was held at the International Maritime Organization Headquarters in London, UK. Around 140 subject-matter experts from around the world gathered at this event for two and half days. The purpose of the workshop was to identify the state of knowledge on quiet ship technology, provide an opportunity for international collaboration, and exchange research ideas.

2 This London workshop followed a similar format to an event held in Halifax, Nova Scotia, Canada in November 2018. Prior to these two workshops, the topic of the underwater noise from shipping and its impact on marine life has been addressed by numerous programs held by other governments and non-governmental organizations. Elevated anthropogenic underwater noise in the oceans has been a known issue since the early part of the twenty-first century, and marine biology researchers have determined that the increase in underwater-radiated noise has multiple negative impacts on various species of marine life.

3 For Canada, this issue is part of a broader concern with the health of the oceans and waterways that surround Canada and their marine eco-systems. Canada's oceans are home to 42 distinct populations of whales. The issue of underwater noise is a predominant concern for one Canadian species in particular, the Southern Resident Killer Whale, but there are also impacts on other species including the St. Lawrence Estuary Beluga and the North Atlantic Right Whale.

4 Ahead of this workshop, Transport Canada commissioned Vard Marine, Inc. to prepare a report on noise mitigation technologies available for commercial ships. The report was provided to all London workshop attendees ahead of the workshop. The London technical program consisted of nine topical presentations addressing topics such as impact of underwater noise on marine life, challenges in setting underwater noise limits, marine industry activities in controlling undersea sound from shipping, engineering of noise control treatments, and methods of noise prediction from hull and propeller. All the presentations were given by experts in their field.

5 The key segment of the workshop was the breakout and plenary sessions held over one and half days. The workshop was divided into five groups of experts and each group was given a separate series of topics in their area of expertise. These areas included marine biology impacts, propeller & hull design, machinery noise control, predictive tools and measurements. These groups produced a large number of ideas and concepts aimed at solving the problem of excessive ship/shipping noise. There was a good amount of input, dialog, consultation and deliberation on a series of statements and recommendations.

6 It was widely acknowledged throughout the workshop that the issue of quieting ships to protect the marine environment is complex, but necessary. Some of the key policy and research recommendations that came out of the event include:

.1 recognition that a biological limit for underwater noise levels applicable to all species, in all regions of the world, is challenging to develop at this time. A ship-based limit on underwater noise was recommended;

.2 ensuring that the feasibility of noise mitigation measures also considers the contribution to efforts to improve energy efficiency and reduce Greenhouse Gas (GHG) emissions in line with the Initial IMO Strategy on Reduction of GHG Emissions from Ships (resolution MEPC.304(72)) and the Paris Agreements;

.3 continue to gather data and in situ measurements of vessels and the noise they emit in order to further the understanding of this issue and its consequences. This also relates to validating modelling measurements, establishing biological limits and the alternative of feasibility based limits;

.4 the potential value of explicitly identifying underwater vessel noise as a form of pollution in the relevant maritime and environmental conventions;

.5 advancing research on some of the specific technological solutions identified over the course of the workshop, and develop a guide for shipbuilders on available technologies (such as Air Bubble Systems and noise mitigation for machinery);

.6 development of a comprehensive framework of international standards for precision measurement in shallow water and ships of opportunity, as an enabler to establish policy objectives for quieter ships; and

.7 increasing education and outreach efforts with ship owners, ship designers, shipbuilders and machinery and equipment manufacturers to better inform them of the issue of underwater noise and feasible mitigation measures. In addition, encourage companies to begin measuring the underwater noise emitted from their vessels in order to establish baselines.

Background

7 Elevated anthropogenic underwater noise in the oceans has been a known issue since the early part of the twenty-first century. Oceanographic scientists using cold-war listening stations have tracked the annual levels of underwater sound over a period of nearly sixty years. They have quantified that low-frequency background noise has approximately doubled (i.e. an increase of 3 decibels, dB) in each of the past four decades primarily as a result of increased commercial shipping.[1]

8 Marine biology research has also determined that the increase in underwater radiated noise (URN) has negative impacts on many species of marine life. Quoting a recent study, "The introduction of noise can adversely affect marine life by altering the behavior; reducing communication ranges for social interactions, foraging, and predator avoidance; and temporarily or permanently reducing hearing sensitivity. Noise also can affect the physiological functions or cause generalized stress responses and may function as an additive or synergistic stressor, exacerbating other environmental and anthropogenic pressures experienced by marine life."[2]

1 Wright, A.J. (ed) 2008, International Workshop on Shipping Noise and Marine Mammals, Hamburg, Germany, 21st-24th April 2008.

2 Southall, Brandon, Amy R. Scholik-Schlomer, Leila Hatch, Trisha Bergmann, Michael Jasny, Kathy Metcalf, Lindy Weilgart, and

Andrew J. Wright, Underwater Noise from Large Commercial Ships—International Collaboration for Noise Reduction, Encylopedia of marine and Offshore Engineering, online © 2017 Jon Wiley & Sons, Ltd.

9 Several conferences, workshops and symposia have been held around the world over the last fifteen years to discuss this complex issue and have suggested possible steps forward in order to mitigate the negative effects of increased ocean noise. One important initiative led by the IMO was the development of generalized non-mandatory guidelines for reduction of URN from ships.[3] This document provided information on the prediction of underwater noise levels, a list of useful standards and references, and a discussion of design considerations for ships, including propellers, hull form and onboard machinery.

10 The European Union (EU) has shown leadership in this effort by funding various research programs to identify the knowledge and technology gaps in regards to URN. Two major reports have been published summarizing the results of these projects, one on the AQUO Project[4] and another on the SONIC Project.[5]

11 In Canada, this issue is part of a broader concern with the health of the oceans and waterways that surround Canada and their marine eco-systems. Canada's oceans are home to 42 distinct populations of whales. The issue of underwater noise is a predominant concern for one Canadian species in particular, the Southern Resident Killer Whale (SRKW), but there are also impacts on other species, including the St. Lawrence Estuary Beluga and North Atlantic Right Whale. Canada's SRKW is an acute example of this global issue, as there are only 74 Southern Residents remaining.

Purpose and Objectives

12 The purpose of the London Workshop was to provide an opportunity for international collaboration and allow participants to share the newest research and technical solutions for quiet ship design and retrofits. By hosting this workshop at the IMO Headquarters in London, it brought further international attention to the issue and allowed for greater participation and interest. The specific objectives were to:

.1 validate current technologies and identify important gaps and challenges to further progress;

.2 assess areas by ship class for innovation, and potential to determine where further research is needed;

.3 understand whether improvements made to ship design for fuel efficiency overlap with improvements made to reduce noise; and

.4 document the conclusions of the workshop to guide future discussions on reduction of underwater ship noise or as groundwork for a review of the existing IMO Guidelines[4].

13 The workshop intentionally did not focus on vessel operational and maintenance measures, such as vessel slowdowns and lateral displacements from shipping lanes. While these measures have proven quite effective in reducing underwater vessel noise, and should certainly be considered in regional efforts to reduce underwater noise, the workshop

[3] Guidelines for the Reduction of Underwater Noise From Commercial Shipping to Address Adverse Impacts on Marine Life, MEPC.1/Circ. 833, 7 April 2014, International Maritime Organization, London, UK.

[4] AQUO (Achieve Quieter Oceans by shipping noise footprint reduction), FP7 - Collaborative Project No. 314227, WP 5: Practical Guidelines, Task 5.1, Comprehensive Listing of Possible Improvement Solutions and Mitigation Measures.

[5] Suppression of Underwater Noise Induced by Cavitation, FP7-Collaborative Project No. 314394 - SONIC Final Report.

deliberately focused on longer-term, larger-impact engineered solutions related to quiet ship design and retro-fits.

Noise Mitigation Technology Report

14 Transport Canada commissioned Vard Marine, Inc (a Fincantieri Company) to prepare a report on the noise mitigation technologies available for quieting commercial ships. The draft report was circulated prior to the Halifax Workshop where participants had the opportunity to provide feedback. The report was then updated by the author, and issued ahead of the London Workshop for further review[6] along with a comment form for further feedback. This report is available as document MEPC 74/INF.28.

Recommendations

15 The breakout and plenary sessions produced many ideas for future action and research. Table 1 lists the recommended actions, which could be completed in the 1-2 year period. Table 2 lists the recommended actions, which could be completed in the 2-5 year period. Table 3 lists the recommended actions, which could be completed in the greater than 5 year period.

16 All time periods are estimated based on assumed political will and/or interest in achieving reduced URN. In addition, based on comments at the workshop, and knowledge of organizational roles and responsibilities, potential "implementing bodies" have been suggested as a way to move the recommendations forward. However, it is recognized that appropriate responsibility for the recommended actions and research will require further discussions.

TABLE 1: Recommendations for Action & Future Work
(1-2 year time frame)

Recommendation	**Potential Implementing Bodies**
Publicize existing quiet ship design guides[7] to allow for immediate dissemination of such information.	Engineering NGO Govt. Sponsor(s)
Create an updated (new) quiet ship design guide to educate vessel owners and operators regarding ship design and noise mitigation features required in order to meet Class Society or other noise limits.	IACS Engineering NGO
Develop standard set of URN limit curves similar to the airborne noise Noise Criteria curves. These curves could later be adopted by the Class Societies. [8]	ISO TC 43/SC 3[9]

6 Vard Marine Report, Ship Underwater Radiated Noise, report 368-000-01, rev 3, dated January 9, 2019.

7 Vard Technology Report & Matrix (2019), Encyclopedia of Maritime and Offshore Engineering (2017), & SNAME MVEP T&R Bulletin 6-4 (2014).

8 ANSI/ASA 12.2-2008; Criteria for Evaluated Room Noise.

9 ISO Technical Committee 43 (acoustics); subcommittee-3 (underwater acoustics); secretariat is currently the Acoustical Society of America (ASA), located in Melville, NY-USA.

Recommendation	Potential Implementing Bodies
Harmonize the "Silent" Class URN limits and measurement methodologies used by class societies.	IACS[10]
Encourage CIS monitoring for research and operational guidance.	Shipping NGO R&D Consortium
Add URN listening stations to at least one major port for largest shipping nations.	Port(s) Govt. Sponsor(s)

TABLE 2: Recommendations for Action & Future Work
(2-5 year time frame)

Recommendation	Potential Implementing Bodies
Develop standard methodologies for ship URN measurements in shallow water and for ships-of-opportunity (i.e. single pass by). There should also be standard formats for URN reporting and other associated information.	ISO TC 43/SC 317
Develop a universal and publicly accessible database of ship URN data, which includes vessel type, noise control features, and other characteristics. It should use standard data reporting formats as noted above.	Govt. Sponsor(s)
Develop design for sound & vibration isolation of 2-stroke, slow-speed diesels engines on commercial ships.	Industry Govt. Sponsor(s)
Develop design for "Air Bubble" System for sound attenuation on commercial ships.	Industry Govt. Sponsor(s)
Develop improved codes/software for hull and propeller URN prediction	R&D Consortium
Develop more knowledge of sound propagation and implement as algorithms in new prediction codes (as above)	R&D Consortium

TABLE 3: Recommendations for Action & Future Work
(>5 year time frame)

Recommendation	Potential Implementing Bodies
Establish economic incentives and/or legal consequences to encourage and/or mandate ship owners/operators to invest in noise mitigation for quieter ships.	Shipping NGO
Establish a regulatory ship noise limit based on engineering feasibility and phased in over time. This limit should not result in increases in other environmental emissions.	IMO Government
Establish a requirement for compulsory URN measurement of ships.	IMO Government
Encourage greater research toward the understanding of ship URN versus impact on marine life.	R&D Consortium Govt. Sponsor(s)

[10] The International Association of Classification Societies' (IACS) is a technically based non-governmental organization that currently consists of twelve-member marine classification societies with offices located in London, UK.

Conclusions

17 The workshop was a great success with nearly 140 people attending the two- and half-day event. Participants came from all parts of the world, including Europe, North America, and Asia. The workshop was attended by numerous experts in the fields of underwater acoustics, ship design & quieting, marine biology, and policy. The IMO headquarters proved to be a good central meeting point, and holding the workshop at IMO demonstrated the support for work on this topic at the highest levels of the marine regulatory body.

18 The workshop presenters provided up-to-date information and data regarding impacts to marine life, ship silencing, industry activities in the field and industry limitations. All are important factors to addressing the problem at hand. It was agreed upon by participants that ship underwater noise is increasing every day, and this increase has a menacing effect on marine life.

19 The breakout and plenary sessions produced many important suggestions and key recommendations along with potential implementation timing and bodies. Of all the suggestions, there are three that are statements of fact, which should be clearly noted and recognized. The following three statements can be regarded as conclusions of the workshop:

.1 Even though underwater noise impacts to marine life have been documented by numerous researchers, there is currently not enough information to develop a biology-based universal (receiver-type) noise limit for the seas. Ship-based noise limits should therefore be the focus.

.2 As a starting point, there should be a goal of a 3 dB/decade reduction of global (or at least regional) underwater shipping noise in order to reverse the trend of the past 60 to 80 years.

.3 The optimal hull and propeller configuration has a maximum efficiency with tradeoffs between cavitation hindrance and energy efficiency. Put another way, lower propeller noise (i.e. cavitation) does not automatically give higher efficiency.

20 The first two statements are directly connected. During the workshop, marine biologists explained that there is significant proof showing that increases in ship noise are impacting marine life. However, there is not enough knowledge to set a universal ocean noise limit; a point at which, below such a noise level, there is no harm to marine life. Ship designers and engineers have been asking for this limit. However, a biology-based universal noise limit would translate to different ship-based noise requirements depending on distance sound travels through the water and the local oceanographic conditions. Therefore, it seems clear that even if the universal noise limit could be developed, it would not easily result in information which engineers could employ to design quieter ships.

21 Since a biology-based noise limit cannot be realized at this time, it is recommended that a noise limit be established for individual ships (by class, speed, tonnage or other). This limit should be based on current URN emissions (by class etc.) which can be gradually reduced over some period. This limit shall depend on feasible engineering noise controls for ships. Establishing a ship noise limit should follow the format of many of the class societies notations already established at ABS, BV, DNV-GL, and RINA. Harmonization of these notations would greatly improve the marine industry's ability to comply with such new requirements.