ADVANCE/DEVELPOMENT IN AUTONOMOUS SHIPS

ACS Seminar 2022

Emirates Classification Society (TASNEEF)
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Contents

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History of Automation

- IMO started discussion as early as 1964 on Automation in Ships.
- World War II–Unmanned Drones were used.
- German Navy-First one to use autonomous vessels (mine sweepers) since early 1980's.

INTER-GOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION

IMCO

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MSC VIII/11
9 March 1964

Original: ENGLISH/FRENCH

MARITIME SAFETY COMMITTEE COMMITTEE - 8th session
Agenda item 11

AUTOMATION IN SHIPS

Note by the Secretariat

IMO Development

- 103rd session approved the outcome of Regulatory Scoping Exercise (RSE) for user of MASS.
- IMO MSC Committee 105th Session agreed to develop non-mandatory Goal-based Instruments for MASS. Outline of the draft guidelines submitted by Japan, Russian Federation and United Arab Emirates.

"MASS" was defined as a ship which, to a varying degree, can operate independent of **HUMAN** interaction

IMO INTERNATIONAL MARITIME ORGANIZATION

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MARITIME SAFETY COMMITTEE
105th session
Agenda item 7

MSC 105/7/2
13 January 2022
Original: ENGLISH
Pre-session public release: ☒

DEVELOPMENT OF A GOAL-BASED INSTRUMENT FOR MARITIME AUTONOMOUS SURFACE SHIPS (MASS)

Outline of the draft guidelines for MASS operations

Submitted by Japan, Russian Federation and United Arab Emirates

SUMMARY

Executive summary:	This document provides an outline of draft guidelines for Maritime Autonomous Surface Ships (MASS) operations mainly related to SOLAS requirements, which would ultimately become a part of a mandatory goal-based instrument. The structure and elements contained in the proposed guidelines are also expected to facilitate discussion on the development of a road map for its finalization at MSC 105.
Strategic direction, if applicable:	2
Output:	2.23
Action to be taken:	Paragraph 21
Related documents:	MSC104/15/26, MSC104/18; MSC 105/7; MSC.1/Circ.1638; LEG.1/Circ.11; FAL/ISWG/MASS 1/4 and FAL 46/14

Tasneef Guide for MASS

❖ Equivalent Safety & Quality of Service

- Ship operation carried out through MASS technologies to provide:

- A level of safety & security to people, properties and the environment, and
- Quality of Service.
- at least equivalent to what is normally provided in the corresponding operations carried out without them (conventional ship operation).

Tasneef
TASNEEF Maritime تصنيف ماريتايم

Amendments to "Guide for Maritime Autonomous Surface Ships (MASS)"

Effective from 1/10/2021

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MASS Technology-Degree of Autonomy

- Degree One: *Ship with automated processes and decision support:* Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.

- Degree Two: *Remotely controlled ship with seafarers on board:* The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.

- Degree Three: *Remotely controlled ship without seafarers on board:* The ship is controlled and operated from another location. There are no seafarers on board.

- Degree Four: *Fully autonomous ship:* The operating system of the ship is able to make decisions and determine actions.

Courtesy-Kongsberg

Analysis of MASS Technology

❖ High Level Functions

➢ Several High-Level Function can be identified as being part of ship operation, such as:

- Navigation
- Machinery, Propulsion & Steering management
- Communications
- Cargo & Ballast management, including load/unload
- Safety, watertight integrity and fire protection
- Distress, rescue & Security
- Habitability & Crew/passenger servicing

Impact of MASS Technologies

❖ In Conventional Ship Operation, seafarers play a role in all fu nctions and interact with:

➢ Ship Systems and

➢ Environment.

➢ The use of Mass Technologies brings changes with respect to conventional ship operation in:

- How tasks are carried out, and
- How duties and responsibilities are assigned

Scope of Application of MASS Technologies

❖ The MASS technologies can be used for both or one of the follo wing scopes:

➢ Support (monitoring, decision support, telemetry)

➢ Operation & Management (execution of control actions on processes, management operational parameters..)

Courtesy-Kongsberg

Development-AL SWARM

- ❖ **AL-SWARM: An agnostic maritime technology that can be used in creation of autonomous systems that collaborate together to conduct a specific maritime services.**

- ❖ **Al-Swarm consists of:**

  - ➢ **Autonomous Tugs, boats and drones**
  - ➢ **Swarm technology implementations**
  - ➢ **Cloud assessable AI-Powered software pack**
  - ➢ **Fully UAE based from A-Z**
  - ➢ **Three project phases over five years- AED 64M**

Courtesy-ABUDHABI MARITIME ACADEMY & SYSTEM RIO

Development-SWARM Technology Stack

Hardware — Software — Business Intelligence — Products

Current Marine System

Current marine hardware are limited by human operators with semi-autonomous/remote-controlled sensing capabilities. Making them inability to carry **complex autonomous missions.**

The system is integrated using **universal interfaces** and adapters for adaptation to potential future needs.

Autonomy

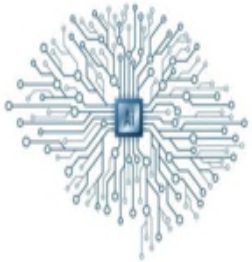
An intelligent cutting-edge software stack along with feedback from advanced sensors is developed to enable the execution of **autonomous** missions in challenging **unstructured** and GPS-**denied** environments, without the need of direct operation of guidance from an operator.

Swarm Behaviour

Collective intelligent **SWARM behaviour** was developed in order to coordinate a group of heterogeneous Unmanned systems in order to increase the **efficiency** and **resilience** of the group while executing **critical** and **sensitive missions**.

A.I Core

Software Core developed radically accelerates **A.I development**, training, and validation workflows by integrating **purpose-built** data management, **models** and analysis workflows, scalable replay and simulation, and **self-directed learning**.



Swarm-based Autonomous Services

Autonomous Monitoring

Courtesy-ABUDHABI MARITIME ACADEMY & SYSTEM RIO

Development-AL-SWARM USE CASES

1. AUTONOMOUS BERTHING SYSTEMS : SWARM + AUTONOMOUS ROBOTIC TUGS

2. INFRASTRUCTURE MANAGEMENT: SWARM SYSTEMS FOR SURVEILLANCE AND STUDIES

Courtesy-ABUDHABI MARITIME ACADEMY & SYSTEM RIO

Advantages

- Improved Safety of ship operation.
- Cost efficiency (reduce entire deckhouse and accommodation and spaces that serves the crew). This reduces the design, construction and operational cost, weight and space thus carry more cargo. Also, deckhouse will reduce more air resistance a nd improves efficiency.
- Maritime accidents (80% human error).
- Workload reduction hence response to shortage of seafarer.
- Reliability & Reduction of environmental impacts.
- Development of new technology and new technical interest.

Challenges

- Human Issues & liability of collision.
- Human reliability assessment, human element & operational risk assessment
- Decision Making system- Flooding situation, engine damage, optimum use of fuel, collision avoidance, routing, hull loads and damages, ice navigation routing, stability and cargo, weather condition, ship maneuverings etc.)
- Propulsion system & Ship design
- Communication system to be robust and suitable protection of data and cybersecurity
- Maintenance and repair
- New Hazard & Risk analysis of autonomous ships

ACS Website: http://www.asiancs.org