ARTES 4.0 Generic Programme Line Business Applications - Space Solutions
ACTIVITY DESCRIPTION

"Coastal Resilience to Climate Change"

THEMATIC CALL FOR PROPOSALS

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Table of Acronyms

Acronym	Definition
3D	Three-Dimensional
4S	Space Systems for Safety and Security
5G	Fifth Generation Mobile Network
6G	Sixth Generation Mobile Network
AI	Artificial Intelligence
APQ	Activity Pitch Questionnaire
AoF	Authorisation of Funding
ARTES	Advanced Research in Telecommunications Systems
BASS	Business Applications - Space Solutions
CfP	Call for Proposal
CPU	Central Processing Unit
CRSD	Corporate Sustainability Reporting Directive
DTs	Digital Twins
ESA	European Space Agency
ESRIN	European Space Research Institute
FP	Full Proposal
GNSS	Global Navigation Satellite Systems
GPU	Graphics Processing Unit
HPC	High Power Computing
IRO	Impact, Risks, Opportunity
LoA	Letter of Authorisation
NBS	Nature-Based Solutions
OP	Outline Proposal
OSIP	Open Space Innovation Platform

Acronym	Definition
PSI	Project Security Instruction
SatCom	Satellite Communication
SatEO	Satellite Earth Observation

1. OVERVIEW

This document provides an overview of the "Coastal Resilience to Climate Change" thematic call for proposals under the ARTES BASS, 5G and 4S programme lines. It invites companies to submit business ideas that develop space-based services aimed at enhancing coastal resilience and management in the face of climate change.

2. BACKGROUND AND RATIONALE

Coastal cities, rural coastal areas and infrastructure such as ports are particularly vulnerable to the effects of climate change, including rising sea levels, severe storms, flooding, and coastal erosion. These changes threaten essential ecosystems and the infrastructure supporting tourism, trade, or fisheries, while also affecting the livelihoods of coastal communities. In Europe alone, over 200 million people reside within 50 kilometres of the coastline, placing them at increased risk of climate-related hazards. These coastal regions play a crucial role in Europe's economy, contributing to nearly 40% of the continent's GDP and handling 75% of its international trade via maritime routes[1].

Since 1980, Europe has experienced climate-related extremes resulting in about 650 billion EUR in damages. Projections indicate that worsening climate impacts could reduce the EU's GDP by approximately 7% by the end of the century. Without climate adaptation, the EU and UK could face an overall GDP loss of 1.26% (871.8 billion EUR)[2]. This underscores the urgent need for targeted resilience and adaptation measures, particularly in highly exposed coastal economies.

Climate-related hazards, combined with ecosystem fragmentation, pollution, unsustainable agriculture, and social inequalities, threaten the world's food security, public health, ecosystems, infrastructure, and economy[3]:

- **Food**: Rising temperatures and extreme weather events disrupt fish stocks and marine biodiversity, threatening coastal communities
- **Health**: Coastal areas face increasing health risks due to rising temperatures and extreme weather events.
- **Ecosystems**: Coastal and marine ecosystems are threatened by coastal erosion, rising ocean temperatures, and acidification.
- **Infrastructure**: Damage to critical infrastructure disrupts supply chains, trade, and economic activity.
- **Economy and Finance**: Climate change poses significant economic and financial risks to coastal areas, impacting public finances, insurers, and financial markets.

Coastal resilience and management solutions offer economic benefits and business opportunities by leveraging satellite technologies and data analytics. These solutions enhance

[1] Cortés Arbués, I., Chatzivasileiadis, T., Ivanova, O. *et al.* Distribution of economic damages due to climate-driven sea-level rise across European regions and sectors. *Sci Rep* **14**, 126 (2024). https://doi.org/10.1038/s41598-023-48136-y
[2] Cortés Arbués, I., Chatzivasileiadis, T., Ivanova, O. *et al.* Distribution of economic damages due to climate-driven sea-level rise across European regions and sectors. *Sci Rep* **14**, 126 (2024). https://doi.org/10.1038/s41598-023-48136-y
[3] https://op.europa.eu/en/publication-detail/-/publication/8e234e44-7bb5-11ef-bbbe-01aa75ed71a1/

coastal erosion monitoring, flood prediction, ecosystem health assessment, and infrastructure protection, leading to increased resilience and cost savings.

3. OBJECTIVES OF THE CALL

The objective of this call for proposals is to support the development of services that leverage space technology to address the challenges posed by climate change to coastal cities, rural coastal regions, and ports. These services should focus on tackling the increasing risks associated with climate change, with the ultimate goal of enhancing coastal resilience and ensuring the sustainability of economic activities in these vulnerable regions. The initial areas of interest include, but are not limited to, the following:

Monitoring and Early Warning Systems

- **Monitoring and Early Warning Systems**: Environmental changes can be monitored to provide early warnings for extreme weather events, such as storms, floods, and heatwaves. This helps in timely evacuation and preparation, reducing the impact on infrastructure and communities.
- **Monitoring Coastal Erosion and Sea-Level Rise**: Tracking coastal erosion and sea-level rise provides critical information for planning and implementing coastal defences. This is essential for protecting infrastructure and habitats in coastal areas.

Water and Ecosystem Management

- **Water Management**: Managing water resources by monitoring rainfall patterns, river flows, and drought conditions is crucial for ensuring the availability of fresh water in coastal and rural areas.
- **Biodiversity and Ecosystem Services**: Monitoring changes in biodiversity and ecosystem services helps protect and manage natural habitats. This includes tracking the health of coastal ecosystems.

Urban and Infrastructure Planning

- **Urban Planning and Infrastructure**: Accurate geospatial information supports urban planning by helping design resilient infrastructure that can withstand climate impacts, such as flooding and heatwaves.
- **Adapting Coastal Agriculture:** implementing services to protect crops from salinity intrusion, flooding, coastal erosion, extreme weather events, and changes in precipitation patterns. These services include farming systems with improved drainage systems to mitigate flooding and saltwater intrusion, efficient irrigation systems to optimise water availability, crop diversification to incorporate a variety of crops with different tolerance levels to climate variability, and coastal defences such as seawalls and mangroves to reduce erosion and flooding.

Disaster Response and Recovery

- **Disaster Response and Recovery**: Reliable communication during and after disasters ensures that emergency services can coordinate effectively. This is particularly important in remote and rural coastal areas where terrestrial communication infrastructure may be limited.
- **Nature-Based Solutions (NBS):** Traditional measures to mitigate climate change primarily involved building infrastructure and heavy engineering. The current approach focuses on developing NBS. Implementing NBS, such as mangrove restoration, can enhance coastal resilience and provide multiple ecosystem services.

Port Solutions

- **Port Solutions:** Services may involve management systems that recommend strategies such as raising the height of quays and docks, installing advanced drainage systems, and developing climate adaptation plans that include monitoring and early warning systems for extreme weather events.

Tourism and Economic Activities

- **Tourism:** Coastal regions are popular tourist destinations, and climate change poses significant risks to this sector. Rising sea levels, coastal erosion, and extreme weather events can damage tourism infrastructure, such as hotels, resorts, and recreational facilities. Additionally, changes in temperature and precipitation patterns can affect the attractiveness of these destinations. Implementing climate adaptation strategies, such as building resilient infrastructure and promoting sustainable tourism practices, can help mitigate these impacts and ensure the long-term viability of the tourism industry.

Insurance

- **Insurance:** Insurance is vital for climate adaptation and resilience, especially in coastal areas prone to extreme weather. It provides financial protection against economic losses from storms, flooding, and erosion. Using satellite data, insurers can better assess risks and manage claims, offering tailored products for coastal communities. This technology helps monitor natural disasters, assess damage, and provide accurate payouts, enhancing the resilience of these regions to climate change and enabling faster recovery from extreme events.

Corporate Sustainability Reporting Directive (CSRD)

- **CRSD:** The CSRD highlights the need for companies to report physical risks and opportunities related to climate change, especially in coastal areas prone to sea-level rise, erosion, and extreme weather. Therefore, services that help companies to disclose the impacts on their assets and operations and outline strategies for resilience are

needed. Key requirements include Impact, Risks, Opportunity (IRO)-1, and Environment (E1)-2—4, E1-9. The 2021 EU Adaptation Strategy stresses systemic approaches and digital technologies to reduce climate risks, while the EU Floods Directive and Maritime Spatial Planning Directive mandate flood risk management and sustainable coastal area management.

4. SPACE ASSETS AND DIGITAL TECNOLOGIES

Satellite and digital technologies are essential for enhancing coastal resilience and management in the face of climate change.

Satellite Earth Observation (SatEO): Satellite Earth Observation (satEO) provides vital data for monitoring environmental changes and supporting climate adaptation strategies. This data is essential for tracking coastal erosion, sea-level rise, and alterations in biodiversity and ecosystem services. Furthermore, satEO facilitates the development of early warning systems for extreme weather events such as storms, floods, and heatwaves, thereby mitigating their impact on infrastructure and communities. By observing rainfall patterns, river flows, and drought conditions, satEO data also aids in the management of water resources.

Accurate geospatial information from satEO supports urban planning and infrastructure development, ensuring designs are resilient to climate impacts like flooding and heatwaves. SatEO data can be utilised for both real-time monitoring and historical analysis, providing inputs for nowcasting and forecasting models for events such as landslides, weather predictions, and floods. Combined with satellite communications (SatCom) systems, this data is highly effective in reducing disaster risk impacts.

Finally, SatEO can also be used to assess risks and manage insurance claims more effectively. For example, satEO data can be used to monitor environmental changes, track the progression of natural disasters, and assess damage to infrastructure and property. This data enables insurers to provide more accurate and timely payouts to affected individuals and businesses.

Global Navigation Satellite Systems (GNSS): GNSS are crucial for the effective coordination and management of resources in the aftermath of a disaster. GNSS enables the tracking of vehicles, vessels, or any mobile assets involved in response efforts. Additionally, it is indispensable for pinpointing the location of sensors that measure physical parameters for early warning systems or monitor the progression of a disaster. The geolocation of natural disaster events is vital for orchestrating timely early warning actions. GNSS can also be used by insurance companies who leverage the data to enhance their risk assessment and claims management processes. By accurately tracking the location of insured assets, such as vehicles and equipment, insurers can quickly verify claims and assess the extent of damage. This helps in providing timely and accurate payouts to policyholders.

Satellite Communication (SatCom): Satellite communications offer dependable connectivity during and following disasters, thereby ensuring that emergency services can coordinate efficiently. This capability is particularly critical in remote and rural coastal regions where

terrestrial communication infrastructure may be inadequate. Satellite communications are essential for transmitting early warning messages during natural disasters, whether directed at individuals or field action institutions, to synchronise assistance and support efforts. They play a crucial role in maintaining connectivity in the aftermath of an event when terrestrial communications are either unavailable or overwhelmed. Additionally, satellite communications can provide connectivity for on-site data collection in remote areas, offering supplementary information that can be integrated with satellite Earth observation (SatEO) data to produce actionable insights. SatCom also supports the collection of real-time data from remote sensors, aiding in the accurate assessment of damage and risk.

High Power Computing (HPC): HPC supports services requiring substantial computational power for tasks like data processing, simulations, and high-speed calculations, such as AI or Digital-Twin solutions. In March 2025, ESA, in collaboration with Hewlett Packard Enterprise, launched Space HPC at its ESRIN facilities in Italy, providing a secure environment for industries to develop their services[4]. Company interested in exploiting this resource shall submit a request to explain how they intend to use HPC (e.g. for deep learning, GPU or CPU computation.

Digital Twins (DTs): Digital twins can enhance coastal resilience to climate change in several ways:

- **Monitoring and Diagnostics**: Integrate data from satellite imagery, sensors, and historical records for real-time monitoring of sea levels, wave patterns, and weather events, allowing early threat detection.
- **Scenario Simulation**: Create 3D replicas of coastal areas to simulate climate scenarios and impacts, aiding planners in developing response strategies for extreme weather, erosion, and sea-level rise.
- **Infrastructure Management**: Assess vulnerability of critical infrastructure like ports, bridges, and seawalls, optimising design and maintenance for enhanced resilience.
- **Disaster Preparedness and Response**: Provide insights into effective evacuation routes, resource allocation, and emergency strategies, coordinating efforts among agencies for efficient responses.
- **Environmental Impact Assessment**: Simulate development scenarios to assess environmental impacts, identifying sustainable practices that minimise harm to ecosystems.
- **Community Engagement and Education**: Use as interactive tools to educate the public on climate risks and promote community involvement in resilience planning.

Leveraging digital twins enables better preparation and adaptation to climate challenges, boosting coastal regions' resilience and sustainability.

[4] https://commercialisation.esa.int/space-hpc/

5. SCOPE OF THE CALL

The proposals submitted under this Call for Proposal (CfP) should focus on innovative services that use advanced digital and space-based technologies. These proposals should aim to address the challenges of climate change in coastal regions, with the goal of improving coastal resilience and ensuring the sustainability of economic activities in these areas.

The Bidder has two options for addressing use-cases in their proposal: either address the optional use-cases included in the Annexes (available on the website), or address other use-cases and requirements related to the Call by involving other customers or users directly. If choosing the latter, the Bidder must provide letters of interest from these potential customers as evidence of their support, which should be attached to the Outline Proposal (the second step in the application process). Both options will be considered equally in the evaluation process

The service provider shall be identified and be part of the bidding team to ensure the commercial operational roll-out of the proposed service following completion of a demonstration project.

This Call for Proposal covers two types of activities:

1. **Feasibility Studies** which provide the preparatory framework to identify, analyse and define new potentially sustainable services.

   The applications and/or services covered by the proposed Feasibility Studies must:

   - **Be customer - and user-driven:** proposals should demonstrate a clear understanding of user needs and present a strong potential for sustainability.
   - **Leverage integrated space assets:** propose a service demonstrating the benefits of the utilisation of integrated space assets.
   - **Include a plan to test business hypotheses:** a plan should be included that details how the user desirability, technical feasibility, and commercial viability of the service will be tested.
   - **Target marketed readiness:** Aim to evolve the targeted applications and services to marketability and operational roll-out, potentially through a Demonstration Project after successful completion of the Feasibility Study

2. **Demonstration Projects** dedicated to the implementation and demonstration of pre-operational services.

   The applications and/or services covered by the proposed Demonstration Projects must:

- **Be customer- and user-driven**: Active user involvement is essential throughout the project, including their participation in defining requirements, validating results, and contributing to the pilot activities.
- **Showcase the value of space assets**: Proposals must clearly demonstrate how the utilisation of space technologies provides a distinct advantage, with a strong potential for long-term sustainability.
- **Deliver measurable socio-economic benefits**: The project should quantify its impact, highlighting improvements in efficiency, sustainability, or other key outcomes that align with user and societal needs.
- **Ensure user participation**: Representatives from the target user communities must actively engage in the project, including participation in the pilot phases to ensure alignment with their requirements and expectations.

The goal of Demonstration Projects is to validate pre-operational services in a real-world environment, paving the way for scaling and operational deployment.

To apply to a demonstration project, the Bidder is required to have addressed the key technical and business risks associated with the proposed project, and to have established a solid business plan including clear support from prospective customers.

6. PROCUREMENT APPROACH

The proposals submitted in reply to the call shall be implemented in the context of ARTES 4.0 Generic Programme Line “Business Applications – Space Solutions”, “Space Systems for Safety and Security” (4S) and “Space for 5G/6G and Sustainable Connectivity” Strategic Programme Lines in coordination with National Delegations.

The Bidder shall submit first an Activity Pitch Questionnaire, and following evaluation, may be invited to submit the Outline and Full Proposal. The Activity Pitch Questionnaire (APQ) template provided by ESA shall be used. This is considered as entry point for companies to submit their idea, providing a simplified and single point of access to the ESA ARTES framework.

The price of activities carried out in a given State are charged against the contribution of that State in the programme. A letter of Authorisation of Funding (AoF) from the relevant National Delegation is therefore required as part of the Full Proposal. The Bidder is however advised to inform the relevant National Delegation(s) when submitting the Pitch. The contact information of the National Delegates can be found here:
https://artes.esa.int/national-delegations.

The Agency will admit for evaluation only (Outline and Full) proposals from a bidding team composed of a company and/or organisations (be it Prime or Subcontractor) residing in any of those states that subscribe to the Programme under which you wish you submit your proposal:

I) **for the ARTES 4.0 BASS Generic Programme Line:** Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Sweden, Switzerland and the United Kingdom.
II) **for the ARTES 4.0 Space for 5G/6G and Sustainable Connectivity Strategic Programme Line:** Austria, Belgium, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, the United Kingdom and Canada.
III) **for the ARTES 4.0 Space Systems for Safety and Security (4S) Strategic Programme Line:** Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, Norway, Portugal, Romania, Spain, Switzerland, the United Kingdom and Canada.

7. PROCESS AND SCHEDULE

The call for proposals is scheduled to open on **09 June 2025** and will remain open until **31 October 2026**, 13:00 CEST.

7.1 Timeline and procedure

The Bidder shall submit first an **Activity Pitch Questionnaire,** and following evaluation, may be invited to submit the **Outline Proposal** and subsequent **Full Proposal.** The Activity Pitch Questionnaire (APQ) template provided by ESA shall be used, which is considered as entry point for companies to submit their idea. The details of the APQ can be found here: Open Space Innovation Platform - OSIP - Channel: APQ for ARTES Downstream Business Applications

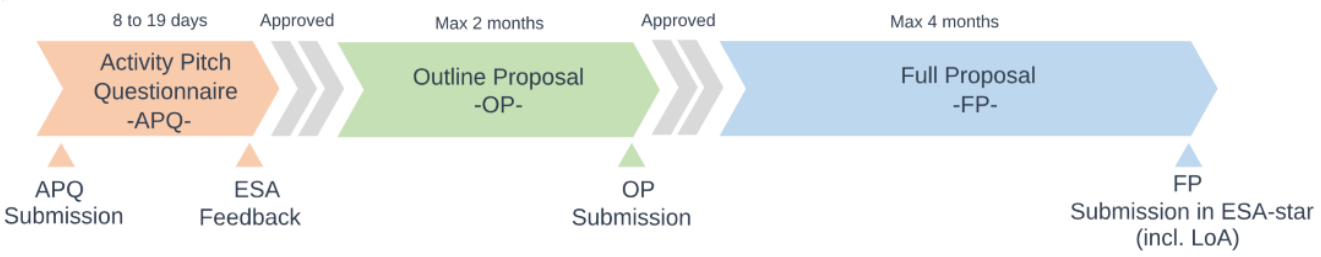

Figure 11: Application steps

This Call is planned to be implemented according to the following stepwise approach.

Step 1: APQ Submission

In Step 1, the interested Bidders are requested to submit their proposal(s) based on a short Activity Pitch Questionnaire (APQ) template made available by ESA that can be downloaded from the Thematic Call website. The pitch should provide the initial idea of what the Bidder would like to propose, elaborated on the basis of the thematic areas and either the use cases

proposed by ESA's partners or others selected by the Bidder. If the Bidder has the relevant information available to them, they may consider completing the supplementary questions (AP5) in the APQ template as part of the APQ+, which may allow to skip Step 3 below, at ESA's discretion.

Should the bidder wish to cooperate with any of the listed partners in the annexes, they shall give to the Agency the authorisation to distribute the activity pitch questionnaire to these stakeholders by explicitly stating it in the Activity Pitch Questionnaire. Subject to such authorisation, the Agency will follow up distributing the APQ to the bidder's authorised stakeholder(s) and liaise with them to facilitate interactions with the Bidder.
The completed Activity Pitch Questionnaire (APQ) shall uploaded using the online web submitter, ESA's open space innovation platform (OSIP) in the channel named "APQ for ARTES Downstream Business Applications".

Multiple Pitches with different ideas can be submitted.

It is strongly recommended that the interested Bidder liaises from the beginning with the relevant ESA Member States Delegates.

APQ Evaluation

Following an assessment of the pitch by ESA, ESA will provide feedback to the company, aiming to provide a reply within 10 working days following the deadline for submission of the pitch.

It is recognised that some interactions with the Bidder may be required, and ESA may therefore consult with the Bidder and may offer support in providing further clarifications, aimed at better shaping the Outline Proposal(s). Dialogue sessions may be organised individually with potential partners prior to Step 3.

ESA might also consult, when necessary, with the relevant National Delegation(s) for orientation and will provide key information (e.g. title, cost, price, subcontractor) to the relevant National Delegation(s).

Subject to a positive evaluation of the pitch and the Bidder having informed the National Delegation(s), the Bidder will be notified by ESA and invited to submit an Outline Proposal. Note that the APQ+ can act as a substitute for the Outline Proposal, thus if having adequately answered the additional questions included in the APQ+, the Bidder may be able to skip Step 3.

Step 2: Outline Proposal Submission

In Step 2, the Bidder will submit the Outline Proposal, based on a template provided by ESA, with letter(s) of interest from users/stakeholders. The Outline Proposal expands upon the pitch with a more extensive level of details. The Bidder will be allowed 2 months from ESA's approval of the APQ to the submission of their Outline Proposal. The outline proposal shall be submitted on the OSIP platform under the channel "Outline Proposal for ARTES Downstream Business Applications – Feasibility Studies/Demonstration Projects".

Step 3: Full Proposal Submission

In Step 3, subject to a positive assessment from ESA and in-principle support from the National Delegations, the Bidder will be invited to submit a Full Proposal on ESA-STAR in accordance with BASS programme line. The Bidder will be allowed 4 months from submission of their Outline Proposal to submit their Full Proposal on ESA-STAR.

A letter of Authorisation of Funding (AoF) from the relevant ESA National Delegation is required as part of the Full Proposal. The Bidder is however advised to inform the relevant National Delegation(s) when submitting the Pitch. The details of the National Delegates can be found here: https://artes.esa.int/national-delegations.

After the Bidder have submitted a Full Proposal with the Authorisation of Funding (AoF) from the relevant National Delegation(s) and following a positive assessment by ESA, the proposed activity will be approved for implementation.

7.2 Evaluation Criteria

The evaluation process is non-competitive, as each proposal will be assessed individually on its own merits, according to the evaluation criteria applicable for CALL FOR PROPOSALS FOR DOWNSTREAM APPLICATIONS IN ARTES 4.0 (esa star ref.: 1-10494).

More information for the assessment of the APQ and outline proposal stages can be found on the OSIP page "APQ for ARTES Downstream Business Applications".

More information on the evaluation criteria for the final proposals can be found within the document "Appendix 1 to AO/1-10494/20/NL/CLP (Issue 2.2) " which can be found on ESA-STAR at the following link under "Tender conditions".

1. GENERAL CONDITIONS

The submissions and all correspondence relating to it shall be in English.

The tender shall not contain any Classified Information, whether in the APQ, Outline Proposal or in the Full Proposal. To avoid any confusion with Classified security markings, the unclassified protective marking used by the Tenderer in the proposal shall not contain the terms: "Restricted", "Confidential", or "Secret".

However, should the Tenderer consider necessary to include Classified Information in the tender, the Tenderer shall inform beforehand the ESA Security Officer.

The Tenderers are informed that Classified Information can be shared with ESA only in compliance with the Project Security Instruction (PSI) duly established by the Agency beforehand and subject to the approval by the ESA Member States.

The Agency will treat commercially sensitive or proprietary information confidentially and solely for the purpose of the assessment of the response.

Expenses incurred in the preparation and dispatch of the response to the announcement will not be reimbursed. This includes any expenses connected with a potential dialogue phase. The announcement does not bind the Agency in any way to place a contract. The Agency reserves the right to issue amendments to the announcement.