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EngiNe enhances safety and efficiency in the port, maritime, and offshore sectors through advanced towing, mooring, and berthing solutions, powered by integrated information systems.
EngiNe is also active in nearshore coastal managment through enviromental monitoring network with no water touch devices.

EngiNe's is IRM Offshore partner
www.irmome.com

IRM OFFSHORE AND MARINE ENGINEERS PVT. LTD.

ABOUT US

EngiNe, partner of ZENITA Group, born in 2003 as leader company for vehicle safety speed traffic control.

In 2025 EngiNe become a marine system integrator company to develop new monitoring system in Nearshore and Offshore marine field.

EngiNe is now a safety design company for monitoring technology from coastal to deep water. New Marine Department is state of the art to support stakeholders in real-time monitoring in waterbody for structures and coastal management

This brochure is only a summary to highlight EngiNe One Step Ahead potential marine customize project for its worldwide portfolio client.

EngiNe enhances safety and efficiency in the port, maritime coastal, and offshore sectors through advanced real-time monitoring EU patented tools:

- **EBAS®** *(mooring, and berthing solutions, powered by integrated information systems);*
- **EMIC®** *(nearshore new coastal erosion monitoring)*.

EngiNe employs full-time staff with degrees in maritime hydraulic engineering and extensive experience in maritime works, coastal management and marine monitoring devices integrator.

EngiNe's professional network includes collaborations with numerous public and private entities across Italy, the Southern Mediterranean region, Africa, America including Middle/Far East.

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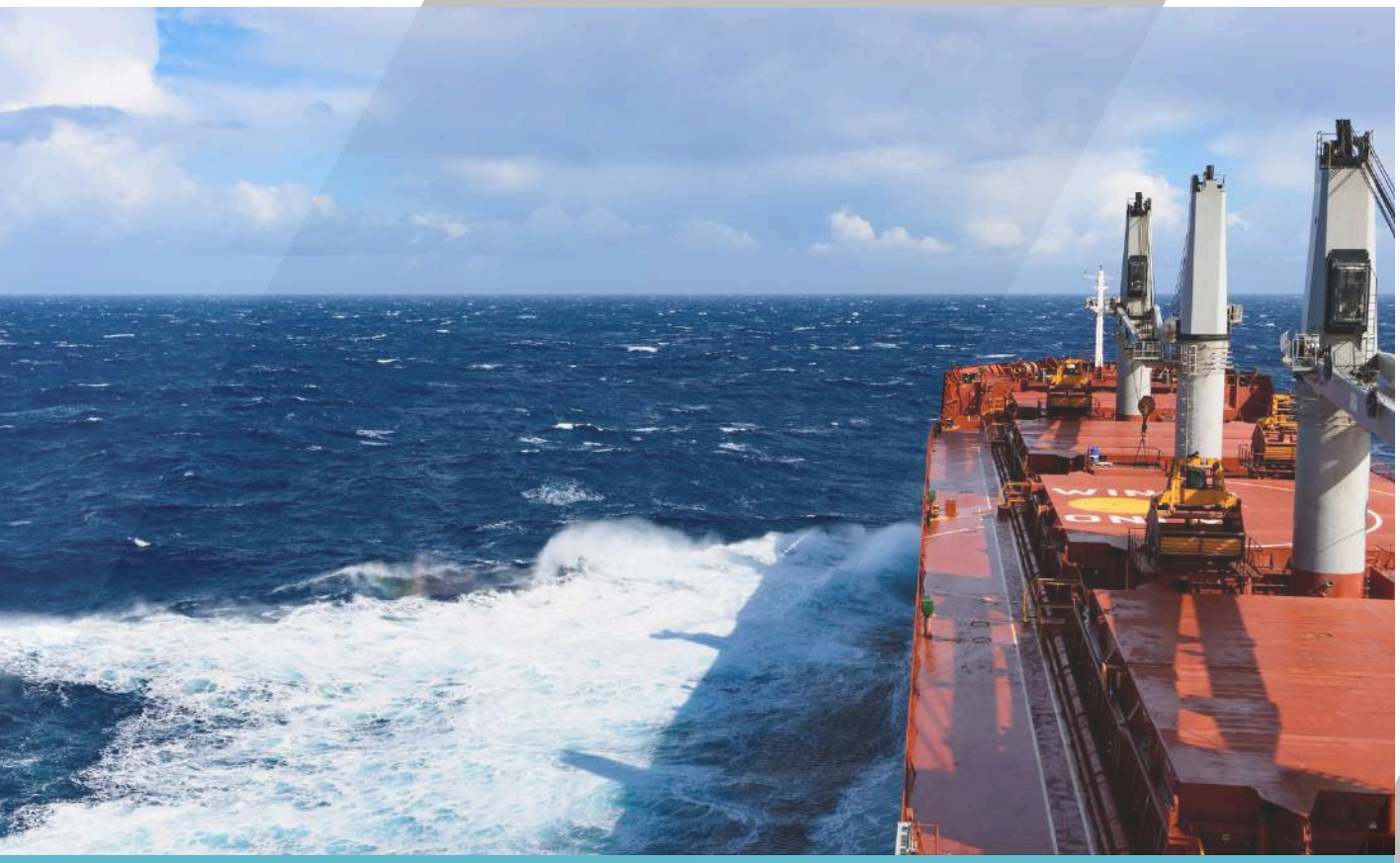
OUR SOLUTIONS



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EngiNe Marine System Integrator

Advanced Berthing and Mooring Safety Solutions

PROJECT MANAGEMENT

01

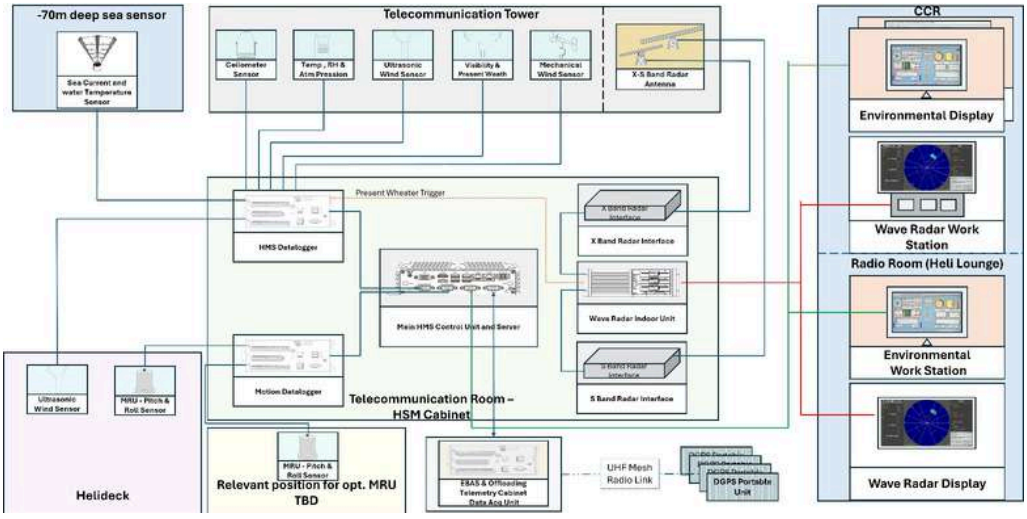
EngiNe manages all phases of the process, including engineering, design, calculations, manufacturing, certification, documentation, testing, delivery, and commissioning.

EngiNe relies on a team of highly qualified professionals—technical sales engineers, project managers, and electrical and mechanical engineers—specialized in marine technologies. This ensures accurate know-how and reliable support from the initial concept through to final implementation and monitoring network start-up.

EngiNe dedicated project management team acts as your single point of contact throughout the entire project lifecycle, ensuring efficiency, clarity, and full coordination at every project stage.

EngiNe after contract award normally provide:

- Supplier Documentation Register (SDR)/ Document Index
- Functional design specifications (one per each system)
- Block diagrams (one per each system with equipment and cables tags)
- Equipment list (with all field equipment, all JB main equipment into the cabinets)
- Spare part list
- License/frequency application documents
- Telecommunication cables schedule (update Contractor master cable list)
- Cabinets/consoles general arrangement drawings and face elevation
- Dimensional drawings
- Data sheets
- Software list (including software release)



PROJECT MANAGEMENT

SOFTWARE LIST

The list shall include but not be limited to:

- Device operating system
- Network operating system
- Client interface system
- Application software
- Installation guidelines specification
- Typical mounting details
- Terminal block layouts
- Wiring diagrams
- Grounding system diagrams
- Power system diagrams

REPORTS

In addition, EngiNe shall provide following reports:

- Design (including as-built)
- User Manual
- FAT specification
- FAT report
- Commissioning & Testing Procedures
- Installation manual
- SAT specification
- SAT Report
- Maintenance Guidelines
- Certificates of conformity of system components
- Certificate of conformity to the Order of Supply (CoC)
- Equipment technical and service manuals
- AoB required by client

MARKETS & APPLICATIONS

02

Real-time monitoring solutions to ensure safe vessel approach during berthing operations.

OIL & GAS and, in general, **marine infrastructures safety demand requires** to implement all possible technologies to prevent any unsafe approach by monitoring in real-time carrier ship approach during berthing operations to the terminal berth. This always with environmental nearshore costal assessment (i.e. shoreline stability, erosion, seabed stability, dredging, etc...).

Markets and applications are as per below figure.

EngiNe provides all tasks, **carried out in close cooperation with our customers**, from site visit/design to installation and start-up with, upon request, witnessed by independent third-party surveyors. Performs comprehensive **testing prior to customer delivery to ensure that all products are fully comply with applicable specifications and international standards**.

TESTING SERVICES INCLUDE:

- Factory Acceptance Test (FAT)
- Site Acceptance Test (SAT)
- Certified Production Processes

EngiNe operates in accordance with **internationally recognized quality standards**, including UNI EN ISO 9001:2015, UNI EN ISO14001:2015, UNI CEI EN ISO/IEC 27001:2017 and UNI ISO 45001:2018.

All systems can be supplied for hazardous areas, with explosion-proof certifications compliant with standards such as **ATEX, IECEx, UL, ILAC-MRA** and **CU TR**.

All EngiNe products are fully customizable to meet specific operational and environmental requirements.

EngiNe develop tailored solutions for demanding applications, including low-temperature environments, all marine terminals and floaters, as well as the revamping and upgrading of existing jetties/floaters.

2.1 REVAMPING & UPGRADING

To enhance safety and performance on existing jetties, EngiNe provides advanced solutions for the modernization and upgrading of installed, if any, monitoring passive safety systems.

Our integrated solutions are designed to minimize downtime and reduce installation costs, offering seamless integration with existing infrastructure.

OPEX reduction costs can be reached by proper customise terminal safety monitoring system. Monitoring system prompt to be used for maintenance planning and to detect third party responsibility.

CUSTOM SOLUTIONS FOR ALL TYPES OF MARINE TERMINALS

03

In this brochure are introduce following EngiNe devices:

- **EBAS® (EngiNe Berthing Aid System)**

Berthing & Mooring Solutions Environmental Monitoring System Optional tools:

- Wave Radar,
- Quick Release Mooring Hooks
- Mooring Load Monitoring System
- Fender Dolphin Fatigue
- Marine Structural Health Monitoring
- Remote Control Systems

- **Central Monitoring System (Black Box)**

- Software Platform

- **EMIC® (Integrated Coastal Monitoring System)**

3.1 EBAS® BERTHING AND MOORING SOLUTIONS

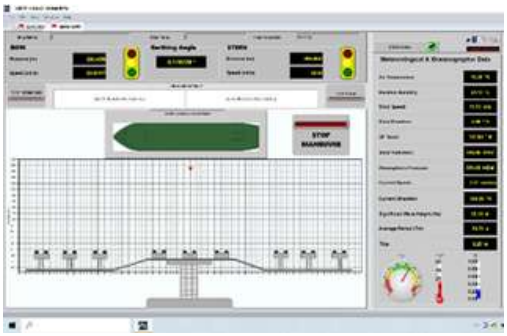
EBAS® is a registered mark in all EU countries facing any sea.

Across all continents, there is a total number of ports where EBAS® shall increase terminals passive structural safety.

EBAS®, where it is installed, **introduces in all terminals the principle of semi-automatic mooring control management**.

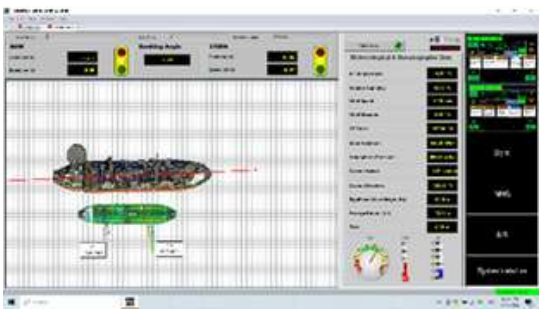
EBAS® is **comparable and is like car parking sensors**. It controls distance, velocity and angle during mooring operation and, by adding additional optional tools, not limited only to these functions.

The **Laser Sensor is compact, Class 1 eye-safe**. Two laser sensors are installed on the jetty one for bow and one for stern.

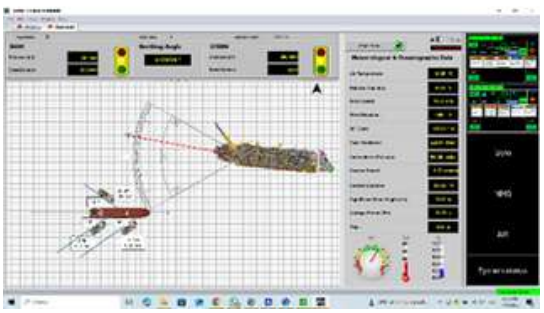


EBAS® Jetty Mooring System

Other EBAS® available are **based on DGPS system and are typical for Ship 2 Ship and Tandem mooring**.



EBAS® Ship 2 Ship Mooring System



EBAS® Tandem Mooring System

EBAS® allows to control the vessel's berthing operation from the approach phase up to the mooring and sometimes also unmooring. At the same time, EBAS® assists the pilots during the maneuvers of the ships.

EBAS® **measures and tracks the speed, distance** of the vessel as well as the berthing angle between the carrier ship and the berthing line.

EBAS® **provides real-time data to support safe and efficient vessel berthing operations**.
Using advanced laser/DGPS sensors, the system measures key approach parameters and displays them on LED panels and traffic lights or, in case of DGPS sensor, trough portable device on board incoming vessel. Both systems are enabling pilots and marine personnel to make accurate decisions during the berthing process.

During vessel approach, the system displays essential information such as distance, speed, and angle. Once the vessel is moored and in contact with the fenders, EBAS® continues to **monitor fender deflection and vessel drift-off. This is ensuring ongoing safety operation**.

Adjustable alarm settings provide immediate warnings in case of excessive speed or incorrect berthing angle.
While the vessel is moored, EBAS® can also **monitor and measure the elastic motion of the Fenders and Dolphins** (FDF - Fender Dolphin Fatigue) according to the "Guideline for design Fenders System"

EBAS® has been designed with the purposes to **monitor all the effects of the operation of a Marine Infrastructure** also, inclusive of:

- **Vibration, and Acceleration of the structures (SHM)** caused both by weather and met-oceanographic conditions and by the load that the carrier ship induces on the structure. All the events related to the operation manoeuvres are recorded in real-time in a dedicated black box (equivalent to aircraft Black Box) and data can be retrieved at any time, for terminal maintenance planning and/or occurs of an accident.

EBAS® is necessary for vessel safety and integrity of mooring structures.

EBAS® (EngiNe Berthing Aids System) as **support to marine operation** must be used for:

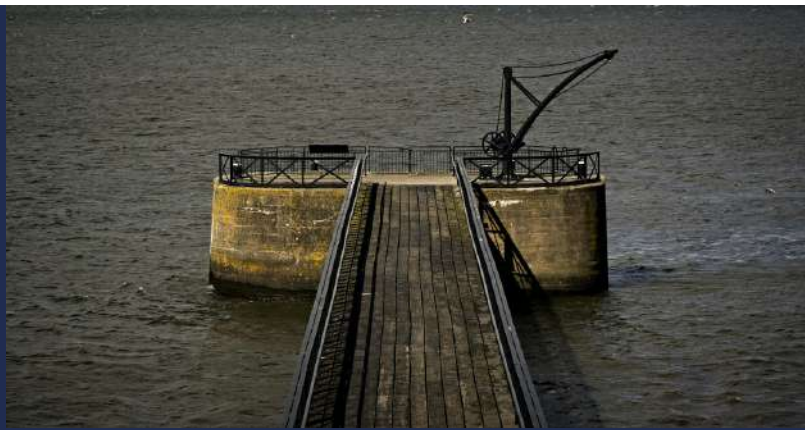
- Monitor vessel during terminal approach up to berth and beyond the end of this mooring phase
- Increase safety during all manoeuvres
- Increase terminal operation and structures
- Reduce OPEX through preventive maintenance and reduce down-time for extraordinary maintenance

ASSET INTEGRITY

- Recording of all vessel berthing operations
- **Use of a black box** (stored in terminal control room) with the entire database of raw data recorded for each single different vessel including all phases: approach, berthing, mooring time for loading or un-loading operations, un-berthing and ship sailing off from terminal
- Identification, if any, collision risks:

- Change in weather conditions not reported, unforeseen event, force majeure and human error.

EBAS® BERTHING AND MOORING SOLUTIONS



- Without EBAS® **potential damage of berthing maneuvers generates**:
  - Terminal and involved vessel stop operations and downtime until both are repaired
  - Inspections and damages quantification (terminal and vessel)
  - Legal disputes between the parties involved
  - Incominig scheduled vessels to be redirected (hijacked) to other port with increased costs
  - Increasing of terminal operation costs (OPEX)

EBAS Specification (*)	
ATEX Compliancy	Ex II 2GD Ex d IIC T6 Other ATEX Ex standards available on request
Laser Eye Safety Class	1 - 905nm according to EN60825-1:2003-10
Max Operative Distance	800 m
Distance Accuracy	±10mm Distance > 300m ±1mm distance < 300m
Distance Resolution	1mm
Berthing Angle Accuracy	± 0.1°
Speed Accuracy	± 0,1 cm/s
Data Update time	1s
Stoplights and Laser self test	Automatic at the start of the approach – On request out of the operations.
Berthing Report	Automatic at the end of the operations

(*) equivalent or better due to system update.

3.1.1 LED DISPLAY

The LED Display only for EBAS® **Jetty Mooring System is an integral part of the system**, ensuring clear and reliable visualization of real-time berthing data.

High-visibility LED digits can be seen from **over 300 meters**, in all weather conditions, both day and night, with minimal maintenance requirements.

Dedicated software is available for portable devices

DISPLAYED INFORMATION

- Distance (bow and stern)
- Speed of approach
- Speed alarms
- Berthing angle
- Angle alarms (during mooring)
- Drift-off (after mooring)

Integrated traffic lights provide immediate visual alerts for speed and angle deviations.

3.2 ENVIRONMENTAL MONITORING SYSTEM

EBAS® is always associated with weather station to **collect and transmit environmental data to Terminal control room where data are displayed and analysed**. The Environmental Monitoring System collects and records real-time meteorological and oceanographic data from a range of sensors, supporting safer and more efficient marine operations.

During the Mooring Phase Met-oceanographic data are directly interfaced with EBAS® to **help the pilots and operators to operate in higher safety conditions**. The measured data will be acquired by dedicated datalogger through the inside resident firmware, which will perform the necessary mathematical calculations to get the parameters into engineered forms (raw data are always stored and saved for any future analysis).

Averages, maximum, least & histograms can be obtained according to the choice of the user.
By analyzing environmental conditions and trends, the system enables pilots and marine personnel to better predict vessel behavior during approach and berthing, improving decision-making, overall safety and **ASSET INTEGRITY**.

3.2.1 WEATHER STATION

KEY ATMOSPHERIC PARAMETERS

- Wind speed and direction
- Humidity
- Barometric pressure
- Air temperature
- Precipitation

Additional sensors—**such as solar radiation and cloud height**—can be integrated upon request.
A compact and lightweight **multi-sensor weather transmitter** is provided as standard, offering reliable performance with minimal maintenance.

Weather station Specification (*)	
Wind Speed	• Range: 0.5 to 50 m/s – guest survival 60 m/s • Threshold: 0.5 m/s • Accuracy ± 0,5m/s
Wind Direction	• Range: 0-360° • Accuracy 5° • Operating range: -50 +50 °C
Atm Pressure	• Range: 600-1060 mB • Accuracy ± 0.5 mB (20°C) – 2mB (0-60°C) • QNH-QFE: Yes
Air Temp	• Range: -40 +to°C 70 • Accuracy ± 0.4 °C (-40 +70°C) - 0m/s (+20 +60°C)
Air RH	• Range: 0-100% • Accuracy ± 1.8%
Solar Radiation	• Range: 0-2000 wm^2 • Spectral range: 385 to 2105 nm (net shortwave radiation) • Operating range: -50 +50 °C
Visibility	• Range: 0-100km • Resolution & accuracy: 3m • Current weather identification: Drizzle, rain, snow, snow grains, ice crystals, ice pellets, freezing rain / drizzle, snow pellets, hail, fog / freezing fog, mist, haze

(*) equivalent or better specification, additional environmental parameters can be supplied.

3.2.2 CURRENT SENSOR

SUBMERGED DEVICE DESIGNED TO MEASURE

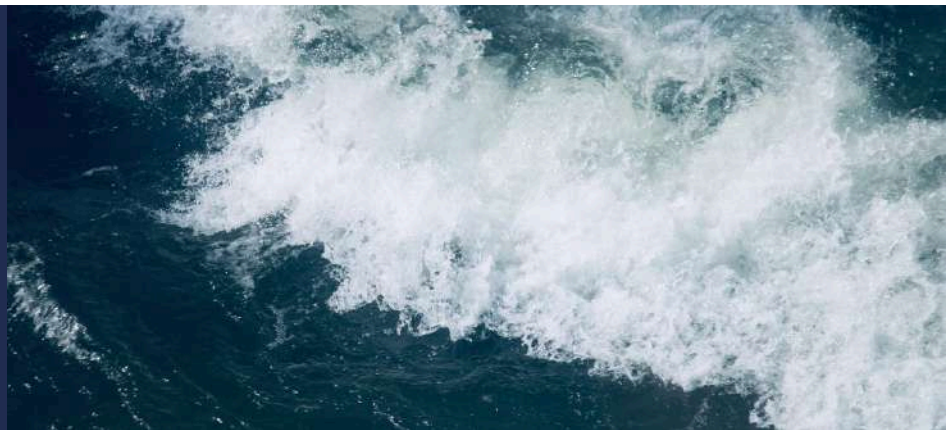
- Current speed and direction
- Water temperature

A **Doppler current sensor** with true vector averaging is supplied as standard. It is robust, reliable, and resistant to fouling, making it ideal for installation on buoys, quays, and jetties.

Current Sensor Specification (*)	
Measuring range current speed:	0–5 m/s
Accuracy current speed:	±0.5 cm/s
Resolution current speed:	1 cm/s horizontal velocity precision
Measuring range current direction:	0 – 360*
Accuracy current direction:	± 5°
Resolution current direction:	0.01°
Measuring range temperature:	-4 – 40 * Celsius
Accuracy temperature:	0,1 * Celsius
Resolution temperature:	0.01 * Celsius
Output Parameters	
• Current Sensor	(m/s)
• Current Direction	(*)
• Water Temperature (optional)	(° Celsius)

(*) equivalent or better specification, additional environmental parameters can be supplied. Other types of current sensors, including profilers, can be integrated upon client request.

3.2.3 WAVE & TIDE SENSORS



NO WATER CONTACT WAVE & TIDE SENSOR (*)

Standard solutions include submerged pressure sensors or non-contact wave and tide sensors. Additional sensor types, such as advanced profiling systems, can be integrated upon request.

- Wave height (cm)
- Wave direction (°)
- Mean wave amplitude (cm)
- Wave Period (s)
- Mean wave period (s)
- Tide level (cm)
- Wtaer depth

(*) equivalent or better specification, additional environmental parameters can be supplied.

3.3 EBAS® OPTIONAL SUB-SYSTEMS

- Wave Radar
- Quick Release Mooring Hooks
- Mooring Load Monitoring System
- Fender Dolphin Fatigue
- Marine Structural Health Monitoring
- Remote Control Systems

3.3.1 WAVE RADAR

Wave Radar can **monitor up to 2.5km from radar location** and is the solution tor:

- **Monitor sea waves and sea surface** currents in coastal and marine terminal areas (including floaters).
- **Measure sea state parameters** where it is difficult with the precision and spatial resolution required by the relevant applications and/or instruments.
- **Measure surface currents near the coast** to safeguard biodiversity; predict coastal erosion and support decisions for oil spill crisis events (including floaters).

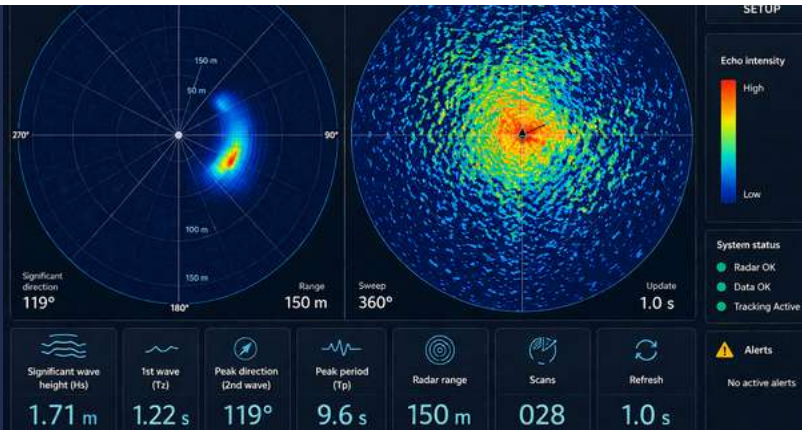
All **oceanographic parameters** are providing **real time information** on surface sea state by a graphical and textual representation of:

- Dominant Wave: H_s height, direction, length, and period of primary and secondary waves
- **Wave Directional Spectrum:** 2D waves representation in the wave number domain
- **Wave Motion:** waves Space-Time Reconstruction
- **Sea Surface Currents:** interactive high-resolution map
- **Bathymetry maps:** interactive bathymetry reconstruction (water column below 20m)

MINIMUM WAVE RADAR OPERATING CONDITIONS ARE:

- *Wind ≥ 2 m/s*
- *MBTF ≥ 10 years*
- *Magnetron replacement parts every 4000 h*

WAVE RADAR SEA STATE PARAMETERS



Wave Radar acquired parameters Symbol, Range, Resolution and Accuracy.

Name	Symbol	Range	Resolution	Accuracy
2D-wave number spectrum	$S(k_x\, k_y)$	-0.45 to +0.45 rad/m -0.45 to +0.45 rad/m	0.005 rad/m	string (YYYYMDDHHMMSS)
2D-frequency direction Spectrum	$S(f, \theta)$	0.02 - 0.35 Hz 0 - 360°	0.005 Hz 4 deg	- -
1D-frequency spectrum	$S(f)$	0.02 - 0.35 Hz	0.005 Hz	-
Significant wave height	Hs	0.5 - 20 m	0.1 m	+/- 10% or +/-0.5 m
Mean wave period	T_{mo2}	4 - 20 s	0.1 s	+/- 0.5 s
Peak wave period	T_p	4 - 20 s	0.1 s	+/- 0.5 s
Mean wave direction	θ_p	0 - 360°	1.0°	+/- 2°
Integrated wave spreading	Spr	0 - 90°	-	-
Peak wave length	L_p	15 - 600 m	1.0 m	+/- 10%
1st peak period	T_{p1}	4 - 20 s	0.1 s	+/- 0.5 s
1st peak wave length	θ_{p1}	15 - 600 m	1.0°	+/- 2°
1st peak wave period	T_{p2}	4 - 20 s	0.1 s	+/- 0.5 s
1st peak period	λ_{p1}	15 - 600 m	1.0 m	+/- 2°
2nd peak wave length	T_{p2}	4 - 20 s	0.1 s	+/- 0.5 s
2nd peak wave length	λ_{p2}	15 - 600 m	1.0 m	+/- 2°
Surface current speed	U	0 - 40 m/s	+/-0.2 m/s	+/- 0.2 m/s
Surface current direction	θ_U	0 - 360°	+/- 2°	+/- 2°

3.3.2 QUICK RELEASE MOORING HOOKS

Quick Release Mooring Hooks are designed to **safely and efficiently disconnect mooring lines under full load conditions in emergency situations**, minimizing potential damage to both the terminal structures and the surrounding environment. Standard units are available for safe working loads and can be supplied in multiple configurations.

All hooks are individually tested in accordance with major classification societies such as **LR, BV, DNV, RINA,** and **ABS**.

In addition to the standard manual release, the mooring hooks can **optionally be equipped with a remote release system**. This enables the operator to release the hooks from a distance individually or simultaneously in case of an emergency.

The remote-control system is compatible with EBAS®. The **central control can be operated from multiple positions and by portable devices, like PDAs**. Pushbuttons can be installed on the hook's local control panel for local operation as well. An indication whether the hook is open or closed can be transmitted to the remote-control panel or displayed by the EBAS® application software.

ALL UNITS CAN BE FULLY INTEGRATED WITH:

- Integral Capstans
- Remote Control Systems
- Mooring Load Monitoring Systems

Options devices can be provided to suite with terminal owner specifications this include special configuration to be design after site visit from EngiNe engineer's to marine terminal.

EngiNe can provide for each terminal proper hooks specifications based on mooring system design, environmental conditions at terminal and vessel data.

3.3.3 MOORING LOAD MONITORING SYSTEM

The Mooring Load Monitoring System provides continuous and accurate **monitoring of forces acting on mooring lines**, ensuring safe and efficient mooring operations.

Real-time load data allows operators to immediately detect and respond to slack or overload conditions. Configurable alarm settings enhance operational safety, while mooring line patterns and alarm parameters can be stored in the system database for future operations.

The **Load Measuring Pins** are full bridged strain gauge-based shear pins designed to provide a signal output directly proportional to the applied load. The load cells are typically installed into the rear horizontal swivel joint of the quick release mooring hook.

INFORMATIONS OF ALL LOAD CELLS

- Real Time Load on Each Hook
- High Load Alarms (Hi and Hi-Hi)
- Low Load Alarms (Slack Line)

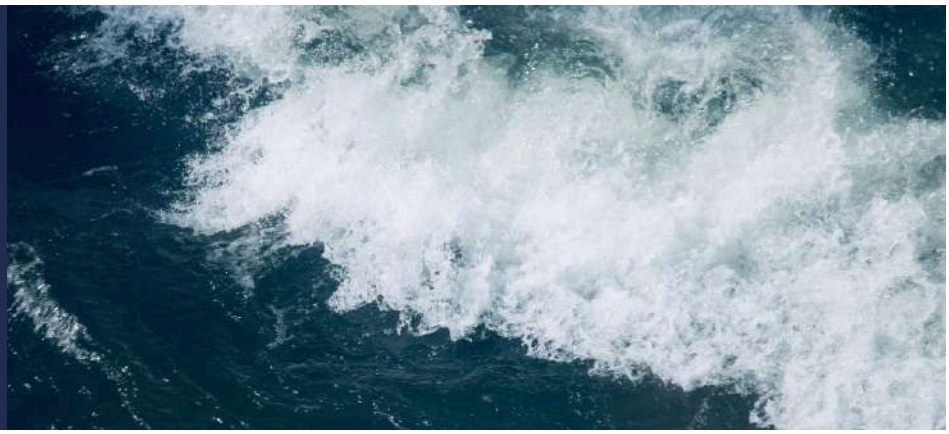
Load data can be accessed from the **jetty control system** as well as from portable devices, including laptops, tablets, and mobile devices.

The system supports both **wireless communication and ship-to-shore data transmission**, enabling real-time monitoring on board carriers or at onshore control stations. Dedicated software is available for portable devices or for installation on onboard display systems.

Calibration certificates are issued and witnessed by major classification societies, including **LR, BV, DNV, RINA,** and **ABS**, ensuring full compliance with international standards.

EngiNe can provide for each terminal proper mooring load monitoring system specifications based on mooring system design, environmental conditions at terminal and vessel data.

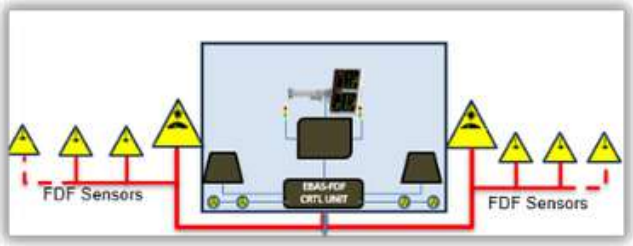
3.3.4 FENDER DOLPHIN FATIGUE (FDF)



- FDF consists of a **special Laser sensor** that measures the displacements of the Fender, and the Dolphin while are impacted by a ship
- FDF Control Unit can **monitor up to 8 fenders on the same berth line**
- FDF is a **modular system**
- FDF system **is 100% compatible with EBAS®**, and it contributes to increasing its own functionalities. By using FDF together with EBAS® it is possible to **monitor the effects of berthing operation maneuvers** on the elements designed to dissipate impact energies
- FDF is necessary where **high tide excursions require special fender plates and monitor ship impact** at different elevation
- FDF also **allows terminal operator** to evaluate the effects of an incorrect berthing maneuver by analyzing the out-of-range force over the fender panels

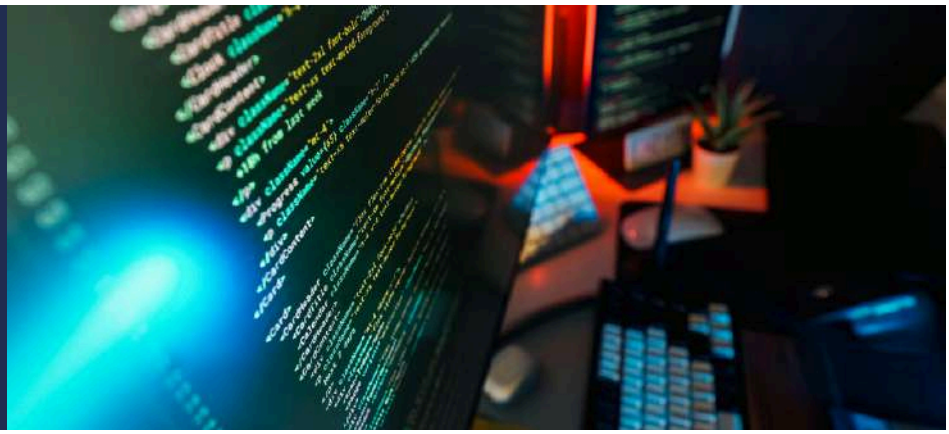
FDF specifications (or equivalent)	
ATEX Compliancy	Ex II 2GD Ex d IIC T6 Other ATEX Ex standards available on request
Laser FDF Sensor	1 – 905 nm according to EN60825-1:2003-10
Max Operative Distance	5m
Resolution	0,01 mm
Data Output	0,1s per sensor
Accuracy	0,01mm
Temperature Range	-30 +80°C
Stoplights and Laser self-test	Automatic at the start of the approach On request of the operations.
FDF Report	Automatic at the end of the operations

› EngiNe can provide for each terminal proper Fender Dolphin Fatigue system specifications based on mooring system design, environmental conditions at terminal and vessel data.



Laser Sensor housed in EEx-D Certified Enclosure. High laser accuracy measurement

3.3.5 MARINE STRUCTURAL HEALTH MONITORING (MSHM)



- MSHM consists of a special sensor, engineered by EngiNe, that **measures the displacements of the structural elements while the structure is impacted by a ship**
- **MSHM Control Unit** can **monitor and control up to 80 Static sensors and/or 12 Dynamic sensors**, distributed along the structure
- MSHM is a **modular system**. The system is **100% compatible with EBAS®** and it contributes to increasing marine terminal integrity and safety
- MSHM together with EBAS® **can estimate the effects of berthing maneuvers** on the elements of the terminal structure
- MSHM can be considered the most advanced system that **can be implemented as tool to evaluate the Structure Health Status**
- MSHM by recording terminal structures data can **allow design life ASSET extension**

MSHM specifications (or equivalent)	
ATEX Compliancy	Ex II 2GD Ex d IIC T6 Other ATEX Ex standards available on request
Gyro Triaxial Accelerometer	Up to 8G - Max Data rate 1000Hz – Temperature compensated -
Fast Inclinometer	Data rate up to 5Hz – Accuracy ±0.00021 – Range 0-90°
Crack meter	Resolution: 0,001mm – Accuracy_ 0,001mm – piston extension from 50 to 300mm
Concrete Temperature sensor	Temp. Range: -30 +80°C - Accuracy: 0.1°C
MSHM Temperature Range	-30 +80°C
Sensor and Control Unit self-test	Continuous monitoring of the functioning of each sensor.

› EngiNe can provide for each terminal proper Marine Structural Health Monitoring system specifications based on mooring system design, environmental conditions at terminal and vessel data.

BLACK-BOX - CENTRAL MONITORING SYSTEM

04

The Black Box provides a **unified platform for real-time monitoring and management of all systems** involved in the berthing and mooring process. This including the storage of all raw data for any post-processing or required new analysis by any Authorised Third Party.

It enables operators to access up-to-date information, visualize trends, and centrally store vessel and operational data, supporting safer and more efficient decision-making.

DATA MANAGEMENT

The system includes dedicated databases for:

- EBAS®
- Environmental Data
- Quick Release Hook
- Mooring Load Configurations
- Fender Dolphin Fatigue
- Marine Struttural Conditions
- High load Alarms
- Rope Tension Limits
- Trend logs
- Event and Alarm Archives
- Emergency Release Data

SYSTEM INTEGRATION

The Black Box HW integrates and visualizes data from multiple sources, including:

- Berthing Approach Systems
- Environmental monitoring (metocean data)
- Wave Radar
- Remote Hook Release and hook status
- Mooring Load Monitoring Systems
- Fender Dolphin Fatigue
- Marine Struttural Conditions
- AIS and CCTV systems (Optional)

Data can be distributed locally or globally via **LAN, WLAN, UHF, or internet connections. Monitoring & Control.**

The system processes data from all connected sensors and displays it through the jetty/floater control interface.

Operators can access real-time information via various devices, including tablets, mobile phones, laptops, and onboard portable systems.
A ship-to-shore communication link enables seamless data exchange, particularly for LNG carrier operations.

The software platform is , fully customizable, and can be easily integrated with third-party systems.

4.1 INTELLIGENT MOORING SYSTEM SOFTWARE

The Intelligent Mooring System Software provides a **fully integrated platform for monitoring and controlling all critical berthing, mooring, and environmental operations**.

By combining multiple systems into a single interface—including berthing approach, mooring load monitoring, remote control, environmental data, AIS, and CCTV—the platform delivers complete real-time situational awareness to jetty/floater operators.

This enables safer operations, improved decision-making, and optimized terminal efficiency.

MONITORING & VISUALIZATION

The system provides a clear and intuitive interface for real-time monitoring of vessel approach, mooring loads, and environmental conditions.

During vessel approach, key parameters such as **distance, speed, and angle** are continuously displayed, with configurable limits and replay functionality for performance analysis.

Mooring operations are visualized through graphical and numerical displays, with **color-coded indicators** highlighting normal, warning, and alarm conditions. Load trends and historical data allow for in-depth analysis and operational optimization.

Environmental data—including wind, tide, waves, and current—is continuously monitored and displayed across all system screens.

CONTROL & SAFETY

The platform enables full control of mooring operations directly from the interface. **Operators can remotely control hook release, either individually or in groups, with configurable emergency release sequences**. Hook status is clearly displayed through intuitive visual indicators, ensuring immediate understanding of system conditions.

Automatic alarms and acoustic signals alert operators to overload, slack, or unsafe approach conditions, supporting rapid response and enhanced safety.

INTELLIGENT MOORING SYSTEM SOFTWARE

DATA MANAGEMENT & PERFORMANCE ANALYSIS

All operational data is stored in a centralized database, including:

- Mooring plans and configurations
- Load limits and safety thresholds
- Vessel-specific operational parameters
- Event logs and alarm history

This allows quick retrieval of **ship-specific data** for future operations and supports detailed performance analysis through trend visualization and replay functions.

SYSTEMS

- **Berthing Approach System (EBAS®)** – approach monitoring status
- **Environmental Monitoring (EMS)** – metocean data
- **Wave Radar (EWR)** – sea surface wave monitoring
- **Mooring Load Monitoring (MLM)** – real-time load control
- **Remote Control Systems (RCS)** – hook release and status
- **Fender Dolphin Fatigue (FDF)** – real-time Fender condition and status
- **Marine Structural Health Monitoring (MSHM)** – real-time structures conditions
- **AIS** – vessel tracking and trajectory prediction
- **CCTV** – high-definition visual monitoring

AIS data provides real-time vessel tracking and projected trajectories, supporting early-stage approach planning. CCTV integration ensures continuous visual control of all operational areas, including night vision capability.

FLEXIBILITY & CONNECTIVITY

The system supports monitoring of multiple jetties from a single workstation and can be configured with multiple displays for a complete operational overview.

Data **can be accessed locally or remotely via various communication systems**, and the **platform can be easily integrated with third-party systems**.

The software is fully customizable, allowing adaptation to specific operational requirements and terminal configurations.

EMIC®– INTEGRATED COASTAL MONITORING SYSTEM

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EMIC® is a registered mark in all EU countries facing any sea. Coastlines worldwide are increasingly exposed to erosion and degradation, driven by climate change and growing environmental pressures.

Marine terminal are a kind of traditional coastal defense, but simply monitoring approaches are no longer sufficient, often lacking real-time monitoring and failing to fully understand the short- and medium-term effects of implemented interventions.

The EMIC® (EngiNe Integrated Coastal Innovative Monitoring System) introduces a new methodology for continuous, real-time coastal monitoring (24/7, 365 days a year), enabling a deeper understanding of coastal dynamics and supporting more effective, sustainable mitigation strategies.

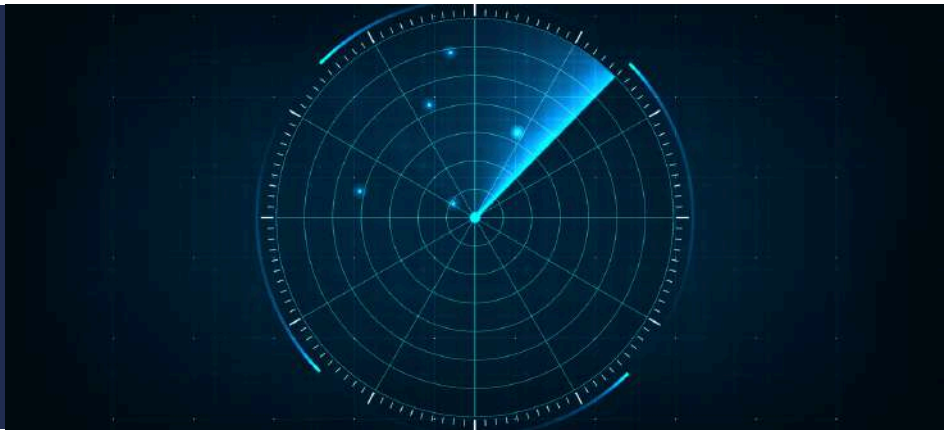
A NEW APPROACH TO NEARSHORE TERMINAL AND COASTAL MANAGEMENT

EMIC® is designed to **monitor and analyze the dynamic evolution of coastal areas**, including:

- Shoreline position changes
- Nearshore terminal impact
- Seabed morphology and slope variations
- Sediment transport and redistribution (Sediment Trend Analysis)
- Wave, current, and environmental conditions

By providing reliable real-time data, EMIC® supports decision-makers in planning and implementing **sustainable nearshore protection projects**, optimizing the use of public investments and reducing long-term operational costs.

ADVANCED MONITORING TECHNOLOGY



At the core of the system is the EWR (EngiNe Wave Radar), a non-intrusive monitoring solution that operates without electronics submerged in water.

SYSTEMS

- Real-time acquisition of wave and surface current data over a radius of up to **4 km**
- Detection of seabed variations from offshore depths to the shoreline
- Monitoring of shoreline evolution during storm and calm conditions

Through advanced frequency analysis, **EMIC® detects wave spectrum distortions caused by**:

- Surface currents (Doppler effect)
- Seabed variations

This allows accurate estimation of both **current dynamics and seabed depth changes in real time**.

SEDIMENT TREND ANALYSIS & COASTAL DYNAMICS

A key innovation of EMIC® is the real-time implementation of **Sediment Trend Analysis**, enabling:

- Identification of sediment movement patterns
- Monitoring of sandbar formation and evolution (down to ~20 m depth)
- Evaluation of natural beach recovery processes after storm events
- Estimation of sediment volumes available for beach nourishment
- Provide information to Nearshore Terminal on dredging maintenance operation

The system also determines the **return period (Rt)** of storm events and identifies thresholds beyond which sediment loss becomes irreversible.

This information is essential for planning **targeted and cost-effective nearshore coastal interventions**.

OPERATIONAL BENEFITS

EMIC® provides a comprehensive **tool for coastal management**, offering:

- Continuous monitoring of environmental and hydrodynamic conditions
- Real-time support for erosion mitigation strategies
- Real-time safe access to nearshore terminal assuring minimum required watre depth
- Improved prediction of coastal behavior and risks
- Support for emergency management (e.g. oil spills)
- Enhanced protection of biodiversity and coastal ecosystems
- Reduction of operational costs through planned interventions (OPEX optimization)

The system also enables **monitoring of wave-induced** stresses on coastal and port structures, supporting infrastructure safety.

METHODOLOGY & PROJECT PHASES

EMIC® follows a **structured methodology covering** the entire lifecycle of nearshore coastal management projects:

- Data acquisition and analysis of existing conditions
- Pre-work monitoring
- Numerical and physical modeling using real-time storm data
- Design of nearshore terminal or coastal defense solutions
- Construction including mitigation works
- After-work monitoring
- Long-term management and optimization of nearshore assets

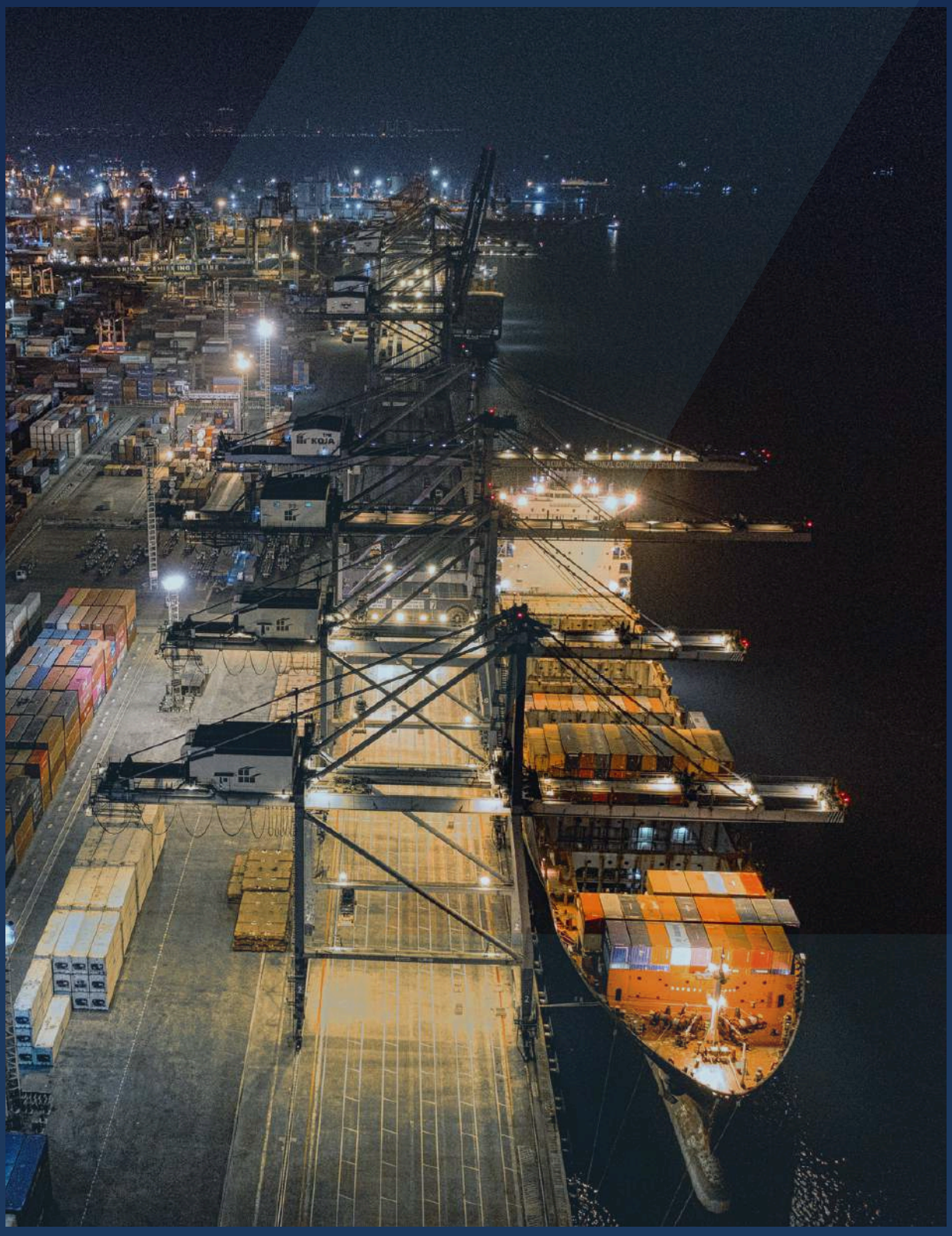
SUSTAINABLE COASTAL ASSET MANAGEMENT

EMIC® transforms coastal monitoring into a **continuous, data-driven process**, enabling:

- Planned, cost-efficient interventions instead of emergency responses
- Recovery and reuse of naturally displaced sediments
- Long-term preservation of nearshore terminal (safe meteomarine operation condition including minimum draft before maintenance dredging)
- Long-term preservation of beach resources (“beach asset”)
- Integration with advanced data assimilation techniques

By supporting updated guidelines and regulatory frameworks, EMIC contributes to a more **sustainable and resilient management of nearshore environments**.

ENGINE



One Step Ahead

ENGINE

ZENITA GROUP

EngiNe SpA

Loc. Sentino Ficaiole snc - 53040
Rapolano Terme - (SI) Italia

+39 0577 704514

marine.department@engine.it

www.engine.it