Agenda Item 4.4

Priorities in the Implementation of the Triennium Work Plan (2010-2012)
Review of New Information on the Extent of Negative Effects of Sound

Document 4-17

IMO MEPC61 Noise from Commercial Shipping and its Adverse Impacts on Marine Life – Report of the Correspondence Group

Action Requested

- Take note of the report
- Comment

Submitted by

Secretariat

NOTE:
IN THE INTERESTS OF ECONOMY, DELEGATES ARE KINDLY REMINDED TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

INTERNATIONAL MARITIME ORGANIZATION

E

MARINE ENVIRONMENT PROTECTION COMMITTEE
61st session
Agenda item 19

MEPC 61/19
23 July 2010
Original: ENGLISH

NOISE FROM COMMERCIAL SHIPPING AND ITS ADVERSE IMPACTS ON MARINE LIFE

Report of the Correspondence Group

Submitted by the United States

SUMMARY

Executive summary:	This document is the report of the Correspondence Group on the issue of "Noise from commercial shipping and its adverse impact on marine life". The Correspondence Group was established to identify and address ways to minimize the incidental introduction of noise from commercial shipping operations into the marine environment to reduce potential adverse impacts on marine life.
Strategic direction:	1, 7, and 13
High-level action:	1.1.2
Planned output:	1.1.2.3
Action to be taken:	Paragraph 6
Related documents:	Resolutions A.989(25), A.982(24), A.900(21), A.720(17), and A.468(XII); MSC/Circ.1014; MSC 84/INF.4; MSC 83/28; MEPC 60/18; MEPC 59/19; MEPC 59/19/1; MEPC 58/19; MEPC 57/INF.4; MEPC 57/INF.22

Introduction

1 MEPC 58 approved the inclusion of a new high priority item in the work programme of the Committee on "Noise from commercial shipping and its adverse impact on marine life". The Correspondence Group continued its work on this issue between MEPC 59 and MEPC 61. This document summarizes the interactions and progress on this issue thus far and offers recommendations for future work from this Correspondence Group.

2 The following Member States and entities were on the e-mail list for this Correspondence Group, although not all actively participated in the discussions:

ARGENTINA	ITALY	REPUBLIC OF KOREA
AUSTRALIA	JAPAN	SINGAPORE
BAHAMAS	LIBERIA	SWEDEN

CANADA	MARSHALL ISLANDS	UNITED KINGDOM
CHINA	NETHERLANDS	UNITED STATES
GERMANY	PANAMA	
CESA	CLIA	IFAW
IWC	UNEP/CMS	IMarEST
WWF	FOEI	INTERTANKO
ICOMIA	ISO	ICS
IUCN	WDCS	

Substantive Issues

3 The Correspondence Group agreed that sources of underwater noise should be treated according to their relative contribution. Since shipping noise is characterized by a spectral signature which clearly relates to propellers, we agreed to concentrate our efforts on the major element of propeller cavitation. The noise from the propeller in relation to the ship's speed, its loading conditions and the environmental conditions under which the ship operates are to be considered accordingly. It was noted that ongoing work in MEPC towards improving ship's efficiency may also result in significant noise reduction from ships. The other aspects of incidental underwater noise generated from shipping were noted and retained for future consideration.

4 The Correspondence Group addressed the demand for further research activities. The Group noted that coordinated measurements and applied research along shipping routes may lead to substantial progress in order to identify both the loudest ship types and the noisiest individual ships, as quieting a relatively few of the loudest ships is a potential way to efficiently reduce the overall contribution of shipping noise to the global ocean noise budget.

Recommendations

5 The final summary and recommendations of the Correspondence Group are included in the annex to this document. Additionally, several documents, the titles of which are included in the annex, were referenced by members of the Correspondence Group as background information.[1]

Action requested by the Committee

6 The Committee is requested to take note of this report of the Correspondence Group and take any other action it deems appropriate.

***

[1] These documents are available electronically from the Chairman of the Correspondence Group: Trisha.Bergmann@noaa.gov.

ANNEX

FINAL SUMMARY AND RECOMMENDATIONS OF THE CORRESPONDENCE GROUP

Summary of work to date

1 Since MEPC 58 in October 2008, the Correspondence Group (CG) has worked to review existing knowledge on ship-quieting technologies and their potential application on large commercial vessels. Specifically, the CG has operated under the following terms of reference: "(to) identify and address ways to minimize the introduction of incidental noise into the marine environment from commercial shipping to reduce the potential adverse impact on marine life, in particular develop non-mandatory technical guidelines for ship-quieting technologies as well as potential navigation and operational practices". This focus was specified in the first report of the CG to MEPC 59 (MEPC 59/19), along with a detailed scope of work and basic assumptions on which the CG has continued to operate.

2 Substantively, the first report of the CG (MEPC 59/19) provided the results of a series of detailed technical questions to Correspondence Group members regarding areas of emphasis regarding ship-quieting technologies. Subsequently, the CG approached: (1) national shipowners to identify whether/how they consider/impact noise reduction measures since the vessel design stage has already been completed; and, (2) model basins in a number of countries for technical input on issues relating to the design of quieter vessels. The results of these assessments are summarized in the second report of the CG (MEPC 60/18), which forms the technical basis from which the CG has operated in attempting to complete its recommended course of action.

3 Since the MEPC 60, the CG has continued to formulate conclusions from its work (and from the reports submitted to MEPC 59 and MEPC 60) in order to develop a detailed set of recommended actions and areas of emphasis. A current summary/assessment of those recommendations, for the consideration of other CG members, is given below (and is the primary purpose of this document). Additionally, however, there have been several other recent noteworthy developments, including:

.1 Presentation of an information paper on the chronology and history of the formation of and progress of the CG which was provided to a special session on masking of hearing and communication convened by the International Whaling Commission, Scientific Committee, Environmental Concerns Sub-Committee[2]. Note also that this paper was described in a presentation by C. Clark on behalf of B. Southall to the World Ocean Council Sustainable Ocean Summit[3];

.2 Progress on the development of measurement standards for underwater noise from large vessels, including an American National Standards Institute standard (ANSI S12.64-2009 entitled "Quantities and Procedures for Description and Measurement of Underwater Sound from Ships"). This standard specifies operational requirements, measurement systems, methodologies, and metrics used for the beam aspect measurement of underwater sound pressure levels for surface vessels operating in various, specified conditions. A related effort, being coordinated with the ANSI standards group that developed ANSI S12.64-2009, is well underway

[2] Southall, B. L. 2010. *Progress on vessel quieting efforts for large commercial ships*. Working group paper #4 to the IWC Scientific Committee, Environmental Concerns Sub-Committee special session on masking (Agadir, Morocco, June 2010).

[3] See: www.oceancouncil.org.

within a technical committee of the International Standards Organization (ISO/TC8/SC2);

.3 A popular article in Science magazine dealing with related issues entitled "A push for quieter ships"[4]; and

.4 Several relevant technical and scientific publications[5].

Correspondence Group conclusions

4 The CG, as reported in documents MEPC 59/19 and MEPC 60/18, has conducted a thorough assessment of the existing design and operational modifications and possibilities potentially relevant in the reduction of incidental noise produced by large vessels. These documents include specific technical responses by CG members, shipowners, and engineers and researchers from model basins. These recommendations and conclusions, as well as those made in the course of the NOAA[6] and Okeanos[7] workshops, have been integrated into the following draft conclusions and recommendations of the CG.

5 The CG agreed that the propeller is the main source for ship generated underwater noise. Accordingly, future research programs should focus on the propeller and the relationship between cavitation and the cause of underwater sonic energy. The CG also highlighted the demand for reliable underwater noise data.

6 Parallel to the above mentioned research activities, the definition of an appropriate measuring method for underwater noise of ships should be developed (i.e. outcome of ISO/TC8/SC2 and/or new ANSI/ASA standard S12.64-2009/part1) to make sure that reproducible measuring results can be derived.

The Audience for CG recommendations

7 Should include the following:

.1 Governments of member states (collection and evaluation of existing noise data along shipping routes);

.2 Scientific community (measurements of single ship noise profiles AND collective ship noise contributing to ambient noise levels in specified waterbodies, e.g., large scale port based up to small scale ocean based);

.3 Environmental organizations interested in issues relating to underwater noise;

---

4 See: D. Malakjov. (2010). *A push for quieter ships*. Science 328, 1502-1503.

5 Arctic Council. (2009). *Arctic Marine Shipping Assessment*. A 2009 report of the Arctic Council.
Clark C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, and D. Ponirakis. (2009). *Acoustic masking in marine ecosystems: intuitions, analysis, and implication*. Marine Ecology Progress Series 395, 201-222.
Hatch L.T. and Fristrup K.M. (2009). *No barrier at the boundaries: implementing regional frameworks for noise management in protected natural areas*. Marine Ecology Progress Series 395, 223-244.
Laiolo, P. (2010) The emerging significance of bioacoustics in animal species conservation" Biological Conservation 143: 1635-45.

6 Southall, B.L. (2005). *Final report of the 2004 International Symposium "Shipping Noise and Marine Mammals: A Forum for Science, Technology, and Management."* National Marine Fisheries Service, Office of Protected Resources, Technical Report. National Oceanic and Atmospheric Administration, Washington, D.C.
Southall, B.L. and A. Scholik Schlomer. (2008). *Final report of the NOAA International Conference: "Potential Application of VesselQuieting Technology on Large Commercial Vessels*," 1-2 May, 2007, Silver Spring, MD, USA.

7 Wright, A.J. (ed). (2008). *International Workshop on Shipping Noise and Marine Mammals*, Hamburg, Germany, 21-24 April 2008. Okeanos Foundation for the Sea, Auf der Marienhohe 15, D64297 Darmstadt. 33+v p.

.4 International organizations concerned/interested in issues relating to underwater noise (e.g., the International Whaling Commission, Scientific Committee); and

.5 Marine engineers, naval architects, and vessel owners and operators.

CG recommendations

8 The CG recommends:

.1 Non-binding, technical guidelines and consideration of solutions to reduce the incidental introduction of underwater noise from commercial shipping and, in turn, reduce potential adverse impacts to marine life.

CG recommendations: Focus Areas for Vessel Quieting (in priority order)

9 The CG has reported on technical considerations in a large number of specific possible treatments, the following approaches have emerged as the most plausible design and/or retrofit options. The CG recommends that these specific high-priority focus areas be assessed by naval architects and engineers. Although the recommendations are intended primarily for new ships, special consideration should be given to existing ships, depending on the practicality/cost of noise mitigation measures. Possible operational modifications should be considered for both new and existing vessels.

10 This assessment should include both the practicality and specific engineering considerations as well as, to the extent possible, economic considerations given these practical design and construction considerations. Given the relatively little attention to underwater radiated noise in ship design and construction to this point, the CG believes that the primary focus area should clearly be on various aspects of vessel propulsion, followed by hull design, on-board machinery, and (practically speaking) operational measures. We note, however, that the optimal quieting strategy for any ship should take into account all four of these subgroups.

1) PROPULSION

A) Propeller design and modification to reduce cavitation

- Basic design optimization of propellers
- Fixed vs. variable pitch propellers
- Contra-rotating propellers
- Propellers with tip (Winglet) engineering

B) Propulsion Systems

- Twin screw design systems to allow for reduced tip speed
- Screw systems with open (high) screw propulsion to allow for a smoother (less turbulent) wake field
- Podded propulsion (azimuth electric propulsion drive) systems to allow for an improved wake field by placing propellers deeper

C) Propeller/Hull Form Optimization (requires model basin testing)

- Determining optimal hull design for propulsion system and propeller type, in order to reduce hull resistance and minimize turbulence in the wake field
- Propagation and radiation of pressure fluctuations induced structure-born noise

2) HULL DESIGN
   A) Flow noise associated with various hull forms
   B) Flow noise as function of vessel speed
   C) Flow around underwater appendages, e.g., skeg shape, trailing edge, bow thruster, rudder, other hull openings
   D) Bow shape and form
   E) Use of dampening coatings and variability among coating types

3) ON-BOARD MACHINERY
   A) Passive and/or dynamic equipment mounts for: main engines, generators, reduction gears/gear boxes, and pumps (fixed and variable speed)
   B) Other equipment isolation techniques (filters, hangers) for pipes/pumps
   C) Damping/shrouding systems or isolation chambers
   D) Engine synchronization
   E) Purchasing focus on selection of low-noise profile equipment

4) OPERATIONAL MODIFICATIONS
   A) Speed variations, including the impact of vessel speed on the noise profile of a given vessel
   B) Load variations (full load, partial load, ballast)
   C) Hydrographic variations (shallow vs. deep water operations, water column characteristics)
   D) Maintenance – periodicity and type

CG Recommendations: Current Gaps/Future Focus Areas

1) Propeller noise and the relationship between cavitation and cause of underwater sonic energy
2) Noise profiles for individual ships using standardized measurement protocols, including those in which quieting technologies have been implemented
3) Temporal and geospatial variation in ambient noise levels in relation to environmental factors and shipping density
4) Quantification of relationship between individual ship noise reductions and regional ambient noise level reductions
5) Linkage of noise measurements (ship and waterbody) to appropriate tracking mechanisms e.g., AIS
6) Continued progress in quantifying scales over which animal communication may be masked by noise from individual ships as well as increased average background noise from ships
7) Continued progress in quantifying the biological significance of auditory masking in marine mammals
8) Consideration of navigational and operational procedures that may lead to quieter ships including speed reductions and routeing decisions