RINA MARITIME INNOVATION COMMITTEE

Theme: Safety & Environment

Version: 1

Date: January 2019

Safety & Environment

This theme covers involves This includes design for safety, operational safety, human and organisation errors, and environmental protection due to maritime accidents/incidents.

Objectives

- Key objectives and benefits addressed by the innovation theme are:
  - Improving safety, including human & organisational factors
  - Addressing environmental concerns

Technology Priorities

Technologies that we believe will have the most significant impact on the marine industry

Technology	Technology Description
Design for safe operations/ maintenance	This includes provision of safety inherent in design. This also includes consideration of different maintenance strategies in the design process. Use of E-Safety Certificates Need to include design for safe production/manufacture also
Impact of smart system design reducing fatigue/distraction	As above in Operations - situational awareness/decision making toolsets to reduce information overload.
Human Machine Interface (HMI)	This is about provision of a user-friendly interface between the system domain and the software domain to minimise human error.
Augmented Reality	Can be used to bring critical safety information to light for anyone working in a tough environment with complex tools and equipment. guide employees through complex tool preparation, and to highlight critical part information. " .

Technology Priorities

Technologies that we believe will have the most significant impact on the marine industry

Technology	Technology Description
Data Analytics/Machine Learning	"Technology draw from other industries (Rail prime example) where it has been shown that certain patterns of occurrence of minor HSE incidents can assist in predicting when the likelihood of a more significant incident might occur. Data analytic tools can be used in numerous ways to aid in understanding links between human activities, fatigue, training and HSE incidents. Large suite of potential application. Techniques are in most instances dependent upon interrogation of large datasets but to date industry has been shown to be poor in sharing applicable data."
SOx Scrubbers	Utilises the alkalinity of SeaWater to react and neutralise Sulphur emissions. Effluent is washed directly to sea post cyclonic separation of sludge. Negatives are the deposit of amongst other undesirables heavy metals found in fuels. Unlikely to be acceptable in long term given negative aspects of system operation, especially in coastal waters (Note: MARPOL requires operation to be accompanied by an environmental impact statement/report).

Technology Priorities

Technologies that we believe will have the most significant impact on the marine industry

Technology	Technology Description
Open Loop Scrubber System	Utilises the alkalinity of SeaWater to react and neutralise Sulphur emissions. Effluent is washed directly to sea post cyclonic separation of sludge. Negatives are the deposit of amongst other undesirables heavy metals found in fuels. Unlikely to be acceptable in long term given negative aspects of system operation, especially in coastal waters (Note: MARPOL requires operation to be accompanied by an environmental impact statement/report).
Closed Loop System	Neutralisation of Sox is achieved by chemical dosing of a closed loop system that washes the exhaust emissions. Simple top up and bleed of the system encompassed. Neutral on environment from an effluent perspective but introduces risks to crew.
Hybrid System	Combines benefits of both Open Loop and Closed loop systems. In deep water the system is operated as an open loop system and when in confined water as a closed loop system. Significantly reduces the amount of dosing chemicals that need to be carried whilst protecting the more delicate environments to be found in shallow coastal waters.

Technology Priorities

Technologies that we believe will have the most significant impact on the marine industry

Technology	Technology Description
NOx abatement technologies	NOx technical code deals with emissions. Dealt with under IMO MARPOL chapter 13. Emission requirements dealt with under tiering regime linked to date of engine and locality of operation. All modern engines are tier II compliant commensurate with world wide operations. Tier III requirements are associated with ECA localities. Tier III compliance requires in majority of cases out of engine solutions
Fuel Switch	Movement to LNG fuel dampens the flame front and closes gap in compliance. Slow Speed Low Pressure engines (XDF) are compliant with Tier III requirements without additional technology.
EGR	Exhaust Gas Recirculation. Reduces the oxygen content of combustion mix reducing the flame front – Tier III compliance.
HARM	Humid Air Recirculation - injection of water within the combustion mix again dampening the flame front in the combustion process

Technology Priorities

Technologies that we believe will have the most significant impact on the marine industry

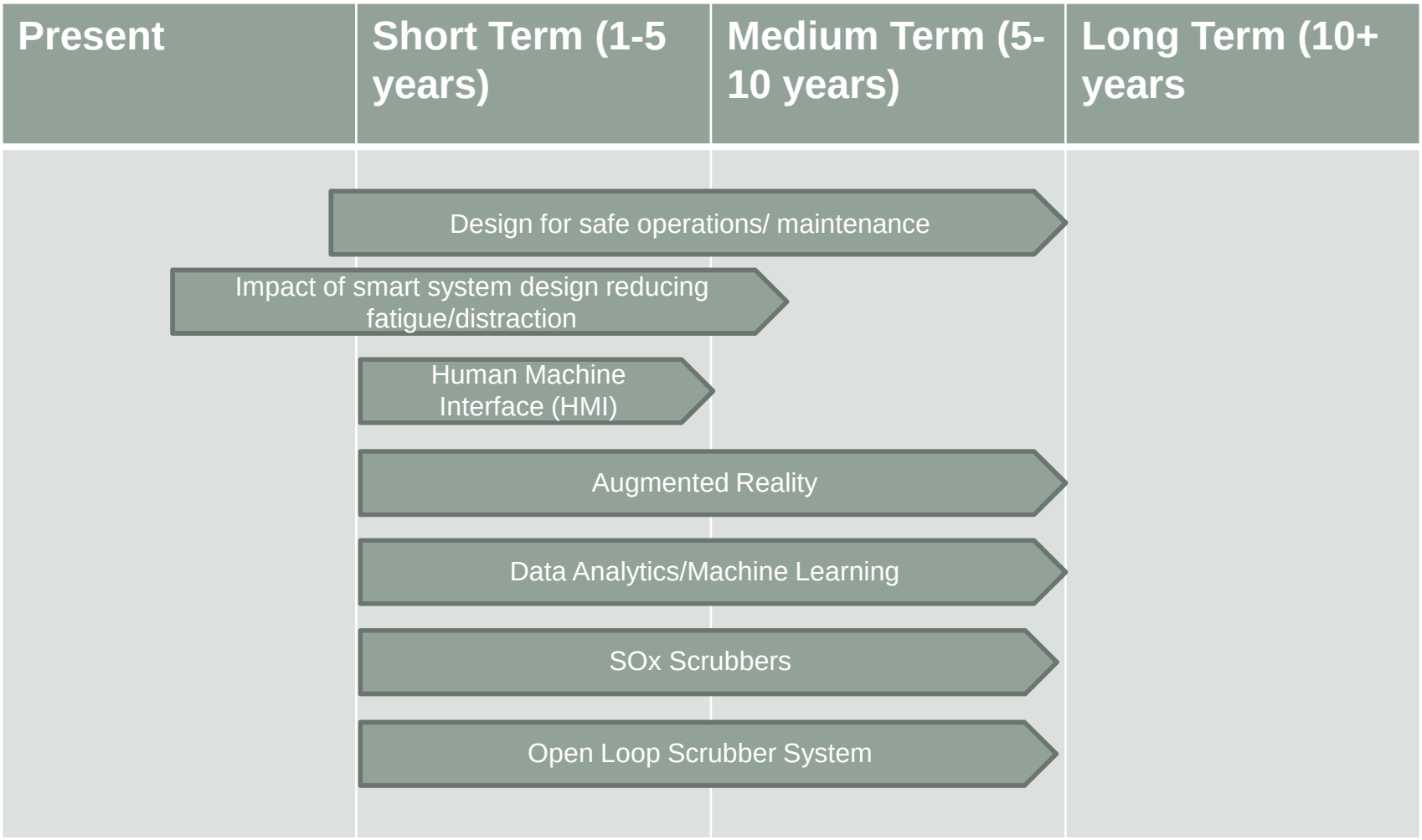
Technology	Technology Description
Selective Catalytic Convertors	UREA passed through the catalyst reacts with the NOx emissions to neutralise. Care needed to avoid poisoning particularly sensitive to Sox. Concerns relating to ammonia slip
Chemi Luminescence or Cascade Lasers	Movement to LNG fuel dampens the flame front and closes gap in compliance. Slow Speed Low Pressure engines (XDF) are compliant with Tier III requirements without additional technology.
Hull Cleaning	ROV Systems, Robotic Systems, At Berth Systems
Ballast Water Treatment	Numerous technologies within this space ranging from chloronation, active carbon, ozone treatment, ultrasound and UV systems

Technology Priorities

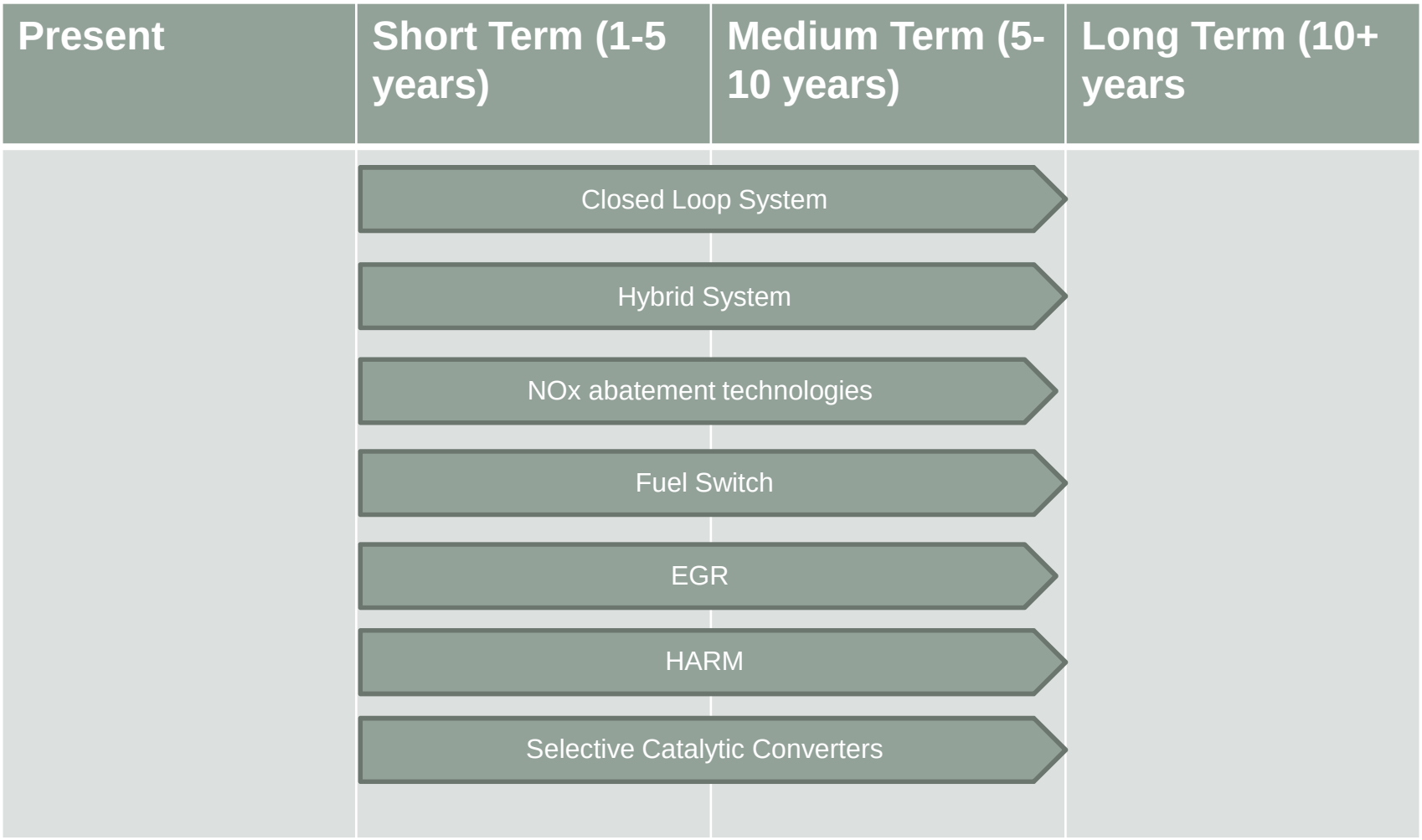
Technologies that we believe will have the most significant impact on the marine industry

Technology	Technology Description
Noise propagation that impacts primarily toothed mammals	"Not a regulated subject at this time. However concern building and potential to become a future topic for regulation. Solutions will likely draw from existing suite of technologies. The key will be in how they are integrated within the overall design. Likely will draw from defence industry. Works to date have focused upon studies of noise propagation and associated modelling. Lots of works/material available in respect to impact of noise upon fish and mammals"

Exploitation Timescales



Exploitation Timescales



Exploitation Timescales

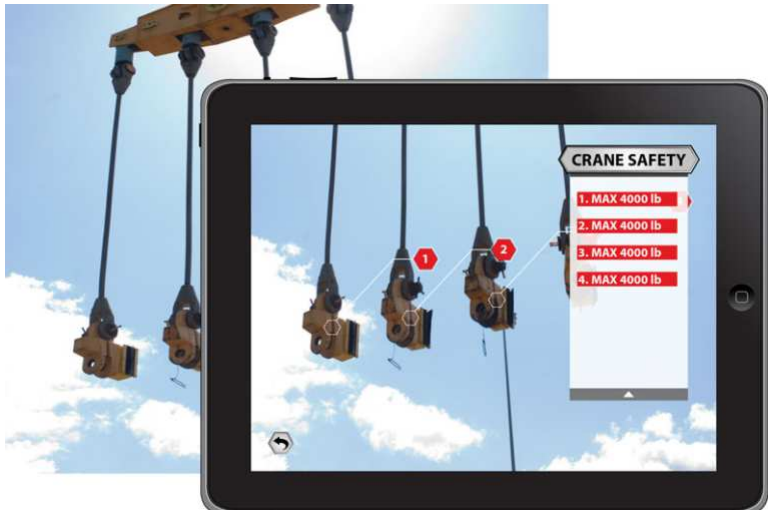
Present	Short Term (1-5 years)	Medium Term (5-10 years)	Long Term (10+ years
	Chemi Luminescence or Cascade Lasers		
	Hull Cleaning		
	Ballast Water Treatment		
	Noise propagation that impacts primarily toothed mammals		

Challenges & Risks

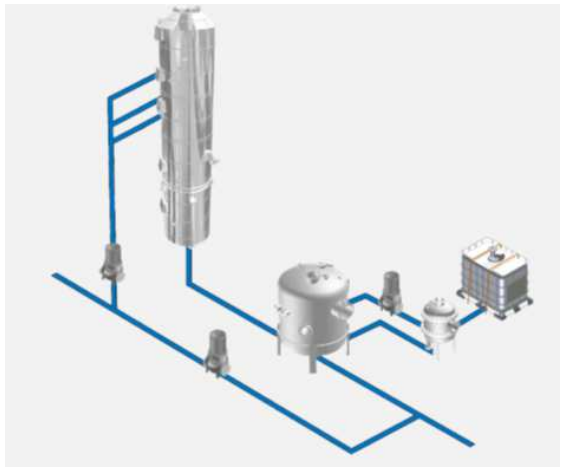
- Increased requirement for enhanced operational safety.
- Augmented reality example have shown how this can be very effective for on-board operation.
- Also need to look to adjacent industries to view how safety is managed.
- Environmental requirements are becoming more demanding. A number of technology areas and specific technologies presented which address environmental concerns. These range from mature to low maturity solutions.

Examples

- Newport News Augmented Reality bringing safety critical information to light.



- Environmental:
- Open Loop Scrubber System



Conclusions

- Technology priorities may change with time since technologies are rapidly developed.
- Exploitation and implementation of new technologies are largely dependent on the technology readiness level (TRL).
- Collaboration between research organisations and industry can facilitate the application of new technologies.