# Civil Security from Space

**In the past decade, Europe, along with the rest of the world, has started to face increasing challenges caused by climate change, humanitarian crises, natural disasters, extreme weather events, cybercrime and geopolitical instability. OpenSpace looks at how government organisations and industry are working together using space technology and assets to help support, mitigate and resolve civil security and crisis events.**

According to the Global Risks Report 2025 commissioned by the World Economic Forum[1], geopolitical unrest, extreme weather events amplified by climate change and continued technological advancements, such as artificial intelligence (AI), are among the top concerns of organisations and society in general. Data and services provided by space systems have a very important role to play in helping to deal with many of the challenges and can also benefit from technological developments.

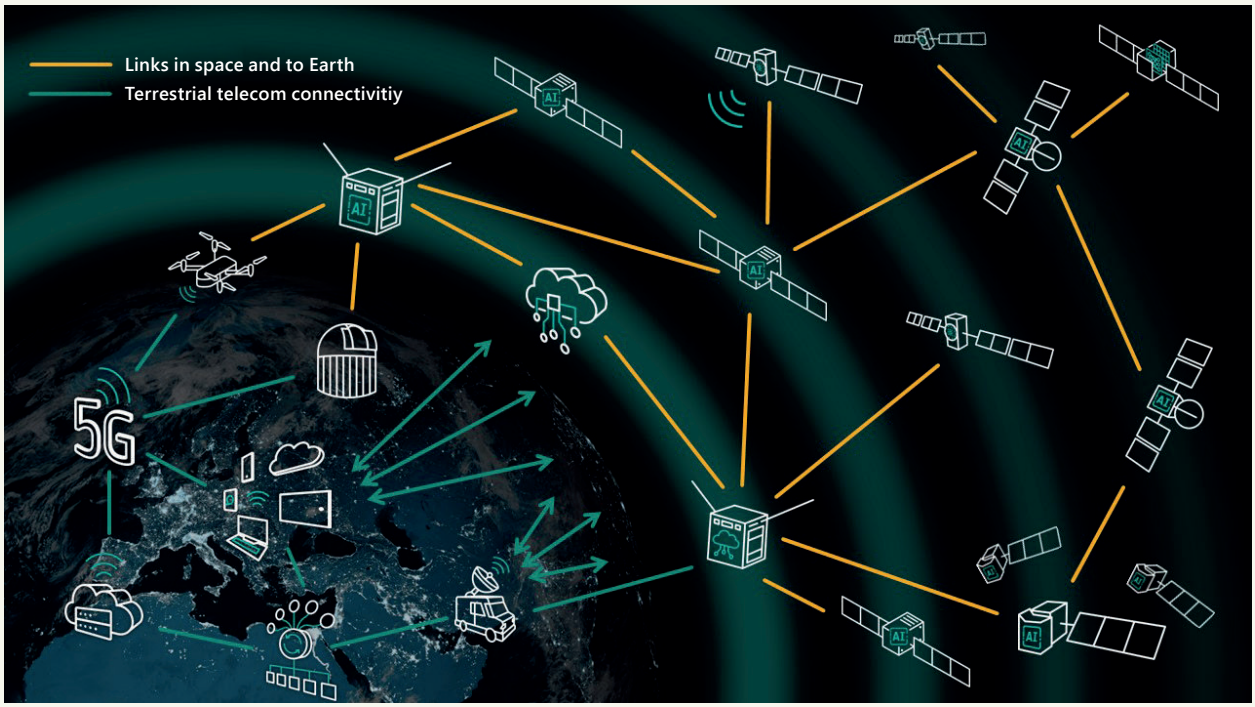
## Protecting the Earth from space

In November 2022, the European Space Agency (ESA) launched its Civil Security from Space (CSS) programme. The aim was to foster the use of space-based solutions that help save lives and livelihoods and enable organisations involved in civil security to prepare and then act swiftly in the event of humanitarian crises, law enforcement, and safety and emergency events – anytime, anywhere, for the benefit of everyone.

The primary objective of the CSS programme has been to build on and enhance existing and planned governmental and commercial capabilities to rapidly develop effective solutions, while also fostering long-term innovation. Co-funded by industry, the programme was designed to support the development of commercially viable solutions for the European market, backed by ESA.

"The CSS has been a pioneering programme, paving the way for end-users and industry to foster mutual understanding of how space-enabled services and products can deliver real benefits to users," explains Hanna-Miina Sihvonen, Head of Civil Security from Space Programme Office at ESA. "It also helps end-users gain clearer insights into the technologies available on the market and what they can offer. Most importantly, it gives users a platform to convey their needs, share their operational practices and goals, and articulate the problems they're trying to solve.

"I've spent over 20 years working in civil security, and in an ideal world these kinds of solutions should have been in use for crisis responders and first responder organisations yesterday. But with ESA's CSS programme activities, we have been able to bridge the gap between users and industry.




*The vision for 2035 of ESA's Civil Security from Space programme is to foster the creation of a unified, secure, resilient, responsive and smart network for civil security actors. Image © ESA*

"CSS has gone beyond simply focusing on the technology – it adopts a user-centric approach and supports comprehensive capacity building within user organisations. You can't just impose new technology on users; you have to walk alongside them, understand their situation, let them feed back their experiences into the system, and then identify the right organisation capable of turning the project into a viable commercial solution once the project ends."

The CSS programme has also recognised the importance of delivering interoperable industry solutions that support the creation of a federated system-of-systems. This approach allows for broader industrial participation, enables the development of new use cases, and supports scalable solutions that evolve through continuous improvements and advanced capabilities. Ultimately, this model is expected to drive growth, encourage adoption among end-users, and promote a diverse and collaborative supply chain of compatible technologies and services.

## Building blocks

"There are currently 10 distinct projects under the CSS programme," Hanna-Miina Sihvonen continues. "All the projects have contributed to creating novel space-enabled solutions and help to shape future activities, which will focus on establishing space resilience nodes in different countries. These nodes are intended to work together to support first responders. When similar nodes exist across countries, they can be connected and made interoperable through agreed frameworks, enabling seamless collaboration and data sharing.

"The programme focuses on designing and scoping various foundational building blocks that use a wide range of data services, including Earth observation

"ESA's Civil Security from Space programme focuses on transforming raw data into actionable information."

[EO], drones, telecommunications, Internet of Things [IoT] and open data. While these are valuable, they alone are not sufficient for end-users. To truly meet their needs, an additional layer of building blocks is required – ones that can transform raw data into actionable information. This involves deploying advanced AI algorithms to process data from secure data lakes, establishing testbeds for validation, and building onsite capacity to support users in effectively integrating and utilising these services. All this information needs to have a secure and resilient connectivity solution in place to get the information to the responders on the ground via the best connectivity platform available.

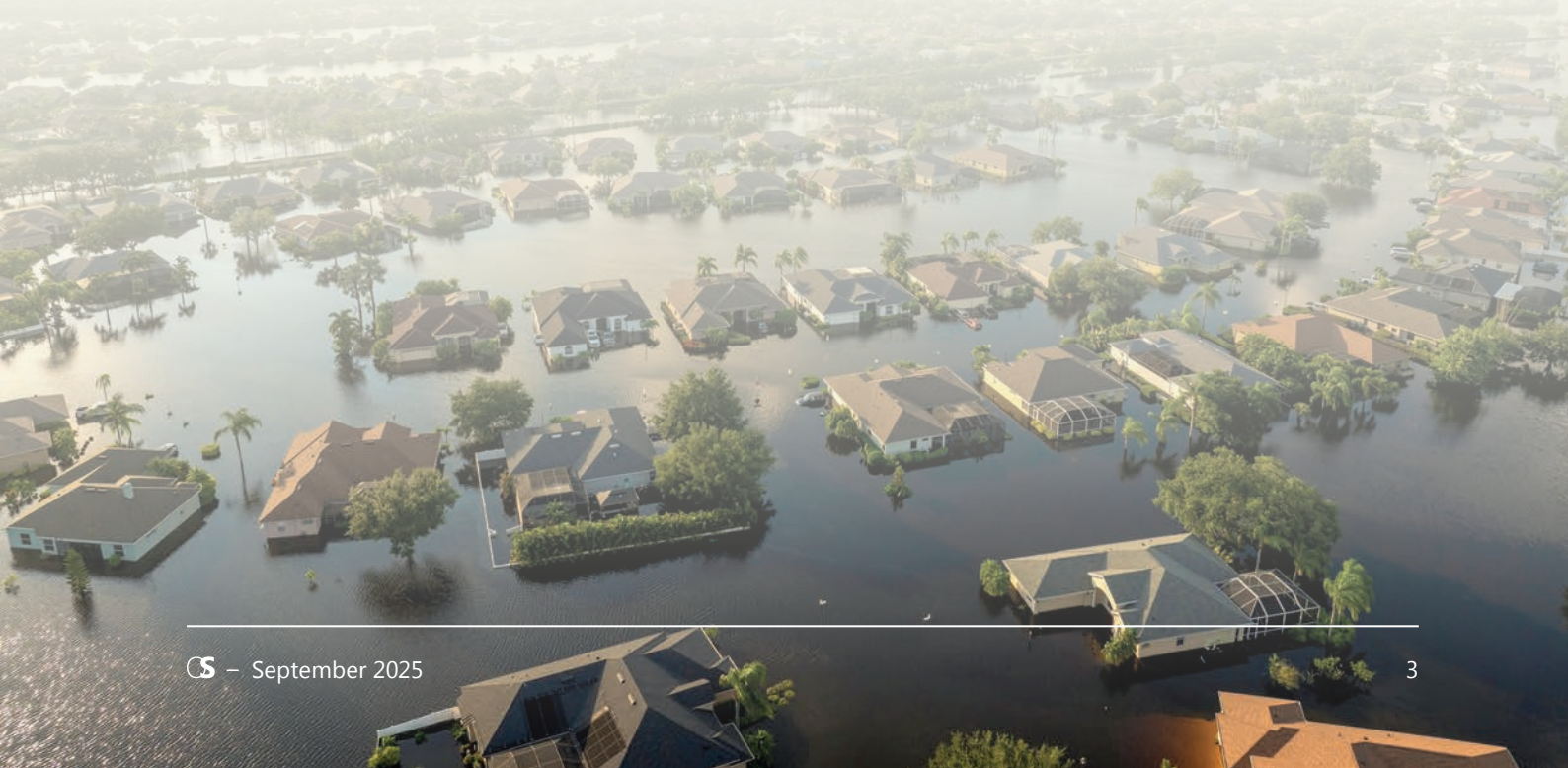
"Ultimately, we have different nodes: these are data services, information services, a digital marketplace and the authorities who can receive and process the data in the field in an actionable form. It is also important that users can interact in their own language during any incident."

## A new crisis management platform

As part of the CSS programme, Starion is leading a multinational consortium developing a new service that will provide prompt, up-to-date situational awareness information for crisis and disaster management organisations. SAFEPLACE will leverage EO, wearable device-based positioning of personnel and assets, IoT data and satellite communications (satcom) services to help overcome challenges caused by poor communications, lack of access to the affected areas, data delays and bottlenecks, and the need to identify key information from raw data.

"SAFEPLACE offers a centralised and secure crisis management platform for relevant disaster management services and products. It will provide near real-time actionable information to an array of different stakeholders – be it for operation centres or first responders who deal with preparedness and crisis management," says Alex Vorobiev, Programme Manager at Starion.

"What that means is there are a lot of different technologies, services and applications already being developed by experts in their domain. The purpose of SAFEPLACE is to bring these assets together, combining the information to create other value-added products and distribute all the information to downstream users in consolidated and standardised ways through its own portal or via APIs, ready to be integrated into existing crisis management software already utilised in operation rooms around the world. The SAFEPLACE platform not only provides a hub that can share



data with national resilience nodes but can itself be replicated to provide the basis for those national nodes.

"Another great advantage for SAFEPLACE is that it will provide multilingual guidance to crisis managers, using its AI-based large language models [LLM] to interpret user inputs and provide guidance in their preferred languages. This enables fast support for different actors across Europe and helps them make informed decisions in the face of complex emergencies such as wildfires, floods, toxic chemical spills and earthquakes.

"By fusing diverse data into a unified interface, SAFEPLACE will allow first responders and crisis managers to access critical information without the need for technical data expertise. Importantly, it can help keep the first responders, such as emergency services and those on the ground, safe. And, of course, the system must be trustworthy because in an emergency there is no room for error."

Although there are several commercial satellite constellations that already offer timely EO data, SAFEPLACE goes further by combining this space-based data with terrestrial data. It will apply AI and advanced data fusion techniques to translate raw data into actionable information. This information can then be delivered directly through existing platforms already used by emergency responders, eliminating the need to learn new systems during a crisis.

Alex Vorobiev adds: "An initial proof of concept was successfully demonstrated in June this year during an event held at ESA's ESEC [European Space Security and Education Centre] in Redu, Belgium, and the completed platform is scheduled for delivery in 2027. To date, SAFEPLACE includes organisations from Belgium and Spain, and is being extended to Luxembourg, but other countries have expressed interest in becoming involved as well as their emergency services."

## Other regional programmes

Another critical disaster response platform being developed for southern and eastern Mediterranean countries is the Prevention, Preparedness and Response to Natural and Man-Made Disasters in the Mediterranean (PPRD-Med) programme, which offers a collaborative web portal to strengthen resilience in the region. Countries such as Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Mauritania, Morocco, Palestine and Tunisia will benefit from this initiative, which uses publicly available information and offers access to secure data and tools, including educational, training and country-specific content.

PPRD-Med is part of ESA's Rapid and Resilient Crisis Response (R3) programme. It is funded by the European Union Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG-ECHO) and led by the International Science and Technology Center (ISTC). The platform will provide a broad, publicly available knowledge base about disaster risk management and secure access to educational and training ('didactic') information and

tools. Future phases will add operational tools, such as stakeholder and resource mapping, designed for use during crises caused by natural or technological hazards, including technological incidents triggered by natural hazards.

Alex Vorobiev, who also works on this project, comments: "PPRD-Med is a 'wiki' type interactive platform that empowers member states with access to essential information and tools. This gives them the information they need to deal with each disaster and make informed decisions. To ensure strict data sovereignty and privacy, the team follows a 'security by design' approach, ensuring authentication, confidentiality, integrity and privacy of information.

"Our design places security at its core, featuring local hosting for country modules connected to a central hub and strict access controls to ensure users can only view data they are authorised to access. Each country's data is stored on segregated nodes secured by robust access controls. In parallel, the 'least privilege' principle is applied to ensure that only authorised personnel can access sensitive data. This overall design and implementation strategy supports compliance with data protection regulations and alignment with local legal requirements in each country."

Providing disaster-related information in a centralised format and fostering collaboration among participating countries strengthens the entire region. Broader access to information benefits all stakeholders, including through the education and training resources offered by PPRD-Med, as well as valuable insights derived from satellite-based data. Part one of the project has been delivered, with part two expected to be available in October 2025.

## Addressing RF spectrum vulnerabilities

As the rollout of 5G networks accelerates across Europe, the radio frequency (RF) spectrum is now

emerging as a critical area of vulnerability. The rapid growth of the telecommunications market has outpaced the development of tools needed to effectively monitor and manage the RF spectrum used by next-generation networks. At the same time, 5G-based services are increasingly becoming a core element of civil security programmes, providing the means to share essential data and information, while their unauthorised use could indicate potential sources of conflict or areas for concern, both on land and at sea. Recognising this gap, there is a growing consensus for the need for an independent European system dedicated to RF spectrum oversight.

In response to this challenge, Starion is leading an innovative project to launch an in-orbit demonstrator for a European RF Spectrum Monitoring Service (ESMS) as part of ESA's Space Systems for Safety and Security (4S) programme, which in turn is part of ESA's Advanced Research in Telecommunications Systems (ARTES) framework. The project is 75% funded by the Belgian Science Policy Office (Belspo) and 25% funded by Starion. Initially, ESMS will launch a demonstrator mission that will lay the groundwork for a robust, sovereign capability that will enhance spectrum security and support the safe deployment of 5G and future 6G networks across Europe.

ESMS will provide a fully integrated end-to-end solution, combining space- and ground-based products to enable continuous space-based monitoring of the wireless spectrum environment on land, sea and air. While not limited to 5G, it will specifically offer insights into the deployment of 5G and 6G networks throughout Europe. Once proven, it will offer a commercial service to telecom operators, military organisations, regulatory bodies and European institutions, as well as to governmental and commercial stakeholders.

## Testing new technologies

The ESMS consortium brings a wealth of innovative technologies. Aerospacelab, a leading satellite manufacturer in Belgium, will build and operate the spacecraft – a SmallSat measuring 100 x 60 x 60cm based on its Versatile Satellite Platform (VSP).

Together, Starion and Aerospacelab are co-developing the satellite's payload. The VSP will be adapted to incorporate and test ArianeGroup's innovative water propulsion system.

Recently, another Belgian company, Edge X, has joined the programme, bringing new AI capabilities that will allow operators to pre-process the data on the satellite itself, rather than on the ground. This provides the opportunity to remove 'garbage' data on the satellite, reducing the amount being sent back down to the ground station.

Luis Rodriguez, Space Missions Project Manager at Starion, says: "In a nutshell, ESMS will be monitoring radio frequency bands from 160 megahertz up to 24 gigahertz. We are all familiar with 4G and 5G, but as we make our way up to 20 or even 24 gigahertz, we can open the door for a broader range of use cases.

"In a security context, the system could be used to monitor remote areas, such as dense jungles, polar regions or open oceans, where no legitimate signals are expected. ESMS can detect unauthorised or 'rogue' signals, determine if they are moving, track their trajectory and monitor them from space. This capability supports the regulated use of the RF spectrum by supplying data to authorised stakeholders, helping to detect and respond to illegal or unauthorised activities. Ultimately, ESMS aims to equip Europe with the technological foundation and intelligence needed to progress toward a future space-based spectrum monitoring constellation and a viable, long-term operational solution."

## 5G-based services are increasingly becoming a core element of civil security programmes

## Where next?

ESA's Hanna-Miina Sihvonen concludes: "ESA is undertaking the fundamental groundwork by bringing industry and the user community together, while breaking down barriers between military and civil activities and fostering international collaboration. There are many governance models and barriers between different authority organisations and we're working to bridge these gaps – delivering information and services that can be adapted to fit the specific structures of each country.

"By taking a user-driven approach and actively engaging mandated public protection and disaster relief organisations, we are placing a strong emphasis on standardisation and interoperability. This will be key to enabling effective pooling and sharing of resources."

In the future, the hope is that there will be a catalysed deeper cooperation across countries and authorities, allowing organisations to work more closely together to respond to a broad range of civil security-related requirements. Ultimately, the goal is not only to support disaster response efforts on the ground, but also to strengthen early warning and prediction capabilities, reducing the number of people affected by future crises.