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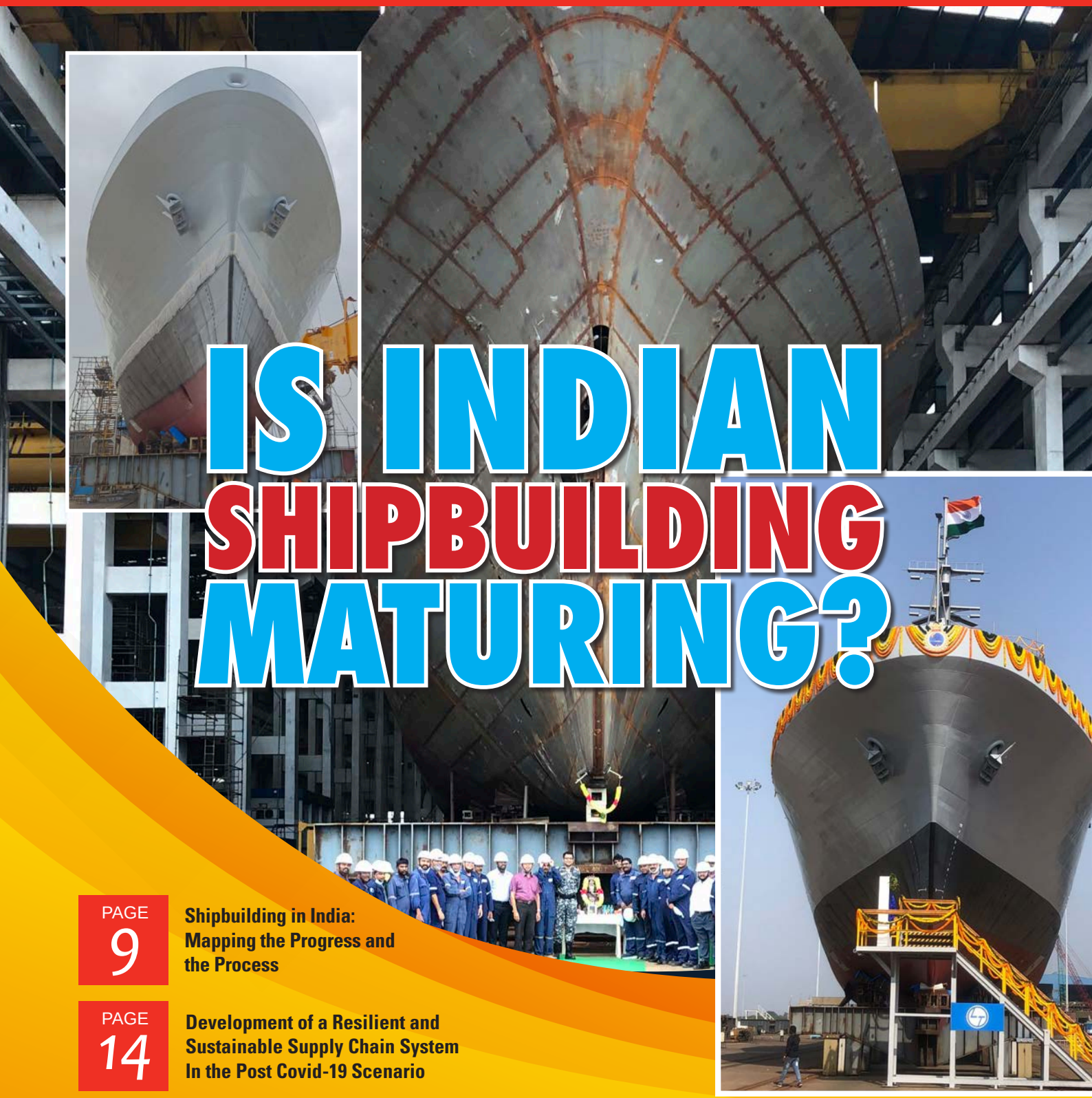

IS INDIAN SHIPBUILDING MATURING?

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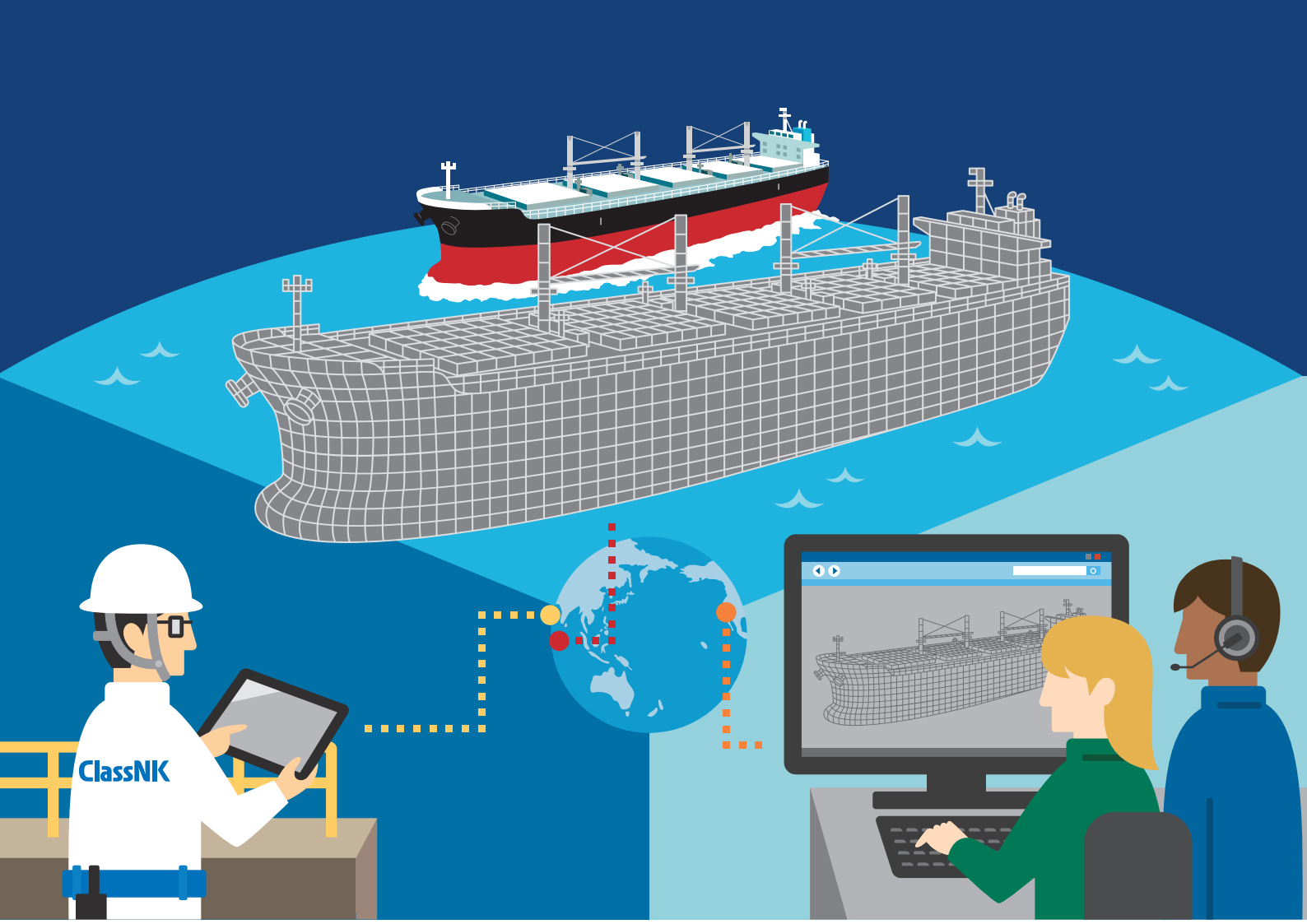

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EDITORIAL

A river seems a magic thing. A magic, moving, living part of the very earth itself.

- Laura Gilpin (poet)

Prior independence, our Eastern riverine paths appear to have been explored and navigated, providing hope for connectivity. Across the States, many Canals had carried local produce (tea, timber, fruits, grains, local produce etc., and even oils) between points. History may observe that partition, politics and pollution had stunted progression through the inland waterways. In the present times, inland waterways mode has attained a serious tenor in our development plans.

There are more changes being sighted to the history pages...

Bangladesh has indicated consent to the use of Chittagong port. The rivers that we may use are the great Brahmaputra and Barak systems. Chittagong had provided the access through the Assam-Bengal railway during the British times and now we are reengaging.

The BD bonhomie is expected to bring floods of benefits to the adjoining NE States and most importantly, in connecting our mainland with the multimodal route. We may hope our other inland waterways also flourish and be navigated by more inland vessels.

Rivers run their courses differentiating no nations... probably that is what make them majestic and magical. But the nations do differ... as we see the battle for the banks of another big river rage on (Kiev sits across both sides of the Dnieper river). The picturesque skyline is turning into a splintered graph of many cragged, dark, concrete shreds. The world waits for the Dnieper to get its mojo back and move as a living part into the Black Sea, as she had been flowing ever since.

In this issue...

New shipbuilding orders are on the rise (South Korea has touched a 6-year high) and so are the costs (Conventional LNG Tanker costs have touched US$220M). Our southern yard of CSL had announced its green project of developing and building Hydrogen fuelled electric vessels.

But will these winds favour India as a comfortable destination for building ships?

Ship building in India sometimes appears akin to Sisyphean task, but considering the statistics of the last few decades, an introspection would be worth the effort. And incidentally, in the post-pandemic count, the other Asian heavyweights, China and South Korea lead in the order book tonnage. Digesting all these, Hrishikesh Narasimhan presents a short analytical series on Indian shipbuilding. In his Part 1, he traces the global shipbuilding briefly and lands in the Indian yards' dilemmas. Productivity must precede support, especially financial, he argues. To improve the order books and sustain, building of Naval vessels is highlighted as a path.

Adding to the notes, the global buzz is on digital dockyards, decarbonisation efforts, future proofing of ships at building stages, digital twinning and transformations with resilience in building yards and berths too. We hope Hrishi will have some energetic discussions on these also in the coming parts.

Following this is the discussion on supply chain. Dr. Acharya looks at the post-pandemic scenario and pitches for a resilient supply chain model. This is a much talked about model for being more pragmatic.

The globalisation might have brought the countries closer but the geopolitical situations have always presented a challenge for the supply chains. In the recovery scenario, sourcing out raw materials from closer locales, inventory control with a foresight and acting quickly to the changing scenarios are identified as the characteristics of this resilient supply chain. A couple of interesting takeaways are the brief discussions on maritime digitalisation and the FAL Convention scope.

Under Technical Notes, Sanjiv enlightens on the role of additives in lube oils. We also have a discussion on a cylinder condition monitoring program, which is being used on board. While the program is from the perspective of analysing the LO, Ketan Damle has promised to continue this discussion with few real case studies. Let us hope for that.

Under Heritage Hourglass, Amruta takes us to the top of the Mamallapuram lighthouse.

And we are adding a look-back column ...

While MER has accommodated itself in all possible forms of modern media, we thought it would be worthwhile to look at the only-print version era. We will be digging out the MER issues from four decades deep and project a few interesting sections. We are sure that there will be some recallable connections and we look forward to you all reverting.

We enter into the month of June and will be crossing the half-yearly mark soon. We will see the monsoons filling and flooding our rivers, which will live and wind their ways into the seas.

June is believed to symbolise the celebration of the youth. Let the celebrations of the rivers extend on to healthier youth and lower infections too.

Here is the June issue with that wish...

Dr Rajoo Balaji
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MARINE ENGINEERS REVIEW INDIA

JOURNAL OF THE INSTITUTE OF MARINE ENGINEERS (INDIA)

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SHIPBUILDING IN INDIA: MAPPING THE PROGRESS AND THE PROCESS (PART 1)

Hrishikesh Narasimhan

Introduction

Most Indian yards today are building for the Defence establishment. However, at times when the demand for commercial ship go up, can these yards compete with International shipyards, earn more profits and exploit an export opportunity?

Warships are designed to serve the strategic interests of the nation but can the national interest to earn revenue be ignored? Should a person continue to put his money in a fixed deposit when the stock market is booming?

The Modern Shipyard continues to be a place where ships are assembled efficiently. However, an efficient assembly line is a strategic competency of the yard. It is the secret sauce of that efficient yard and the knowhow is not easily transferable. Neither do they write about it anywhere or discuss this aspect.

So what is the way to become an efficient shipyard? Can financial subsidies alone help? This paper examines the conflicting requirements of a shipyard to have an order book at lean times and also cash in on a 'boom time' in ship building.

It argues that Shipbuilding is a mixed manufacturing industry and enhances the various verticals such as steel, paint, machinery and banking. That's why emerging economies use it to leapfrog their status. Efficient shipyards are a combination of organised process and good management but most of all, technique. This is the key ingredient in efficient Japanese and Korean yards and very hard to absorb by the casual observer.

The paper examines the concept of a Hybrid Shipyard to help India in its pursuit and the Author believes the key to this is technique. One does not become *Bismillah Khan* by documented process and management alone!

Background

The pioneers of an assembly line production have been the engineering giants both in Europe and Japan. By the late 70's Japan became a leading ship building nation. The South Korean copied the Japanese model, adopted it and is now more advanced than the Japanese.

In the 70's, the Korean government commenced a program that would propel them as a top ship building nation (The Author had translated a Korean paper on the topic).

With hindsight, the main success factors of the Korean shipbuilding industry were:

1. The Governments guaranteed long term support to Shipbuilding. Point to note that this was despite their domestic shipping industry not supporting their shipyards.
2. Asking the revolutionary private companies like Hyundai, Samsung and Daewoo to take up ship building.
3. Creating fierce competition for exporting amongst the shipyards.

   However, the key to the Korean shipyards emerging as a top shipbuilding nation was the thrust on productivity.
4. The Korean shipyards adapted to the Japanese and European technology and further improved to create their own method to build ships.
5. Active cultivation of Korean personnel in universities, training courses and incentives to learn.

India also has a vision to develop itself as a self-reliant nation that can build a strong Defence and Commercial navy. We are adopting many of their methods except

India also has a vision to develop itself as a self-reliant nation that can build a strong Defence and Commercial navy

there is no serious plan to improve productivity at the national level.

India's Maritime Vision on Ship Construction

India has, for many years, successfully pursued an indigenisation programme for Naval Construction. It has a documented vision to achieve self-reliance in shipbuilding and 'Make in India'. To its credit, this is a half century activity that has yielded good results.

But India also has maritime commercial interests and there is an urgency to grow its merchant fleet.

Economic Growth has four pillars that directly or indirectly influence ship-building and freight. Agriculture, Construction, Energy and Military. Shipping caters to these four sectors. Bulk Shipping could be fertilizers, chemicals, raw materials for steel construction etc. This makes tracking and participating in Energy Transport, movement of construction materials and finally Defence or Military crafts vital for a country. India needs to be reasonably self-sufficient in the carriage of its own commercial cargo.

This view that our commercial shipyards must grow is also a long time agenda but it is yet to show results. In the 'Maritime India Vision 2030', the Government of India has specifically mentioned Productivity at our yards as a major hurdle.

Don't Mix Productivity and Financial Assistance

At most conferences the shipbuilding industry is always asking for financial assistance. This may give some short term relief but does not address the long term issue of poor productivity in Indian yards.

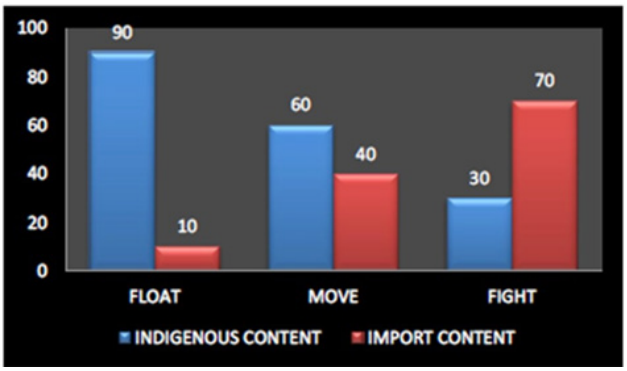

Figure 2: Indigenisation Content in Indian Defence ships. (Ref: Indian Naval Indigenisation Plan 2015-2030)

Productivity is a combination of Technique plus Operation and Management. It is internal to the yard. In the long run financial hand-outs only encourage inefficiency.

While Financial subsidies, localisation, cabotage and restrictive laws give domestic ship owners an edge, there are only short term measures. The governments of today require the industry to grow and pay back the government by revenue in the way of taxes, create jobs and boost the country's profile internationally.

When such measures don't yield tangible results, the Government will tire of the industry.

In areas where clusters of similar ships are being produced like Goa, we see that the development of Indigenous shipbuilding ancillaries have created a small export opportunity for Indian suppliers. Valve manufacturers from Coimbatore, Electrical Panel manufacturers from Goa and Siemens at Mumbai are a few examples. Some foreign companies have also set base but are mostly exporting using India as a low cost production centre. Eventually we must have a sizeable production of typical ships that will help to scale the upstream industries.

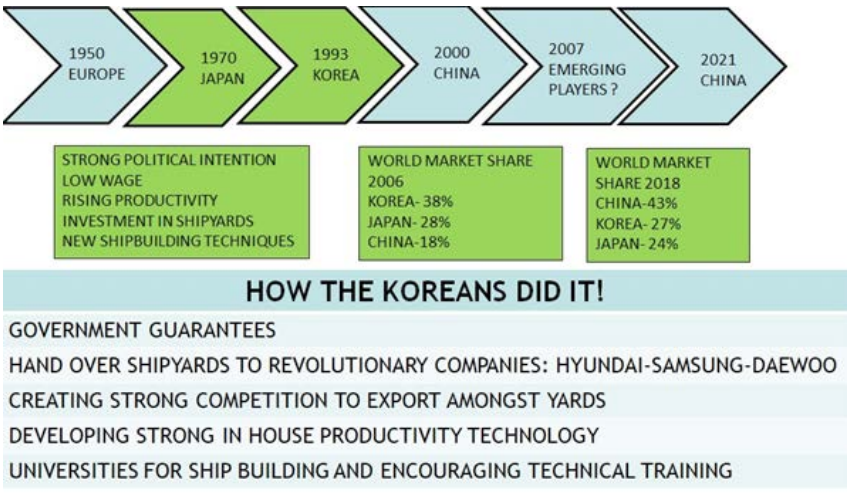

Figure 1: Lessons from the East

For the Indian shipbuilding industry to become truly sustainable, the Indian yards must have

1. An order book that is continuous
2. An assembly line that is able to improve its productivity
3. A few products which is recognised internationally

Case Study! The British Shipyards Today

In order to examine these issues better, its' good to look historically at the British Shipbuilding industry

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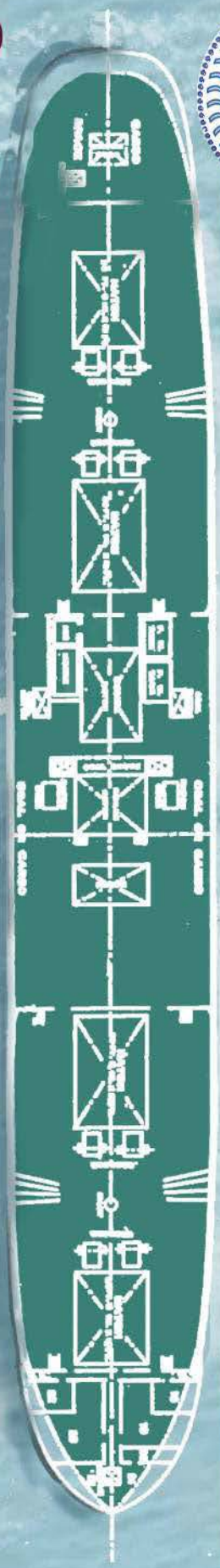

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ABOUT THE CONFERENCE:

Since its inception in 1982, INMARCO has always witnessed an overwhelming response from the Maritime sector which in turn has prompted the Institute to organise this conference and exhibition quadrennially.

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> *The governments of today require the industry to grow and pay back the government by revenue in the way of taxes, create jobs and boost the country's profile internationally*

which steadily lost ground and is now mostly building ship for the Ministry of Defence.

In 1980's, though the demand for global shipbuilding increased steadily till a peak in 2003, the British shipyards steadily turned away from commercial shipbuilding as they were not competitive. By 2005 , the British shipyards had only one principal client, the Ministry of Defence.

Way Forward

In the dynamic world, the push to reduce costs is going to be the greatest incentive for Naval Shipyards to try to re-enter the commercial market for the advantages it offers.

Advantages of building Military Ship are many:

- It offers a higher Profit
- Military ships have high engineering content
- Less Competition from overseas yards
- Allows large infrastructure developments
- Allow higher value engineering to be indigenised

However, the single biggest disadvantage is that the motivation to retain that competitive edge is lost. The long lead times between contracts is another factor and retention of steady labour force is difficult.

The Case for Hybrid Shipyards

In order to take the best of the two worlds different nations have tried various ways.

	Material Costs (60-70% of vessel costs)			Labor Cost (30-40%)				Financing		
Country	Steel	Other Material	Relative MatL Cost	Labor rate	Productivity	Net Labor Cost	Relative Labor Cost	Vessel cost (Relative)	Financing cost	Total cost of Ownership
	30-40% of material costs	60-70% of material costs		$/mhr	Mhr/CGT	$/CGT			Rate of interest (%)	
	100%	100%	100%	3-4	150-180	620	100%	100%	10-12%	100%
	90%	85%	87%	5-6	50-60	300	48%	75%	2-5%	74%
	95%	85%	89%	15-20	10-15	325	52%	78%	1-2%	78%
	95%	87%	90%	20-25	10-15	350	56%	80%	0-1%	79%

Note: Productivity analysis basis analysis for 9 major shipyards across China, Japan and South Korea, Other material costs basis relative costs for marine equipment and other overheads (power, etc.). India vessel cost does not include subsidy.
Source: International Journal of Business Performance Management, OECD, Industry Expert discussions

Figure 3: Indian Shipyards have a low Productivity compared to world average

Korean yards keep their Military ships and commercial ships in two separate areas, but Japanese yards have built them together. The best Indian shipyards are of medium size, and they must earmark a product mix that allows them to concentrate some ship that have an international market and volume. The Military projects can be their insurance during lean times. This way there is comfort that the work is continuous and the speed and efficiency of commercial orders can be passed on to the military vessels/shipbuilding as well.

The per capita GDP of a country is fully linked to a country's productivity and as far as shipbuilding goes, this a matter of concern.

The Maritime Vision 2030 acknowledges productivity of Indian labour at shipyards to be its biggest challenge and this bring us to the next question.

Why Productivity Enhancement is so hard at Indian Yards?

Enhancing productivity in a process industry such as the Automobile Industry is easier than in a mixed process industry such as ship building should be easy. In assembly lines changing the process and standardising it is relatively simple. However, it appears that it repeatedly fails in shipyards.

The reason is that shipbuilding is not a mere process being repeated many times. Improvement is a concept that has to be applied with much thought.

While choosing a profitable array of new-buildings there must first be a thought on the Product Mix.

The Product mix will decide the orders that you will target. This will in turn influence the yard throughput of steel. The steel throughput in a given yard may vary depending on the steel scantling thickness of the ship. Ships with higher thickness may give a higher throughput with lesser effort than a ship with steel thickness of say 6 mm which is typical in Naval construction. Finally, all other things being similar the Yard layout, employee skills and Micro Planning decides the higher productivity in a yard.

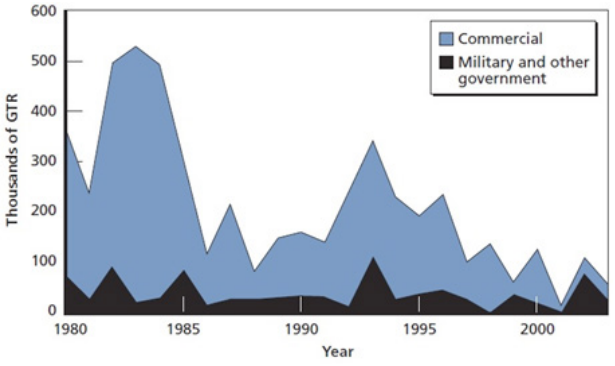

Figure 4: British Shipyards have a very small share of commercial ships
(Source: Differences Between Military and Commercial Shipbuilding; Rand Europe)

A documented risk analysis over almost 6 ships have shown that when the hull was completed early and ahead of schedule, the chances of an early delivery was almost guaranteed

End of Part 1.

Introduction to Part 2

Hull Fabrication in Indian Shipyards

There is a litany that has almost become a chant that anyone can make a hull but few can complete the

engineering in Indian yards. A documented risk analysis over almost 6 ships have shown that when the hull was completed early and ahead of schedule, the chances of an early delivery was almost guaranteed.

Why is that so?

It is easy to understand engineering, since Indian engineers are extremely hands on and competent. They can read, understand and innovate. On the other hand, the hull work is carried out by the Markers, Fitters and Welders who are almost coming from an un-organised sector. They have no formal training. The Hull Engineers and Naval architects are not 'tradesmen' and so without a formal training for the tradesmen and no hands-on experience for the Naval Architects, there is a 'process' but no 'process innovation and improvement'.

Part 2 of this series will discuss how to cover this huge deficiency in Indian yards.

ABOUT THE AUTHOR

Hrishikesh Narasimhan is a Marine Engineer from DMET. After his sailing years as Chief Engineer etc., and his tenure with DNV, he is currently the General Manager with L&T Shipyard, Kattupalli. He is on the Editorial Board of MER.

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DEVELOPMENT OF A RESILIENT AND SUSTAINABLE SUPPLY CHAIN SYSTEM IN THE POST COVID-19 SCENARIO

Jai Acharya

ABSTRACT

The integrated supply chain today is more complex than ever and there have been numerous studies and research conducted in recent times on the complexity, impact of Covid-19 syndrome and the implications of a large-scale disruptions for the industry, relevant stakeholders and supply chain system. In specific, the sustainability and resilience of maritime supply chain largely depends on overall health of the complementary components of supply chain systems. Though, the concept of a resilient supply chain system is not a new one, it's time to understand, act and adopt the changes befitting to the system and develop strategies for a more resilient supply chain system.

A resilient supply chain is defined by its capacity for resistance and recovery. The techniques for building a resilient global supply chain to stay competitive include, increase in inventory levels of raw material, continuity of ongoing work, quality control of the final product, strengthening the storage capacity and manufacturing surge capability.

In the wake of Covid-19 and other fragile scenarios, the leaders of supply chain system have to balance resilience and efficiency to secure their networks with a robust approach. To build a resilient supply chain system, the three phases such as survive, recover, rebuild are focussed by addressing and taking priority task of the capacity, capability and competency building in order to emerge out from each phase successfully.

The part of supply chain resilience is characterised by the stabilisation phase after which a return to a steady-state of performance is achieved. Generally, the businesses and companies take time to learn from its experience to make future planning and risk management strategy.

In a rapidly changing geopolitical scenario, fluctuations and trends toward nationalisation, especially after the Covid-19 pandemic, have changed the priorities of many of the supply chain leaders. They now need to balance the cost, performance and operational efficiency with a greater supply chain resilience.

The most supply chain leaders recognise that becoming more resilient is a necessity in the current environment of fragile scenarios. The risk assessment and management of supply chain security in the enhancement of building the supply chain resilience play an important role in the system. Along with a resilient supply chain system, a strong and resilient value chain system is equally important.

INTRODUCTION

In a recent Gartner survey, only 21% of respondents stated that they have a highly resilient network today, meaning good visibility and the agility to shift sourcing,

In a rapidly changing geopolitical scenario, fluctuations and trends toward nationalisation, especially after the Covid-19 pandemic, have changed the priorities of many of the supply chain leaders

manufacturing and distribution activities around fairly rapidly. The cost of retaining multiple supply locations must be seen more as a cost of doing business, rather than an inefficiency. It suggests that increasing resilience will be a priority for many as they emerge from the current crisis. More than half expect to be highly resilient within a period of two to three years. (Gartner's Survey 2021)

The first benefit of a resilient supply chain is the availability. With the quality operating systems, one can access real-time inventory data and adapt to global constraints.

There are three strategies for the building of resilience in the supply chain management, namely - To Diversify sources of raw materials, Build reserves to absorb the predicted and unpredicted shocks and Predict, Sense and Respond with Agility by Mapping out structural risk across the supply portfolio.

It has been observed that during the global pandemic period, the importance of adopting digitalisation of the supply chain sector was realised considerably. This is seen as an opportunity to assess the operational performance of the overall value chain of system such as procurements (sourcing), planning (scheduling), warehousing (distribution centres) and retailers including maritime sector such as vessels, ports and logistics management. The investment in new technologies took an interesting turn towards the digitalisation, operational technology (OT), Blockchain technology and application of artificial intelligence (AI).

Many stakeholders and corporate business strategists, CEOs and CTOs have learnt from pandemic scenarios and do have plans in place for developing a resilient supply chain system and moving towards the adoption new technologies enabling them to enhance the service standards to their customers' satisfaction.

The risk assessment and management of supply chain security in the enhancement of building the supply chain resilience play an important role in the system. Along with a resilient supply chain system, a strong and resilient value chain system is equally important.

A value chain takes the perspective all the way from where materials are mined or explored, the metals that are created, how they pass through the system including physical infrastructure, IT and human resources supports, land transportation, warehousing, maritime shipping and then finally how the end finished products get to the customers. So, a supply chain will be defined by a company, and it might include their first tier of suppliers. and might even include the suppliers of those suppliers. But very rarely do companies think of their supply chain all the way back to where do the raw materials come from and how they come together at each step. As an integral part of value chains, both within and across international borders, logistics firms facilitate trade and commerce and help businesses get their products to customers. Supply chain disruptions to the sector caused by the pandemic could, therefore, impact competitiveness, economic growth, and job creation. As a matter of fact, when we say value chain, we mean that whole process, from mines (source) to the end consumers (final destination).

It has been observed that during the global pandemic period, the importance of adopting digitalisation of the supply chain sector was realised considerably

DEVELOPMENT OF REVISED STRATEGIES

To create a resilient and sustainable supply chain system, the leaders and main stakeholders need to focus on instinct of survive, recover and rebuild; with a meticulous plan for a revised strategy to build a safe and greater resilience into their networks. It would be a rigorous exercise to embrace a change in adoption of major strategies and rebuild a resilient supply chain system.

Below stated six major strategies are required to be adopted and implemented.

Enhancement of Inventory and Capacity Buffers

Diversification of Manufacturing Networks

Creation of Multi-sourcing to Mitigate the Risks

Enhancement of Regional and Local Supply sources

Focus on Harmonised Product and Technology

Broaden Collaborative Approach and Diversified Sourcing

DIGITALISATION OF THE MARITIME TRANSPORT & SUPPLY CHAIN SYSTEM

The digitalisation and investment in new technologies will create a robust and resilient supply chain system. Selection and Implementation of befitting and result oriented technology will make a safe, secured, seamless and resilient system. For the operational excellence, below stated technology tools are required to be adopted and implemented across the supply chain network system.

Cyber Security Management

Data Analytics / Machine Learning and Artificial Intelligence (AI)

Robotic Process Automation

Block Chain Technology

Internet of Things (IoT)

The maritime sector is at the intersection of new developments and in particular, the rise of digital

Minimising disruption in the logistics supply chains, including maritime transport, will mean extending international frameworks, building more public-private partnerships, and further digitalising trade facilitation

technologies and innovations. Many of these technologies and futuristic technological advances have yet to become widely trusted and accepted, yet the speed at which they are evolving underscores the pressing need for the sector to prepare and embrace their potentially transformational effects. An important consideration in this regard is the potential for new technologies and innovations to help the sector to comply with the requirements of the global sustainability agenda while at the same time remain competitive and respond to the demands of the growing world economy and trade.

DIGITALISATION OF INTERNATIONAL CONVENTIONS (WTO TFA & IMO FAL)

The COVID-19 crisis has highlighted the many national regulations and administrative bottlenecks involved in the emergency supply of medical equipment, drugs – as exemplified by the ongoing vaccine supply chain. Minimising disruption in the logistics supply chains, including maritime transport, will mean extending international frameworks, building more public-private partnerships, and further digitalising trade facilitation. Such reforms will rely on harmonised international frameworks such as the WTO TFA and the IMO FAL Convention. These instruments, which provide governments with guidance and incentives in reforming trade facilitation measures, are paving the way for digitalisation, transparency, and rationalisation of administrative formalities. They already serve as the bases for many bilateral and regional trade facilitation agreements, and other initiatives are emerging as complementary building blocks.

FAL CONVENTION

The Convention on the Facilitation of International Maritime Traffic (FAL Convention) covers in its Standard 2.1 a detailed list of certificates which public officials can ask with respect to a ship. It also suggests the limits for information, number of copies needed etc.

The WTO TFA addresses issues in relation to the clearance of goods. The Convention on Facilitation of International Maritime Traffic (FAL Convention), on the other hand, which is managed by the IMO, focuses on the formalities and procedures for ships calling in ports, including those related to the arrival and departure of seafarers. Trade facilitation initiatives are likely to involve both agreements, so careful coordination and integration will be needed at the national level in order to ensure that regulations and procedures are aligned.

The Convention on the Facilitation of International Maritime Traffic (FAL Convention) covers in its Standard 2.1 a detailed list of certificates which public officials can ask with respect to a ship

ISSUES FOR DISCUSSION

The COVID-19 Pandemic has caused widespread impacts on almost every sector of global industry and economy, including international trade and global supply chains. Numerous research studies have reported the implications of such a large-scale disruption for businesses, supply chains and many other stakeholders. As a result, there is a widespread recognition among businesses and companies to re-strategise their critical supply chains, create policies of a sustainable business model and more importantly, build resilience.

The concept of supply chain resilience is nothing new. However, it has received significantly more attention in the past few years. Researchers and industry players have been investing in this area to manage supply chain risks and disruptions. It has been recently observed that the impact of disruptions has remained stubbornly high and uncertainty on business sustainability is seen high, the building up of a resilient system by enhancing capabilities that complements the traditional risk management processes and practices in many organisations.

Increasing the sustainability of the maritime transport sector is key to achieving the 2030 Agenda and the Goals, as well as the Paris Agreement. Examples from the Central Corridor Transit Transport Facilitation Agency and the Northern Corridor Transit and Transport Coordination Authority and small island developing States in the Caribbean show the importance of tapping the sustainability dividend of the freight transport sector. The examples underscore that achieving economic expansion need not be at the expense of social and environmental objectives and that applying a sustainability filter can be an important strategic tool in the optimal use of resources and enhancing efficiency gains.

Maritime transport and supply chain system has an important role in delivering on the global sustainability imperative. However, unsustainable maritime transport practices and related external costs need to be addressed. Mainstreaming sustainability principles into relevant maritime transport planning and investment decisions is important.

Tailored and targeted policies, regulations, incentives and enabling programs are required to promote more efficient, competitive and environmentally friendly and less energy intensive maritime transport systems. Implementing sustainable maritime transport solutions entails some cost implications and additional resources. It is therefore important to scale up investment, including through new sources and mechanisms, and promote greater private sector involvement, such as through public–private partnerships that also mainstream sustainability and resilience criteria.

INFRASTRUCTURE GAPS, ACCESS AND CONNECTIVITY

Inadequate and poor conditions of maritime transport infrastructure, as well as limited and constrained physical access to ports and inadequate hinterland connections, can undermine the sector's role as a driver of trade, global economic integration and sustainable development. Such conditions raise costs, extend delays, reduce reliability and undermine shipping connectivity. Limiting the shipping connectivity of countries, in particular small island developing States, calls into question the sustainability of the sector.

NEED FOR RECONFIGURATION OF GLOBAL VALUE CHAINS

The pandemic has exposed the vulnerability of extended and complex value chains to production disruptions, particularly in the East Asia Pacific region. As a reaction, many of these supply chains may shorten or diversify through reliance on alternative partners (for example, nearshoring) or intensified efforts to bring home (such as reshoring) strategic value chains. The shortening of supply chains may benefit countries with capable manufacturing sectors and beneficial exports' policy (for example, Colombia, India, and Mexico) to partially substitute China over the medium term. There may also be a trend towards placing additional warehousing capacity or dry ports near demand centres to shorten the time to get goods to market.

KEY FACTORS SHAPING SUSTAINABILITY IN MARITIME TRANSPORT

With over 80 per cent of world merchandise trade carried by sea and with shipping and ports forming an integral part of any door-to-door transport solution, the strategic importance of maritime transport and its potential to support more sustainable economies and societies cannot be overemphasised.

The ability of the maritime transport sector to deliver on the sustainability imperative is influenced by various developments. Sustainable maritime transport entails affordable and reasonably priced shipping and port services that, at the same time, generate value for service providers. This requires effective control over the factors influencing maritime transport costs, including infrastructure, trade (volumes, economies of scale and directional imbalances), competition, type of products shipped and position in relevant shipping networks (centre and / or periphery, hub and / or feeder ports and services). Greater sustainability in maritime transport therefore requires, as a matter of priority, the determinants of maritime transport costs to be better understood and the overreliance of the sector on oil-based propulsion systems to be effectively reduced. (Source: UNCTAD, 2021)

UNCTAD has long recognised the linkages between sustainable development and trade logistics, including in the context of relevant global processes and policy frameworks. It has focused on promoting the integrated treatment of the economic, social and environmental dimensions of transport, as reflected in the Accra Accord, the Doha Mandate and the Nairobi Maafikiano. UNCTAD is also actively involved in multi-stakeholder collaborative efforts such as the Sustainable Mobility. (Source: UNCTAD TD/B/C. I/MEM.7/17)

For All initiative, which brings together various transport stakeholders from the public and private sector committed to advancing equitable, safe, efficient and green transportation worldwide. In this context, some issues are particularly important and require further consideration and improved understanding. To consider how best to support and enable the sustainable maritime transport agenda and determine clear directions for the way forward, delegates at the sixth of the Multi-Year Expert Meeting on Transport, Trade Logistics and Trade Facilitation had the following issues to ponder:

How best can the sustainability transition of the maritime transport sector be accelerated?

What is the role of industry, policymakers, investors, users, developing banks and United Nations entities, such as UNCTAD?

What would be the best market-based measures that may be applied to reduce greenhouse gas emissions in maritime transport? What are the implications for transport and trade in developing countries?

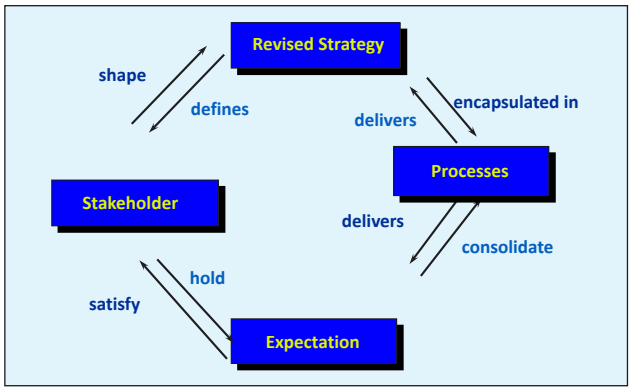

Figure 1 Aligning Processes with Revised Strategy

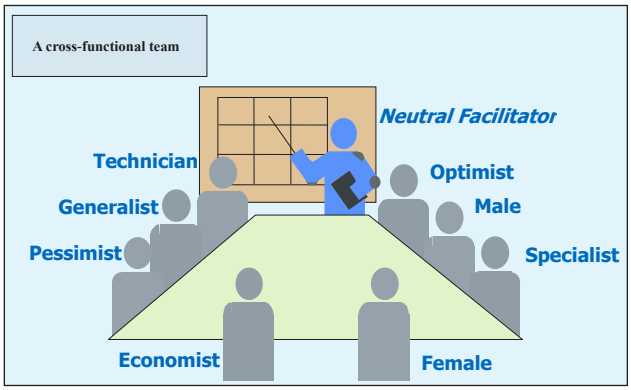

Figure 3 The Scenario AnalyticsTeam

How can financial resources and investment be scaled up and diversified? What are the options available to maritime transport?

How can maritime transport effectively reap the benefits arising from the ongoing digital revolution? How can the maritime sector and trade in developing countries benefit?

How can greater standardisation, coherence and harmonisation in standards and methods be enhanced, for the increased interoperability of systems, in the context of the digital revolution?

RISK ASSESSMENT

A consistent policy on conducting risk assessment and addressing the potential threats mitigation will assist in creation of a resilient supply chain system. All the six revised strategies have to undergo for the risk assessment exercise consistently. Supply Chain Risk Exposure Evaluation Network of BSI (SCREEN) Intelligence reports that while COVID-19 matters remain a primary concern, the impact created a number of additional disruptions and risks which are impacting supply chains, including cargo thefts, smuggling, and child labour. The outbreak of pandemic has led to complex and varying responses by individual governments and businesses and has wreaked havoc on supply chain continuity.

A Business Scenario Planning, Interpretations, SWOT analysis and Venn Diagram Logics Tools could be another set of complementary techniques to assist in reaching towards the revised strategy and establishing the relationship amongst the supply chain system components in order to build an overall resilient and sustainable system [**Figures 1, 2, 3**].

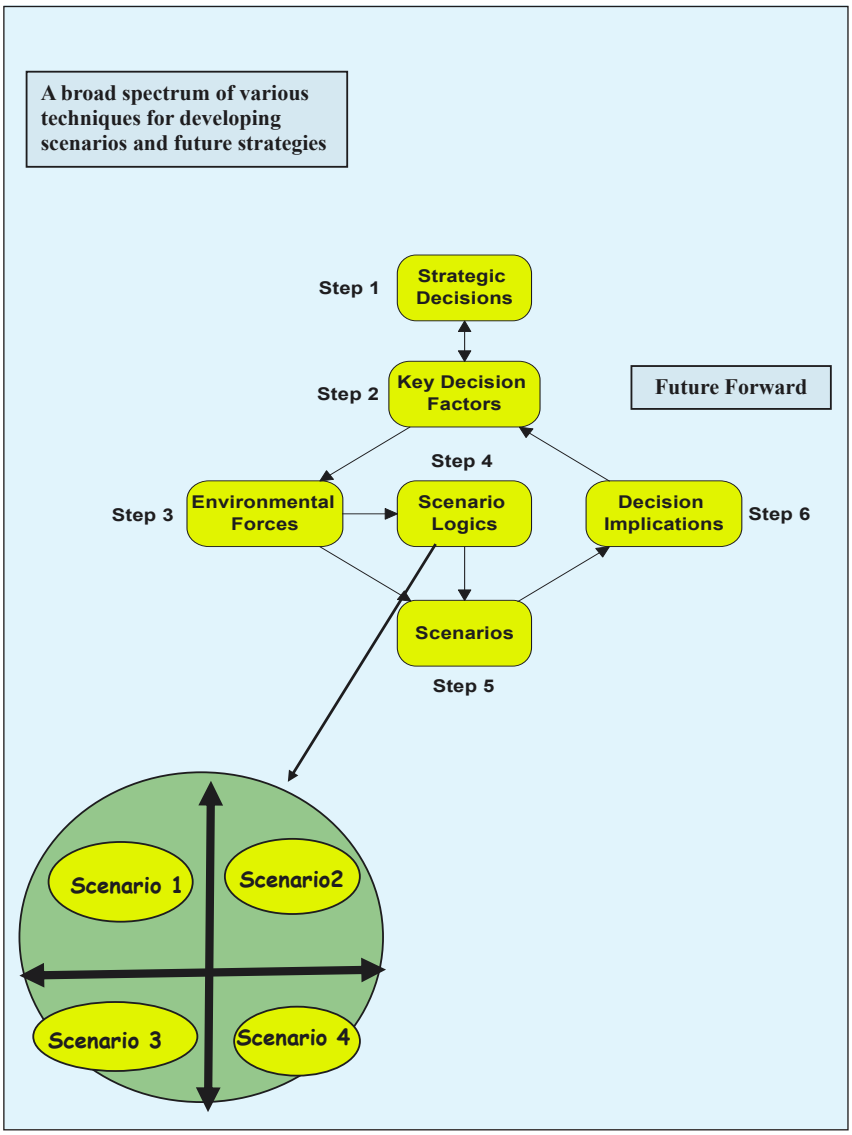

Figure 2 Scenarios – Techniques

CONCLUSIONS

In summary, Supply chain resilience is a complex, broad, multi-faceted and overarching concept. Resilience strategies are contingent upon

situation and context. Resilience capabilities are manifold and can range from hard technological capabilities to soft rational capabilities. Building a resilient business system usually takes a phased approach and the strategies and capabilities differ across those phases. Investigating different aspects of 'resilience' also demands different methodological visions.

Building a resilient supply chain should focus on three phases – survive, recover and rebuild by following the basic steps of understanding the risk, being open from the outset, taking a long-term view, conducting the risk analysis with due diligence and evolve through the lessons learnt.

Managing lead times and inventory levels using series of agreements with multi-tier suppliers; maintaining transparency and visibility with suppliers and consumers is an essential part of a resilient supply chain. Supply chain industry leaders need to review and revise the major strategies to build greater resilience into their networks.

References:

1. UNCTAD (TD/B/C. I/MEM.7/17
2. UNCTAD Review of Maritime Transport (2021)
3. Gartner's Survey Report 2021
4. https://insights.sap.com/what-is-a-resilient-supply-chain/
5. FAL Convention (FAL.2-Circ.131-MEPC.1-Circ.873-MSC.1-Circ.1586-LEG.2-Circ.3)

ABOUT THE AUTHOR

Dr. Jai Acharya [MSc (Maritime Studies); B.E. (Hons) EEE; FIE; CEng.] is a multi-faceted maritime professional. Currently, he is holding position of Principal Consultant with International Maritime Management & Consultancy Services (IMMC), a Company Incorporated in the Republic of Singapore, the Director of International Ocean Institute (IOI), Singapore (Focal Point) and recently established IOI Ocean Academy (Singapore), having its HQ incorporated in the Republic of Malta.

He has been appointed as an Adjunct Professor at University of Tehran (UT) - College of Engineering (Faculty of Business Management in Transportation, Logistics & Supply Chain Management). He regularly contributes to various maritime publications, including MER.

Dr. Jai is co-opted as an industry expert in the Australian Maritime Logistics Research Network (AMLRN), founded by the Royal Melbourne Institute of Technology (RMIT University) and the "Journal on Logistics and Supply Chain Management Network of Iran" founded and published by AMADGARAN, Iran. He has been a Member of Intellectual Committee for the International Maritime Research Confluence (IMRC) since 2020, known for its contribution in building a research ecosystem towards the UN SDGs with the maritime industry and academia.

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WMTC 2022 - A REPORT

The 7th World Maritime Technology Conference (WMTC 2022) was held in Copenhagen from 26th to 28th April at the Tivoli Congress Center. Being delayed by a year due to Covid, it saw a large turn-out of delegates. The WMTC 2022 was combined with the Danish Maritime Fair and saw over 30 exhibitors displaying their various products.

Over 100 papers of very high quality were presented during the 3 days, which saw lively deliberations on the Theme of the conference, **'Help set the green agenda for the years to come'**. There were over 300 delegates and 5 keynote speakers from various countries.

India was represented too and the paper presented by IME(I)'s Cadet Shree Waghmare from Tolani Maritime Institute on 'Ammonia – A Pungent Propulsion' was particularly appreciated.

The WMTC flag was handed over by Mr. Henrik O. Madsen – President, WMTC to Mr. V. K. Jain, President of The Institute of Marine Engineers (India) at the closing ceremony, since Chennai will be the host for the next WMTC to be held in 2024.

LUBE MATTERS # 12

FILM FORMING ADDITIVES

Sanjiv Wazir

Introduction

Wear can occur in all machinery components where moving parts are in contact. Surface contact with foreign matter can lead to abrasive wear and can be controlled by installing oil cleaning devices (filters, centrifuges) to maintain oil cleanliness. Wear caused by contact with corrosive materials (e.g., acids) is corrosive wear and can be controlled by using additives to neutralise the reactive substances. Wear caused by direct surface-to-surface contact is adhesive wear. A key function of a lubricant is to separate interacting surfaces, minimising the possibility of adhesive wear. Base oil viscosity plays a key role in forming an intervening lubricant film and achieving this separation. However, beyond a certain threshold temperature, as the base oil viscosity drops, the lubricant film formed may be insufficient. Film forming additives are used to counter this. Such additives work either by adsorbing or by chemically reacting to the metal surfaces.

Friction Modifiers (FM)

FM molecules are long slender molecules with a polar head and a linear non-polar hydrocarbon chain tail. The polar head is strongly attracted to the metal surface and the molecule is physisorbed on the metal surface. Other FM molecules with similar structure have a reactive head that reacts with the metal surface and the molecules are chemisorbed on the metal surface.

In both cases, the long hydrocarbon chain is left solubilised in the oil. The anchoring of the molecule to the metal surface results in the tail being perpendicular to the surface. The hydrocarbon chains line up with each other and through hydrogen bonding and Van der Waals attractive forces, the molecules form multi-molecular clusters parallel to each other **Figures 1 (a)** and **(b)**. When two metal surfaces are moving against each other in the same lubricant then both would have the FM adsorbed on them. Such layers are hard to compress but easy to shear and hence the surfaces acquire a slippery aspect.

This lubrication mechanism is also known as boundary film lubrication, and these additives are also known as boundary lubricant additives. They are made from fatty acids, fatty alcohols, fatty amides, and molybdenum compounds. These additives are used to decrease or increase friction depending on the application.

In engine oils & gear oils, the primary function of FM is to reduce friction, minimise wear & noise. At low temperatures, where lubricant viscosity is high enough to form an effective lubricating film, FM have little role to play. At elevated temperatures FM become important because of the drop in lubricant viscosity, which may lead to boundary lubrication conditions (**Figure 2**).

In transmission oils and hydraulic fluids, these additives are used to facilitate timely engagement and disengagement of

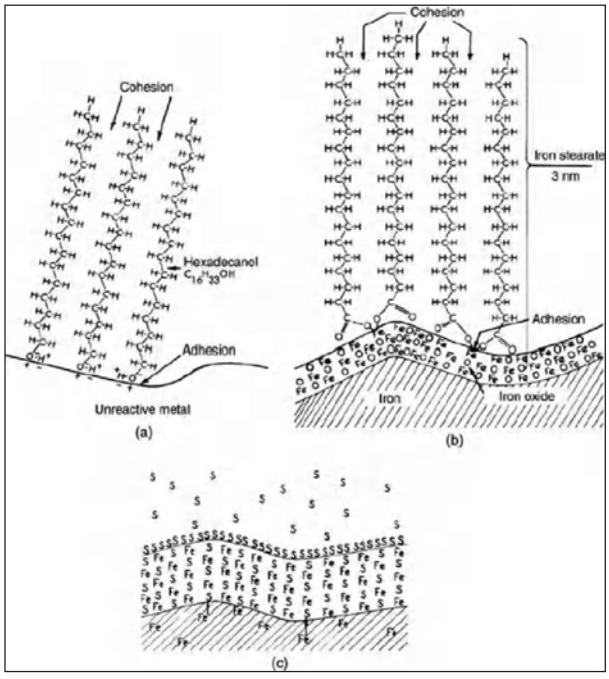

Figure 1 Different mechanisms of boundary film formation a) Physisorption (b) Chemisorption (c) Chemical reaction (7)

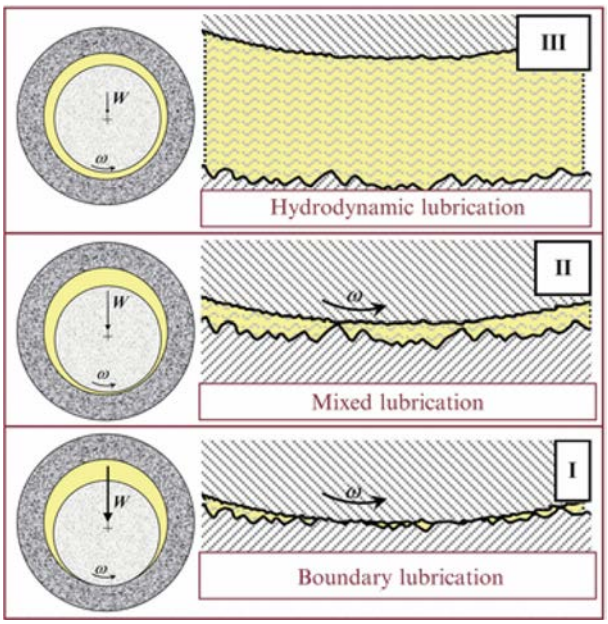

Figure 2 Lubricant film thickness in different Lubrication regimes (5)

wet brakes and wet clutches and bands to ensure smooth and noise-free operation. In Automatic Transmission fluids, at low sliding speeds, where metal to metal contact is likely, FM minimise such contact and associated rough shifting. At high speeds, their effect is minimal because high speeds promote hydrodynamic lubrication (1).

Antiwear (AW) and Extreme Pressure (EP) additives

The two moving metal surfaces are separated by a hydrodynamic lubrication film under normal operating conditions. An increase in load and/or decrease in speed can promote metal-to-metal contact. Frictional heat causes rise in temperature which results in loss of lubricant viscosity and hence its film forming ability. Progressively the lubrication regime changes from hydrodynamic to mixed-film to boundary lubrication. Often boundary film additives are unable to provide sufficient wear protection under such conditions.

AW and EP additives provide enhanced protection under mixed-film & boundary lubrication regimes. Most AW and EP additives contain sulphur, chlorine, phosphorous, boron or their combinations.

Both function by thermal decomposition and react with the metal surfaces to form a solid protective layer of iron sulphides, halides, or phosphates, depending on the composition of the additives. This solid metal film fills the surface cavities (asperities) and facilitates effective film formation, thereby reducing friction and preventing welding and surface wear. The most used AW additive is zinc dialkyldithiophosphate (ZDDP) (6).

EP additives require higher activation temperatures than antiwear additives and hence perform under severe conditions. These additives usually contain sulphur and phosphorus compounds. The EP mechanism is a two-step process. The first step involves adsorption of the EP additive onto the metal surface. After being adsorbed these materials thermally decompose to reactive compounds that react with the iron surface to form EP films. These inorganic films, which are only a few molecules thick, have lower shear strength than the base metal and are easily removed during the rubbing between the surfaces, preventing welding and seizure between opposing asperities. Removal of EP film exposes fresh metal and the EP film forming process is repeated. Some base material is inevitably lost each time the EP film is removed.

Many effective EP & AW additives are corrosive to metals (especially yellow metals). Hence lubricants are typically formulated to achieve a balance between corrosivity and protection.

Antiwear & EP differ from Boundary Lubrication additives in that they form protective films by chemical reaction whereas boundary additives form films by adsorption.

Rust and Corrosion Inhibitors

Corrosion is the destruction of metal substrate by chemical reaction (in the absence of electrolytes) or electrochemical reaction (in the presence of electrolytes).

Chemical corrosion can occur in both aqueous and organic media and involves attack by corrosive substances such as acids, alkalis, and sulphur on metals. The wear occurs when the resulting compounds are removed.

Electrochemical corrosion involves the reaction of metals in the presence of electrically conducting solutions (electrolytes) and is a two-stage process. In the anodic process, metal goes into solution as ions with extra electrons leftover. The cathodic process involves the reaction of thus generated electrons with water and hydrogen to form hydroxide ions. In solution, the metal ions combine with the hydroxide ions to form metal hydroxides.

For protection, two types of corrosion inhibiting additives are used. Acid-neutralisers neutralise aggressive

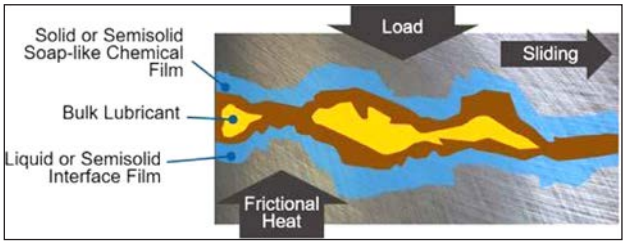

Figure 3 Antiwear (AW) additive (3)

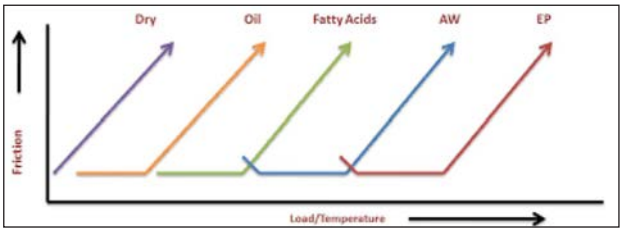

Figure 4 Load vs Friction Control by different Friction Modifiers preventing Seizure (4)

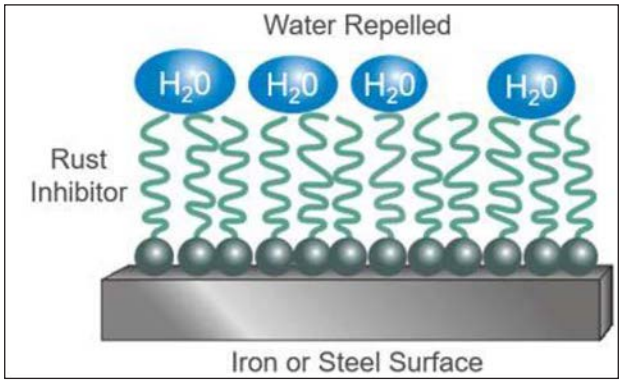

Figure 5 Rust inhibition by film-forming (3)

acidic materials. Film-formers attach themselves to metal surfaces to form an impenetrable film.

The mechanism is like that of boundary additives in that the polar head attaches to the metal surface and the non-polar tail associates with the lubricant. Corrosion inhibitors are used in engine oils, gear oils, metal-working fluids, and grease. For many applications, such as gear oils, rust & corrosion inhibitors are required to provide both vapour-phase and liquid-phase protection (i.e., for surfaces above and below the oil level).

Conclusion

Different film-forming additives impart specific characteristics to the lubricant that affect the coefficient of friction between the rubbing surfaces and control wear. However, since all these films have affinity to the same surfaces, lubricant formulators have to ensure that their chemistry and dosages are such that they work synergistically with each other.

References

1. Additives and Additive Chemistry, Syed Rizvi, Fuels & Lubricants Handbook, Ed. George E Totten, ASTM Intl. 2003.
2. All about Lubricant additives, Anthony Grossi, Nye Corporation, in POWERMAG,08/2016.
3. Lubricant Additives, A practical guide; Machinery Lubrication, Noria Corporation (04/2017).
4. Automotive Fluids Lubricating Oils & Greases, Kew Engineering, 2009.
5. Mixed Lubrication, M. Dobrica, Encyclopaedia of Tribology, Ed.Q. Jane Wang et al, 2013.
6. Miscellaneous additives and vegetable oils, J. Crawford et al., Chemistry & Technology of Lubrication, Ed. R.M. Motimer et al, Blackie Academic 1997.
7. Researchgate.net upload by Hamdy S Abdel-Hameed.

About the Author

Sanjiv Wazir is a Technical Adviser with LUKOIL Marine Lubricants. He is a mechanical engineer from IIT-Bombay. He is a marine engineer and a member of the Institute of Marine Engineers. He is a Certified Lubrication Specialist from the Society of Tribologists & Lubrication Engineers (STLE), USA and is a member of the Tribological Society of India. He has contributed to MER on marine lubrication developments in the past, and on oil contamination issues under "Lube Matters," earlier.

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OBITUARY

Nori Srinivasarao (F-3015)

01.06.1959 – 14.05.2022

IMEI(I) deeply condoles the sudden passing away of senior Fellow Member **Mr. Nori Srinivasarao** on 14th May 2022 on board BW ELM, LPG Tanker at Visakhapatnam, due to heart attack. He was on board as an attending safety surveyor.

He was from 1977 - 1981 batch of Marine engineering apprentice, Visakhapatnam. He obtained his B.A. degree in 1981. He obtained his Class I (M) certificate of competency in 1988. After passing out from Apprentice ship training, he worked in Jayashree shipping corporation, from 1982 – 1989, Varun Shipping till 2001, Paramount Shipping, Eurasia & BSM till 2017.

He was a Fellow Member of IME(I) attached to the Visakhapatnam Branch.

He is survived by his wife and daughters, Srujana, Spandhana and son- in-law, Arun.

Thomas Kurian (F-2233)

08.05.1947 – 21.05.2022

It is with deep regret that we inform the sudden and sad demise of Lt. **Thomas Kurian** Retd. (F-2233), the immediate past Chairman of our Kochi Branch.

He left us for his heavenly abode at 8:30 PM on 21st May, 2022 due to cardiac arrest. He is survived by his wife Mrs. Ally Thomas and daughter, Sarah Thomas James.

The IME(I) expresses its deepest sympathy and heartfelt condolences to the bereaved family and the near and dear ones.

IT'S TIME TO MONITOR... LUBE MONITOR

Ketan Damle

Summary

The article describes the growing importance of establishing a robust cylinder condition program for 2 stroke engines on board vessels. This will help prepare for the upcoming regulatory changes as well as adopt to alternative fuels as the industry moves towards decarbonisation. A cylinder condition monitoring tool to assist operators to view multiple parameters across the engine or a fleet of vessels as well as ability to interrogate a particular cylinder down to details, to make informed and timely decisions is described.

Introduction

After over a century since the Marine industry made the transition from coal to oil, the last decade signals a significant transition on the horizon. The engine makers have continuously adapted their designs to cater to the demand for greater power/ weight ratios, and more recently also to comply the IMO Emissions Regulations such as the 2020 Sulphur Cap. The upcoming regulatory environment (EEXI/ CCI regulations as well as the IMO ambition to reduce emissions to 50% by 2050) demands a further shift in the way the vessels are operated and the fuels that the engines need to be capable of handling.

Monitoring condition of engines through these operational and fuel changes is vital to ensure safe and reliable operation. Close monitoring and ability to monitor trends and co-relations will be essential, and modern digital solutions can help in a big way. This article describes a platform designed to help monitor the cylinder condition of modern two stroke engines for vessels.

LubeMonitor can be used with existing hardware on board, so there's no need to purchase new testing kits or complicated expensive testing hardware

Discussion

Traditionally, 2 Stroke Engine Condition Monitoring was based on a combination of inspection of the piston ring pack and the crown, as well as part of the Liner, through Scavenge spaces, during Port stay. This was combined with a calibration of liner during piston overhauls. Various challenges with cold corrosion issues during use of high Sulphur content fuel oils led to increasing awareness that these tools were not enough. This led to increasing adoption of regular drain oil analysis as an additional tool to determine the cylinder operating condition. With changes in engine design allowing higher liner wall temperatures as well as the IMO 2020 Sulphur cap now in force the sulphur related corrosion challenges are seen less frequently.

The next challenge for the industry is the **EEXI / CII regulations**, requiring vessels to comply with higher performance standards than they were originally designed for. This has slowed down vessels and in some cases by as much as 40% of their original rated power.

At the same time, the first signs of shift to alternate fuels in Shipping can be seen in Methanol burning engines in use on for a limited number of vessels starting with the Stena Germanica in early 2015, as

well as the LNG fuelled vessels with the orderbooks indicating significant numbers. There are also widespread discussions about using Blended Fuel Oils (FAME and HVO blends), as well as potential shift to Hydrogen and some trials planned for Ammonia albeit the concerns with toxicity hazards remain a challenge for this fuel.

What emerges as a certainty in this complex and uncertain environment is that the engines will be required to handle varying fuel oils, with some engine designers aiming to offer engines that are capable of handling multiple fuels; giving shipowners the flexibility based on the emerging market conditions.

There has been some experience in the industry in continued low load operation. The impact this has on the engines include inefficient combustion, inadequate scavenging and increased stress on combustion chamber components, as well as on the cylinder lubrication. This impacts the reliability of the engines as well as the maintenance costs, and early detection is critical for planning timely corrective action.

The potential fuel options on the pathway to decarbonisation bring their own challenges. Having a well-established baseline and close engine monitoring is essential.

Currently engine condition is monitored through the combination of drain oil analysis, scavenge space inspections and calibrations during overhaul. The results and reports from these tools are logged across various technology platforms, ranging from oil analysis reports in form of documents from Labs, and on excel based sheets for on board drain oil testing, to the scavenge space and calibration reports typically entered into the planned maintenance systems, or using the OEM templates. The leads to a situation where all of the information is available to the operator, but it tends to be across several platforms. Thus, the ability to identify links, changes and trends across several different parameters is very difficult.

It is to tackle this challenge, with collaboration of technical experts from multiple disciplines, Shell created the new **LubeMonitor** platform, with the objective to provide insights, taking the operator away from "data overload" to "data organised".

The engine inspection feature also allows recording of measurements of ring gap and piston ring coating thickness

LubeMonitor is more than just cylinder oil condition monitoring based on drain oil analysis. It is an engine condition monitoring service where the relevant maintenance history, running hours and engine inspection as well as oil analysis are combined into one platform. LubeMonitor can be used with existing hardware on board, so there's no need to purchase new testing kits or complicated expensive testing hardware.

The platform has model specific engine profiles for checking the data recorded from the vessel for compliance with OEM service letters and known performance history for the engine type. The new report format reflects emerging market needs and moves away from pure drain oil based TBN and Iron content, to consider full engine health including cylinder condition, condition of engine components, maintenance, running hours, comparison with lab data and long-term trends. The engine inspection feature also allows recording of measurements of ring gap and piston ring coating thickness.

The platform gives a technical manager an overview of his fleet in terms of cylinder condition as illustrated in **Figure 1**. This makes it possible to spot the outliers

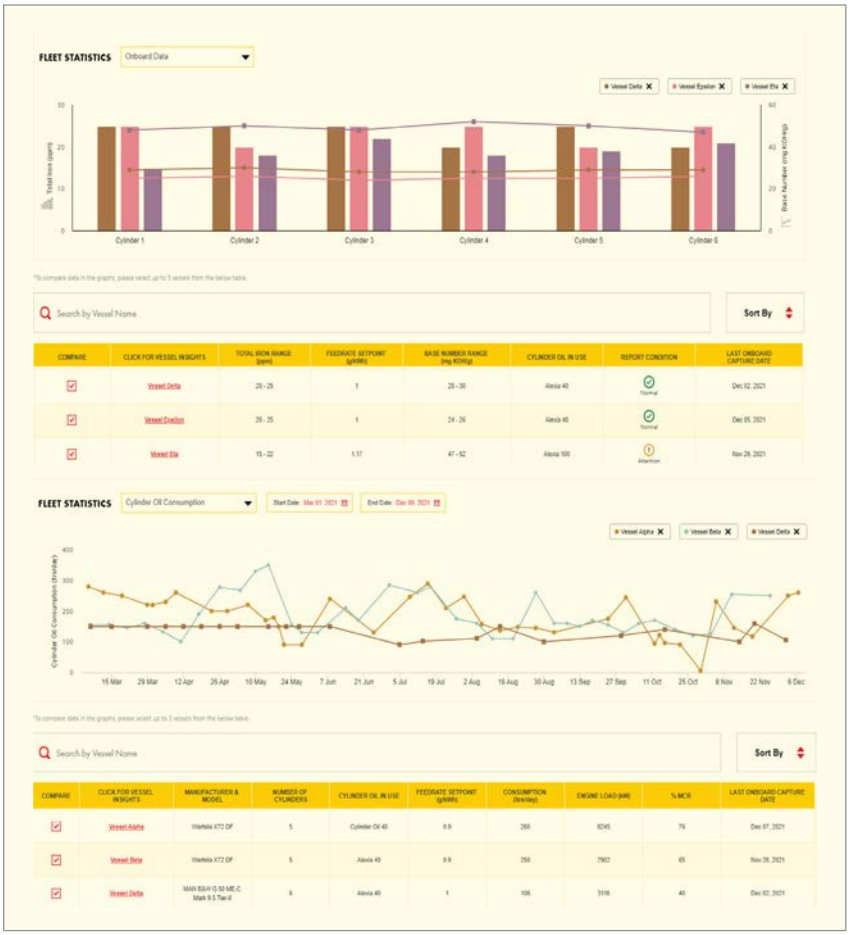

Figure 1. Fleet-wise Performance Overview

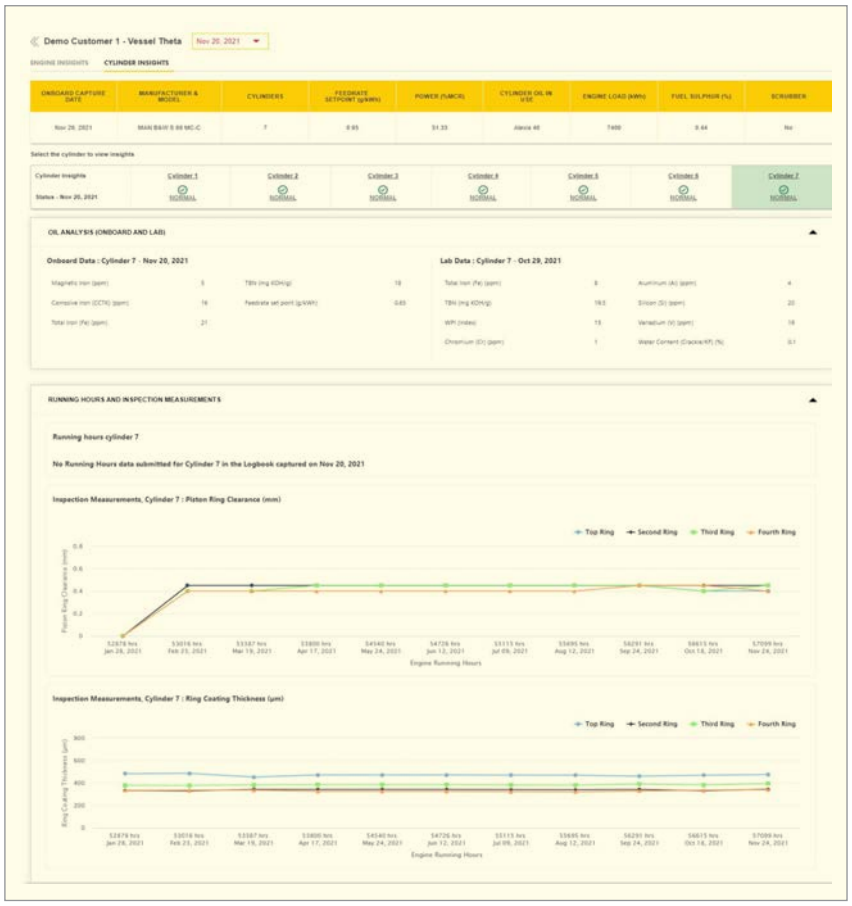

Figure 2. Cylinder Insights using Shell LubeMonitor

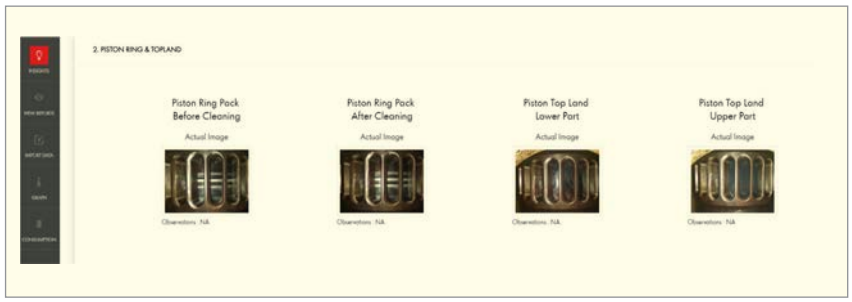

Figure 3. Piston Ring Condition

Figure 4. Cylinder Liner Condition

i.e., vessels which have higher than expected oil consumption / iron content/ other alerts from lab analysis. The tool then allows selection of the individual vessel, where the oil analysis results can be viewed alongside piston ring measurements, and liner condition as illustrated in **Figure 2**.

A simple guided tool within the platform allows images to be uploaded for each cylinder during scavenge space inspections or during overhauls. These are then available within the platform itself, as clickable thumbnail images, as shown in **Figures 3** and **Figure 4**. These, when viewed alongside the parameters in **Figure 2** within the platform itself, allow the operator to make an overall assessment without having to resort to multiple sources of information and plan timely intervention where required.

Conclusion

The operating landscape for the 2 stroke engines has been going through a transformation over the last decade, and with the upcoming regulatory changes this will change even further, starting with the EEXI compliance measures and future Fuels shift. It is very important for operators to prepare well in advance for these changes. Establishing a baseline of cylinder condition is very important ahead of the upcoming changes, so that operators will be able to better diagnose any changes to the operating conditions and take corrective actions in a timely manner.

About the Author

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DIGITAL TWIN: A DEEP DIVE INTO ARTIFICIAL INTELLIGENCE AND BIG DATA TECHNOLOGIES

Menon Ashwin Pramod,
Mithun Sudheendra Moudgal,
Anirudh Kumar

Abstract- *The Great Growling Engine of Change – Technology, has impacted every sector of social space, including the shipping industry, where automation has changed the sector immensely. With Industrial Revolution 4.0 advancing at a rapid pace, digitalisation and artificial intelligence have become the center of attention in all vocational domains, and Digital Twin is at the forefront of this revolution. The Maritime Industry, despite being conservative, has been conforming to changes over the past decade by delving into automated systems, and Digital Twin might be the silver bullet in its quest. Although it is just at the conceptual stage and with several un-addressed demurs, considering the propitious studies and rapid technological advancements, Digital Twin is set to be a game-changer in the maritime industry.*

Keywords: *Industrial Revolution 4.0, Digital Twin, Digitalisation, Artificial Intelligence, Maritime Industry*

1) Introduction

Digitalisation is becoming an integral part of the engineering arena, and an interesting technology that aspires to move the industries forward is the Digital Twin. Digital Twin is a digital replica of a living or non-living physical entity, usually including historical data, production details and other information[1]. This allows the user to utilise the Digital Twin as a virtual version of the entity to plan future actions, perform simulations and other analyses to assess the status of the system and predict future problems and possibilities when the system is in operation. It combines the physical and the virtual world such that it provides data, enabling the virtual entity to exist simultaneously with the physical entity.

With the advent of new technologies and regulations in the maritime industry, the operation and management of a ship throughout its lifecycle have become an enormous and complex task. Digital Twin allows for the integration of a ship's components into a single software and hence offers innumerable benefits to the maritime industry for stages starting from development concept and continuing through design, construction, commissioning and operations.

This paper throws light on the concept of Digital Twin and its potential in the maritime industry, considering the advantages and challenges faced in the shipping industry.

2) Concept

Digital Twin is an exact replica of a physical asset and is unique for each entity. The life of a Digital Twin begins with experts in the particular field collecting the required data in order to create a virtual model. This data can consist of design specifications, production processes and engineering information like material, parts, etc. It also consists of maintenance records, management data and historical analysis in order to develop a mathematical model that simulates the original. [2] These models can be displayed via augmented reality, virtual reality and 3D representations for easier understanding by humans.

IoT components like sensors are used to collect data like real-time status and working conditions from the physical object. This feedback is received by a cloud-based system and analysed, enabling the digital model to mimic and simulate the operations taking place in the physical entity, creating opportunities to gather insights into performance, methods of optimisation and any potential issues.

The digital twin only gathers data from the physical entity, which is a one-way transfer of data. It does not

control the physical entity in any way, thus differentiating itself from intelligent machinery. This technology is already being used in several other industries, like Aerospace, Medical, Oil and Gas Industries.

3) Enabling Technologies

The Digital Twin relies heavily on five technologies whose development is of paramount importance to the success of the Digital Twin concept. They are:

- **IoT (Internet of Things) -** High precision sensors enable the continuous collection of machine data and operational data from the physical asset and relay it to its Digital Twin in real life via wireless networks.
- **Cloud Computing-** It allows storage and processing of large amounts of machine data received from the asset and its Digital Twin via sensors in real-time.
- **API and Open Standards-** They provide the necessary tools to extract, share and harmonise data from multiple systems that contribute to a single Digital Twin.
- **Artificial Intelligence-** It leverages historical and real-time data paired with the machine learning framework to make predictions about future scenarios or events that will occur within the context of the asset.
- **Augmented, Mixed and Virtual reality-** They render the physical model and digitalisation of the Digital Twin providing the medium for collaboration and interaction with it, which helps the users get a better understanding of the physical asset.

4) Digital Twin in Maritime Industry

Digital Twin, without a doubt is the future of the maritime industry which will help the industry in taking a leap into the bandwagon of digitalisation and begin a new era in shipping. Ideally, in the shipping industry the Digital Twin should be created prior to and in parallel with the construction of the vessel.[3] It can be used to optimise the early design phase and construction phase of the ship. During the ship's operation, real-life updates about operational aspects and environmental data can be provided to the twin by IoT sensors. It will also enable exchanging data amongst stakeholders such as ship-owners, charterers, manufacturers, maritime authorities, and management companies. In a nutshell, the Digital Twin can be used to support the vessel over its entire life cycle starting from its design stage to its eventual decommissioning.

The opportunities for Digital Twin in the maritime industry are limitless, but some of the significant opportunities are:

- **Efficient Voyage Planning:** Digital Twins can be used for weather optimised voyage planning by analysing data provided by the weather sensors. This route optimisation can help reduce fuel consumption, voyage duration, time spent for voyage planning and improves the condition of the voyage with regards to stability.
- **Ship Safety:** It can be used to discover design flaws and simulate various emergency scenarios. For example, it can be used to simulate a fire emergency and predict the spread of fire from the point of ignition

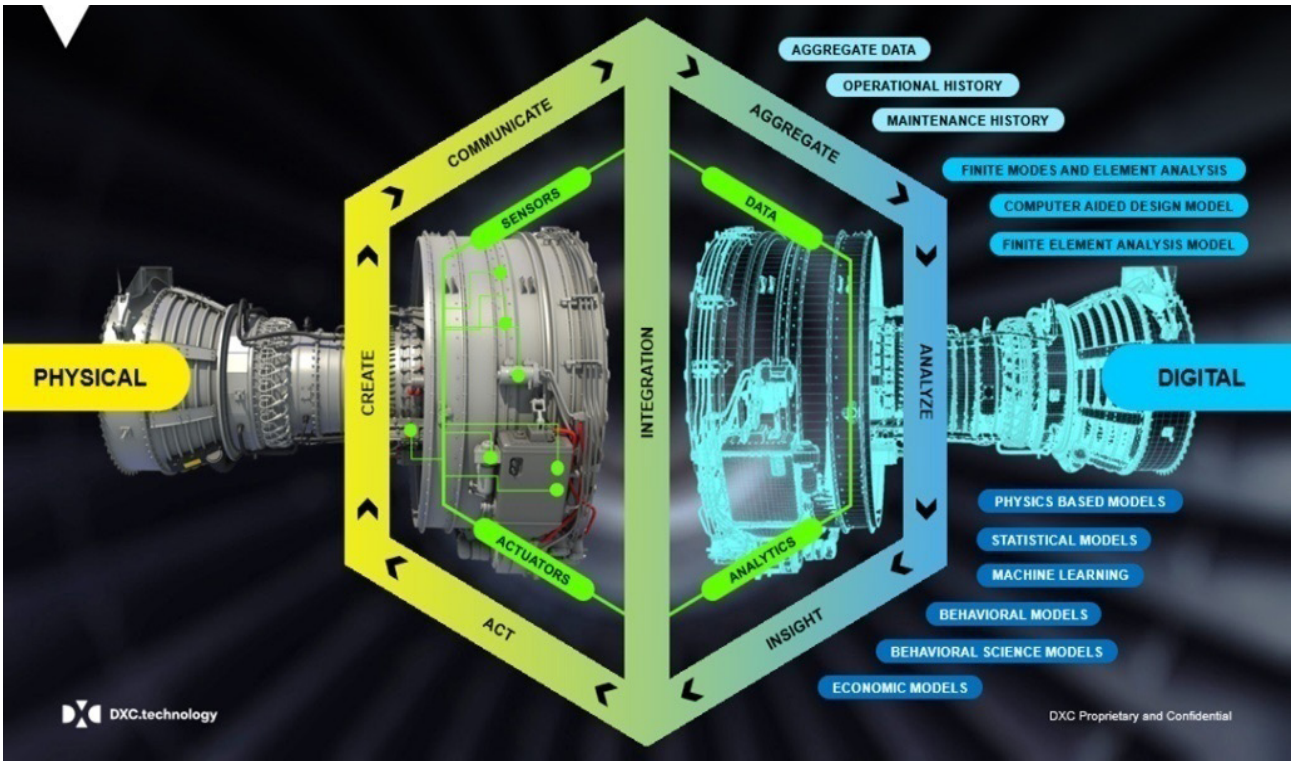

Figure 1: Digital Twin Flow Chart [3]

by taking the physical layout of the ship, flammable substances, ventilation, construction material and installed fire suppression systems into consideration. [4]

- **Training:** Digital Twin can be used to train seafarers virtually without the need for the physical presence of machines with the help of virtual reality and augmented reality simulations. It will help the seafarers gain a better understanding of the working of machines and the consequences of actions taken during maintenance. [1]
- **Ship Structure Health Monitoring:** Ships can be fitted with sensors that detect the movements of the ship in the sea like rolling, pitching, pounding etc., whose data can be analysed to get an insight into the corrective actions and maintenance required. It can be used to optimise the hull and propeller cleaning with the help of predictive maintenance technology.
- **Damage Prevention of Machinery:** The data received from sensors along with the behavioural data from the machines can be used to predict future failures of machines and give an insight into the cause and effect of the failure in real-time. It can also be used to diagnose malfunctioning parts or systems and facilitate maintenance. It can be used to test scenarios and predict the outcomes of different actions without harming the machine and people onboard using AI and simulations.

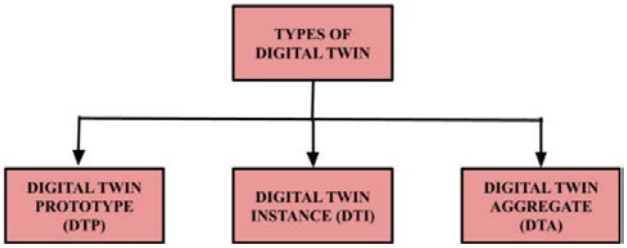

Figure 2: Types of Digital Twin

- **Ship Design Optimisation:** A Digital Twin allows shipbuilding companies and designers to predict the effects of design choices and hence create an optimised design of the vessel. This optimisation of the ship's structure can help in the reduction of fuel consumption and emissions.
- **Port Optimisation:** Digital Twin can also be used for port optimisation by raising real-time situational awareness. The areas of improvement are traffic management, security and cargo handling, which is done by using Digital Twin as an operational planning tool for the coordination and synchronisation of port operations.[5]

5) Challenges of Digital Twin in Maritime Industry

Although Digital Twin is an up-and-coming concept and has already been very successful in several industries, it is not the case in the Maritime Industry as there are still several challenges that need to be overcome before this concept can be feasibly adopted. Some of these challenges are:

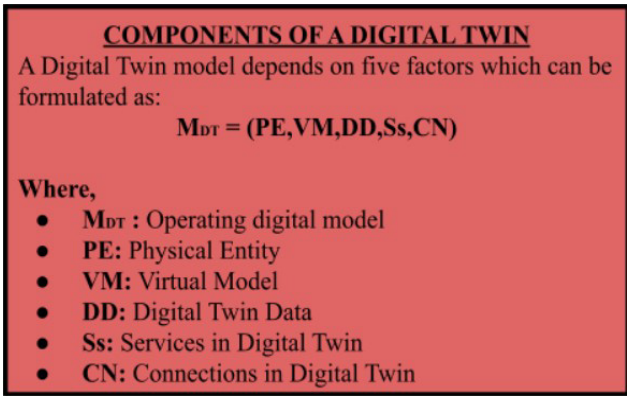

Figure 3: Major components of a Digital Twin.

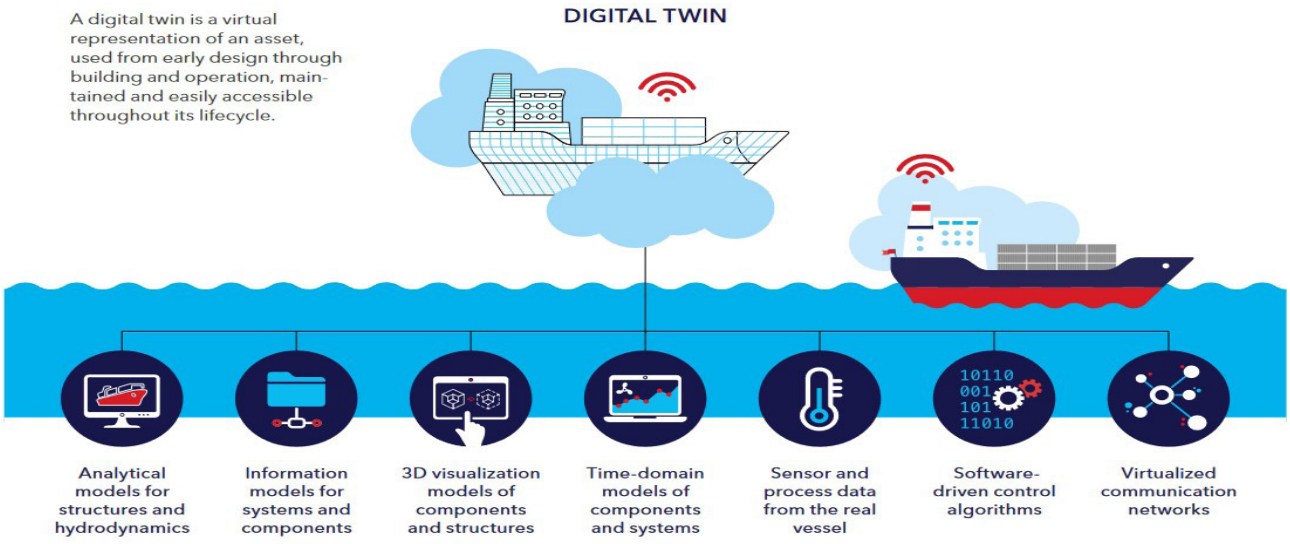

Figure 4: Uses of Digital Twin in Maritime Industry. [1]

Figure 5: NYK LINE adapting Digital Twin. [9]

- **Connectivity:** There are several challenges related to network connectivity that still exists, especially prevalent when trying to achieve real-time monitoring. As there are an enormous number of IoT sensors onboard that collect a large amount of real-time data, it is challenging to connect all of them and transfer this information to the digital twin. Data transmission onboard is usually done using geostationary satellites, contributing to high bandwidth cost, latency and limited speed. Data Compression can help solve this problem to an extent and with recent advancements in communication technologies, the connectivity issue will not be a problem in the future. [6][7]
- **Integrating Machinery Data:** To create a digital twin in the first place, we need to access real-time data from numerous parts of that machinery, which is sometimes a hideous task as there are many sub-parts manufactured by third parties that do not integrate well with the sensors. The workaround to this problem is to create rules and regulations that are applicable to the adoption and use of digital twins in the maritime industry, which can be created by maritime agencies and classification societies which will drive the market in favour of digital twins due to need and opportunity.
- **Cyber Security:** As the sensors collect data and intellectual capital which is sent to servers on-shore via satellite internet, there is a probability of cyber/phishing attacks that can access the historical data, voyage data, etc. Cryptography, Blockchain Technology and Malicious Activity detection software can be used to make the digital twin resilient to cyber-attacks. We can also implement the Secure Access Control Mechanism for users who access the digital twin data.[6]
- **Data Quality:** The data collected by the sensors and sent to the servers has to be of high quality with a constant uninterrupted data stream without which the digital twin will underperform. A solution to these problems is Big Data Technologies which can analyse, process and extract data from extremely complex and large datasets.

6) Recent Developments in Shipping

- NYK LINE has dwelled into the Digital Twin concept in order to prevent unpredicted downtime, reduction in maintenance cost and to operate in an energy-efficient ecosystem by monitoring the real-time data.
- Mitsui O.S.K Line has ventured on a joint research program to develop a Digital Twin model of a two-stroke main diesel engine by collecting operational data of MOL operated ships, enabling the visualisation of the main engine with the help of AR and VR technologies.[8]
- Rolls-Royce Marine along with DNV GL, SINTEF Ocean have created a digital platform known as Open Simulation Programme open to all parties for improvement of ship design, maintenance and sustainability. This platform is already being used in a dynamic positioning vessel and a simulated ship.[1]

7) Conclusion

The inception of Industry 4.0 has seen the world shift towards cyber-physical systems, and hence there is no doubt that digital twin has the potential to move the shipping industry into a new era of digitalisation. The use of digital twins throughout a ship's life cycle will help create an optimum design, predict potential dangers, and reduce operating cost and the constructional period, which will significantly enhance safety and operation.

Even though the concept of digital twin has witnessed notable advancements, the creation of a cohesive

digital twin faces various challenges like connectivity, data security and lack of governance. However, there are proposed solutions, which if put into action, will aid in virtual ships becoming the standard method for commissioning, designing, operating and maintaining vessels and whole fleets. This can be achieved if all the actors in the ship value chain like maritime agencies, ship-owners and classification societies come together and show an active interest in carrying out research, exchanging information by building open-source platforms and most importantly, accepting the solutions put forward.

References

[1] The Digital Twin Concept explained, safety4sea.com, Available:https://safety4sea.com/cm-the-digital-twin-concept-explained/ [Accessed on 23/06/2021]
[2] "What is Digital Twin Technology and How Does it Work?", twi-global.com, Available: https://www.twi-global.com/technical-knowledge/faqs/what-is-digital-twin, [Accessed on 23/06/2021]
[3] Michaela Ibrion *et al* 2019 *J. Phys.: Conf. Ser.*1357 012009, On Risk of Digital Twin Implementation in Marine Industry: Learning from Aviation Industry Available: https://iopscience.iop.org/article/10.1088/1742-6596/1357/1/012009, [Accessed on 23/06/2021]
[4] Digital twins revolutionize shipbuilding, dxc.technology, Available:https://www.dxc.technology/aerospace_defense/insights/146602digital_twins_revolutionize_shipbuilding, [Accessed on 24/06/2021]
[5] Mikael Lind, Richard T. Watson, Digital twins for the maritime sector, smartmaritimenetwork.com, Available: https://smartmaritimenetwork.com/wp-content/uploads/2020/07/Digital-twins-for-the-maritime-sector.pdf, Page 4, [Accessed on 23/06/2021]
[6] A. Rasheed, O. San, T. Kvamsdal, "Digital Twin: Values, Challenges and Enablers From a Modeling Perspective," in *IEEE Access*, vol. 8, pp. 21980-22012, 2020, doi: 10.1109/ACCESS.2020.2970143. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8972429 , Page 7, [Accessed on 26/06/2021]
[7] Ørnulf Jan Rødseth, Arne J. Berre,From digital twin to maritime data space: Transparent ownership and use of ship information, researchgate.net, Available:https://www.researchgate.net/publication/332728436_From_digital_twin_to_maritime_data_space_Transparent_ownership_and_use_of_ship_information page 3, Page 3, [Accessed on 26/06/2021]
[8] Baibhav Mishra, Applying Digital Twin in Shipping and Maritime, seanews.co.uk, Available:https://seanews.co.uk/features/applying-digital-twin-in-shipping-and-maritime/, [Accessed on 28/06/2021]
[9] Hideyuki Ando, Digitalisation in Shipping - Approach of NYK -, monohakobi.com, Available:https://www.monohakobi.com/en/wpcontent/uploads/2018/05/20180531_Digitalisation-in-Shipping-Approach-of-NYK-.pdf , Page 16, [Accessed on 28/06/2021]

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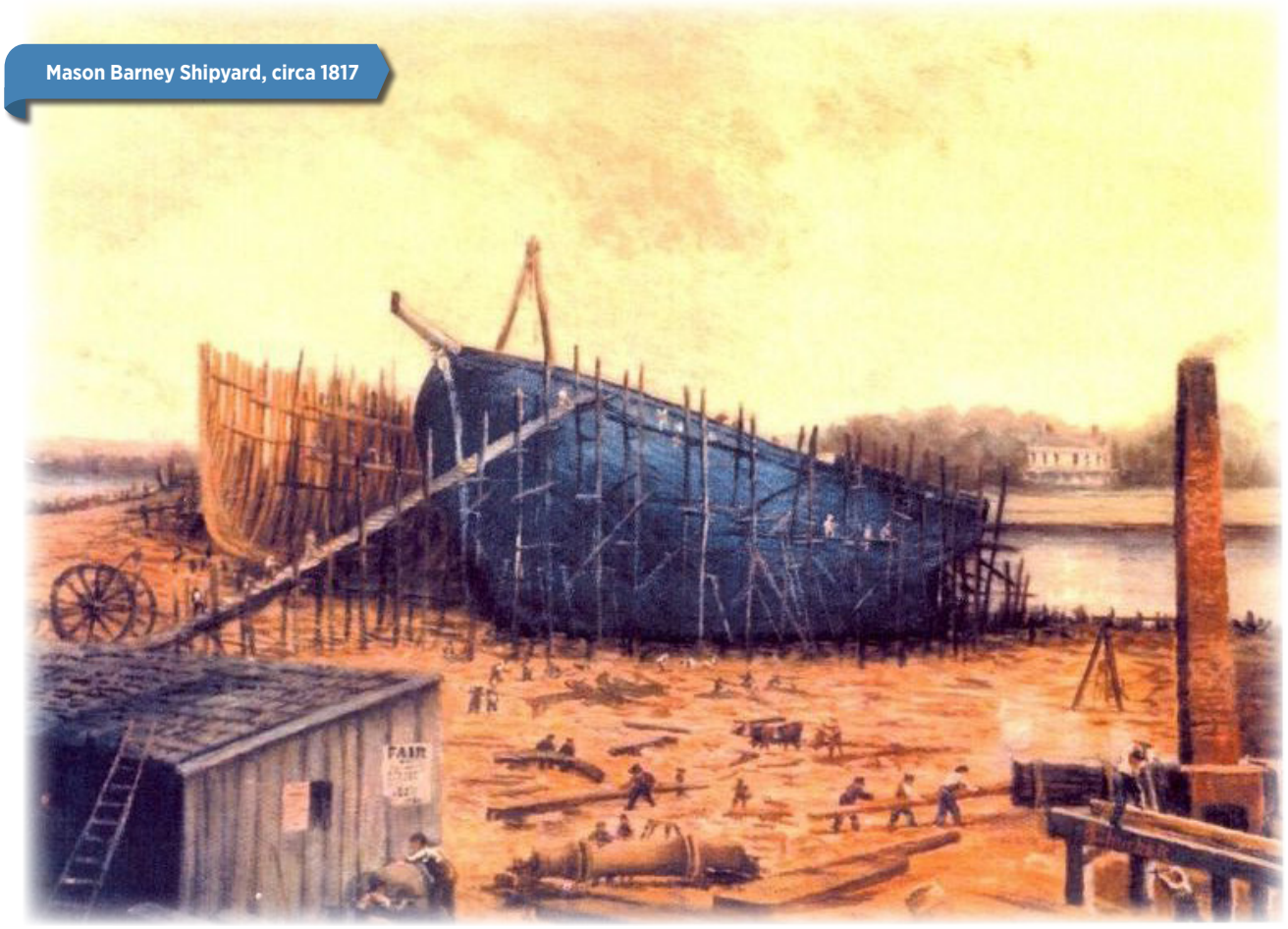
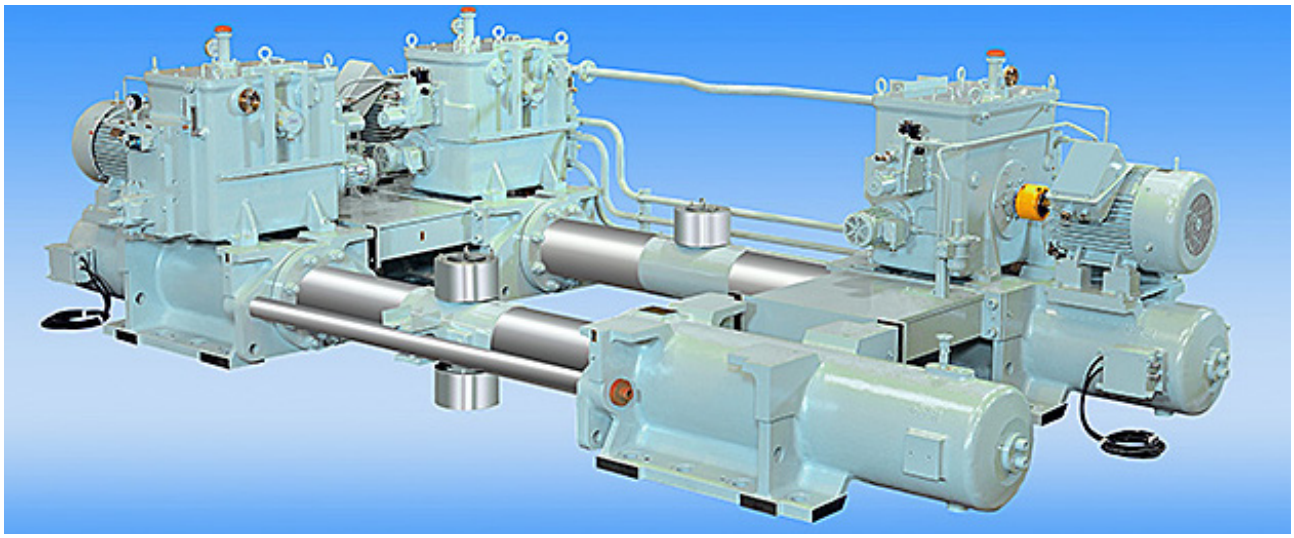


AN ALTERNATE DESIGN OF ELECTRO-MAGNETIC ACTUATORS FOR RAM-TYPE STEERING GEAR ON-BOARD SHIPS



Nishant Neeraj Gadey

Abstract: For several decades, hydraulic actuators have been used for steering gear in the ships. However, with increased focus on the concept of 'All-electric ships", decreasing of crews on- board vessels and demand for more compact systems, the focus within maritime sector has shifted towards electrical systems, rather than Hydraulic and Pneumatic systems. A major component of any ship, which consumes a lot of space and adds to the weight of the vessel is her hydraulic steering gear. Here, we present an implementation of a new type of electro-magnetic actuators for operation of the ship's steering gear. This type of actuator has previously been used on electro-magnetic railguns. Compared to the hydraulics, the electro-magnetic system is quieter, has a quicker response, requires lesser maintenance and occupies lesser space. We present the implementation of electro-magnetic actuators for the operation of ram-type steering gear, in both 2-ram and 4-ram configurations.

Keywords: Electro-Magnetic, Ram-type, Actuator, Steering

I. INTRODUCTION

A. Background

Ram type steering gear is widely used on the ships. It has two possible variations, the 2-Ram and 4-Ram system, selected as per the torque requirements of the vessel. The 2-ram system consists of two hydraulic actuators mounted on the tiller, and 4-ram system consists of four actuators, as shown in **Figure 1** [1], [2].

The hydraulic steering is difficult to handle, due to potential oil leakages and the requirement to control the oil temperature. Also, the system and its related components (Oil reservoir, pumps, valves, etc.) are bulky and occupy a large volume.

The idea of using electrical actuators to substitute hydraulic actuators is not new. Some all-electric steering systems have been briefly mentioned in [2]. These are of two types, i.e., Ward-Leonard system and Direct single motor system.

Some of the recent examples of electrical systems include the ones mentioned in [3], [4]. The use and relevance of these recent research works is further discussed in detail in following sections.

B. Current use of electro-magnetic actuators in Maritime sector

1) *The systems on-board Gerald R. Ford class aircraft carriers:* Two noteworthy recent developments relating electro-magnetic actuators on-board are the EMALS (Electro-Magnetic Aircraft launch system) and AAG (Advanced Arresting gear) on-board United States Navy's Gerald R. Ford class aircraft carriers. Both the systems replaced their hydraulic counter-parts which were used on the previous Nimitz class aircraft carriers. The EMALS works by storing a high amount of energy. Then, at the time when aircraft is to be launched from the flight deck, the energy is input to a linear induction motor at very high rate. The resulting force, drives a shuttle, attached to the front wheel of the aircraft and propels the aircraft forward [5].

   Similarly, when an aircraft comes in for landing on the flight deck, the rear hook catches a cable. The cable is connected below deck to a motor through pulleys. Hence, as aircraft lands, it drives the motor and the

resulting resistance offered by the motors bring the aircraft to a stop [6].

A noteworthy fact, which is of great interest for our study is that the force (or resistance) offered by both the systems described above, can be adjusted (according to the weight/speed of the aircraft) by simply adjusting the input power. On the other hand, the steam or hydraulic systems used on earlier carriers had to do so by adjusting the pressure, which was only possible within a limited range of operation.

2) *Electro-magnetic Railgun:* Another application of electromagnetic actuators, again in the defense sector is the railgun. In this, instead of using the explosive (essentially a pneumatic system) to shoot the bullet, an electro-magnetic actuator is used. The working of this actuator is used for our study as described further **(Refer section II)**. This actuator is capable of firing the bullets at supersonic speeds. It is seen that the railgun is much quieter and efficient as compared to the conventional explosive based guns. [7], [8], [9]

3) *Permanent Magnet linear-actuators-A similar research work:* A study, very similar to our paper was done by [3]. This concept uses a permanent magnet (as opposed to the electro- magnet in our study) for operation of ship's steering gear. Further improvements to the system are shown in [10]. The papers and related works analyze the possibility of permanent magnet linear actuators for ship steering in great detail. The main focus of the study, i.e., replacing the hydraulic actuators with electro-magnetic actuators, makes it a work of great relevance to our study [3], [4], [10], [11].

II. ACTUATOR WORKING AND DETAILED DESCRIPTION

The proposed actuator works on the principle similar to that of the electro-magnetic railgun. However, instead of using the same current to produce magnetic field as well as drive the shuttle, we separate the currents. This is done, as we require controlled motion, unlike the sudden, impact motion of the railgun [7], [8], [9].

The actuator consists of two rails, each having a rail conductor, a shuttle with multiple shuttle conductors and an arm connected to the shuttle.

High current is passed through rail conductors in opposite directions as shown in **Figure 2b**. This develops a magnetic field, as per the Right hand thumb rule, which acts in same direction in the gap between the two rails. A small amount of current is passed through shuttle conductors when required. This develops a force on the shuttle in accordance with Fleming's left hand rule. The shuttle motion is controlled by the magnitude and direction of shuttle current. The shuttle current is controlled by an auto-transformer. The direction of shuttle current is controlled by a two-way switching mechanism, having POSITIVE, NEUTRAL AND NEGATIVE MODES. The POSITIVE mode is used to propel the shuttle forward, NEUTRAL mode represents the stand-still condition and NEGATIVE mode is used to propel the shuttle backwards.

A. Actuator Electric Circuit working

Figure 3 shows the detailed circuit diagram of the presented system in the 4-Ram configuration. The rails of actuators are energised in such a way that the actuators produce only a motion, which is supportive to each other. For instance, if shuttle current is considered from top to bottom direction, an anti-clockwise motion is produced the rudder stock.

In this case, the magnetic field in Actuator No. 01 and 02 is outward from the page and that of No. 03 and 04 is into the page. Hence, for same direction of the shuttle current (supplied through the tiller to the respective shuttles), each actuator pair will provide motion in same direction. R_{SH} (Shuttle auto- transformer) is the main control element for the magnitude of torque produced and the S_{SH} is the two-way switch, used to switch the direction of current.

In above system, the speed and direction of the motion of rudder stock is controlled. To stop the motion of rudder at any given point, the system has a damping actuator. The actuator is similar to the other actuators, but produces force of opposite nature to the force produced by the main actuators. On achieving the desired rudder position, the power to the main actuators is reduced, which also reduces the force produced by them. This reduced force is then compensated by the damping actuator, to hold the rudder stock in the desired position.

For redundancy, the system also consists of an auto-transformer on the main circuit (R_{MAIN}). This can be deployed in case of failure of S_{SH} . In similar way, another two-way switch may be connected to the main circuit, making it possible to achieve full control through actuators, in case both R_{SH} and S_{SH} fail.

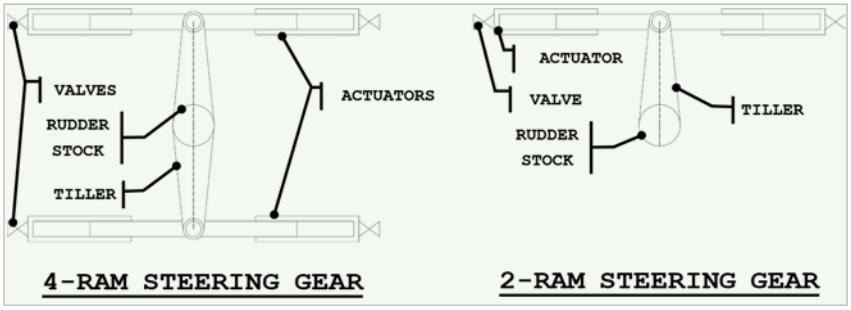


Figure. 1. Diagram showing the basic components of the ram-type steering gear. We do not include the detailed hydraulic circuits, for simplicity and also because our study only focuses on the actuators

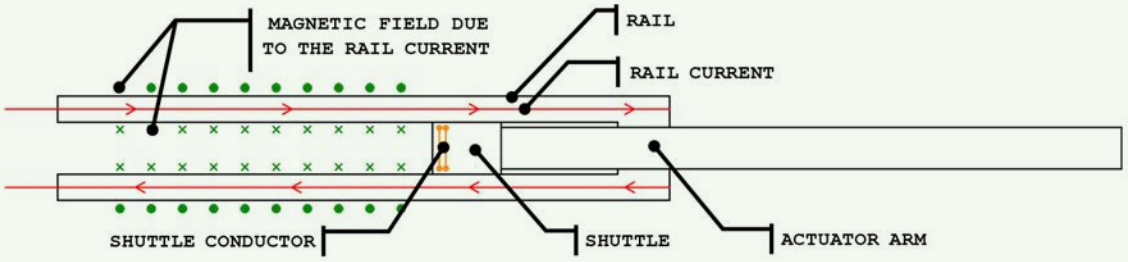


Figure.2a Actuator and Related Components

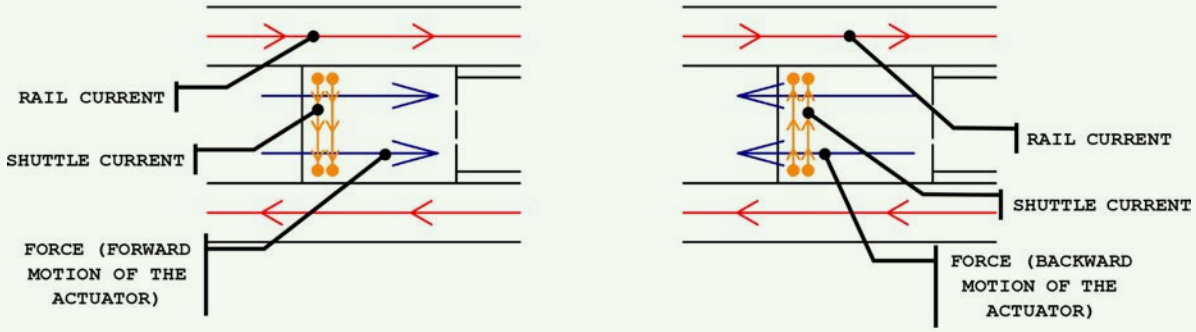


Figure 2b FORWARD ACTUATOR MOTION

BACKWARD ACTUATOR MOTION

Figure. 2a Overall components and the magnetic field associated with the actuator rail
Figure 2b Enlarged view of the shuttle and its operation for both the directions of motion, along with the associated currents

III. ADVANTAGES AND DISADVANTAGES OF THE PRESENTED SYSTEM

A. Advantages

The system is advantageous in comparison to the conventional hydraulic systems in several aspects, such as:

i The system is much more compact, light-weight and requires lesser number of components. As a result, the system also requires lesser maintenance.

ii The system is more efficient in operation. Also, it has a lower response time. Hence, it can respond to inputs quickly. This leads to the crew having greater control on the vessel.

iii The system is easily repairable. A disconnected wire, or a failed electrical component can be replaced within minutes and the operations restored to full capacity. This is not possible with failures associated with hydraulic systems, such as oil leaks, oil over-heating, etc.

iv The system is quieter in operation, as the driving force is the electro-magnetic force, unlike the mechanical force, used in the hydraulic systems.

B. Dis-advantages

Some limitations and implications of the presented system are as follows:

i The system uses high currents and voltages, associated with it. Hence, it is an electrically hazardous system.

ii The system compartment needs to be magnetically insulated to ensure that the magnetic fields, associated with the system do not interfere with other nearby electrical/electronic equipment.

iii The system, although having high efficiency, also has high power demand. This implies that, a separate, back-up power storage for the system is must, so that the system does not stop operating in case, a fault or problem arises in the ship's electrical power system.

CONCLUSION

We have presented and analysed an alternative electro-magnetic actuator for operating one of the most vital components of a sea-going vessel, i.e., here steering gear. Another similar study, that is of great interest for our study is that of Permanent- Magnet based linear actuators, discussed by [3], [4]. The actuator system proposed here, has numerous advantages along with some limitations as described earlier.

The system clearly out-performs the conventional hydraulic systems in several ways. With more such developments, projected towards achieving the goal of "All-electric ships", the electro-magnetic actuators are expected to be used more commonly in the near future. The electro-magnetic actuators, in several ways

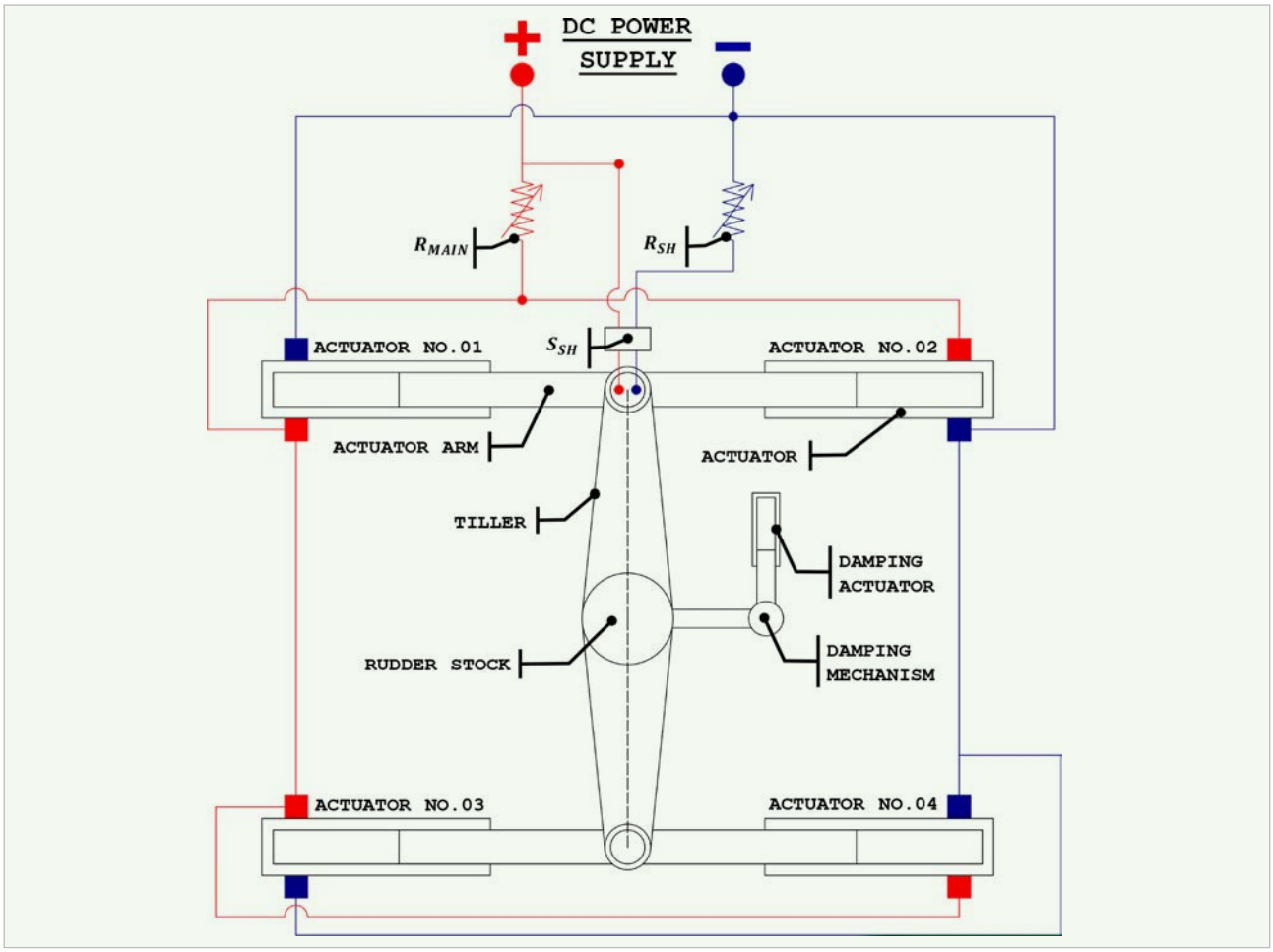


Figure.3. Detailed circuit diagram of the actuator system. Note that the system requires far less number of basic components and devices for operation, as compared to the hydraulic system. The terminals, currents, etc. are not shown for the damping mechanism for clarity. The damping mechanism shown in figure is for illustrative purpose.

are expected to become an integral part of the future ships, thereby making the vessel more efficient in her operation in one or the other way. The hydraulic power transmission has driven the maritime community for several decades. The recent developments in electro-magnetic technologies, with its better and more efficient operating characteristics has a vast potential of further research and development and will play a vital role in realisation of the goal of "all-electric ships".

REFERENCES

[1] H. MCGEORGE, *Marine Auxiliary Machinery*. Elsevier Science, 1998.
[2] D. Taylor, *Introduction to Marine Engineering*. Elsevier Science, 1996.
[3] C. Bruzzese, "A high absolute thrust permanent magnet linear actuator for direct drive of ship's steering gears: Concept and fem analysis," in *2012 XXth International Conference on Electrical Machines*, pp. 556– 562, 2012.
[4] C. Bruzzese, "Direct drive of ship's steering gears through permanent-magnet linear motors featuring high thrust and efficiency," in *2012 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, pp. 1–8, 2012.
[5] M. Doyle, D. Samuel, T. Conway, and R. Klimowski, "Electromagnetic aircraft launch system-emals," *IEEE Transactions on Magnetics*, vol. 31, no. 1, pp. 528–533, 1995.
[6] C. R. Leo Holland, "Turboelectric arresting gear," 06 2006.
[7] I. McNab, F. Stefani, M. Crawford, M. Erengil, C. Persad, S. Satapathy, H. Vanicek, T. Watt, and C. Dampier, "Development of a naval railgun," *IEEE Transactions on Magnetics*, vol. 41, no. 1, pp. 206–210, 2005.
[8] J. Hindmarsh, *Electrical Machines and Their Applications*. Applied electricity and electronics, Butterworth-Heinemann, 1984.
[9] A. Sitzman, D. Surls, and J. Mallick, "Design, construction, and testing of an inductive pulsed-power supply for a small railgun," *IEEE Transactions on Magnetics*, vol. 43, no. 1, pp. 270–274, 2007.
[10] D. Zito, C. Bruzzese, E. Santini, A. Raimo, and A. Tessarolo, "Performance and efficiency improvement of a hydraulic ship steering gear by a permanent magnet linear synchronous servo-motor," in *2015 International Conference on Renewable Energy Research and Applications (ICRERA)*, pp. 1537–1542, 2015.
[11] C. Bruzzese, E. Ruggeri, M. Rafiei, D. Zito, E. Santini, T. Mazzuca, and G. Lipardi, "Mechanical arrangements onboard ship of innovative permanent magnet linear actuators for steering gear," in *2017 International Symposium on Power Electronics (Ee)*, pp. 1–6, 2017.

ABOUT THE AUTHOR

Cadet Nishant Neeraj Gadey is currently pursuing his B. Tech in Marine Engineering from IMU Kolkata Campus.

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[On 5 April 2022, India celebrated the 59th National Maritime Day. At the Indian Maritime University – Kolkata Campus, the cadets participated in various events including paper presentation with great zeal and enthusiasm. This article was selected as one of the best paper. The paper is published after a few language corrections.]

MUMBAI BRANCH

FELICITATING MS. DIVYA JAIN ON THE OCCASION OF INTERNATIONAL DAY OF WOMEN IN MARITIME ON 18TH MAY 2022

With great pleasure and honour, The Institute of Marine Engineers (India) Mumbai Branch along with its Navi Mumbai and Gujarat Chapters proposes to felicitate Chief Engineer Ms. Divya Jatin Jain, who became the first woman C/E for achieving the feat of leading the all women engineers team, on board M.T. Swarna Krishna. The vessel M.T. Swarna Krishna made history, when she commence upon the voyage from Mumbai to Vadinar, a 'historic' and 'first ever' sailing, commanded and managed wholly by Women Officers on board on the eve of International Day of Women 2022.

She is one of the most renowned, brave and an eminent sailor, who not only survived the male oriented domain of Maritime Industry, but enjoyed each and every moment of life as a lesson and made beautiful memories to cherish.

Ms. Jain, a woman full of enthusiasm and endeavors, has completed her Marine Engineering in the year 2008 from Tolani Maritime institute. She started her sailing journey as TME with Seaarland Shipping in the year 2008 on Bulk carrier M.V. Montrose. She rose to the rank of Chief Engineer in the year 2020 on Shipping Corporation of India Ship M.T. Desh Shanti. She has sailed on tankers, bulk carrier and a Passenger ship. She says that her sailing journey has been very adventurous and full of learnings. In her spare time, she likes to travel and spend time with her family.

Born in Kanpur and raised in the holy city Prayagraj of Uttar Pradesh,. her father was her mentor at that young age where she was raised with a mindset that, "nothing is impossible if you really want it, you can achieve it". The three most important values which were taught to her throughout her training - 'Knowledge', 'skill' and 'attitude'. And from there she embarked on her journey of becoming a Marine professional.

Embracing motherhood without quitting sailing was one of the main challenges faced by her, but with support from her family she continued the journey.

Her message to all the shipping fraternity is to give equal opportunities to everyone and have confidence in hiring female seafarers.

The felicitation ceremony is scheduled to be conducted in the upcoming Annual General Meeting of the IME(I) Mumbai Branch along with its Navi Mumbai & Gujarat Chapters.

PUNE BRANCH

NATIONAL MARITIME DAY CELEBRATION

The Institute of Marine Engineers (India) Pune Branch with CMMI and IMF celebrated the National Maritime Day on 30th April, 2022. Capt. Gokhale of CMMI introduced the speakers. There were two presentations: One was by Edelweiss Personal Wealth representative on "SETTING YOUR FINANCIAL GOALS" and another was by Dr. Sanjeet Kanungo, Principal, TMI, F.I.Mar.E. on "TRANSITION TO NET ZERO-EMISSION."

Dr. Kanungo dealt on the general concept of the Net Zero Emissions, highlighting the objective of the topic in bringing down the Green House Emissions, based on the landmark 2015 Paris Agreement. To achieve this goal, countries are aiming to reach net zero emissions by mid-century—a point representing the balance between unavoidable GHG emissions and their removal from the atmosphere, through reforestation or carbon capture and storage technologies, by the agreed deadline of 2050.

The scope of the relevant research is enormous, which encompasses solar, wind, bioenergy and other clean energy sources, the economics of electric power systems, infrastructure, energy storage, batteries for electric vehicles, smart home technologies, data security and privacy, etc., to name but a few. All of these are critical to ensuring that clean energy plays its required role. The energy sector holds the key to decarbonising the global economy: energy-related emissions account for about three-quarters of total CO_2 emissions. In conclusion, the speaker highlighted that, while technologically available, most green fuel technologies are not market ready. Globally, there is no clear single choice when it comes to zero-emission fuels today. Cross-cutting innovations are essential to address systemic gaps that affect all fuel types. All three parts of the value chain (fuel production, fueling infrastructure, and vessel design) require fuel-specific innovation at the same time to meet zero-emission targets.

The twenty-minute session was followed by Q & A.

CHENNAI BRANCH

DR. MALINI V. SHANKAR, VICE CHANCELLOR, IMU INAUGURATES INDIA'S 1ST STUDENTS' CHAPTER OF IME(I) AT HIMT COLLEGE

In the history of IME(I), 24th May 2022 will always be a memorable day as India's 1st Student Chapter of IME(I) at HIMT was inaugurated in the presence of Honorable Chief Guest Dr. Malini V. Shankar, IAS (Retd.), Vice Chancellor, IMU and Guest of Honour Shri. Vijendra Kumar Jain, President, IME(I). The day also had a Passing out Ceremony of Final year students including B.Sc., B. Tech, G.P and ETO Trainees.

After a brief introduction with the Faculties of HIMT College, the Chief Guest inaugurated the MERIT (Marine Education Research and Information Technology) Block and inspected the Double Bottom Tank Arrangement and live size gang-way.

The event was full of stalwarts from the industry, including the 1st Chairman of IME(I) , Shri I. M. Rao, Shri. Sanjeev Ogale, Chairman, Pune Branch and Chairman of Student Sub-committee and also the members of the executive council. Additionally, many from the industry joined from India and overseas through the Youtube link.

The Welcome Address was presented by Shri. Sanjeev S. Vakil, Founder & CEO, HIMT and the introduction of the Chief Guest and Guest of Honour was given by Principal, HIMT, - Capt. Anand Subramanian. This was followed by Cadets Oath of Honour under the guidance of Shri V. Ganapathi Rao – Director, New Projects HIMT. The Principal announced the name of the winners, and the prizes were awarded to the passing out batches by Dr. Malini Shankar and Shri. Vijendra Jain.

The signing of MoU between IME(I) and HIMT was exchanged between Principal, Capt. Anand and Shri. Jain, in the presence of Dr. Shankar. The 1st Student Chapter of IME(I) was declared open by Dr. Malini Shankar.

The President, Shri. V.K. Jain, in his address spoke on the objectives of establishing the Students' Chapter and urged the students to take part in various activities of the Chapter. He assured that there will be new programmes to improve soft skills, mentorship etc., under the Chapter. He also praised the growth recorded by HIMT College in the last 24 years.

The honourable Chief Guest Dr. Malini Shankar started her speech with a positive note by stating that Covid has taught the entire world the new way of looking at life. She appreciated the initiative of HIMT in making use of the technology, and creating 3D animated modules for the industry. She also emphasised that marine engineering is an applied field where we require a dynamic and active partnership with the industries and motivated the students for further growth by experiencing things rather than just reading conventions. She concluded her speech with hearty wishes to the passing out cadets.

THE RISE OF METHANOL AS FUTURE PROOF MARINE FUEL

(From Left to Right) - Cmde (IN) Bhupesh Tater , Mr. S.M. Rai, Mr. Rajesh Kasaragod, Mr. Sunil Kumar, Mr. David Birwadkar, Mr. Sanjeev Mehra, Mr. Amit Bhatnagar

A techno-commercial seminar on the above topic was held in hybrid mode (offline & online) on 29th April 2022. It was conducted by **Technical Sub-Committee, Institute of Marine Engineers (India), Mumbai Branch** jointly with **Sea Commerce (America) Inc. Texas.** The event was conducted at Banquet Hall -MCA, Bandra – Kurla Complex, Bandra (E), Mumbai, on zoom platform and was also broadcasted live on Facebook. The objective of the event was to create an awareness among the maritime fraternity to find cleaner energy pathways to comply with current and future IMO decarbonisation goals.

Mr. Sunil Kumar, Head -Technical Sub-Committee, IME(I), Mumbai Branch in his opening remarks expressed his delight to host this event jointly with Sea Commerce and welcomed all. In his talk, Mr. Kumar recalled the words of Sir Winston Churchill, "To improve is to change; to perfect is to change often" and expressed the significance of need to change to an alternate fuel for regulatory compliance. Further, Mr. Kumar invited **Mr. David Birwadkar, Vice Chairman, IME(I), Mumbai Branch** to share a few words on this occasion.

Mr. Birwadkar extended his warm welcome to everyone and highlighted the relevance of the topic being very current and one of the most debated and discussed one. He also briefed the august audience regarding the forthcoming event of INMARCO 2022. He then invited **Capt. Saleem Alavi, President, Sea Commerce (America) Inc. Texas** to take the proceedings further.

Capt. Alavi extended his greetings from Texas to all and highlighted the expertise of the speakers. An informative video was played on "Methanol in our Lives". Capt. Alavi then called upon **Mr. Richard Clayton, Chief Correspondent, Lloyds List, London** to take the proceedings forward.

Mr. Clayton mentioned that shipping is moving in a bit of an uneven space towards a cleaner energy pathway, but it is an industry which cannot be looked from only one aspect and we need to look at fuels and propulsion systems, seafarer skills, class, safeties, new technologies, etc. which affect the industry. He requested all the speakers to focus on "What makes methanol a future proof fuel?". Thereafter, Mr. Clayton introduced the speakers. Firstly, he invited **Mr. Vijay Arora, Managing Director, Indian Register of Shipping, Mumbai** to express his views**.**

Mr. Arora's presentation focused on perspective of classification society on the use of Methanol as a future fuel in India.

Then **Ms. Ayca Yalcin, Director, Marketing Development EMEA, Methanex, Belgium** was invited to express her views on the "Availability of Methanol and its Economics". She introduced Methanex to the audience and spoke about methanol as a marine fuel, and transition of shipping to a low carbon future.

Thereafter **Ms. Berit Hinnemann, Head of Decarbonization Business Development, Maersk, Denmark,** in her presentation enumerated the factors that prompted Maersk to select Methanol as a fuel and Maersk's Green Offtake Partnership.

After that **Mr. Chris Chatterton, Chief Operating Officer, Methanol Institute, Singapore** provided updates on methanol regulations and the reason for using methanol as a future proof fuel. He also explained the demand, supply, and

potential of Methanol. Indicative cost of renewable methanol, policy impact, availability in ports etc. were also elucidated.

Next invitee was **Mr. Fredrik Stubner, Chief Operating Officer, Green Marine Engineering, Copenhagen,** who gave a presentation on Methanol Dual Fuel Technology from concept and design to fruition, initial challenges which can come across, safety features, NOx Emissions, operating and bunkering, training requirements, investment costs etc.

Capt. Alavi was thereafter invited to express his views on alternative fuels, methanol, comparison between methanol, ammonia, LNG (methane) and Hydrogen. Sea Commerce has examined this issue and estimates that to install a shore-based 20,000cbm methanol storage tank would cost approximately $2.5 million whereas a LNG tank facility of similar size would cost approximately $50 million. A significant price differential also exists for the establishment of truck or bunkering barge infrastructure, indicating that methanol could be made available more economically than LNG or other new fuels that require cryogenic or pressurised containment systems. Methanol has the simplest storage and handling compared to competing fuels such as LNG, hydrogen, ammonia, and LPG.

In his presentation**, Mr. Rene Laursen, Director – American Bureau of Shipping, Fuel and Technology, Global Sustainability, Copenhagen** explained about GHG emissions, IMOs strategy for GHG reduction, properties of methanol, class perspective on methanol, IMO IGF Code etc.

Thereafter, **Mr. Vikrant Rai, Engineer, and Ship Surveyor cum -Deputy DG (Tech), Mumbai** presented the regulatory views on the subject. He articulately expressed that the decarbonisation of international shipping is centered around identification of an alternate fuel, production of an alternative fuel, infrastructure for bunkering these fuels, ships and technology which can operate on alternative fuel and retrofitting technologies. He also stressed upon the importance of energy enhancements for ports and ships.

Mr. Kjeld Aabo, Director, New Technologies, 2 Stroke Promotions, MAN ES, Denmark then gave a presentation on the evolution of 2 stroke methanol powered DF engine, the latest dual fuel engine technology, and Methanol Engine 3.0.

Capt. Alavi conducted an audience-poll at the end of each session and shared the outcomes.

Subsequently, **Mr. S M Rai, Member, Technical Sub-Committee, IME(I), Mumbai Branch** handled the Q&A session.

Mr. Sanjeev Mehra, Hon. Secretary, IME(I) Mumbai Branch proposed the vote of thanks. Thereafter**, Mr. Amit Bhatnagar, IRS** presented mementos to Capt. Alavi and Mr. Clayton. **Mr. Bhupesh Tatar, Hon General Secretary of the Head Office, IME(I)** presented mementos to Ms. Yalcin and Mr. Arora. Mr. Birwadkar presented mementos to Mr. Stubner and Mr. Chatterton. Mr. Kumar presented mementos to Mr. Aabo and Mr. Laursen. Mr. Mehra presented memento to Mr. Vikrant Rai. Mr. Clayton then did the task of summing up the discussion. Capt. Alavi gave the concluding remarks of the session. The event was followed by cocktails and dinner at physical gathering.

Speakers:


Mr. Sunil Kumar


Mr. David Birwadkar


Mr. Vijay Arora


Mr. S M Rai


Capt. Saleem Alavi


Mr. Richard Clayton

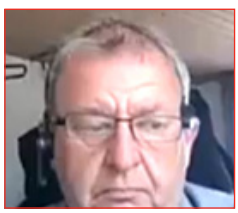

Mr. Vikrant Rai

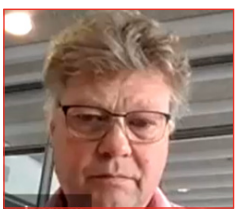

Ms. Ayca Yalcin


Ms. Berit Hinnemann


Mr. Chris Chatterton


Mr. Frednik Stubner


Mr. Kjeld Aabo


Mr. Rene Laursen

CLASS ACTION/INDUSTRY MOVES

Compilation: **Rashmi Tiwari**

INDIAN REGISTER OF SHIPPING COMPLETES NOISE & VIBRATION ANALYSIS OF 5 OFFSHORE PATROL VESSELS BUILT FOR INDIAN COAST GUARD AT GOA SHIPYARD

Indian Register of Shipping (IRS) has successfully completed noise and vibration measurement and analysis for five offshore patrol vessels built at Goa Shipyard Ltd (GSL) for the Indian Coast Guard. **IRS' Marine Technical Services (MTS) are recognised for accurate data acquisition and in-depth analysis.** Noise and vibration measurement are carried out to ascertain compliance with crew and passenger comfort requirements. These requirements are verified as per MLC Code - Regulation 4.3 & Para B.4.3.2, which deals with preventing the risk of exposure to hazardous levels of noise and vibration on board ships, and to provide an acceptable occupational and onboard living environment for seafarers.

For more information, please visit: http://www.irclass.org

YOKOHAMA PORT PLANS AMMONIA-FUELLED TUG

NYK Line, IHI Power Systems, and Nippon Kaiji Kyokai (ClassNK) have signed a memorandum of understanding (MoU) with City of Yokohama for the acceptance of an ammonia-fuelled tugboat (A-Tug) at the port of Yokohama. **The conclusion of this MoU is part of the Green Innovation Fund project within Japan's New Energy and Industrial Technology Development Organization (NEDO) for the development of vessels equipped with a domestically produced ammonia-fuelled engine, adopted in October 2021 for NYK Line and IHI Power Systems.**

The MoU includes the following:

1. Realisation of smooth acceptance of A-Tug at the port of Yokohama

2. Supply of fuel to A-Tug at the port of Yokohama

3. PR to citizens to affect efforts to reduce environmental load

4. Other matters related to the business of the parties

For more information, please visit: https://www.cleanshippinginternational.com/yokohama-port-plans-ammonia-fuelled-tug/?utm_source=email&utm_medium=2022-24-05-newsletter&gmc=KOPFtVZf7I&gm=8906&gml=0zw_Fa3fUD&gmv=0

ASSURING THE QUALITY OF MARITIME LEARNING: DNV CERTIFIES FIRST TRAINING PLATFORM PROVIDER SEABLY

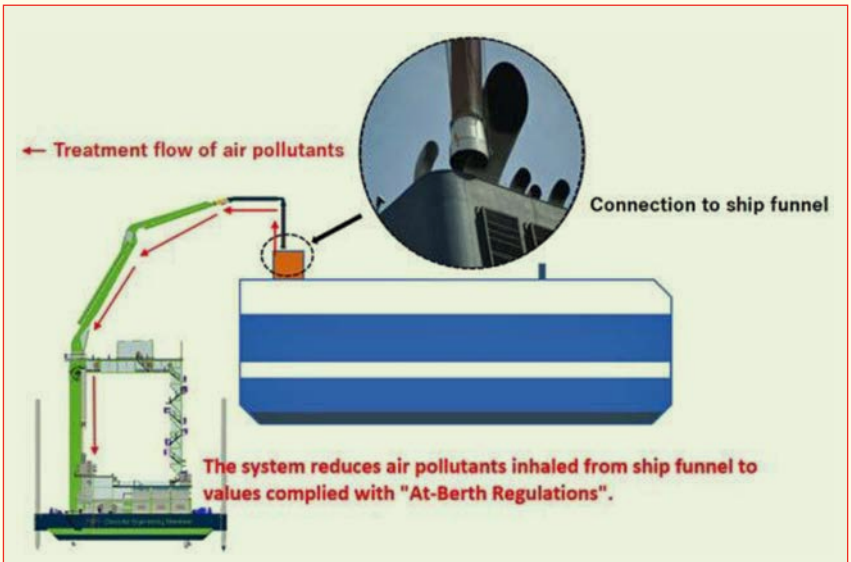
DNV has awarded the Swedish maritime training platform Seably a new DNV competence certification for its digital services. The DNV SeaSkill™ standard ST-0595 is the first of its kind and addresses an emerging trend in the maritime training market: the emergence of training platform providers. The standard's certification framework aims to ensure the quality of the training platforms, as well as their learning products and operation. It was developed in co-operation with Seably as a pilot customer. Rapid digitalisation, a move to offer more learning experiences on board and two years of operating during a global pandemic have transformed the maritime training market.

For more information, please visit: www.dnv.com/maritime

BUREAU VERITAS CERTIFIES METIS CYBERSPACE TECHNOLOGY SA ON CYBER RESILIENCE

Bureau Veritas (BV), a world leader in testing, inspection and certification, has awarded type approval certification (TAC) to an IoT solution offered by METIS Cyberspace Technology SA: 'METIS IoT SYSTEM'. **This solution is a combination of two services, 'METIS SHIP CONNECT' & 'METIS SPACE'. It offers data acquisition and analysis through a highly sophisticated AI-based system.** METIS Cyberspace Technology SA specialises in Data Acquisition, Real-time Performance Monitoring and Intelligent Analytics for the Maritime Industry, using Machine Learning and Artificial Intelligence. Its secure digital tools help shipping companies to enhance vessel performance and quantify gains in areas as diverse as route cost optimisation, energy efficiency, fuel efficiency, total emissions management and fulfilment of charter party agreements.

For more information, please visit: https://bureauveritas.com



AIP FOR MHI AND NYK'S JOINT LCO2 CARRIER PROJECT

Mitsubishi Shipbuilding, a part of Mitsubishi Heavy Industries (MHI) Group, and Nippon Yusen Kabushiki Kaisha (NYK Line) have been granted Approval in Principle (AiP) from the Japanese classification society ClassNK for their joint development of CO_2 transport technology for liquefied CO2 (LCO2) carriers. **LCO2 carriers will be used to transport liquefied CO_2 at low temperature and high pressure, contained in the cargo tank system.** Since the design of cargo containment system depend strongly on the condition of liquefied CO_2 such as their temperature and pressure, it is an important technical development issue to increase the size of cargo tank systems and hulls for future mass transportation.

For more information, please visit: https://www.cleanshippinginternational.com/aip-for-mhi-and-nyks-joint-lco2-carrier-project/

MOL TO FUND NEW EXHAUST GAS TREATMENT SYSTEM

Mitsui OSK Lines (MOL) has agreed a contract to provide the funds for California-based Clean Air Engineering Maritime (CAEM), a ship-auxiliary generator exhaust treatment company, to develop a new-generation Marine Exhaust Treatment System for use on MOL-operated car carriers from 2025 to cut air pollution in California. **The US California Air Resources Board (CARB) is taking advanced measures to prevent air pollution.** In particular, according to CARB At-Berth Regulations, which regulate the emission of exhaust from diesel auxiliary engines on certain classes of ships arriving in Californian ports, regulated ships calling in that state are required to reduce the amount of air pollutants including NOx and particulates emitted during mooring at ports.

For more information, please visit: https://www.cleanshippinginternational.com/mol-to-fund-new-exhaust-gas-treatment-system/?utm_source=email&utm_medium=2022-10-05-newsletter&gmc=Vw90vHX-xh&gm=8907&gml=DZKFJMcycF&gmv=0

WÄRTSILÄ DIGITISES ANGLO-EASTERN SHIPS TO IMPROVE SUSTAINABILITY AND SAFETY

Wärtsilä Voyage and ship manager Anglo-Eastern have reached a significant milestone in their joint project to improve safety and environmental sustainability at sea, with more than 500 vessels in Anglo-Eastern's fleet now fitted with Wärtsilä Voyage's Fleet Optimisation Solutions (FOS) decision support software platform for voyage planning, charter-party compliance, fuel efficiency, and fleet performance management. **Wärtsilä Voyage's FOS is a shared digital platform that helps to monitor, manage and optimise everyday processes on board and onshore.** By combining cloud-based analytics and artificial intelligence, FOS reduces workload and provides all stakeholders with a clear overview of their fleet's performance.

For more information, please visit: https://www.cleanshippinginternational.com/wartsila-digitises-anglo-eastern-ships-to-improve-sustainability-and-safety/?utm_source=email&utm_medium=2022-31-05-newsletter&gmc=9eK8DVmXrf&gm=8907&gml=I3-whMAvPH&gmv=0

HYDROGEN ENERGY SYSTEM FOR CRUISE VESSELS: DNV GRANTS PRELIMINARY APPROVAL TO HAV GROUP ASA

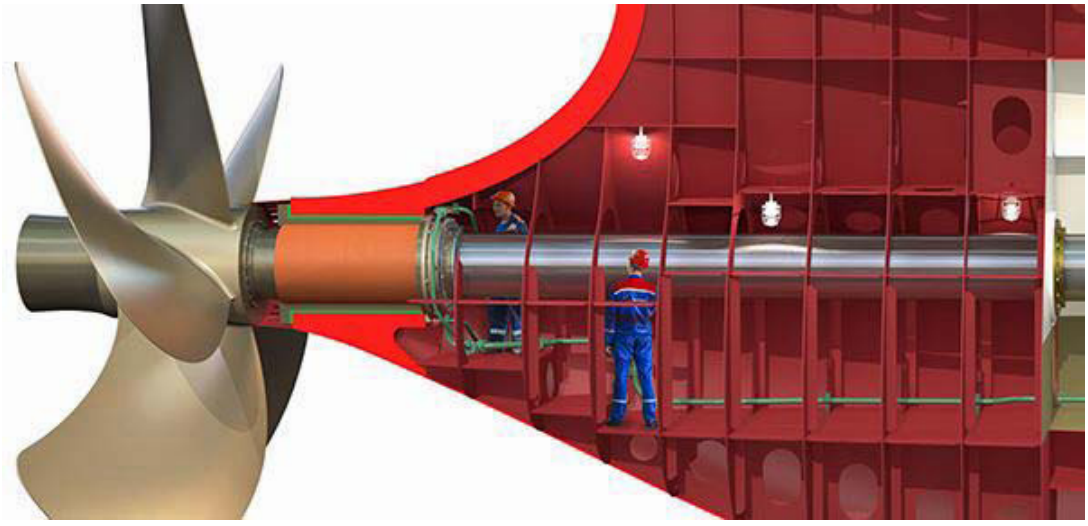
DNV has awarded the Norwegian technology provider HAV Group ASA preliminary approval for its hydrogen-based energy system. **The system uses liquefied hydrogen storage and fuel cells and was created as part of the FreeCO2ast project**, which is currently developing a high-capacity hydrogen energy system that can be retrofitted onboard two coastal cruise vessels owned by the Norwegian operator Havila Kystruten. The preliminary approval through DNV means that HAV Group ASA can confidently enter the final design stage and is one step closer to commercialising its hydrogen system.

For more information, please visit: www.dnv.com/maritime

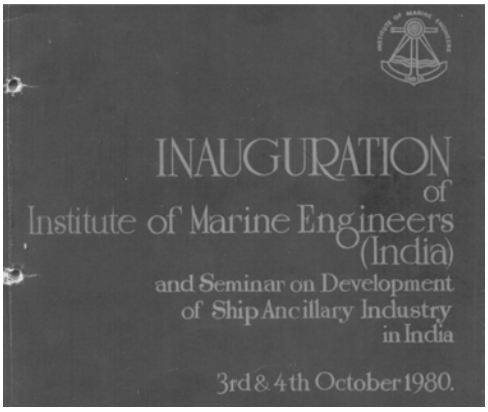
AiP FROM ABS FOR SDARI'S POLLUTION-FREE STERNTUBE CONCEPT

ABS has granted Approval in Principle (AIP) to the Shanghai Merchant Ship Design and Research Institute (SDARI) for a new vessel design with a novel aft layout, which is claimed to eliminate pollution and promote efficient vessel operations. **The SDARI design, developed in cooperation with the National Technical University of Athens (NTUA) and Thordon Bearings, introduces a new approach to the vessel's aft layout, including removal of the stern tube casting, employing seawater for lubrication and creation of a chamber to permit in-water maintenance for the first time.** These innovations enable shipyards and owners to eliminate shaft-bearing oil leaks, simplify maintenance and reduce costs.

For more information, please visit: https://www.cleanshippinginternational.com/aip-from-abs-for-sdaris-pollution-free-sterntube-concept/



GOING ASTERN INTO MER ARCHIVES



Information Adviser
to the Prime Minister

PRIME MINISTER'S OFFICE
NEW DELHI-110011

1 September 1980

F.14(11)80/PMO/I

Dear Sir,

The Prime Minister thanks you for your letter. She is glad to know that an Institute of Marine Engineers (India) has been formed and that it will be inaugurated by the Union Minister for Shipping and Transport in October. She wishes success to the activities of the Institute.

Yours sincerely,

(H.Y.Sharada Prasad)

Shri M.S.Rao,
President,
The Institute of Marine Engineers (India),
16th Floor, Nirmal Building,
Nariman Point, Bombay - 400 021.

Technical Papers:

1. Indigeneous Development of Equipment for Merchant & Naval Ships. — Rear Adm. C. L. Bhandari (Retd.) & Capt. M. M. Puri
2. Operating Experiences with Ancillary Items. — Commander M. K. Banger, Indian Navy.
3. Development of Ship Ancillary Industry in India. — C. S. Rao, Hindustan Shipyard Ltd.
4. Thermosetting Plastics for Marine Application. — P. Roy, Bakelite Hylam.
5. Manufacture of Steel Hatch Covers in India. — Mr. Rana, Scindia Workshop.
6. Across the Waters on Gears — B. K. Gadre, Kirloskar Pneumatics.
7. Standardisation & Specification of Indigenous Marine Auxiliaries. — P. S. Das, I.S.I.
8. Survey and Testing Requirements for Certification of Marine Aux. Equipments at Manufacturer's Works. — S. M. Bhola, Lloyd's Register of Shipping.
9. The Use of High Speed Main Generator Sets of Indigenous Origin. — R. G. Sathaye, Scindia Steam Navigation Co.
10. M.V.Switchboards for Marine Applications. — V. Mohan, Larsen & Toubro.
11. Developing Custom Built Welding Machine. — S. S. Karnad, Advani Oerlikon.
12. Requirement of Ancillary Machinery & Equipment for Barges — A. S. Tambwekar, Dempo Engineering Company.
13. Blending and Supply of High Quality Lubricants in India. — F. J. D'Sa, B.P. Agencies, India.
14. Development of Auxiliary Diesel Motive Power in India. — K. Sharma
15. Study of Barge Operations in Goa — A. V. Chitale, Kirloskar Oil Engines.

I am aware of few fellow engineers who have preserved the MERs saving them from termites and occasional temptation to make space, maybe for other curios. MER has survived the ravages of time and astoundingly the gales of information technology. The die-hard readers would have noticed that the bountiful technical content and information now has shifted to more engaging media platforms. The Journal has also accommodated to these demands by appearing as pdf version, flip book version and also in palm size accessibility models. We thought it would be worth our time to look into the pirate's chest and pull out a few old MER Journals and check out the legacy.

The first leaf we are pulling out of the punch-hole file is the inauguration of the IME(I). With the typewritten missive from PMO, there are a few more including one from Sir CPS, the then SG of IMCO (now IMO). A remarkable feature was the focus and the relevance of the technical papers collection under the theme.

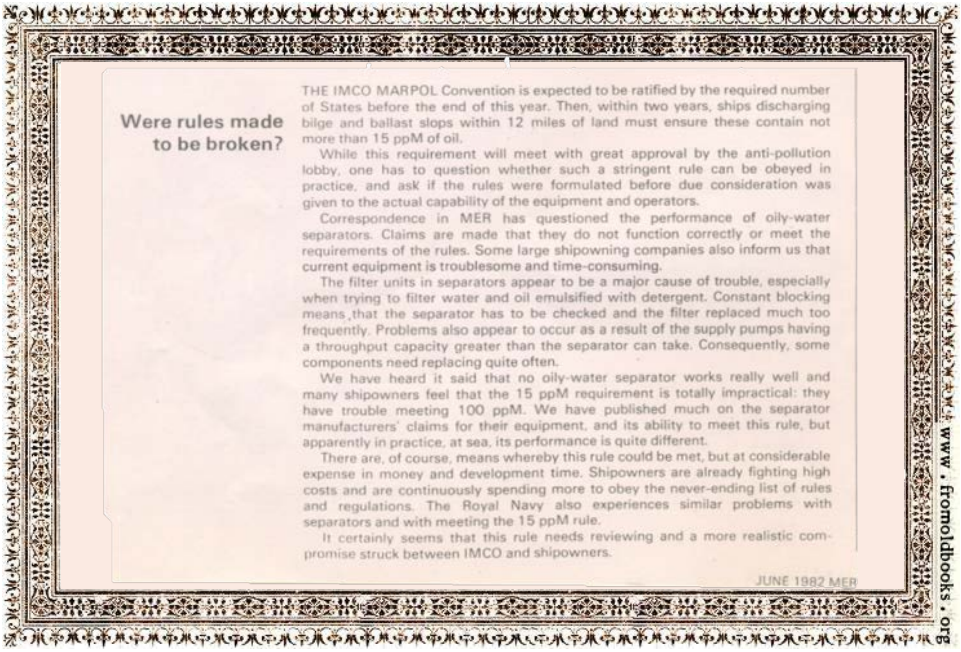
MER... Four decades back

We go dead slow ahead into 1982 from 1980...

In the 'post Bag' section, there is an interesting discussion on proposed International Marine Fuel specifications. The 'Opinion' column carries a pertinent discussion on MARPOL being ratified and the performance of the OWS. Guess the lament is still valid today... or can we boast of high performance OWS? The issues could be still having relevance in the current ship running, however, we may safely rest the case that OWS efficiencies and controls have got much better than yesteryears.

We reproduce the section for your eyes and would invite some healthy discussions too.

Technical articles included a couple of write-ups on Slow speed diesel engine designs of B&W and Sulzer,



Were rules made to be broken?

THE IMCO MARPOL Convention is expected to be ratified by the required number of States before the end of this year. Then, within two years, ships discharging bilge and ballast slops within 12 miles of land must ensure these contain not more than 15 ppM of oil.

While this requirement will meet with great approval by the anti-pollution lobby, one has to question whether such a stringent rule can be obeyed in practice, and ask if the rules were formulated before due consideration was given to the actual capability of the equipment and operators.

Correspondence in MER has questioned the performance of oily-water separators. Claims are made that they do not function correctly or meet the requirements of the rules. Some large shipowning companies also inform us that current equipment is troublesome and time-consuming.

The filter units in separators appear to be a major cause of trouble, especially when trying to filter water and oil emulsified with detergent. Constant blocking means that the separator has to be checked and the filter replaced much too frequently. Problems also appear to occur as a result of the supply pumps having a throughput capacity greater than the separator can take. Consequently, some components need replacing quite often.

We have heard it said that no oily-water separator works really well and many shipowners feel that the 15 ppM requirement is totally impractical: they have trouble meeting 100 ppM. We have published much on the separator manufacturers' claims for their equipment, and its ability to meet this rule, but apparently in practice, at sea, its performance is quite different.

There are, of course, means whereby this rule could be met, but at considerable expense in money and development time. Shipowners are already fighting high costs and are continuously spending more to obey the never-ending list of rules and regulations. The Royal Navy also experiences similar problems with separators and with meeting the 15 ppM rule.

It certainly seems that this rule needs reviewing and a more realistic compromise struck between IMCO and shipowners.

JUNE 1982 MER

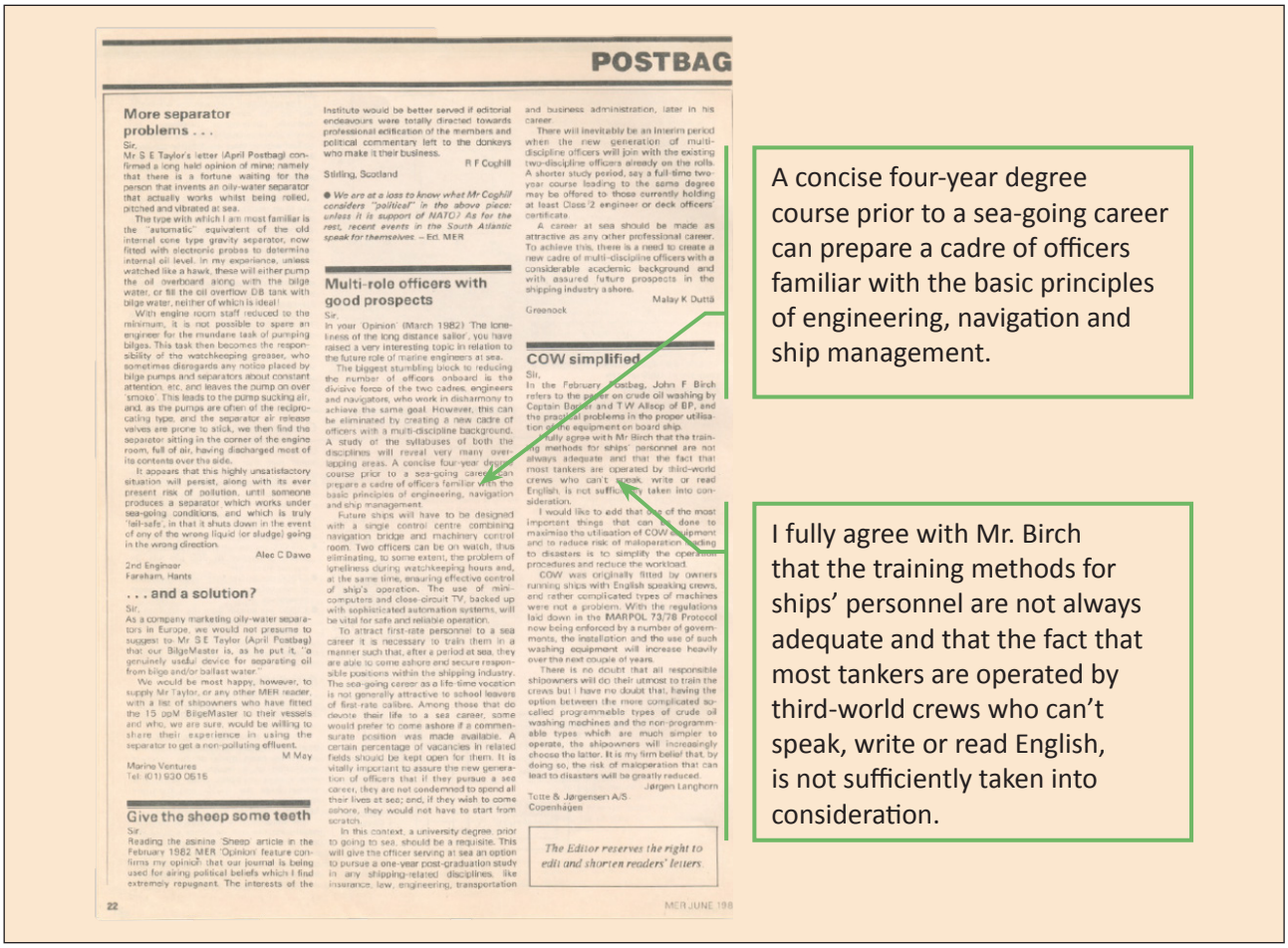
gas-turbo electric drives and constant speed shaft driven generator etc. The others are on fluidised bed, superconducting DC motors for propulsion (has meaning in the current times), one on how medium speed engines are competing with slow speed diesels, one article on offshore drilling operations, one article on developments in ship design etc.

The Post Bag had many letters discussing technical issues. In our current times, I see a lot of technical discussions in social media forums...WA etc. A sample extract for your eyes...

Two sentences are placed in the pull outs for the benefit of the readers. If there are any interesting threads which can be generated from these, we would be glad to have them going under the Indicator Cards column.

But can we hope for some similar letters (non-controversial/non-blaming, purely technical) in the current MER spaces?

The content is worth extending the discussions in this forum and outside of this. We will feature some titbits of information from this issue. If the interest sustains, will then venture to reproduce sections or the whole article (technical and digital limitations permitting).



POSTBAG

More separator problems . . .

Sir,
Mr S E Taylor's letter (April Postbag) confirmed a long held opinion of mine; namely that there is a fortune waiting for the person that invents an oily-water separator that actually works whilst being rolled, pitched and vibrated at sea.

The type with which I am most familiar is the "automatic" equivalent of the old internal cone type gravity separator, now fitted with electronic probes to determine internal oil level. In my experience, unless watched like a hawk, these will either pump the oil overboard along with the bilge water, or fill the oil overflow DB tank with bilge water, neither of which is ideal!

With engine room staff reduced to the minimum, it is not possible to spare an engineer for the mundane task of pumping bilges. This task then becomes the responsibility of the watchkeeping greaser, who sometimes disregards any notice placed by bilge pumps and separators about constant attention, etc, and leaves the pump on over 'smoko'. This leads to the pump sucking air, and, as the pumps are often of the reciprocating type, and the separator air release valves are prone to stick, we then find the separator sitting in the corner of the engine room, full of air, having discharged most of its contents over the side.

It appears that this highly unsatisfactory situation will persist, along with its ever present risk of pollution, until someone produces a separator which works under sea-going conditions, and which is truly 'fail-safe', in that it shuts down in the event of any of the wrong liquid (or sludge) going in the wrong direction.

Alec C Dawe
2nd Engineer
Fareham, Hants

. . . and a solution?

Sir,
As a company marketing oily-water separators in Europe, we would not presume to suggest to Mr S E Taylor (April Postbag) that our BilgeMaster is, as he put it, "a genuinely useful device for separating oil from bilge and/or ballast water".

We would be most happy, however, to supply Mr Taylor, or any other MER reader, with a list of shipowners who have fitted the 15 ppM BilgeMaster to their vessels and who, we are sure, would be willing to share their experience in using the separator to get a non-polluting effluent.

M May
Marine Ventures
Tel: (01) 930 0616

Give the sheep some teeth

Sir,
Reading the asinine 'Sheep' article in the February 1982 MER 'Opinion' feature confirms my opinion that our journal is being used for airing political beliefs which I find extremely repugnant. The interests of the Institute would be better served if editorial endeavours were totally directed towards professional edification of the members and political commentary left to the donkeys who make it their business.

R F Coghill
Stirling, Scotland

● *We are at a loss to know what Mr Coghill considers "political" in the above piece: unless it is support of NATO? As for the rest, recent events in the South Atlantic speak for themselves.* – Ed. MER

Multi-role officers with good prospects

Sir,
In your Opinion (March 1982) The loneliness of the long distance sailor, you have raised a very interesting topic in relation to the future role of marine engineers at sea.

The biggest stumbling block to reducing the number of officers onboard is the divisive force of the two cadres, engineers and navigators, who work in disharmony to achieve the same goal. However, this can be eliminated by creating a new cadre of officers with a multi-discipline background. A study of the syllabuses of both the disciplines will reveal very many overlapping areas. A concise four-year degree course prior to a sea-going career can prepare a cadre of officers familiar with the basic principles of engineering, navigation and ship management.

Future ships will have to be designed with a single control centre combining navigation bridge and machinery control room. Two officers can be on watch, thus eliminating, to some extent, the problem of loneliness during watchkeeping hours and, at the same time, ensuring effective control of ship's operation. The use of mini-computers and close-circuit TV, backed up with sophisticated automation systems, will be vital for safe and reliable operation.

To attract first-rate personnel to a sea career it is necessary to train them in a manner such that, after a period at sea, they are able to come ashore and secure responsible positions within the shipping industry. The sea-going career as a life-time vocation is not generally attractive to school leavers of first-rate calibre. Among those that do devote their life to a sea career, some would prefer to come ashore if a commensurate position was made available. A certain percentage of vacancies in related fields should be kept open for them. It is vitally important to assure the new generation of officers that if they pursue a sea career, they are not condemned to spend all their lives at sea; and, if they wish to come ashore, they would not have to start from scratch.

In this context, a university degree, prior to going to sea, should be a requisite. This will give the officer serving at sea an option to pursue a one-year post-graduation study in any shipping-related disciplines, like insurance, law, engineering, transportation and business administration, later in his career.

There will inevitably be an interim period when the new generation of multi-discipline officers will join with the existing two-discipline officers already on the rolls. A shorter study period, say a full-time two-year course leading to the same degree may be offered to those currently holding at least Class 2 engineer or deck officers' certificate.

A career at sea should be made as attractive as any other professional career. To achieve this, there is a need to create a new cadre of multi-discipline officers with a considerable academic background and with assured future prospects in the shipping industry ashore.

Malay K Dutta
Greenock

COW simplified

Sir,
In the February Postbag, John F Birch refers to the paper on crude oil washing by Captain Bagley and T W Allsop of BP, and the practical problems in the proper utilisation of the equipment on board ship.

I fully agree with Mr Birch that the training methods for ships' personnel are not always adequate and that the fact that most tankers are operated by third-world crews who can't speak, write or read English, is not sufficiently taken into consideration.

I would like to add that one of the most important things that can be done to maximise the utilisation of COW equipment and to reduce risk of maloperation leading to disasters is to simplify the operation procedures and reduce the workload.

COW was originally fitted by owners running ships with English speaking crews, and rather complicated types of machines were not a problem. With the regulations laid down in the MARPOL 73/78 Protocol now being enforced by a number of governments, the installation and the use of such washing equipment will increase heavily over the next couple of years.

There is no doubt that all responsible shipowners will do their utmost to train the crews but I have no doubt that, having the option between the more complicated so-called programmable types of crude oil washing machines and the non-programmable types which are much simpler to operate, the shipowners will increasingly choose the latter. It is my firm belief that, by doing so, the risk of maloperation that can lead to disasters will be greatly reduced.

Jørgen Langhorn
Totte & Jørgensen A/S
Copenhagen

The Editor reserves the right to edit and shorten readers' letters.

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A concise four-year degree course prior to a sea-going career can prepare a cadre of officers familiar with the basic principles of engineering, navigation and ship management.

I fully agree with Mr. Birch that the training methods for ships' personnel are not always adequate and that the fact that most tankers are operated by third-world crews who can't speak, write or read English, is not sufficiently taken into consideration.

We invite observations, discussion threads from readers, taking cues from these sepia-soaked MER pages — Hon.Ed.

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COLUMN

Heritage Hourglass
EARLY MARITIME INTERACTIONS AND RELEVANCE TODAY: TRACING INDIA'S MARITIME HISTORY AND LESSONS LEARNT
Lighthouses in India: An Odyssey of its Architecture (A case study of the Mamallapuram lighthouses)

Amruta Talawadekar

Introduction

Surrounded by water, India has been a maritime nation since antiquity. We have seen the association of Indians with the sea since the Indus Valley Civilization who settled on the coast to aid seaborne travel and trade. The earlier boats were made from reed that could travel near the coast. This helped mariners recognise the coastal features easily and assisted in safe landing in case of emergency. Eventually, the watercraft began to evolve leading to open sea voyages. To navigate at sea, knowledge of various navigational aids such as stellar navigation, coastal features, geography, pattern of winds and tides etc. was necessary. Various coastal features began to be recognised and noted by the seafarers while travelling by the maritime medium. Coastal features for navigational aid include unique landmarks, geography of the coast, natural features like mountains, tall or unique buildings or even fortifications that would help in easy recognition of the coast. Lighthouse is one of them. With experience and knowledge passed on from generations, the lighthouses began to evolve in their design for easy recognition of the coast. Since then, the structure of the lighthouse has evolved from just a lamp to a blinking, electrical and fully equipped light ray by various dominant rulers for the benefit of the seafarers. These lighthouses that once defined the beauty of the coast are now lying in an inconspicuous corner. While one is aware of the contemporary lighthouse structure, not many are aware of the evolution of these lighthouses and the reason behind their contemporary evolution. This paper thus investigates the history of architecture and function of the design of the lighthouses in India from the past to the present to establish a need for conservation of the lighthouses in contemporary times.

What is a Lighthouse?

A lighthouse is a structure (a tower either on land or on the seabed) constructed to help in maritime coastal navigation by warning seafarers of risks, determining their location, and directing them to their objectives . The concept of a lighthouse came up to aid night travel at sea. While navigational aids were useful mainly in the day, light could be easily interpreted at night. A lighthouse is an orientation mark that can be detected by a seafarer without the use of any instrument or gadget. Several seafarers still prefer visual navigation and lighted marks that are simple, reliable and low cost. Advantageously, they can be used by vessels with no special equipment on board, providing a reliable backup against the failure of sophisticated systems.

The Architectural Evolution of a Lighthouse

Pre-Victorian Era

The concept of a lighthouse is said to have been used since the discovery of fire. Early travel included sailing across the coast. A bonfire would be erected on the pinnacles of rocks near the coast for easy interpretation. With experience and the advent of transoceanic travel, bonfires proved to be inefficient. Slowly temples began to be constructed at high altitudes bearing a light for coastal identification. The profile of a temple would be used as a mark during the day while the light would help during

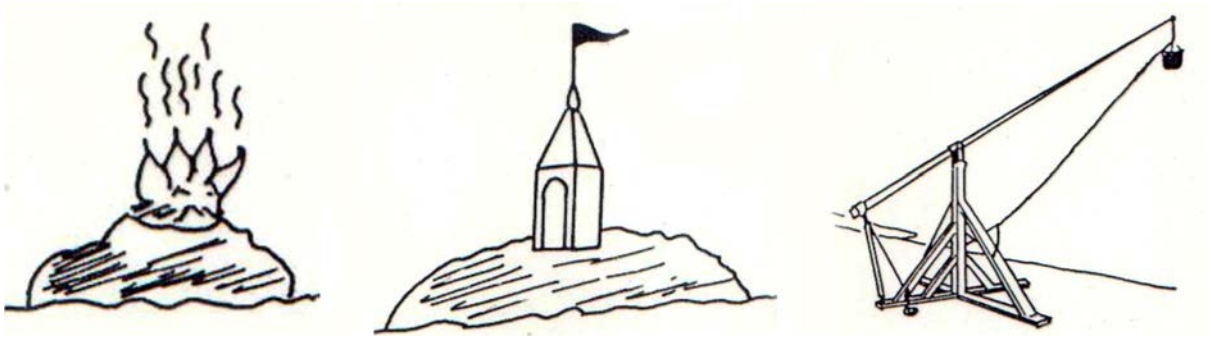


Figure 1. Various forms of navigational aids used prior to lighthouses - A bonfire, a temple and a wooden lever (Source - S.A Kapote - Bhanti, R.K. 2000. Indian Lighthouses: An overview. India: Directorate General of Lighthouses and Lightships, pg 20.)

nighttime. Over time the design evolved from a bonfire to wick burners, oil lamps and then electrical lamps. Subsequently, wooden overhangs or wooden levers were created on high altitudes bearing a light.

Victorian era

In the Victorian era, a separate tower would be built that resembled the ones that still exist. It consisted of a light tower and accommodation for the keepers and their families. The lantern room would be designed at the top of the tower that hosted the key element of the lighthouse – the light. The light was protected by glass all around. A small balcony or gallery surrounded the lantern room. This is designed especially for the keepers to maintain the windows and structure of the lantern room for a clear vision of the light at all times. It also acted as a convenient and safe platform from which the keeper would observe passing ships and communicate to warn them of danger.

In some places, a bell or horn was also mounted out on the gallery that was used to indicate the presence of the lighthouse when it was covered in heavy fog and the light could not easily be seen. The remaining height of the lighthouse acted as a storage and occupancy area for the keeper and his family. This provision was made for island or open sea lighthouses while onshore-based lighthouses had separate quarters for the keeper. The tower also had a long spiral staircase that led to the lantern room.

Early Victorian lighthouses were decorated with an oil-fired lamp. The lighthouse keeper had to carry new candles, fuel, or wicks halfway up the tower each time. Keeping soot and smoke off the glass and lenses was a tedious and frequent task, as was filling the lamps and trimming the wicks so they burned evenly and minimise smoke. This was resolved by the discovery of flammable Acetylene gas by combining water with mineral calcium carbide. This was cleaner and brighter and was easy to produce, safe and easy to maintain. All it required was water and carbide to form acetylene gas.

Modern Era

The development of modern lighthouses is said to have started around the 18-19th century when improvements in structures and lighting equipment began to appear more rapidly. Today, modern construction methods have considerably facilitated the building of lighthouses in the open sea. While masonry and brick continue to be employed in lighthouse construction, concrete and steel are the most widely used materials today. After the advent of electricity, electric lights came to be installed in place of Petroleum Vapour Burners and Dissolved Acetylene Gas Burners as illuminants at the lighthouses. Each of these electrical lights emitted differing characteristics for clear identification. The navigator would recognise the lighthouse based on the number of times it blinked and the timespan between each blink. Several lighthouses such as the ones at Okha, Mangrol, Korlai Fort, Bhatkal, Dolphin's Nose in Vishakhapatnam, Puri and False Point at Orissa were equipped with the first electrically operated lights with diesel generating sets. Initially, powerful incandescent lamps up to 3.5 kW were used. Solar energy was also introduced during the same period. These and the remaining photovoltaic lights were replaced by Metal Halide lamps and Acetylene Gas lights with Halogen lamps during 1990-2000. In bad weather conditions, especially during fog, the visibility considerably lowered in certain regions where fog signal equipment such as air sound horns were installed. These were discontinued in 1988 replacing most of them with `Racons". Today, many of them are automated and do not require a keeper.

Site Selection

The site chosen to build a lighthouse was generally exposed to the sea due to which the material and style of construction were to be adopted according to the location. Some were placed onshore overlooking the water, while some were offshore on reefs or patches of rocks. The ones built on the coast were less tedious and could be built extravagantly but the lighthouses built in the water were simple and sturdy to withstand several conditions. The lighthouses would be constructed on elevated locations to provide farsighted visibility and ensure a clear vision of the flashing characteristics. The materials used to build lighthouses have changed through time, including wood, brick, stone, concrete, reinforced steel, and even cast iron. The height of the tower varied from one lighthouse to the next depending on the view from the water. The design of the lighthouse too depends on the locality. At locations

where a lighthouse could not be constructed, the concept of a floating lighthouse was introduced. It involved a form of light hung on a moored ship.

To understand the odyssey of the architecture of the lighthouses across centuries, let's take Mahabalipuram as a case study.

Lighthouses at Mahabalipuram

Mahabalipuram, also known as Mamallapuram is a town located around 59kms from Chennai. Being a coastal town on the eastern coast of India, the town has a rich history dating back to the beginning of the Christian era. Periplus of the Erythraean Sea mentions references of this port town along with Poduke (modern Pondicherry) as a port North of Kaveri. it was an important port built by the Pallavas during the 7th century. It has had a maritime connection and trade relations with countries of Southeast Asia and the Mediterranean.

Figure 2. Location of Mahabalipuram on the eastern coast of India (Source - Google Earth)

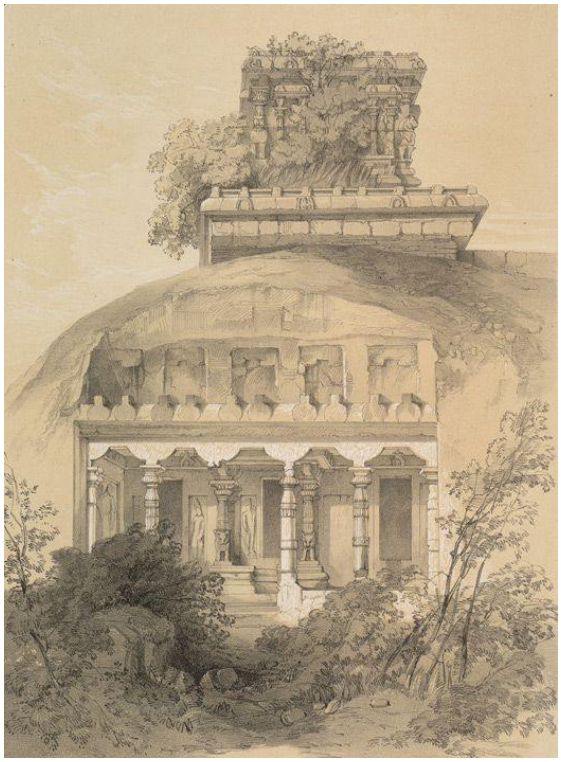


Figure 3. Artist's representation of the Olakannisvara Temple on the Mahishasuramardini Caves (Source: James Fergusson's 'Illustrations of the Rock Cut Temples of India)

For ships entering the Mahabalipuram harbour in the dark, the placement of a log fire on one of the rocks served as a light source. The Pallavas are said to have built the Olakannisvara Temple on the *Mahishasuramardini* caves in Mahabalipuram. While there have been several controversies regarding its name, some say that the name stands for 'flame eye'[1] which indicates the presence of light back then. Sources say that it might have been a navigational aid during that time due to its location at a high altitude. It is said to be the highest place in the region with the temple being around 36 m above the sea. The British established the first conventional lighthouse by placing a wick lamp inside a 4th order optic and lantern on the roof of Olakannisvara Temple on 15th May 1887[2]. The roof of the temple was recreated with granite and concrete that hosted a lantern above. Locals also speak of depression in its roof that could have acted as an oil reserve for the bonfire to remain burning.

Just besides this temple, a lighthouse was constructed by the British in 1904. This lighthouse is a circular tower with a balcony and lantern built on granite stone[3]. A circular tower in stone masonry, 26m in height was built on a nearby rock in 1900. Its exterior surfaces were left natural and unpainted so as to blend with the surroundings. Equipments imported from Birmingham were installed over this tower that was inaugurated on 31st March 1901. In 1937 and 1940, the equipment underwent changes and modifications to give a single flash every ten seconds. The PV source was replaced by an incandescent electric lamp in 1994[4].

Conclusion

The concept of light as a navigational aid has been part of our nation from its inception. These lighthouses are a sentinel of India's maritime prowess. They are structures borne out of experiences at sea and due to the evolution of mankind. The evolution in its architecture has quite spoken for itself. It is also a depiction of the importance of the maritime medium to the nation and its prosperity. Thus, in the era before GPS and digitalised navigational aids, lighthouses served as an important aid for navigation at sea. Each lighthouse is unique in the context of its geographic location, architectural style, and history. Today, with the upgradation of equipments, some of these lighthouses have become obsolete. While some are still being used, many have fallen prey to several changing conditions. They will continue to remain the basic source of assistance to mariners for all time to come. Starting from the days of a log fire, these lighthouses have withstood the test of time and need to be preserved for future generations to understand their evolution. Tourism or revived use as a lighthouse can be ways to its revival. A holistic tourism model can help sustain the maintenance and working of the lighthouse that can be visited by

Figure 4. Ancient and modern lighthouses at Mahabalipuram

maritime enthusiasts to enjoy a 360-degree view of the locality. Today, these lighthouses are a symbol of global infrastructure and development that has become a crucial part of our coastal heritage.

References

1. M.K Dhavalikar, "Kuntasi: A Harappan Port in Western India," South Asian Archaeology, Prehistory Press, Madison, 1992, 73.
2. Rao, S.R, Marine Archaeology in India. (India: Publications Division, Ministry of Information and Broadcasting, 2001), 3.
3. Clingan, I. C. "Lighthouse." *Encyclopedia Britannica*, March 5, 2019. https://www.britannica.com/technology/lighthouse.
4. Bhanti, R.K. 2000. Indian Lighthouses: An overview. India: Directorate General of Lighthouses and Lightships, pg 8.
5. Navy, Indian. 2016. Maritime Heritage of India. Hyderabad: Pragati Offset Pvt Ltd, pg 111.
6. Sivaramamurti, C. 2004. Mahabalipuram. New Delhi: Archaeological Survey of India, pg. 1.
7. Ibid, pg. 19.
8. Bhanti, R.K. 2000. *Indian Lighthouses: An overview.* India: Directorate General of Lighthouses and Lightships, pg 170.
9. Ibid.
10. Ibid.

About the Author

Amruta Talawadekar is an Architect by profession with a Master's degree in Architecture and Urban Conservation from Kamala Raheja Vidyanidhi Institute for Architecture and Environmental Studies. She has been working with the Maritime History Society, Mumbai as a Research Associate. She has been contributing to the MER.

Email: amruta.rab@mhsindia.org

IN THE WAKE

Rajoo Balaji

Corona Chronicles

The Shangai shackles (lockdowns) are still on and has a telling effect on the shipping movements, especially in the SA (South Asia) circuits. But the boosters and lesser numbers are lifting the sentiments.

Can we hope that the seafarer movement will ease to normalcy in the second half of 2022?

Shipping matters

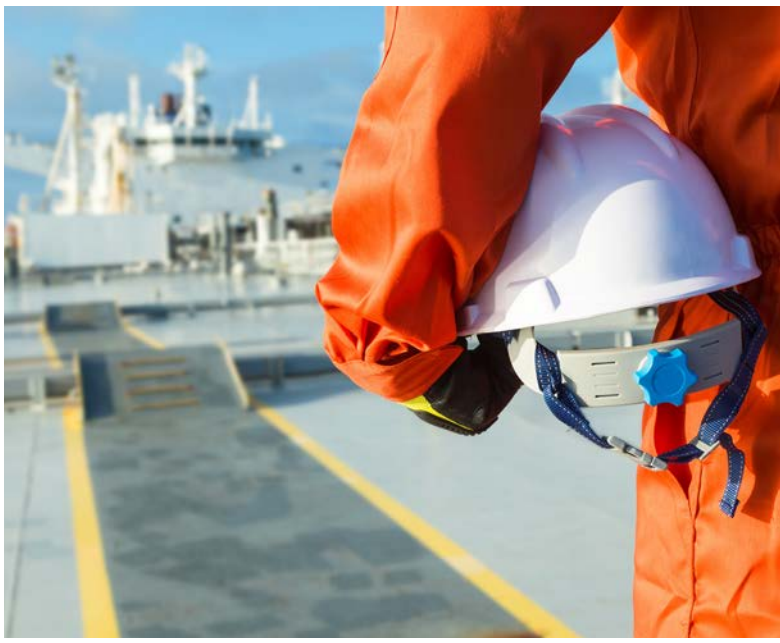
18/5 passed on as the IMO International Day of Women in Maritime (the first?). SCI sailed out its second all-women ship on the occasion. While the global maritime women workforce is around 40%, women seafaring force lags at around 2%, single digit range.

Backing the UN SDG#5(Gender Equality), IMO's punchline theme of 'Training-Visibility-Recognition: Supporting a Barrier-free Environment' can gain some momentum in the scheme of things.

Can we say we have come a long way from Victoria Drummond, the first woman CE?

Yes, but still a long way from the state that Sheryl Sandberg wants: **In the future, there will be no female leaders. There will just be leaders.**

The ILO site has some updates on the amendments to the MLC. One thing which caught the attention was: 'seafarers are provided with appropriate social connectivity by ship-owners and States provide internet access in their ports'. Good news but the downside: With costs going up (providing these facilities), it might be passed on to the seafarer.



Just to recall the old times long ago... when radio communication used to be sparse and many times burnt a hole in the purse.

Tech Talks

From sights of funnels spewing plumes of smoke, we might be treated to ships with puffing sails (conventional, old sails) on the decks. Eco Clipper's De Tukker is getting ready while the sail schedules have already been announced. This sailing will demonstrate the sail-ship as a proof of concept.

Some technical details of De Tukker: 131' long; 8' draft (being increased); Hull space: 60 m^3 (about 40–60 tons of cargo). Propeller generator + solar panels are being thought of.

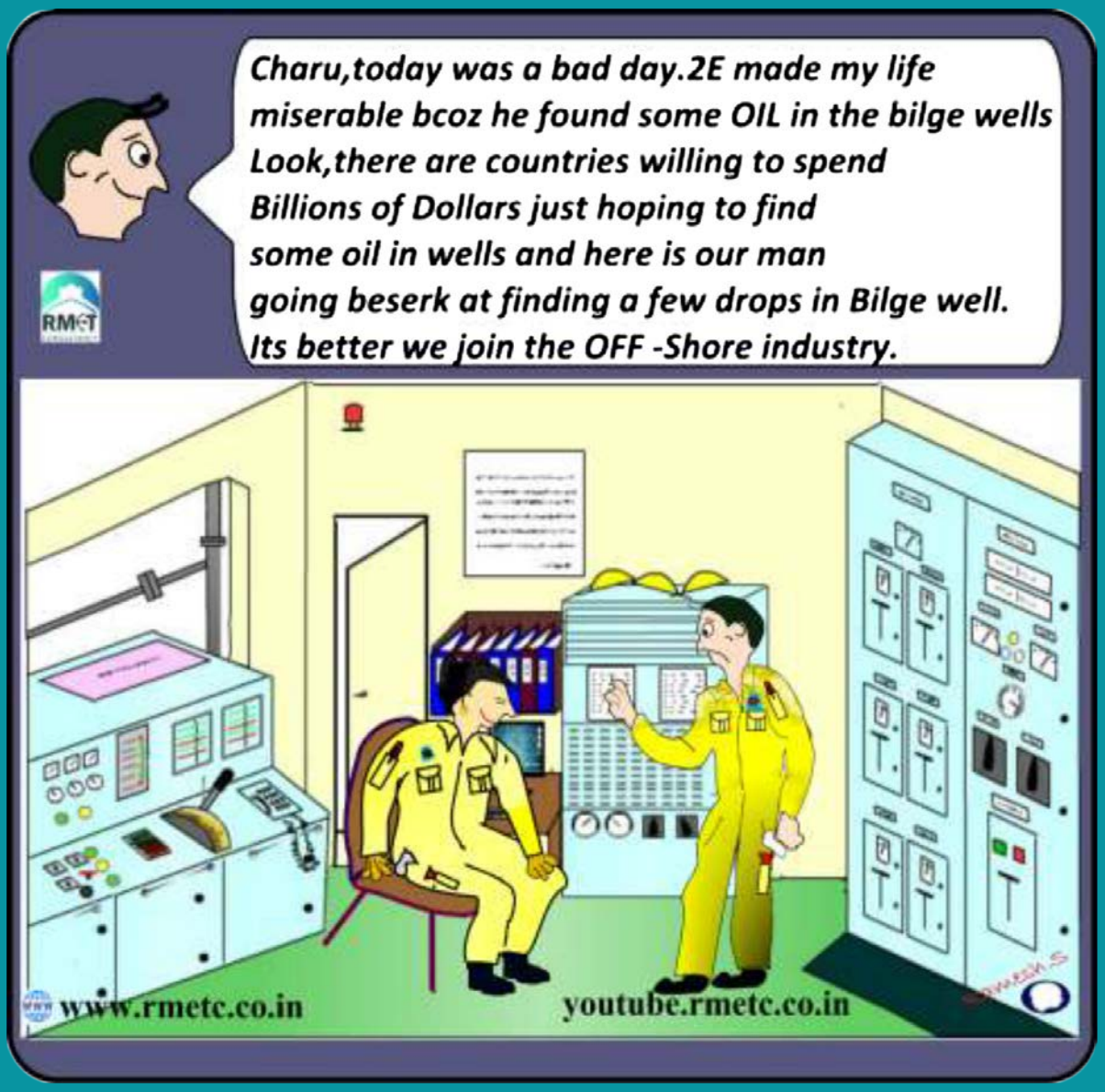
The first sailing has been scheduled on 15/8 for 500nm. Eco Clipper invites interested persons to participate in sailing and also 'enjoy the experience'; Costs: €1050/pax. For 10 days on board (Twelve paying guest cabins are being readied). Joining...?

About June

Let us go with the 3 days in the first week this time... IYD (21/6) can wait.

World Bicycle Day (3/6); World Environment Day (5/6); World Food Safety Day (7/6). Wish we could take a bicycle trip around, breathe good air and be back home for safe food... every day.

THE END VIEW

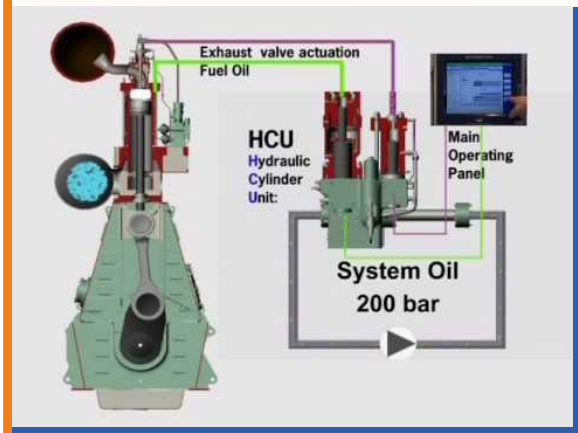


Idea, Words & Drawing: **Ramesh Subramanian**

MASSA Maritime Academy, Chennai

The Institute of Marine Engineers (India)

Electronic Engine Familiarisation Course (ME-Type Engine) Delivered online with Cloud access to ME Engine Simulator



This 3 days course is designed for all Ship's Engineer Officers and Electro Technical Officers responsible for the operation of ME Engine. This course consists of technical lessons and practical instructions on the design, principles, operating procedures and maintenance activities for the safe, efficient and optimal performance of the engine system.

Course Aims and Objectives:

The course aims to provide practical understanding of the principles, design, operation and maintenance of the ME Engine System, enabling participants to safely and efficiently operate the engine and perform fault-finding in the control system.

Coverage / Program Focus:

This course deals with the following training areas:

- **Introduction to ME Engine**
- **Hydraulic Power Supply (HPS)**
- **Hydraulic Cylinder Unit (HCU)**
- **Engine Control System (ECS)**
- **Main Operating Panel (MOP)**
- **Standard Operation**

Entry Requirement / Target Group:

Entry is open to all Ship's Engineers and Electro Technical Officers with basic knowledge of diesel engines.

DATE & TIMING : 14th to 16th **June'22**; 19th to 21st **July'22**; 16th to 18th **Aug'22**; 20th to 22nd **Sep'22** **8:00 am - 4:00 pm IST**

VENUE : Web Platform / Zoom**. APPLICATION LINK:** https://forms.gle/e4As7kCucR5xoJBm9

REGISTRATION & PAYMENT : Rs. 15,000/- /- per participant – inclusive of taxes.
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