Webinar - Space for Infrastructure: Water

ESA // Ofwat Innovation Fund

ESA Space Solutions

18/04/2024

Using **any space asset(s)** and integrating them with terrestrial assets for the **benefit of life on Earth**

→ ESA SPACE SOLUTIONS: OUR OFFER

Our aim is to work together to make your idea commercially viable, with:

- Zero-Equity Funding (€50K-€2M+)
- Tailored Project Management Support
- Access to our Network and Partners
- Use of ESA Brand for Credibility

→ PARTNERSHIPS IN ESA BASS

ESA Space Services works with partners in many ways:

- Collecting use cases & priories for ESA funded innovation programs
- Joint innovation programs
- Involving industry in running pilot projects & studies
- Visibility & scaling of innovative services based on space technologies
- And many others..

Aviation
Emirates, AIRFRANCE KLM, Lufthansa Innovation Hub, Hifly

Smart Cities
Comune di Firenze, Comune di Bari, Roma, Regione Abruzzo, Comune di Genova, City of Amsterdam, Comune di Milano, Città di Torino, Città dell'Aquila

Energy
E.DSO, entsoe, areg, EPRI Electric Power Research Institute, DECOM North Sea, IESA, eit InnoEnergy, enel, dewa, elia, DMEC, Friends of the Supergrid, GSGF Global Smart Grid Federation, Department for Business, Energy & Industrial Strategy, Department for Digital, Culture Media & Sport, Sviluppo Economico

ICT
vodafone, IBM, aws, Microsoft, MIT Massachusetts Institute of Technology

Health
Pfizer, AXA OneHealth, NHS, Johnson & Johnson, WISH, gsk

Food and Agriculture
Legambiente, unicri, efsa European Food Safety Authority, ICT AGRI FOOD, Ellen MacArthur Foundation, Europol

Infrastructure
ferrovial, Ferrovie dello Stato Italiane, suez, Autorità di Sistema Portuale del Mar Tirreno Centrale, Autorità di Sistema Portuale del Mar Ionio, Autorità di Sistema Portuale del Mar Tirreno Settentrionale

Circular economy
PLUGANDPLAY, WWF, European PropTech Association, CEO Water Mandate, ARUP, EMSA European Maritime Safety Agency, Toilet Board Coalition, Net Zero Technology Centre, Ellen MacArthur Foundation, Sea Cleaners, Mirpuri Foundation, Legambiente, plasticbank

Ofwat Innovation Fund, BMW, IVECO • GROUP

Ofwat and the Innovation Fund?

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Ofwat is the economic regulator for the water sector in England and Wales. Ofwat sets price controls for monopoly water companies and ensures water companies provide best value and outcomes for customers, communities and the environment.

In 2020 it launched the Ofwat Innovation Fund making £200m available to catalyse innovation in the water sector (funding 77 projects valued at £114m between 2021-2024).

For 2025-2030 the Innovation Fund will grow in ambition and value (£400m), including a growing emphasis on looking to other sectors to understand if they have solutions that the water sector could use to help it respond to its challenges.

- **Accelerating the creation and roll-out of innovative products, services and concepts**
- **Growing the capacity and capability of the sector to innovate**
- **Embedding a culture that values, encourages and supports innovation**

Thematic call for Proposals – 'Space for Infrastructure'

Key Objectives:

- Support the infrastructure sector by stimulating the emergence of innovative space applications and services with high market potential.
- Improve efficiency in the selected domains within the infrastructure sector through allowing lower costs, better capacity management and increased output while reducing environmental footprint.
- Increase the resilience of the infrastructure with more accurate resilience models and reducing the impact of disruptive events.

Water Infrastructure:

Opening Date: Already OPEN

Closing Date: 29th May 2024

Accepting both Feasibility Studies and Demonstration Projects.

Energy Infrastructure – The Power of Space

Satellite Communications (SatCom) enables the provision of ubiquitous connectivity to enhance the communication links, connectivity of IoT devices, support for remote locations. In addition, satellite communications can provide real-time, long-range communications with infrastructure monitoring systems (i.e. UAVs/robots/remote assets).

Global Navigation Satellite Systems (GNSS) can be used to enable geo-referencing of in-situ data, as well as navigation and tracking of vehicles, people and goods; PNT. GNSS-based technologies can be used for time-stamping reference system information, ensuring the traceability of the data.

Satellite Earth Observation (satEO) can be used for the monitoring of the status of the working sites, the planning, construction and maintenance of the infrastructure, collecting information on geographical and environmental parameters for the sustainability analysis, integration of environmental data; identification of patterns and trends that may be linked to infrastructure safety risks, and provide insights into how to best address them.

Water Asset Resilience and Performance

Overview

The UK water sector is increasingly focusing on enhancing asset resilience through investments in network and asset upgrades, adoption of innovative technologies, and implementation of digital, AI-led smart (proactive) maintenance and management strategies.

Implementation and Operational Context

- The UK water sector has an urgent need to modernise ageing infrastructure and enhance system efficiency.
- The current technological landscape includes advanced monitoring and diagnostic tools, such as AIoT (Artificial Intelligence of Things) systems and sensors and AI-driven analytics, which provide real-time insights into system performance, enabling proactive identification and resolution of potential issues.
- The sector benefits from a strong supply chain, comprising technology providers, engineering firms, and academic institutions, but pace of adoption and/or change is relatively slow. The integration of digital twins and smart water networks exemplifies how the sector is leveraging technology to enhance asset performance and optimise operations.

Challenges and Considerations

- Integrating advanced technologies with legacy systems (hardware, operational technologies, software, and IT skills) as well as computational and data science skills gaps in AI and smart water applications.
- High initial costs of adopting cutting-edge technologies especially for smaller Water Only Companies (WOCs).
- Water companies are given performance incentives or penalties (ODIs) and performance commitments in a number of areas relating to asset resilience – supply interruptions, leakage, supply outage, mains bursts, sewer collapse etc. – and these carry significant fines if targets are not met, therefore innovations in this area can contribute to significant savings and even outperformance rewards for water companies.

Use of Space Assets

- SatCom can be used to provide ubiquitous and secure connectivity for deployed sensors which can be used to detect defects or monitoring infrastructure.
- SatEO applications can vary from monitoring large bodies of water (i.e. reservoirs) to ensure the provision of continuous water supply, to monitoring water infrastructure plants on a regional level.
- SatNav can be used for geo-fencing key water assets, geo-referencing monitors and providing timestamping of monitoring data to ensure data traceability.

Water Catchment Management

Overview

Water catchment management refers to the holistic approach to managing both water quality and quantity within a given drainage basin or catchment area. This encompasses a range of activities and interventions aimed at protecting and enhancing the natural environment from which water is sourced and abstracted, whilst also ensuring the sustainable use of water resources through optimal land use practices.

Implementation and Operational Context

- In the UK water sector, catchment management innovations are applied within a context that increasingly recognises the importance of integrated, ecosystem and nature-based approaches to water management.
- The current technological landscape features advanced monitoring and analytical tools, including remote sensing, GIS technologies, and data analytics platforms, to enable precise mapping, assessment, and management of catchment areas.
- The sector is seeing a rise in collaborative partnerships that bring together water companies, environmental agencies and Non-Governmental Organisations, landowners, and community groups (citizen science) to co-develop and implement catchment management solutions.

Challenges and Considerations

- Extensive stakeholder engagement, ensuring that landowners, farmers, local communities, and regulatory bodies are involved in the planning and decision-making processes. Education and training programmes are also essential for building understanding and capacity among stakeholders to adopt and maintain new practices, especially among farming communities and citizen-led initiatives.
- The deployment of catchment management innovations demands not only technological solutions but also adaptive management practices and strong collaborative networks. The geographical scope and complexity of catchment areas can pose significant technical challenges, from data collection across vast and varied terrains to the analysis of complex environmental interactions.

Use of Space Assets

- SatEO can be used for the monitoring of run-off in a certain water catchment, allowing for easy, region-scale monitoring, looking at a number of different environmental factors such as water quality, soil, flow rates, etc… In addition, SatEO can provide a top-down view of a regional area, providing key environmental metrics to policy decision makers.
- SatNav can be used for geo-location, underpinning GIS technologies, feeding into more accurate models of the water catchment area.

Drinking Water Quality

Overview

High-quality drinking water supports the overall health of communities, reducing the burden on healthcare systems by preventing illness. Maintaining stringent water quality standards fosters public trust and confidence in the water supply, which is vital for the social and economic wellbeing of the country.

Implementation and Operational Context

- In the UK water sector, drinking water quality is shaped by stringent regulatory standards, growing environmental concerns, and an increasing emphasis on sustainability and customer satisfaction. The regulatory frameworks which drive these standards are in alignment with EU directives (now adapted into UK law post-Brexit) and WHO guidelines.
- The sector employs advanced treatment processes, including membrane filtration, ultraviolet (UV) disinfection, and granular activated carbon (GAC) filtration, to ensure the safety and palatability (taste and odour) of drinking water.
- The sector is increasingly looking at its abstraction and raw water management processes, leveraging catchment management and nature based solutions to minimise treatment costs whilst improving the natural environment.
- Continuous Water Quality Monitoring, largely driven by recent legislation mandating water companies continuously monitor water quality upstream and downstream of CSOs (Combined Sewer Overflows), is an emerging technology opportunity for sensing hardware as well as soft sensing and broader AI applications.

Challenges and Considerations

- Regulatory hurdles from bodies such as the Drinking Water Inspectorate (DWI), especially if locating a technology solution in an “in-pipe scenario”, requiring any new technology to undergo extensive testing and approval processes to prove its efficacy and safety.
- Compatibility and integration with existing systems – especially when dealing with network assets and data.
- Maintaining public perception and trust. Water customers and users are increasingly sensitive to issues of water quality. Overcoming these challenges requires a multi-faceted approach, including robust pilot studies, strategic partnerships, and comprehensive stakeholder engagement strategies to demonstrate the efficacy, safety, and economic viability of any innovation.

Use of Space Assets

- SatCom can be used for providing IoT monitoring devices and a constantly available and ubiquitous communication channel to send data back to a central location.
- SatEO provides advantages in the areas of regular, regional scale monitoring. It can be used to monitor environmental parameters such as water pollution, soil quality.
- SatNav can be applied by providing timing and geo-location services to IoT devices. The IoT devices can be both geo-located and geo-fenced to a specific location.

Reducing leakage lost from potable water distribution systems

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Overview

Leakage measurement involves calculating the difference between water supplied and water delivered, with adjustments for unmetered properties and other uses like firefighting. Innovations can help address leakage across all stages of the PALM (Prevent, Aware, Locate, Mend).

Implementation and Operational Context

- Currently it is estimated that over a fifth of water that enters the potable water distribution mains is lost through leakage. Water companies face annual leakage targets, with financial implications for non-compliance.
- Physical sensors are most likely to be deployed in contact with the existing infrastructure, either buried next to pipelines, or at access points such as hydrants, customer metres or inspection chambers.
- The sector has increased its deployment of smart water technology over the last decade with many companies now using large volumes of acoustic, pressure and flow sensors throughout their distribution systems.
- New solutions are needed to be less reliant on ground investigations to accurately locate leaks to less than 1m as well as solutions for quickly and efficiently conducting targeted repairs without impacting customers' water supply.

Challenges and Considerations

- Integrating leakage innovations into existing water sector infrastructure can be a challenge, particularly due to the diverse and often outdated nature of current systems and supporting data. Some of the following considerations need to be made when developing solutions for the market:
  - **Diverse, patchwork of infrastructure** – the water distribution network has been updated incrementally and is now built from a wide range of materials, sizes and ages.
  - **Inaccurate or outdated datasets** – As a result of its incremental upgrading, data about buried assets such as pipelines may not be accurate and is often outdated
  - **Repair speed** – leak repairs need to be made quickly to not impact performance commitments.
  - **Impact on water quality** – intrusive solutions in contact with water must be made from approved materials (DWI Regulation 31) and not dislodge sediment that has built up in pipes.
  - **Detection accuracy** – leak locations need to be pinpointed to an accuracy of roughly 1m.
  - **Data transmission** – physical sensors are likely to be deployed underground and often under heavy metal covers that impact data transmission.

Use of Space Assets

- SatEO can be used to detect leaks over a regional-size area. It can also be used to predict where water leaks may occur. I.e. Through the monitoring of land slippage.
- SatNav can be used for navigation of technologies such as robotics or drones which can be used to monitor the network for leaks or to pinpoint leak sources.
- SatCom can be used to communicate remotely with infrastructure monitoring devices such as remote drones or IoT devices in remote locations where terrestrial cellular network coverage is poor.

Operational Carbon Reduction

Overview

Operational carbon reduction in the UK water sector refers to the strategies and practices implemented to decrease carbon dioxide and other greenhouse gas (GHG) emissions produced during the day-to-day operations of water and wastewater treatment facilities and networks.

Implementation and Operational Context

- Operational carbon reduction technologies are being applied across the entire operational cycle from raw water collection to effluent disposal against a backdrop of regulatory, customer and financial pressure, which has led to Water Companies committing to achieving "Net Zero" by 2030, for Scope 1 & 2 emissions*.

- The current technological status quo includes advanced treatment processes that are energy-intensive, such as reverse osmosis and activated sludge systems for wastewater treatment, aeration, and disinfection of drinking water. Innovative solutions should optimise energy use, incorporate renewable energy sources, employ novel, less energy-intensive treatment technologies and measure spatial and temporal fugitive emissions from treatment processes.

*Scope 1 emissions are direct emissions from owned assets - e.g. GHG released from the combustion of fuels or fugitive emissions from treatment processes. Scope 2 emissions are indirect emissions from the generation of purchased energy - e.g. emissions from the electricity used to power equipment.

Challenges and Considerations

- Complexity of navigating key regulatory frameworks

- Compatibility between new technologies and legacy infrastructure, to achieve seamless integration.

- Availability of skilled professionals to train and be trained in the latest techniques and technologies.

- Support from a wide range of stakeholders, including water utility companies, technology providers, regulatory bodies.

- Technical limitations of new technologies - scalability and/or reliability issues.

Use of Space Assets

- SatEO – Suitable for monitoring the operational carbon emissions (e.g. CH4, CO2) from water infrastructure plants.
- SatCom can be used to:
  - Enable (real-time) remote monitoring (e.g. IoT) water infrastructure emissions;
  - Enable the use of security UAVs/robots in areas which are remote or in a harsh environment.
- SatNav provides benefits through timestamping data to ensure data traceability. Geo-locating and geo-fencing assets is useful for digital twins to help decrease the operational carbon of water infrastructure plants.

Minimise pollution events into the natural and human environment

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Pollution and Sewer Flooding

Overview

Pollution events include untreated sewage spilling into the natural environment or customer properties. The reasons for this can be simplified to: bursts or failings in the sewer pipes, or blockages in the pipes that lead to sewage backing up into properties, or releases from a storm overflow due to groundwater intrusion or a pump failure.

Implementation and Operational Context

- The topic area encompasses a wide range of potential technological solutions, and there are a range of products already available on the market. There is a particular need for solutions in the following areas:
    - **Condition assessment** to identify sewers which may be close to failure, and to identify the condition of pumps before they fail, in particular those which are low cost, reliable and provide accurate early warnings.
    - **Sewer rehabilitation and repair** to prevent bursts and releases, in particular solutions which are "no dig" i.e. can be used without taking out a pipe, or causing disruption to the land above the sewer.
    - **No maintenance valves** and the use of other technology to prevent backflow into customer's properties.
    - **Blockage detection**, to provide early warnings of issues.
    - **Blockage reduction and destruction** which don't require manual intervention.
    - **Blockage prevention**, through flushing technologies or interventions before discharge to sewer.
- Within the water company business plans for the next investment cycle (AMP 8) there are targets to reduce flooding and pollution events. It is a key metric for performance within the water companies, and one that very much captures the public's attention.

Challenges and Considerations

- A trial is generally required before any solution will be deployed. Such trials will look the performance of a technology, its operational requirement, maintenance needs and ease of installation.
- Any solution placed within a sewer must be able to operate in an environment where there can be hazardous gases such as methane and hydrogen sulphide. Sewage can contain rags and items which can snag on equipment. Any solution placed within a sewer needs to demonstrate that it will not cause an issue in itself, for example by encouraging a blockage.
- Gaining access to a sewer to deploy a solution can be a challenge. There are manholes placed along a sewer and the distances between them will vary from sewer to sewer. All are classified as confined spaces, and require certified staff to operate within them.

Use of Space Assets

- SatEO via non-invasive techniques could possibly detect where leaks and blockages are occurring, monitor the impact of any wastewater flooding through monitoring water quality and predict weather data to digital twins to predict surges.
- SatCom can provide stable communication channels where cellular networks are not available, e.g. at remote sites.
- SatNav enables the navigation of robotics or other unmanned vehicles in sewers. SatNav can be used to geo-locate wastewater overflow sensors, and be timestamped due ensure data traceability.

Increase accurate monitoring of storm overflows

Overview

Storm overflows include combined sewer overflows and storm tank discharges at treatment works and are designed to discharge dilute but untreated sewage into the water environment. This is done during particularly heavy rains in order to prevent sewage backing up into properties or overwhelming treatment works.

Implementation and Operational Context

- The Environment Act in 2021 placed further responsibilities on English water companies, regulators and the government to reduce use of storm overflows, monitor all storm overflows in England and monitor the quarter quality upstream and downstream of a storm overflow.
- As of 2023, all storm overflows had been fitted with Event Duration Monitors (EDMs), showing when an overflow is discharging and how long for. With around 15,000 overflows in England, many of these sites are remote and without power or internet connectivity. The intermittent nature of storm overflows means that the monitors may sometimes be dry and other times submersed in water. This water can sometimes contain debris such as twigs, grit and rags. Being able to continue to operate in these conditions is crucial.
- There is still a need for low-cost monitors which includes solutions which have an extended life span, reduced maintenance requirements, and which require no external power source. Providing a reliable and accurate reading is imperative. Technologies which provide an integrated solution to EDM and water quality could be of interest to the sector.

Challenges and Considerations

- With any monitor or sensor that is placed within the environment, the key challenges are:
  - Self sufficient operation
  - Battery life
  - Connectivity to relay signals and data back to a central location
  - Low maintenance requirements
  - Vandalism proof, and robust enough to operate in flows which may contain debris and rags
  - Able to operate in dry and wet conditions
- Any monitor will need to be able to communicate with the existing systems within a water company, providing the raw data in the correct format.
- Business models where the raw data is not owned by the water company tend not to be popular.

Use of Space Assets

- SatCom can provide ubiquitous connectivity (even in storms and other high stress events), and edge computing to ensure efficient data transfer.
- SatNav can be used to geo-locate and geo-fence devices, ensuring they are installed in the right place and ensuring the devices are not tampered with. Time referencing of the data produced can also lead to a high degree of data traceability.
- EO could possibly be used for the prediction of events in which wastewater is discharged (i.e. a storm).

How to Apply

Space for Infrastructure – Water Opening Dates:

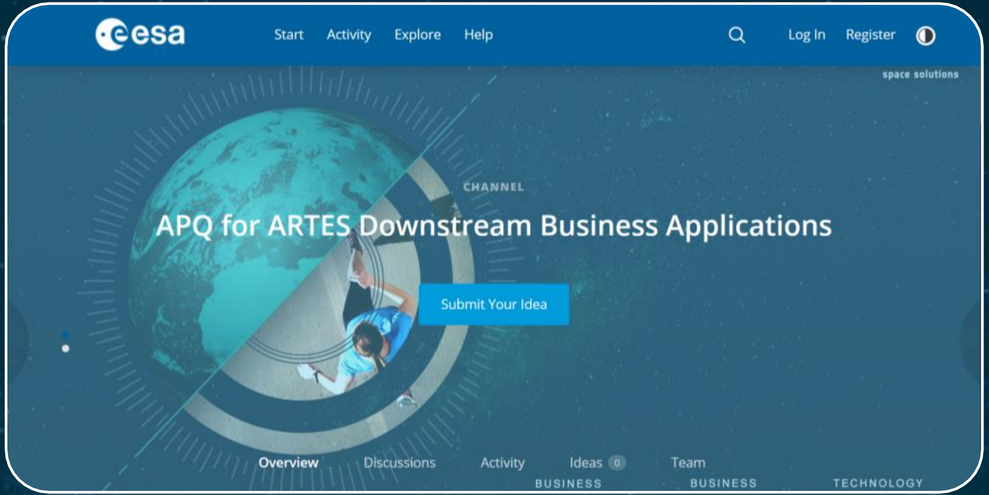
5th April 2024 – 29th May 2024

If you wish for the deadline to be extended, please get in touch!

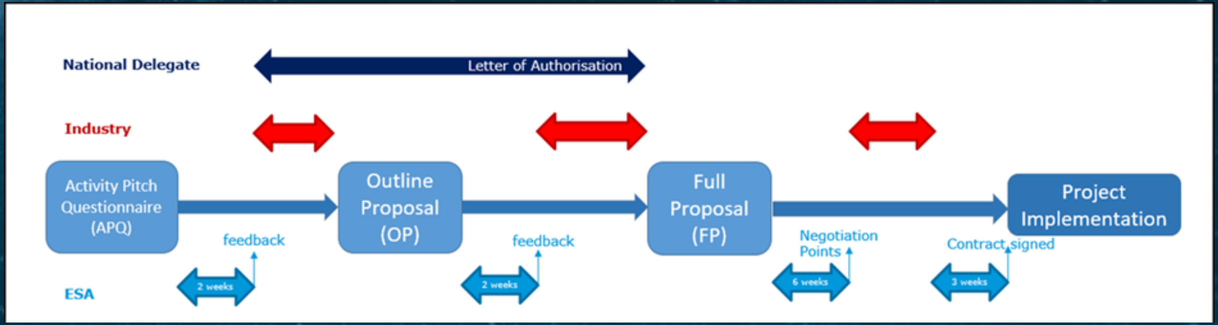
Things you will need to do:

- Submit your APQ pitch via ESA's Open Space innovation platform in the "APQ for ARTES Downstream Business Applications". Making it clear you are applying as part of the "Space for Infrastructure – Water Management Thematic Call".
- If successful, you will be asked to submit an outline proposal and then (if acceptable) a final proposal (and dependent on national delegation support).

Please do not wait until the end of the opening period to apply! We will be reviewing proposals regularly throughout the opening period.



https://ideas.esa.int/



Funding Details

	Feasibility Study	Demonstration Project
Activity Cost	Max. 500 000€ (limited to acceptable cost)	Case by Case Assessment (limited to acceptable cost)
ESA Co-Funding		
Baseline	Max. 50% of company's cost	Max. 50% of company's cost
Micro, Small and Medium- Enterprises	Max. 80% of enterprise's cost	Max. 80% of enterprise's cost
Universities and Research Institutes with no commercial interest in the product/service	Max. 100% of institute's cost And Max. 30% of activity cost	Max. 80% of institute's cost And Max. 30% of activity cost
Industry Co-funding	Remaining part of the cost to carry out the activity	

- Activities in Direct Negotiation, streamlined process with ESA guidance.
- ESA will bear up to 50% (non-SME) or 80% (SME) of the eligible cost **pending support from the National Delegation**, and the remainder must be financed by the tenderer and/or other partners.
- IPRs (Intellectual Property Rights) will **remain with the company**.

Who can participate?

PARTICIPATING MEMBER STATES

Austria	Finland	Italy	Poland	United Kingdom
Belgium	France	Lithuania	Portugal	Switzerland
Czech Republic	Germany	Luxembourg	Romania	
Denmark	Hungary	Netherlands	Slovenia	
Estonia	Ireland	Norway	Sweden	

A tool at industry's disposal – the Ambassador Network

Ambassadors are present in **7 countries** and are the local interface for **ESA Business Applications** enquiries.

They analyse market trends, industry needs, and emerging technologies to recognize potential areas for growth and adoption of space solutions.

Ambassadors create and manage relationships with the non-space industries, actively engaging with communities in line with national strategies.

Ambassadors act as advisors for companies from the initial stages of awareness on ESA funding opportunities, eligibility criteria, to the application process, etc.

Where to find the Details

For more information see: business.esa.int

- Scroll down to the "Featured Opportunities" section to see all activities open or under preparation.
- Look for "Thematic Call for 'Space for Infrastructure: Water Management"

https://business.esa.int/funding/call-for-proposals-non-competitive/space-for-infrastructure-water-management

Q&A

For more information visit:

- https://business.esa.int/
- https://business.esa.int/funding/call-for-proposals-non-competitive/space-for-infrastructure-water-management
- Email: jonathan.crabb@esa.int