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Research and Innovation

CORDIS Results Pack on space downstream market

Unlocking space-based innovation for Europe's resilience, sustainability and mobility

A thematic collection of innovative EU-funded research results

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Editorial

Satellite data and services are more than just research instruments. Europe's downstream space sector is rapidly expanding, driven by European businesses that draw on Copernicus and Galileo to develop, validate and commercialise solutions. This Results Pack showcases 11 EU-funded projects that demonstrate how the EU Agency for the Space Programme (EUSPA), through Horizon Europe, is supporting European SMEs to develop solutions that address Europe's key challenges, from environmental management and resilience to smart mobility.

Europe's space infrastructure has become a key element of the digital economy. Copernicus and Galileo underpin thousands of services used every day by citizens, businesses and public authorities. Yet the true engine of Europe's space ecosystem is much closer to the ground, in the downstream companies transforming space data into applications that strengthen resilience, protect the environment and enable smarter mobility.

This downstream market is evolving quickly. New entrants, SMEs and specialised innovators are using space data in new ways: delivering emergency alerts when terrestrial networks fail, improving renewable energy forecasting, enabling precision water management, and supporting autonomous navigation in complex environments. As demand grows, so too does the need for solutions that are accurate, reliable and ready for commercial deployment.

This Results Pack highlights research and innovation projects supported by EUSPA. Together, they show how EU investment accelerates the journey from research to market, helping companies validate technologies, build partnerships and scale their services. The projects span three strategic domains – resilience, environment and mobility – each demonstrating how space data can address concrete societal and economic challenges.

Strengthening Europe's resilience

Several projects in this Pack focus on enhancing Europe's crisis response capabilities, bolstering preparedness and capacity.

AWARE demonstrates how Galileo's Emergency Warning Satellite Service (EWSS) can deliver alerts even when terrestrial networks are disrupted, ensuring that citizens receive critical information through multiple channels, while GEXTRECS provides more robust communications infrastructure for emergency services.

Meanwhile, OVERWATCH and BUILDSPACE explore how Copernicus satellite data can support emergency responders, infrastructure monitoring and urban resilience, helping authorities anticipate risks and act faster.

Supporting the green transition

Copernicus data, combined with AI, IoT sensors and advanced modelling, is powering new approaches to accelerate Europe's environmental objectives, including climate neutrality and sustainable resource management.

Projects such as SWIM and SWIFTT demonstrate how multi-sensor data fusion can deliver real-time insights into water quality, drought risks and forest ecosystem health.

By integrating Copernicus and Galileo data into grid management, RESPONDENT supports Europe's shift to renewable energy, while COMUNIDAD shows how space-based services can empower local communities to manage natural resources more effectively.

Enabling smarter, safer mobility

As mobility systems become more automated, connected and data-driven, the need for precise, reliable positioning grows. Galileo's high-accuracy services are central to this transformation.

EGeNiouSS advances visual localisation to support navigation in dense urban environments, where satellite signals become degraded. EDGAR offers robust systems to complement existing air navigation services, improving safety and airport capacity. And SPATRA explores new applications for multimodal transport, helping to keep ground transport moving on road and rail.

A dynamic market with strong commercial potential

Space data creates most value when combined with cutting-edge innovation, user-driven design and real-world validation. The projects featured in this Pack reflect how SMEs, public authorities, infrastructure operators and end users can work together to develop practical solutions and deploy these at scale.

By supporting these innovators, EUSPA is strengthening Europe's strategic autonomy, boosting competitiveness and ensuring that space-enabled services deliver tangible benefits to society and progress to Europe's digital, green and resilient future.

A multichannel approach to emergency alerts

Millions of Europeans are exposed to multiple natural hazards. The EU-funded AWARE module delivers reliable, accurate emergency warnings to people when and where they are needed. When disaster strikes, every second counts. Civil authorities and citizens must know what to do – and when.



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This is where the Galileo Emergency Warning Satellite Service (EWSS) comes in.

The forthcoming service will allow national civil protection entities to transmit emergency alerts directly via satellite signal to Galileo-enabled devices such as smartphones. Each alert will include information on the type of hazard, severity, time, duration and affected area, along with detailed instructions on what to do to stay safe.

"While disasters can disrupt or destroy terrestrial telecommunication networks, EWSS transmits its alerts using Galileo satellites, meaning it will continue to work even when other channels are down," explains Charly Faradji, project manager at Telespazio France.

Through support from the AWARE project, Telespazio France, together with FDC, has developed an EWSS receiver that can be integrated into a range of existing devices, including digital

display panels, speakers, sirens and even the IT networks of critical infrastructure such as buildings, alerting citizens via audio, video and written messages.

"By casting a wider net and enabling emergency alerts via as many channels as possible, the AWARE receiver amplifies the Emergency Warning Satellite Service's impact," adds Faradji.

Developed and ready for action

The AWARE module has been tested and validated in several live demonstrations. The Logarska Dolina region in Slovenia – which experienced devastating floods in 2023 – was selected as a test site. It is a mountainous area where traditional communications networks may fail to reach isolated communities. AWARE integrated modules into the long-range acoustic devices from Genasys, allowing authorities to deliver crystal-clear audio warning messages in both Slovenian and English within seconds.

EWSS transmits its alerts using Galileo satellites, meaning it will continue to work even when other channels are down.

A second demonstration simulated the impact of a severe thunderstorm over Paris resulting in a highway collision involving a vehicle transporting hazardous materials. Here, an AWARE receiver was installed in an urban digital panel from JCDecaux, commonly found by bus stops. Once the module received the EWSS alert, the panel immediately began broadcasting the warning message in English and French.

"Both events – the storm and the accident – pose significant dangers to people, and a multichannel approach to public warning ensures that as many people as possible are alerted on time through relevant channels," says Faradji.

Access for all

With the Galileo EWSS expected to go live in 2027, AWARE partners are busy working not only to commercialise the existing module but also to ensure it is used to its maximum potential.

As to the latter, Telespazio has set up a new consortium with siren manufacturers and civil protection entities from France, Germany and Lithuania to specifically address the use case of widespread legacy siren systems. This will ensure uniform alert dissemination to urban and rural areas, even in territories that are not able to invest in cutting-edge technologies.

"The threats that Europe faces are increasing both in quantity and intensity and we would be remiss not to leverage this life-saving technology," concludes Faradji. "The AWARE solution helps ensure that everybody, regardless of location or device, gets an equal chance of receiving the emergency information they need when and where they need it."

PROJECT
AWARE – enAbling EWS/GAlileo maRket uptake in widEspread PWS solutions

COORDINATED BY
Telespazio France in France

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082555

PROJECT WEBSITE
euproject-aware.eu

Ensuring resilient communications in emergencies

Secure satellite communications are vital to saving lives during crisis situations. The EU-funded GEXTRECS project enhances their robustness and usability through an innovative and interoperable Service Pack.



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Response to natural disasters such as floods, earthquakes and wildfires, as well as human-made emergencies, depends strongly on the availability of seamless connectivity. Terrestrial infrastructure is not fully reliable, as it may get damaged in these situations. Secure satellite communications (SATCOM) allow emergency services to coordinate activities and share information, enhance situational awareness and deliver an effective response. Public authorities can also use robust space-based connectivity to disseminate alerts, evacuation orders and safety instructions.

Despite these benefits, significant challenges remain for effective integration of non-terrestrial connectivity in emergency operations. The GEXTRECS project sought to enhance the usability and reliability of SATCOM during crises, in synergy with other EU Space Programme components such as Copernicus and Galileo.

"We prioritised tackling the complex processes for getting satellite feeds, and related challenges in terms of inconsistent connectivity, limited coverage or reliance on single systems, and poor interoperability between satellite and terrestrial systems," says Gema Rueda Montenegro, project coordinator from GMV Aerospace and Defence, the project host.

The result is a prototype solution that optimises resources through access to alternative satellite constellations and orbits, while also enabling their interoperability.

The innovative Crisis Management Service Pack

The GEXTRECS project comprised a multidisciplinary consortium of eight partners from four EU Member States (Germany, Italy, Poland and Spain), combining institutional, industrial, operational and communications expertise.

The goal was to develop a pre-operational EU Governmental Satellite Communications (GOVSATCOM) Crisis Management Service Pack that is secure, interoperable, rapidly deployable, affordable and user-friendly.

The Dynamic Planner lies at the solution's core. It uses intelligent search methods that rapidly identify the best satellite resources depending on availability and specific need, allowing the use of space-based resources in an optimal manner.

"The algorithm considers factors such as service type, priority level and performance requirements to maximise the SATCOM system's effectiveness. The solution also includes capabilities to manage congestion during peak demand and dynamically replan for more agile responses to rapidly changing conditions," explains Rueda.

First responders request communication services via the Dynamic Planner's dedicated web interface. The Dynamic Planner connects to the GEXTRECS Network Balancer, which switches across different satellite channels and between satellite and terrestrial links to maintain secure, uninterrupted communications.

GEXTRECS also explores the use of a Galileo-based secure positioning system tailored to operational needs, as well as the transmission of Copernicus-based products.



It was the first event of its kind to showcase synergies across the EU Space Programme components such as GOVSATCOM-like solutions, Copernicus and Galileo.

Assessing usability and performance in realistic scenarios

The GEXTRECS Service Pack was validated in realistic demonstration scenarios undertaken in Germany and Spain with around 200 attendees, including crisis managers, civil protection professionals and security practitioners, alongside representatives of GOVSATCOM, and national and EU authorities.

"It was the first event of its kind to showcase synergies across the EU Space Programme components such as GOVSATCOM-like solutions, Copernicus and Galileo," adds Rueda.

The final demonstration was a simulated 7.4-magnitude offshore earthquake near Porto causing widespread infrastructure damage and loss of 5G/LTE connectivity for at least 36 hours and affecting 300 000 people.

"Alongside features such as livestreamed videos, Galileo secure positioning services and Copernicus geo-intelligence products were transmitted through SATCOM channels, highlighting the added value of integrating EU Space Programme components," notes Rueda.

The success of the approach to meet real needs was validated by post-demonstration analysis, alongside positive participant feedback, and further boosted by first responder surveys from other European countries, especially during the 2025 NATO emergency management exercise in Bulgaria.

"Although still a prototype, there is interest in our solution, including from EU public authorities, as a potential contribution to future advanced and flexible resource pooling and sharing mechanisms," adds Rueda.

PROJECT
GEXTRECS – GOVSATCOM Extreme Events Crisis Management Service

COORDINATED BY
GMV Aerospace and Defence in Spain

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101129626

PROJECT WEBSITE
gextrecs.space

Holographic system supports Europe's response to climate change emergencies

A new state-of-the-art system involving holography, drones and artificial intelligence developed by the EU-funded OVERWATCH project helps Europe's first responders manage and address climate-related disasters such as wildfire.



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The impacts of climate change are already being felt keenly across Europe. Warming temperatures are increasing both the frequency and severity of climate-related disasters, such as flooding and wildfires, and citizens' lives are increasingly at risk.

Response and recovery teams face several critical challenges. A lack of real-time situational awareness about unfolding events means decision-making is slow and resources are allocated inefficiently. Communication systems can also fail during extreme events, through disruptions from blackouts, damaged

infrastructure or network congestion. Coordination across various European agencies is also complex, making it difficult to build a unified operational picture.

"Additionally, reconnaissance missions can be dangerous for personnel, especially in unstable or inaccessible environments," explains project coordinator Vanina Fissore, from the Italian innovation SME Ithaca. "Many of these tasks could be performed safely using unmanned systems."

The OVERWATCH project designed a new integrated system to address these challenges. The project combines Earth Observation data from satellites and drones, processing by artificial intelligence tools, and resilient communication through fallback networks supplied by tethered drones. It also supports real-time, rapid decision-making with immersive visualisation tools, while enhancing the safety and efficiency of first responders through autonomous reconnaissance.

"By integrating data from satellites and drones, and presenting it through intuitive interfaces such as web dashboards and augmented reality, the system helps teams better understand evolving conditions on the ground," says Fissore.

Trialling the system through real-world challenges

The OVERWATCH consortium designed and developed the system, which also includes a holographic/augmented reality (AR) element operating on specialised visors to support response efforts on the ground.

"The AR component enables firefighters and civil protection commanders to visualise the same information available on the web dashboard – such as live maps, fire perimeters, drone positions and flood data – directly overlaid onto their physical surroundings," adds Fissore. "Instead of relying on fragmented and delayed information, commanders can access a clearer, real-time picture of the situation, enabling faster and more informed decisions."

The system was trialled and demonstrated in real-world scenarios: a wildfire exercise in Portugal and a system tools demonstration in Poland. During these activities, practitioners and end users were able to test the full system, including all platform functionalities and the AR interface.

Supporting Europe's resilience against climate change

Two demonstration events, held in Portugal in October 2025 (on wildfires) and in Poland in March 2026 (on floods), were also a key part of this achievement. These events brought together civil protection agencies, military units and emergency responders from diverse countries to exchange knowledge and operational experience.

The researchers will continue to refine the system, incorporating vital user feedback. To this end, the team launched a free 30-day trial in March 2026, allowing emergency management agencies, and all interested users, to gain hands-on experience with the platform.

By integrating data from satellites and drones, the system helps teams better understand evolving conditions on the ground.

"In the longer term, the hope is that platforms like OVERWATCH will strengthen Europe's overall resilience to climate-related disasters by improving coordination across agencies and countries, supporting more proactive emergency management, and ultimately helping to reduce the impact of these events on people, infrastructure and the environment," says Fissore.

PROJECT
OVERWATCH – Integrated holographic management map for safety and crisis events

COORDINATED BY
Ithaca in Italy

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082320

PROJECT WEBSITE
overwatchproject.eu/en

Advancing the use of space data and digital twins in cities

The EU-funded BUILDSPACE project demonstrates how space data can be transformed into actionable decision support tools for making buildings more energy-efficient and urban centres more climate-resilient.



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Responsible for 40 % of the EU's total energy consumption, Europe's building stock is the single largest consumer of energy, and one of the largest emitters of carbon dioxide – the primary driver of climate change.

If Europe is to meet its ambitious goal of becoming carbon-neutral by 2050, it must improve the energy efficiency of its buildings. Space downstream data can support this goal.

"With space data and services, we have an opportunity to transform urban development and construction practices," says Stamatia Rizou, R&D manager at SingularLogic.

The BUILDSPACE project, coordinated by SingularLogic in Greece, demonstrates how Copernicus Earth Observation data, together with digital twin technologies, can support energy-efficient buildings and climate-resilient cities.

"Our aim is to bridge the gap between advanced space data and real operational needs in the building and urban planning sectors, delivering technically robust and ready-to-use solutions," adds Rizou.

Using digital twins to identify heat loss

Taking a user-centred, co-creation-focused approach that involved over 100 stakeholders, including city authorities, urban planners, engineers and researchers from nine countries (Belgium, France, Greece, Latvia, Poland, Slovenia, Spain and the United Kingdom), the project designed and tested five unique services.

Two of these services looked to help optimise a building's operational efficiency by reconstructing a digital twin of the structure. This was done using a combination of drones, thermography and simultaneous localisation and mapping (SLAM) – three approaches that benefit from the precise navigation and positioning provided by a Galileo-enabled global navigation satellite system (GNSS).

SLAM enables autonomous robotic mobile scanning of indoor, outdoor and subterranean environments. "These services help building facility managers, urban planners, and real estate and construction companies understand the state of the building in terms of heat loss or other energy-related incidents, which can be observed in the digital twin," explains Rizou.

Climate control – and adaptation based on EU space data

The project also delivered three city-scale services that can be used to predict how climate change, urban heat and flooding impact a city's built environment.

All three services leverage Copernicus data and products. For example, the urban heat analysis tool uses Copernicus and socio-economic and demographic data to evaluate how urban heat impacts a building's energy demand.

The built environment climate scenarios service, on the other hand, combines geospatial datasets, standardised models and Copernicus climate projections. The result is an interactive, web-based tool that estimates and projects the energy demand of residential building stock under current and future climate conditions.

Finally, the urban flood resilience service integrates Copernicus land-use data and local data to provide users with map-based calculations for assessing expected flood damage to buildings as well as identifying urban flood vulnerability hotspots.

All the project's services were tested in real-world pilots in Greece, Latvia, Poland and Slovenia.

Supporting key EU priorities

The BUILDSPACE project successfully advanced the practical use of space data and digital twins in the built environment. "We concretely demonstrated how space data can be transformed into actionable decision support tools for making buildings more energy-efficient and cities more climate-resilient," concludes Rizou.

In doing so, the project supports such key EU priorities as the European Green Deal, Renovation Wave and Energy Performance of Buildings Directive.

The project's many partners are now busy integrating BUILDSPACE's results into follow-up research, municipal workflows, and commercial and service-based offerings.

With space data and services, we have an opportunity to transform urban development and construction practices.

PROJECT
BUILDSPACE – Enabling Innovative Space-driven Services for Energy Efficient Buildings and Climate Resilient Cities

COORDINATED BY
SingularLogic in Greece

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082575

PROJECT WEBSITE
buildspaceproject.eu

Satellite data strengthens water management capabilities

Integrating Earth Observation data with ground sensors and artificial intelligence-based analytics, the EU-funded SWIM project delivers early environmental warnings and cost-effective monitoring of valuable water resources.



© e.Ray

Population growth, changing climate patterns and widespread pollution are putting water resources under pressure. In many regions there is a lack of timely, reliable and actionable data for decision-making on water quality and availability.

"Extreme weather events like severe droughts and rainfall have sharply increased over the past two decades, causing massive infrastructure damage," says SWIM project member Keenan Lucas, technical project coordinator at Offshore Monitoring in

Cyprus. "Additionally, water bodies are increasingly threatened by harmful algal blooms that cause significant economic losses, particularly to the aquaculture industry."

Predictive modelling and actionable recommendations

The SWIM project sought to strengthen water management capabilities with an 'all-in-one' platform that not only displays data, but provides predictive modelling, real-time alerts and actionable recommendations. To achieve this, a multidisciplinary team from five countries was brought together, combining skills in Earth Observation, internet of things (IoT) hardware, software engineering, hydrology, and local socio-environmental governance.

"The project used a data fusion approach, combining broad Copernicus satellite imagery with precise, real-time ground measurements from floating Water Monitoring (WAMO) IoT sensors," explains Lucas. "To process this massive amount of data, machine learning was used to actively calibrate satellite readings against the ground truth data."

An artificial intelligence-assisted decision support system (AI-DSS) was integrated to generate automated, actionable alerts. The whole system was then tested in real-world scenarios in Colombia, specifically at the La Fe Reservoir (for water quality and balance) and the Las Palmas watershed (for natural disaster risks). "The team worked directly with local utilities and municipalities to ensure the platform met practical, operational needs," adds Lucas.

Multi-sensor data fusion approach

This pilot testing demonstrated that the SWIM research concept works in practice. The project's solar-powered WAMO buoy successfully transmitted live water-quality data directly onto the platform, while American partner Rayner Software's Orbiter app leveraged the vast amount of data collected by the Copernicus programme.

The project team also showed that machine learning can predict river discharge even in areas with very limited local monitoring. The team believe that utilities, regulators, emergency responders, private companies, insurers and local communities can all benefit from having better, more timely information about what is happening in a water basin.

"The real strength of this solution is that it combines technologies that are often kept separate: satellite observation, on-the-ground sensing, machine learning and decision support," notes Lucas.

Integrating satellite with ground monitoring

Next steps involve moving from a strong prototype to a fully operational platform. This will involve completing validation across the pilot sites, strengthening the integration between satellite and on-the-ground monitoring, and proving that the system's core modules can work together in real conditions.

"We also want to enhance the platform's emergency response features, improve the user experience for different types of stakeholders, and make it easier to connect SWIM with monitoring systems already used by utilities and public authorities," says Keenan. "In parallel, we're developing the commercial roadmap, securing the right funding pathways, and protecting the project's core innovations so the platform is ready for scale."



The real strength of this solution is that it combines technologies that are often kept separate: satellite observation, on-the-ground sensing, machine learning and decision support.

PROJECT
SWIM – Surface Water Information Management

COORDINATED BY
O.M. Offshore Monitoring in Cyprus

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101180055

PROJECT WEBSITE
theswimapp.com

Harnessing satellite data for proactive forest management

Connecting field expertise with satellite data and advanced artificial intelligence tools, the EU-funded SWIFTT project helps land managers and scientists work together to ensure healthier, more sustainable forests.



© Timbtrack

Europe's forests provide habitats for countless species of amphibians, birds and mammals (including people), and healthy forest ecosystems help to regulate water flows, prevent erosion and store carbon. However, increasing numbers of fires, pest outbreaks and climate pressures pose significant risks to forest health and sustainability.

"These risks are intensified by climate change," says SWIFTT project coordinator Ariane Kaploun, head of nature-based

solutions at AXA Climate. "Insects breed more frequently, more dry fuel for wildfires is made available, and the frequency and severity of storms increases."

Regular, accurate forestry information

Gathering regular and accurate information on the condition of forests is a vital first step to protecting these resources. The EU's Copernicus Earth Observation programme can play a critical role here, providing information that can be used to estimate biomass changes and even leaf chlorophyll content.

The SWIFTT project set out to develop an artificial intelligence (AI)-powered forest monitoring platform to better leverage satellite data, as well as machine learning, to detect, analyse and predict major forest threats across Europe.

"Working with foresters, risks experts and AI engineers was an extraordinary opportunity to build a state-of-the-art and reality-grounded platform," adds Quentin d'Huart, CEO at project partner Timbtrack in Belgium.

To achieve this, researchers from both academia and the private sector worked together to create and improve AI models, strengthening the SWIFTT platform's ability to identify threats. Finally, SWIFTT's foresters were responsible for collecting forest datasets in Belgium, France, Germany and Latvia, and for testing the SWIFTT solution on the ground.

"Ground data was needed to calibrate our AI models," explains Annalisa Appice, professor at project partner the University of Bari in Italy. "Partners collected precise, time-stamped and geo-referenced datasets on bark beetle, wind and fire damage in their forests, as well as identifying areas with healthy, intact trees. This helped train the SWIFTT system models to distinguish between damaged and undamaged forests."

Satellite monitoring and AI-driven analytics

The key result of the project is the SWIFTT platform, an all-in-one web and mobile platform that combines high-resolution satellite monitoring with AI-driven analytics. The platform currently provides a range of actionable information, such as monthly assessments of spruce bark beetle and fire damage, as well as wind damage assessments.

Other services include the detection of active fires, identification of fire-risk forestry areas for the following three months, and indications of forest health. Foresters receive alerts containing analysis of the threat, allowing them to prioritise responses. The mobile app allows foresters to collect field data that will be used by the platform to improve its accuracy.

"By centralising these functionalities into a single platform, SWIFTT enables forest owners, managers and industry stakeholders to shift from reactive to proactive decision-making," notes d'Huart. "This will help to reduce losses and optimise forest management strategies."

SWIFTT enables forest owners, managers and industry stakeholders to shift from reactive to proactive decision-making.

Preserving biodiversity through healthier forests

Following project completion, the SWIFTT platform will be commercialised by Timbtrack, further developing the software's capabilities and extending the coverage of the platform within and beyond Europe.

"In this way, SWIFTT will not only enable forest managers to adapt to climate change and its financial consequences, but also make Europe better positioned to combat climate change and preserve our biodiversity through healthier forests," says Kaploun.

PROJECT
SWIFTT – Satellites for Wilderness Inspection and Forest Threat Tracking

COORDINATED BY
AXA Climate in France

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082732

PROJECT WEBSITE
swiftt.eu

Space data that stabilises renewable energy grids

Integrating renewable energy into the grid is essential for Europe's green transition. The EU-funded RESPONDENT project helped energy operators use data from Copernicus and Galileo to predict changes in supply and demand.



© Future Intelligence

Europe's energy portfolio is diversifying away from fossil fuels, presenting new challenges for grid operators. "With the shift to renewable energy sources such as solar and wind, which are highly weather-dependent, there is a lot of uncertainty in power generation," says Nikolaos Zotos, CEO of Future Intelligence.

The Greek telecom engineering company coordinated the RESPONDENT project, which set out to channel data from Europe's space programmes into a set of tools that help forecast renewable energy supply and manage the electricity grid in real time.

Harnessing satellite services

The RESPONDENT platform combines readings from local weather stations with data supplied by the EU's Earth Observation programme Copernicus and its satellite navigation system Galileo.

"We combined satellite data with local weather stations to improve accuracy and better predict how much energy would actually be generated," adds Zotos. Using multiple sources makes it easier to estimate how much energy will be delivered by solar and wind installations at specific locations.

Timing is the other side of the problem. As more renewable energy feeds into the grid, everything needs to stay aligned. RESPONDENT uses Galileo's precise timing to keep measurements in sync across the network, helping operators spot issues earlier and respond before they escalate.

Together, these elements make up a single platform that combines generation forecasting, demand forecasting and grid monitoring all in one place.

Testing RESPONDENT in real conditions

The project moved beyond modelling and into real-world testing through two pilot sites, each focusing on different parts of the platform.

In Greece, the focus was on renewable energy generation forecasting at the KIEFER photovoltaic park in Artemida. What began with a small number of installations was expanded to cover multiple plants, bringing them into a single platform. This made it possible to test forecasting at scale and improve accuracy by combining data across sites.

In Barcelona, Spain, the focus shifted to grid monitoring. The system was installed at a substation and within a microgrid control system, where Galileo-based synchronisation was tested using hardware integrated directly into the network. This allowed the team to see how the system behaves under real operating conditions, including periods of stress on the grid.

With the shift to renewable energy sources such as solar and wind, there is a lot of uncertainty in power generation.

"We had the opportunity to validate the platform in real environments, with users and under real operating conditions," notes Zotos. Forecasting accuracy improved 8-12 % compared to existing approaches, and at the same time, more precise timing helped improve the reliability of grid monitoring.

The pilots also showed wider benefits. In the demonstration, operators were better able to manage congestion, keep voltage levels stable and respond more quickly when supply and demand shifted. With more reliable forecasts, they could make adjustments earlier, rather than reacting at the last minute.

Making the grid easier to manage

RESPONDENT takes data and services from Copernicus and Galileo and turns them into tools for day-to-day grid operations, helping distribute the right amount of energy, at the right time, where it is needed. To do that, the platform brings together forecasting and grid monitoring in a single system that can be used by grid operators, energy providers and aggregators.

Developed by a consortium of eight partners across Greece, Ireland and Spain, the technology is currently being tested for potential integration into operational activities. The next step is to scale it up, test it in larger networks and bring it to more users.

For Europe's energy system managers, RESPONDENT's value is clear, helping operators see problems earlier and avoid expensive last-minute fixes. This increased resilience allows greater adoption of renewable energy, ensuring that Europeans benefit from an energy system that is sustainable and reliable.

PROJECT
RESPONDENT – Renewable Energy Sources Power FOrecasting and SyNchronisation for Smart GriD NEtworks MaNagemenT

COORDINATED BY
Future Intelligence in Greece

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082355

PROJECT WEBSITE
respondent-project.eu

Delivering the potential of Copernicus to everyone

From sustainable coffee cultivation to improved water management, local decision makers are benefiting from digital tools developed by the EU-funded COMUNIDAD project that boost access to Europe's Earth Observation data.



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Copernicus products and services have the potential to transform the agriculture and rural development sectors worldwide. But turning this potential into practice requires that the relevant sectors know how to use these services.

"With the goal of building regional capacity in Chile and Colombia, we developed the platforms, tutorials, workshops and training users need to fully benefit from everything Copernicus has to offer," says Karel Charvát Jr., project manager at LESPROJEKT-SLUŽBY, the COMUNIDAD project's coordinating partner.

Easy-to-use Earth Observation solutions

The project developed a suite of integrated tools designed to help local researchers and developers explore and analyse Copernicus data, as well as use it to create their own applications.

The COMUNIDAD Platform is a modular, interoperable solution that helps users transform Copernicus and other data into actionable decision support tools. "By leveraging multi-source data, pre-configured processing pipelines, and user-friendly interfaces, this solution can be easily used by anyone – no advanced technical training required," explains Charvát.

The COMUNIDAD platform helps local decision makers turn Earth Observation data into effective water management strategies.

COMUNIDAD also delivered ready-to-use algorithms and services that use Earth Observation data to provide users with actionable insights for decision-making, risk management and sustainability assessment. "Designed for direct operational use, these solutions help public authorities, private actors and researchers unlock localised, high-impact applications and scalable replication," adds Charvát.

Turning space data into strategy

One such application involves assessing how coffee production impacts the local environment. During a pilot in Colombia's Caldas region, the project used Copernicus imagery to map the distribution of coffee crops and vegetation. This information helps decision makers to assess an area's suitability for cultivation, forecast harvest yields and implement sustainability strategies. Other applications can be used to calculate water balance and manage the risk of landslides, both of which impact coffee planters and the wider local community.

The project conducted a second pilot in Chile, where its platform used Copernicus data to monitor snow coverage in the country's Aysén region and support land-use management. "Snow accumulation has a direct impact on water availability and life in the region in general," notes Charvát. "The COMUNIDAD platform helps local decision makers turn Earth Observation data into effective water management strategies."

Addressing challenges with Copernicus data

While the project is now over, its impact continues to be felt – and to grow. "Beyond the platform, the applications and the algorithms, COMUNIDAD's most important legacy is a number of stakeholders who see opportunities in using the COMUNIDAD platform and Copernicus data to address other challenges affecting their lives," says Charvát.

The project is currently working to host the COMUNIDAD platform at two consortium members in Chile and Colombia, where it can be used to develop new solutions. Project partners are also exploring expanding the platform to other Latin American and Caribbean countries.

PROJECT
COMUNIDAD – Combined Use of EGNSS and Copernicus Data to Develop Innovative Downstream Services for the Users from Chile and Colombia

COORDINATED BY
LESPROJEKT-SLUŽBY in Czechia

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101131859

PROJECT WEBSITE
comunidad-project.eu

Vision-augmented navigation resolves satellite blind spots

As we increasingly depend on satellite-based global positioning systems, the EU-funded EGeNiouSS solution offers a complementary visual localisation cloud service to ensure more complete coverage.



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Satellite systems that provide positioning, navigation and timing services are considered critical infrastructure, supporting autonomous vehicles, engineering surveys and much more. Yet coverage remains incomplete.

"In urban environments especially, navigation devices often lose satellite signals, disrupting positioning information, underlining the need for more resilient systems," says Phillipp Fanta-Jende, coordinator of the EGeNiouSS project.

To address this, EGeNiouSS augmented global navigation satellite systems (GNSSs) with visual localisation technologies, boosting their reliability and accuracy. Advanced computer vision, photogrammetry and geodesy techniques offer GNSS-independent absolute positioning information, thanks to highly accurate geospatial datasets distributed via the EGeNiouSS cloud service.

"As GNSS-complementary positioning becomes increasingly important, especially for autonomous systems, we demonstrate it can be both cost-effective and scalable," adds Fanta-Jende from the Austrian Institute of Technology, the project host.

Visual localisation and multi-sensor fusion

Maintaining accuracy and reliability in complex environments, such as dense urban areas or locations where signals are degraded or unavailable, is a constant challenge of modern satellite positioning services.

Most workarounds rely on fallbacks such as radio-navigation systems for aviation, or other radio-based technologies such as Wi-Fi or ultra wideband for terrestrial applications including smartphone localisation-driven services.

The EGeNiouSS solution uses sensors, such as a smartphone camera, alongside GNSS services, including Galileo's High Accuracy Service, to calculate both relative and absolute positioning.

This is complemented by a cloud-based component which distributes geospatial reference data to the operating platform or edge device, which cross-references camera images with these datasets; all while adhering to strict privacy principles.

"While GNSS, or similar systems, must be available to initialise our solution, the system can still provide users with essential localisation information if this signal becomes unavailable," Fanta-Jende explains.

Towards smarter and safer everyday mobility

All core components were tested under experimental conditions appropriate to their function. For example, the sensor-fusion module was evaluated for its ability to estimate a smartphone's real-time position and orientation by combining the available sensor inputs.



As GNSS-complementary positioning becomes increasingly important, especially for autonomous systems, we demonstrate it can be both cost-effective and scalable.

An algorithm processes the signals from an inertial measurement unit (IMU) and GNSS phone-mounted receiver, while comparing the detail of camera images against close-range, terrestrial mobile mapping and aerial geospatial reference datasets of the same area. Post-processing techniques then compare this position and orientation estimate to centimetre-accurate 'ground truth' to validate the performance of this real-time solution.

"Alongside individual components performing well, EGeNiouSS showed promising adaptability to very different deployment priorities, from low-cost computational efficiency, to maximum accuracy and robustness," notes Fanta-Jende.

End-to-end solutions are currently being tested with volunteers and external participants in three use cases: smartphone land surveying using QField, prioritising accuracy; bicycle navigation using the Naviki app, with low-cost and low-power paramount; and, drone goods delivery, with cached geospatial maps offering offline visual localisation.

"It is key to assess the solution not only from a technical perspective, but also in terms of usability and practical deployment," adds Fanta-Jende. "The flexibility of the solution gives it the potential to support both consumer-oriented services and high-value professional applications."

PROJECT
EGeNiouSS – EGNSS-based Visual Localisation to enable AAA-PNT in small devices & applications

COORDINATED BY
Austrian Institute of Technology in Austria

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101082128

PROJECT WEBSITE
egeniouss.eu

Safer and more sustainable airport operations, come rain or shine

The EU-funded EDGAR project advanced a robust, ground-based global navigation satellite system precision landing concept that aims to support aviation approaches and descents in all weather conditions.



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As air traffic continues to increase, airports must find new ways to increase capacity and prevent delays, even in the face of adverse conditions such as rain, fog and snow.

"When weather reduces visibility, pilots require reliable guidance to help them land," says Javier de Andrés-Díaz, project coordinator at ENAIRE, Spain's air navigation service provider.

For over half a century, that has been provided by the instrument landing system (ILS), a radio signal broadcast from the runway to guide aircraft in descent.

However, this signal can be distorted while aircraft on the ground pass close to the beacon, meaning that, in poor weather conditions, the operational capacity of the airport is reduced.

A ground-based augmentation system (GBAS) offers an alternative. "Whereas ILS creates a single straight 3D path, GBAS allows for greater operational flexibility by serving multiple procedures and runways and even enabling advanced operations – all with a single system," adds Andrés-Díaz.

With the support of the EDGAR project, ENAIRE is helping develop an improved GBAS – one that provides safety, availability and robustness in all operating conditions and for visibility conditions (known as Category I, II and III Approaches).

Leveraging dual-frequency signals from multiple GNSS constellations

GBAS augments existing global navigation satellite system (GNSS) signals by providing precise corrections and integrity data to aircraft in the vicinity of an airport.

This ensures accurate and reliable navigation during such critical phases of flight as approach, landing and take-off.

The EDGAR project builds on this concept by increasing the number of satellite signals used to calculate an aircraft's position and flight path, drawing from both Global Positioning System (GPS) and Galileo constellations, known as dual-frequency multi-constellation (DFMC) GNSS.

"The result is greater accuracy, higher signal availability and improved robustness against interference and ionospheric anomalous conditions," explains Andrés-Díaz.

Future evolutions of satellite-based augmentation systems (SBASs), including the European Geostationary Navigation Overlay Service (EGNOS), will also augment dual-frequency signals from multiple constellations to enhance GNSS navigation across Europe.

Fewer delays and lower emissions

By conducting a wide range of research and validation activities, the EDGAR team helped advance the DFMC GBAS solution. These activities included validating the solution's performance using GNSS data collected at Tenerife Norte and Ishigaki airports under challenging ionospheric conditions caused by solar flares, which disrupt the normal propagation of GNSS navigation signals.



The result is greater accuracy, higher signal availability and improved robustness against interference.

Researchers further analysed the use of Galileo in DFMC GBAS functioning and its benefits, and tested various fallback modes that operate using just single-frequency signals. They also advanced the development of a GBAS system capable of providing Category II service to current GBAS Category I airborne users.

With standardisation essential for civil aviation, the project also presented their work to relevant standardisation bodies.

By contributing to the technical development of a navigation system that can prevent flight delays, cancellations, diversions and holding times caused by low-visibility conditions, the project is reducing noise levels, fuel consumption and carbon emissions. Furthermore, the project's use of Galileo supports the development and competitiveness of EU space technology.

PROJECT
EDGAR – EGNSS DFMC for GBAS bAsed opeRations

COORDINATED BY
ENAIRE in Spain

FUNDED UNDER
Horizon Europe – Digital, Industry and Space

CORDIS FACTSHEET
cordis.europa.eu/project/id/101130407

PROJECT WEBSITE
gbasportal.eu/edgar

Space-based applications to keep the roads and rails flowing

The increasing congestion, complexity and environmental impact of Europe's land transport network are a key challenge. The EU-funded SPATRA project uses artificial intelligence-enhanced satellite data to achieve safer, more efficient and more environmentally friendly land transport networks.



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While Earth Observation data provides critical, actionable insights for sectors such as agriculture and disaster management, there are many areas where this technology's full potential remains untapped. The SPATRA project identified road and rail transport as two key sectors that could benefit further from such satellite-enabled applications.

"When we speak about using satellite data for land transport we tend to think about applications that use global navigation

satellite systems such as EGNSS," says SPATRA project coordinator Danijela Ristic-Durrant from OHB Digital Services in Germany.

"Earth Observation data, for example openly accessible Copernicus Sentinel data, is not used so much. In this project, we wanted to demonstrate situations where such data could bring benefits."

Monitoring rail temperature fluctuations

The project proposed and developed two use cases, one for road transport, the other for rail. The first use case focused on monitoring and forecasting temperature impacts on rail networks. "Infrastructure managers often use weather forecasts to predict if tracks are likely to get too hot," explains Ristic-Durrant. "They then issue what are called low-speed orders to train drivers or stop traffic altogether." This can lead to significant disruptions in rail operations.

The SPATRA team developed a system that combines Copernicus thermal satellite data with machine learning to increase data resolution for rail temperature monitoring and rail buckling risk estimation. Field-tested in Serbia, the system demonstrated the potential to enable infrastructure managers to continuously monitor rail temperature fluctuations across the whole network, and to identify track deformation risks earlier, ensuring safe and efficient rail services.

Targeting congestion at border crossings

The second use case focused on targeting congestion and optimising parking facilities at Serbia's Batrovci border crossing. "The idea was that satellite data could be used by logistics managers to monitor congestion levels at borders and also assess parking slot occupancy," adds Ristic-Durrant.

By harnessing the capabilities of both the European Global Navigation Satellite System and Copernicus satellite systems, combined with drone-based vision and artificial intelligence (AI), logistics managers could plan journeys more efficiently and estimate arrival times more accurately.

Environmentally friendly land transport networks

The SPATRA project has shown how Earth Observation data can be applied in AI-enhanced models to ensure smooth and safe transport. Improving road traffic management and rail infrastructure monitoring will contribute to more efficient and therefore more environmentally friendly land transport networks.

Earth Observation data is not used so much. In this project, we wanted to demonstrate situations where such data could bring benefits.

"We succeeded in increasing the technology readiness level of these applications," notes Ristic-Durrant. "As with any system that uses AI models, we now need to gather more data to train the models." Further improvements and field testing will help to bring the technology closer to market readiness, and also hopefully encourage further investment in satellite-based land transportation solutions.

PROJECT
SPATRA – Space-based Applications for Transport Monitoring and Management

COORDINATED BY
OHB Digital Services in Germany

FUNDED UNDER
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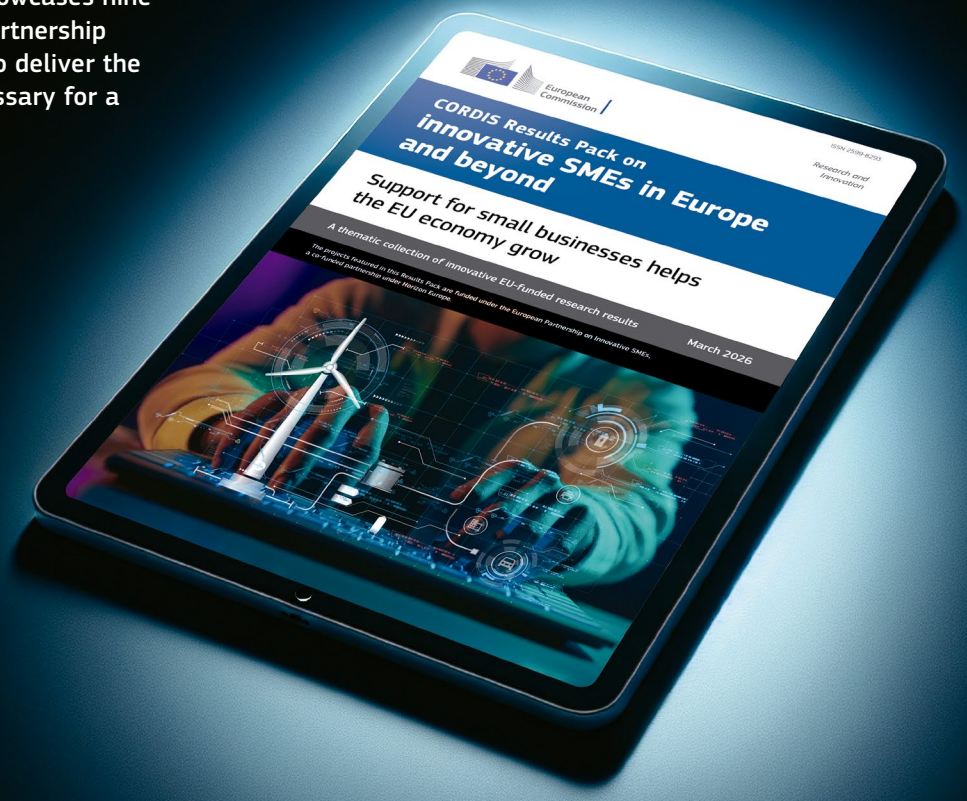
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