Tallinn University of Technology

VME0510 Navigational Risk Management

Extended syllabus

Spring 2026

General information

ECTS:	6 ECTS
Language of instruction:	English
Lecturer:	Dr. Amit Sharma, amit.sharma@taltech.ee.
Course aims:	The aim of this course is to provide an integrated perspective on navigational risk management by emphasizing the interdependencies between human performance, maritime technologies, and organizational processes in an increasingly digitalized shipping environment.
Brief description of the content of the subject(s):	The course takes a multi-disciplinary and system's perspective on the factors influencing the safety of navigation on the ship's bridge. It will discuss the following topics in relation to the above: - Navigational risk, safety, security as socio-technical outcomes - Case studies of contemporary maritime navigational accidents - Human factors in ship's bridge operations and impact of digitalisation - Maritime 4.0 and evolving regulatory landscape - Autonomous shipping and remote maritime operations - Maritime cybersecurity and digital risk management
Learning outcomes:	After completing this course, the student: - critically assess the benefits, limitations and risks of digital system integration in shipping considering a human, technology and organizational perspective; - evaluate and compare the various frameworks and models available in research literature for understanding human performance on ship's bridge; - analyse the emerging trends of automation and digitalization in shipping including conventional, remote and autonomous operations; - analyse the impact and interplay of operational and regulatory constraints on modern shipping;

Evaluation and constructive alignment

Evaluation method	Teaching methods	Relationship with learning outcomes
Comparative literature review and oral presentation on human performance frameworks (individual or small group)	Research-led seminars, student-led presentations, structured debates	Assess the student's ability to evaluate and compare frameworks and models of human performance on the ship's bridge,

		including human factors, socio-technical, and systems-based approaches
Individual critical analysis report (e.g. digital system integration or automation case study)	Lectures, guided reading of research literature, seminar discussions	Assesses the student's ability to critically assess benefits, limitations, and risks of digital system integration and to analyse emerging trends of automation and digitalization from a Human–Technology–Organization perspective
Scenario-based analysis / simulation debrief report	Simulator exercises, case-based learning, regulatory analysis workshops	Assesses the student's ability to analyse the impact and interplay of operational and regulatory constraints in modern shipping, and to integrate human, technological, and organizational considerations in navigational risk management
Final examination	A final 4-hour home examination based on set of questions in addition to a case study to be solved individually by the students	A final summative assessment of all the learning outcomes of the course

Formation of the final score:

"0" – Insufficient (0-50)
"1" – Sufficient (51-60)
"2" – Satisfactory (61-70)
"3" – Good (71-80)
"4" – Very good (81-90)
"5" – Excellent (91-100)

Note – The first three assignments/reports/presentations will form the part of formative assessment and will only be graded as pass or not pass. These will not add to the final grade. The final home examination will be the summative assessment and will be graded 1-5 as described above.

Alignment with the curriculum

Required prior knowledge and/or prerequisite subjects:	Learners are expected to have foundational knowledge of maritime navigation and bridge operations. Prior exposure to maritime safety management, risk assessment concepts, or human factors is beneficial but not mandatory.
Relationship to the curriculum:	The elective course is aimed to provide safety perspective to the students in the ara of increasing automation and digitalization of maritime operations particularly with focus towards ship's bridge and maritime navigation. It complements the technical focus of the curriculum with an overview of human factors related research and its application to improve the overall safety of maritime digital solutions.

Learning aids

E-support for the subject:	Moodle / OIS environment
Educational literature:	*Suggested reading list given at the end*
Resources required:	MS Office (Word, Excel, PowerPoint) and MS Teams
Getting in touch with the lecturer:	The preferred method of contact to address any query is through the official email address of the lecturer, answered within 2-3 working days after reception.

Detailed schedule and topics

Week 1

Introduction to Navigational Risk Management – Introduction to course, generic overview, motivation, expectations, formative and summative assessment criteria, practical aspects of course.

Date: 05.02.2026

Learner's activities:
before the contact hour: read the course description and introductory message by the lecturer in the Moodle
contact hour: lecture and discussions
after contact hour: read the material in Moodle

Week 2

Case studies in maritime accidents – Contemporary maritime accidents, ECDIS supported groundings and RADAR assisted collisions, paradox of modern ship bridge environment, Safety – I and II.

Date: 12.02.2026

Learner's activities:
before the contact hour: Generic research on listed contemporary maritime accidents, preliminary reading of accident reports where available
contact hour: lecture and discussion
after contact hour: read the material in Moodle

Week 3

Human factors in maritime navigation – Theoretical background of operator performance in complex socio-technical systems, psychological factors, cognitive workload, situational awareness and decision making.

Date: 19.02.2026

Learner's activities:

before the contact hour: Generic research on psychosocial factors influencing human performance in complex socio-technical systems
contact hour: lecture and discussion
after contact hour: read the material in Moodle

Week 4
Bridge Resource Management – Evolution of BRM in shipping, application, role of non-technical skills their training and assessment.

Date: 26.02.2026

Learner's activities:
before the contact hour: Read selected academic articles related to BRM research in shipping
contact hour: lecture and discussion
after contact hour: read material in Moodle, review key takeaways

Week 5
Pilotage operations – Pilotage operations in shipping, their importance, current technical developments, role of VTS and state authorities.

Date: 05.03.2026

Learner's activities:
before the contact hour: Generic research on pilotage operations, importance and characteristics
contact hour: lecture, and discussion
after contact hour: read the material in the Moodle, write and submit the first assignment before the deadline.

Week 6
Voyage planning and Navigational risk assessment – Factors to consider during navigational risk assessment, purpose, planning process and standard templates

Date: 12.03.2026

Learner's activities:
before the contact hour: review the standard templates available for navigational risk assessment
contact hour: lecture, seminar and discussion,
after contact hour: read material in Moodle, go through the feedback for the first assignment

Week 7
Emergency situations and contingency planning – types of emergencies encountered, drills, role of ship's bridge team

Date: 19.03.2026

Learner's activities:
before the contact hour: Review information and requirements related to emergency drills conducted onboard
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 8

Communication and safety leadership – why communication is central to navigational safety, importance of leadership onboard, examples of when things go wrong

Date: 26.03.2026

Learner's activities:
before the contact hour: Generic research on communication and safety leadership on ship's bridge
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 9

Human centred design for navigational safety – Impact of design on maritime navigation, design principles, industry standards and guidelines

Date: 02.04.2026

Learner's activities:
before the contact hour: Generic research on importance of human centred design
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 10

Fatigue – Why fatigue is dangerous, types of fatigue, fatigue related accidents in shipping, mitigating measures

Date: 09.04.2026

Learner's activities:
before the contact hour: Generic research on fatigue causing factors, consequences
contact hour: lecture and discussion
after contact hour: read material in Moodle, write and submit the second assignment before the deadline.

Week 11

Autonomous shipping and maritime 4.0 – trends and evolution of autonomous shipping, active projects, challenges and opportunities

Date: 16.04.2026

Learner's activities:
before the contact hour: Generic research on trends related to autonomous shipping
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 12

Maritime Cybersecurity – threats, countermeasures, risks and the role of human element
Date: 23.04.2026

Learner's activities:
before the contact hour: Generic research on maritime cybersecurity
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 13
Emerging risks and digitalization – Impact of digitalization and cyber hygiene for ship's bridge

Date: 30.04.2026

Learner's activities:
before the contact hour: Generic research regarding impact of digitalization on ship's bridge
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 14
Regulatory and legal frameworks in maritime domain – associated regulations, key changes and overall compliance framework

Date: 07.05.2026

Learner's activities:
before the contact hour: Generic research on regulations and legal frameworks
contact hour: lecture and discussion
after contact hour: read material in Moodle

Week 15
Simulation exercise – tabletop simulation OR full mission simulation of a scenario, debriefing and discussions of key takeaways

Date: 14.05.2026

Learner's activities:
before the contact hour: read the description of simulation exercise
contact hour: lecture, seminar and discussion
after contact hour: read material in Moodle, write and submit the third assignment before deadline.

Week 16
Course recap, reflections and debrief – summary of the course, key areas to focus, final examination tips

Date: 21.05.2026

Learner's activities:
before the contact hour: Recap and read the material in Moodle,
contact hour: lecture and discussion
after contact hour: read material in Moodle,

Suggested Reading List

- Schröder-Hinrichs, J. U., Hollnagel, E., & Baldauf, M. (2012). From Titanic to Costa Concordia—a century of lessons not learned. *WMU journal of maritime affairs*, *11*(2), 151-167.
- Chauvin, C. (2011). Human factors and maritime safety. *The Journal of Navigation*, *64*(4), 625-632.
- Bainbridge, L. (1983). Ironies of automation. In *Analysis, design and evaluation of man–machine systems* (pp. 129-135). Pergamon.
- Endsley, M. R. (2023). Ironies of artificial intelligence. *Ergonomics*, *66*(11), 1656-1668.
- Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors*, *37*(1), 32-64.

- Parasuraman, R., & Riley, V. (1997). Humans and automation: Use, misuse, disuse, abuse. *Human factors*, *39*(2), 230-253.
- O'Connor, P. (2011). Assessing the effectiveness of bridge resource management training. *The International Journal of Aviation Psychology*, *21*(4), 357-374.
- Sharma, A., Nazir, S., & Ernstsen, J. (2019). Situation awareness information requirements for maritime navigation: A goal directed task analysis. *Safety Science*, *120*, 745-752.
- Porathe, T., Prison, J., & Man, Y. (2014). Situation awareness in remote control centres for unmanned ships. In *Proceedings of Human Factors in Ship Design & Operation, 26-27 February 2014, London, UK* (p. 93).
- Burmeister, H. C., Bruhn, W. C., Rødseth, Ø. J., & Porathe, T. (2014). Can unmanned ships improve navigational safety?. In *Proceedings of the Transport Research Arena, TRA 2014, 14-17 April 2014, Paris,*.
- Porathe, T. (2016). Human-centred design in the maritime domain. *DS 85-1: Proceedings of NordDesign 2016, Volume 1, Trondheim, Norway, 10th-12th August 2016*, 175-184.
- Lützhöft, M. H., & Dekker, S. W. (2002). On your watch: automation on the bridge. *The Journal of Navigation*, *55*(1), 83-96.
- Grech, M. R. (2016). Fatigue risk management: A maritime framework.
- Lützhöft, M., Grech, M. R., & Porathe, T. (2011). Information environment, fatigue, and culture in the maritime domain. *Reviews of human factors and ergonomics*, *7*(1), 280-322.
- Alop, A. (2019). The main challenges and barriers to the successful “smart shipping”. *TransNav: International Journal on Marine Navigation and Safety of Sea Transportation*, *13*(3).
- Alop, A. (2019). The challenges of the digital technology era for maritime education and training. In *2019 European Navigation Conference (ENC)* (pp. 1-5). IEEE.
- Bauk, S. (2025). Maritime Cybersecurity. Springer. London.
- van den Broek, J. H., Griffioen, J. J., & van der Drift, M. M. (2020). Meaningful human control in autonomous shipping: An overview. In *IOP Conference Series: Materials Science and Engineering* (Vol. 929, No. 1, p. 012008). IOP Publishing.