Mariner Feedback during the Design and Operation of Ships and Systems

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Human Cantered Design (HCD) calls for mariner feedback at each stage of design. But where do manufacturers find a ready pool of such mariners, what is an 'average' mariner, and how can mariner feedback continue to be captured once the systems are installed and during their operational lives?

In January 2016 The Nautical Institute and CIRM (the principal international association for marine electronics companies) launched a joint initiative to improve the usability of navigation and communication technology on board ships - the *CIRM User Feedback Forum*. This aims to solve the problem that many mariners are keen to offer feedback into the design process, but struggle to identify how. The *User Feedback Forum* offers a way to bring together willing seafarers and interested manufacturers to ensure that designs are validated using human-centred design principles. The Nautical Institute will encourage mariners from around the world to register as potential 'beta testers' for CIRM members' research and development projects.

This paper will explore some of the issues and provide an update on the *CIRM User Feedback Forum* as a potential future solution.

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1. Introduction

Seafarers don't complain – well, not often. Seafarers are a very adaptable species. They tend to arrive on a ship anywhere in the world and usually just get on with the job. It is rare for a seafarer of any rank to refuse to sign on due to the condition of a vessel or even complain about social issues or bullying, although they will grumble about food…

Seafarers can be remarkably clever about adapting their environment to suit their needs. This is sometimes a good thing and sometimes a bad thing. It is very common to find bunks pinned against a bulkhead by safety gear to form a V to sleep in to prevent falling out during a storm (surely after a few thousand years we can design a better bunk?), and the first thing any investigator looks for during an accident investigation is the match sticks used to silence recurring alarms by wedging the silence button permanently down.

When I first joined The Nautical Institute, one of my first jobs was to proof read our first edition of Improving Ship Operational Design (second edition published in 2015). I was quite surprised to find it outlined how all areas of ship design should be looked at in terms of whether they were 'fit for purpose'. I had just spent 15 years at sea without giving it much thought! How many poor designs had I overcome with jury rigs and extra manpower? How many risks had I taken and asked my crews to take without even questioning the design?

But what good would it do to complain? Electronic systems tend to have a lifecycle of maybe 10 years, and ships structures last 20-30 years. Can a comment by a mariner change a design – not usually. Even if he/she is listened to, it may be years before a design change is made, perhaps on another ship and there is no way for that single mariner to realise the ownership of that changed design. Take for example improving the layout of a mooring station. Even a simple improvement might require the involvement of the Classification Society, naval architects, and considerable costs in a shipyard – how likely is this?

In rare situations shipowners will ask crew (of all rank) to comment on new build design. Even then only if a shipowner is a '*very*' good customer will an electronics manufacturer adapt a design based on feedback concerning an already installed and type approved piece of equipment.

With this perceived impotence to improve anything, seafarers tend to keep quiet, do their job and if they are lucky they won't get injured and might consider not re-joining that ship again – if they are lucky. Hopefully though, with the impact of the Maritime Labour Convention (MLC 2006) and an increasing emphasis on risk assessment and Human Centred Design (HCD) things may be improving.

2. **The problem with questionnaires**

For those who do seek the views of seafarers, circulating questionnaires seems a popular mechanism. The problem is that even for very simple issues, questionnaires and their analysis can be very misleading. As an example, in the early days of AIS development there was an issue of whether the AIS symbol should be portrayed on an ECDIS or Radar – surely a simple enough question. So a questionnaire was developed asking just that, but the NI chose not to support this initiative. At the time, no one had actually seen an AIS symbol, other than in articles, and very few mariners had seen or used electronic charts - after all this was during the late 1990s. The NI suggested instead that simulation trials be done, trying both in similar exercises and seeking feedback after that. No, too expensive.

In the end, about 100 (of about 250,000 deck officers) completed the questionnaire. Job done, mariners consulted. The results were announced, presented and accepted by the industry.

Where possible, questionnaires should provide as much background information and provide graphics or Internet links where appropriate. Care needs to be taken to avoid leading questions, confusing language or cultural bias. As wide a geographic area as possible should be covered to get feedback from different operational and training cultures. At the NI we find our wide Branch and Membership networks invaluable for this. This use of a broad sample will be particularly important as we are currently seeking user needs for eNavigation S-Mode.

Returning to the subject of AIS, during the development phase, the NI repeatedly lobbied for simulation trials to be done using real mariners from a multi-cultural and multi-lingual sample. We were not able to find funds or support for such trials as it was perceived that AIS was so simple that what was there to trial? Years later, as an unintentional consequence, AIS is often blamed for the over use of VHF communication, often resulting in the contravention of the ColRegs. Could this have been anticipated, could it have been addressed during the design stage, if mariners had been directly involved in the development?

3. The eNavigation Challenge

In 2006 the IMO adopted a work plan to develop eNavigation which was defined as: "The harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment".

With the best of intentions, this proposal was brought to the IMO by a collection of IMO member states along with a 'compelling need'. At the IMO it was stressed that this initiative should be 'user led,' meaning that the development should only be made in response to the end users (ship and shore). Sounds simple: walk up a gangway find a mariner, read them the definition, and ask them what they want! Well, I did this many times, and the most usual response was that we should make the existing stuff work first.

Ultimately it took years for the NI to articulate what it saw as 'user needs'. The Nautical Institute held Branch meetings on a global basis, wrote numerous articles in Seaways to stimulate discussion and understanding, visited ships, liaised with Members, utilised NI Committees and conducted research. Two years after the work plan was introduced, in 2008, the NI was able to propose the concept of S-Mode (Nav 54/13/1) for a standard navigation system interface, based on the overwhelming feedback that there were too many current systems making familiarisation too difficult. A year later, we were able to articulate a wider range of user needs (Nav 55/Inf.8) including improved reliability, better alarm management, graphic display of MSI, automated reporting , etc… Fortunately most of these issues have been adopted into the current IMO eNavigation Strategic Implementation Plan (SIP).

The IMO have now adopted Human Centred Design & Software Quality Assurance Guidelines which will hopefully ensure that those 'user needs' identified in the eNavigation Strategy Implementation Plan work well when they come to fruition.

4. The thing about complexity

Complexity is not necessarily a bad thing. Donald Norman is quoted as saying "forget the complaints against complexity; instead, complain about confusion". Human Centred Design (HCD) is defined by ISO as an approach for interactive system development that aims to make systems usable and useful by focusing on the users.

It will be interesting to see how the application of HCD will apply to and work with seafarers. Seafarers come from a very wide range of cultures and education. There are young seafarers from IT savvy areas who seem to need very little familiarisation to work complex systems. There are very experienced mariners who have highly effective traditional skills but may struggle with the array of systems that come with modern ships. There are crews working on ships where minimum competency is the norm, and other crews working with companies that promote continual professional development and who provide training well in excess of the minimum standards.

The challenge for the maritime industry will be how to design systems that are effective, but which are still capable of handling the complexity of modern shipping. In addition to being useable, future systems will need to be far better at capturing human error. Both Engineering and Deck officers spend much of their time making critical decisions while on their own. I regularly meet junior

officers and ask them how often they make critical decisions on their own. For a navigational officer that includes following the passage plan or taking action to avoid collisions. The usual answer is about 90%. Given that humans are 100% liable to make mistakes, this offers a great challenge for our management and systems to prove usable and fit for purpose.

5. Sea Traffic Management

The MonaLisa project is a European project to explore Sea Traffic Management. Their website proclaims "The vision is to shake up and sharpen the whole transport chain by making real-time information available to all interested and authorised parties. It is called Sea Traffic Management (STM) and it will change the maritime world. It is like introducing the Smartphone, at first no one really knows what they need it for, and then they cannot live without it."

Now here is an opportunity to apply HCD and test to see if this initiative will work, and how to improve it before its possible implementation. In this brave new world, mariners and STM operators will need to have a close working relationship. Over the past few decades the maritime industry has struggled to define, refine and implement best practices for Master/Pilot Exchange (MPX), Bridge Resource Management (BRM) and even Maritime Resource Management (MRM). However in all these cases the individuals are likely to be able to train together and in fact work together in person (possibly not MRM); and body language is essential. When working together in person you can sense competence, detect stress, and gauge understanding all by body language. In STM, a wider navigational team will need to work seamlessly communicating critical information without body language or having trained together. Will that work?

In order to test this approach and obtain 'user feedback' MONALISA 2.0 identified a need to validate STM in ports and on board ships supported by service centres on shore. 300 "STM-Systems" will be developed and installed onboard ships free of charge by ECDIS manufacturers. They will start running live in 2017. The ships will then be able to use STM services to further optimise routes, sharing route information with other test vessels and service centres to increase safety, and with participating ports to optimise the port calls. This project will also seek to make use of the newly formed European Maritime Simulator Network (EMSN) to obtain user feedback. Officially inaugurated in November 2014, the EMSN has already claimed to have provided value in several test runs. EMSN connects civil shiphandling simulation centres of different brands across Europe. Brian Simpson, the European Coordinator for the Motorways of the Sea: "EMSN offers tremendous potential for distributed simulations, for example emulating large scale traffic situations with individuals manning the bridges of all vessels involved."

6. The CIRM User Feedback Forum

In January 2016 The Nautical Institute and CIRM (the principal international association for marine electronics companies) launched a joint initiative to improve the usability of navigation and communication technology on board ships the **CIRM User Feedback Forum**. This aims to solve the problem that many mariners are keen to offer feedback into the design process, but struggle to identify how. The User Feedback Forum offers a way to bring together willing seafarers and interested manufacturers to ensure that designs are validated using human-centred design principles. The Forum can be accessed at http://cirm.org/services/cuff.html

The NI will encourage mariners from around the world to register as potential 'beta testers' for CIRM members' research and development projects. The process is absolutely free for seafarers and confidential for the manufacturers. Training centres are also invited to become involved and to form relationships with manufacturers that may be interested in running trials.

Mariners gain by being able to preview, understand and influence new designs. Seafarers often challenge why, or even how, certain design features have been developed. The Forum provides an opportunity for them to get involved with the design before it ends up on their ships. Cost considerations often make it hard for training centres to expose students and instructors to the latest technology. Now maritime colleges will not only be able to see the latest designs, but will also be able to use their training experience to assist in the development of new equipment and systems.
CIRM and The Nautical Institute invite the industry to promote the Forum and encourage users to register so that it can make a positive contribution to future navigation and communication systems.

7. **Conclusion**

The world is growing increasingly intolerant of maritime accidents and insurers warn of the commercial consequences from $1 billion plus USD claims that were experienced with the Costa Concordia and Rina. To ensure that risks are as low as possible the Human Element must be addressed and ships and systems must be made 'fit for purpose'.

The best way to insure that initiatives such as MLC 2006 and eNavigation are fit for purpose is to work with and listen to mariners. Mariners often live in remote areas, are difficult to contact at sea and suffer from the feeling of futility when it comes to offering advice for industry improvement.
Tools and techniques for applying the science of Human Centred Design are becoming more available, and the Internet age offers more opportunities for interacting with seafarers and other essential maritime 'users'.

Given a collective industry will, mechanisms for obtaining feedback from mariners can be improved and mariners themselves can be taught (and encouraged) how to effectively identify design issues and work with those who can effect change.

8. **Related Reading**:

- Improving Ship Operational Design (second edition 2015) ISBN 978 1 906915 28 5
- Human Performance and Limitations for Mariners (2015) ISBN 978 1 906915 34 6
- Navigational Accidents and Their Causes (2015) ISBN 978 1 906915 32 2
- Mentoring at Sea (2012) ISBN 978 1 906915 39 1
- Alert! Human Element Bulletins & resource centre (www.he-alert.org)
- The Navigator magazines (www.nautinst.org/navigator)