Copernicus and its evolution

Europe's eyes on Earth

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Space

Copernicus EU

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Copernicus
Europe's eyes on Earth

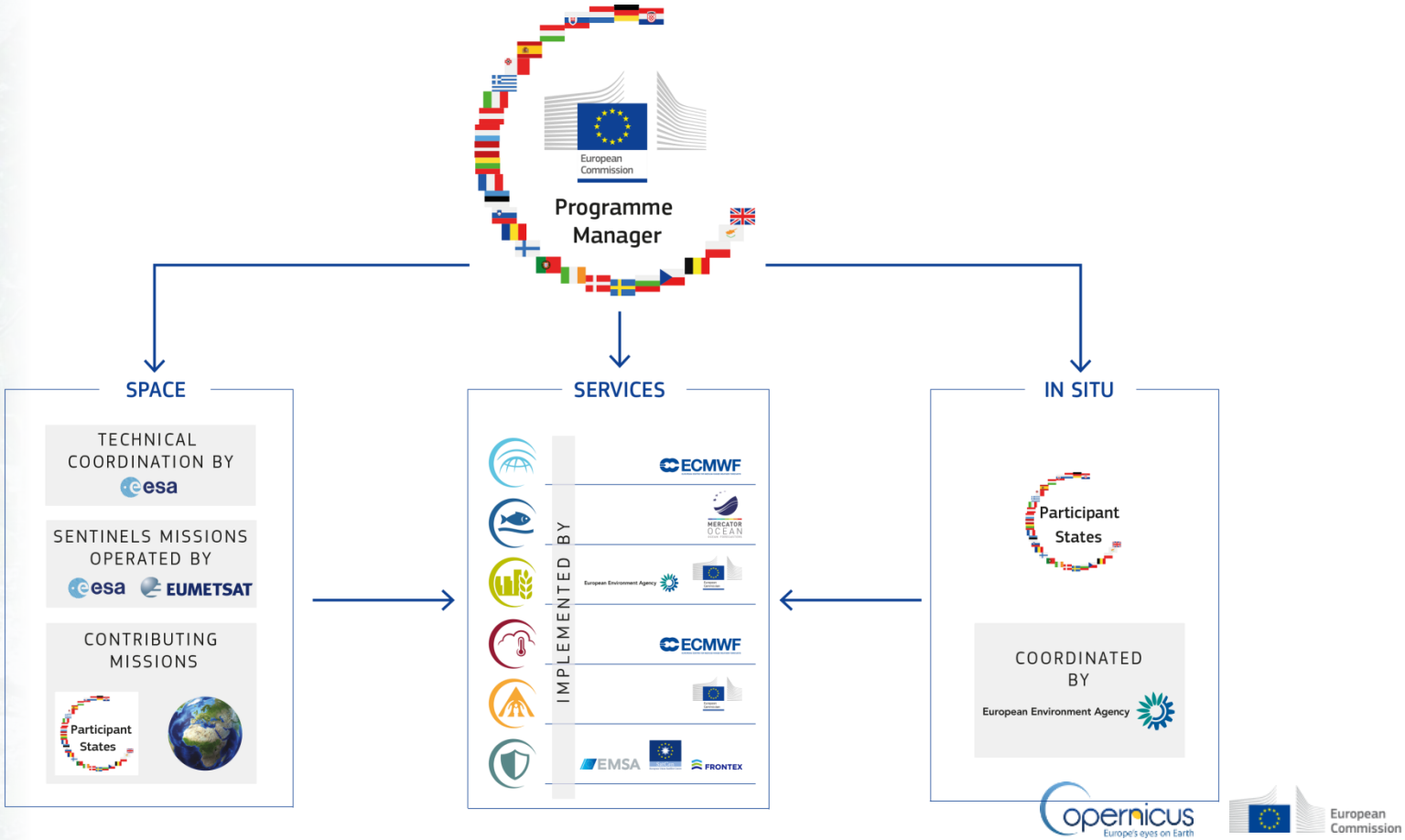
OUTLINE

- Copernicus in brief
- Copernicus evolution
- European Union Space Programme (2021-2027)

COPERNICUS IN BRIEF

- **The Copernicus programme** *(REGULATION (EU) No 377/2014)* is a cornerstone of the European Union´ efforts:
  - To monitor **the Earth,** its environment and ecosystems
  - To ensure its citizens are prepared and protected for **crises, security risks** and **natural or man-made disasters**
- Places a world of insight (data and information) about our planet at the disposal of citizens, public authorities and policy makers, scientists, entrepreneurs and businesses on a **full, free and open basis**
- Is a tool for **economic development** and a driver for the **digital economy**

COPERNICUS GOVERNANCE



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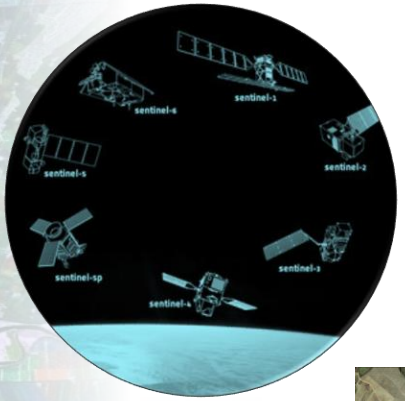
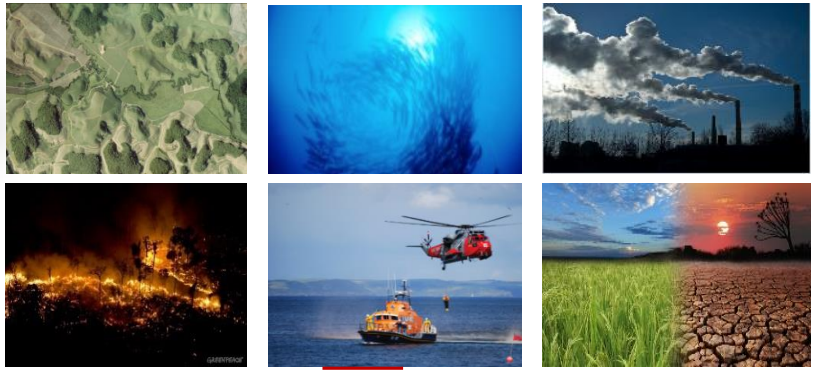
COPERNICUS ARCHITECTURE

Copernicus



Sentinels

6 services use Earth Observation data to deliver



added-value products

Contributing missions

In Situ

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THE SENTINELS

FULL, FREE AND OPEN

		Key Features
 SENTINEL-1: 4-40m resolution, 3 day revisit at equator	*2 Sats in orbit*	Polar-orbiting, all-weather, day-and-night radar imaging
 SENTINEL-2: 10-60m resolution, 5 days revisit time	*2 Sats in Orbit*	Polar-orbiting, multispectral optical, high-res imaging
 SENTINEL-3: 300-1200m resolution, <2 days revisit	*2 Sats in Orbit*	Optical and altimeter mission monitoring sea and land parameters
 SENTINEL-4: 8km resolution, 60 min revisit time	*1st Launch in 2020*	Payload for atmosphere chemistry monitoring on MTG-S
 SENTINEL-5p: 7-68km resolution, 1 day revisit	*1 Sat in Orbit*	Mission to reduce data gaps between Envisat, and S-5
 SENTINEL-5: 7.5-50km resolution, 1 day revisit	*1st Launch in 2021*	Payload for atmosphere chemistry monitoring on MetOp 2nd Gen
 SENTINEL-6: 10 day revisit time	*1st Launch in 2020*	Radar altimeter to measure sea-surface height globally

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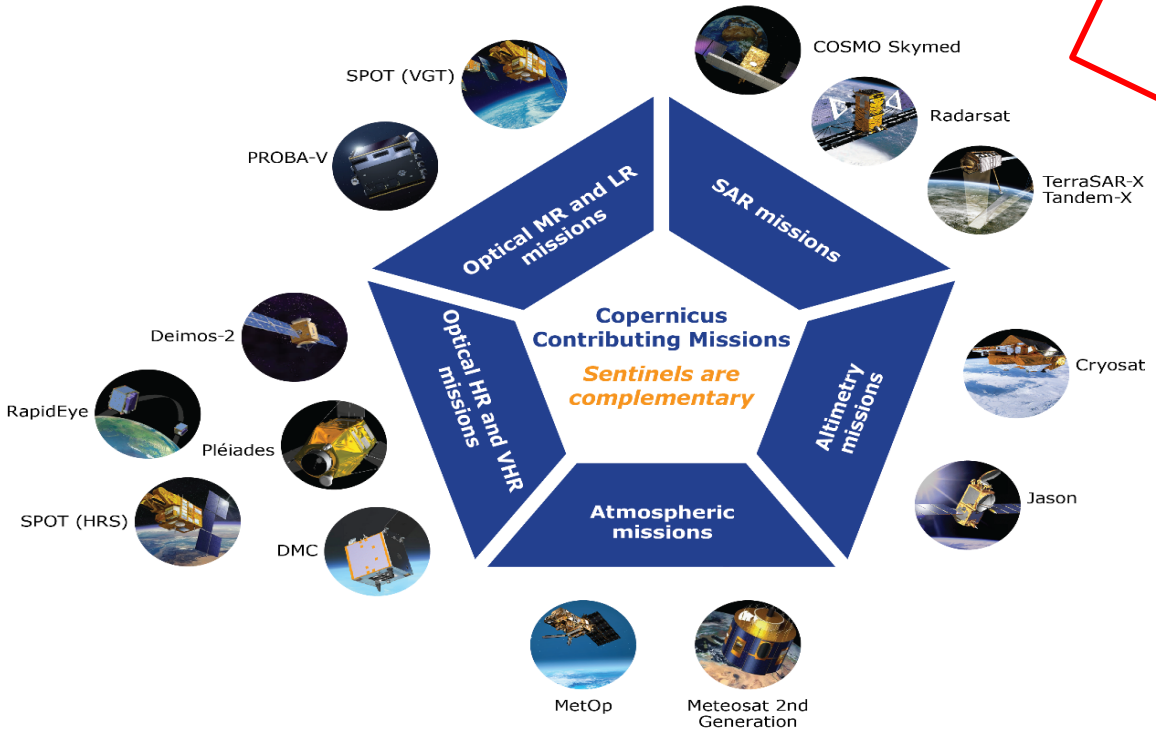
THE CONTRIBUTING MISSIONS

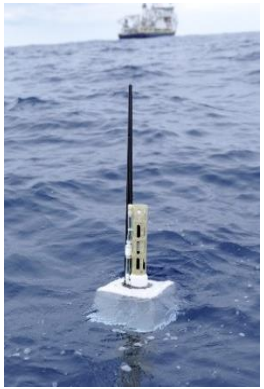
Subject to Data Owner's Data Policy



IN-SITU COMPONENT: OVERVIEW

In situ

- *In situ* data = "observation data from ground-, sea-, or air-borne sensors, reference and ancillary data licensed or provided for use in Copernicus" *(Copernicus regulation – article 3)*
- Use of *In situ* data:
  - Validate & calibrate Copernicus products
  - Reliable information services



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COPERNICUS SIX SERVICES

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CONTEXT

- Copernicus: User driven Programme
- Space Strategy for Europe (COM(2016)705) - Advancing the EU space programmes and meeting new user needs :
  - *"Additional services will be considered to meet emerging needs in specific priority areas, including:*
    - i. *Climate change and sustainable development, to monitor CO2 and other GHG emissions, land use and forestry, and changes in the Arctic with Copernicus*
    - ii. *[Security and defence]*"*

** Not part of this presentation*

Inputs for observation requirements

- User requirements activities
  - User requirements study including desk studies and user consultations (GMV study)
  - Consultations with Copernicus Entrusted Entities (Space and Services component)
  - Workshops held in 2016-2018 on Agriculture, Forestry, polar areas, Climate Change, Cultural Heritage, raw materials and other topics
  - User requirements Workshop on 14 September 2017
- Expert Groups on CO2, Polar areas and Agriculture
- ESA Mission Task Forces based on Phase 0 studies (Thermal, Hyperspectral)
- Copernicus4EC study* (report expected end 2018)

* Study examining the fit-for-purpose of Copernicus for EU legislation / EU policies

Key Policy drivers

Key policy drivers for the definition of these mission concepts have been the need for (in line with the space strategy):

- Monitoring of anthropogenic CO2 emissions in support of the Paris Agreement
- Monitoring of *changes in the Arctic* to support navigation and climate change applications (in line with the Arctic policy)
- Improved monitoring of agricultural production and forecasting (supporting agriculture and water policies)
- Improved monitoring of forestry, raw materials and minerals

Some of the identified missions have wider application fields, addressing also other (secondary) requirements.

Phase A/B1 studies have started in Q1 2018 to further define mission concepts and fine-tune mission requirements.

6 Missions

- Based upon these inputs, 6 possible satellite missions have been identified:

Priority 1: Anthropogenic CO2 Monitoring Mission (CO2 Mission)

Priorities not yet defined

- Polar Ice and Snow: Passive Microwave Radiometer Mission (PMR Mission)
- High Spatio-Temporal resolution Land Surface Temperature Mission (TIRI Mission)
- Polar Ice and Snow: Topography Mission
- L-Band Synthetic Aperture Radar Imaging Mission (L-Band Mission)
- Hyperspectral Imaging Mission (CHIME)

Hyperspectral mission (CHIME)

Primary observation requirements to be addressed:

- Measurements should support **sustainable agriculture and food security** and allow for the characterisation of **raw materials**, in particular:
  - support sustainable use of nutrients and water, i.e. crop nutrient deficiencies, crop diseases and growth stages, including photosynthesis activity at European field level (30-50m)
  - allow to map soil mineralogical composition to assess soil fertility, soil properties and degradation
  - provide information to support raw materials exploration and mine environment management

Potential other observation gaps covered:

- Measurements of the electromagnetic spectrum could support a wide range of applications, including:
  - Biodiversity, ecosystem sustainability, forestry (tree/vegetation species diversity)
  - Coastal and inland waters (quality, suspended sediments, chlorophyll content)
  - Environmental degradation and hazards, Hydrology and Cryosphere applications

Summary and way forward

- Considerations for Prioritization*:
  - Political Drivers
  - Coverage of policies and general user requirements
  - Potential impact on application areas
  - Autonomous access to EO data or availability of alternatives at international level
  - Technological readiness and feasibility
  - Potential for international cooperation

- Critical milestones
  - Release of the user requirements document from COM
  - Adoption of the EU Multiannual Financial Framework
  - Adoption of the Commission Space Policy Programme
  - ESA Ministerial in 2019

**Availability of funds is a boundary condition for the implementation of prioritized missions*

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EU Space Programme Regulation

June 2018

European Commission
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EU in space today

- **2nd space power in the world**
- European space industry employs over **230 000 people** and its turnover was estimated between **€46 and 54 billion in 2014,** representing around **21% of the value of the global space sector.**
- EU space flagship programmes – **Galileo**/EGNOS and **Copernicus**
- Operational **on time and on budget; world class references**
- EU investment in Space: **€5 billion for 2005-2013 and €11 billion for 2014-2020** (plus investment by Member States)
- Next EU budget: **€16.2bn –** reflects the importance of space for the EU
- **Not a Single Member States could do it alone**

2018 — All 6 services OPERATIONAL

7 — SATELLITES IN THE ORBIT

7 — Data distributed in PB – The 4th big data provider

150 — Thousands of registred users

The most advanced earth observation system in the world

Copernicus
Services & application

DIAS platforms: easy access to data

Climate change & environmental monitoring

Natural disasters
Floodings, earthquakes, fires, huricanes

AGRICULTURE
Farmers use Copernicus for precise farming

SECURITY/BORDER MANAGEMENT – (frontex, ESMA)

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Space in support of EU policies

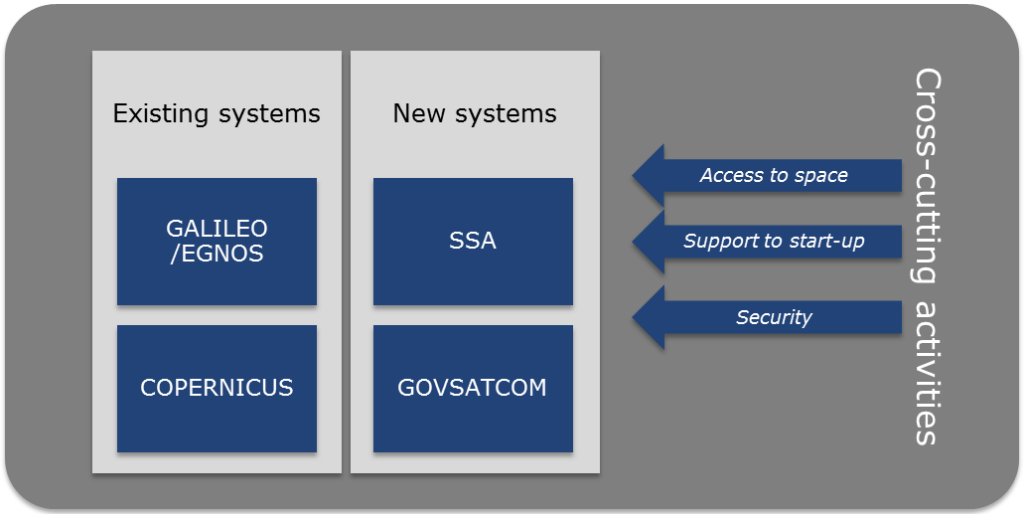
- Mapping of natural disturbances and weather-related challenges
- Monitoring COP21 commitments and CO_2 emissions
- Better execution of CAP due to policy monitoring and precision farming
- Enabling technologies in automotive, aviation and maritime sectors
- Supporting civil protection thanks to Emergency Management Service
- Aiding the digitalisation through space and satellite communication

Challenges

- **Revolution in space sector and increased competition**
  - from traditional, emerging and new space powers both state (USA, Russia, China, Japan, India)
  - and private (SpaceX, Blue Origin) supported by Venture Capital investments; New space, disruptive technologies & business models
- **Security dimension**: EU needs a clear strategy to secure its industrial and political leadership as well as autonomy to remain its comparative advantage on the global market.
- **New needs:** Climate change, data economy, security/defense

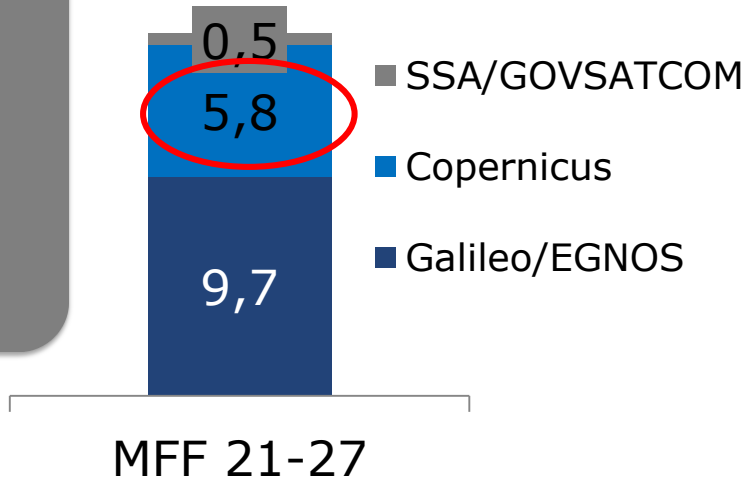
Space Programme

Scope of the Programme



4 components – 3 horizontal activities

Allocation of the €16bn



EVOLUTION of GALILEO & COPERNICUS

- **GALILEO:** 2nd generation gradually operational from 2030 with higher precision and greater resilience, providing new services for Drones, Internet of things, Driverless cars, Security and defence.

- **COPERNICUS:** New observation capacities for:

  - **CO2 emission monitoring** supporting the objectives of the COP21 Paris agreement
  - **Land use** including support to agriculture
  - Observations of the **Polar areas**
  - **Security needs**, to improve detection of small objects (e.g. vessels) in support of the fight against illegal trafficking or needs for external actions.

Thank you for your attention

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