Maritime Autonomy: Developments and Way Forward

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Agenda

- Industry Use Cases
- ABS Approach
- Going Forward



Industry Use Cases



Industry Use Cases

- (1) Small vessels (~Length <24m)
- (2) Remote Control
 - Marine
 - Offshore
- Larger vessels SOLAS Vessels (>500 GRT)
 - (3) Autonomous vessels
 - (4) Autonomous functions



Industry Use Cases – Small Vessels (Length <24m)

- Technology is ready
- Specialized functions:
 - Sea floor mapping
 - Patrol and surveillance
- Non SOLAS Vessel
- National regulations akin to UK Industry Conduct Principles and Code of Practice
- Key considerations:
 - Risk assessment to environment
 - Code of Conduct
 - Lights/signals





Industry Use Cases – Remote Control

- Remote control from shore
- Technology is available
 - Communications
 - Remote monitoring in use by shipowners
- New concept
 - May have major impact on overall ecosystem
- Key considerations:
 - Human in the loop involvement
 - Complex systems: Ground-up design using systems engineering principles
 - Remote operator training and requirements





Industry Use Cases – Autonomous Functions

- Industry demand:
 - Autonomous navigation and CDCA
 - Electronic lookout
 - Increased safety
 - Applicable to conventional vessels
- Barriers:
 - Regulations are human-centered
 - Requirements are dispersed:
 - SOLAS, STCW, COLREG
- Industry need: Assurance framework for autonomous functions





Industry Use Cases – Autonomous Vessels

- Long term view
- Specialized routes and functions
- Complex systems ground-up design using Systems Engineering concepts
 - Function based instead of equipment based
 - Human-in-the-loop
- Barriers:
 - Need regulations
 - Industry needs to embrace systems engineering
- Collection of functions





ABS Approach



Requirements for Autonomous and Remote Control Functions

- Focus on Functions "a group of tasks, duties and responsibilities necessary for vessel operation, safety of life at sea or protection of the marine environment"
- Risk-based approach
- Mix of goal-based and prescriptive requirements
- Notations:
 - AUTONOMOUS
 - REMOTE-CON



V-Model Implementation Process



Going Forward



Going Forward





- Personnel training immersive simulators
- Augmented Reality / Virtual Reality inspection tools
- Remote control through visualization technologies

ARTIFICIAL INTELLIGENCE

- Self-diagnostic and selfrepair
- Assurance

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 Verification and Validation of AI models

VIRTUAL ASSETS

- Modeling and simulation
- Virtual simulation tests
- Model-based systems engineering

AUTONOMOUS OPERATIONS

- Increased use of autonomous functions
- Real-time decision support through advanced simulation based analysis
- Diversification of seafarer knowledge, skills and abilities



Product Transformation

Product transformation

- Digital and autonomous technologies being implemented on conventional vessels
- Connected vessel
- Ship as System-of-Systems





Conclusion

- Our view:
 - Small Vessels
 - Remote Control
 - Autonomous Functions
 - Autonomous Vessels
- MASS Code:
 - Target date of 1 January 2028
 - Work in progress critical
- Digital transformation
- Regulations have to adapt to new technologies





Thank You

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