SFI AUTOSHIP
Autonomous ships

Safety and Assurance of Autonomous Ships: Framing of Research Actions

Knowledge for a better wolrd

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Agenda

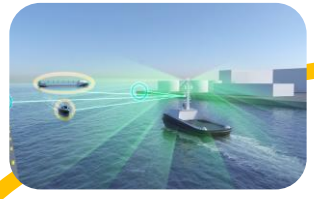
- About SFI AutoShip
- Joint industry and research challenges
- Selected research focus

SFI AutoShip

- Research-based innovation centre headed
- Headed by NTNU
- 8 years (2020-2028)
- Increase the adaption of autonomous systems and technologies
- 23 partners
- Educating > 20 PhDs, > 5 Postdocs, 50-100 master students

Research scope and applications

WP1: AutoRemote
Developing autonomy that manage complex environments



WP2: Digital infrastructure
Optimizing communication capacity for robustness and security

WP3: HF and ROC
Monitoring from shore – Design and operation with people in new roles

WP5: Sustainable Operations
Ensuring sustainability of total transport solution

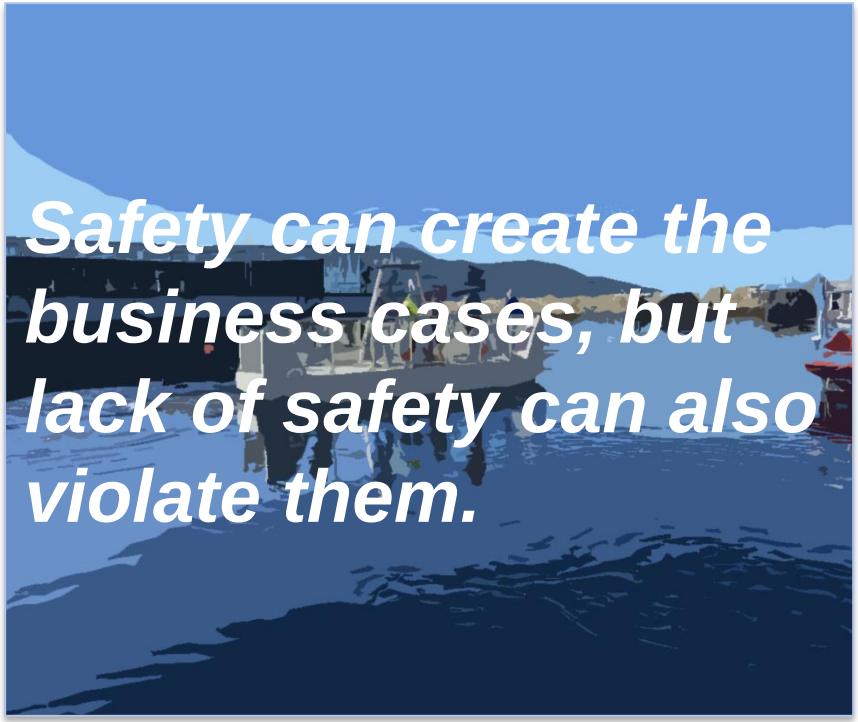
<u>Use cases:</u>
Raising level of autonomy for:

- Deepsea shipping
- Short sea shipping
- Ferries
- Unmanned surface vessels

WP4: Safety and Assurance: Incorporating risk and safety management in design and operation

Illustration/photos: NCL, KM, NTNU and Massterly

Joint industry and research challenges



Lack of:

- Ability to translate regulations into technical requirements
- Ability to address software faults in risk assessments
- Ability to incorporate effect of changes in the operating environment for online risk monitoring
- Ability to capture dependencies and coupling of interacting systems
- Effective use of digital twin for safety demonstration in the whole lifecycle

Selected research first phase

Legal deployment

Motivation:

Autonomous vessels a unique opportunity of exploring topics which delve deeper into the relationship between Law and technology

Tasks:

- Legal analysis and application in court
- Develop legally-substaintiated explanation of rules to deploy in autonomous systems

Use case:

Risk related to software

Motivation:

Software risk in the maritime environment in early stage of development and understanding. Existing practices from the automotive and railway industries. Are restrictive in terms of high-level autonomous functions.

Tasks:

- Development of software risk and failure taxonomy
- Integration of software risk into risk methods
- Suggest countermeasures

Use case:

Use of DT for safety demostr

Motivation:

Digital twins have been used in different domains for several years now but approaches to represent autonomous systems with digital twins started recently.

Tasks:

- Identify requirements to digital twin and environment for safety demonstration
- Build a prototype to test with applicable use cases

Use case:

Reliable Design & Operation

Motivation:

Electric propulsion plants may suffer from complex failure modes and require careful and predictive maintenance. Critical failures may create unsafe situations.

Tasks:

- Investigate the reliability and safety combining qualitative and quantitative methods
- Incorporating hydrodynamics for stability analysis and prediction of grounding.

Use case:

Online risk monitoring

Motivation:

Autonomous ships will be subjected to dynamic factors, such as equipment degrading and changing environmental factors, affecting risks., Must be considered in the autonomous system and tools for decision-making.

Tasks:

- Develop online risk models, developed on the basis of identifying hazards related to safety and security
- Test the risk models and their use for decision-making

Use case:

Thanks for your attention

Questions?

www.ntnu.edu/sfi-autoship

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