

# Bringing the human element to ship design

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Credit: Fraunhofer FKIE

On a technological behemoth like a ship, in many cases the crew, or "human element" get little attention when planning the design and operations – a mistake, as statistics show: most accidents at sea can be traced back to human error, not technical error. The CyClaDes project brought the industry together and showed how more consideration can

be given to the human operators and their contexts in the shipbuilding and operational process.

Ships are a safe means of transport. When something happens, [human error](#) is usually the cause – according to the latest studies, in 80 percent of the accidents. Economic and technical aspects are often the primary focus when [ships](#) are being planned and designed. How the crew can be included in the on-board procedures then either takes second chair or gets left out completely. "Established ergonomic concepts that improve the interaction between man and machine have, up to now, scarcely been implemented in the maritime industry. The reason often lies in the lack of communication or understanding between crews and engineers, who build the vessels and approve them. Even when there is a transfer of available knowledge, there are often still barriers to implementing it, such as extra costs and inherent risk in changes to a technically proven design," says Dr. Eric Holder of the Human-Machine System's Department of the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE in Wachtberg near Bonn.

## **The maritime industry at one table**

In the EU-sponsored CyClaDes (Crew-Centered Design and Operation of Ships and Ship Systems) project, the FKIE sat at one table with universities, professional organizations, shipbuilders, ship owners, [government agencies](#) and ship crews. The goal of the collaboration: To better integrate the "human factor" in the development phase and the life cycle of a ship – to make shipping even safer. The interdisciplinary team extensively analyzed the places on ships where human needs have been neglected up to now, discovered potential areas where processes could be improved and sent the latest research findings to the relevant parties involved. The project resulted in an e-learning platform, guidelines, checklists and a book for naval architects, which can be put to use immediately by the maritime industry.



The captain looks at the navigational situation from the bridge. The CyClaDes project developed concepts to improve the communication between two control centers onboard (Bridge and Engine Control Room). Credit: Fraunhofer FKIE

Among other things, in cooperation with the World Maritime University, the FKIE scientists defined, planned and conceived several modules for an e-learning platform: The platform provides training scenarios for each stakeholder group. Regardless of whether they were a crew member, ship owner, regulatory agency, systems designer or naval architect, each can find information and instructions here on the topic of user-friendly design. The book "Improving ship operational design", published by the Nautical Institute and written by CyClaDes members and experts in the field, provides naval architects with concrete requirements that crews

face at sea. This knowledge is critical since these days architects and engineers seldom go to sea and sailors hardly have any opportunities to meet with them and exchange ideas. Government agencies can use the guidelines and checklists developed during CyClaDes in regulatory standards and design guidelines or directly in the ship design audit.

## **Two worlds: captain and engineer**

"However, the industry only produces the concepts if they have practical uses," explains Holder. The FKIE examined the navigation bridge and the machine room more closely. "Both of these places play a decisive role in the safety on ships. If something goes wrong here, it can quickly become critical," emphasizes Holder. Communication here often takes place via signals or the ship's telephone. The perspectives from each department on the moving ship can be very different: the clear view from the bridge or an isolated room inside the ship; above the captain wants to move ahead as quickly as possible, below the engineers see the safety and durability of their engines first.

The FKIE methodologically analyzed the communication processes and overlapping tasks between the two departments and spoke in depth with all of those involved. Then, the scientists developed the concept for a touch-screen planning table, which demonstrates the potential of the user-oriented approach in concrete terms. In this concept the bridge and engineers come together in person, have all the information they need at one glance and can plan and discuss together how to proceed.

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