

## IAF EARTH OBSERVATIONS COMMITTEE (EOC)

### Introduction

The IAF Earth Observations Committee (EOC) is responsible for organizing, curating, and coordinating EO-related activities at the IAF, namely running the Earth Observations Symposium during the IAC. The Symposium covers all aspects of Earth Observations from space, especially observations related to the Earth's environment, including mission planning, microwave and optical sensors and technologies, land, oceanographic, and atmospheric applications, and ground data-processing systems.

### Summary

Commercial Earth Observation continue to be a major trend with the vibrant sector fostering fast-moving innovations in technology, datasets and downstream applications. For example, ESA summarizes the overall state with 6 trends:

- 1) **Relatively small but ramping up:** the space economy as a whole has seen annual growth of 7% since 2017 and expected to continue up to 2031. A similar trajectory for the Earth observation data and service market is expected, increasing from US\$4.6 billion last year to US\$8 billion by 2032.
- 2) **The innovation and adoption horizon:** Technologies such as SAR, Hyperspectral, Edge Computing in Space and Thermal Infrared have created significant buzz in recent years, but remain in the early phases of development. In terms of application sectors, some of the significant areas on the rise are thought to be carbon monitoring, parametric insurance, climate risk reporting and pipeline monitoring, although adoption remains at an initial stage.
- 3) **Going backwards to move forward:** Earth observation is increasingly being seen as a strategic asset for organizations, giving rise to a process of backward steps leading to forward progress.

4) **The European Earth observation canvas:** The European Earth observation industry is dominated by SMEs (Small and Medium-sized Enterprises) which are mainly active in downstream activities. The rest of the world has a larger proportion of capital-intensive businesses, showing a more favorable mix of industrial maturity, together with a higher concentration of start-ups and LSIs (Large System Integrators) and larger average company sizes.

5) **The cash injection inflection:** As reported by Euroconsult at SEOB, private investment in commercial space grew from US\$1.4 billion worldwide in 2017 to a peak of US\$14.9 billion in 2021, only to fall back to US\$6.3 billion last year.

6) **Breaking down barriers:** Experts envisage several hurdles that need to be overcome for the European Earth observation market to continue to flourish. There is still demand which is not being met by current suppliers, and this is coupled with a need for market creation to take advantage of opportunities for diversified data and innovative services.

While the Earth Observation domain continues to grow, it still faces challenges such as the difficulty for different Earth Observation system to exchange information easily. "The way we are interoperable today is messy and time-consuming and annoying to the end user," David Gauthier, National Geospatial-Intelligence Agency Source Commercial & Business Operations Group director, said Oct. 14 at the MilSat Symposium. As governmental users see more and more reliance on commercial observation systems, there is the need for something more like a hybrid space architecture with interoperability by design as the basis of that capability. Still, making government and commercial Earth observation systems interoperable remains a challenging endeavor.

## Highlights

The **European Union** and the **United Kingdom** have reached a deal that will allow the UK to resume participation in the EU elements of the **Copernicus Earth observation** program. The European Commission and the UK government announced Sept. 7 that they had completed an agreement to permit the UK to be a part of Copernicus as well as the **Horizon Europe** research funding program. The UK had been cut out of both programs after it completed its exit from the EU in 2020. Neither government disclosed how much the UK would contribute to the EU's portion of Copernicus. The European Commission said the UK would provide an average of nearly 2.6 billion euros (\$2.8 billion) a year to the combination of Copernicus and Horizon Europe, a much larger program. In 2021, ESA said the UK contribution to the EU aspects of Copernicus was valued at 750 million euros over several years.

**Ball Aerospace, Northrop Grumman, Orbital Micro Systems and Spire Global** won contracts, announced Aug. 31, to design microwave sounders for the **National Oceanic and Atmospheric Administration**. Under the contracts awarded by **NASA** on behalf of **NOAA**, the four companies will conduct studies and design sounders for the Near-Earth Orbit Network, or NEON, NOAA's next generation of polar-orbiting weather satellites. After the firms complete the 12-month studies, NASA and NOAA will decide whether to proceed with development and manufacturing of the sounder.

**THEOS-2** was successfully launched on a Vega rocket on 9 October 2023. The Geo-Informatics and Space Technology Development Agency on Thailand (GISTDA) mission carries a high-resolution imager built by Airbus Defence and Space. It will be joined in a constellation by THEOS-2A, which will also have the ability for video capture.

**FY-3F** launched on August 3 from Jiuquan Satellite Launch Centre. As the newest member among the FY meteorological satellites of the **China Meteorological Administration**, FY-3F will undertake the in-orbit operation of FY-3C. The collected data will serve weather forecasting, atmospheric chemistry and climate change monitoring. The satellite will operate in a sun-synchronous orbit, with an altitude of 830km and a local solar time at ascending node (LTAN) of 14:00.

On May 26<sup>th</sup>, a Soyuz rocket launched the **ROSKOSMOS** satellite **Kondor-FKA N-1**. The satellite hosts an S-Band Synthetic Aperture Radar (SAR) Instrument, which can image at resolutions up to 1m, and swaths as wide as 500 km across various modes. Kondor-FKA is the

civilian counterpart to the commercial Kondor-E and military Kondor satellites.

**NASA's TEMPO** (Tropospheric Emissions: Monitoring of Pollution) instrument launched on April 7, as a payload onboard Intelsat 40E, a commercial GEO satellite. **TEMPO** is the first space-based instrument to provide hourly measurements of air quality over North America during the daytime and at spatial scales of several square miles.

Norway's **NORSAT** Tech Demonstration (**NORSAT-TD**) launched in April on SpaceX's Transporter 7 mission. A collaboration between **NOA, NSO, ASI** and **CNES**, **NORSAT-TD** carries multiple advanced or experimental payloads, including an iodine propulsion system, a satellite tracking and navigation payload, a laser data downlink system, and an AIS receiver.

**China** added to its recent flurry of reconnaissance satellite launches in late November 2023, sending three new **Yaogan-39** spacecraft into orbit. Yaogan satellites are thought to variously carry optical, synthetic aperture radar (SAR) and other sensors. Some satellites are described generically as being for electromagnetic environment detection and related technical tests.

Smallsat developer **Open Cosmos** (UK) has raised \$50 million to expand the company and develop larger satellites and constellations focused on Earth observation.

**Satellogic** has received a remote sensing license in the United States, the Earth observation operator announced Nov. 21 as it moves operations to the country from Uruguay in search of more government business.

**Urban Sky**, a startup offering high-resolution imaging from small stratospheric balloons, has raised \$9.75 million in a Series A round.

## Future Outlook

The **Mass-change and Geoscience International Constellation** (MAGIC) of **ESA** and **NASA** will consist of a pair of satellites due to launch in 2032. NASA will lead the construction of the Mass Change Designated Observable mission (MCDO), while ESA will complement with the Next Generation Gravity Mission (NGGM). Together, they will form a constellation to accurately monitor the temporal variations of Earth's gravity field at high resolution in time, following on from the work of previous missions such as **GRACE**, **GOCE**, and **GRACE-FO**.

The **China National Space Administration (CNSA)** launched the BRICS Joint Committee on Space Cooperation on May 25, with the goal of cooperation in the remote sensing satellite observation and data sharing among China, Russia, India, Brazil and South Africa, the five nations that form an economic partnership called BRICS. The joint committee will guide cooperation on the BRICS Remote Sensing Satellite Constellation to better serve economic and social development in member countries.

**Canada's** newly announced plan to invest 1 billion Canadian dollars (\$739 million) over the next 15 years in the **Radarsat** mission is part of the federal government's climate resilience strategy. The **Radarsat** satellite series has been a pivotal component of Canada's climate change strategy and international disaster response. With the current Radarsat satellites aging, the new funding will serve a dual purpose. Firstly, **Radarsat+** will introduce a fourth satellite to complement the three existing ones in the **Radarsat Constellation Mission (RCM)**, which was developed by MDA and launched in 2019 and is expected to operate until 2026 without intervention. The addition of the fourth satellite will extend the timeline of the constellation.

Israel Aerospace Industries (IAI) signed an agreement to sell two EO satellites to **Azerbaijan** space agency Azercosmos.

NOAA announced selection of L3Harris to develop the GEO XO next generation Geostationary weather satellite imager in March 2023. NOAA announced selection of Ball Aerospace to develop the GEO XO Atmospheric Sounder in September 2011.

**Italy** thanks to the **Italian National Recovery and Resilience Plan** resources has invested in the very challenging IRIDE Constellation composed by 36 satellites of different types and sizes and that includes all components (upstream, downstream, and services) to provide geospatial services at the national and European levels, both to public administration and private customers and it is planned for completion by 2026. These innovative satellites also feature sophisticated operating modes to support high revisit rates, providing data that can be integrated with that from other existing or future programs and infrastructures, including COSMO-SkyMed Second Generation and Prisma, as well as Europe's vast Copernicus Earth observation program.

**Thales Alenia Space** has won in 2023 the contracts from the European Space Agency (ESA) to supply a first batch of **six small satellites** with synthetic aperture

radars (SAR) and one satellite based on optical technology. Both the radar and optical satellites are built on the modular NIMBUS (New Italian Micro Bus) platform, weighing about 170 kilograms with the capacity to be produced rapidly. The optical payload is being developed by the Italian companies **Media Lario** and **TSD-space**, specialized in the creation of instruments and electronics for space. The context and scale of IRIDE's projects are such that they will generate numerous job opportunities for young talent, researchers and professionals working on space technologies.

**Finland's Kuva Space** won a 5-million euro European Commission contract to supply **hyperspectral data to the Copernicus Contributing Mission program**. Under the five-year contract Kuva Space will provide data for monitoring farms, forests, methane emissions, harmful algal blooms and other applications.

**Orbital Sidekick** is building a **constellation of hyperspectral satellites** to be launched by the end of this year, with a plan to build a total of 14 that will give the company the ability to map "every square inch of the globe multiple times a week with high res hyperspectral imagery." The company announced the launch of the first two satellites of the constellation on April 17.

**Airbus Defence and Space** announced an agreement for Angeo-1, an Airbus S250 optical satellite and the first very high-performance **Angolan Earth observation satellite**, to be manufactured in France, which strengthens the collaboration between the two countries. Angola has already developed various operational applications using satellite imagery from ADS, such as land use mapping, agriculture monitoring and maritime surveillance and also operates its own telecommunications satellite (Angosat-2). Once in operation, it will become the most advanced satellite in its class in the region, positioning Angola as a leading space power. This sovereign satellite will further foster the development of the country in many different sectors, improving the life of Angolan.

Others:

- The Slovakian **Startup 3IPK and Thales Alenia Space** was awarded an ESA contract to implement Innovative blockchain solution for managing traceability and ensuring the integrity of Earth-observation data under its FutureEO program.
- The consortium, led by **Thales Alenia Space** with the partner Serco, was awarded an ESA contract to implement **DestinE Core Service Platform (DESP)**, a key element of the European Commission's flagship initiative Destination Earth (DestinE).

- **OHB Digital Services**, a subsidiary of the space group OHB, was awarded a contract worth €1.7M by the European Union Agency for the Space Programme to lead the “Copernicus Demonstrators - Mobility, Emergency and Infrastructures” project.
- **NASA selected seven EO companies to provide commercial data** as part of its Commercial Smallsat Data Acquisition Program - Airbus DS Geo, Capella Space, GHGSat, Maxar, PlanetiQ, Spire Global and Umbra will compete for contracts with a maximum value of \$476 million over five years.
- **Planetek Italia** won a contract from Saudi Arabia to provide monitoring services based on EO for afforestation initiatives in the Kingdom.
- **Planet** announced the launch of its Forest Carbon Diligence product - a global, 30-meter historical time series of forest carbon, as well as tree height and cover, expected to be used in carbon accounting projects;
- GHG monitoring firm **GHGSat**, which launched the first commercial CO2 sensor, is teaming up with aerospace firm Kairos Aerospace to demonstrate multi-scale methane emission monitoring for the energy sector;
- **EUSPA** and the **European Commission** announced the winners, during the EU Space Week 2023 in Sevilla (Spain), to detect and remove plastics from water bodies;
  - » Coastal Marine Litter Observatory by SCIDRONES: Using an innovative combination of Copernicus multi-spectral data with high-resolution drone imagery and advanced AI-algorithms, this application helps differentiate between plastic pollution and natural debris sources such as driftwood and seaweed. Local authorities can use the application to guide their cleanup operations, allocating resources to those beaches and environments most affected by plastic pollution.
  - » Eyes on Plastic by EOMAP: This data-driven web app combines Sentinel-2 optical imagery and commercial optical satellite imagery, on-site cameras, cloud-based big data processing chains, Earth Observation analytics and crowdsourcing to identify, map and monitor plastic pollution in near real-time. The solution looks to help governmental stakeholders meet their mandates for managing and reporting plastic pollution, including that found in rivers.
  - » Ocean Plastic Alert and Tracking by GEOMATYS Combining satellite images with meteorological and oceanographic models, this application is designed to detect debris at sea from space and predict its drift. By

coupling ocean current and wind models with satellite observations, the solution can make forecasts both forwards and backwards in time. This allows coastal authorities to locate and predict where the front of plastic and debris is after a major weather crisis that causes navigational safety issues. It also optimises the collection of debris in collaboration with the likes of fishing boats.

## Committee activities

Earth Observations Committee had an extremely active period from April – October 2023. The first major activity was leadership of the IAF Global Space Conference on Climate Change (GLOC 2023), with two EOC members serving as two of three International Program Committee Co-Chairs and two more committee members as Co-Chair for the Technical Program and Co-Chair for the plenary program. EOC members also participated in development of the summary paper for GLOC. This was followed by a paper summarizing outcomes of GLOC 2023 published on the IAF website during IAC 2023 in Baku on the day of the Highlight Lecture conveying results of the GLOC 2023 to the broader IAC audience. EOC member Jim Graf gave the lecture, and EOC Chair Harry Cikanek served as moderator. The IAF has also organized a high-level session dedicated to the GLOC 2023 findings and recommendations at the GEO Week and Ministerial in November 2023, in Cape Town, South Africa.

For IAC 2023, EOC had a very robust program of seven sessions and over 50 IP presentations, and conducted a Special Session (SpS) on wildfires supported by Agency Earth Science Directors. The session was extremely well attended with excellent audience engagement.

EOC and the GEOSS subcommittee plan to offer another robust program and set of proposals for IAC 2024 to showcase the challenges and progress addressing climate change, the continued expansion of commercial industry, and the many advances occurring in technology, missions, and associated science.