Tanker Operator Conference
Challenges of the next ten years

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Outline

- Context
- What's the Problem today?
- The Future?
- IMarEST

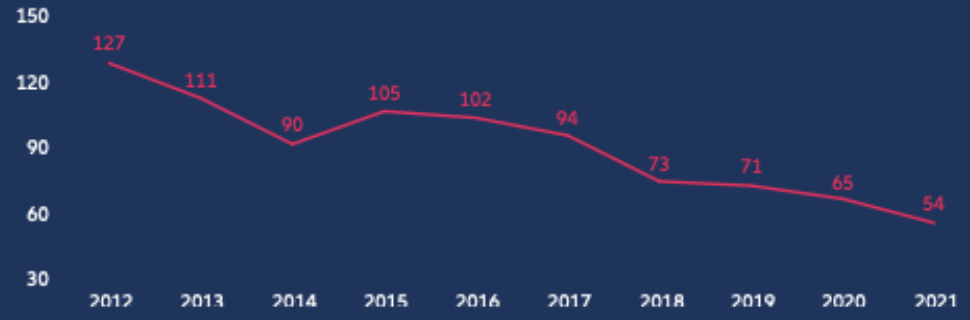
CONTEXT

Casualty trends

Total losses by year - 57% decline over a decade

Safety improvements have been impressive. In the early 1990s, the global fleet was losing 200+ vessels a year. This rate has dropped to around 50 to 75 a year over the past four years.

Vessels over 100GT only



Source: Lloyd's List Intelligence Casualty Statistics
Data Analysis & Graphic: Allianz Global Corporate & Specialty

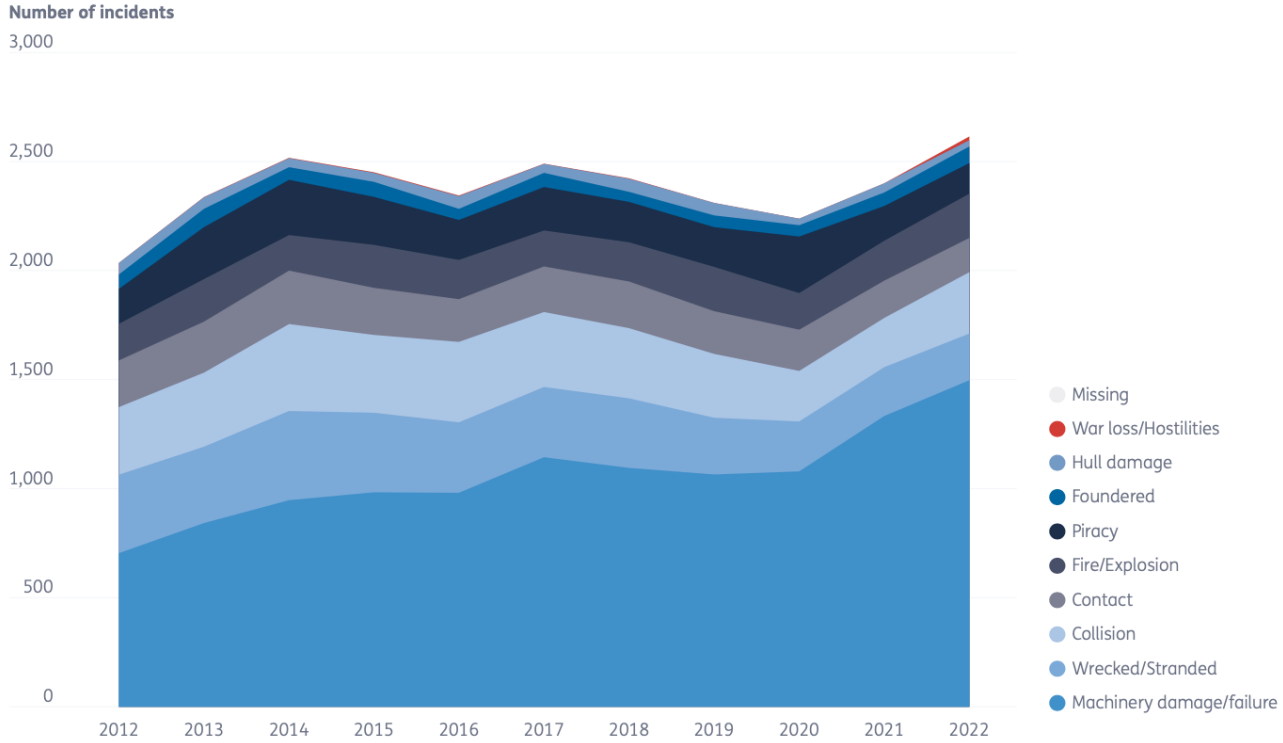
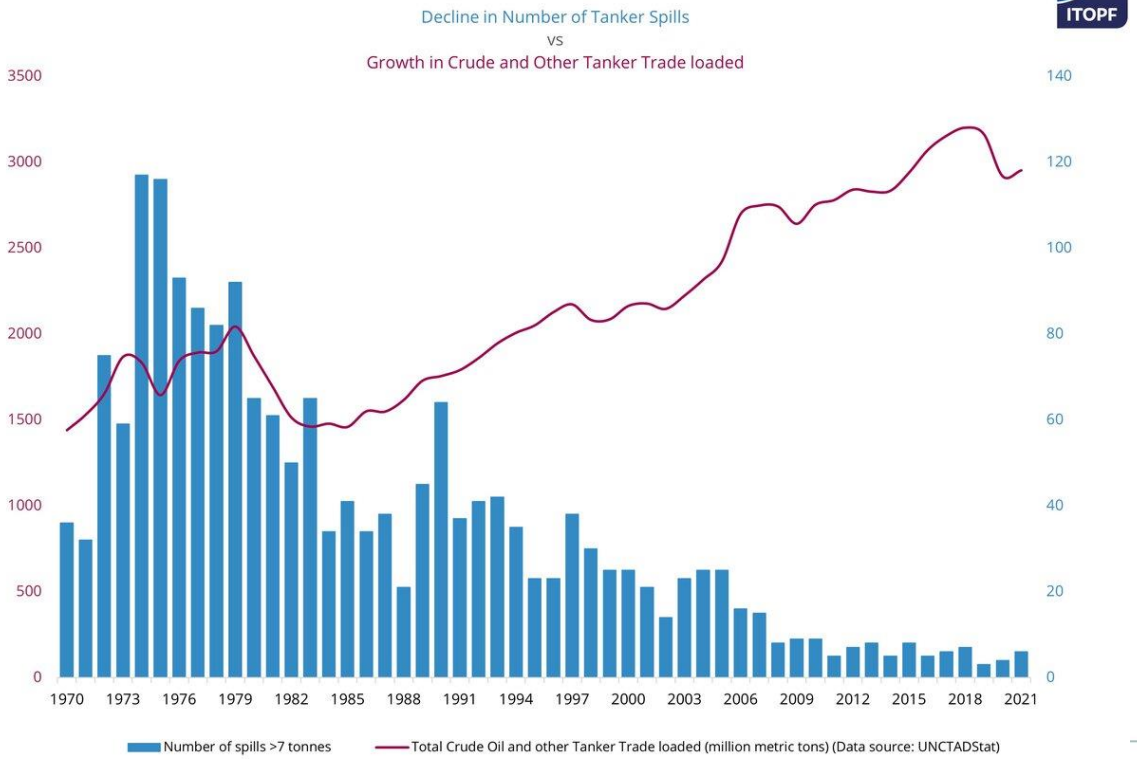


Figure 2: Incidents by casualty type 2012-2022

Maritime safety trends 2012-2022

Advancing a culture of safety in a changing industry landscape

A Remarkable Result



WHAT'S THE PROBLEM TODAY?

What's the Problem?

'Things that have never happened before happen every day'

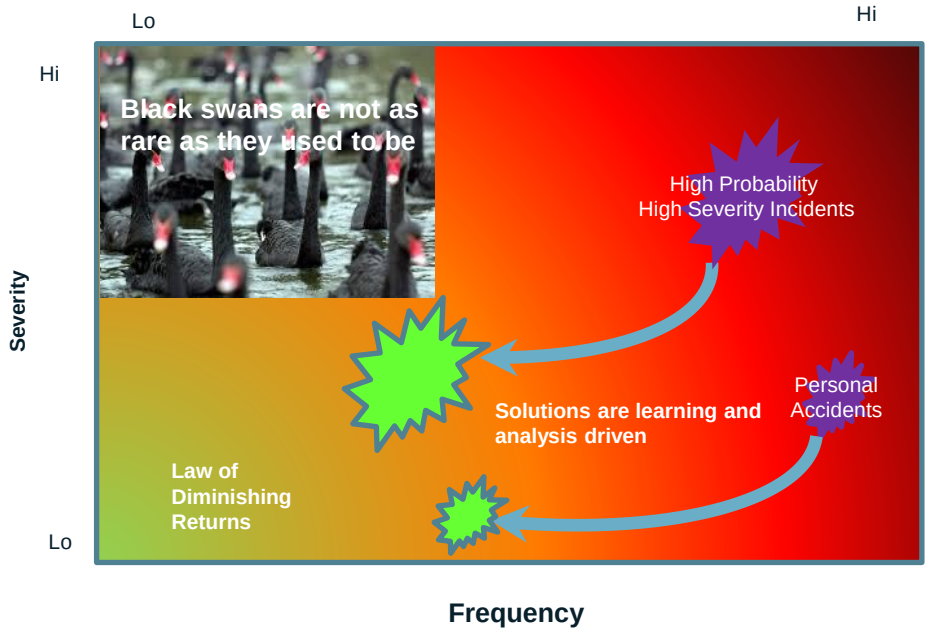
Scott Sagan The Limits of Safety

'In the marine industry things that **have** happened before happen every day in different ways'

Shaw's corollary

The industry has become more complex and less predictable.

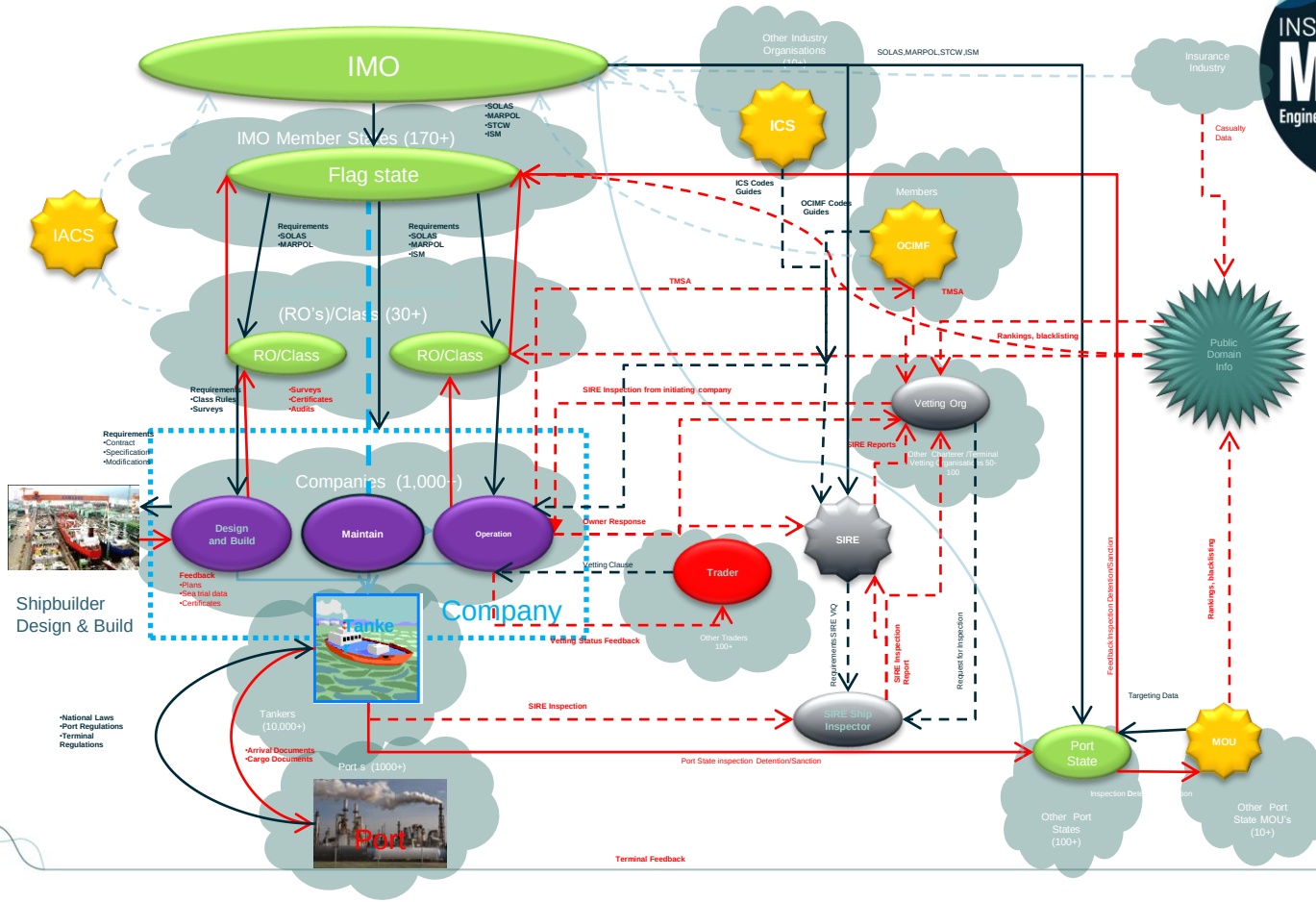
Risk assessment & Black Swans



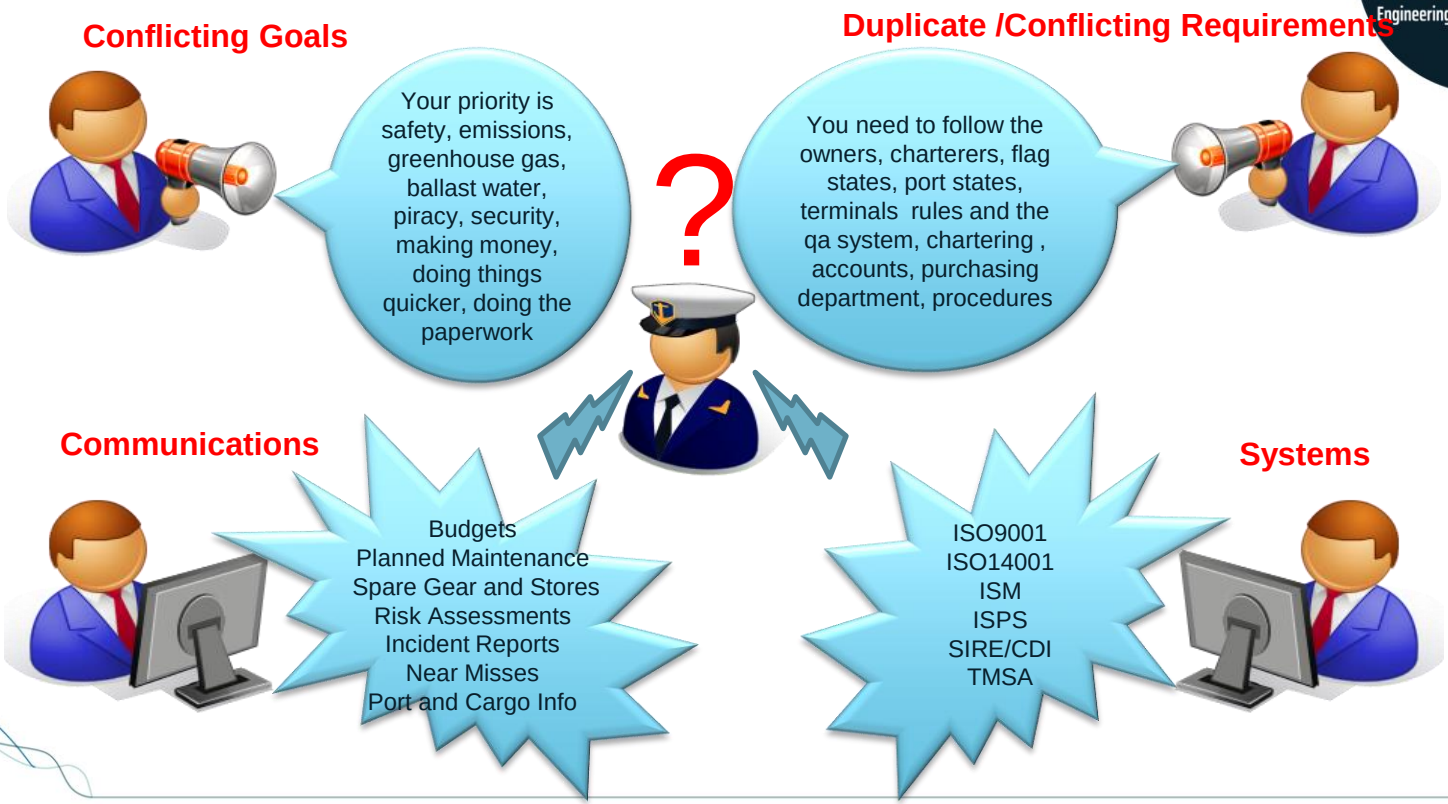
Unruly Technology

- Automation & Navigation
  - ECDIS
  - Arleigh Burke collisions?
  - Air France Airbus
  - B737 Max
- Irony of Automation
  - Automation may mask the development of a serious system failure, resulting in limited time for the operator to gain ‘situational awareness’ and react
  - Lack of practice running systems on manual
- System design
  - Reliability of control systems
  - Poor integration
  - Lack of standardisation
- Limited information and specific training

Is this a Complex System?



The View Onboard



The 80% Myth

- 80% of accidents on ships are caused by human error (some even say the 'human element').
- What's wrong with this statement?
  - Are seafarers the only humans in shipping?
  - Where is the evidence?

The 80% Myth

'Rather than being the main instigators of an accident, operators tend to be the inheritors of system defects created by poor design, incorrect installation and bad management decisions. Their part is usually that of adding the final garnish to a lethal brew whose ingredients have been long in the cooking'

James Reason 1990

'With regard to a common belief that the majority of maritime accidents are to some extent caused by a human error of a kind, the performed review identified a handful of references. However, little evidence has been found within the reviewed sample of scholarly literature to support the popular 80% value.'

Searching for the origins of the myth 80% human error impact on maritime safety ***Krzysztof Wrobel 2021***

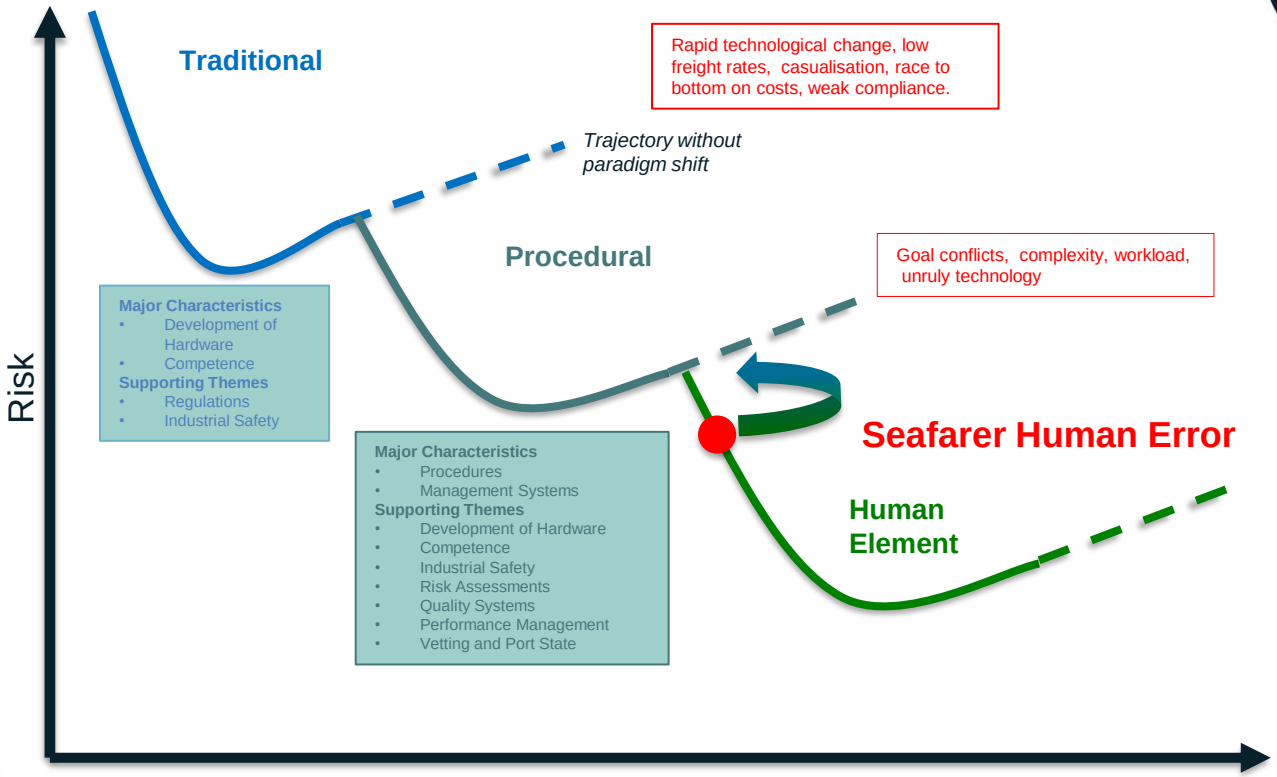
What's the Answer?

100% of accidents aboard ship are caused by human error but they are caused by all the humans in the system not just those at the 'sharp end'. This includes designers of ships and equipment, shipbuilders, classification societies, shipowners, repairers etc and even computer programmers !!

Even if you remove seafarers from ships 100% of accidents will still be caused by human error!!

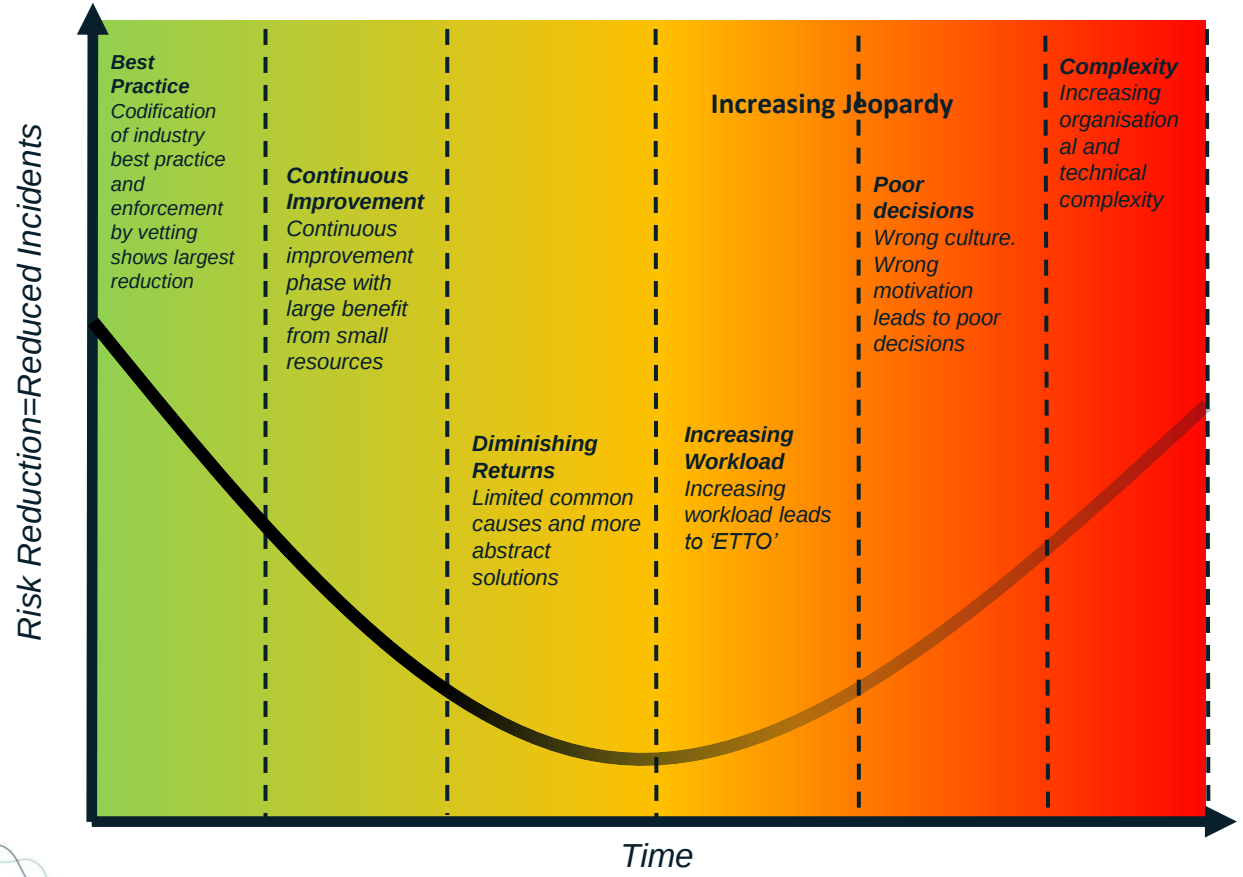
We need to blame less and have more humility

Where should we be now?

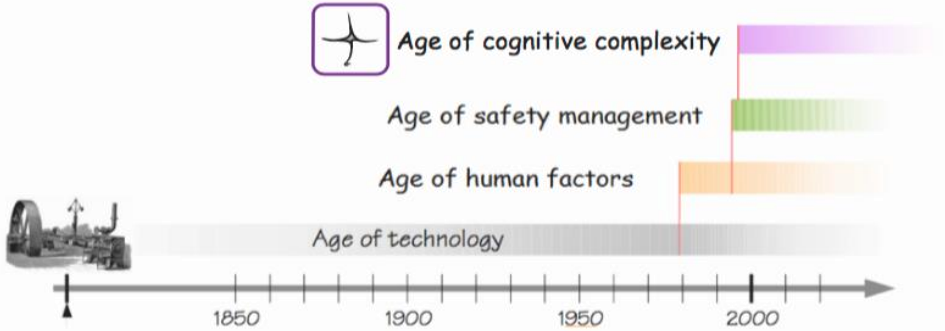


Caught in a loop.
Blame the seafarer

ISM - Law of Diminishing Returns



Evolution of safety



AGE OF TECHNOLOGY
- Humans are cogs in a machine
- Safety-I: what's going wrong

AGE OF HUMAN FACTORS
- Humans as hazards
- Rules-based safety culture

AGE OF SAFETY MANAGEMENT
- Engineering systems thinking
- Humans as heroes
- Safety-II: what's going right

AGE OF COGNITIVE COMPLEXITY
- Complex adaptive systems
- Resilience v Robustness
- Human sensor networks
- Distributed cognition

Source: Erik Hollnagel, 2012 (modified)

Time Pressure-A Titanic Problem

The myths-blue riband

*The enquiry '…. **the loss of the said ship was due to collision with an iceberg brought about by the excess speed at which the ship was being navigated'***

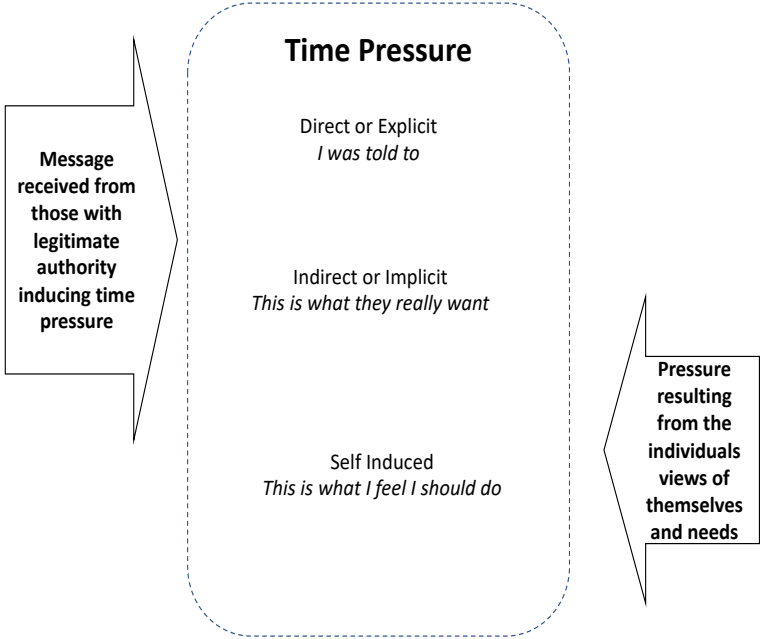
*'… **which other skilled men would have done in the same position. However, the practice itself was faulty and it is to be hoped that the last has been heard of this practice. What was a mistake in the case of the Titanic would without doubt be negligence in any similar case in the future? '***

Other Examples

- Torrey Canyon
- Rena
- Herald of Free Enterprise
- Hoegh Osaka
- Thames Incident
- Time pressure can be identified in:-
  - Collisions and Groundings
  - Mooring, Cargo, Maintenance and Enclosed Space incidents

- **110 years after the Titanic we know time pressure is there but has it been dealt with ??!!**
- **Time pressure is increasing**
- **Who owns the problem?**

About Time Pressure



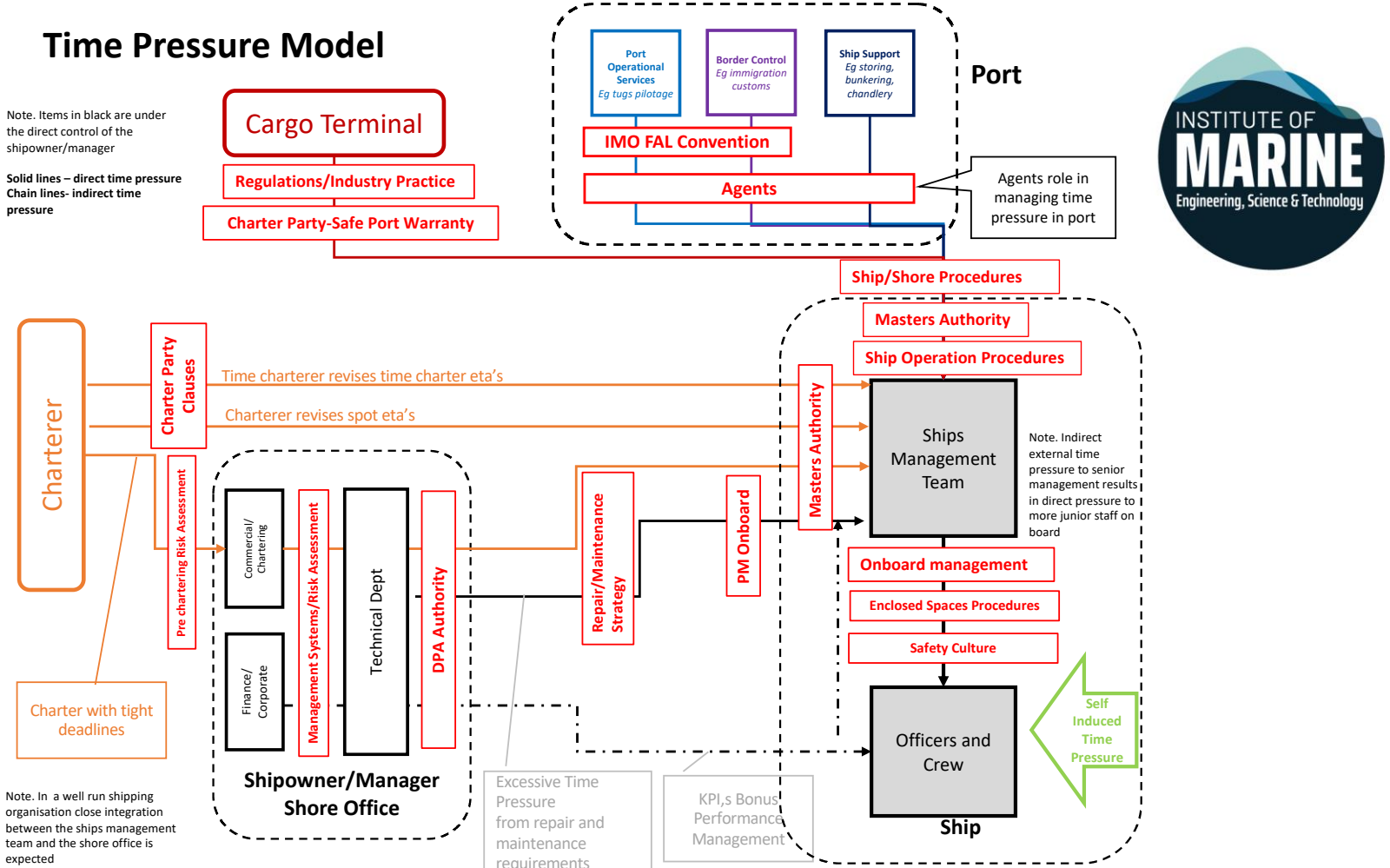
Effect of Time Pressure

- Fast and Slow Thinking
  Thinking Fast and Slow-Daniel Kahneman
- Efficiency Thoroughness Trade off
  The ETTO Principle Erik Hollnagel
- 'Rescuers syndrome'
- Stress and Fatigue

Fatigue

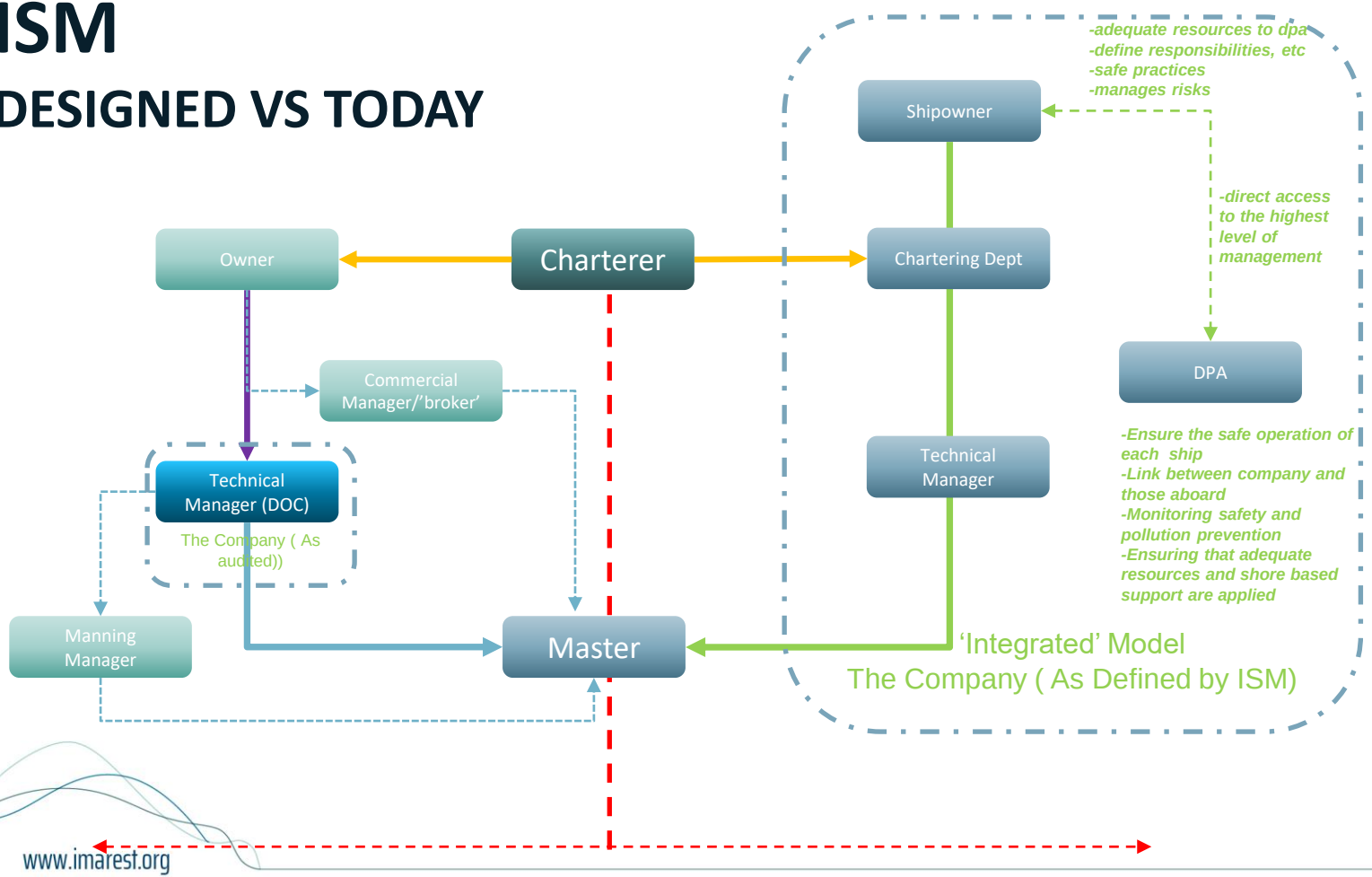
Time pressure is specific to a task or operation, fatigue is cumulative

Time Pressure Model



ISM

DESIGNED VS TODAY



Managed by Contract ('Hard' Relationships)

Managed by People ('Soft' Relationships)

Human Element Industry Group (HEIG)

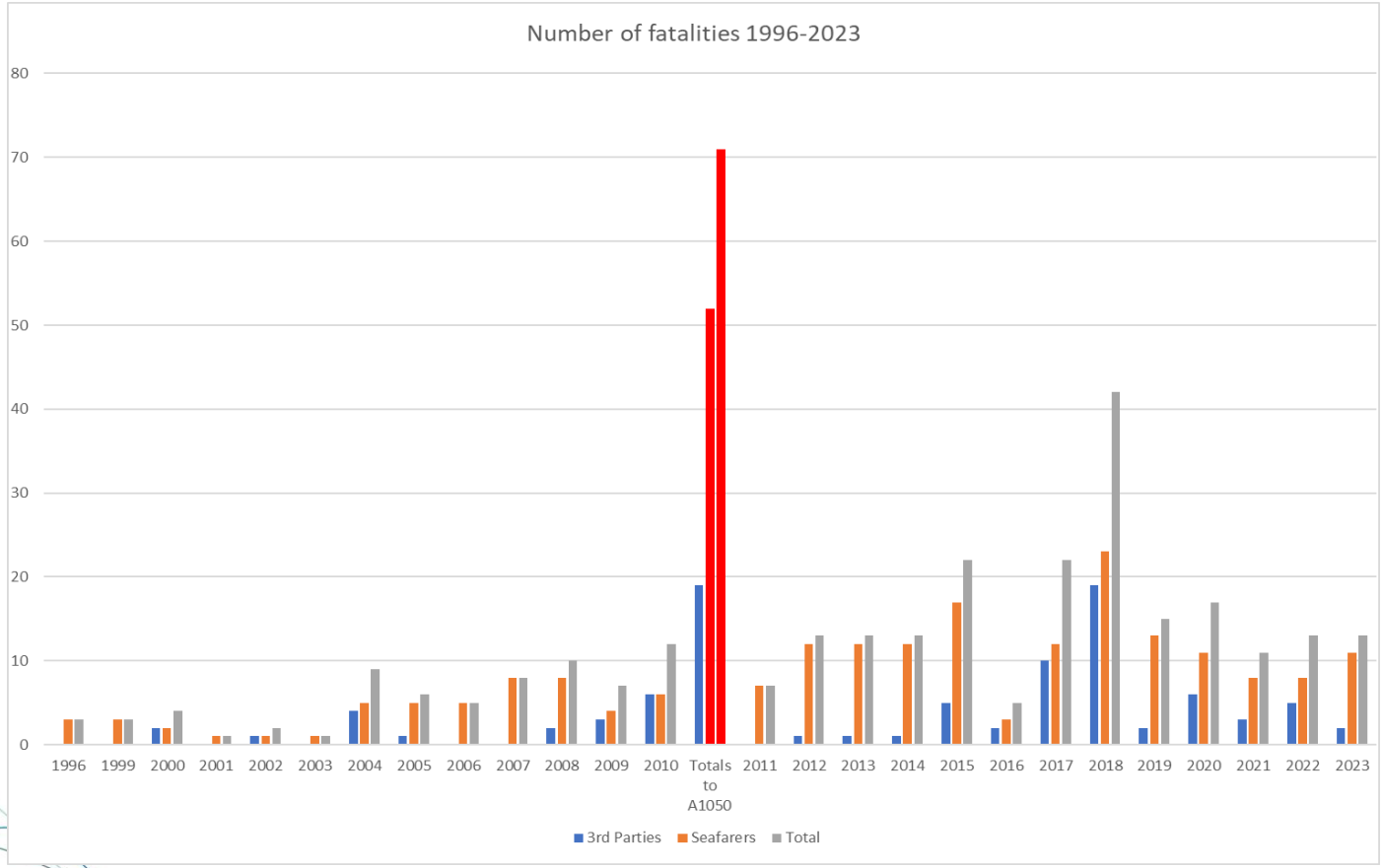
What it is

- Set up 2018 at request from Sec Gen IMO to facilitate progress in the Human Element
- Membership NGO's accredited to IMO
- Can co-opt other members and work with flags
- NI (Chair), IMarEST, ICS, ITF, Nautilus, OCIMF, Intertanko, Intercargo, SIGTTO, IMPA, IFMMA, ICMA, International Group of P&I Clubs, IACS,BIMCO.
- IMarEST founder member
- HE Checklist

Enclosed Space Project

- Initiated by Intermanager following survey of 5000 seafarers as deaths appear to be increasing
- Biggest occupational safety killer aboard ship (CHiRP)
- Many investigations tend to blame the victim
- Workstreams
  - *Procedures, Regulations and Cargo*
  - *Investigation*
  - *Technical Solutions*
  - *Human Factors*
  - *Time Pressure (abuse)*

40-50 people from about 20 organisations on 5 continents working on project



INSTITUTE OF MARINE Engineering, Science & Technology

Source Intermanager

WHAT'S THE FUTURE?

Teens to Twenties-challenging our assumptions

Assumptions

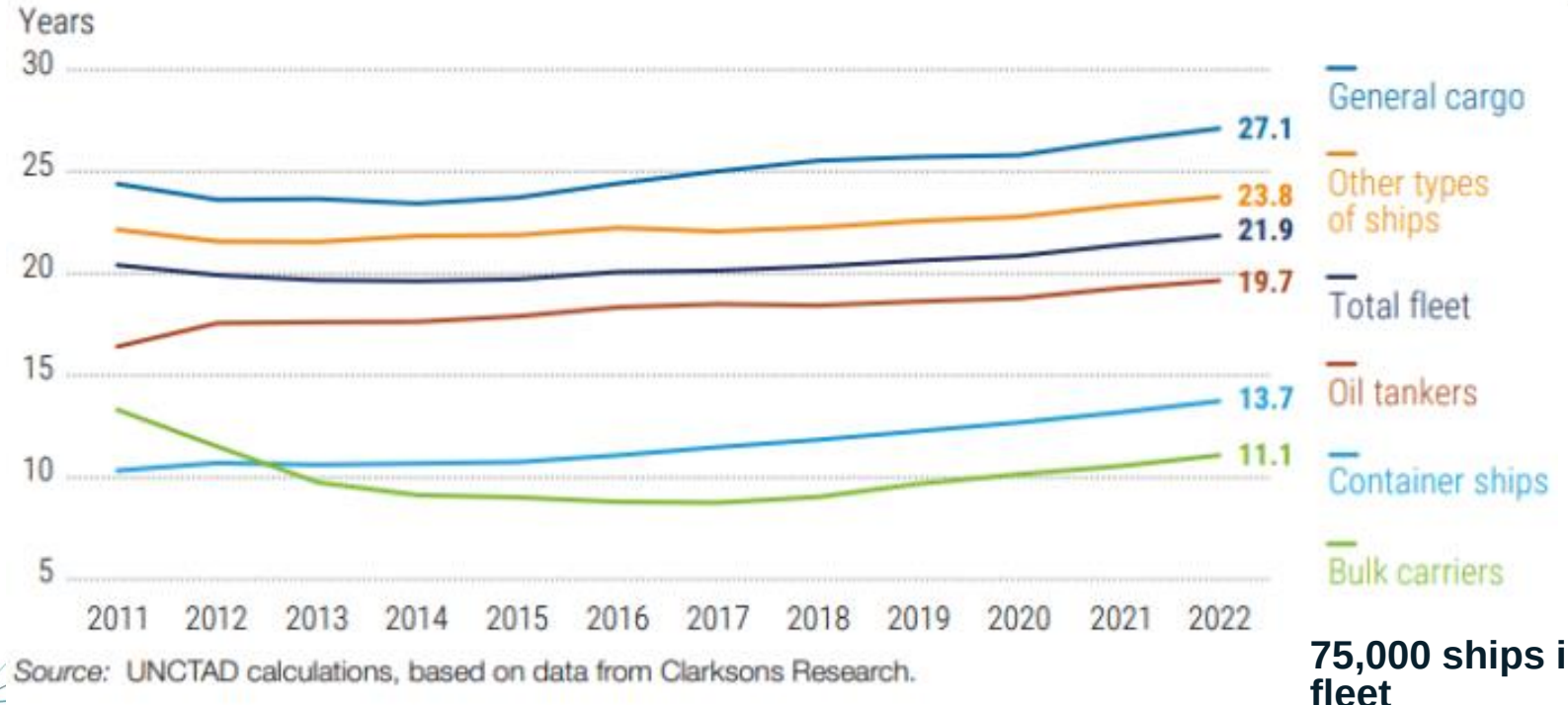
- Globalisation Works
  - Economics beats world dominance
  - Ricardo was right
- Cheapest is best
  - Steady State
  - Optimisation
  - Who needs stock?
- Environment
  - Emissions
  - BWT
  - GHG
  - Oil is dead
- Digitalisation
  - will change the world for the better

Legacy

- Changing Trade Patterns
- Loss of Resilience/fragile supply chains
- Wrong ships?
- Unruly Technology
  - Scrubbers/IMO2020
  - Ballast Water Treatment
  - CII
- Organisational Complexity
- Proceduralisation reduces resilience

Have we adapted to the change?

Age and Size of Fleet



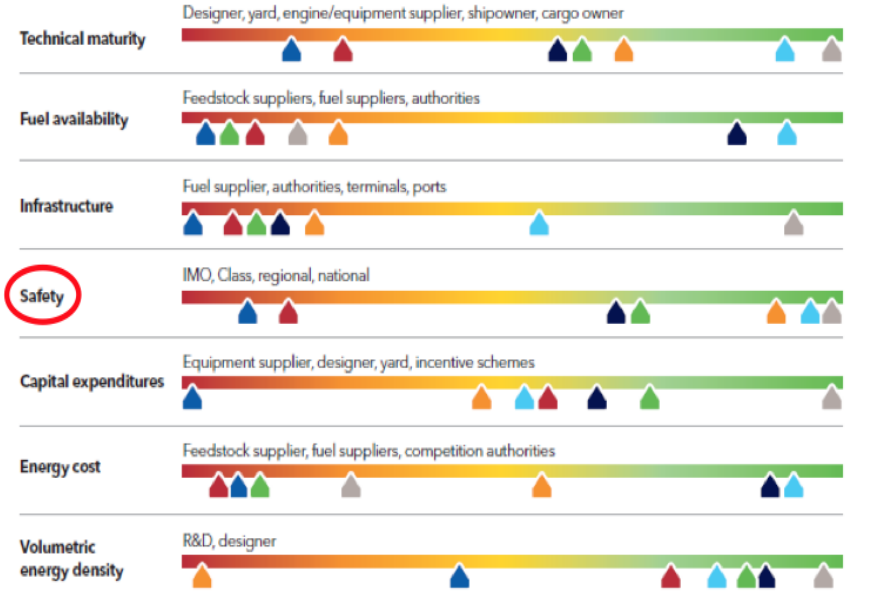
Source: UNCTAD calculations, based on data from Clarksons Research.

75,000 ships in fleet

The current (and future) fleet

- World trade is more unpredictable and JIT supply chains are under pressure-leading to increasing time pressure risk
- Current design of ships will continue to operate (obviously) and be built to maintain world trade.
- Those ships need to be managed, manned, maintained and operated
- Investment decisions, especially as interest rates rise, require a long life and a residual value :-
  - Long life written down to scrap
  - Shorter life with sale for further trading
- How do you finance new ships when residual values are low?

Target Zero Maturity of Technology



HVO – hydrotreated vegetable oil;

LNG – liquefied natural gas;

LPG – liquefied petroleum gas;

Hydrogen – carbon-neutral liquefied hydrogen consumed in fuel cells;

Ammonia – carbon-neutral ammonia burned in internal combustion engines;

Electricity in batteries – full-electric with batteries;

Methanol – carbon-neutral methanol burned in internal combustion engines.

SOURCE DNV

Target Zero

- 1.5% CO2 is the target (even that is too high!)
- There is no other option
- New infrastructure has to be built and financed
- New ships have to be built and financed-$3.4 Trillion
- We need to understand the ‘bottlenecks’
- We need to prioritise the engineering

Autonomy

- Modern merchant ship highly automated manning reduced. (15-20 for medium tanker)
- Limiting factor for manning is critical operations and maintenance
- Autonomous vessels for military and exploration use operate from base on prepare-deploy-task-recover-repair cycle.

Image Kongsberg

Cargo carrying autonomous ships

- What changes required to ports to support?
- How do you do maintenance when port turnaround must be fast for economics-otherwise more ship required to move the same cargo?
- Can quality of vessels and systems be maintained with price competition?
- Will autonomous ships only do dedicated trades or can enough ports be prepared for spot?
- Are we prepared for the social impact?
- The tanker paradox?
- Funding in difficult times – increasing interest rates discourage capital investment?
- Will environmental investment take priority especially with owners desire for long asset life?

AI/Digital/Autonomy

- IMO – workload /training for staff on autonomous ships
- Discussion evolving to how can technology help humans
- AI-newbuild or retrofit?

Summary

- 50 years of development from traditional to procedural to modified procedural/human error paradigm
- When will we engage with human factors?
- Oil Pollution an example for environmental change?
- Existing fleet needs focus
- Target zero not negotiable it affects us all.
- Increasing ambition means more urgency in engineering the solution
- Is there enough capital for autonomy and target zero?
- AI/Digital is about helping humans not replacing them ?
- Target zero is non negotiable, Autonomy a choice?

IMarEST

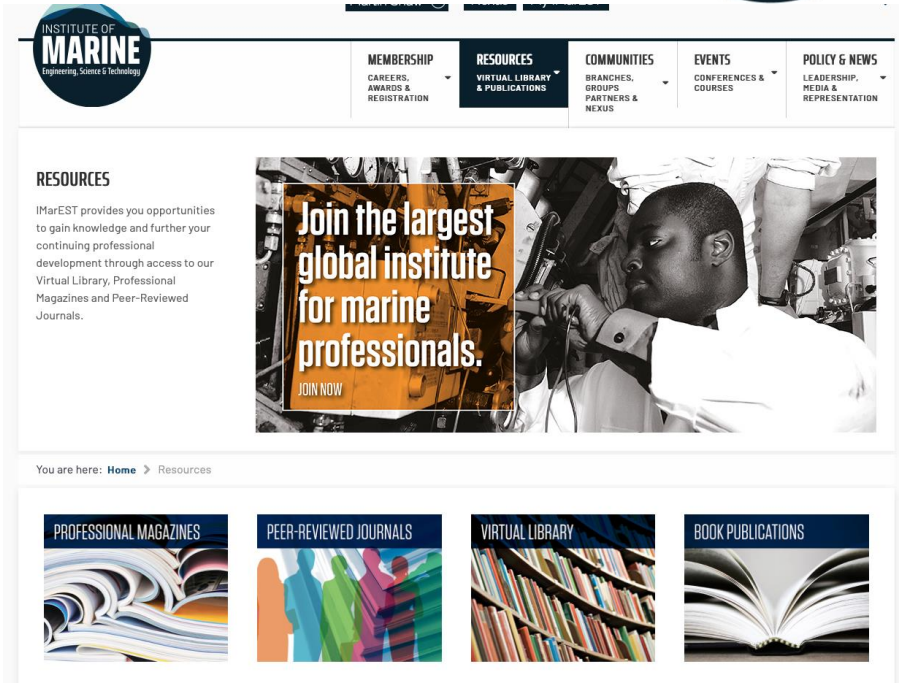
- Formed in 1888
  - *'social elevation of members generally'*
  - *'...advancement of knowledge....'.*
  - *'....new and improved ways of working.....'*
  - *'...status of profession'*
  - *'reading and recreation rooms'*
- 20,000 Members-Largest Marine Engineering Professional Body

Qualification and Accreditation

- Internationally recognised professional qualifications:-
  - Chartered Engineer/Chartered Marine Engineer
  - Incorporated Engineer
  - Marine Engineering Technician
- Post Nominals
  - Fellow (FIMarEST)
  - Member (MIMarEST)
  - Associate Member (AMIMarEST)
  - Student (SIMarEST)
- Accreditation of Educational Institutes

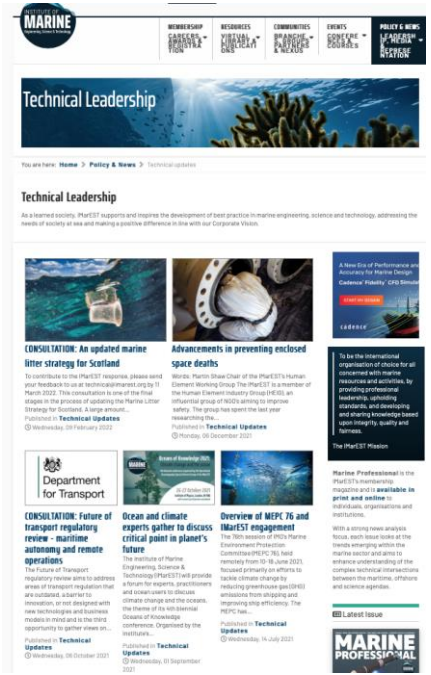
Knowledge

- Journal of Marine Engineering and Technology (JMET)
- Marine Professional
- Virtual Library
- Livestreams/IMarEST TV
- Books and Publications



Sharing Views and Knowledge

- Branches
- SIGs
- Technical Leadership
- NEXUS



Influencing

- Influencing Industry
  - Membership of industry groups and projects
- Voice at IMO
  - Environment
  - Autonomy
  - Human Element