

O Kitamura Mitsubishi Heavy Industries, Ltd./SAJ

The 8th Asian Shipbuilding Experts' Forum: Jeju, 27-28 Nov. 2014

Introduction: Problematic trends claimed

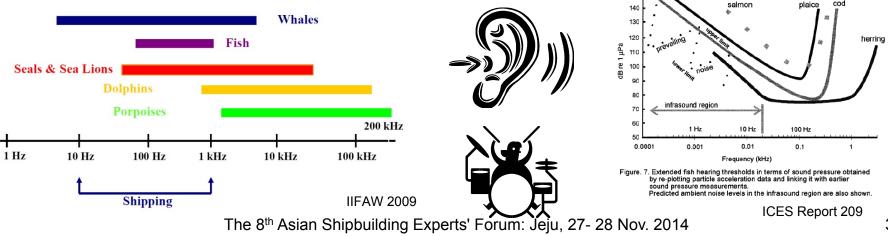
- It is said that commercial ships, which are increasing in both number and size, are producing ever-greater amounts of underwater <u>low frequency</u> noise.
- It is estimated that background noise from commercial shipping in some ocean areas off the coast of California has been <u>doubled</u> per decade in terms of sound level.
- Potential adverse impacts of incidental shipping noise is not related to acute exposures but rather to the general increase in continuous background ambient noise and the potential <u>masking</u> of marine animals' communication systems.



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Opening: Proposal made by USA

- To MEPC58 (2008), USA proposed a new work item to develop technical Guidelines for minimization of radiated underwater noise from commercial shipping, with a view to protecting critical life functions such as communicating, foraging, evading predators and navigating of marine animals (including mammals, fish and even some invertebrates).
- Supported by Australia, the International Fund for Animal Welfare (IFAW) and Friends of the Earth International (FOEI), IMO decided to tackle this issue.



Draft Guidelines submitted by CG to DE 57 (Mar. 2013)

- Original draft Guidelines submitted to DE57 referred to:
 - Quantitative effect of cavitation on underwater noise;
 - Needs for minimization of welding bead projection on wet outer shell plates and their weld distortion, and smooth paintwork;
 - Needs for making wake field as homogenous as possible;
 - Preference of diesel-electric, turbine, podded propeller or water jet propulsion system rather than direct dieseldriven one, and active vibration control devices on diesel engine;
 - Needs for propeller cleaning and maintenance of smooth underwater hull surface; and
 - Needs for periodical inspection and monitoring of machinery and equipment, etc. throughout operational life The 8th Asian Shipbuilding Experts' Forum: Jeju, 27- 28 Nov. 2014

Actions taken by Shipping Industry at DE 57 (Mar. 2013)

- Shipping Industry expressed great concern at DE57 (2013) over the details one by one based on the understanding that there had been <u>limited</u> technical backgrounds such as noise level acceptable to marine life to compel into investment.
- Shipping Industry finally succeeded to delete or moderate the contents extensively <u>without</u> objection by member States.

DE 57/17 Arnex, page 1	DE 57/17 Annex, page 4	DE 57/17 Annex, page 6
ANNEX	intended for consideration for new ships. However, consideration can also be given to existing	[7.2.3 Rotary engines (e.g. turbines) will induce less vibration to the hull resulting in less
AUTICA	whence the consideration for the strips. Hower, consideration can also be given to externing ships, depending on the practicality and cost of noise militation measures. While flow noise	17.2.5 rotaty engines. Allemative propulsion systems using water lets codded properties.
GUIDELINES FOR MINIMIZING UNDERWATER NOISE FROM COMMERCIAL SHIPS	around the hull has a negligible influence on radiated noise, the hull form has influence on the inflow of water to the proceller. For effective reduction of underwater noise, hull and propeller	etc., may be considered to minimize underwater noise.][for reciprocating machinery]
	design should be adapted to each other. These design issues should be considered	7.3 Reciprocation machinery (such as diese) engines, refrigeration plants, air
Preamble	holistically as part of the overall consideration of ship safety and energy efficiency.	compressors, and pumps): Consideration may be given for the appropriate use of vibration isolation mounts as well as improved dynamic balancing. Vibration isolation of other items
1 Concern has been raised that a significant portion of the underwater noise	6.1 Propellars	and equipment such as hydraulics, electrical, pumps, piping, fans (large M/AC), vent and
generated by human activity may be related to commercial shipping. The international	significantly 4	AC ducting, etc., may be beneficial for some applications, particularly as a mitigating
community recognizes concern that underwater radiated noise from commercial ships may	6.1.1 Propellers should be designed and selected in order to minimize cavitation.	measure where more direct techniques are not appropriate for the specific application under
have both short- and long-term negative consequences on marine life, especially marine	Cavitation will be the dominant radiated noise source and may increase underwater noise	consideration. Such approaches may contribute to reduction of both underwater radiated
mammals.	[20dB] or [by as much as 20dB over the frequency range of 10Hz to 100,000Hz]. Cavitation	and onboard noice affecting passengers and crew (inside working and living spaces).
	can be minimized/reduced under normal operating conditions through good design, such as	
2 It is important to recognize that both the technical and cost effectiveness of	optimizing propeller load, ensuring uniform water flow into propellers (which can be influenced by hull design), and careful selection of the propeller characteristics such as: size	17.4 Large HVAC fans: Consideration could be given to the isolation of these fans from the ship structure, especially when located below the main deck. HVAC fans may be fitted
measures considered either individually or in combination will be strongly dependent on the design, operational parameters, and mandatory requirements relevant for a particular ship. A	innuenced by huil design), and careful selection of the propertier characteristics such as: size and blade-deeign, section, bitch and cambles. Considerations-for-properties-used-most	with variable speed controls, attenuation of the air inlet (sound absorbing muchroom hat)
oregen, operational parameters, and managing requirements relevant to a particular sing. A successful strategy to reduce radiated noise should consider interactions and contributions		with variable speeu contained water may an ane to contain account and the transfer laboration chamber. I
from measures provided to achieve other objectives such as reduction of onboard noise and	commonly on commercial shipe include:as - as possible	and an election million and compared and a second or an electronic of an e
improvements in energy efficiency.	1 the use of fixed origon proceilers may be considered in order to minimize	17.5 Sea pipe systems (such as seawater cooling systems): The flow induced noise
inprovention in energy enantray.	cavitation during normal operations. Optimized propellers could be	could be analysed and reduced. Elexible hosing may be used to isolate the machinery from
[3 Noting the importance of evaluation of ship underwater noise radiated from	employed in order to control cavitation to achieve optimized propeller	the ship structure. Optimizing the layout of the piping system, using elastic supports, fluid
commercial ships under various operating conditions, it is suggested that where practicable.	efficiency with consideration on minimizing ship noise radiation into water.	mufflers, and flexible structure-borne insulation for pipes for penetrating bulkheads may also
evaluation is undertaken by the company to determine the success or otherwise of ship noise	Even high efficiency propellers on modern ships can cavitate depending	be used to structurally isolate the machinery and mitigate fluid noise.]
reduction efforts and to guide and enhance future efforts at noise reduction.] 《 文章曾接多化	on the ship type and transit speed (e.g. single screw containerships	
1 Application	above 16-knots, tankers-above 12-knots). Technology-is available to predict and control togal components at harmonics of blade rate (shaft	8 Operational and maintenance considerations
	present and control tonal components at namonics of blade rate (shan speed x, number, of propeller, blades). The broad, band noise part of	Although the main components of underwater noise are generated from the ship design
1.1 These guidelines can be applied to any commercial ship.	operativitation - below 300Hz which dominates deep water-background-noise is	(i.e. hull form, propeller design, the interaction of the hull and propeller and machinery
	not investigated but it can be assumed that minimizing the tonals will also	confluctational modifications and maintenance measures could be considered as
1.2 These quidelines do not address the introduction of noise from naval or war ships or	reduce broad band noise]」 日5の文で代表する	ways of reducing noise for both new and existing ships.
the deliberate introduction of noise for other purposes such as sonar or seismic activities.		
	12 the use of controllable pitch propellers may be considered for designs with	 8.1 Propeller cleaning: Propeller polishing done properly removes marine fouling and
2 Purpose	constant shaft speed when the ship speed is not controlled by shaft speed	vastly reduces surface roughness, helping to reduce propeller cavitation. Available
	adjustment but by changing the pitch of the propeller blades. This may lead	information from technical articles indicate that in some cases effective propeller cleaning
2.1 These non-mandatory guidelines are intended to provide general advice about reduction of underwater noise to designers, shipbuilders and ship operators. They are not	to unfavourable hydrodynamic conditions with pronounced cavitation at low speed possibly exceeding noise at full speed. [Ships with constant shaft	and polishing may also result in power savings of up to 10 per cent.
reduction of underwater noise to designers, shipbuilders and ship operators. They are not intended to form the basis of a mandatory document.	speed, possibly, exceeding noise at full speed, joints, with constant shan speed may make use of a power take off (PTO) is a generator directly	8.2 Underwater hull surface: Maintaining a smooth underwater hull surface and smooth
interfect to form the basis of a manuatory occurrent.	connected to the propeller shaft, in such cases, noise can be reduced by	 Onterwater null surface: maintaining a smooth underwater null surface and smooth paintwork may also improve a ship's energy efficiency by reducing the ship's resistance and
2.2 Given the complexities associated with ship design and construction, the guidelines	allowing come flexibility in shaft speed. The generator could be adjustable	propeller load. Hence, it will help to minimize underwater noise emanating from the ship.
focus on primary sources of underwater noise. These are associated with propeller design.	or electrically disconnected from ship mains by a converter.	Effective hull coatings that reduce drag on the hull, and reduce turbulence, can facilitate the
hull form, onboard machinery, and operational aspects. Much, if not most, of the underwater		reduction of underwater noise as well as improving fuel efficiency.
noise is caused by propeller cavitation. Hull design, onboard machinery, and operational	[6.1.2 Another source of radiated noise could be related to the vortex released at the blade	
modification issues may also be relevant, but of secondary importance. The optimal	tip and the whole vorticity and turbulence fields occurring downstream the propeller. These	[8.3 Inspection and maintenance: Consideration could be given to the inclusion within
underwater noise mitigation strategy for any ship should at least consider a combination of	important features of the flow field may heavily depend on the operating conditions of the	planned maintenance procedures, of periodic inspections/monitoring of machinery and
factors related to these areas.	propeller and, very often, also on the rudder location. The possibility to alter in a suitable way	equipment with respect to any noise control/reduction features. Should such activities reveal
2.3 These guidelines consider common technologies and measures that may be	these important effects. (for example, by an optimized design of the blade tip and the analysis of the hydrodynamic interactions, between the propeller and the rudder) could be accurately.	defects or areas of improvement, appropriate action can be taken.}
2.5 These guidelines consider common technologies and measures that may be relevant for most sectors of the commercial shipping industry. Designers, shipbuilders, and	investigated in view of a hydro a countie optimization of the propeller.)	48.4 Selection of ship speed: In general, for ships equipped with fixed offch propellers.
ship operators are encouraged to also consider technologies and operators are encouraged to also technologies are encouraged t	and a grant and a start of a start of the start of the property of the property of	(c)4 Colorado and papera. No anipe equipped with need picture properties, considering the cavitation inception speed of the propeller when selecting ship speed can be
included in these guidelines, which may be more appropriate for specific applications.	6.1.3 Noise reducing propeller design options are available for many applications.	a very effective operational measure for reducing underwater noise (i.e. the selected ship
	However, it is acknowledged that the optimal propeller with regard to underwater noise	speed should be less than the cavitation inception speed).
	reduction cannot always be employed due to technical or geometrical constraints	
	[(e.g. ice-strengthening of the propeller)]. It is also acknowledged that design principles for cavitation reduction (i.e. reduce pitch at the blade tips) can cause decrease of efficiency.	
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Closing: Decision made at MEPC 66 (Apr. 2014)

- MEPC66 (2014) approved the relaxed Guidelines brought up by DE 57 with minor changes (MEPC.1/Circ.833) noting that:
 - There are **a large number of** <u>gaps in knowledge</u>;
 - There are various sources of underwater noise and their contribution is a complex issue;
 - Setting future <u>targets</u> for underwater noise levels is **premature**; and
 - **More** <u>research</u> is needed.
- Shipping Industry is very much **reluctant** to revisit this issue.
- Shipbuilding Industry should also refrain from reopening this issue thoughtlessly.