Proc. of the European Safety and Reliability Conference (ESREL 2026)
Edited by José C. Matos, Paulo B. Lourenço, Michael Beer, Daniel Oliveira, Edoardo Patelli, Hélder S. Sousa, Rui A. Silva and Monica Santamaria

doi: 10.3850/ESREL2026061419_esrel26-p26151-cd

Chasing Wind with Wind-Assisted Propulsion: Seamanship or Button-Pressing?

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Wind-assisted propulsion systems (WAPS) are important technologies to achieve greener maritime transportation. There is a research gap in the knowledge on the competence for operating WAPS – what competence is needed by whom, for operating vessels safely and efficiently. In this study, we explore operation of WAPS on two vessels with suction sails and rotor sails to learn from current experiences. The method consists of qualitative interviews and observations on board that are analysed through a simplified thematic analysis. The findings show that there is great variation in the demands that WAPS put on the crew and land-based personnel to gain maximum potential of sails on board. A central dimension is whether optimizing of WAPS operations requires competence to make context-specific deliberations with regards how and when to «chase wind», or if skills to operate automated systems are sufficient.

Keywords: Wind-Assisted Propulsion, WAPS, Competence, Wind, Seamanship, Maritime.

1. Introduction

In the quest for more carbon-neutral, efficient maritime transportation, Wind-Assisted Propulsion Systems (WAPS) are promising technology. As a green propulsion source that may be installed both on existing ships as well as newbuilds, the potential uptake of the technology is enormous, as current technology reduces CO2 emissions by 20-30% (European Maritime Safety Agency [EMSA], 2023). The International Wind Ship Association (IWSA) estimates that the number of vessels with WAPS increases to 40,000 in 2050 (IMO MEPC 2024). (Comoros et al., 2024). To achieve the promised effects on sustainability and operational efficiency, a necessary contingency is of a technological, human, and organizational nature. Technology needs to demonstrate its prolonged effectiveness, human operators need adequate competencies, and organizational needs to adapt roles, responsibilities and training (Feldtmann et al., 2026).

Generic competency requirements have been established for ship operations (STCW-Code), but not for WAPS, although recognized as crucial (Chou et al., 2021). It is recognized that introduction of WAPS results in simultaneous changes that alter the need of competence among seafarers (Lamvik et al., 2025). However, less is known about what competence is needed to (1) optimize the wind fully, and (2) ensure safety when operating the vessels and reduce the risks associated with any new hazards that the new technologies may introduce.

The research question of the study is addressed within human, technological and organizational aspects:

What is the additional needed competence for operating vessels with WAPS safely and efficiently?

Our research utilizes a comparative framework between Work-as-Imagined (WAI) and Work-as-Done (WAD). Drawing on Hollnagel's (2017) conceptualization, WAI encompasses how managers, designers, or regulators envision tasks—typically codified in formal procedures and safety manuals. In contrast, WAD reflects the actual, nuanced activities performed in practice. The study of WAPS practices (WAD) in this paper is limited to passage planning and passage plan execution. These are considered the two phases in ship operations where the use of sails is most actualized. Capturing the complexities of WAD, relies on interpretations of interview data and participant observations conducted aboard the vessels.

Furthermore, the study draws on "Seamanship" as a meaningful concept closely connected to competence. "Good seamanship" is used in IMO regulations and guidelines (Kongsvik et al. 2020). However, it remains notably undefined. Gilmore and Black (1975) propose that within legal and regulatory frameworks, seamanship encompasses all tasks a seafarer is expected to perform, including the ability to exercise sound judgment in dynamic and unexpected circumstances. They contend that "good seamanship" serves as a solution to address situations not covered by rules. Studies of seafarers' use of the term show that its meaning is even more comprehensive. The term is used to describe personal character and interpersonal behavior. It encompasses traits like e.g. technical skills in operating a vessel, the ability to make sound judgments in unpredictable situations, strong work ethics, the capacity for social compatibility and cooperation within the ship's community, ability of independent initiatives, sociability, loyalty, reliability, and strong willingness to work (Lamvik & Bye 2004, Knudsen 2009, Antonsen 2009, Aalberg & Bye, 2020, Kongsvik et al. 2020). If we look at the context of the use of the term, it may express individual and collective identity (Knudsen 2009), act as a mechanism for social categorization to divide between "us" and "them" (Bye et al. 2015), and as an honorific word when recognizing someone's efforts (Knudsen 2009, Bye et al. 2015). The term is also sometimes used to express resistance to procedures and some types of administrative work (Knudsen, 2009, Størkersen et al 2011, Aalberg & Bye 2020). Further, Bye and Aalberg (2020) claim that the use of the term also could be seen within the context of the traditional training of seafarers, with an emphasis on socialization by imitating practices, and not by internalization of written or oral descriptions of how the work should be performed. By using the term, the mentor could mediate to the "novice" that a certain task performance is in accordance with the expected practice. New studies show that "seamanship" continues to evolve as new advanced technology is implemented on board, through adapting both practice and technology showing practical and ethical deliberations (Aalberg, 2024).

Drawing on Rasmussen's (1983) model of human performance, the concept of seamanship aligns closely with knowledge-based behavior, i.e. the ability to combine information and handle problems and situations where no pre-existing habits (skills) or established procedures (rules) are available. Rasmussen distinguishes knowledge-based performance from skill-based and rule-based modes. Skill-based behavior consists of highly practiced, automated sensory-motor actions, whereas rule-based behavior involves following stored procedures or 'if-then' logic to navigate familiar tasks. In contrast, the knowledge-based mode is reserved for unfamiliar situations requiring conscious analytical reasoning and mental modeling.

2. Method

2.1. *Study Design*

This study was designed as a qualitative case study based on two cases (see Table 1).

Table 1. Case Descriptions of WAPS-vessels

Case 1 – Suction Sails (Retrofitted)	Case 2 – Rotor Sails (Retrofitted)
Deep Sea:	Short Sea:
Trans-Atlantic/Pacific Voyages	North Sea basin/ Norwegian Coast
Chemical Tanker	RoRo-Cargo Vessel
Sails installed Q1/2025	Sails installed Q1/2021

Qualitative data has been obtained through:

(i). semi-structured interviews (individual and group)
(ii). in situ open interviews, and
(iii). Observation (Observer-as-Participant) onboard vessels equipped with WAPS.

The cases were selected due to their differences in:

(i). WAPS technology,
(ii). Operational area and type of trade (Deep-Sea/Short Sea), and
(iii). Organization of task-allocation, responsibilities, and authority related to operational decision-making.

2.2. *Data Collection Method & Analysis*

In total, four group interviews were conducted in Case 1 (3 digital, 1 physical). No ship visit was possible during the research period in 2025. In Case 2, one group interview was conducted before two vessel visits, five semi-structured interviews during the first visit. Further observations and open interviews were done in-field onboard for four days in 2025 and four days 2026. Observations onboard were related to navigational aspects on bridge throughout the voyage. Open interviews were conducted during the periods of observations (approx. 8 h/day, divided into periods of watches). The data in both cases were analyzed by means of a simplified thematic analysis (Braun & Clarke, 2009). To capture the nuances of WAD, we applied a Human-Technology-Organization (HTO) framework. This systems-based approach allowed us to analyze WAD as an emergent property of the dynamic interactions between human, technical, and organizational factors. Findings from the two cases were systematically compared to identify similarities and differences regarding WAD and HTO factors. These analyses served as a basis for discussing the additional competence required to operate WAPS-equipped vessels safely.

2.3. *Strengths & Limitations*

Strengths of this study can be regarded within its naturalistic data collection methods in-field, increasing the ecological validity of the research. Moreover, the use of two distinctively different cases satisfies the maximum variation principle of qualitative study credibility.

The research is limited in the number of interviews conducted and duration of observational days. Furthermore, methodological asymmetry between the cases appeared with accessibility considerations (No vessel visits possible in case 1). In addition, the asymmetry in operational history (Case 1: 2025-2026 vs. Case 2: 2021-2026) has an impact on the crew's experience base regarding the use of the two WAPS systems under various situational conditions.

3. Results

The main findings are described along the two cases. For each case the WAI is briefly described, followed by a description of WAD related to passage planning and passage execution. This is followed up by a presentation of the informants' reflections upon their need of competence and training.

3.1. *Case 1 – Suction Sails*

3.1.1. *Work as intended*

The implementation of Suction Sails was described as important towards the goal of lowering fuel expenses and compliance with environmental regulations. In addition, officers onboard described the hope for slight improvements in average speed and increased stability, based on what they heard from other WAPS technologies.

They further expressed to rely on the weather routing system regarding the voyage planning as well as full automation of the sails for most of the time. Awareness regarding uncertainty of the vessels' behavior in traffic situations was outlined. Familiarization with the sails was expected to follow "usual" approaches through guidance from the manufacturer, but mainly as a smooth integration into established routines. Furthermore, visibility was regarded as an issue; therefore, cameras and radars were installed.

3.1.2. *The practice of passage planning*

Passage planning was described as the main area in which Suction Sails influence operational decision-making. Crew reported that course deviations and route changes were particularly relevant when aiming to increase the effect of the sails. They described a general reliance on their weather-routing system to support voyage planning and decisions related to routing and adjustment of the main engine power. The system was reported to account for waves, wind, currents and the polar diagram of WAPS, generating updated routes approximately every 12 hours. Trust in this system was described being important. In addition, awareness for human errors was outlined, as system parameters and restrictions are set by humans. From the crew's perspective, ship-shore collaboration was limited and mainly focused on monitoring the vessel and analyzing performance outcomes (e.g. fuel consumption and speed). They did not report shore-based interference in voyage planning, instead the crew described themselves as operating autonomously onboard. However, they mainly decided to trust the routing system, aligning with shore-based expectations to follow the guidance provided through it.

3.1.3. *The practice of passage execution*

During the voyage, the Officers on the Watch (OOWs) stated that they followed the sailing corridors specified by the weather routing system. Within the designated corridor, the navigators made minor course adjustments to maximize efficiency of the sails, based on information from the system. According to informants, friendly competition has emerged among the officers to achieve the highest possible effect from the sails.

At an early stage, the crew reported uncertainty regarding potential safety and maneuverability implications. They anticipated unintended side effects for navigational safety in crossing situations regarding the Collision Regulations at Sea (COLREG).

It was noted that lift generated by the sails affected maneuverability and vessel speed. For instance, turns were described as potential concern, as they might lead to undesired increases in speed, due to the change in wind direction. However, at a later stage, they did not experience any direct impact on compliance with COLREG. The crew further emphasized that responsibility for navigation remained fully onboard. They reported reduced visibility and small blind spots on radar, which required compensation through additional radars and increased movement on the bridge through the OOWs) to maintain full visibility

Finally Suction Sails were described as largely fully automated and that they can be switched on and off easily, although there is an option to change between modes with regards to drag and visibility. Emergency responsiveness of the technology was described as fast.

3.1.4. *Reflections upon competence & training*

The crew did not identify a need for dedicated WAPS-specific training. Instead, they described competence development as being supported through a short sailing course, internal familiarization and experience transfer. Checklists and procedures were highlighted as best practices for experience transfer, serving as written artifacts that capture and accumulate operational experience. It was further noted that competence needs may differ across different vessels. They emphasized the value of experience transfer between crews operating on several vessels. Supplier participation was described as important during first voyages, mainly to address technical failures and share knowledge with the crew. Later, internal experience transfer was described as sufficient.

Regarding the crew onboard, a huge motivation was described since they wanted to observe "real effects" of the sails and the weather routing onboard. Further, new technology was regarded as being very interesting, in particular for younger seafarers, since they expressed the wish being a part of this implementation. It was further outlined that competent and engaged shore-based personnel had a positive impact on crew motivation. Overall, feedback on the implementation was reported as positive, and both shore- and onboard personnel were described as motivated to optimize the use of WAPS.

3.2. *Case 2 – Rotor Sails*

3.2.1. *Work as intended*

The shipping company's choice to install rotor sails was based on an ambition to reduce fuel consumption and improve stability. The stability improvement was expected to enable safe sailing in harsh weather conditions and reduce the risk of damage to the cargo. To achieve this, the navigators were expected to prepare passage plans that give the most effect of the sail, and balance this against the scheduled arrival times at the ports. This implied that the navigators must plan the routes differently, taking into account wind and weather conditions and evaluate and apply this information differently than what is usual when operating conventional vessels. Additionally, there was an expectation that those on watch would make adjustments of the effect of engine, of the rotor sails and make course alterations within a limited defined sailing corridor. From the shipping company's side, it was emphasized that the captains should be empowered to make all assessments and decisions without detailed control from the onshore organization.

3.2.2.*The practice of passage planning*

As on conventional vessels, the voyage and passage planning is conducted by the masters, with support from the officers. This was primarily guided by their professional judgment, based on knowledge and experience. During the years they have operated the vessel, they have built up a catalogue of planned routes for the various sections. The passages plans are prepared based on the prevailing weather and wind conditions at the time. Captains use these plans as templates for new voyages when current weather and sea conditions mirror those of a previously successful route. The pre-planned routes are then adjusted based on more resent weather forecast, and consideration regarding e.g. schedules of port calls, vessel traffic, obstructing structures (Traffic Separation Schemes – TSS, offshore installation and wind farms), the weight and type of cargo, the implications for the stability of the vessel, and potential damage of equipment (sails, engine rodder etc.). Masters may operate with several alternative passage plans that can be used if the actual weather and sea conditions become different from what they assumed. If the weather and sea conditions change considerable during a passage, and none of the prepared passage plans are adequate, the plan will be adjusted en route. The length of most of the preplanned routes is more or less equal. However, in some harsh weather and sea conditions, alternative routes might imply longer distances. Additional distances during some crossing may be in the range of 80-100 nautical miles. In specific weather conditions, a longer route may contribute to lower fuel consumption, greater stability, higher speed and earlier arrival time.

Initially a weather-routing systems was introduced as a decision support tool for passage planning. Later, this tool was abandoned. According to the informants, this was largely because the system overlooked several previous mentioned critical factors (e.g. vessel characteristics, cargo, obstacles TTS etc), and the complex interaction between them.

According to officers, there are differences between the masters when it comes to develop a passage plan. This variation ranges from using calculation-based methods, to rely more on experiential judgment. One master claimed that he mainly followed the same route they would have chosen with a conventional vessel, treating the rotor effects as an added “bonus”. This approach was explained as an adaption to the high degree of uncertainty regarding changes in the weather conditions. Altering the course to “catch the wind” can be detrimental if conditions shift unexpectedly, resulting in additional time and fuel expenditure. A route that initially appeared as favourable for fuel efficiency may later prove disadvantageous - both in terms of fuel consumption and maintaining the port call schedule. Furthermore, delays were described as having a cascading effect on fleet operations. A late arrival at port can disrupt schedules for other vessels belonging to the company, creating operational inefficiencies. An early arrival at some of the ports will often mean that they have to wait.

When the masters are developing the overall voyage plan, they present alternative passages plans to the onshore operations department, outlining the implications for arrival times and fuel consumption. Operations then provides feedback based on their priorities, such as punctuality or fuel efficiency. They emphasize that the master should have autonomy to make changes to the passage plan based on their situational awareness.

3.2.3.*The practice of passage execution*

Both the masters and officers note that navigators differ in their approach to operate the vessel during crossings. Some of the navigators “play with the RPM” to balance/optimize stability, fuel efficiency and arrival times. Others, just rely on the automatic mode of the system. The extent of "playing with the RPM" is within the limits given by the masters. If the OOW experiences the need for new instruction they may call the master. It seems to be individual differences between the officers in what extent they call the master and to what extent they empower the mates to "play with RPM".

Course alteration along the operational corridor is mostly limited to collision avoidance situations. Small course alterations along the planned operational corridor in order to "catch the wind" were not seen as something that gives benefits. It seems that there also are some differences between the captains in which degree they choose to modify the passage plan en route, in order to optimize the effects of the sails.

When maneuvering the vessel, the officers experienced a different turning behavior compared to conventional vessels. When changing the heading, the thrust from the sails would change, resulting in increased or lower speed. Adjusting the main engine power to keep the same speed was difficult to achieve, and sometimes it was impossible. This effect of the sails was considered to represent a major hazard, especially in relation to:

1) manoeuvres in coastal waters
2) collision avoidance situations (COLREG)
3) engine failure, rotor sail failure or blackout

When sailing in coastal waters, the crew described unpredicted effects of the rotors when navigating along the Norwegian coast. They stated that wind conditions and wind phenomena due to local topography can cause unintended changes in speed and the movement of the vessel (drift). In a worse-case scenario this could contribute to allision, grounding or collision. When performing collision avoidance, short-term maneuvers may lead to lower or increased speed. In order to handle this, it might be necessary to perform maneuvers that deviates from current practice in such situations and gives incorrect signals to oncoming vessels. Further, when the vessels are close, an increased or decreased speed may jeopardise a passage of the bow or the stern of the other vessel. A worst-case scenario is that an unforeseen change in speed results in a collision.

There are indications that different OOWs have different ways of dealing with these challenges. Some have explained that they always put the sails into invisible mode (no effect of the sails), while others consider this as dangerous practice due to the possible effect on the stability and the vessel movements. Furthermore, the impact of the rotor sails could have unforeseen implications in case of engine failure. They also expressed uncertainty and worry regarding how the ship will behave during a situation with engine failure, loss of the rotor sail or total blackout, especially during harsh weather conditions. If the engine fail, situational conditions with impact of the sail may be beneficial (ensure propulsion), but under other conditions the loss of the interaction between the engine and the sail may threaten the stability and the manoeuvrability of the vessel.

If the rotors stop, this will affect stability and the prerequisites for the passage plan will change completely. This is considered to represent a significant hazard for the safety of the vessel.

3.2.4. *Reflections upon competence & training*

The crew explained that training had taken place in the form of a combination of e-learning courses, classroom teaching, and a practical sailing course with small yachts. Since the vessel acted as an R&D site for technology providers, the crew acquired further knowledge through ongoing dialogue with them.

There were different perceptions about the learning outcomes from the training. Some claimed that the sailing course had limited transfer value to reality. Others believed that it gave them theoretical knowledge about the interaction between the system and weather conditions and that they experienced how wind and sea affect the vessel's performance. However, practical onboard training and knowledge sharing were regarded as most useful by the informants.

There were also different opinions about what training they needed. Some stated that they needed extensive training beyond a briefintroduction to the system, combined with learning by doing based on the guidance of experienced colleagues. Others believed that it would be useful with courses or workshops making passage plans based on different weather and sea conditions, performing collision avoidance and learning about the vessel response in black out situations. Some believed that using a simulator was not very useful, since they believed that it would be impossible to include the unique characteristics of the specific ship they operated. Others believed that training containing passage planning, followed by execution of plans in a simulator, would have been beneficial.

4. Discussion

4.1. *Technological aspects*

Variation in design has a significant impact on how the vessels are operated, and how it respond to weather and sea conditions. Both vessels are retrofitted and are not originally designed for sail systems. Rotor Sails in Case 2 underwent several design adaptations over time, as that both sails could be adjusted independently. As a general concern it was stated that the equipment might not be robust enough to withstand the exposure of weather and climatic conditions in the North Sea. The power output of the WAPS installation on the vessel in case 2 is relatively to the ship size significantly larger than the installation in case 1. The WAPS has a greater impact on the operation of the vessel in case 2, as the forces from the wind impact the vessel's stability and how it responds to weather and wind conditions. The navigators have to consider the effect of the interaction between weather and sea conditions, the vessel's stability, and the weight of the cargo. The combinations of these factors introduce new hazards, particularly in connection with harsh weather conditions, black out situations, passages close to shore and collision avoidance situations. The vessel in case 1 is also retrofitted but the sail system has a small effect on the vessel's stability and how it behaves in the sea. Another factor is that the sail effect can be switched off more quickly than on the vessel in case 2. Another significant difference is that weather routing system is used in Case 1.

4.2. *Organizational and operational aspects*

The differences between the two cases with regard to trade area, deep sea vs. short sea, have an impact on the extent to which they can plan the passages. Crossing the Atlantic or Pacific Ocean allows for relatively more options than operating in the North Sea basin. Case 2 involves frequent port calls and tighter schedules. The navigators face higher vessel traffic, structural obstacles (such as oil installations and wind farms), and Traffic Separation Schemes (TSS). Furthermore, the lack of onshore involvement in the passage planning, frequent high-uncertainty decision-making, and a deficiency in decision-support tools (like weather routing systems) require onboard officers to make more complex judgments.

4.3. *Human related aspects and WAPS related competence needs*

In Case 1 the need of WAPS related competence seems to be about operating skills and routines in interaction with the weather routing system and make judgement regarding fuel consumption and effects from the sails when navigating within the recommended sailing corridors. In case 2 there is a need for additional knowledge and understanding on the effect of the WAPS as a stand-alone system. The size of the sail forces has a significant effect on the ship’s motion characteristics which requires new shiphandling skills. Handling emergency situations also add new competence elements for navigation officers at the management and operational level. In Case 2 it seems apparent to be a need of comprehensive new WAPS related competence, especially related to complex judgments based on interactions of many factors when conducting passage planning and passage plan execution. With reference to Rasmussen's conceptualization of behavioural modes, it appears that the use of WAPS requires new competencies related to skill-based, rule- based and knowledge-based behavior. Furthermore, it appears that the competence requirements associated with knowledge-based behavior are more extensive in case 2 than in case 1. In case 2 the introductions of WAPS seems to actualize the concept of seamanship as used in e.g. IMO regulations. This is knowledge that can only be codified to a limited extent into rules.

5. Conclusion

The study explored the needed competences for safe and efficient operation of WAPS and how they are shaped through HTO-conditions based on two cases. It outlines that competences for WAPS vary with the vessel/design, area of trade and distribution of decision-making. Suction sails are largely automated and “light touch”, competences are centred on familiarization, mode awareness and small operational adaptations.

Rotor Sails show a more complex and safety-sensitive operational picture, competences extend to situational anticipation and management. It can be concluded that chasing the wind is not one particular practice, but a spectrum of activities: From button pressing to seamanship.

Acknowledgement

The study is a part of the WAPS-IT project, funded by the Research Council of Norway grant number 356019. We thank the shipping companies and seafarers involved in the study.

References

Aalberg, A. L., & Bye, R. J. (2020). The intangible concept of good seamanship–a comparison of the ingredients of seafarers' descriptions using a hybrid qualitative-quantitative approach. *ESREL 2020*.

Aalberg, A. L. (2024). Seamanship in the Age of Automation: Reduced Practical Wisdom? Observations from Fieldwork on Automated Car Ferries in Norway. Public Anthropologist, 6(2), 342-371.

Antonsen, S. (2009). The relationship between culture and safety on offshore supply vessels. Safety science, 47(8), 1118-1128.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Bye, R.J., Antonsen, S., Lamvik, G.M., (2015). Godt sjømannskap - Ferdigheter og yrkesidentitet. [Good seamanship – Skills and professional identity] In: Antonsen, S., Kongsvik, T.: Sikkerhet i Norske Farvann. [Safety in Norwegian Waters]. Gyldendal Akademisk, Oslo.

Bye, R.J., Aalberg, A.L., 2020. Why do they violate the procedures? – An exploratory study within the maritime transportation industry. Safety Sci. 123, 104538.

Chou, T. et al. (2021). A comeback of wind power in shipping: An economic and operational review on the wind-assisted ship propulsion technology. *Sustainability*, *13*(4), 1880.

European Maritime Safety Agency (2023), Potential of Wind-Assisted Propulsion for Shipping, EMSA, Lisbon

Feldtmann O. N., Oltedal, A. & Fjeld, G. (2026) "Operational and Human Dimensions of Wind-Assisted Propulsion Systems: A Systematic Review Informed by Newer Safety Paradigms" *ESREL2026* (to appear)

Gilmore, G., Black, C.L., (1975). The Law of Admiralty. Foundation Press, New York, NY. Goffman, E., 1961. Asylums. Penguin Books, New York, NY.

Hollnagel, E. (2017). Why is work-as-imagined different from work-as-done?. In *Resilient health care, Volume 2* (pp. 279-294). CRC Press.

International Windship Association.(2024). Reduction of GHG emissions from ships – Wind propulsions. IWSA.

Knudsen, F., 2009. Paperwork at the service of safety? Workers' reluctance against written procedures exemplified by the concept of 'seamanship'. Safety Sci. 47 (2), 295–303.

Kongsvik, T. et al. (2020). Re-boxing seamanship: From individual to systemic capabilities. *Safety science*, *130*, 104871

Lamvik, G. M., & Bye, R. (2004). National culture and safe work practice—a comparison between Filipinos and Norwegian seafaring professionals. In Probabilistic safety assessment and management (pp. 1315-1321). Springer, London

Lamvik, G. et al. (2025). Onboard Competence for Optimal Application of WAPS Systems. TransNav, 19(2)

IMO MEPC. (2024). Reduction of GHG Emissions from ships. White paper on wind propulsion, Submitted by Comoros, France, Solomon Islands and IWSA. MEPC 81/INF. 39, 12 January 2024.

Rasmussen, J. (1983). Skills, rules, and knowledge; signals, signs, and symbols, and other distinctions in human performance models. IEEE Transactions on Systems, Man, & Cybernetics, SMC-13(3), 257–266.

Størkersen, K.V., Bye, R.J., Røyrvik, J.O.D. (2011). Sikkerhet i fraktefarten. Analyse av drifts- og arbeidsmessige forhold på fraktefartøy. [Safety in coasting. An analysis of operational and work-related conditions on cargo vessels]. Studio Apertura, NTNU, Trondheim.