

The Institution of Engineers (India)

Andhra Pradesh State Centre



THIRTY-SEVENTH NATIONAL CONVENTION OF MARINE ENGINEERS

and

NATIONAL SEMINAR *“Environmental Protection and Port Safety”*

13-14 November, 2025

Organised by

**THE INSTITUTION OF ENGINEERS (INDIA)
ANDHRA PRADESH STATE CENTRE**

Under the aegis of

Marine Engineering Division Board, IEI

Venue:

**The Institution of Engineers (India)
Andhra Pradesh State Centre, Vijayawada**

37th National Convention of Marine Engineers : IEI AP State Centre CORE TEAM



Er V B Singh
President, IEI



**Er K K Gopalakrishan
Nair**
Vice President



**Prof(Dr) Girish S
Mundada**
Vice President



**Maj Gen (Dr) MJS
Syali**
SDG



**Prof(Dr) Shilpa
Tripathi**
Chairperson CATE



**Dr Duggirala
Rajasekhara**
Chairman MRDB



Prof(Dr) Koonam Ramji
Vice Chancellor, KRU



**Dr P. Dinesh
Sankar Reddy**
Registrar NITAP



**Cdr (Dr) Bhaskar
M Bhandarkar**
Member, MRDB



Er Sanjeev Mehra
Member, MRDB



**Er Vijay Prathap
Singh**
Member, MRDB



**Er P V S Ganesh
Kumar**
Asst. Director Rtd, NSTL



**Prof(Dr) M L S Deva
Kumar**
Chairman, IEI APSC



Prof(Dr) A V Naresh Babu
Hon' Secretary,
IEI APSC



**Prof G. Narayana
Murthy**
Convenor



Dr. C V Sriram
Org. Secretary

Dr Kingshuk Sen, P Eng (India) Asst. Director (Technical), IEI HQ

The Institution of Engineers (India)

AN ISO 9001 : 2015 CERTIFIED ORGANISATION
(ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER 1935)

Er.V B Singh, FIE
President



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A Century of Service to the Nation



MESSAGE

I am pleased to learn that the Andhra Pradesh State Centre of The Institution of Engineers (India) is organizing the **37th National Convention of Marine Engineers** and the **National Seminar on “Environmental Protection and Port Safety”** during **13–14 November 2025**, under the aegis of the **Marine Engineering Division Board, IEI**. The theme chosen for this seminar is both **timely and visionary**, reflecting the urgent need to harmonize industrial progress with environmental stewardship and safety excellence.

Our ports serve as gateways to global trade and progress—connecting nations, enabling economic growth, and fostering international cooperation. Yet, this progress must go hand in hand with a strong commitment to **protecting our environment and ensuring safety in port operations**. Safeguarding our seas, air, and coastal ecosystems is not merely a statutory requirement; it is a **moral obligation to future generations**.

Environmental protection and port safety are inseparable. A safe port is an efficient port, and an environmentally responsible port stands as a symbol of progress and care. The highest standards of protection and safety must be maintained to prevent accidents, fires, and pollution incidents. Through vigilance, responsibility, teamwork, and the adoption of modern, sustainable technologies, we can protect lives, property, and our shared environment.

This seminar provides a **vital platform** for engineers, researchers, academicians, policymakers, and industry professionals to exchange ideas, share best practices, and collaborate on innovative solutions that promote both environmental protection and operational safety in the maritime sector.

I extend my **heartiest congratulations** and **best wishes** to the Andhra Pradesh State Centre of The Institution of Engineers (India) for organizing this important event. I am confident that the deliberations during the seminar will lead to valuable insights and contribute meaningfully to the sustainable development of our ports and marine industries.

I wish the seminar grand success.

V B Singh



The Institution of Engineers (India)

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Maj Gen (Dr) MJS Syali, VSM (Retd), FIE
Secretary & Director General

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A Century of Service to the Nation



MESSAGE

I am delighted to learn about the **37th National Convention of Marine Engineers and All India Seminar on Environmental Protection and Port Safety** organized by the Andhra Pradesh State Centre of The Institution of Engineers (India) under the aegis of the Marine Engineering Division Board (MRDB) of IEI, during **13-14 November 2025**.

Environmental protection and port safety are vital components of sustainable maritime operations. Ports, as gateways to global trade, face increasing pressure to minimize ecological impact while ensuring secure logistics. Initiatives such as green port development, pollution control, and waste management help mitigate environmental risks. Simultaneously, safety frameworks like PSHEMS and adherence to international codes (SOLAS, ISPS) ensure safe handling of hazardous cargo and emergency preparedness. By integrating digital monitoring systems and climate-resilient infrastructure, ports can enhance operational efficiency and environmental stewardship. Together, these efforts foster a balance between economic growth and ecological responsibility in the maritime sector.

I am confident that this National Convention will serve as a vibrant platform for intellectual synergy, drawing on the wisdom of distinguished engineers and academicians. It promises to catalyze insightful dialogue and foster a dynamic exchange of knowledge. My heartfelt greetings to the organizers and participants, along with best wishes for a truly impactful and successful event.

Maj Gen (Dr) MJS Syali, VSM (Retd)
Secretary & Director General

The Institution of Engineers (India)

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A Century of Service to the Nation



MESSAGE

It gives me great pleasure to note that the 37th National Convention of Marine Engineers and National Seminar on “Environmental Protection and Port Safety” is being organized by The Institution of Engineers (India), Andhra Pradesh State Centre, under the aegis of the Marine Engineering Division Board, during 13–14 November 2025 at Vijayawada.

The theme of this year’s convention is timely and significant, as the maritime sector continues to face growing challenges in balancing environmental sustainability, climate resilience, and operational safety. Safeguarding marine ecosystems while ensuring efficient and secure port operations calls for collaborative innovation, advanced technologies, and robust policy frameworks.

This convention provides an excellent opportunity for professionals, researchers, and policymakers to share insights and develop sustainable strategies for the maritime industry.

I extend my best wishes to the Chairman and Honorary Secretary of the Andhra Pradesh State Centre for the successful organization of this important event.

Hope these two days will always be memorable for all the participants.

A handwritten signature in black ink, appearing to read 'Shilpa'.

Dr. Shilpa Tripathi

Chairman, Committee for Advancement of Technology & Engineering (CATE)

Member, Chemical Engineering Division Board Member

Prof & Dean of Student Affairs, Medicaps University, Indore (MP)

M. No. 9827529922

Email id: slptrip@yahoo.com

The Institution of Engineers (India)

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A Century of Service to the Nation



MESSAGE

It gives me immense pleasure to learn that Andhra Pradesh State centre is organizing the 37th National Convention of Marine Engineers and National Conference during 13-14 November 2025 at Vijayawada, under the aegis of Marine Engineering Division Board (MRDB), IEI.

It is indeed a matter of pride for every Indian that IEI; an Indian Professional Society is offering services to the professional community the world over. The theme of the conference “Environmental Protection and Port Safety” is quite important and relevant in the contemporary maritime scenario.

This Conference holds immense significance as we gather to address the barriers that hinder Technology Exploitation. Our aim is to share knowledge, exchange ideas, and identify collaborative solutions that can propel the maritime community towards a sustainable and prosperous future. The benefits of the sustainable and ethical use of modern technologies would be the game changer, ensuring the availability of superior, low-cost, world-class products and services, thus delivering enhancing value to the customers I extend my heartfelt gratitude to all the esteemed speakers, experts, and researchers who have consented to share their in-depth knowledge and expertise to enrich this conference.

I am confident that the participants would be greatly benefitted from this event. I hope that the participants will also enjoy the hospitality of IEI APSC in Vijayawada. Organizing these trendsetting events requires a great amount of vision, leadership, and dedication. I compliment APSC, IEI and the organizing committee for achieving this successfully.

My Best wishes for the Grand Success of the Convention and the National Conference!

Dr D Rajasekhar Ph.D. (Eng)., FNESA.,
(Recipient of National Maritime Award, Green Technology Award, Distinguished Scientist Award)
Former Chief Scientist & Group Director, National Institute of ocean Technology, Chennai
Former Chief Engineer (Marine)
Independent Director (TVS Group of Industries)
Director (Consulting) at IMO, UN

The Institution of Engineers (India)

Andhra Pradesh State Centre



A Century of Service to the Nation



MESSAGE

It is with immense pride and heartfelt joy that I welcome all delegates, speakers, authors, and guests to the 37th National Convention of Marine Engineers and the National Seminar on “Environmental Protection & Port Safety”, being held from 13th to 14th November 2025 at The Institution of Engineers (India), Andhra Pradesh State Centre, Vijayawada.

This convention marks a historic milestone for IEI APSC, as we host a National Convention for the first time in recent years. It is a testament to the resilience, dedication, and collaborative spirit of our engineering community in Andhra Pradesh. Our state, with its vast coastline and emerging maritime infrastructure, is the ideal venue to deliberate on sustainable practices and safety in port operations.

I extend my deepest gratitude to our esteemed President, Er. V.B. Singh; the Secretary & Director General Maj Gen (Dr) MJS Syali, VSM (Retd), Chairperson of the Committee for Advancement of Technology and Engineering (CATE) Dr. Shilpa Tripathi, Chairman of the Marine Engineering Division Board (MRDB) Dr. Duggirala Rajasekhar; Members of MRDB; and all our committed State Committee Members. Their guidance and unwavering support have been instrumental in the successful organization of this prestigious event. The unwavering involvement of Convenor Prof. Gulla palli Narayana Murthy, Organizing Secretary Dr.C.V.Sriram and Hon’ Secretary Prof.Dr.A.V.Naresh Babu with the external support of National Advisory Committee, Technical Committee members and Organizing Committee members is commendable.

My heartfelt congratulations to the Eminent Engineering Personality awardees being felicitated during this convention. Your contributions continue to inspire generations of engineers.

A special note of appreciation goes to the distinguished speaker of the Rear Admiral T.B. Bose Memorial Lecture Ms. Arathi Narayanan, whose insights will undoubtedly enrich our understanding of maritime safety and leadership. I also thank all our invited speakers for sharing their expertise and vision.

To the authors and paper presenters of the National Seminar, I commend your scholarly contributions and commitment to advancing knowledge in environmental protection and port safety. Your research and ideas are the cornerstone of this seminar’s success.

Let this convention be a beacon for innovation, collaboration, and sustainable development in the marine engineering domain. I wish all participants a fruitful and memorable experience.

Warm regards,

Prof. Dr. M.L.S. Deva Kumar, FIE

Secretary & CEO, Board for Community Development through Education (BCDE), Govt of AP

The Institution of Engineers (India)

Andhra Pradesh State Centre



A Century of Service to the Nation



MESSAGE

It gives me immense pleasure to extend a warm welcome to all distinguished delegates, esteemed speakers, and participants to the 37th National Convention of Marine Engineers and the National Seminar on “Environmental Protection & Port Safety” being held from 13th to 14th November 2025 at The Institution of Engineers (India), Andhra Pradesh State Centre, Vijayawada.

The maritime sector continues to be the lifeline of global trade, and as engineers, we carry the vital responsibility of ensuring its sustainability, safety, and efficiency. In today’s rapidly evolving world, where environmental challenges and operational risks are growing in scale and complexity, it is imperative that we reaffirm our commitment to eco-friendly engineering practices, technological innovation, and robust safety standards at our ports and coastal facilities.

This convention and seminar provide a unique platform for professionals, academicians, policymakers, and industry experts to deliberate on contemporary issues, share best practices, and explore forward-looking solutions. The chosen theme—Environmental Protection & Port Safety—is both timely and significant, aligning with India’s vision for sustainable maritime growth and the global call for cleaner oceans and resilient port infrastructure.

I take this opportunity to express my heartfelt gratitude to all members of the organizing committee, speakers, sponsors, and delegates for their invaluable contributions and active participation. Your continued enthusiasm and expertise are what make such events truly meaningful and impactful.

I am confident that the deliberations and outcomes of this convention will inspire new initiatives and collaborations that further strengthen our engineering fraternity and contribute to a safer and greener maritime ecosystem.

I wish the event grand success and all participants a rewarding and enriching experience.

Warm Best wishes,
Prof. (Dr.) A.V.Naresh Babu , FIE
Honorary Secretaty,IEI Andhra Pradesh State Centre

The Institution of Engineers (India)

Andhra Pradesh State Centre



A Century of Service to the Nation



MESSAGE

It gives me great pleasure to welcome the Distinguished Guests, Eminent Engineer Awardees, Corporate Members, Speakers, Authors, Delegates and Future Engineers to the 37th National Convention of Marine Engineers and the National Seminar on “Environmental Protection and Port Safety” being held during 13 – 14 November 2025, under the aegis of the Marine Engineering Division Board, IEI at The Institution of Engineers (India), Andhra Pradesh State Centre, Vijayawada.

This is the first National Convention and Seminar conducted by the IEI, APSC and that it is starting with Marine Division, I am sure it will be memorable.

I extend my gratitude to the Chairman and Members of National Advisory Committee, Organising Committee and Technical Committee for their continuous guidance and support.

I congratulate the Eminent Engineer Awardees being felicitated during this convention.

I thank in advance all the invited speakers for sharing their knowledge, expertise and vision.

I also thank the authors of the technical papers of the National Seminar for sharing your knowledge and research.

I wish all participants a memorable experience.

Warm regards,

Prof. Gullapalli Narayana Murty, FIE
EC Member, Marine Division,
The Institution of Engineers (India),
Andhra Pradesh State Centre

The Institution of Engineers (India)

Andhra Pradesh State Centre



A Century of Service to the Nation



MESSAGE

It gives me immense pleasure that The Institution of Engineers (India) is organizing the Thirty-Seventh National Convention of Marine Engineers and the National Seminar on “Environmental Protection and Port Safety” during 13–14 November 2025, under the aegis of the Marine Engineering Division Board (MRDB) at the Andhra Pradesh State Centre, Vijayawada.

The marine industry has always been at the forefront of global trade and economic development. However, with the growing concerns over environmental sustainability and the increasing complexity of port operations, the need for responsible engineering practices has never been greater. The theme of this National Convention, “Environmental Protection and Port Safety,” is therefore most appropriate and timely. It reflects our collective responsibility as engineers to ensure that maritime activities remain efficient, safe, and sustainable.

This National Convention brings together a distinguished gathering of engineers, academicians, researchers, professionals, and students to deliberate on innovative ideas, emerging technologies, and best practices that contribute to a cleaner and safer marine environment. The exchange of knowledge and experiences in this forum will undoubtedly promote awareness and inspire actionable strategies for reducing pollution, enhancing port safety, and protecting marine ecosystems.

I convey my sincere appreciation to the Organizing Committee of IEI, Andhra Pradesh State Centre, and the Marine Engineering Division Board for their dedicated efforts in conducting this important event. I am confident that the deliberations and recommendations emerging from this convention will pave the way for sustainable development in the marine engineering sector.

I extend my best wishes to all participants for the success of this Convention and Seminar and hope it will serve as a platform to reaffirm our commitment to environmental stewardship and maritime safety.

Warm regards

Dr. C V Sriram, FIE
Organizing Secretary,
Immediate Past Chairman, IEI, AP State Centre

*Details of Receipients of
Eminent Engineering personality felicitation.*



The Institution of Engineers (India)



Er K Bindu Mohan

*Chairman & Managing Director
M/s KVA Rao Marine Technocrats Private Limited*

The Institution of Engineers (India) is proud to felicitate Er.K. Bindu Mohan, an illustrious marine engineer, visionary leader, and dedicated professional, in recognition of his outstanding contributions to the field of marine engineering and engineering service to the nation.

A graduate in Mechanical (Marine) Engineering from Andhra University College of Engineering, Waltair, Er. Bindu Mohan distinguished himself early by securing First Class with Distinction. He holds a First Class (Motor) Certificate from the Ministry of Transport and is a certified Hazmat Expert and Senior Professional Engineer.

With over 20 years of sailing experience, including 15 years as Chief Engineer, he rose swiftly through the ranks, commanding respect and admiration from peers and superiors alike. He has led M/s. KVA Rao Marine Technocrats Pvt. Ltd., a pioneering MSME in ship repair, as its Chairman and Managing Director for over three decades. The company, named in honor of his father—Late Prof. K. Venkata Appa Rao, founder of the Marine Engineering course at Andhra University—has become a beacon of excellence in maritime services.

Er. Bindu Mohan has served in numerous leadership roles, including:

Chairman, Institution of Engineers (India), Visakhapatnam Local Centre (2007–2009); Chairman, Institute of Marine Engineers (India), Visakhapatnam (2007–2010); All India Chairman, Marine Engineering Division Board, IEI (2009); Vice President, Vizag Ship Repairers' Association; President, Merchant Navy Officers' Association (2007–08)

He is a Gold Medallist of the Indian Engineering Congress (2011) for his acclaimed paper on “Ship Building in India”, and a Fellow of both the Institute of Marine Engineers and the Institution of Engineers (India), as well as a Chartered Engineer.

His service extends beyond engineering: he runs the Maa Leelavathi Free Acupressure Clinic, teaches yoga, meditation, and chess, and is a certified ISO 9000 Lead Auditor and Maritime ISM Auditor.

For his lifelong dedication, technical brilliance, and service to society, Er. Bindu Mohan has been honored with multiple Eminent Engineer Awards by IEI Tamil Nadu State Centre (2023), IEI Visakhapatnam Local Centre (2023), and the Institute of Marine Engineers (India), Visakhapatnam (2024).

In recognition of his valuable contribution to the field of Marine Engineering, The Institution of Engineers (India) is proud to felicitate Er K Bindu Mohan as an Eminent Engineering Personality on this auspicious occasion of the 37th National Convention of Marine Engineers held during 13-14 November 2025 at Vijayawada.

Er Duggirala Rajasekhara
Chairman
Marine Engineering Division Board, IEI

Prof (Dr) M L S Deva Kumar
Chairman
Andhra Pradesh State Centre, IEI





The Institution of Engineers (India)



Prof (Dr) V V S Prasad

*Professor & Chairman, Board of Studies
Department of Marine Engineering
Andhra University, Visakhapatnam*

The Institution of Engineers (India) proudly felicitates Dr V V S Prasad, an eminent academician, researcher, and marine engineering visionary, in recognition of his outstanding contributions to engineering education, research, and professional development in the field of marine engineering.

Dr Prasad currently serves as Professor and Chairman, Board of Studies, and formerly as Head of the Department of Marine Engineering, College of Engineering (Autonomous), Andhra University, Visakhapatnam. He holds a BE in Mechanical Engineering from Andhra University, an M Tech from IIT Kharagpur, and a Ph D in Mechanical Engineering from Andhra University.

With over two decades of teaching experience, Dr. Prasad has mentored generations of engineers and guided 18 Ph D scholars and over 100 M Tech theses, with several more currently under his supervision. His research spans nano-composites, natural fiber reinforced polymers, marine coatings, and sustainable materials, with 135 publications in reputed national and international journals and conferences.

Dr. Prasad is a prolific innovator, credited with 14 patents, including pioneering work on marine coatings, fuel cell technologies, and nano-materials for ship hulls and engine protection. His research has been supported by AICTE, UGC, and RUSA, with projects focused on advanced composites and marine applications.

He has authored multiple books, including:

Production Technology-II (AU Press); Development of Bio-Based Nano Polymer Composite Materials (Lambert); Bacterial Synthesis of Zinc Oxide Nanoparticles (Springer).

Dr Prasad has received numerous accolades, including:

Col. B.N. Bajpai Gold Medal (IEI Journal, 2007); Best Paper Awards from IIT Madras and IME(I); Prathibha Puraskar from Andhra University;

He has actively contributed to professional bodies, serving as:

Chairman, Institution of Marine Engineers (India); Vice President, IME(I), Visakhapatnam Branch; Member, Research Committee, IME(I), India.

Dr. Prasad has organized and chaired several national and international conferences, including ISTAM, ITMAAE, and ICLJET, and has delivered invited lectures across India and abroad. His leadership in curriculum development, faculty recruitment, and academic governance has left a lasting impact on engineering education.

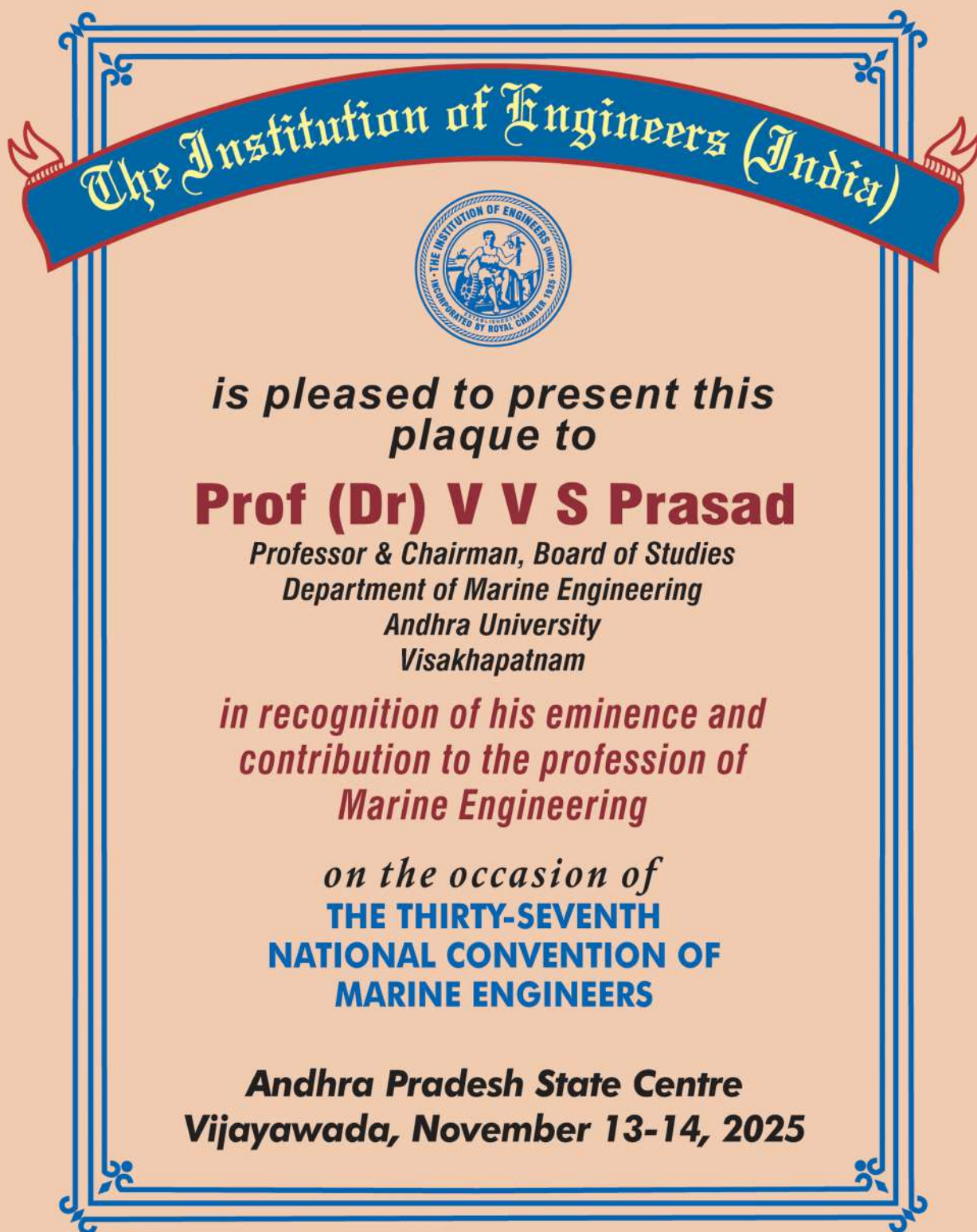
In recognition of his valuable contribution to the field of Marine Engineering, The Institution of Engineers (India) is proud to felicitate Prof (Dr) V V S Prasad as an Eminent Engineering Personality on this auspicious occasion of the 37th National Convention of Marine Engineers held during 13-14 November 2025 at Vijayawada.

Er Duggirala Rajasekhar
Chairman

Marine Engineering Division Board, IEI

Prof (Dr) M L S Deva Kumar
Chairman

Andhra Pradesh State Centre, IEI





The Institution of Engineers (India)



Er Samavedam Venkata Durga Prasad

*Marine Engineer Officer Class I (Motor) &
Former Chief Manager
National Ship Design & Research Centre*

The Institution of Engineers (India) is honored to felicitate Er. Samavedam Venkata Durga Prasad, a distinguished marine engineer, academic leader, and visionary contributor to India's maritime sector, in recognition of his exemplary service and enduring impact on marine engineering education, administration, and practice.

Er. S.V.D. Prasad holds a Master's in Business Administration (Shipping & Logistics), a Bachelor of Law (LL.B), and the prestigious Marine Engineer Officer Class I (Motor) certification. He is a Fellow of both the Institution of Engineers (India) and the Institute of Marine Engineers (India), and serves on the Technical Committee of the Indian Register of Shipping.

His career spans over four decades, beginning with his tenure at sea from 1986 to 1999, rising from Junior Engineer to Chief Engineer. Ashore, he has held pivotal roles including:

Principal, Vizag HIMT; Controller of Examinations, Indian Maritime University, Chennai (2015–2020); Additional Registrar and Director, IMU Chennai Campus; Surveyor cum Deputy Director General (Technical), Mercantile Marine Department; General Manager (Technical), Dredging Corporation of India Ltd.; Chief Manager, National Ship Design & Research Centre, Visakhapatnam

His leadership has shaped maritime education and policy, notably initiating MEO Class IV examinations at Visakhapatnam, and guiding the induction of B.Tech (Marine Engineering & Naval Architecture) at Andhra University. He played a key role in organizing the 27th National Convention of Marine Engineers (2013) and the Maritime International Conference (MARINCO 2019).

Er. Prasad's scholarly contributions include:

Autonomous and Conventional Ships – A Comparative Economic Study with Special Reference to India (MARINCO 2019); Port Efficiency Index – A Pioneering Model for Major Ports in India (MER(I), Feb 2020)

He has served as a General Council Member of the Institute of Marine Engineers (India), and was conferred the Eminent Engineer Award in 2023 by IME(I) for his outstanding contributions.

In recognition of his valuable contribution to the field of Marine Engineering, The Institution of Engineers (India) is proud to felicitate Er Samavedam Venkata Durga Prasad as an Eminent Engineering Personality on this auspicious occasion of the 37th National Convention of Marine Engineers held during 13-14 November 2025 at Vijayawada.

Er Duggirala Rajasekhara
Chairman

Marine Engineering Division Board, IEI

Prof (Dr) M L S Deva Kumar
Chairman

Andhra Pradesh State Centre, IEI

The Institution of Engineers (India)



*is pleased to present this
plaque to*

Er Samavedam Venkata Durga Prasad

*Marine Engineer Officer Class I (Motor) &
Former Chief Manager
National Ship Design & Research Centre*

*in recognition of his eminence and
contribution to the profession of
Marine Engineering*

on the occasion of
**THE THIRTY-SEVENTH
NATIONAL CONVENTION OF
MARINE ENGINEERS**

**Andhra Pradesh State Centre
Vijayawada, November 13-14, 2025**

Details of
REAR ADMIRAL T B BOSE MEMORIAL LECTURE



The Institution of Engineers (India)

Andhra Pradesh State Centre



Ms. Arathi Narayanan FICS

Director of ABS Marine Services Limited, Director at Ocean deep Energies Private Limited
Chairperson & Fellow of Institute of Chartered Shipbrokers, Madras Branch

The Institution of Engineers (India) proudly felicitates Ms. Arathi Narayanan FICS, an accomplished maritime law expert and strategic leader, will deliver the prestigious Rear Admiral T B Bose Memorial Lecture during the National Convention of Marine Engineers & National Seminar organized by The Institution of Engineers (India), Andhra Pradesh State Centre, held on 13th–14th November 2025 at Vijayawada

Ms. Arathi holds a B.A.B.L (Hons) and an LLM in Maritime Law, and currently serves as Director of ABS Marine Services Ltd and Oceandeep Energies Pvt Ltd. She is Chairperson and Fellow of the Institute of Chartered Shipbrokers, Madras Branch, and General Secretary of the Women's International Shipping and Trading Association, India. Her contributions extend to social outreach as Director of Mission Seafarers India Association and Past District Chairman of Inner Wheel District 323.

Recognized with multiple accolades including "Personality of the Year" (WISTA, 2022), "Women Achievers" Award (The Malayalee Club, 2024), and "Empowerment Advocate" Award (JJ Diamonds, 2024), Ms. Arathi Narayanan exemplifies excellence in governance, leadership, and sustainability in the maritime domain. Her lecture has reflected her commitment to modernizing maritime operations, fostering inclusive leadership, and aligning industry practices with international compliance frameworks.

In recognition of her valuable contribution to the field of Maritime Law, and delivering Rear Admiral T B Bose Memorial Lecture, The Institution of Engineers (India) Andhra Pradesh State Centre is proud to felicitate Ms. Arathi Narayanan FICS on this auspicious occasion of the 37th National Convention of Marine Engineers held during 13-14 November 2025 at Vijayawada.

Er Duggirala Rajasekhara
Chairman
Marine Engineering Division Board, IEI

Prof (Dr) M L S Deva Kumar
Chairman
Andhra Pradesh State Centre, IEI



The Institution of Engineers (India)



*is pleased to present this
plaque to*

Ms Arathi Narayanan

Director, ABS Marine Services Limited

&

Director, Ocean Deep Energies Private Limited

for delivering the

**Rear Admiral T B Bose
Memorial Lecture**

on the occasion of

**THE THIRTY-SEVENTH
NATIONAL CONVENTION OF
MARINE ENGINEERS**

Andhra Pradesh State Centre

Vijayawada, November 13-14, 2025

REAR ADMIRAL T B BOSE MEMORIAL LECTURE

Rear Admiral T B Bose in 1938 started his career as Lieutenant in the Royal Indian Navy and was appointed an Officer on the dockyard staff. He took special interest in the apprentices assigned to the Dockyard of Engineer Cadets to pass out the IMMTS 'Dufferin'.

Admiral Bose was Principal Officer, Mercantile Marine Department at Calcutta in 1952. Right from the time the new DMET Course was inaugurated in 1949, he identified himself with the new system of training, gave it his full support and, until his retirement from service and even afterwards, became a guiding spirit.

In 1957, when he was Chief Surveyor to Government of India, he was appointed Chairman of a Committee to advise Government on the indigenization of ship-ancillaries. The assignment involved considerable touring, data collection and discussions with shipyards and industrial enterprises. The Report of the Committee led to the formation of a Marine Engineering Division of the then ISI (now BIS) and to the setting up of an indigenous development cell at the Hindustan Shipyard, Vishakapatnam.

Admiral Bose was largely responsible for the development of Naval College of Engineering at Lonavala. Even though he had retired from the Navy, Naval Headquarters had a very high regard for his sagacity and expertise and valued his advice greatly. Even after his retirement from service, he took keen interest in the development of marine engineering and was a constant source of inspiration to all at the Ministry in New Delhi and at the new shipyard at Cochin.

As Vice-President of the Institute of Marine Engineers, London, he was a beacon light to the marine engineers of India. In spite of the high offices he held, he was easily accessible to young marine engineers who found his guidance invaluable. Admiral Bose, during his professional career, was closely involved in shipping, ports, shipbuilding, and ship repair and state policy pertaining to these sectors.

Cabotage and Right of First Refusal in India

India's cabotage framework reserves coastal trade for Indian-flagged and licensed vessels to safeguard national interests and strengthen the domestic fleet. Recent policy reforms now extend preference to Indian-built ships, giving them priority in chartering and coastal trade to promote indigenous shipbuilding and self-reliance. This alignment with Make in India encourages investment in local yards and greater synergy between shipowners and builders. While these measures enhance employment and strategic capacity, they also raise concerns on competitiveness and operating costs, making it essential to strike a balanced approach between national protection and market efficiency in maritime development.

37th National Convention of Marine Engineers and National Seminar Environment Protection and Port Safety

About The Institution of Engineers (India):

The Institution of Engineers (India) or IEI is the largest multidisciplinary professional body that encompasses 15 engineering disciplines and gives engineers a global platform for sharing professional interest. IEI has membership strength of above 2.6 lakhs. Established in 1920, with its headquarter Kolkata, IEI has served the engineering fraternity close to a century. During this period of time, IEI has been inextricably linked with the history of modern-day engineering. In 1935, IEI was incorporated by Royal Charter and remains the only professional body in India which has been accorded this honour. Today, its quest for professional excellence has given it a place of pride in almost every prestigious and relevant organization across the globe. It provides a vast array of technical, professional and supporting services to the Government, Industries, Academia and the Engineering fraternity, operating through its 124 Centres located across the country and 6 overseas chapters. Besides, IEI has bilateral agreements with about 31 international bodies and membership of another 8 international bodies of the developed nations across the globe. Being recognized as a Scientific and Research Organisation (SIRO) by the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India, IEI promotes the cause of research and development by providing Grant-in-Aid support to undergraduate, post graduate students and PhD Research Scholars of Engineering Institutions and Universities. IEI has been recognized as Scientific and Industrial Research Organization (SIRO) by the Ministry of Science & Technology, Government of India and besides conducting its' own research, provides Grant-in-Aid to UG/PG/PhD students of Engineering institutes and Universities. IEI holds the International Professional Engineers (IntPE) Register for India under the global International Professional Engineers Alliance (IntPEA). The institution also awards the Professional Engineers (PE) Certification. IEI in collaboration with Springer regularly publishes peer-reviewed international journal in five series, namely, Series A, Series B, Series C, Series D and Series E covering fifteen engineering disciplines.

About State Centre:

The Institution of Engineers (India) Andhra Pradesh State Centre was in operation for the undivided Andhra Pradesh State at Hyderabad the then capital of Andhra Pradesh. Due to formation of Telangana in the year 2014, the remnant of state continued as Andhra Pradesh leaving behind Hyderabad. On advent of this, Vijayawada Local Centre was upgraded as Andhra Pradesh State Centre in the year 2015. The operations at State centre are gaining momentum with quick pace, overcoming the historic loss in all terms. In Andhra Pradesh State there are 7 IEI Local Centre viz., Ananthapuram, Bhimavaram, Kadapa, Kakinada, Srikakulam, Tirupathi and Visakhapatnam catering the services pan AP. The IEI Andhra Pradesh is covering 15 disciplines of Engineering with membership strength around 14,000. Vijayawada is well connected with Air, Rail and Road. For details, please visit <http://apsciei.org> Andhra Pradesh, with its extensive coastline and strategic ports, is poised to become a hub for maritime development in India. The state government has been actively promoting the development of ports, shipping, and logistics infrastructure, creating opportunities for investment and growth. Out of 4 Maritime States located in the East Coast of India, Nature has endowed 15m to 20m deeper depths within 3 to 4 km from shoreline of Andhra Pradesh in many locations such as Gangavaram, Bhavanapadu, Kalingapatnam, Karedu, Ramayapatnam, Juvvaladinne, Krishnapatnam etc., on the 1053.7 km of coastline, making it more Economical to construct Deep Water Ports and Ship Building Yards. With this positive environment at Andhra Pradesh, there is a scope for increased employment opportunity at the upcoming ports. As ports are

becoming functional there is necessity of safety of the ports as well as environmental protection. Hence the national convention at Andhra Pradesh is very much essential for planning for appropriate policies and regulations with deliberations among stakeholders of maritime operations.

About the Theme:

The National Convention aims to bring together marine engineers, industry experts, and policymakers to discuss the latest developments, challenges, and opportunities in the maritime sector. The convention will provide a platform for knowledge sharing, networking, and collaboration to promote sustainable maritime development especially in the field of environmental protection and port safety. Environmental protection and port safety are crucial aspects of sustainable port operations, requiring a multi-faceted approach to minimize the negative impacts of port activities on the environment and ensure the safety of personnel and infrastructure. This involves implementing measures to prevent pollution, manage waste, and protect marine life, while also adhering to safety regulations and best practices. Key Areas of Focus: Pollution Prevention, Environmental Management and Port Safety & Management, Sustainable practices.

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Index

S. No.	Title of the Paper	Author(s) Name(s)	Page No.
1	All-Electric Marine Propulsion Using Containerized Sodium-Ion Batteries with Hybrid Fuel Cell Backup and Supercapacitor-Based Hyper-Speed Charging	1. Saptarshi Basu, 2. Capt. Dr Bhandarkar, 3. Manish Sahoo	27
2	AI-and Standards-Integrated Cyber security Framework for Smart Ports: A Three-Layer, Theory-Driven Integration of OT/IT/Navigation Tools	1. B. Sai Nikhila, 2. G. Dhamodhar Dhanush, 3. Jonnada Kiran Kumar, 4. T.V.K. Bhanuprakash	27
3	Sustainable port operations: Current development in port pollution, prevention and mitigation– An overview	1. Stalin King Tadigiri, 2. Veluru Sridevi, 3. Mamidi Durga prasad, 4. Gadi Jaya Prakash	28
4	Monitoring and Assessment: Smart Environmental Management in Port Ecosystems	1. B. Keerthi Harshitha, 2. M. Hanish Karthik, 3. Jonnada Kiran Kumar, 4. T.V.K. Bhanuprakash	29
5	Neuro Harbor: A Deep Learning Framework for Predictive Port Safety Using Multimodal Sensor Intelligence	1. Mesa Sarah Vasantha Zephyr 2. Mesa Zenith Prakash Kumar	29
6	Enhancing Spillage Response: Pollution Prevention, Environmental Management and Port Safety & Management, Sustainable practices.	1. Md. Meherunnisa Begum, 2. N. Santhoshi 3. T.V.K. Bhanuprakash, 4. Jonnada Kiran Kumar	30
7	Sustainable Port Operations and Oil Spill Management	1. Rayasam Nikhileswar 2. Maddu Chandu 3. Jonnada Kiran Kumar 4. T.V.K Bhanuprakash	31
8	Sustainable Practices in Port Safety	1. Ch. Jhansi Lakshmi, 2. A. Jasmine, 3. K.T.S. Akhilesh, 4. T.V.K. Bhanuprakash	32
9	A study on vertical profiling of atmospheric air pollutants and meteorological variables in Visakhapatnam, an Indian coastal urban environment	1. Priyanka Priyadarshini Nyayapathi, 2. Srinivas Namuduri, 3. Suresh Kumar Kolli	32
10	Sustainable Operations in Port Cities: Problems, Applicability and Practical Pathways	1. Zahirun Akhtar, 2. Prasanna Dharanikota, 3. Sridevi Veluru, 4. Geethika Gudapati	33
11	Activated Carbon-Based Adsorption Technologies for Efficient Pollutant Removal in Environmental Engineering Water Treatment Applications	M. Kiranmai Reddy	34
12	Evaluation of Groundwater Quality and Its Implications for Sustainable Use in Selected Regions of Ankapalli district, Andhra Pradesh.	1. Y Surendra Kumar 2. Suresh Kumar Kolli	35
13	Seawater Intrusion Assessment using Hydrochemical Indices in a coastal aquifer system: A multi-season groundwater study along the coast of Visakhapatnam, India	1. Ravi Prasad Budha 2. N. Sriniva 3. K. Suresh Kumar	36
14	Fabrication and Investigation on Thermo-Mechanical Properties of Hybrid Fibre-Reinforced polymer Nano Composite with GNPS and MWCNTS in Marine Applications	1. Bhaskar Reddy Reddivari 2. Jyotsna Kalpana Velampudi 3. V.V.S. Prasad 4. Srinivas Vadapalli	37

All-Electric Marine Propulsion Using Containerized Sodium-Ion Batteries with Hybrid Fuel Cell Backup and Supercapacitor-Based Hyper-Speed Charging

Author:

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Marine Energy Systems Laboratory

Abstract

This paper proposes an advanced all-electric marine propulsion architecture for large commercial vessels based on containerized sodium-ion energy storage modules integrated with refrigerated forced-circulation cooling systems, LNG/hydrogen fuel-cell hybrid charging, and supercapacitor-assisted hyper-speed charge control. The system is designed to address the challenges of maritime decarbonization, energy density, and rapid energy replenishment. By employing 40-foot modular sodium-ion battery containers and active Robson–Wilson forced circulation cooling, the proposed concept provides scalable, safe, and thermally stable onboard energy storage. Supplementary hydrogen storage at 700 bar coupled with solid oxide fuel cells (SOFCs) ensures range extension and resilience. The inclusion of multi-gigafarad supercapacitor banks enables rapid energy transfer between shore-based infrastructure and shipboard batteries without thermal overload. This system offers a pathway toward zero-emission commercial shipping while maintaining operational feasibility comparable to conventional LNG-powered vessels.

AI-and Standards-Integrated Cybersecurity Framework for Smart Ports: A Three-Layer, Theory-Driven Integration of OT/IT/Navigation Tools

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Abstract:

Digitalisation has made modern ports tightly coupled cyber-physical systems—integrating SCADA/PLC, automated cargo handling, Port Community Systems and AIS/GNSS—while simultaneously expanding the attack surface and raising safety, environmental and operational risks.

This paper presents a theory-driven, standards-aligned integration framework that composes existing OT/IT/AIS tools into three interoperable layers to detect, prioritise and manage cyber-physical incidents in ports. The three layers are: (A) Visibility & Detection — modality-specific collectors and OT-aware sensors that produce canonical telemetry and local anomaly

alerts; (B) Correlation & Safety-Impact Rules — a SIEM/streaming correlation plane and rule engine that enriches alerts with port context (berth schedules, manifests), fuses cross-modal evidence and maps it to operational outcomes; and (C) Governance & Response — SOAR/ITSM playbooks, operator dashboards and human-in-loop procedures that enact auditable, safety-first responses. We justify the framework's effectiveness through literature synthesis, vendor case studies, alignment with IEC- 62443/IMO guidance and MITRE ATT&CK for ICS, and scenario-based risk modelling across representative attacks (e.g., ballast manipulation, AIS spoofing, ransomware). Our theoretical evaluation indicates improved multi-modal detection coverage, faster, operationalised response paths and stronger regulatory alignment when compared with isolated controls. The framework's limits—legacy blind spots, tuning burden and organizational readiness—are acknowledged; next steps are targeted pilots, KPI collection (MTTD/MTTR/false-positive burden) and iterative refinement with cross-stakeholder exercises..

Keywords – Smart ports, OT security, AIS/GNSS integrity, SIEM, SOAR, IEC 62443, MITRE ATT&CK for ICS, rules engine, operational resilience

Sustainable port operations: Current development in port pollution, prevention and mitigation– An overview

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Abstract:

Port pollution and its mitigation, as well as shipping-related concerns, have gained attention due to the growth of marine traffic that has followed globalization. The goal of creating fully sustainable ports, sometimes known as "green ports," is a broad, multifaceted problem that calls for comprehensive methods. Ports have a major influence on air quality, especially when it comes to the emissions of nitrogen oxides, diesel exhaust, and particulate matter. Asthma, various respiratory conditions, cardiovascular illness, lung cancer, and early death are among the health consequences of these air pollutants on local community members. Asthma, bronchitis, lost school days, and ER visits are all associated with children. Given the importance of these effects on environmental health, vigorous measures are needed to address the issue. Additionally, a lot of attention has been paid to the subjects of equipment electrification, alternative fuels, and shore power. Though information on company-based research and development were found to be lacking, this report lists over thirty distinct organizational, legislative, and technical strategies to reduce pollution. Although reducing greenhouse gas emissions and air pollutants is the most crucial area of study, regulatory uncertainty affects this sector. Most ports have recycling facilities, but most don't have any formal recycling strategies in place—62 percent of ports don't have any. If this is to be handled, targets and circular economy strategies should be promoted. Research in academia and business is heavily focused on emissions, whether they be air pollution or contaminants linked to global warming, and emission inventories in particular.

Keywords: pollution prevention, port operations, sustainability, air pollution.

Monitoring and Assessment: Smart Environmental Management in Port Ecosystems

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Abstract - In today's increasing complex maritime landscape, traditional inspection and reporting systems have become very insufficient for ensuring environmental safety and regulatory compliance in port ecosystems. Manual methods like these are often slow, fragmented, and reactive, struggle to keep pace with the demands of modern port operations, where real-time responsiveness and data precision are critical. As environmental standards tighten globally, including under IMO mandates on air quality, SOx/NOx limits, and waste management, ports must transition to smarter, integrated approaches that support proactive oversight. This study explores how AI can be used in monitoring and assessment to transform environmental management across ports to enable real-time insights and predictive capabilities. By placing Intelligent sensors strategically on vessels, in port zones and on buoys, can feed continuous environmental data into analytics systems that use machine learning to forecast shipborne discharges and detect pollutant levels like sulphur oxides. These systems can trigger instant alerts during emission spikes, thereby providing port authorities with the time to act before violations occur. Moreover, digital twins can simulate environmental dynamics port wide, supporting long term sustainability planning. Case studies from ports in Singapore and Rotterdam illustrate how marine engineers can lead in deploying these systems, bridging technology with regulatory goals. The result is a measurable, adaptive framework that shifts environmental oversight from manual inspections to real-time assessment and predictive action, aligning operational efficiency with ecological responsibility.

Keywords – Smart ports; Digital twins; Regulatory compliance; Predictive analysis.

NeuroHarbor: A Deep Learning Framework for Predictive Port Safety Using Multimodal Sensor Intelligence

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Abstract— With the rising automation and complexity of global maritime operations, modern ports face unprecedented challenges in ensuring safety and environmental sustainability. Traditional rule-based systems often fall short in dynamically evolving port environments. This paper proposes NeuroHarbor, an AI-powered predictive safety framework that leverages multimodal sensor intelligence to enhance port safety and environmental protection. NeuroHarbor integrates diverse data streams including real-time video surveillance, radar signals, environmental metrics, and vessel logs to build a holistic situational

model. Visual data is processed using Convolutional Neural Networks, while temporal trends from sensor inputs are analyzed using Long Short-Term Memory networks, capturing spatio-temporal patterns critical for hazard detection. A novel attention mechanism is incorporated to dynamically prioritize high-risk zones and vessel operations, enabling proactive emergency response. The system effectively identifies early indicators of potential threats such as equipment failure, vessel collisions, and chemical or oil spills, facilitating timely intervention and containment. The model's performance was evaluated using both synthetic port simulations and publicly available maritime datasets, showing high prediction accuracy and low latency.

Keywords— Port Safety, Environmental Protection, Deep Learning, CNN, LSTM, AI in Maritime, Sensor Fusion, Emergency Response, Smart Ports, Cybersecurity, Predictive Analytics.

Enhancing Spillage Response: Pollution Prevention, Environmental Management and Port Safety & Management, Sustainable practices.

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Keywords : Enhancing Spillage Response: Pollution Prevention, Environmental Management, and Port Safety & Management, Sustainable practices.

Abstract:

Oil spills in the ocean pose significant risks to the marine ecosystem, coastal communities, and global trade. This study delves in the various aspects of oil spill incidents and assesses the effectiveness and response strategies on preventing pollution, managing the environment, and ensuring port safety. The main goals are to describe the (1) environmental and operational factors affecting spill behaviour; (2) compare mechanical, chemical, and biological cleanup methods in conditions like open water, ports, tidelands, and shorelines; and (3) suggest a decision-support system that speeds up responses, reduces ecological harm, and sustainable practices.

Following the MARPOL Annex I, OPRC Convention, and IMO; using a mixed-method approach. The quantitative part included simulating how oil spreads under different sea conditions and oil types, along with cleanup materials like booms, skimmers, sorbents, and dispersants. For the qualitative data, a case study on two major incidents (Gulf of Mexico Oil spill and MSC Elsa 3 oil spills) highlighting their environmental impacts and the response measures undertaken. The results show that rapid detection technologies, such as satellite remote sensing, drone-based surveillance, AI-aided logistics and vessel tracking, bio-based dispersants.

Overall, this research provides practical advice for policymakers, port managers, and environmental stakeholders aiming to strengthen resilience against maritime spills and protect marine resources.

Sustainable Port Operations and Oil Spill Management

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ABSTRACT:

Oil transfer or "bunkering" activities (either ship-to-shore or through offshore terminals) are one of the most important parts of global maritime logistics. Offshore systems, such as Single Point Mooring (SPM) systems (e.g. CALM buoys, floating hoses, and subsea pipelines), are designed to facilitate the safe loading and unloading of crude oil and petroleum products. These offshore systems are susceptible to failure and spills that present both environmental and human health problems.

A leading reason for spills for in-port bunkering activities is the failure point of the flange joints for hose systems, particularly in hose systems exposed to high internal pressure, movements from the vessels, thermal expansion and contraction and mechanical wear and tear. Further, minor failures (sometimes the result of a gasket or seal that has simply worn out, a misaligned joint or improperly coupled) act as precursors to leaks that can lead to significant contamination and environmental pollution in nearby waters. Spills that reach coastal or inland waterways can severely threaten regional/local marine populations, disrupt functioning ecosystems, and negatively affect the economic activities that rely upon healthy ecosystems for their sustenance.

Preventative measures are crucial to ensure sustainable operations at ports. This paper examines the causes and consequences of hose-based spills, including the importance of vulnerable areas such as flange connections; and emphasizes inspection and maintenance, installation of emergency shutoff systems, rapid containment solutions, and the potential for setback from a spill.

In addition, there are emerging technologies like smart self-healing materials, IoT sensing for leak detection, and automated disconnect systems that may help reduce potential for future spills and, more importantly, support the environmental aspects of sustainability in port operations.

Sustainable Practices in Port Safety

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ABSTRACT:

To maintain a port's operational safety while achieving port's sustainable development has become an increasing need as global ports had transition to multifaceted logistical systems. This article outlines an integrated approach to port safety systems to incorporate environmental concerns, focusing on critical issues like fire safety and emergency preparedness, pollution control, and upkeep of port facilities. Solutions are classified across four strategic domains: Resilient Infrastructure & Eco-Safe Technology, Green Era Emergency Preparedness, Marine Environmental Control, and Integrated Governance & Sustainability Alignment. These categories incorporate the need for functional accuracy and ecological preservation.

Using ISO 14001, ISO 45001, SOLAS, ISPS CODE, UNCLOS and ports like Rotterdam, Long Beach, and Tokyo as case studies, this work demonstrates personnel safety and environmental resilience through the application of green technology like electrified rescue crafts, bio-based extinguishers, solar-powered command systems. The modern safety reforms and National schemes like India's SagarMala Green Ports Policy are also aligned with the UN sustainable development goals of decarbonization and risk reduction.

Keywords: Sustainable Ports, Operational Safety, Green Technology, Emergency preparedness, Marine Environmental control, Integrated Governance, Decarbonization

A study on vertical profiling of atmospheric air pollutants and meteorological variables in Visakhapatnam, an Indian coastal urban environment

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ABSTRACT:

Coastal urban air pollution is shaped by complex interactions between diverse emission sources and meteorological factors, often missed by traditional surface-level monitoring. This study examines the vertical distribution of key air pollutants PM_{2.5}, PM₁₀, SO₂ & NO₂, NO, and

CO, across five high-rise buildings in Rushikonda, Visakhapatnam, during summer and winter. Continuous monitoring over 30 days revealed distinct vertical gradients, with particulate matter concentrations decreasing by up to 15.4% at higher elevations. Gaseous pollutants exhibited smaller vertical declines (3–7%), influenced by their chemical properties and atmospheric dispersion. These patterns intensified during winter, driven by thermal inversions and stagnant air conditions. Statistical analysis using Exhaustive CHAID Decision Trees and 3D visualization identified crucial thresholds for temperature, relative humidity (RH), and height affecting pollutant stratification. Notably, elevated RH promotes particulate growth via hygroscopic processes, limiting vertical dispersion, while long-range air mass transport may elevate particulate levels. The results highlight the importance of vertical air quality monitoring in coastal urban settings, providing valuable insights for more effective air pollution management.

Keywords: Urban environment, Vertical distribution, Air quality monitoring, Decision tree modelling, CHAID model

Sustainable Operations in Port Cities: Problems, Applicability and Practical Pathways

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ABSTRACT:

Port cities are of particular importance to international trade and urbanization, serving as gateway cities that fuel economic development, international exchange, and prospects for urban growth. Industrial effluent, sewage outfalls, and the accelerating intensification of ship traffic collectively these issues jeopardizes marine biodiversity, diminished water quality, and human health. In order to mitigate these challenges, sustainable port operations are an essential strategy, bridging issues and effective solutions by reconciling industrial, ecological, and community-based responses. Examples include technological changes like shore-to-ship electrification, cleaner fuels transition, and electric cargo-handling equipment adoption, which can significantly lower emissions, and ecological restoration methods like dredging polluted sediments, bioremediation via microbial consortia, phytoremediation with aquatic plants, and mangrove rehabilitation, which can enhance water quality and biodiversity restoration, and marine community involvement concurrent with smart logistics systems and digital monitoring devices reduce ship idling, optimize cargo streams, and enhance environmental regulation. Nonetheless, the public's widespread adoption of these solutions is constrained by economics costs, scalability, and difficulty in reconciling economic competitiveness with environmental preservation. Therefore, this review evaluates practical sustainable strategies which integrate technological innovation to mitigate pollution in port cities. It highlights how combining operational efficiency with ecosystem resilience can enable ports to evolve into low-carbon, adaptive, and environmentally sustainable hubs of trade and urban growth.

Keywords: Sustainability, Bioremediation, Phytoremediation, Ports, Pollution.

Activated Carbon-Based Adsorption Technologies for Efficient Pollutant Removal in Environmental Engineering Water Treatment Applications

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ABSTRACT:

The increasing depletion of freshwater resources and rising levels of contamination from domestic, industrial, and agricultural activities have intensified the global demand for efficient and sustainable water purification techniques. Among various treatment methods, adsorption using activated carbon has emerged as an effective and economical approach for removing both organic and inorganic pollutants. The present study investigates the adsorption performance of activated carbon derived from natural precursors and its chemically modified forms toward selected contaminants.

Comprehensive analyses of adsorption parameters, including kinetics, isotherms, and thermodynamic behavior, were conducted to understand the interaction mechanisms and removal efficiency under varying experimental conditions. The results revealed that chemically modified activated carbon exhibited enhanced adsorption capacity due to increased surface functional groups and improved porosity compared to raw carbon materials.

The adsorption process followed pseudo-second-order kinetics, indicating chemisorption predominance, and was found to be endothermic in nature. The study concludes that optimized synthesis and surface modification of activated carbon can significantly improve its potential as a sustainable adsorbent for large-scale water treatment applications. These findings provide useful insights for designing cost-effective and environmentally compatible adsorption systems to address pressing water pollution challenges.

Keywords:

Activated carbon, adsorption isotherms, water pollutants, granular activated carbon, thermodynamics

Evaluation of Groundwater Quality and Its Implications for Sustainable Use in Selected Regions of Ankapalli district, Andhra Pradesh.

Y Surendra Kumar and Suresh Kumar Kolli

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ABSTRACT:

Groundwater quality plays a vital role in maintaining public health, agricultural productivity and industrial development. However, increasing urbanization, industrial discharge and agricultural runoff have significantly impacted the quality of groundwater resources in many regions. This study focuses on the assessment of groundwater quality across 19 villages to evaluate its suitability for domestic and agricultural use. Systematic sampling and laboratory analysis were conducted to determine key physico-chemical parameters such as including pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), major ions (Cl^- , SO_4^{2-} , NO_3^- , F^- , Ca^{2+} , Mg^{2+} , Na^+ , K^+), and trace metals (Fe, Mn, Cr, Pb, Cd, Ni). The obtained data were compared with the standards prescribed by the Indian Standards (IS: 10500) and the World Health Organization (WHO). The analysis reveals that certain locations exhibited higher levels, indicating contamination from anthropogenic sources. Total dissolved solids (TDS) exceeded the desirable limit of 500 mg/L in a substantial proportion of samples, suggesting solute enrichment from both natural mineral weathering and anthropogenic inputs. Trace metal analysis revealed iron, manganese, lead, and cadmium concentrations above acceptable limits in several locations, highlighting both geogenic mobilization and anthropogenic inputs. The study emphasizes the importance of continuous monitoring, proper waste management and community participation in preserving groundwater quality. Implementing integrated water quality management strategies will be essential to ensure the long-term sustainability of groundwater resources

Keywords:

Groundwater Quality, Contamination, Physico-Chemical Parameters, Water pollution, Sustainable Management.

Seawater Intrusion Assessment using Hydrochemical Indices in a coastal aquifer system: A multi-season groundwater study along the coast of Visakhapatnam, India

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ABSTRACT:

Because of their dynamic relationship with the maritime environment, coastal aquifers are extremely vulnerable to seawater intrusion, especially in the context of groundwater over-extraction, urbanisation, and climate variability. Using hydrochemical indicators as diagnostic tools, this study assesses the temporal and spatial extent of seawater intrusion in Visakhapatnam city's coastal aquifer. In eight seasonal cycles from Post-Monsoon 2021 to Monsoon 2023, groundwater samples were taken from 15 typical sites. To evaluate the hydrochemical characteristics linked to saline mixing and ion exchange processes, three widely used indices were calculated: Simpson's Ratio (SR), Sodium-to-Chloride Ratio (Na/Cl), and Base Exchange Index (BEX).

SR values varied between 1.2 and 3.8 across the study period, indicating moderate marine influence with no evidence of complete saline displacement. About 54% of the samples had a Na/Cl ratio of less than 0.86, indicating chloride enrichment typical of seawater mixing. The ratios ranged from 0.58 to 1.47. Widespread reverse ion exchange reactions, in which Ca^{2+} and Mg^{2+} ions from seawater intrusion replace Na^{+} and K^{+} ions from the aquifer matrix, were confirmed by the BEX values, which were primarily negative (93%) of observations. There was a similar pattern that showed zones of relatively increased saline mixing, with multiple groundwater locations showing raised SR, reduced Na/Cl ratios, and substantially negative BEX values. Conversely, certain sites, as GW2, displayed positive BEX values and $\text{Na/Cl} > 1$ in the majority of seasons, indicating a persistent freshwater character driven by active recharging or advantageous hydrogeological circumstances.

Analysis of seasonal variation showed that monsoon seasons had small dilution effects, pre-monsoon and post-monsoon periods had slightly higher fingerprints of salty influence, which were ascribed to decreased freshwater recharge and evaporative concentrations. According to

the integrated interpretation of the indices, the saline front is not entirely progressed onshore but rather in a transitional state, indicating mild to moderate seawater intrusion.

In order to reduce potential development of the seawater intrusion front and guarantee the long-term sustainability of the coastal aquifer system, this study emphasises the necessity of adaptive groundwater extraction tactics, artificial recharge interventions, and ongoing hydrochemical monitoring.

Keywords- Seawater Intrusion, Coastal Aquifer, Hydrochemical Indices, Base Exchange Index; Groundwater, Visakhapatnam.

FABRICATION AND INVESTIGATION ON THERMO-MECHANICAL PROPERTIES OF HYBRID FIBRE-REINFORCED POLYMER NANO COMPOSITE WITH GNPs AND MWCNTs IN MARINE APPLICATIONS

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ABSTRACT:

This work gives the investigation of the thermo-mechanical properties of Jutton-Glass hybrid polymer nano composite with MWCNTs and GNPs as reinforcements used in marine applications like marine rafts, interior panel in marine boats. For preparing the composites, the vacuum Assisted Resin Transfer Molding (VARTM) technique was used with the composition of hybrid nano-material taken as 0, 0.25%, 0.5%, 1%, 1.5% and 2% wt. of GNPs and MWCNTs and the samples were tested for thermo-mechanical properties as per ASTM standards. The samples prepared have been subjected to various testing, and the results are reported. Prior to the preparations of composites, the polymer was mixed with surface-modified nanomaterials and stability tests were conducted to assess uniform dispersion with the aid of UV-Vis spectroscopy, the outcomes showed that the samples were exceptionally uniform over a period. The hardness, tensile, and thermal properties were evaluated, and it was found that surface-modified nanomaterials could improve the properties better compared to the use of pristine nanomaterials as reinforcements. It was found that 0.5% MWCNT and GNPs sample show more improved properties than 0%, 0.25%, 1%, 1.5% and 2% MWCNT and GNPs. However, the composite samples with Graphene nanoplatelets also showcased encouraging mechanical and thermal properties like hardness, tensile strength and thermal effusivity and resistance, specific heat properties.

Keywords:

Composite Materials, MWCNT, GNPs, Ttensile strength, Hardness, Thermal properties, Marine applications



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