

## EO-ALERT

Next Generation Satellite Processing Chain for Rapid Civil Alerts

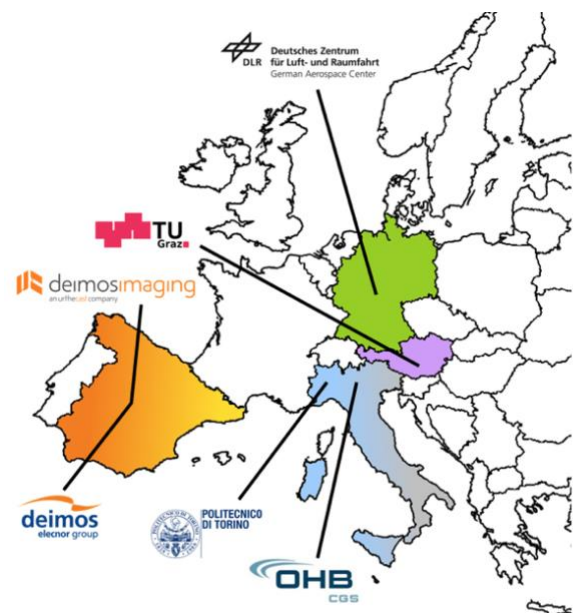
## Newsletter

October 2020 - Issue 3

## EO-ALERT latest news

The world and our day-to-day interactions have changed a lot over the last 10 months since our last newsletter. **We wish the best to all the followers of this innovative project and trust you are safe and well in these challenging times.**

While some time has elapsed since the last EO-ALERT newsletter, and we have faced unexpected challenges, the **progress in EO-ALERT has been excellent.** This is testament to the professional European team of companies, universities, research organizations and institutions that constitute this project. The COVID-19 pandemic has affected EO-ALERT project activities, preventing face-to-face meetings and slowing down the testbench implementation. Nevertheless, during the last months, the EO-ALERT team managed to complete several activities and achieve some very important milestones.



## Recent Progress Highlights

Some highlights: the EO-ALERT maritime [experimental campaign](#) led by DEIMOS Space, with partners DLR and DMI, was successfully concluded in July, in the Mediterranean off the coast of La Spezia, Italy, thanks to the commitment from [multiple partners and supporting organizations](#), such as CMRE and Copernicus Services Coordinated Interface; the EO-ALERT testbench has been assembled by OHB at their Italian premises and is currently being shipped among partners for preliminary integration and testing of their algorithms in the high performance hardware, to ensure compatibility between the different blocks of the EO-ALERT architecture; the **performance of the EO-ALERT end-to-end chain just keeps on improving**, with the latest hardware testing providing confidence that we can **achieve the global EO product latency goal of 1 minute** for both the SAR and the VHR optical chains; the latest results of EO-ALERT activities have been presented at online conferences and virtual events, and more virtual presentations are planned for the near future.



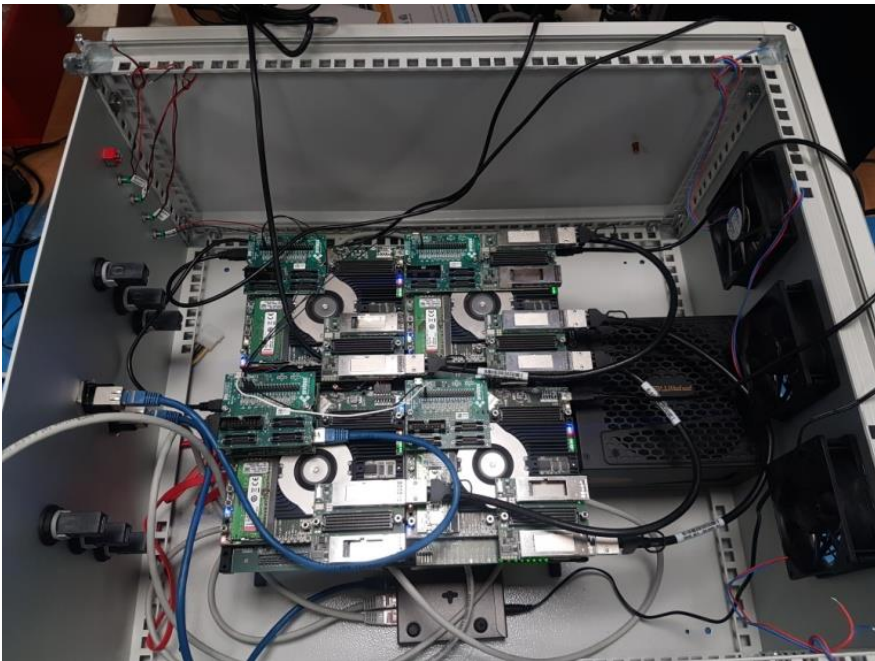
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## EO-ALERT project extension

A project extension to August of 2021 has been requested to overcome the effects to date of the COVID-19 pandemic on the execution of the activity and allow the project team the time to fully assess the project outcomes, which are many, and prepare for their exploitation. The effects of the pandemic have been most pronounced for those partners that were performing laboratory activities (i.e. hardware development, integration and testing) during the March to June 2020 period, and those partners in countries where lockdowns started earlier.

## Roadmap to the EO-ALERT testbench

The current EO-ALERT testbench is composed of a proFPGA Quad Motherboard, equipped with four Zynq™ UltraScale+™ ZU19EG modules, implementing different functions of the avionics subsystem, and a proFPGA Uno Motherboard, equipped with the same module, implementing the TX subsystem. The TX subsystem for the testbench simulates the propagation delay and the error characteristics of the Ka-band high-speed channel for bulk data and alerts and the S-band alert link to hand-held receivers for rescue teams. This TX subsystem includes a representative S-band transmitter and a hand-held receiver.



The bare EO-ALERT testbench has been assembled by OHB in Milan at the beginning of this year. This only includes very basic modules to ensure communication among boards and managing tests. Then, the testbench has been shipped to the other partners, so that they have been able to install their own software and IPs, and test the corresponding functionality on the actual testing platform. The first to receive the testbench was POLITO from mid-June to the end of July, who tested compression and encryption IPs and deployed a

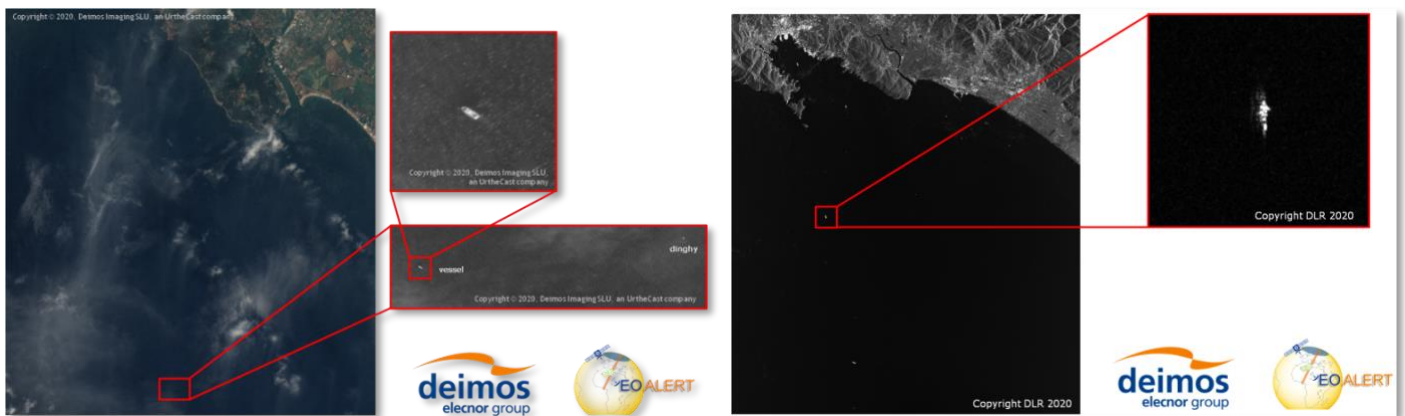
preliminary version of the data handling software implementing the communication protocol among boards. Then, it was the turn of DLR in August, who tested the on-board SAR processing algorithm and the communication with the data handling board. Finally, in September DEIMOS Space tested the on-board optical processing algorithms, the parallelization of the processing over multiple board, and fixed the last issues regarding data transfers in the different test scenarios. The testbench is now being shipped back to OHB, who will prepare it for the execution of the different test cases. Notwithstanding the travel restrictions, this activity resulted in a lot of lessons learned from the partners towards the final deployment of the testbench and the successful demonstration of end-to-end EO-ALERT data chain, from the payload to the user on ground, integrating all the technologies and contributions from the partners



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## EO-ALERT experimental campaign

To validate the performances of the high-speed avionics test bench in a representative environment, a test campaign using real Earth Observation data was executed at the beginning of July 2020 and coordinated by DEIMOS Space. For the ship detection scenario, the CRV LEONARDO ship of the Centre for Maritime Research and Experimentation (CMRE) was deployed off the coast of La Spezia (Italy) during six days. The locations of the ship were selected in order to fall within the optical VHR satellite Deimos-2 (operated by Deimos Imaging) and the SAR satellite TerraSAR-X (operated by DLR) swaths, in order for the space assets to take images of the ship. A feasibility analysis on the observation opportunities for both Deimos-2 and TerraSAR-X, taking into account orbital dynamics and payloads constraints, was performed in order to identify the exact date and time of observations of pre-defined locations in the Tyrrhenian Sea. All the planned activities were executed successfully, with 3 acquisitions by TerraSAR-X and 4 acquisitions by Deimos-2 of the ship and dinghy, for a total coverage of 6400 km<sup>2</sup> and about 100 ships and boats seen in the images. The raw data acquired by the space assets will be used as input in the avionics test bench of the EO-ALERT data processing chain and the in-situ measurements provided by the ship will be used to validate the results of the generated EO products.



Sample acquisitions: Deimos 2 (left); TerraSAR-X (right).

## EO-ALERT Workshop mid-2021

After the very successful [first workshop for EO-ALERT](#), held in November of 2019, we are now starting to plan for the 2<sup>nd</sup> and final workshop, planned for mid-2021. This will cover the results of the EO-ALERT project as a whole, discuss the implications of the developed technologies and the next steps for the exploitation of the capabilities and architecture proven in the project. For entities interested in participating in the workshop, please [contact the EO-ALERT team](#).



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## Upcoming Events

### III Congreso de Ingeniería Espacial

This Spanish event groups together all the main Spanish actors in the space field. It will be held virtually from 27<sup>th</sup> to 29<sup>th</sup> of October 2020. DEIMOS Space will present achievements and results of the EO-ALERT project.

### EUSAR 2020

The European Conference on Synthetic Aperture Radar (EUSAR) is the world's leading international conference dedicated to SAR techniques, technology, and applications. Initially scheduled in June 2020 in Leipzig, Germany, the conference has been postponed to March 29 – April 1, 2021. DLR will present the latest results on the satellite on-board SAR processing chain for the generation of rapid civil alerts.

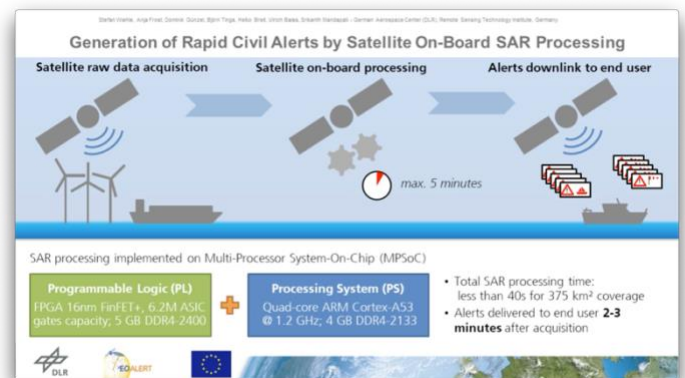
## Past Events

### NWCSAF Users' Workshop 2020

EO-ALERT participated on 12<sup>th</sup> March 2020 in Madrid in this workshop devoted to assess the applicability and usefulness of the Nowcasting Satellite Application Facilities (NWC SAF) products in meteorological nowcasting and very short-range forecasting. Robert Hinz (DEIMOS Space) discussed how the EO-ALERT next generation satellite processing chain can provide very-low latencies for convective storm nowcasting using MSG images and OPERA weather-radar network composites.

### CSRS 2020

EO-ALERT was present at the 41<sup>st</sup> Canadian Symposium on Remote Sensing (CSRS), which this year was an online symposium held from 13<sup>th</sup> to 16<sup>th</sup> June 2020. Stefan Wiehle (DLR) illustrated the satellite on-board SAR processing architecture developed within EO-ALERT for the generation of rapid civil alerts.



### SPIE Remote Sensing 2020

EO-ALERT participated in the Image and Signal Processing for Remote Sensing conference within this year SPIE Remote Sensing Digital Forum, held from 21<sup>st</sup> to 25<sup>th</sup> September 2020. Andrea Migliorati (Polito) presented the selective encryption algorithm integrated in the CCSDS compression standard that has been developed as the encryption solution for the EO-ALERT architecture.

### ESA Phi-week 2020 Virtual Event

The European Space Agency (ESA) organized a Φ-week virtual event from 28<sup>th</sup> September to 2<sup>nd</sup> October 2020 focusing on innovation in Earth Observation, and showcasing the latest achievements in Earth Observation science, technology and applications. Murray Kerr (DEIMOS Space), EO-ALERT coordinator, presented to a multi-disciplinary community the current status of the advanced data chain technologies developed in the EO-ALERT project to support on-board processing for the next generation of rapid civil alerts.



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## ECMWF–ESA Workshop on Machine Learning for Earth System Observation and Prediction 2020

EO–ALERT participated on 5<sup>th</sup> October 2020 in this virtual workshop devoted to the recent advances in the application of Machine Learning and Deep Learning techniques to Earth System Observation and Prediction. Robert Hinz (DEIMOS Space) presented the status of the EO–ALERT on–board multi–spectral VIS/thermal processing, tested on the SEVIRI instrument of MSG, for convective storm nowcasting. This has now shown promising performances with respect to the current state–of–the–art EUMETSAT operational products, showing real potential for services based on on–board processing, despite a limited set of observables.



### IAC 2020

The International Astronautical Congress (IAC) is the annual meeting of the International Astronautical Federation. This year, IAC 2020 was a Cyberspace Edition accessible free of charge to all attendees from 12 to 14 October 2020, under the IAF Motto: “IAF Connecting @II Space People”. EO–ALERT was present with 3 papers. Murray Kerr (DEIMOS Space), EO–ALERT coordinator, presented an overview of the EO–ALERT

project and a description of the EO–ALERT architecture, illustrating the project concept, objectives, and latest developments. Otto Koudelka (TUGRAZ) provided a contribution on the advanced communication solutions developed for EO–ALERT, that importantly allow for rapid global transfer of the alerts directly to the end user. Francisco Membibre (DEIMOS Space) presented the latest results of the optical processing chain, using a local high performance HW testbench located at DEIMOS Space premises, confirming the sub–one minute processing time for the VHR DEIMOS–2 optical payload on–board processing.



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## Partners



## Supporting Organizations



## Follow EO-ALERT



## [Contact the EO-ALERT team](#)



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