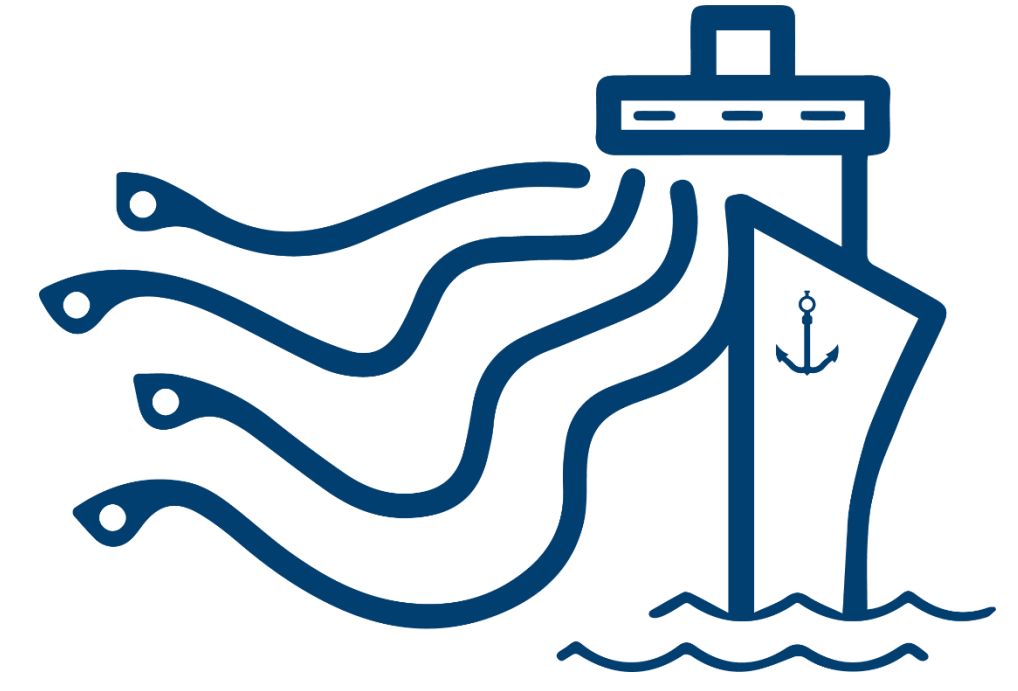


ECDIS EHO: Handling the ECDIS failure at sea

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Abstract

The meaning of navigational safety is changing together with everlasting evolution of technology on ships at high seas. The Electronic Chart Display and Information System (ECDIS) as a most recent breakthrough in shipping, changed drastically not only layout of the navigational bridges but also navigational methods and routines. The safety reasons dictate compulsory redundancy of ECDIS system, recognising its central role in modern day navigation. If a ship's ECDIS back-up arrangement is realized by installation of second independent system, it is known as paperless ship. Duplication increases the reliability of the system, but even a duplication doesn't guarantee full reliability of the system at all times. In emergency situation as ECDIS total failure, navigator should rely on company procedures and guidelines.

The aim of research is to determine navigators' response in case of ECDIS total failure, and to identify if their reaction is supported or guided by company procedures. The research is based on international survey in form of questionnaire conducted among wide spectra of ECDIS stakeholders. This paper analyses part of the questionnaire which refers to the behaviour of navigators in ECDIS failure emergency and seek for procedure clarification by respondents. Answers are presented and discussed, revealing certain drawbacks in failure response and procedures. Along with presented results, survey of practice among shipping companies was carried out, supporting the results of questionnaire. The findings are emphasized in concluding chapter followed by proposal for further research and activities.

Introduction

Two and half years have passed since deadline for mandatory implementation of ECDIS onboard merchant ships. The system's introduction was preceded by preparation for it, in view of policies and procedures implementation, necessary for a smooth transition to a revolutionary navigational aid. After the actual implementation of ECDIS, new navigational routines have been developed, and the system continued to evolve. System integrated other navigational devices and had become the central navigational element of the modern navigational bridge. As electronic equipment failures are inevitable, adequate redundancy for the system is compulsory. When this redundancy is achieved by second independent ECDIS, there is no obligation for a ship to carry Paper Navigational Charts (PNC). The proposed paper focuses on navigator response to a failure of both ECDIS units: primary and back up unit.

Maritime Industry Practice

The adequate handling of the ECDIS failure at sea is a matter of navigational policy and procedures implemented onboard the vessel. The shipping companies should implement policies and procedures in case of emergencies onboard according to the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code).

Procedures in case of ECDIS failure usually vary depending on the shipping company profile. Analysis of the different shipping companies' procedures leads to the conclusion that ISM requirement of providing emergency policies and procedures is not yet fully implemented worldwide.

ECDIS failure procedures of analysed companies

	Company "A"	Company "B"	Company "C"	Company "D"
Inform Master	Yes	Yes	No	No
Inform Chief	Yes	Yes	No	No
Engineer	Yes	Yes	No	No
Engine standby	Yes	No	No	No
Determine ship position	Yes	Yes	No	No
Determine navigational hazards	Yes	Yes	No	No
Verify traffic condition	Yes	Yes	No	No
Manual steering	Yes	No	No	No
Reduce speed	Yes	Yes	No	No
Stop the vessel	Yes	No	No	No
Use redundancy ECDIS/ECS	Yes	Yes	No	No
Take-me-home PNC	Yes	No	No	No
Transmit safety message	Yes	No	No	No
Set appropriate bridge level	No	Yes	No	No

Methodology and survey results

The proposed paper is part of the larger survey started in 2014. International questionnaire as a main source of the survey was used initially as a part of ECDIS courses for merchant seamen at the Faculty of Maritime Studies in Rijeka. Survey evolved by increasing the number of questions and number of respondents. For the survey to reflect global trends, questionnaire was spread among international shipping companies. Results provide insight into opinions and practice of ECDIS stakeholder, assist to identify problems and possible solution, and finally provide some new topics for future research.

The international questionnaire named "ECDIS Survey Analyses: Experience, Handling, Opinion" or ECDIS EHO consist of 26 questions. These 26 questions can be grouped into three categories: introductory profile defining questions, ECDIS handling questions and finally set of opinion questions. Responses regarding response to ECDIS technical failure during the navigation were collected in the period 2014 - 2018.

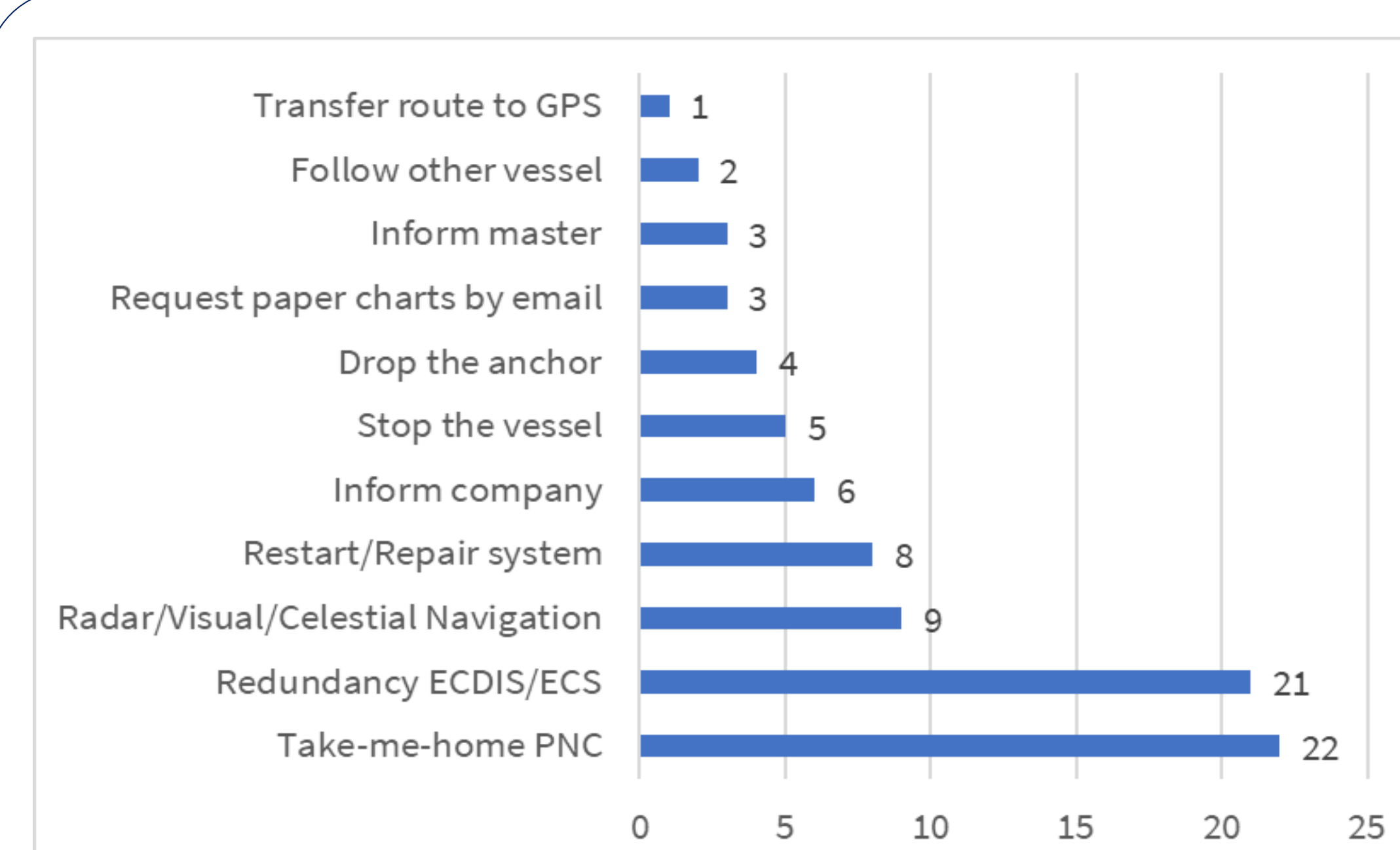
The questionnaire contains answers from wide spectra of maritime professionals, from active seafarers sailing on different types of ships to shore staff. Responses from 350 respondents were collected and classified by rank: 99 Masters (M), 77 Chief Officers and First mates (1/O), 66 Second mates (2/O), 13 Third mates (3/O), 8 Staff captains (SC), 1 Marine safety consultant (MSC), 3 Safety officers (SO), 3 Environmental officers (EO), 4 Dynamic positioning operators (DPO), 1 pilot (P), 1 superintendent (SI), 1 supervisor (SV), 14 port State control officers (PSCO), 25 trainees (T), 1 Yacht-Master (YM) and 33 persons of unspecified position making part of the navigational watch (U)

Elaborated Questions

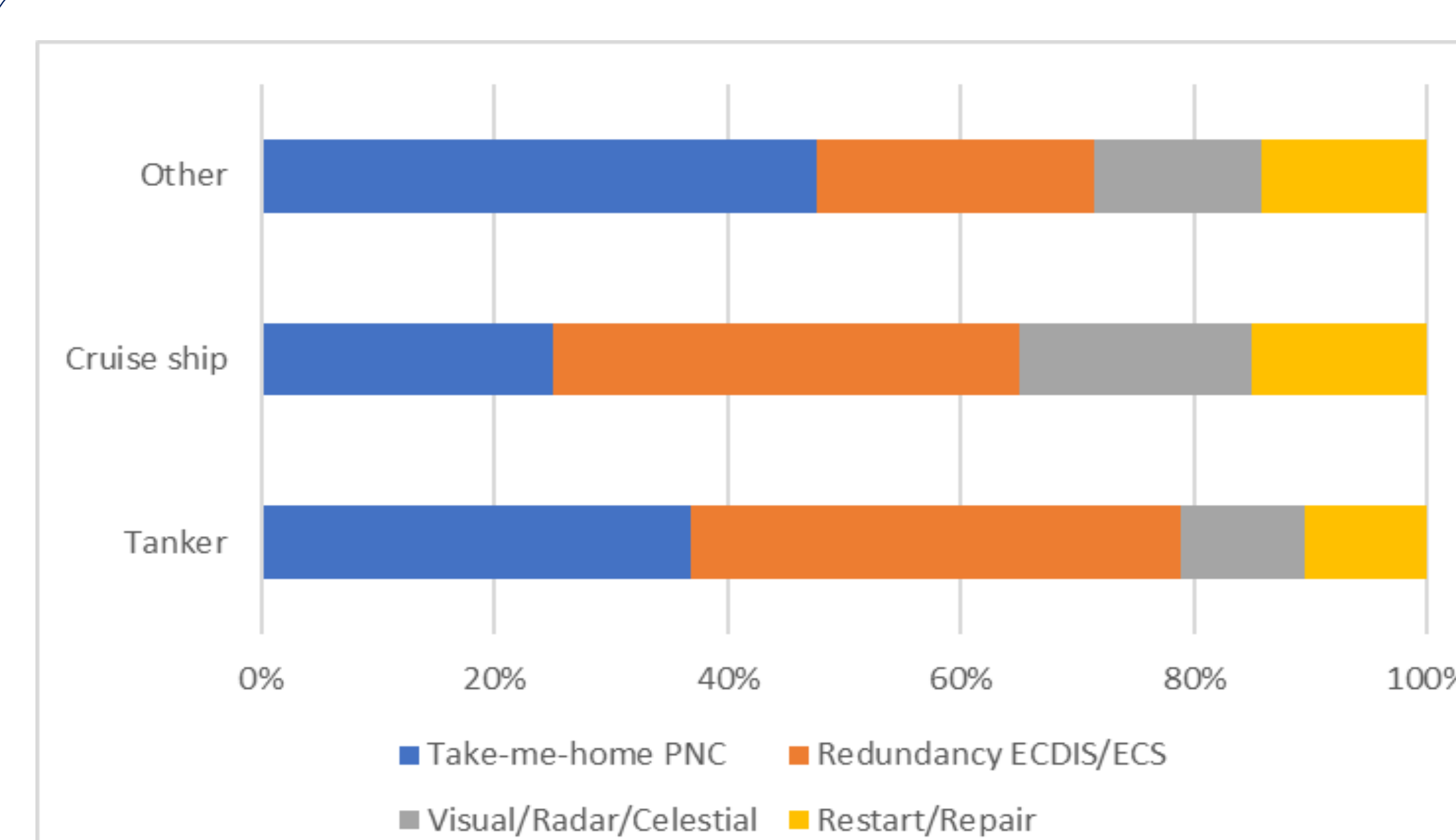
Q1: Is the ECDIS system used as the primary means of navigation on your ship (if ECDIS system was used as the primary means of navigation on one of your previous ships, please indicate so)?

Q2: What is your rank on board?

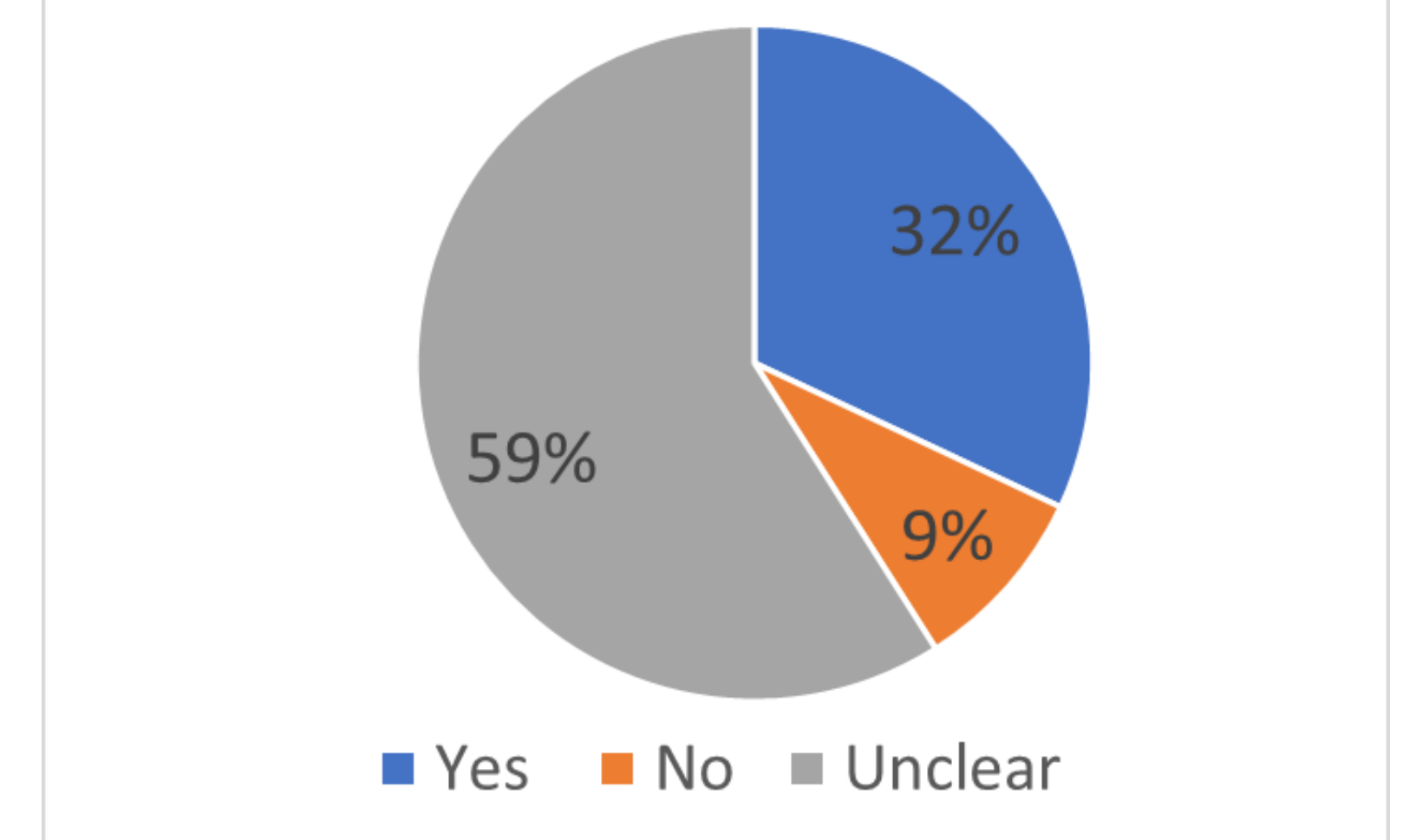
Q3: Assuming that you sail on a paperless ship, what would you do in case of an ECDIS systems technical failure during the navigation (if there are guidelines prescribed by the company in accordance with the ISM, please specify them)?



Distribution of answers on respondent's action in case of ECDIS failure



Distribution of answers on respondent's action in case of ECDIS failure by type of vessel



Results of answers regarding prescribed guidelines by the company ISM

Only 32% of respondents clearly confirmed that their companies have guidelines in case of ECDIS failure, and 9% of respondents reported not to have any guideline. A remarkably high percentage of respondents (59%) did not provide exact confirmation to the second part of the question. A fair share of unclear answers may be in fact confirmation of no procedure in case of ECDIS failure.

Discussion

- The shipping industry is not well prepared to adequately respond to emergency arising from total ECDIS failure.
- Considering ECDIS as vital and central navigational aid in modern shipping, before mentioned survey participants are presenting potential problems for the safety of navigation. What is behind such a result? Is it failure of company to establish a procedure, failure of training and educational facilities, or something third?
- While industry does not provide clear guidelines and procedure it is not possible to expect better results from navigational officers. ECDIS system is implemented globally probably faster than any other navigational aid in history and has changed radically navigator's environment and routines. This was not completely followed by proper procedures and there is still space for improvement of navigational safety.

Conclusion

The proposed paper deals with response to ECDIS failure by active navigators sailing on paperless ships. For the purpose of survey, target group of respondents is selected. Only answers of respondent that are active navigators and have been sailing on paperless ship are considered for analysis. General conclusion of the survey is that navigators are not adequately trained and guided for ECDIS failure situation. Notable number of respondents could not provide any answer on question targeting their reaction to ECDIS failure at sea. Such a result is somehow expected considering that other part of question reveals that procedures for this emergency are not well established. Most of respondent do not have procedures in case of ECDIS failure on board. Obviously, some shipping companies are reliant that technology will not fail them. However, it is obligation of shipping company under ISM to have emergency procedure on board the vessel.

Without proper procedure based on detailed and ship specific risk assessment, there cannot be adequate response of navigators, this is what history of navigation has taught us so far. Future research should focus on defining factors that should be considered for comprehensive ECDIS failure procedure. This could assist the shipping industry in effort to propose suitable framework for shipboard ECDIS failure procedures.

