EARTH OBSERVATION

HERITAGE

In 2019, ESA Earth observation operates 15 satellites and has 25 more satellites under development along three successful programme lines: Earth Explorer satellites for Earth science, Sentinel satellites as part of the ESA-EU Copernicus programme and the meteorological satellites it develops for EUMETSAT. These ESA satellites and their exploitation provide a wide range of socioeconomic benefits, including scientific knowledge, highly-skilled jobs, value-added Earth observation business and innovation. Europe is a world leader in Earth observation and the programme’s proposals at Space19+ are intended to safeguard and further strengthen Europe’s position in this space application area, which is so crucial for humanity.

VISION FOR 2040

To further ESA’s role as the architect of European Earth observation, it ensures maximum benefits for science, society and economic growth by:

• responding to climate change challenges through innovative global observations of all aspects of our planet;
• supporting European grand science challenges such as the water–energy–food nexus, the carbon cycle and climate through innovative world-class research satellite missions (e.g. Earth Explorers);
• expanding the use of space products and services into non-space sectors, both public and commercial; and
• embracing the paradigm shift in Earth observation by exploring radical ideas and harnessing innovation in line with the digital revolution and commercialisation in space and Earth observation.

INTERNATIONAL COOPERATION

At a European level, ESA is a key player in Earth observation, together with the European Commission and EUMETSAT, for the operational programmes Copernicus and in meteorology. In addition, there is also a strong cooperation with ESA Member States and their space agencies at a national level. Furthermore, ESA Earth Observation Programmes (EOP) have concluded over 60 cooperating agreements, including many with European partners and other partners from around the world. ESA is also a founding member and strong partner in the ”International Charter Space and major disasters”.

Finally, ESA takes up a strong role in the multilateral context for Earth observation: CEOS and GEO and in other relevant international organisations, such as WMO and UNFCC.

NARRATIVE

In the field of Earth observation, investments will be needed to continue European leadership in monitoring the state of our planet from space, to advance science and research in the understanding of the Earth system, and to create business opportunities in a fast-evolving geo-services sector. The vast growth of Earth observation activities, in Europe and beyond, reinforces the need to establish an end-to-end system approach. Optimising ESA assets as a complement to those of the Member States will be a must in order to develop a stronger and more coherent Earth observation capacity for Europe.

#Space19plus
Just like different parts of a single tree, each of the ESA EO programmes fulfils a specific & key role in enabling a sustainable and growing Earth observation capacity in Europe.

BASIC ACTIVITIES
The Basic Activities, which are part of the Agency’s mandatory set of activities, are key for the overall success of many ESA missions, including all Earth observation missions. Therefore, the functions it provides – such as data distribution under ‘Earthnet’, the ‘Heritage Data Programme’ and ‘Discovery, Preparation & Technology Development’ – are the metaphorical fertile soil on which successful Earth observation missions and programmes grow.

FUTURE EO
FutureEO is the core programme for Earth observation in Europe: the stem of the tree. This research and development programme takes care of the end-to-end management of innovative Earth observation research missions and capabilities. Many of the operational EO applications, services and capabilities we enjoy today in Copernicus and in satellite meteorology, were initially developed under this programme. This includes the conception of new instruments and platform technologies, the development of new ‘Earth Explorer’ research missions and Earth observation mission management and scientific exploitation.

The scope of the FutureEO programme has been expanded to leverage the potential of disruptive emerging technologies and trends to the European Earth observation sector. The programme will give room to explore radical ideas in a fast-prototyping environment, which may include small satellites (Scouts), nanosatellites (Φ-Sats), high-altitude pseudo satellites (HAPS), and the application of artificial intelligence to EO. This way, ESA can stimulate the fast-evolving Earth observation NewSpace sector and provide growing business opportunities for Europe.

Investing in FutureEO today means we can develop the cutting-edge science and technology necessary to address the societal challenges of tomorrow, be it climate change, access to resources or environmental management. This brings us to the top of the tree, where the fruit grows.

At Space19+ the Earth observation programme proposal for Copernicus foresees a package that makes sure the Copernicus programme can be implemented as foreseen and grows in order to tackle the emerging societal needs of tomorrow:

- Complete the development and launch of the upcoming Sentinel-4, Sentinel-5 and Sentinel-6 missions, launch recurrent Sentinel-1, Sentinel-2, Sentinel-3, Sentinel-4, Sentinel-5 and Sentinel-6 missions, ensuring the continuity of data stream for Copernicus services (co-funded by the EU).
- Prepare the next generation of Sentinels.
- Develop 6 new Missions.

Copernicus: Copernicus has become a global reference model for operational environmental monitoring. Data volumes generated by the Sentinel satellites are the largest in the world, with 250 terabytes of data distributed per day and more than 230 000 registered users worldwide and counting.

OPERATIONAL EO
Operational EO encompasses the Earth observation programmes that generate the bulk of socioeconomic benefits for society: the Copernicus programme and satellite meteorology. At Space19+ only the further development of the immensely successful Copernicus programme is on the table. Future investments in meteorological programmes are to follow at future ESA Ministerial Councils.

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- Ensure the enhanced continuity of the current Sentinel families by initiating the development of the next generation of Sentinel-1 to Sentinel-6 missions.
- Initiate the development of up to six new missions in response to emerging EU policies related to climate change (including anthropogenic CO2 monitoring), Africa, the Arctic and polar regions as well as resources security.
- Ensure the evolution of a coherent space architecture including relevant European national and commercial missions and initiatives.

TAKING THE PULSE
CUSTOMISED EO

In addition to Operational EO, there is another set of smaller programmes among the branches of the tree: Customised EO. Customised EO is a flexible programme allowing ESA to tailor Earth observation activities to Member States’ particular industrial needs, policy interests and focus areas.

InCubed+: allows companies developing innovative systems, components and products in the Earth observation business sector to approach ESA at any time for support to make their venture technically viable and commercially competitive. Proposals could be about satellites, constellations, instruments or big data analytics, for example.

Global Development Assistance: carry out the relevant technical developments (EO product information developments, user-oriented analytics tools) that are required, as defined by the operational activities of key International Financing Institutions and Development Assistance Agencies.

ALTIUS is a small mission dedicated to the operational monitoring of stratospheric ozone profiles with high vertical resolution. The purpose of the revision of the ALTIUS Earth Watch element is to include the procurement of launch services, the launch and in-orbit operation during phases E1 and E2 (for a total of three years in-orbit operations).

TRUTHS: develop a medium-size operational mission to enhance by an order-of-magnitude our ability to estimate the Earth radiation budget through direct measurements and cross-calibration with other satellites.

WHY

Social: Climate change is a concern for everyone. ESA EOP develops satellites and provides crucial data to better understand climate change and its impact on the world’s population – today and in the years to come.

Economic: The development of new satellite technologies, the end-to-end chain of providing value-added information to a variety of users and the focus on emerging technologies such as artificial intelligence and machine learning leads to economic growth and creates new highly skilled jobs.

Geopolitical: Europe has developed the strongest Earth observation programme in the world. This puts Europe in a unique position to provide leadership in Earth observation, realising European global leadership in Earth observation, thereby regaining lost global leadership in Earth observation, and future key scientific questions at stake.

Scientific: FutureEO, and European Earth observation in general, advances scientific excellence through new insights into the Earth system.

FINANCIAL AND VALUE FOR MONEY

Every euro invested in the scientific R&D ESA programme FutureEO directly increases the European GDP by nearly €4. Moreover, FutureEO investments lead to knowledge and innovation spill-overs, and are expected to create 75 000 job-years.

Furthermore, the R&D generated under FutureEO enables the future benefits generated further down the line in the operational EO programmes. It is estimated that €1 invested in Copernicus generates €10 in socioeconomic returns for European society. For meteorology, the expected benefits from the MetOp Second Generation system for European society are estimated between €16-63 billion between 2020-2040.

More information at www.esa.int/space19plus