

Reaping the full benefits of Copernicus after 2020 -The ambitions of the European space industry-

Key elements on the Copernicus programme

Introduction: what Copernicus is

Copernicus is a **user-driven program** and the result of a common ambition (EU, European Space Agency and the Member States) to build a **European autonomous capacity** in the field of earth observation, providing reliable, up-to-date, free, full and open information in **six thematic areas** (“services”): land monitoring, marine monitoring, atmospheric monitoring, climate change, emergency management and security.

The programme is composed of a space (Sentinels & contributing missions), in-situ (ground-based, sea-borne or air-borne monitoring systems) and service component.

Copernicus space segment: a long-term & complex infrastructure

Initially deployed since 2014, the constellation of Sentinels consists of the following satellites¹:

Sentinel-1	All-weather, day and night radar imagery for land and ocean services
Sentinel-2	High-resolution optical imagery for land services
Sentinel-3	High-accuracy optical, radar and altimetry data for marine and land services
Sentinel-4 and Sentinel-5	Data for atmospheric composition monitoring from geostationary orbit and polar orbit (<i>instruments carried on the next generation of meteorological satellites, i.e Meteosat Third Generation (MTG) and MetOp Second Generation</i>)
Sentinel-5 Precursor	Bridge the gap between Envisat (Sciamachy data in particular) and Sentinel-5
Sentinel-6	Radar altimetry data to measure global sea-surface height, primarily for operational oceanography and for climate studies

Rationale for Copernicus continuation and evolution

Users want “more Copernicus”!

The **intense use** (> 120 000 registered users²) and **increased awareness for the potential of Copernicus** have generated great expectations for an evolved Copernicus system. Taking this into consideration, user and observation requirements have been identified, structured and prioritized in a continuous reflection process led by the EC. There is now a **large set of concrete needs and requirements for the future**.

¹ Seven Sentinel satellites are already in orbit: Sentinel 1A & Sentinel 1B, Sentinel 2A & Sentinel 2B, Sentinel 3A & Sentinel 3B (16 Feb 2018), Sentinel 5P

² <http://copernicus.eu/news/editorial-2017-achievements>

Guiding principles

Building on Copernicus achievements³ as well as on the needs and requirements expressed by the users, the following high-level principles should be at the heart of the reflections regarding Copernicus continuation and evolution:

- Assure **continuity and increase the robustness** of the existing Copernicus space component in the future
- **Expand observation** types according to policies and user needs
- **Increase the quality and quantity** of the existing measurements
- **Consolidate European EO system leadership** and reference role
- **Employ latest technologies** for maximum efficiency

Extension & expansion: two key targets underlying Copernicus continuation and evolution

Sentinel extension

Extension of the core missions - Sentinels 1 to 6 - is vital to provide the long-term continuity and enhancement of observational data in support of the Copernicus services. It corresponds to a progressive improvement of the current measurement capabilities, mostly by means of new generation of similar instrumentation compared to the ones currently deployed.

Sentinel expansion

Expansion is a driver to **tackle emerging and urgent needs for new types of observations** -and make therefore Copernicus an even better **integrated instrument at the service of EU public policies**:

- A multi-satellite mission **to measure the anthropogenic contribution to the CO₂ cycle**. The need was supported by the conclusions of COP 21 and was included in the Space Strategy for Europe as a clear priority (a potential Sentinel-7 mission)
- Observations at high spatio-temporal resolution in **the thermal infrared region** of the optical spectrum in order to complement and expand the current Sentinel-2 measurements (**priorities from agriculture and urban applications**; a potential Sentinel-8 mission).
- New measurements on **critical parameters of interest for the polar regions**, such as sea ice/floating ice concentrations and surface elevation (supporting EU Arctic policies and climate change; a potential Sentinel-9 mission).
- Optical observations with **hyper-spectral imaging capabilities** to expand the current Sentinel-2 measurements (priorities from agriculture, food security and land resources; a potential Sentinel 10 mission).

³ For further details on Copernicus past achievement: see Eurospace “Copernicus manifesto”