eMARINA
The quarterly newsletter of
The Hong Kong Joint Branch of The Royal Institution of Naval Architects
and The Institute of Marine Engineering, Science and Technology,
and The Hong Kong Institute of Marine Technology
皇家造船師學會暨輪機工程及海事科技學會香港聯合分會
及香港海事科技學會季刊
Vol. 2 June 2022

HKJB & HKIMT Activities

Blue Marine Economy Summit at HKUST

United Nation (UN) adopted in 2015 a resolution on the 2030 Agenda which set out 17 goals (SDGs) and 169 targets (SDT) for global sustainable development. China had committed to implement the Agenda and to peak its carbon dioxide emission before 2030 and achieve carbon neutrality before 2060. China currently emits on average over 10 billion tons of carbon dioxide per year. A maximum of 12 billion tons per year is expected to be emitted by 2030 and about 80% of which relates to human activities.

In February 2022. China further promulgated global ocean governance through "Blue Partnership". The proposal had 8 themes for the implementation of SDG 14 on the **Conserve and sustainably use the oceans, seas and marine resources for sustainable development**. And without technological development and international cooperation, “Blue Partnership” remains an empty slogan. Hong Kong, as an international financial hub and a city in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA), is most suitable to help out in the development in this regard!

The Hong Kong University of Science and Technology (HKUST), the Hong Kong Branch of the Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou) and Department of Ocean Science of the Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou) jointly took the lead to coordinate the efforts in the technological development aspect. They intended to introduce the “Industry-University-Research” which could help the technological developments in resolving problems and making advancements for the maritime industry in conserving and sustaining the use of all marine resources.

Five summits will be organized to introduce to the industry on areas in which a “Industry-University-Research” approach may be appropriate i.e. **Blue Marine Economy, Applied Fundamental Research, Incubation & Commercialization, Frontier Research and Advanced Industrial Technology** respectively. These summits are funded by the Hong Kong Innovation and Technology Commission.

Figure 1 HKIMT delegates and guest

The first summit was on "Blue Marine Economy". It was held on 23 June 2022 at the HKUST. Capt. T K Cheung, Chairman of HKIMT led the HKIMT delegates to participate in this summit.

Figure 2 Hong Kong Shipowners Association Chairman Mr. Wellington KOO and HKIMT delegate.

This summit had attracted participants world-wide. Some prominent figures present included but not limited to were the Ministry of Natural Resources, China; Liaison Office of the Central People's Government in the HKSAR; International Chamber of Shipping (China) Liaison Office; Consul General of France in Hong Kong and Macau; Consul General of the State of Israel in Hong Kong and Macao; Hong Kong Maritime and Port Board, HKSAR Environmental Department; UNESCO Cluster Office in Beijing; Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou); Hong Kong Shipowners Association and many others from the shipping industry. Over 220 participants registered with the Blue Marine Economy Submit and about a quarter of the participants attended on-line.

Among the various issues raised in the keynote speeches and presentations that may be worthy of the collaboration between the industry and the researchers, the followings key subjects were discussed that might also be of interest to our members!

<u>"Negative Carbon" Path for the Orderly Development of Marine Hydrocarbon Energy</u>

Before embarking on the path to achieving "Negative Carbon", it is important to understand the carbon cycle and how carbon is stored on earth. Carbon is the 15th most common element on earth. It can be found everywhere in rocks, sediments, ocean, atmosphere and in living organisms in the form of chemical compounds. Carbon is released back into the atmosphere in the form of CO_x when organisms die, volcanoes erupt, fire, burning of fossil fuels or through other mechanisms. Most of the time, CO_2 is formed! It can be stored back on earth through the chemical reactions in plants or dissolving back into the ocean forming hydroxides and hydrates. The ocean can absorb as much as 83% of the CO_2 generate in a global carbon cycle and a quarter of the carbon dioxide released by human throughout the years.

The formation of CO_2 is not entirely bad! It can absorb the earth's long-wave radiation and warm the earth's atmosphere. Without this warming effect on the earth's atmosphere, the average temperature on earth would be around -18 degrees Celsius instead of around 15 degrees Celsius. However, when too much CO_2 is released into the atmosphere, the global temperature will rise. This is exactly what has happened today!

According to the experts in the summit, the development of natural gas hydrates (which is a crystalline form of methane) can be one of the future energy strategies. The global reserve of natural gas hydrate is more than 2,100 trillion cubic metres which is far more than the fossil fuel reserve. The carbon content of hydrate is twice as much as that of fossil fuel which means that more carbon can be locked during the manufacturing of gas hydrates. However, the replacement of fossil fuel by gas hydrates alone cannot achieve the "Negative Carbon" path. Combining the study and development on the extraction, exploitation, manufacturing and consumption processes of gas hydrates by the "Industry-University-Research", the "Negative Carbon" path may be achieved.

Monitoring and Forecasting System in Support of GBA Economy and Sustainability

Comparing with New York, San Francisco and Tokyo, the GBA has a much larger population, a bigger land mass and a fast-growing economy. In view of its fast developments and population density, it is particularly vulnerable to natural disasters. This area had experienced many disastrous landslides and wetland losses in the past decades. These disasters and losses not only required a lot of energy to rebuild, they also upset the balance of the ecosystem thereby causing more CO_2 to be released into the atmosphere. Besides, the interactions between physical, biogeochemical and geological interactions in the region has already resulted in high sedimentary rate causing the frequent changes of the waterways and coastlines.

To minimise the effects of natural disasters and geological changes to its ever-increasing population, farmland and industry, the development of a multi-dimensional aquatic platform to observe, monitor and forecast the changes and the coming of disasters is of utmost importance to sustain these developments in GBA.

It is envisaged that the system shall consist of three platforms so that responses can be in place to minimise the damages and effects of the coming disasters. One platform is in space with micro-nano satellites (micro satellites weigh between 11 to 200 kg and nano satellites weigh between 1.1 to 10 kg. They are all low orbit satellites.) and a fleet of unman aerial vehicles to give overall view and regional views of the changes in the region. The land-based platform comprises of high frequency ground wave radar network, coastal and inland stations and seafloor stations. The seafloor platform includes submarine optical fibre cables and small-scale seafloor observatory. The "Industry-University-Research" may help in the integration, development of the software and hardware in implementing such a system.

Research, Developments and Application to Support Water Management

Hong Kong is mountainous and has limited lowland for development. Reclamations along its coastal region were necessary to cope with the increasing population, businesses and infra-structural needs. Although environmental assessments had been conducted to ascertain the acceptability of individual reclamation

project to the marine environment, whether these developments taken together would pose any hidden or insurmountable threat to the marine environment were still unknown.

Dr. CHUI Ho-Kwong, Samuel from Environment Protection Department (EPD) represented the Hong Kong Government to share their experiences on the research and developments taken by the government to assess the impact of human activities on the quality of coastal waters and to protect them. He introduced to the audience the pioneer application of computer modelling for water quality management.

The Delft 3D Flexible Mesh technology for hydrodynamic was applied way back in 1987. The Hong Kong Government had been using water quality and hydrodynamic mathematical models to simulate and examine impacts of human activities and coastal developments on Hong Kong waters. The capability of these numerical models had improved significantly over the past 20 years. Today EPD simulations are carried out regularly using the Delft3D system which is a modular modelling system developed by the WL| Delft Hydraulics from the Netherlands.

Three main factors govern the water quality of Hong Kong were coastline configuration and seabed profile, local pollution sources and background pollution from other coastal waters. The modelling system setup high resolution unstructured grid with size from 50 to 100 meters inside the Victoria Harbour, and a grid size 5 kilometres in waters outside the harbour. Changes in the rainfall in the neighbouring cities and ebb tide of Hong Kong Harbour were identified. The effects on the coastline on pollution (including refuse and marine accidents like spills) can be ascertained with accuracy by the model. EPD is able to give early warning to the government to act promptly to alleviate these pollution problems.

<u>Panel Discussion</u>

During the panel discussion on Global Marine economy and technological development, Mr. Wellington Koo, Chairman of the Hong Kong Shipowners Association, cautioned the global crisis on Green House Gas (GHG). The International Maritime Organisation (IMO) reported that among the various modes of transportation on CO_2 emission, sea transport is the lowest at approximately 3g/km as compared to 18g/km by rail and 45g/km m by road and 560g/km by air. Technology development should be made to reduce emission. The industry should participate in the "Industry-University-Research"

Figure 3 Panel Discussion on Global Marine Economy and Technological Development. Dr. Shin Cheul KIM, Mr. Wellington KOO and Prof.

to help these developments. The government should also take the lead to promote green transportation. Incentives may be given for the operation of green ferries, yachts and oceangoing ships, using electrical propulsion, wind, solar energy etc, to prompt the development and application in these regards!

(Reported by Leslie Lee and Simon Chen)

2021-2022 STEM x Marine Vehicle Design and Construction Competition

The launching Ceremony of this event was held on 3 November 2021 at the University of Hong Kong. The aim of this competition is to promote the maritime industry among local students and to cultivate innovative talents. If you wish to know what happened then, you will find the opening ceremony report in Vol 4 of eMARINA 2021. Please read this publication if you have not already done so! The report can be found in https://www.imarest.org/local-communities/asia-pacific/hong-kong-joint/6380-newsletter-2021-marina-vol-4.

There were 26 teams participated in the competition. 10 teams were from the primary schools who participated in the Underwater Vehicle Design Competition and Model Construction Competition. And 16 teams were from the secondary schools who were competing on both the Underwater Vehicle Design Competition and Model Construction Competition and Underwater Vehicle Speed Awards.

The Training Workshops for the design of the underwater vehicle began in December 2021 in the University of Hong Kong. The function and usage of the design software were introduced to the students. The basics on how an underwater vehicle worked were also explained to the participants. The students were given a few months to finalise their designs. Soft copies of the design were submitted to the Judging Panel on 21 February 2022 as scheduled.

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Under Water Vehicle Designs

The design received from the participants were of high quality. The majority of them were unconventional and futuristic which proved that imagination has no boundary! The competition was able to unleash the imagination of our teenagers!

Due to the COVID-19 pandemic, a hands-on approach to the construction of the underwater vehicle was not possible. 3D printing workshops had to be conducted in February 2022 by ZOOM. The students were able to see their designs materialised in front of their eyes as the 3D printers started to print.

For the secondary school students, they were competing on model design and also their underwater vehicle speed of their models. A model fabrication training workshop for building the propulsion system of their underwater vehicles was also organised by ZOOM in March 2022.

Speed Trial & Competition

As the pandemic ease off, the classes in schools finally resumed. The speed trial and competition of the models was carried out on 28 May 2022.

On 4 June 2022, the models were presented to the Judging Panel for the Model Demonstration Competition at Yuen Long Merchants Association Secondary School. The climax of the Model Demonstration Competition was the show case speed run of the World's fastest Robot Fish by BREED to the school students and the participants. Everyone marvelled at the beauty and performance of the Robot Fish. It had sewn the seed within our younger generations that "Nothing is impossible! There is a will, there will be a way"!

Robot Fish

The awarding ceremony was held immediately after the Model Demonstration Competition.

Award Winners

We were particularly thankful for the financial support of the Maritime and Aviation Training Fund (MATF) and the technical and logistic assistance of the Department of Mechanical Engineering, the University of Hong Kong, Association of Information Technology Leaders in Education (AiTLE), The Hong Kong Institution of Engineers - Mechanical, Marine, Naval Architecture and Chemical Division (HKIE-MMNC), The Hong Kong Joint Branch of the Royal Institution of Naval Architects and the Institute of Marine Engineering, Science and Technology (HKJB of RINA & IMarEST), the Maritime Professional Promotion Federation (MPPF), Yuen Long Merchants Association Secondary School (YLMASS), BREED, the University of Hong Kong

Organizers & Teachers

and the teachers from the schools for their whole hearted guidance and support to The STEM x Marine Vehicle Design and Construction Competition 2021-2022. Without them, the competitions would not be so successful! The organiser is already looking into the possibility to extend the scope of the competition to include primary, secondary and undergraduate students into the new competition in the coming year!

(Reported by Dr K S Fung)

Members' Corner

Unlocking the Power of Digitalization for CII Improvements

The IMO Carbon Intensity Indicator (CII) has become a popular topic in the shipping industry. Becoming effective on 1 January 2023, many shippers keep a close eye on any changes and updates to the regulation and increasingly become aware of the plethora of solutions supporting them to overcome this new regulatory challenge.

Digitalization is one of the best and most cost-effective ways to track the environmental performance of your fleet and improve its CII rating during daily operations. However, this does not mean any digital tool can unlock these benefits unless the appropriate tool is chosen for the job. The followings highlight the possible benefits for the selection and use of such tools!

The Importance of Data Quality for CII Calculations

Data quality is critical when calculating the CII value because even just a tiny data error may lead to a vessel downgrade from a C to a D rating in the CII rating scheme.

Although some shipping companies have used conventional data collection systems (DCS) to comply with IMO DCS, these systems may have several disadvantages making them unsuitable for calculating CII values. For example, if the fuel consumption is summarized by voyage, then the corrections and adjustments in the IMO CII regulation will not be able to include it. Suppose the annual fuel consumption is reported based on bunker delivery notes (BDN). In that case, the fuel consumption or emission will be overestimated by counting BDN shortage and sludge as the fuel consumption. If the data is regularly reported from ship to shore for analysis, the real-time CII rating of the ship cannot be determined.

Benefits of Digital Tools

To comply with the upcoming CII rating scheme, shipowners and operators should consider using more advanced data reporting systems to ensure higher data quality, examples of which are the StormGeo's advanced data reporting system and s-Insight Log. These systems are to be used in tandem. The followings are my experience in their application.

s-Insight Log is an event-based reporting system offering intelligent data validation that immediately alerts users to potential reporting errors or implausible data. Furthermore, the system even ensures that the data quality is revalidated by the experts in StormGeo's Fleet Performance Center.

After assuring data quality, shipowners and operators can use digital tools, such as StormGeo's CII Dashboard, to monitor the CII value and rating of each ship in the fleet onshore. With the CII dashboard, owners and operators can quickly identify the ships with lower CII ratings and implement several optimization methods to improve their CII ratings.

According to the 2022 Guideline SEEMP Part III, any ship with CII rating D for three consecutive years or rating E should submit a corrective action plan. The plan should consist of an analysis of the cause for the low CII rating and an analysis of the performance of implemented measures. That further illustrates the importance of data analysis to comply with IMO CII.

CII Rating Impacts by Operational Factors

After applying the systems on a number of ships, the following key technical management and operation areas have been identified which may be helpful to improve the CII rating of a ship.

Technical Management:

Shipping companies can improve the IMO DCS data quality to improve the CII rating of a ship, for example, via StormGeo's data reporting system s-Insight Log.

Furthermore, hull fouling and trim problems will provide extra resistance to the ship, thereby influencing its CII rating. By using StormGeo s-insight Technical, shipping companies can analyse the hull and propeller performance and perform trim optimization to help avoid any increases in fuel consumption that can influence the ship's CII rating.

Since fuel consumption affects the CII rating, engine efficiency and operation also become important to keep track of. StormGeo's s-Insight Technical helps improve engine performance, while the Fleet Performance Center can provide alerts for the engine performance, assisting shore-based officers in working closely together with onboard crews to improve fuel efficiency.

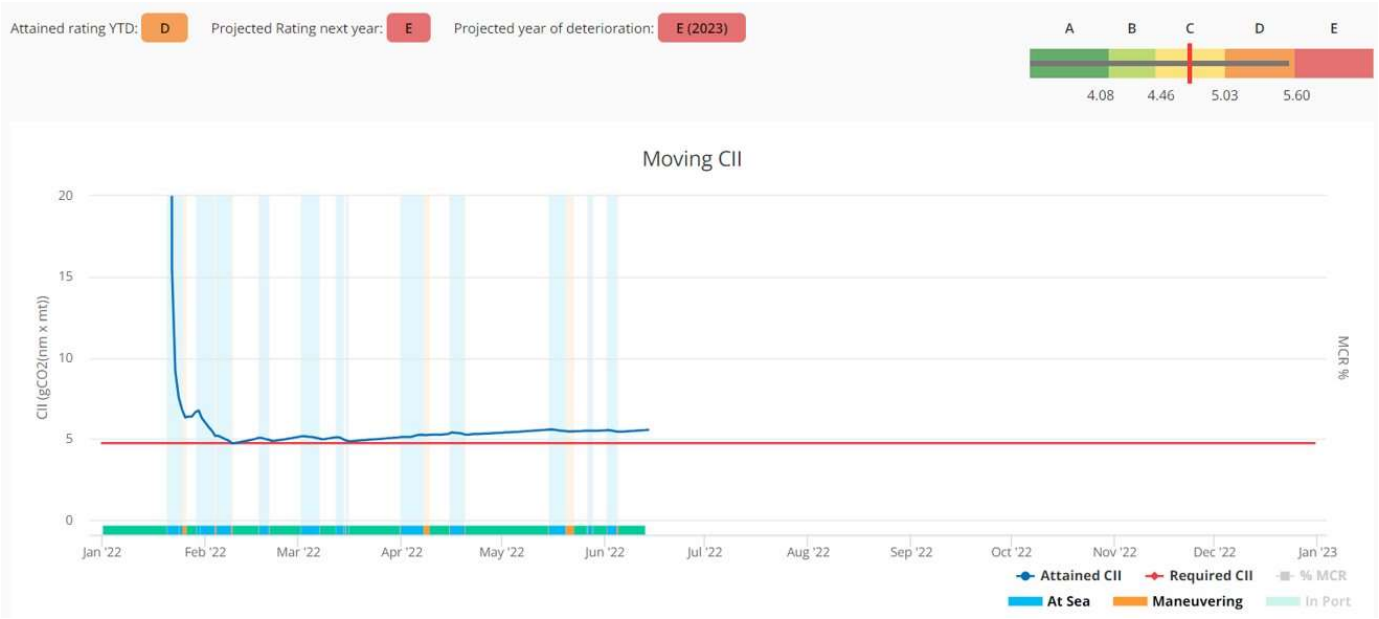
Operations:

During operations, the speed and weather conditions can affect the CII rating. These factors can be improved through StormGeo's weather routing and voyage optimization solutions. Besides, distance, cargo weight, trade routes, and idling time, greatly influences the CII rating as the distance is used to calculate the CII value. StormGeo's CII Simulator can simulate the impact of the voyage and trade routes to the CII rating. Based on the results of the CII simulation, shipowners can make better commercial decisions on the trade routes to ensure a competitive CII rating.

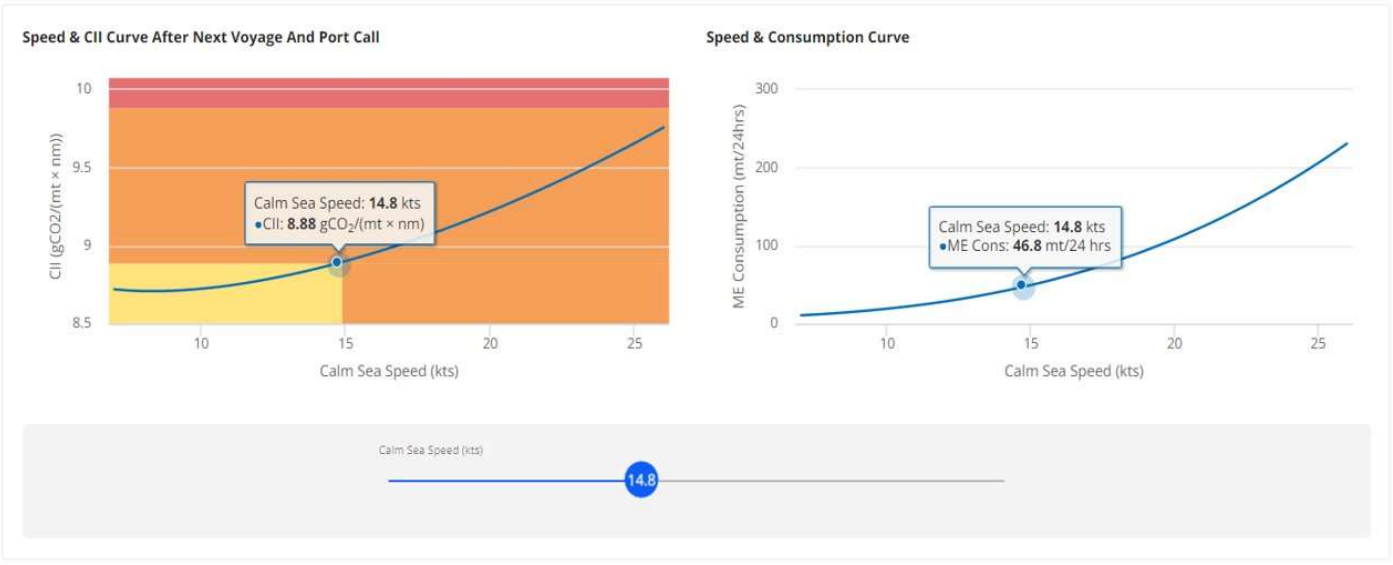
How to Improve CII Ratings with StormGeo's CII Simulator

How you operate a ship during a voyage will directly affect its CII rating. The dynamic chart in StormGeo's CII Simulator allows shipowners and operators to monitor CII ratings in near real-time. The graph also shows different operating conditions such as at sea, in port, and during manoeuvring.

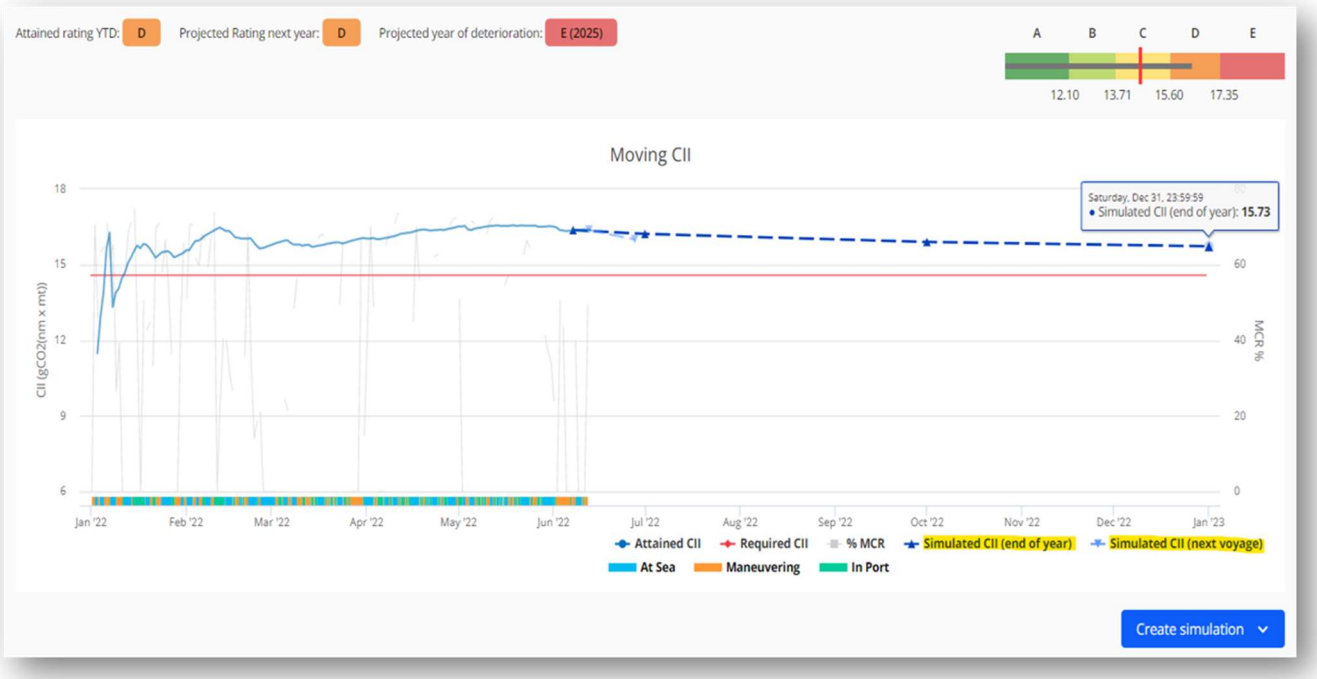
The following screenshot below is taken as an example. In this example, a ship has a CII rating of D. From the graph, one will notice that the ship spent significant time in port and manoeuvring without spending too much time at sea. This means the ship suffers from a lower CII rating due to short, sailing distances and continuous CO_2 emissions in every aspects of its operations.



To improve the ship's CII rating, shipowners and operators can leverage the CII simulator to simulate the CII rating and the value of the ship's next voyage by inputting the information for the next voyage, such as distance, draft, and desired CII. Users can vary the speed on the speed vs. CII diagrams to predict the change of CII value at different speeds until the optimal speed for CII is found.



Alternatively, users can use the CII simulator to predict the ship's CII rating by the end of the year. Similar to the end-of-voyage simulation, users can input the voyage plan and maintenance events to project the CII rating of the ship by the end of the year. The objective is to make sure the ship attains a CII rating of C by the end of the year, then users can continue the current operation plan without implementing any operation measures.



Advanced digital tools play a vital role when shipowners and operators monitor and analyse the performance of their ships. The CII rating can be improved through digitally-driven operations excellence. As the IMO CII regulation soon comes into effect, this is the time to accelerate your digitalization plan.

(Submitted by Michael Qiao - Market Development Manager, StormGeo Shipping)

HKJB & HKIMT Coming Activities

Date	Event
19 July 2022	Committee Meeting
30 August 2022	Shipping in Post-COVID Era
15 September 2002	HKJB/HKIMT Joint Chairmen Cocktail Reception 2022
6 September 2022	Committee Meeting
September 2022	Seminar on New Hong Kong Pilot Boat

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Hon Secretary, Hong Kong Joint Branch of RINA and IMarEST, G.P.O. Box 2516, Central, Hong Kong