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This report presents a framework that defines the concept of ‘trustworthiness’ in marine ships. A set of five aspects for trust is presented, refined from an industry accepted framework of trust, that fully define trustworthiness in this context. Assessment by subject matter experts form references for the in-operation assessment of ship trustworthiness, and a scale of trustworthiness levels is presented, drawing upon similar concepts seen in well-known SILs and DALs as applied to safety assessment.

The concept has been developed considering ship and system level perspectives, though the frameworks and processes have been designed to be generic, modular and readily extensible as required. Wider applicability and scalability of these outputs would form a logical step for future investigation. The concept is presented as a demonstrable baseline and starting point for refinement given considerations of practicability, extensibility, and scalability.

Example applications describing a method of providing additional contextual information to equipment/sub-system operators and ship captains alike has been investigated, in addition to the way in which the concept is applicable to both manned, lean-manned, and fully autonomous ships. Benefits resulting from these applications include clearer and more coherent information access and understanding, more focused operator workload, and improved and quicker situational awareness.

The concept has been developed with potential for refinement through further input from experts and testing of its extensibility, both in terms of breadth (across different ships and applications) and depth (increased or decreased level of system fidelity). Such further work would mature the concept and develop it for inclusion throughout the lifecycle of a ship as a core embedded capability, rather than a later-stage bolt-on capability.

The concept of trustworthiness of unmanned ships is applied in a structured way which is informed both by subject matter experts (considering ship-specific effects of issues on trustworthiness) and real-time events (identification and categorisation of issues through signal monitoring). Trustworthiness levels are a way of quantifying the level of confidence in a system to function as expected and communicating this to the control authority, and are generically applicable to sub-systems and ships alike. The framework allows for a more informed decision to be made, with known confidence, for how to respond to a scenario based on the degradation in trust seen and what the ship-level impacts are.

The application of an automated trustworthiness framework is novel in this context and could have a significant impact upon the future design and deployment of unmanned marine ships, as well as broader applicability to autonomous and unmanned ships in other domains.

## References

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