Les défis du spatial pour une transition vers les navires autonomes

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Ecole militaire, Paris, 10 décembre 2019

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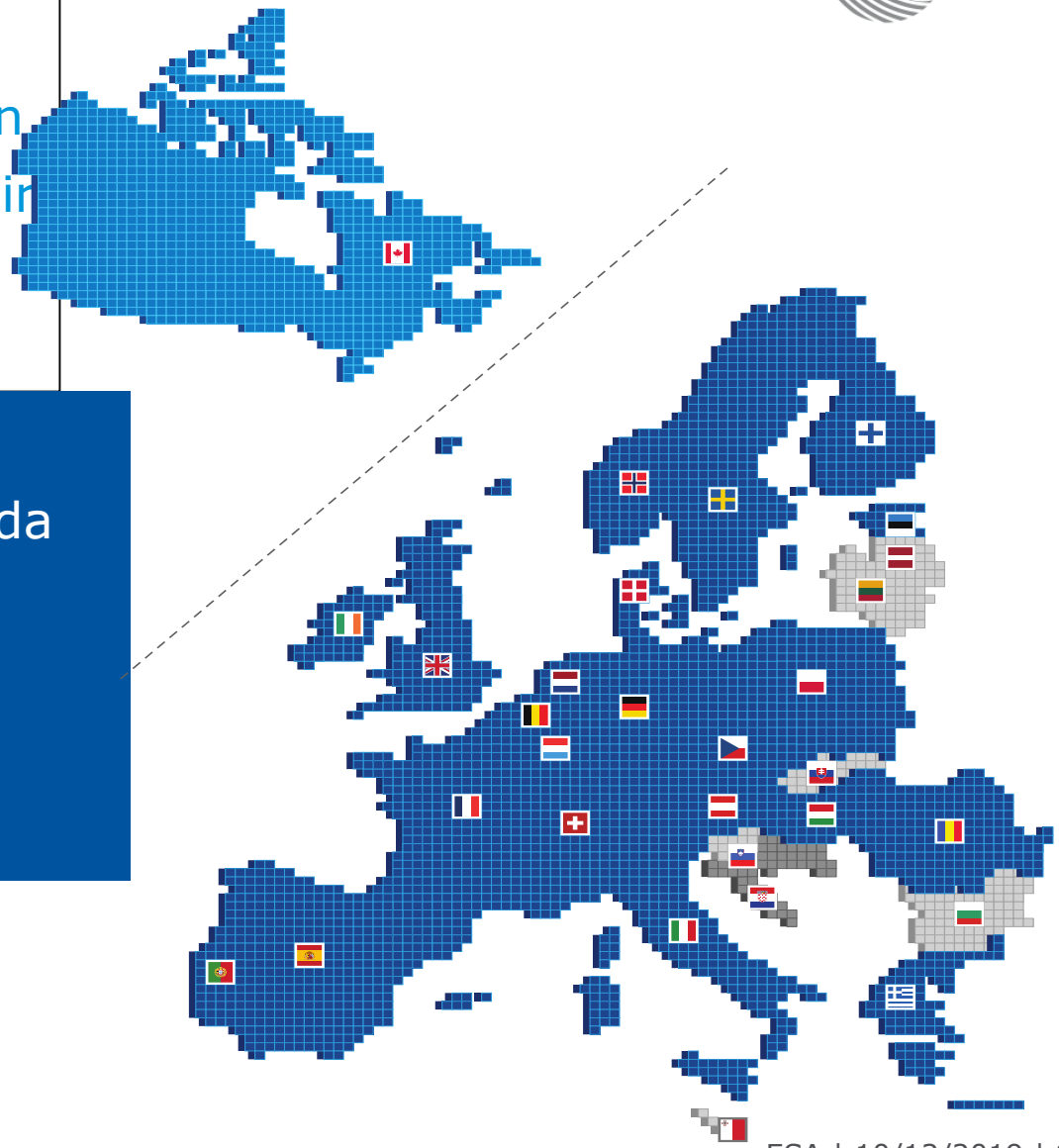
The European Space Agency (ESA)

- "To provide for and promote, for exclusively peaceful purposes, cooperation among European states in space research and technology and their space applications."
- *Article 2 of ESA Convention*



- Intergovernmental organisation - coordinated
- 22 Member States + Slovenia (associate) + Canada + cooperating States + partners
- Some 2300 staff – 5.7 Billion Euros (2019)
- Over 80 satellites designed, tested and operated
- More than 220 Ariane launches +Vega +Soyouz

All areas of space activity:

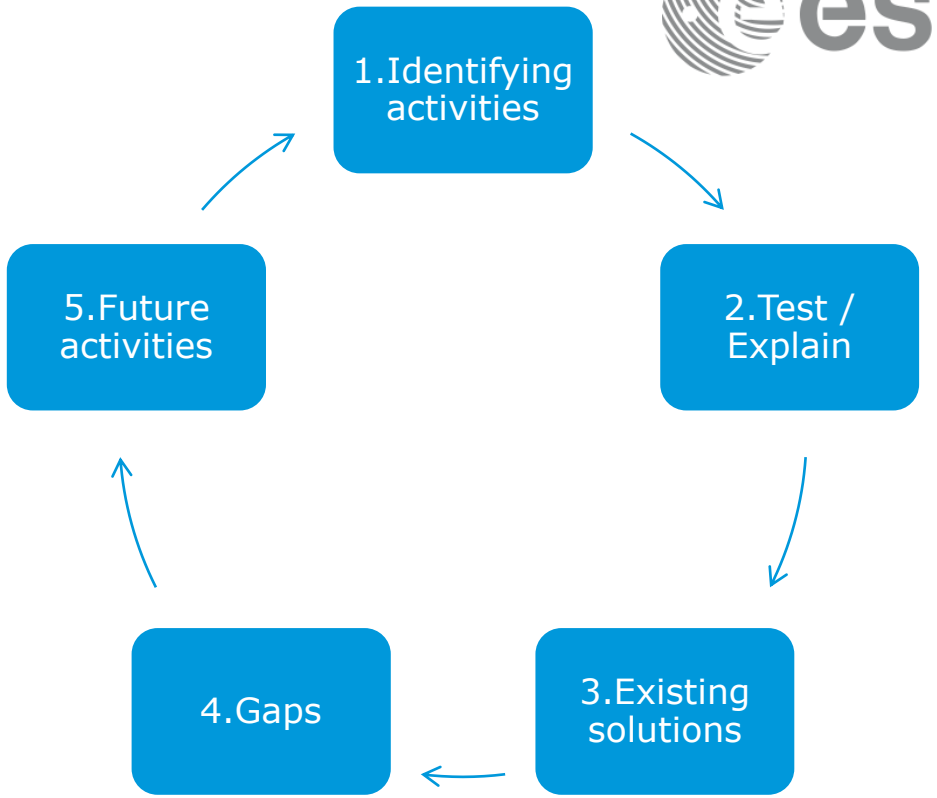
- Space science
- Human spaceflight
- Exploration
- Earth observation
- Navigation
- Telecommunications
- Technology
- Launchers
- Operations

Blue Worlds

The ESA Initiative Towards Space Projects Support for Sustainable Ocean Activities

Blue Worlds Task Force

- Kicked off 17 October 2019
- Member States and internal experts
- Transversal approach



Main dimensions of action:

→ Serving Member States policies and priorities

→ Identifying "user" needs

→ Lead efforts in advancing multi-disciplinary activities

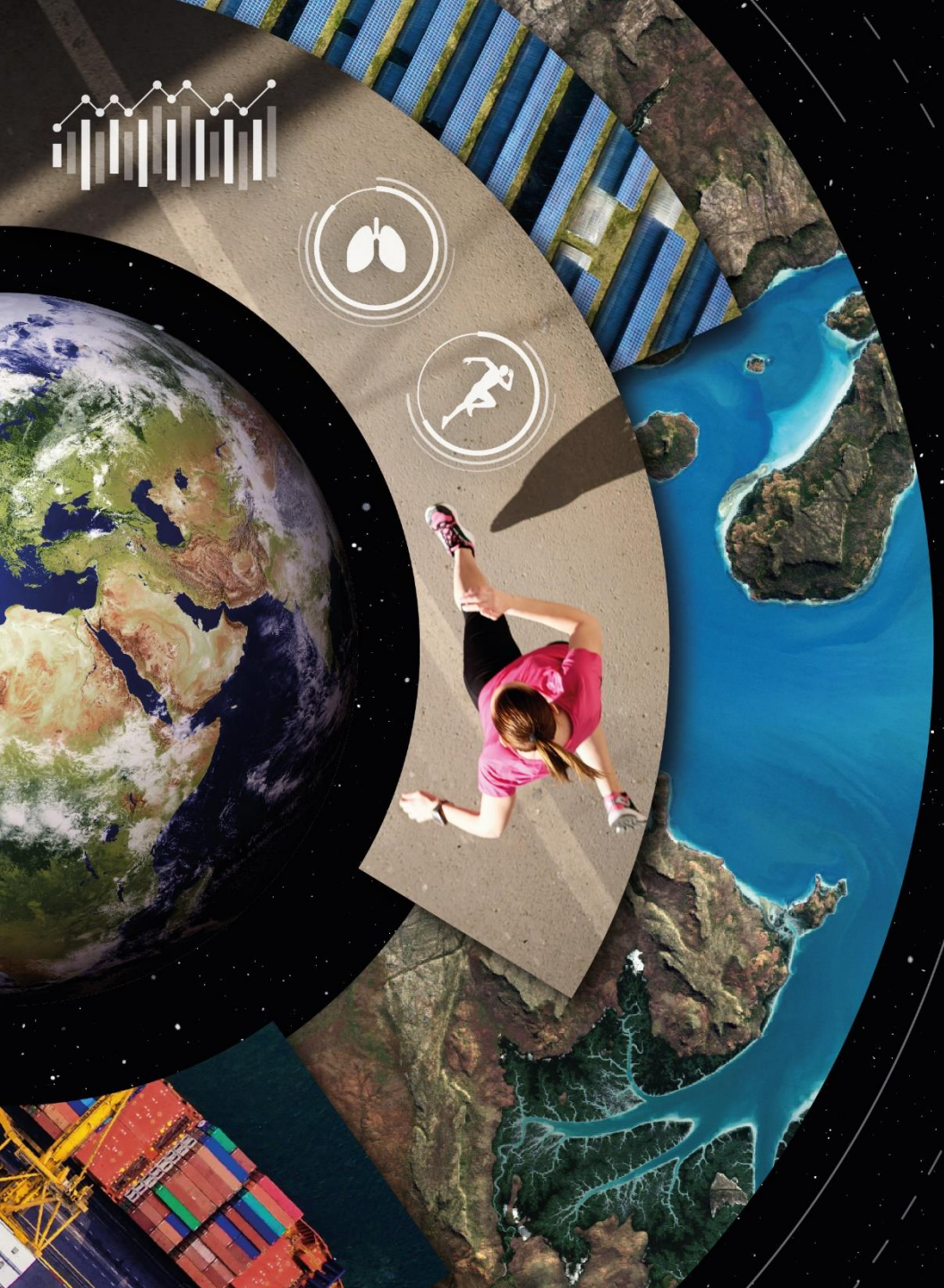
→ Pioneer development of disruptive technologies and business innovations

→ Preparing the future activities and programmes

Blue Worlds

The ESA Initiative Towards Space Projects Support for Sustainable Ocean Activities

The Case of Autonomous Shipping



esa space solutions | business applications

→ WE NEED MORE SPACE

Piera Di Vito- European Space Agency

Could you be leveraging Space technology and data for the benefit of life on Earth?

Space Weather

Maritime

Healthcare

Transport

Earth Observation

Environment

Agriculture

Satellite Navigation

Media

Energy

Satellite Communication

Education

Aviation

Human Spaceflight Technologies

Financial

→ OUR OFFER

We'll work together to make your idea commercially viable, with:

Zero-Equity Funding (€60k-€3M+)

Tailored Project Management Support

Access to Our Network & Partners

Use of the ESA Brand for Credibility

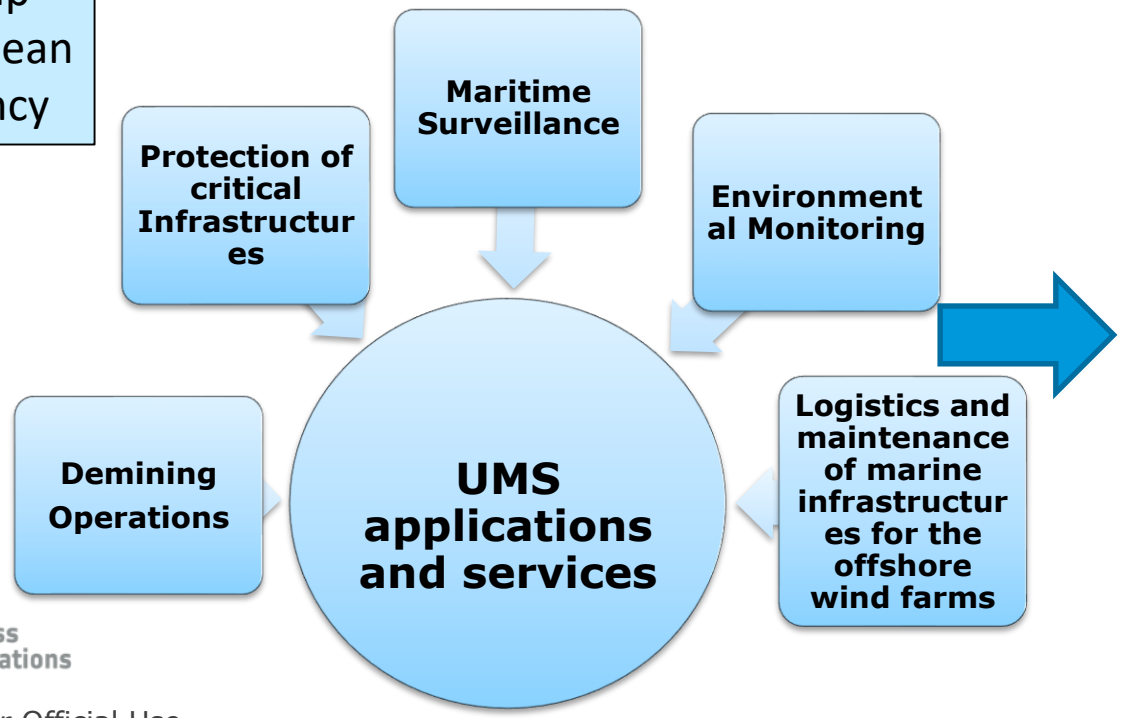
→ SPACE AND UNMANNED MARITIME SYSTEMS (UMS) -BASED MARITIME SERVICES

Feasibility Study Objectives: to identify and characterize UMS based services exploiting at least one space asset, addressing potentially interesting application domains, carry out the analysis of their technical feasibility and commercial viability, select the most promising ones for further development and exploitation, and propose a roadmap for the implementation and demonstration of the proposed services.

In partnership with the European Defence Agency

EUROPEAN DEFENCE AGENCY

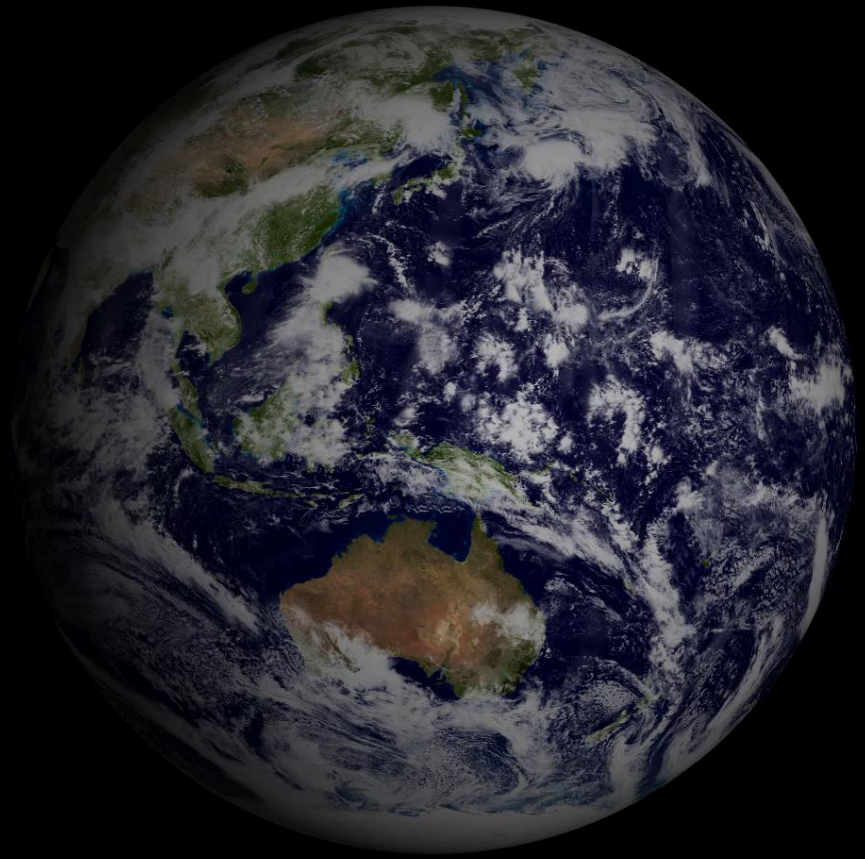
200 kEUR/9 months



- Maritime Safety as a service: intends to create business opportunities for manufacturers and suppliers of ship technology, shipyards, shipping companies, providers of intelligence and reconnaissance services and other industry stakeholders for the implementation of services in the target market.
- Autonaut: data-harvesting services based on unmanned maritime systems.
- SyriUS- Synergetic surveys using Unmanned maritime systems and Satellites: targets three innovative services for maritime surveillance, environmental monitoring and offshore engineering based on unmanned maritime systems.

esa | business applications

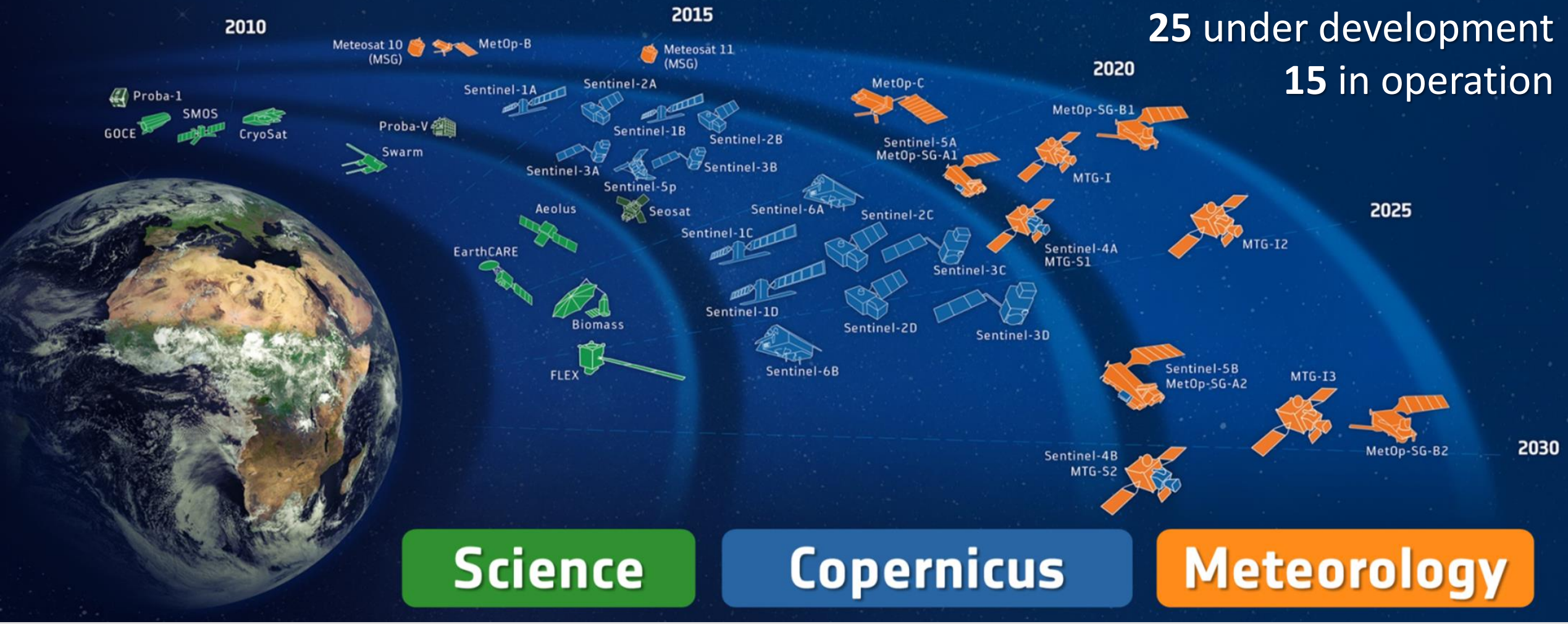
ESA Vision for EO



Feeling the Pulse of our Planet

ESA-DEVELOPED EARTH OBSERVATION MISSIONS

Satellites
25 under development
15 in operation



Science **Copernicus** **Meteorology**

Copernicus: Global European Leadership in EO

> 255.000
registered users
= tip of the iceberg

6 operational services

Land | Atmosphere | Ocean | Climate | Disaster | Security

250 TB satellite data distributed per day

full, free & open data policy

7 satellites flying

S1 | S2 | S3 | S4 | S5P | S5 | S6

preparing Copernicus 4.0

Maritime Transport and autonomous shipping

Opportunity for **wider uptake of EO** derived information:

- Development of fleet and integrated bridge management systems
- Longer term developments for autonomous vessels:
    - optimizing vessel route to minimize exposure to cross swell
    - reduce fuel consumption and increase sustainability (carbon emissions)

How can we **better cooperate with private sector vessel operators**?

- Provision of customized information services to the vessels, and vessels may act as in-situ data collection platforms
- ESA and EC considering additional missions (eg hyperspectral, L-band SAR, Thermal IR, SMOS/Cryosat follow-on)
- Atlantic/Arctic is increasingly crowded and maritime space faces growing problems in safety/SAR, including the issue of operations in ice infested waters
- Vessel detection enhanced for smaller (~20m) vessels with SLC data
- Artificial Intelligence and Machine Learning using co/cross-polarization

MISSION OPERATIONS & AUTONOMOUS SHIPPING

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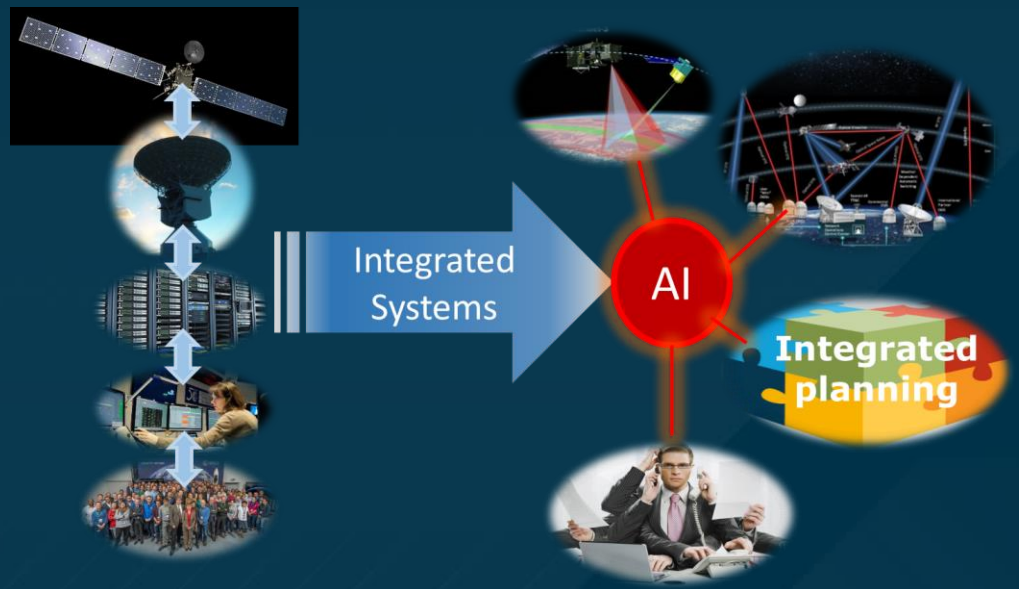
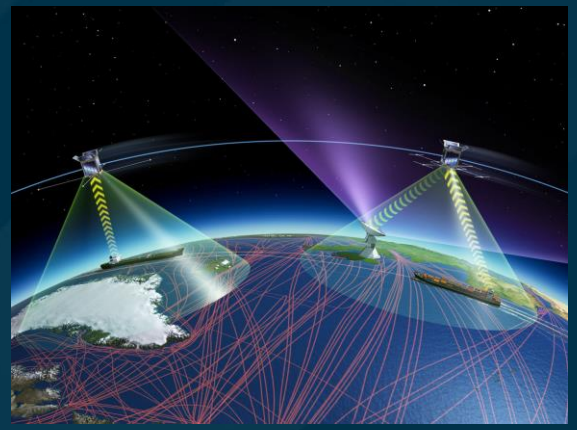
OPS ARTIFICIAL INTELLIGENCE FOR AUTONOMOUS SHIPPING

Autonomous spacecraft operations and autonomous shipping are not so different.

- Commonality between AS and spacecraft ops
  - Risk management / Anomaly handling
  - Collision prediction & avoidance
  - Operations without humans in the loop
  - Inter-objects (ships / satellites) communications
- Relevant OPS Expertise
  - Mission Control Automation
  - Planning & Resource Optimisation: Routing, Fleet Coordination, Decision Making and Workflows
  - Operations for Telerobotics and Autonomous Systems
  - Big Data Assessment & Processing
  - Inter-satellite Communications





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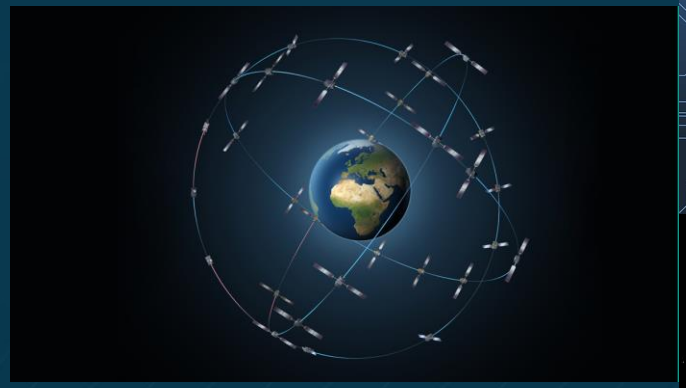
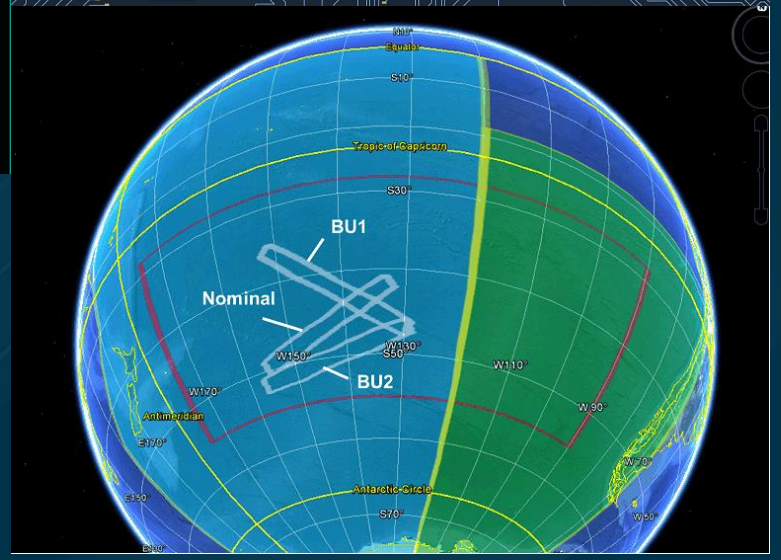
OPS CYBERSECURITY & COLLISION AVOIDANCE SERVICES FOR AUTONOMOUS SHIPPING

Safe & Secure Operations needed for spacecraft and ships.

- Space Operations Cybersecurity for Autonomous Shipping
  - Secure remote asset operations
  - End-to-End communications security
  - AI for detection of malicious activities





- Collision Avoidance Services for Autonomous Shipping
  - Informing ships about traffic (other ships) or fixed (wrecks) and moving obstacles (icebergs)

HOW CAN OPS TECHNOLOGIES SUPPORT AUTONOMOUS SHIPPING?

What are the main challenges related to autonomous shipping that OPS can contribute with its expertise?

- What are the key routing factors for autonomous shipping?

  Foreseen: e.g. wrecks

  Unforeseen: e.g. icebergs other ships

  Optimisation: Energy saving, end-to-end transportation time, docking port utilisation, cost

- Which data needs to be made available to the autonomous ships and why?
- What are the safety and security threats applicable to autonomous shipping?
- How can anomalies / failures be predicted and corrected?
- What are the main challenges for the operations concept of the autonomous ships? (e.g. centralised/ distributed/..)

=?

Autonomous shipping – MoI ESA / One Sea

Et aussi

- Appel à idées récent sur : enabling harbour-to-harbour autonomous shipping
- Communications quantiques: SAGA (Security And cryptoGrAphic mission)
- Système de positionnement Galileo opérationnel
- Robotique et technologies à transférer

Pour aller plus loin:

- Besoins des « utilisateurs » et échanges
- Solutions existantes
- Trous capacitaires
- Futures applications et programmes

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Space_for_Earth/Oceans

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