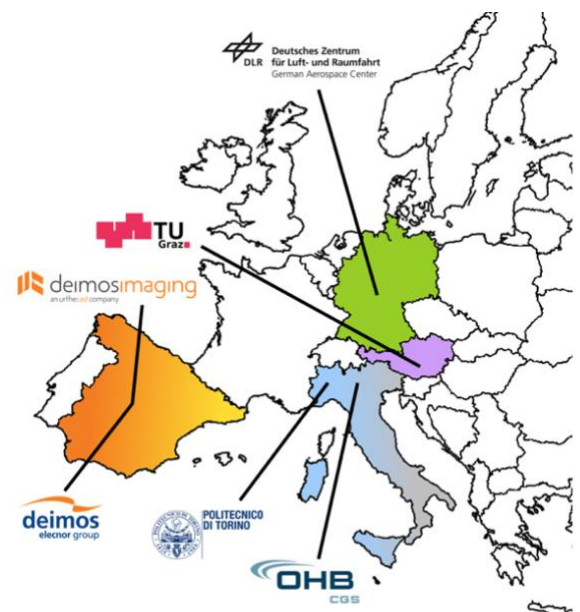


## EO-ALERT latest news

After more than three years in which the European team of companies, universities, research organizations and institutions that constitute this project worked closely together, the EO-ALERT activities are finally drawing to an end. It is thus time to take stock of the results achieved by the project and imagine what would be its legacy. During the last two years the team worked amid quite unexpected challenges. Nevertheless, the outcome of the project has been very successful, demonstrating that a global EO product latency goal of 1 minute, for both the SAR and the VHR optical chains, is indeed a reality. This is excellent news, paving the way to a large range of innovative applications in Earth observation. Follow us in this exciting report of the latest achievements of EO-ALERT team during the last year.



## Demonstration of end-to-end EO-ALERT data chain

A key outcome of the EO-ALERT project is that the performance of the data chain has been confirmed, both analytically and through hardware testing, covering the full data chain (payload to ground).

The technologies have been experimentally evaluated during the project using relevant EO historical sensor data. The results demonstrate the maturity of the technologies, having now reached TRL 4–5. Generally, the results show that, when implemented using COTS components and available communication links, the proposed architecture can generate and deliver **globally EO products/alerts with latency lower than five minutes**, which demonstrates the viability of the EO-ALERT concept. Furthermore, the results show **global EO product latencies below 1 min in realistic scenarios**.

An Avionic Test Bench (ATB), including communication units and emulator, has been implemented for the validation of the integrated technologies chain to quantify the latency of the selected example scenarios.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776311



*ProFPGA Quad Motherboard*



*Engineering Model of the IDRS i100 Terminal  
for the Global Persistent Communications Unit  
Hardware in the Test-Bench*



*Overall End-2-End Avionics Test Bench*

The architecture, although demonstrated for the generation of alerts in two example scenarios, ship detection and extreme weather monitoring, remains quite general and can be easily adapted to alternative scenarios.

The proposed architecture can efficiently be implemented relying on a hybrid solution combining space qualified components and high-performance COTS components and using available communication links. The on-board architecture and technologies reach Technology Readiness Level (TRL) 4 maturity for HW components, and TLR 5 for all SW implementations.

These final results confirm generally that the architecture proposed and now tested in EO-ALERT, exploiting global persistent communications and edge-computing to develop the Earth observation products on-board the satellite, is highly performing and can contribute to new mission concepts and improved services for the general population.

It can be recalled that in January 2021, Deimos released a joint Press Release, together with TU Graz, Addvalue and Inmarsat, with title "[RAPID ALERTS FROM SATELLITE CAN BE DELIVERED IN SECONDS](#)" on the successful validation of the EO-ALERT concept communication chain, thanks to tests performed at Graz University of Technology. The final results exploit again this innovative communication approach, and this marriage of global persistent communications and edge-computing is seen to be highly performing.



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# EO-ALERT End User Workshop

The EO-ALERT End-User Workshop took place virtually the 18th of October 2021.

Organized by Deimos Space, it presented the overall project, the end-to-end satellite processing chain, the individual technologies and the developed applications, giving the opportunity for the consortium to maximise the impact across multiple disciplines and to show the benefits and overcome challenges covered in the project.

It involved the relevant actors of the Space community, thus allowing a “call for ideas” of different new applications/services that the innovative technologies/techniques developed in the project may enable for those actors. The workshop was attended by more than 50 participants, including international and European institutions, such as ESA, EMSA, WMO, AEMET, EUMETSAT NWCSAF and the EU. The workshop involved also research entities and companies, such as OHB, DLR, ADDVALUE and GEOSAT.

The workshop focused on satellite processing chains for very low latency Earth Observation (EO) product delivery. The main objectives of the workshop were to present the outcomes of the H2020 EO-ALERT project, finishing now in Q4 of 2021. The workshop also promoted the dissemination of the EO-ALERT project outcomes, with the aim to support its exploitation in up-coming and future EO missions.

Speaking: Murray Kerr DEIMOS

## Welcome Overview

**EU-H2020 Final Workshop on the Satellite Processing Chain for Rapid Civil Alerts**

- Project to develop a global very low latency (<5 minutes) Earth Observation product service
- Consortium of European industries, research establishments and universities
- Forum for the dissemination** of the work performed in the EO-ALERT project
  - Presentation of the **EO-ALERT system, architecture and technological developments**
  - Presentation of the **E2E HW test results showing ~1 minute global latencies**
- Culmination of 3.5 years of work to date of the EO-ALERT project consortium
- Provides an understanding of **innovative European solutions for responsive EO**

**1 day (morning) workshop with 50+ participants**

- Involvement of international and European institutions, such as ESA, EMSA, WMO, AEMET, EUMETSAT NWCSAF, Spanish Civil Protection, Satellite Applications Catapult, and the EU
- Involvement of research entities and companies, such as OHB, DLR, ADDVALUE and GEOSAT

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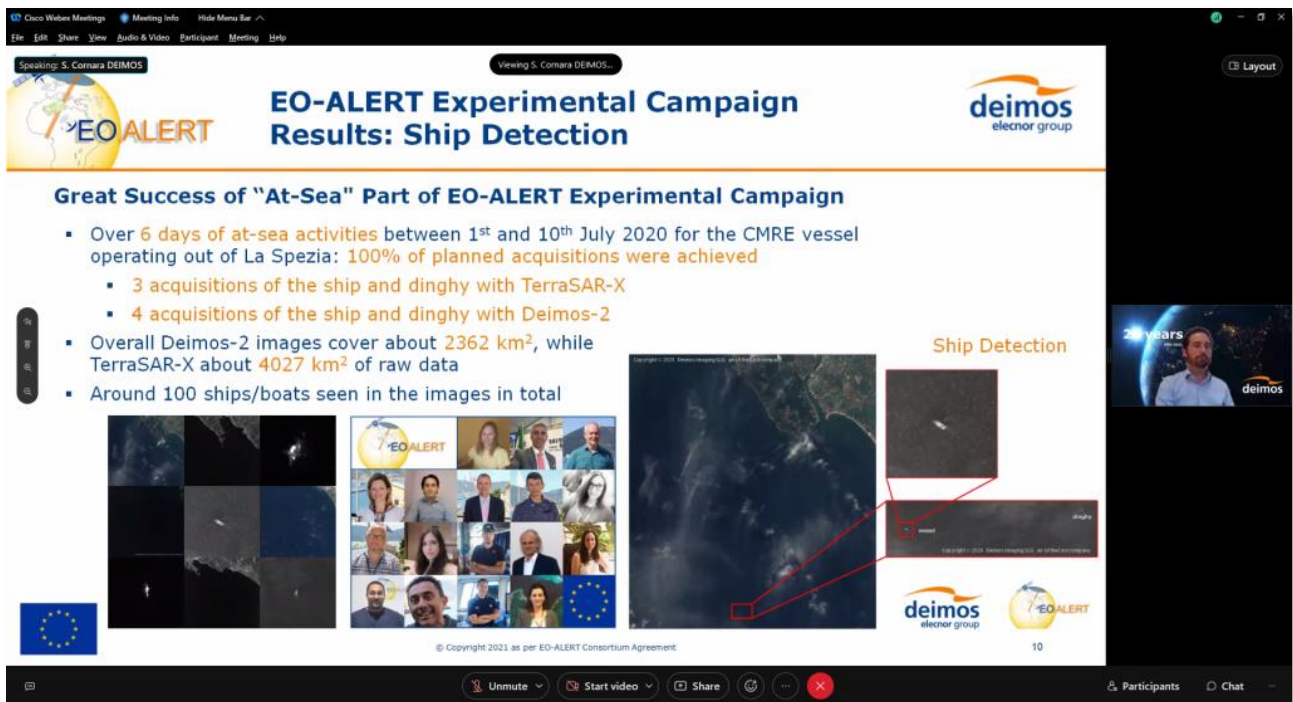
*EO-ALERT Workshop Introduction by Project Coordinator Dr. Murray Kerr*



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*Deimos Space CEO Ismael Lopez welcomes to the EO-ALERT Workshop*



*Presentation of the results of the EO-ALERT Experimental Campaign*



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## Exploitation of EO–ALERT concept and technologies

The system and individual technologies developed during the EO–ALERT project is ready for exploitation and partners are already well positioned to do this, both within the own organizational structures and for End Users and commercial partners. In particular, one can highlight:

### Deimos Space

- One of DEIMOS' next optical platforms, SAT4EO+ for 0.5m Optical Visible/Near Infra–Red intelligent platform and mission, employs edge–computing and global persistent communications, and thus exploits the EO–ALERT outcomes
- Insight4EO is marketed since 2021 as a commercial product for on–board processing and intelligence, both in a software only and integrated hardware–software solution
- Proposing IOD/IOV opportunities for the EO–ALERT system and technologies, and collaboration with external entities

### OHB

- Inclusion of on–board processing technology in their future recurrent satellite platforms

### Politecnico di Torino

- Technology is being exploited in ESA missions, like CHIME, and being fed into industrial standards

### DLR

- On–board SAR technology is positioned to be employed in future national/European SAR mission
- Technology advances can improve the DLR SAR ground station performances

### TU Graz

- Communications emulator is being consolidated as a commercial product for EO missions
- Experience with IDRS is positioned to be exploited in future small satellites ESA missions

The consortium is open to joint exploitation of the system and technologies in future EO missions and is looking for In–Orbit Demonstration/In–Orbit Validation opportunities. End Users are encouraged to engage in that.



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## Past Events



### IAC 2021

The International Astronautical Congress (IAC) is the annual meeting of the International Astronautical Federation. This year, IAC 2021 was held in Dubai, United Arab Emirates, from 25 to 29 October 2021, with the theme: “Inspire, Innovate & Discover for the Benefit of Humankind”. EO-ALERT was present with 3 scientific papers and an exhibition stand. Francisco Membibre (DEIMOS Space) presented the advanced data chain technologies developed within EO-ALERT, supporting on-board processing and the generation of rapid alerts. Murray Kerr (DEIMOS Space), EO-ALERT coordinator, illustrated in a first talk the novel

operational scenarios enabled by the capability of generating rapid alerts, including maritime surveillance, disaster management, extreme weather events. In his second talk, Murray Kerr presented the results of the test of the EO-ALERT communication system, enabling near real-time delivery of alert using either Ka-band, S-band, or INMARSAT L-band transceivers.

In the EO-ALERT exhibition stand, Murray Kerr, Lucía Senchermés and Francisco Membibre welcomed interested visitors belonging to universities, industries, and organizations from all over the world, providing insights on the EO-ALERT project.



### IGARSS 2021

The International Geoscience and Remote Sensing Symposium (IGARSS) is organized every year by the IEEE Geoscience and Remote Sensing Society, putting together different scientific themes including data analysis methods, land applications, atmosphere applications, ocean application, missions and sensors. This year IGARSS 2021, initially planned in Brussel, Belgium, was held as a virtual event from 12 to 16 July 2021. This was one of the main scientific dissemination events for EO-ALERT, with 5 contributions. Murray Kerr (DEIMOS Space), EO-ALERT coordinator, presented an invited contribution describing the EO-ALERT concept and architecture. Michele Caon (POLITO) presented the low-latency architecture for data handling, compression, and encryption. Paolo Motto Ros (POLITO) presented the design of the hardware accelerator for compression and encryption of optical and SAR images. Helko Breit (DLR) presented the design of the low-latency on-board processor for SAR image generation. Stefan Wiehle (DLR) presented the algorithms for on-board ship, wind and sea state detection using SAR images.



### EUSAR 2021

The European Conference on Synthetic Aperture Radar (EUSAR) is the world's leading international conference dedicated to SAR techniques, technology, and applications. Initially planned in 2020, at last EUSAR edition



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was held as a virtual event from 29 March to 1 April 2021. DLR presented the on-board SAR processing chain enabling the generation of rapid alerts.

### **SSEO 2021**

The Symposium on Small Satellites for Earth Observation (SSEO), organized by the International Academy of Astronautics, covers all aspects of small satellite missions. In 2021 SSEO was held as an online event from 27 to 29 April 2021. Deimos presented the EO-ALERT concept, architecture, and rapid alert capabilities in the frame of small satellite missions.

### **MARESEC 2021**

The first European Workshop on Maritime Systems Resilience and Security (MARESEC 2021) was held as a virtual event on 14 June 2021, and dedicated the research on Resilience, Security, Technology and related Ethical, Legal, and Social Aspects (ELSA) in the context of Maritime Systems. Deimos presented the EO-ALERT architecture as a solution for autonomous and near real-time maritime monitoring.

### **OBDP 2021**

The 2nd European Workshop on On-Board Data Processing (OBDP 2021) was held as a fully digital event from 14 to 17 June 2021, with the aim to capture the state-of-the-art in on-board processing techniques and on-board systems and devices. EO-ALERT was present with two contributions. POLITO presented the design of the low latency on-board data handling architecture using off-the-shelf components. Deimos presented the Processor-in-the-Loop (PIL) testing of the optical on-board image processing solution for EO-ALERT.



### **Small Satellite Conference 2021**

The Small Satellite Conference, organized every year by Utah State University, has become internationally recognized as the premier conference on small satellites. The 2021 the conference was held as a virtual event from 7 to 12 August 2021. Deimos presented an overview of EO-ALERT concept and functional and physical flight segment architecture.

### **DLRK 2021**

DLRK (Deutscher Luft-und Raumfahrtkongress) is the German Aerospace congress. The 2021 edition was held virtually from 31 August to 2 September 2021. DLR presented an overview of the on-board SAR processing chain developed for EO-ALERT.

### **CDCEO 2021**

The 1st workshop on Complex Data Challenges in Earth Observation (CDCEO) has been organized by the Institute of Advanced Research in Artificial Intelligence with a focus on advancing research in Earth observation (EO) by effectively interpreting the high-dimensional heterogeneous data obtained by high-resolution remote sensing technologies. The workshop was run as a fully virtual event on November 1, 2021. Deimos described how EO-ALERT can enable very-low latency storm nowcasting through AI-based on-board satellite data processing.



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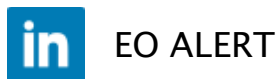
## Partners



## Supporting Organizations



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