From Incident to Insight: Unpacking Lessons for a Safer Maritime Industry

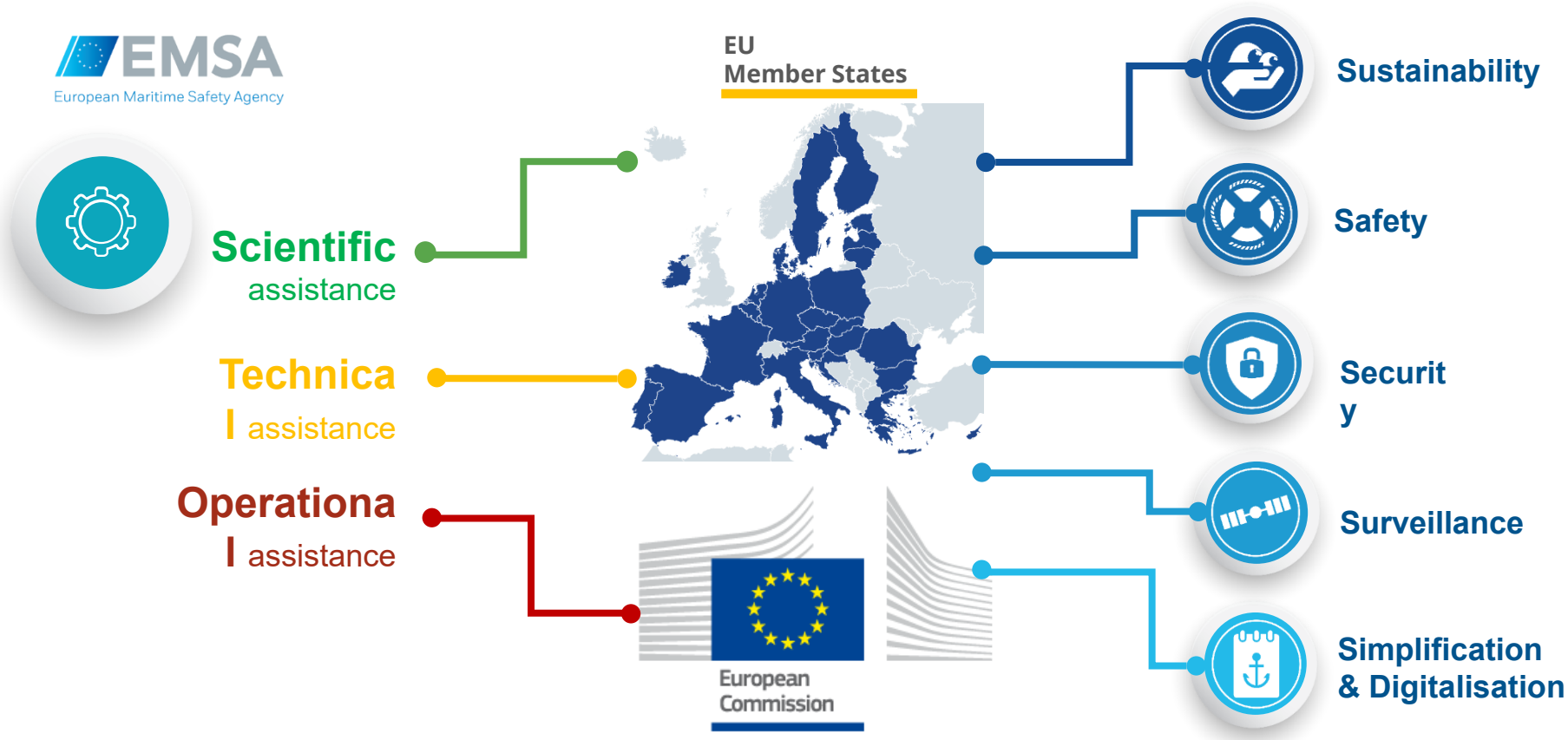
The EMSA approach

International Safety@Sea Week 2025

Singapore, 15 July 2025

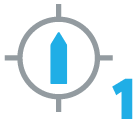
Santiago Encabo
Head of Unit / Unit 2.1 Safety & Security

EMSA


EMSA
European Maritime Safety Agency
EU
Member States
Scientific
assistance
Technica
l assistance
Operationa
l assistance
European
Commission
Sustainability
Safety
Securit
y
Surveillance
Simplification
& Digitalisation

2024

1280
RPAS deployments days



11 000
Daily ABM alerts

16 240
Earth Observation images delivered

54 million
Average daily vessel position messages

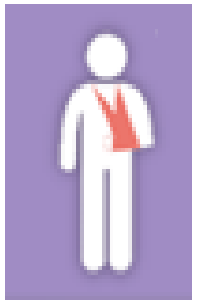
50
Activations of EMSA Contingency Plan

14
Oil spill response vessels

5
Equipment assistance service stockpiles

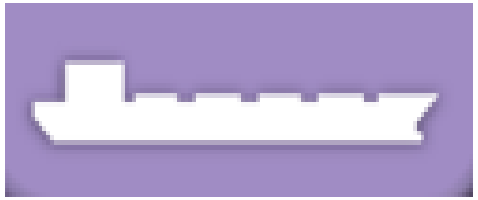
7 931
IMS Users

What's happening at sea during this event?



9

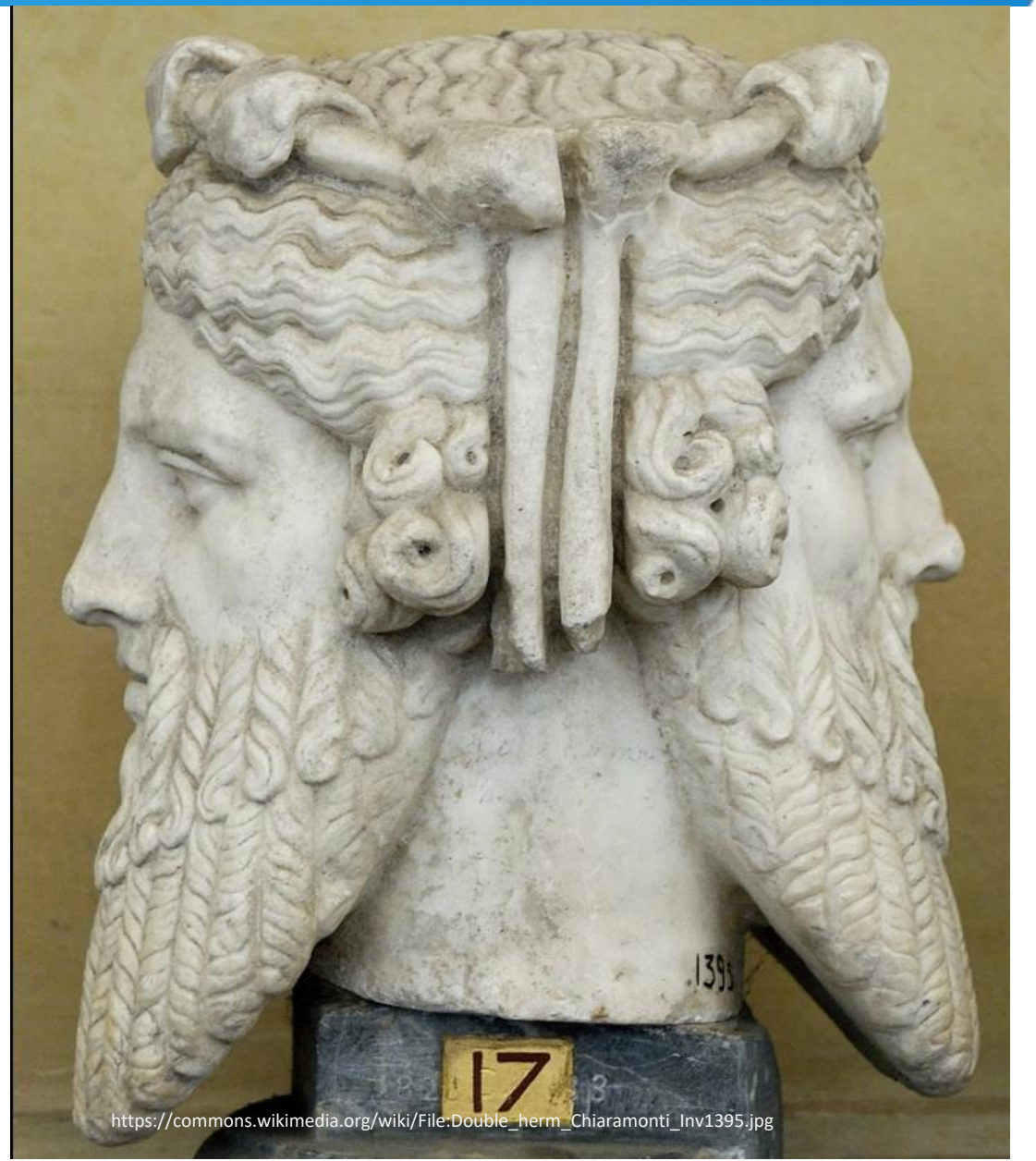
29



32

9

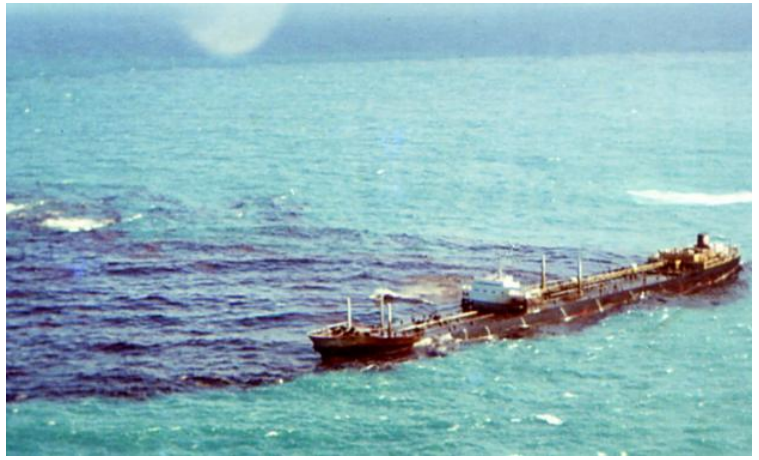
AI in a nutshell…



https://commons.wikimedia.org/wiki/File:Double_herm_Chiaramonti_Inv1395.jpg

What do they have in common?

Titanic, 12 Jan 1912



SS Torrey Canyon, 18 Mar 1967

Erika, 12 Dec 1999

Prestige, 13 Nov 2002

Goals of safety investigation

- ✓ Prevent and avoid to happen again

- ✓ Understand

- ✓ Analyse and conclude

- ✓ Learn lessons and make recommendations

- ✓ Act, change and improve

- ✓ No blame

EMCIP DATABASE

240 USERS

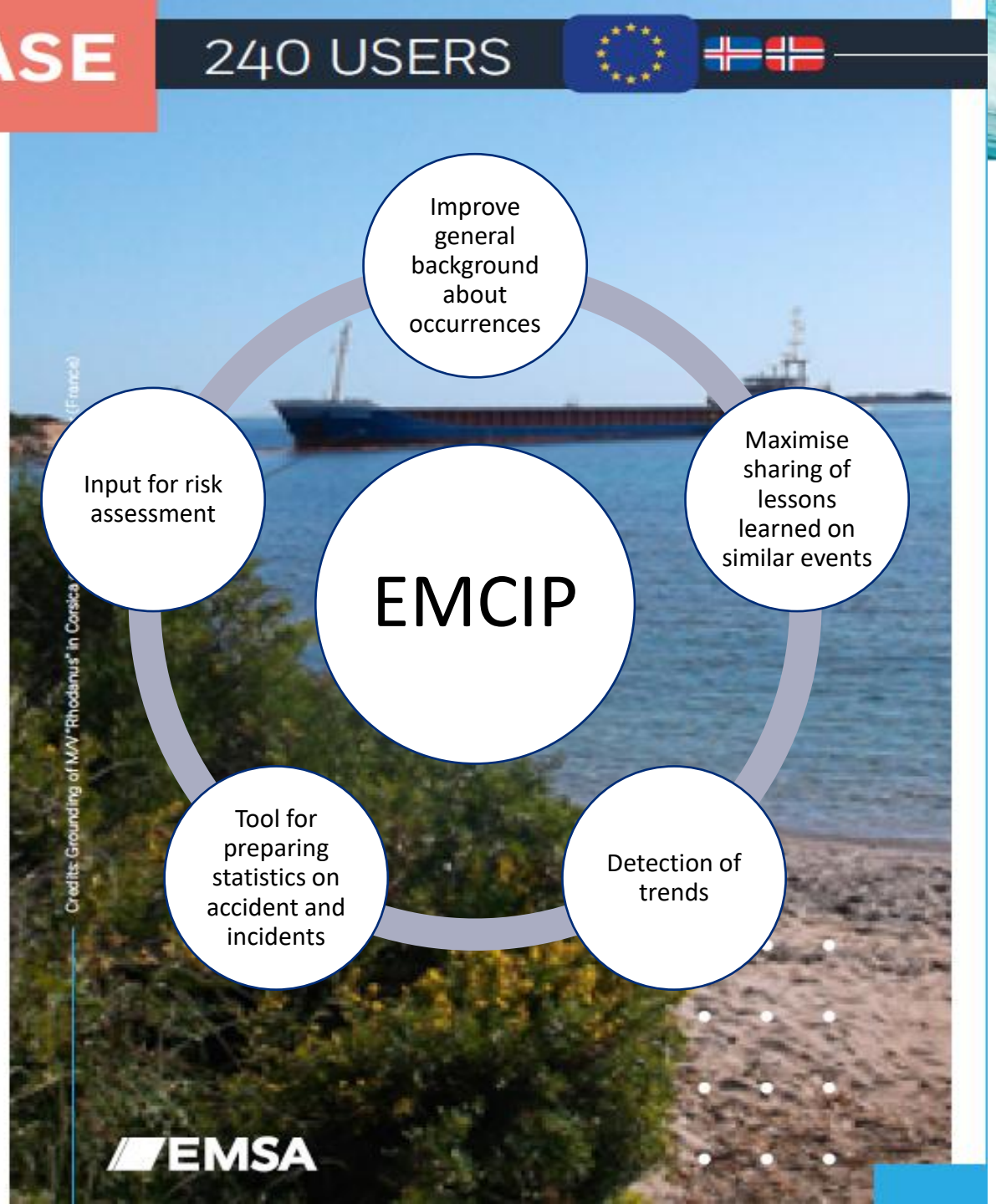
>42,300
OCCURRENCES

3%
Very serious

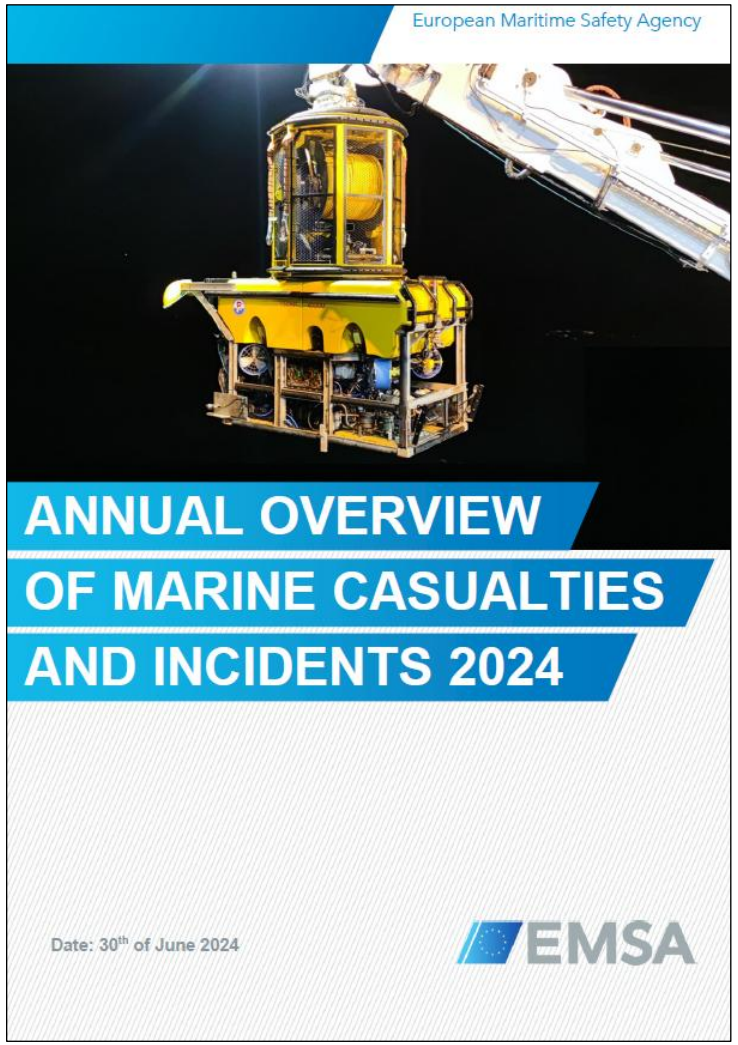
17%
Marine incidents

81%
Other marine casualties

>1,600
INVESTIGATIONS

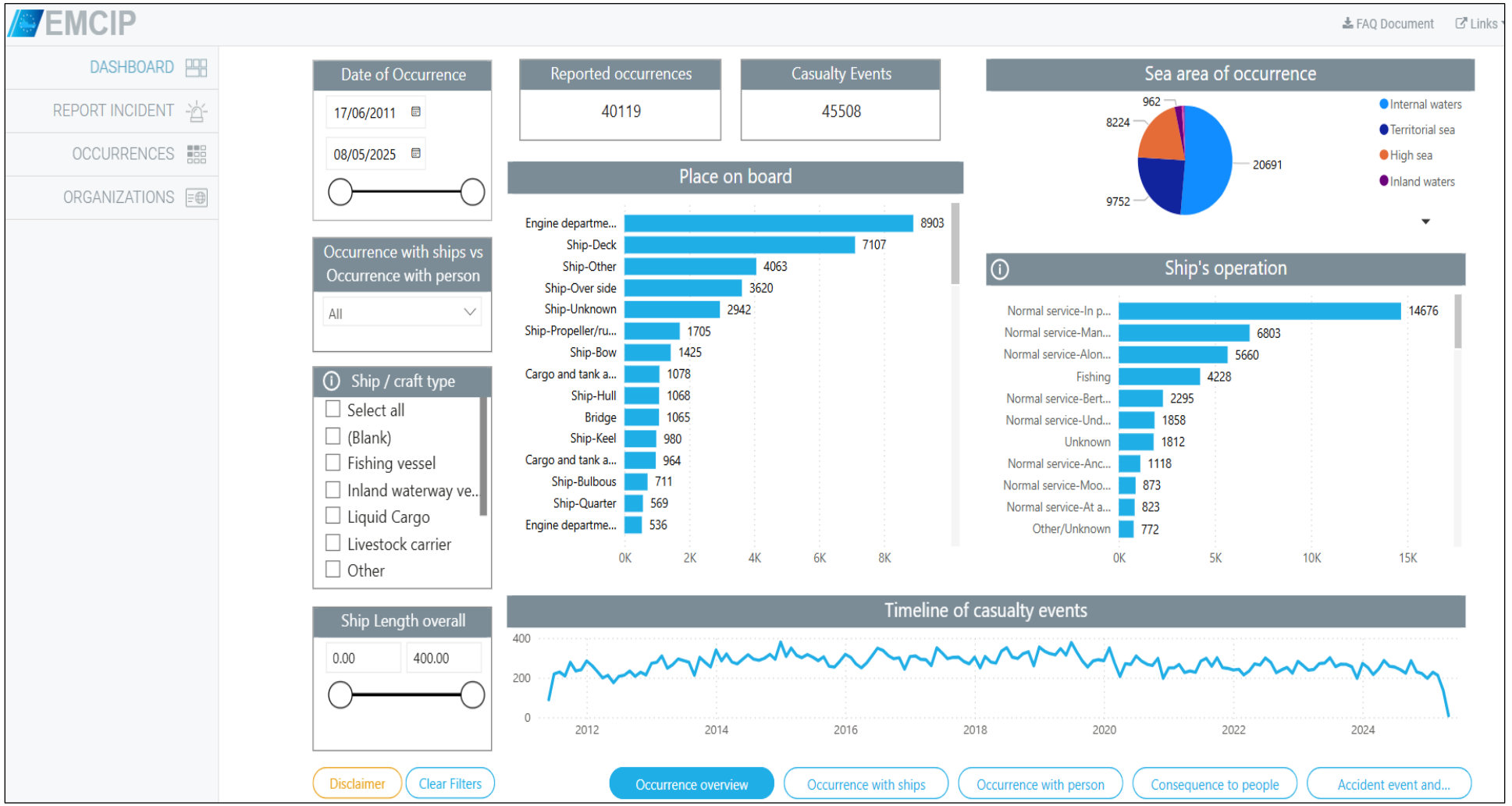


Some of our products



https://www.emsa.europa.eu/accident-investigation-publications.html

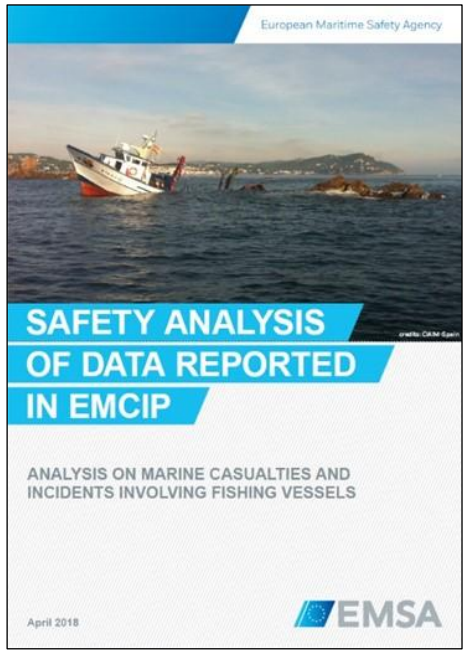
EMCIP public portal

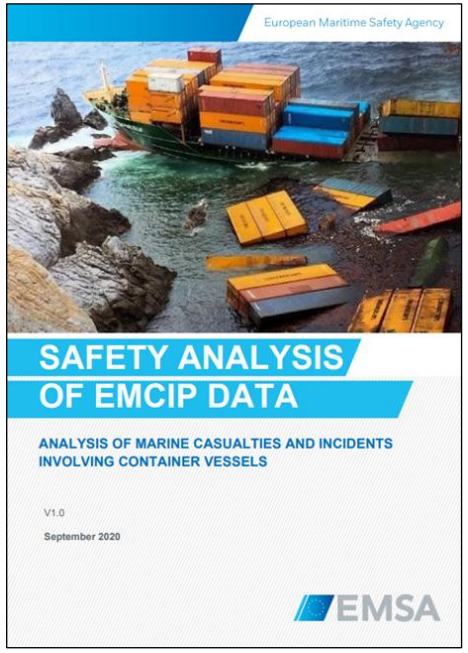


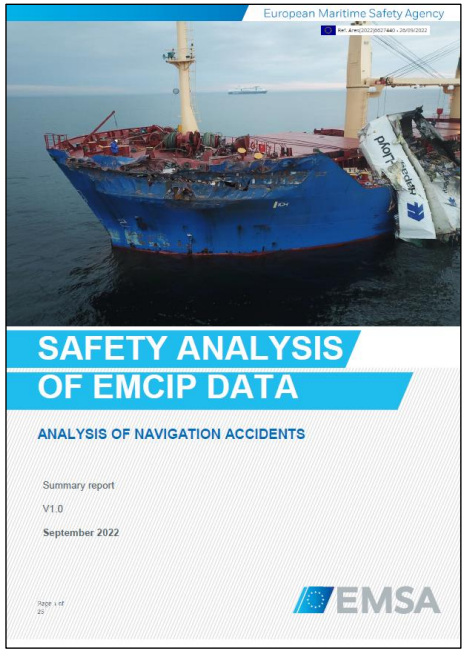
https://portal.emsa.europa.eu/emcip-public/#/dashboard

https://commons.wikimedia.org/wiki/File:Double_herm_Chiaramonti_Inv1395.jpg

Some of our products







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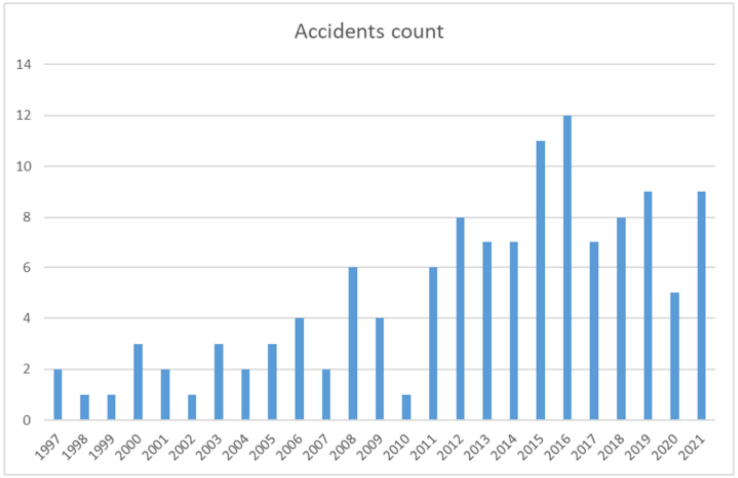
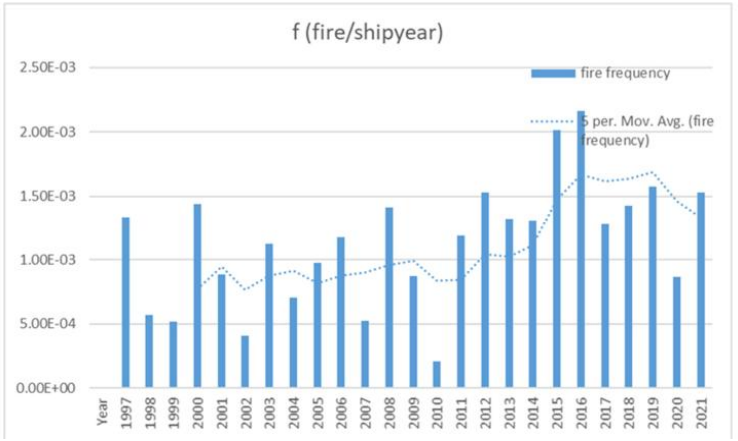
EMCIP IN ACTION - CARGOSAFE





Formal Safety Assessment Process

1 HAZID → 2 RISK MODEL → 3 RISK CONTROL OPTIONS →

→ 4 COST EFFECTIVENESS → 5 POLICY MAKERS - IMO

CARGOSAFE IDENTIFED 17 Cost-Effective Measures:

- **2 for Prevention**
- **6 for Detection**
- **6 for Fire-fighting**
- **3 for Containment**

These measures are being discussed at IMO for SOLAS amendments

New risks – how to approach them without statistics?

Risk assessment – harmonisation

Reliability analysis – need to develop databases

Risk Based Assessment Tool – RBAT for MASS

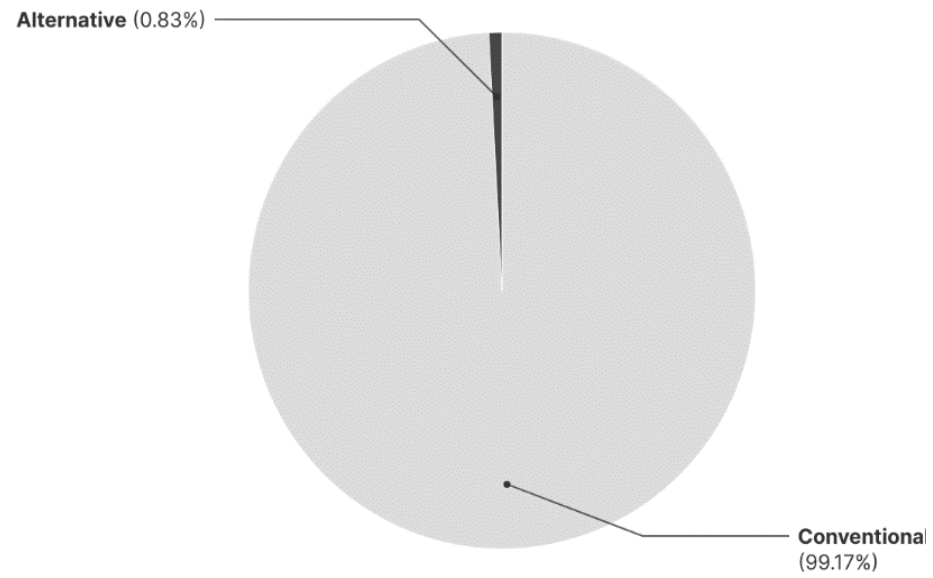
Risk Based Assessment Tool – RBAT is included in the IMO Interim Guidelines for MASS

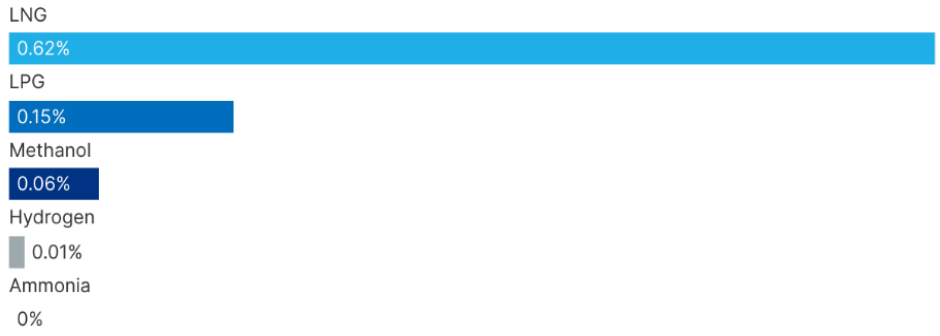
EMSA

Alternative fuels uptake – World Fleet

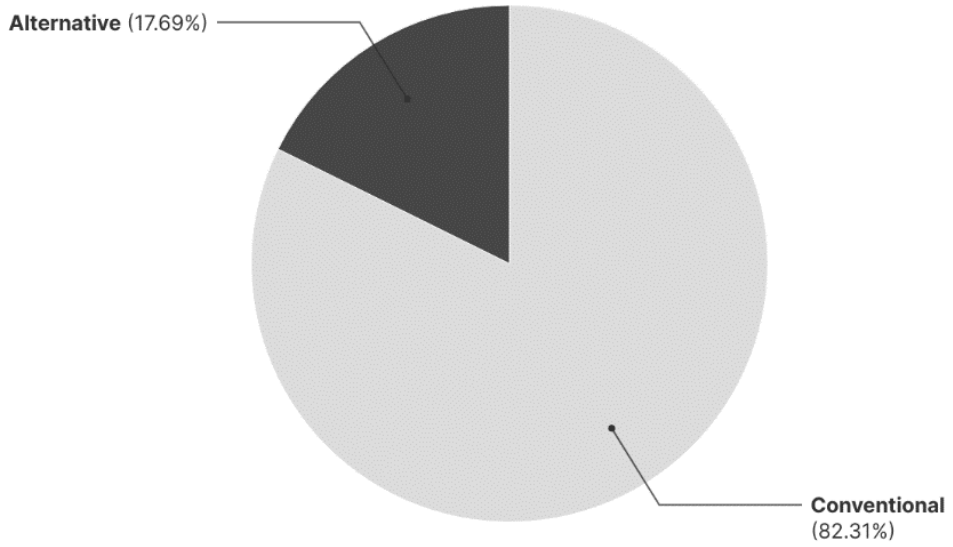
World fleet – all ship types

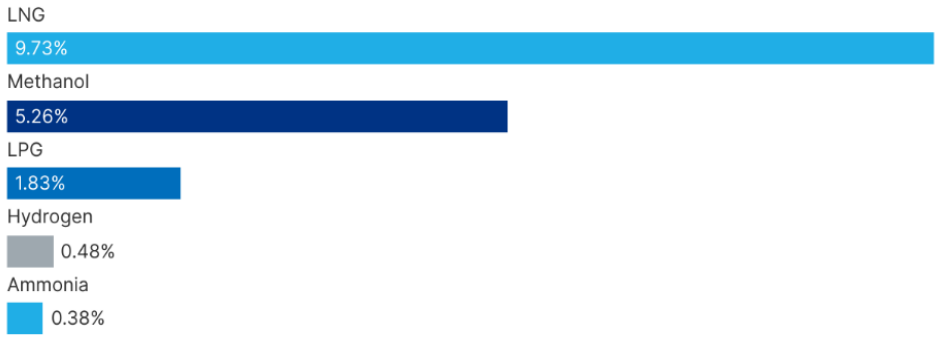
In operation





On order for delivery until 2033





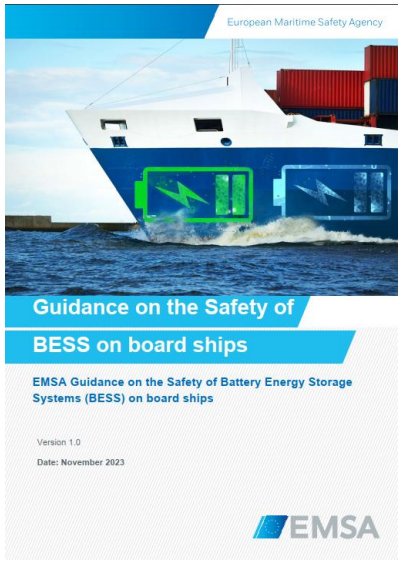
EMSA Guidance - Electrification

Carriage of vehicles using Alternative Fuels/Batteries

AFVs Guidance

May 2022

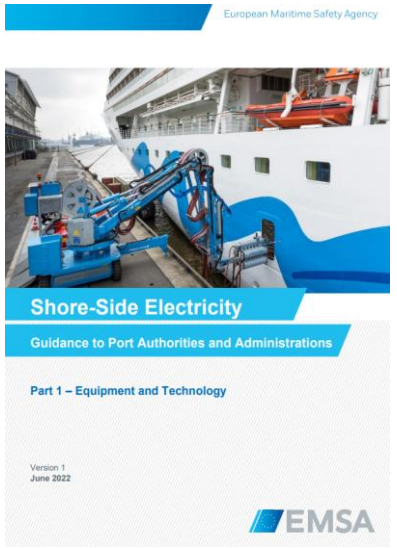
Batteries for ship's services



BESS Safety Guidance

Nov. 2023

Shore-Side Electricity



SSE Guidance

for Port Authorities and Administrations

June 2022

Studies – Alternative fuels

Toxic
20 ppm (8h) EU-EOL
IDLH 300 ppm

Corrosive to metals and skin

Flammability limit
15-28%
Narrow
Medium concentration

Contracted to **ABS Hellenic SM LLC, Fundacion Valenciaport and NTUA**

Start date: 18/09/2023 -
End date: Q4 2025

Contracted to **DNV AS**

Start date: 19/09/2023 -
End date: Q4 2024

Flammability limit
4-77%
Extremely wide
Low concentration

Liquefied gas - cryogenic
Compressed at 350-700 bar
Asphyxiant

BLEVE
Rapid phase transition
High flame velocity (>7x more than LNG)

Contracted to **DNV AS**

Start date: 6/05/2024 -
End date: Q1 2026

ALTERNATIVE FUELS

HYDROGEN EXAMPLE

Hydrogen properties, regulations and accidents overview

PART I – Hydrogen Properties, Regulations and Accidents Review

Some conclusions:

- Technical measures more effective for mitigation and control than operational measures
- ISO 2015 and NASA 1997 - Regulators are advised to assume an ignition source is present even when acceptable standards for certified electrical equipment are followed
- Hydrogen leakages should be prevented from reaching areas where combustion could occur

Hydrogen properties, regulations and accidents overview

HIAD 2.0 Database(575 accidents)

EUROPA - MINERVA Home Page - European Commission - HIADPT

75% initiated by hydrogen systems

25% by non-hydrogen systems

79% involved ignited hydrogen

48% led to explosion

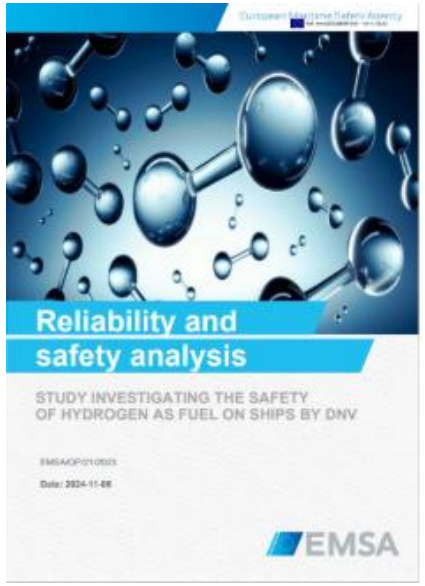
31% resulted in fire

15% resulted in leakage with no ignition

6% were near misses

Note: Accidents recorded since the 1960s - 88 accidents in the past 10 years, 41 in the past 5 years

Reliability analysis



PART II – Reliability analysis

Some conclusions:

- Heat exchangers, compressors, pumps and filters have higher leak rates compared to other components
- Traditional gas detectors have long response time - likely too long to prevent a critical gas cloud from occurring on open deck
- Strategically mounted excess flow valves and restrictive orifices can be used to reduce leak rates, but have limitations
- Lack of hydrogen-specific failure data and uncertainties wrt suitability for ship applications result in a high degree of uncertainty in leak frequency analysis in QRAs for hydrogen fuel system installations

HazID and Risk Analysis
Compressed hydrogen on open deck

- High likelihood of leakages in fuel systems (Reliability analysis)

- Traditional gas detectors have long response time (Reliability analysis)
  - likely too long to prevent a critical gas cloud from occurring on open deck

- Ignition should be assumed (NASA, ISO)

Mitigating actions:

Complete inerted secondary enclosures for hydrogen fuel piping systems

- Enables rapid leakage detection
- Enables leaked hydrogen to be led to a safe area (e.g. vent mast)
- Inerting prevents ignition

Challenging for portable tanks, which depends on non-permanent connections to ship systems

ALTERNATIVE FUEL VEHICLES

FOCUS ON FIRE SAFETY

ALTERNATIVE FUEL VEHICLES

ALTERNATIVE FUEL VEHICLES

- **Separated in three parts:**
  - General;
  - Ropax;
  - Ro-ro cargo and vehicle carriers;
  - + Annexes

EMSA is starting a new safety assessment study addressing

Alternative Fuels Vehicles (AFVs) fire safety on-board of ships

The study includes an extensive experimental campaign and builds on previous studies such as FIRESAFE I and II and LASHFIRE project

Thank you!

emsa.europa.eu

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European Maritime Safety Agency