Space Enabled Solutions for the Future of Logistics

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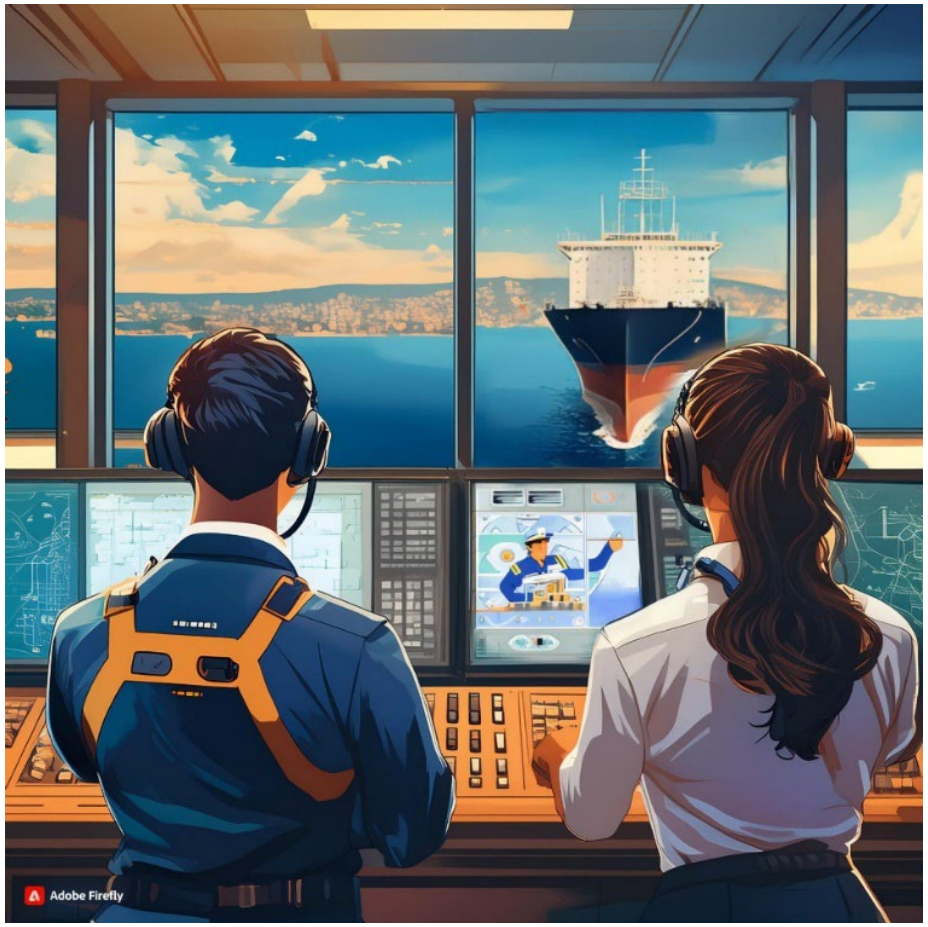
Rome, May 8th, 2025

Agenzia Spaziale Italiana

Outline

- Setting the scene about the Autonomous Ship:
  - regulatory framework;
  - the Italian panorama and motivations.
- Uncrewed shipping in Italy
  - Background and prospects in Livorno;
  - The 5G MASS (*) experience;
  - The role of space technologies for MASS.
- Conclusions and Outlook



(*) Maritime Autonomous Surface Ship

Unmanned Shipping

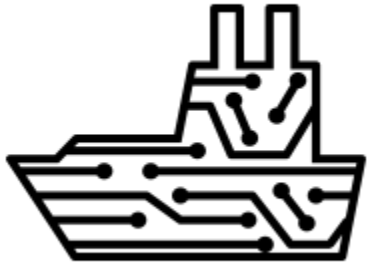
Italian trials

cnit

Credits to the © 5G MASS consortium

Towards unmanned shipping

- Draft MASS code available:
  - MSC 109/WP.8 Dec 2024 (rapporteur Sweden)
- With high-level directives for:
  - ROC functionality;
  - ship assets;
  - port physical/digital infrastructure.
- expected to be realeased (see the IMO MASS Code roadmap):
  - voluntary code (2025-26)
  - experience building phase (2026-28)
  - mandatory code (2030-2032)



ANNEX 1

NOTE: The proposals in the submissions made to this session that have not been discussed, are kept in this version for ease of future reference and discussion.[1]

CONSOLIDATED VERSION OF THE DRAFT INTERNATIONAL CODE OF SAFETY FOR MARITIME AUTONOMOUS SURFACE SHIPS (MASS CODE)

TABLE OF CONTENTS

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cular reminders and additional modification
ade to this session and the proposals by

	Level of autonomy	*Human presence*	*Operational control*	*Human role*
Degree 1	Ship with automated processes and decision support	Yes	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	Supervision and operation
Degree 2	Remotely-controlled with seafarers on board	Yes	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	Backup to manoeuvre, supervise the systems
Degree 3	Remotely-controlled without seafarers on board	No	The ship is controlled and operated from another location. There are no seafarers on board	Monitoring and remote control
Degree 4	Fully autonomous	No	The operating system of the ship is able to make decisions and determines actions by itself	Monitoring and emergency management

Livorno and ESA programme on unmanned shipping

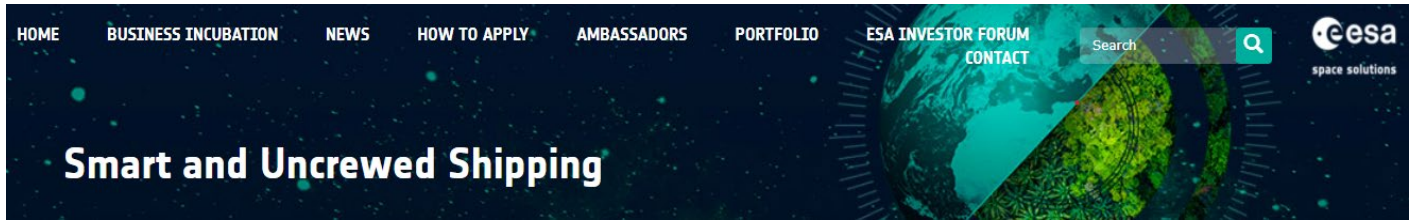
5G MASS: 2022 - 2024

- Submitted to ESA Smart and Uncrewed Shipping Call for Proposals:
  - Supported by ASI;
  - led by TIM as prime contractor;
  - Framed into ESA/ITCG SMTF (see here the press release).
- Objectives:
  - integration of on-board, land-based and nomadic equipment with technological solutions already available from the ICT world;
  - standardization and replicability;
  - field trials and risk assessment;
  - end user requirements and valorization of skills already acquired.

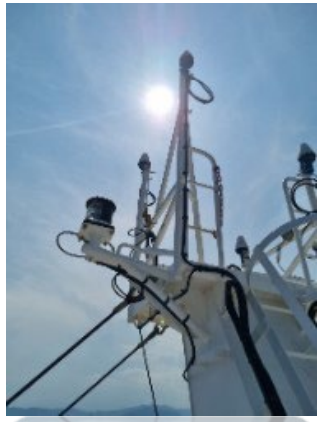
co-funded by ASI in ESA Business Applications (BASS)
Grant n. 4000137214

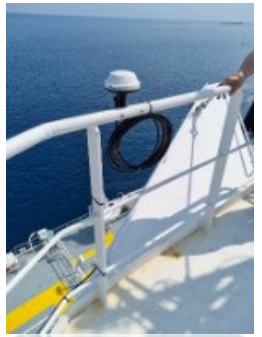
Under the institutional supervision of the Italian Coast Guard

https://business.esa.int/projects/5g-mass



5G MASS showcase





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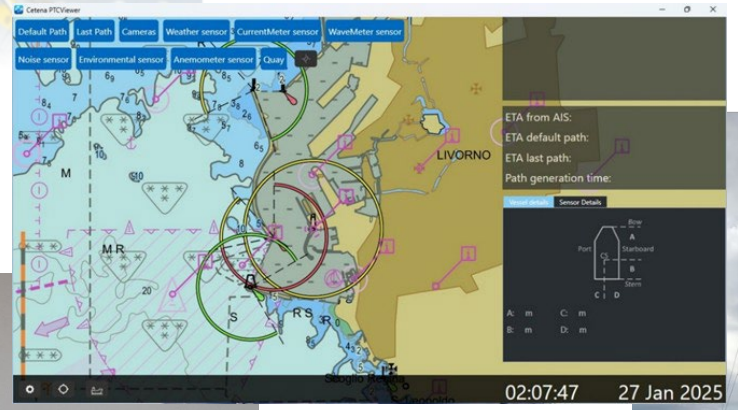
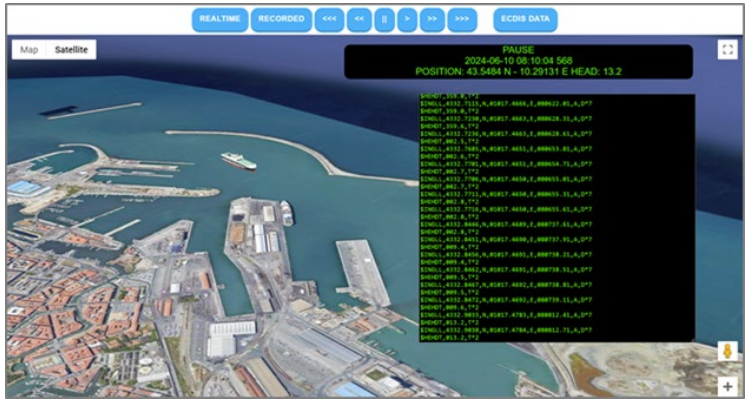
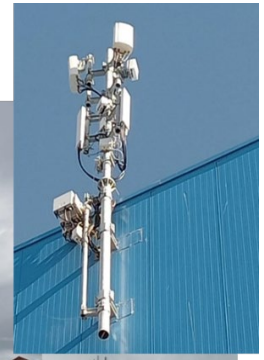






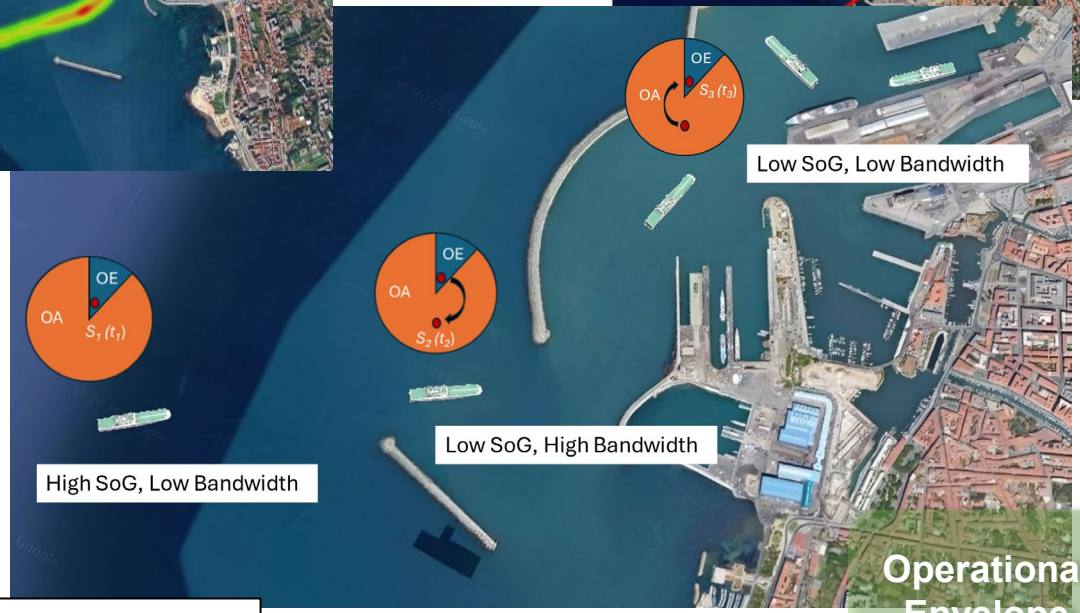
5G MASS results

Network Assessment

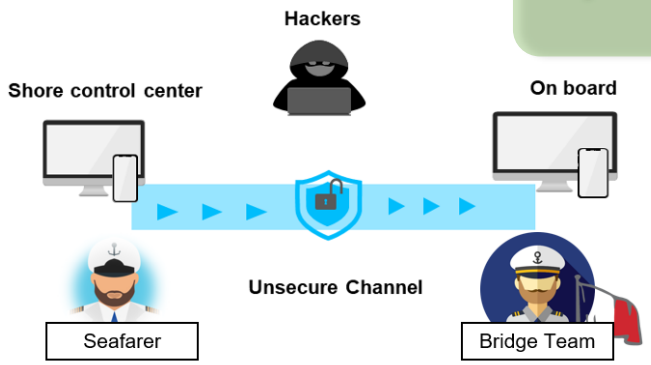
Detection Accuracy

Description	Device	Delta	Ship to obstacle distance
Tugboat (docked)	PTZ_C_Port	n.a.	253
"Punta vegliaia" (breakwater edge)	PTZ_C_Port	69.1	470
Edge A of the quay	PTZ_C_Port	19.46	232
Edge B of the quay	PTZ_C_Port	30	472
Corner of the quay	PTZ_C_Port	12.6	371
Pole on the quay	PTZ_C_Port	4.7	187
Corner of the quay / bollard	PTZ_C_Port	6.5	147
"Punta vegliaia" (breakwater edge)	PTZ_C_St		
buoy	PTZ_C_St		
lighthouse	PTZ_C_St		
Virgin Mary statue	PTZ_C_St		
Edge A of the pilots quay	PTZ_C_St		
Edge B of the pilots quay	PTZ_C_St		
Corner of the pilots quay	PTZ_C_St		
Quay I	PTZ_C_St		

Operational Envelope



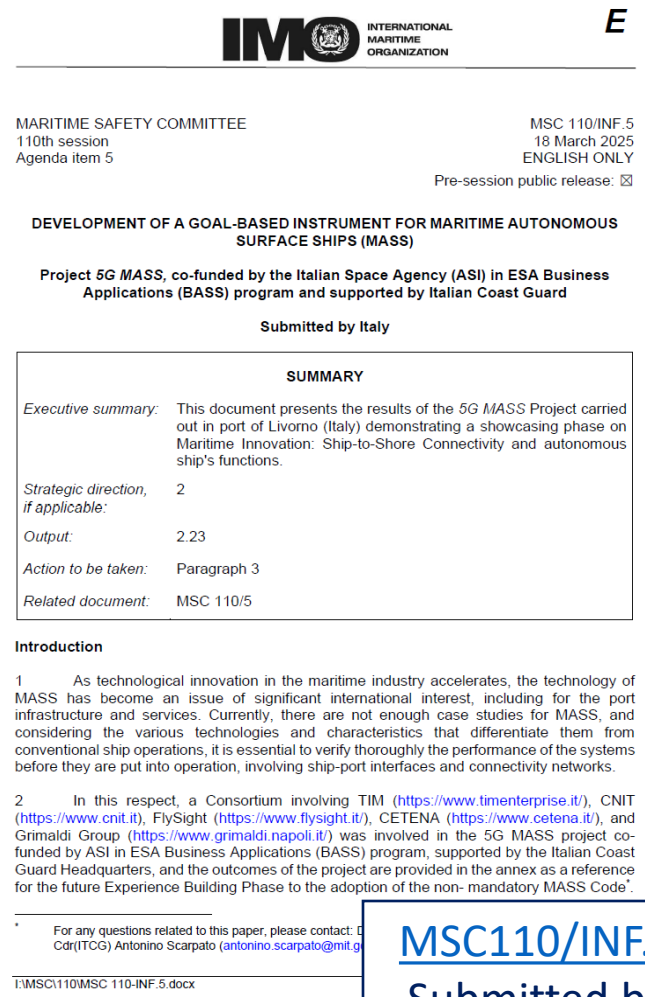
Cybersecurity



A. Tardo @ 78th National Assembly of Fedepiloti, April 8th, 2025, Rome (full recording in Italian)

5G MASS @ MSC 110 (June 2025 in London)

- Introduction
  - Definition of the MASS technical case. Status and progress of the international regulatory framework.
  - The unmanned shipping experimentation and trials in Italy
- Target and objectives
  - Scope, narrative of the trials, and Operational Context
  - Port of Livorno appointed to be the first MASS-ready digital port in Italy
- Assets under development
  - The Digital Ship
  - The Port Network and the Remote Operation Center
- Preliminary Results
  - Trial organization
  - Off-line analysis and obstacle detection performances
  - Preliminary results of real-time performances
- Prospected regulatory aspects
  - Vessel and ROC readiness against the prospected certification
- Conclusions and Outlook



IMO INTERNATIONAL MARITIME ORGANIZATION

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MARITIME SAFETY COMMITTEE
110th session
Agenda item 5

MSC 110/INF.5
18 March 2025
ENGLISH ONLY

Pre-session public release: ☒

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

Project *5G MASS*, co-funded by the Italian Space Agency (ASI) in ESA Business Applications (BASS) program and supported by Italian Coast Guard

Submitted by Italy

SUMMARY

Executive summary:	This document presents the results of the *5G MASS* Project carried out in port of Livorno (Italy) demonstrating a showcasing phase on Maritime Innovation: Ship-to-Shore Connectivity and autonomous ship's functions.
Strategic direction, if applicable:	2
Output:	2.23
Action to be taken:	Paragraph 3
Related document:	MSC 110/5

Introduction

1 As technological innovation in the maritime industry accelerates, the technology of MASS has become an issue of significant international interest, including for the port infrastructure and services. Currently, there are not enough case studies for MASS, and considering the various technologies and characteristics that differentiate them from conventional ship operations, it is essential to verify thoroughly the performance of the systems before they are put into operation, involving ship-port interfaces and connectivity networks.

2 In this respect, a Consortium involving TIM (https://www.timenterprise.it/), CNIT (https://www.cnit.it), FlySight (https://www.flysight.it/), CETENA (https://www.cetena.it/), and Grimaldi Group (https://www.grimaldi.napoli.it/) was involved in the 5G MASS project co-funded by ASI in ESA Business Applications (BASS) program, supported by the Italian Coast Guard Headquarters, and the outcomes of the project are provided in the annex as a reference for the future Experience Building Phase to the adoption of the non- mandatory MASS Code*.

* For any questions related to this paper, please contact: [redacted] Cdr(ITCG) Antonino Scarpato (antonino.scarpato@mit.g[redacted]

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MSC110/INF.5
Submitted by ITCG

Experience building for the 5G MASS «(standard?) model»

- Digital ships:
  - with different level of vessel autonomy
  - minimum performance and conformance procedures
- Port infrastructure:
  - with operational ROCs
  - set of appointed ports supporting MASS traffic
  - upgraded VTS (Vessel Traffic System)
  - upgraded PCS and logistics services
- MASS Zones:
  - locations and specifications
  - attached to one (or more) ROC(s)
- Central command center:
  - managing MASS life cycle
  - supervising and controlling MASS operations

(C) CNIT presentation shared at "La Digitalizzazione del Settore Marittimo: effetti sulla Logistica del Mare" event. (full recording in Italian)

Conclusions

- Unmanned shipping:
  - is a comprehensive full-digital domain subject to complex international regulations;
  - is going to be legally viable from 2025 and IMO conventional from 2032:
    - considers and requires a long period of «Experience Building Phase».
  - challanges refer to:
    - cybersecurity (see WS by the ITCG on May 7th), network architecture and performance, port layout and ROC functionalities, trial set-up and implementation, human element.
- Italy is on the forefront of the innovation, starting from 5G and ROC deployment in Livorno:
  - early results from Italy and prospects have been shown and commented;
  - a set of recommendations have been delivered to Space Agencies

- M. Draghi: “The future of European competitiveness”
  Part A “A competitiveness strategy for Europe”
  - 5. Launch dedicated EU innovation projects leveraging public-private partnerships and cross-border cooperation for decarbonisation and automatisation challenges in different segments. In light of different priorities for each transport segment the EU should provide a range of support tools to foster Innovation until market deployment.
    - **Waterborne: Maritime Autonomous Surface Ships (MASS), Modern inland waterway vessels adapted to new river conditions, and offshore wind platform technologies**