Re-drawing navigation systematically to make it safer – for people, ships, and animals

The OCEAN project

by Fitzwilliam Scott

Navigational accidents at sea are infrequent, but even so, when they do happen, they can have a devastating effect. Arguably, risks are increasing as ships grow larger and world trade expands. Even the best technology can create problems if human factors are not considered when designing ships, vessel equipment, human-machine teaming & interaction, and the planning and execution of the jobs on board. That is why the European Commission has awarded Horizon Europe funding to the Operator-Centred Enhancement of Awareness in Navigation (OCEAN) project: to improve navigational safety for all vessels.

OCEAN – launched in October 2022 and due to run until 2025 – is focused on enhancing operator navigational awareness to reduce the frequency of severe accidents like collision and grounding, likewise to preserve the life of marine mammals and mitigate the risk presented by floating obstacles to smaller ships.

The initiative will contribute to an improved understanding of accident root causes and strive to reduce the resulting human, environmental, and economic losses through socio-technical innovations supporting ship navigators.

The consortium behind the project, coordinated by Western Norway University of Applied Sciences, includes 13 partner organisations across seven different European countries representing the industry, academia, NGOs, and end users.

Fundamental recognition

The ambition of OCEAN is to contribute to the mitigation of navigational accidents by supporting navigators to do an even better job than they do presently. The project consortium will address the most pertinent elements contributing to events-turning-accidents: training, technical, human or organisational factors, operational constraints, processes & procedures, and commercial pressures. It will also recommend improvements and amendments to regulations, standards, and bridge equipment design approaches.

A critical aspect of the project will be enhancing human decision-making rather than replacing it, a clear recognition – in this age of all-things-technology-&-automation! – that technological solutions should support human decisions. Another essential project facet will be its focus on all maritime navigation decision-makers: leisure, fishing, commercial, naval, etc. For instance, the danger of lost containers may be reported by a freighter but could cause a devastating accident with a cutter or sailboat. The project will also pay attention to protecting sea mammals, such as whales and dolphins, from all forms of watercraft – thus creating an improved environment for coexistence.

The project recognises that mariners are fundamentally very competent at what they do. Being a product of skills honed by experience, careful training, adequate equipment, effective practices, rules & regulations, as well as a strong professional culture, navigators safely steer the worldwide commercial fleet that supports the globe with an essential service. From this position, OCEAN seeks to enhance navigational awareness 'on the spot' and to improve the performance of evasive manoeuvring to avoid collision with near-field threats.

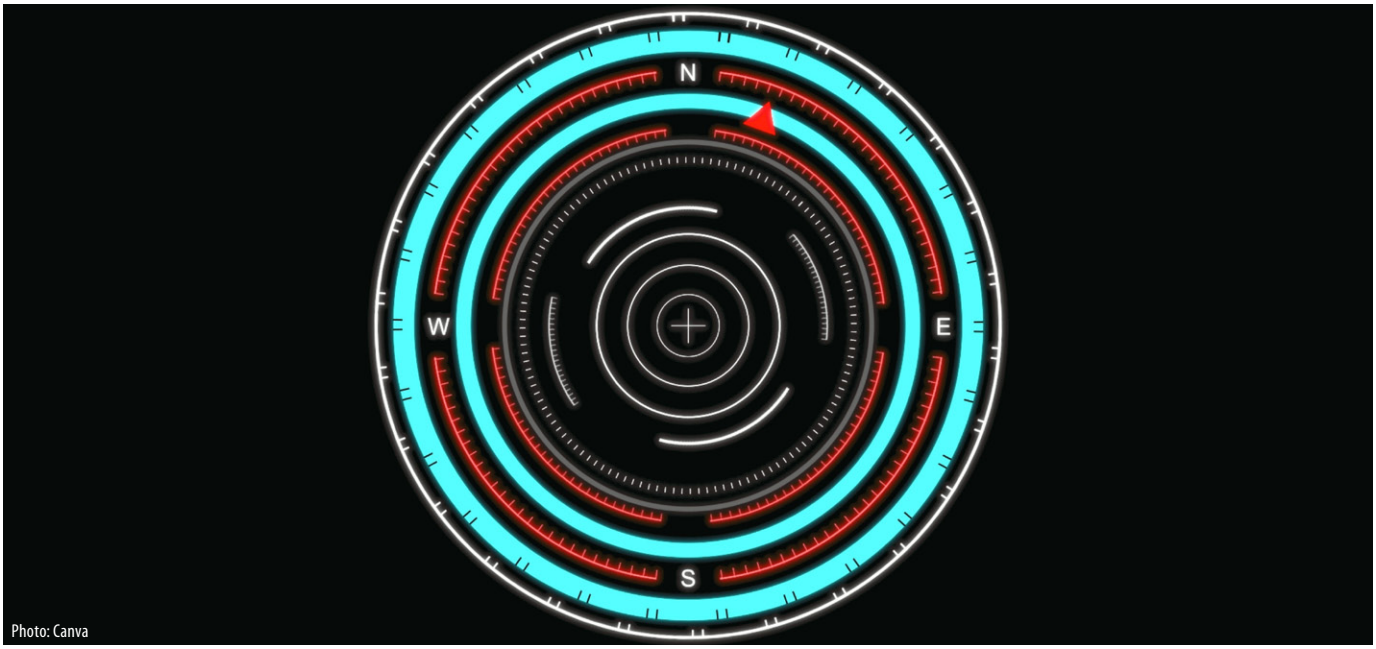


Photo: Canva

To that end, the project will deliver and demonstrate several human-centred innovations. For example, a 4D situation awareness display will improve the visualisation of navigational hazards, integrating current bridge information systems with marine mammals and lost floating containers detection & tracking capacity specifically developed within the project.

Sharp as a navigator

A key OCEAN project convergence point is the overall navigation situation assessment made by the operator. Superior to the discrete data currently available on radar or the electronic chart display and information and automatic identification systems, the objective is to provide an integrated, designed-for-the-purpose, uncluttered, and focused presentation of near-field threats and navigational hindrances. This way, the operators' mental load will be eased while sharpening their attention and awareness, eventually leading to significantly fewer accidents and incidents – scaled for all mariners regardless of the size of their craft.

The vehicle for this purpose is an improved situation awareness display, the design process being co-creative and human-centred. Considering the completeness of the information provided, adding presence data on marine mammals and stranded containers is needed. Yet, while visualising data from present bridge systems is a question of interfacing primarily, obtaining data on the latter two will require a substantial data collection, processing and distribution effort.

The project will also design and implement a European navigational hazard data infrastructure to feed multi-source observations and hazard predictions relating to floating containers and large aggregations of marine mammals into the existing distributed maritime warning infrastructure. OCEAN seeks to transfer this data ecosystem to a relevant European organisation for deployment and maintenance. The project aims to demonstrate practical abilities to improve safety, protect the environment, and enhance commercial productivity. Industry stakeholders will also be invited to join the project on a volunteer basis but with opportunities to engage in the conversion, influence development, and benefit from conducting real-life trials.

En route to new standards

The common wisdom is that the maritime industry is somewhat conservative, which has slowed the uptake of user-experience-in-focus technology. It is a viewpoint arguably supported by current international standards, which lend themselves to designing, implementing and testing specialist bridge equipment as individual components rather than systems. Only a single global standard relates to the bridge from this vantage point.

Conceptually, however, the OCEAN project subscribes to the socio-technical worldview where humans, organisations, and technology are considered the main constituents of a total work system. The project partners ascribe to systems engineering, an interdisciplinary field of engineering and management that focuses on designing, integrating and managing complex systems over their life cycles. Moreover, the project work will be governed by human-centred thinking and methodologies.

It is, at present, a universal assumption that when a ship is equipped per the carriage requirements of the International Convention for the Safety of Life at Sea, the navigator has adequate technical support to navigate and manoeuvre safely. However, the International Maritime Organization's equipment performance standards do not explicitly include considerations relating to factors like fatigue, boredom, inadequate bridge procedures & resource management, commercial pressures, display clutter, improper settings of technical devices, limited experience, and environmental challenges (poor weather, among others) – and how these, separately or in conjunction, can cause the human operator to lose the overview. It is within our technological reach to make them, alongside other non-human 'sea users,' feel safe, as well as de-risk big-&-small sailing as far as possible. ■

ocean Co-funded by the EU research & innovation agenda Horizon Europe and UK Research and Innovation (with UK participants supported by grant numbers 10038659, Lloyd's Register, and 10052942, The Nautical Institute), the OCEAN consortium of 13 members represents seven European (coastal) countries. Head to **ocean-navigation-awareness.eu** to meet the project partners, stay up-to-date with the initiative's progress, and explore the opportunities of becoming an industry stakeholder with advanced access to deliverables.