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

"Advanced Agricultural Monitoring and Management Solutions"

THEMATIC CALL FOR PROPOSALS

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→ THE EUROPEAN SPACE AGENCY

Table of Contents

→ THE EUROPEAN SPACE AGENCY

Table of Acronyms

Acronym	Definition
5G	Fifth Generation Mobile Network
4S	Space Systems for Safety and Security
AI	Artificial Intelligence
APQ	Activity Pitch Questionnaire
AoF	Authorisation of Funding
ARTES	Advanced Research in Telecommunications Systems
BASS	Business Applications - Space Solutions
BVLOS	Beyond Visual Line of Sight
CAP	Common Agricultural Policy
CfP	Call for Proposal
DTs	Digital Twins
ELM	Environmental Land Management
ESA	European Space Agency
FP	Full Proposal
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
IoT	Internet of Things
LoA	Letter of Authorisation
OP	Outline Proposal
OSIP	Open Space Innovation Platform
PSI	Project Security Instruction
SatCom	Satellite Communication
SatEO	Satellite Earth Observation

1. OVERVIEW

This document provides an overview of the "Advanced Agricultural Monitoring and Management Solutions" 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 agricultural monitoring and management.

2. BACKGROUND AND RATIONALE

Agricultural monitoring and management are critical components of ensuring sustainable farming practices and compliance with regulations. Sustainable farming practices, such as crop rotation, cover cropping, and reduced tillage, help maintain soil health, reduce erosion, and minimise the need for chemical inputs. Compliance with agricultural regulations is essential to ensure that farming practices adhere to environmental and safety standards. The European Union's Common Agricultural Policy (CAP 2023-27) mandates specific guidelines for crop management and environmental stewardship in order to qualify for subsidies. In 2025, the European Commission introduced a vision[1] for a fair, competitive, and sustainable agri-food system, aiming to make agriculture attractive to future generations, resilient to global challenges, and focused on well-being. Meanwhile, the United Kingdom is undergoing a significant reform of its agricultural policy, focusing on transitioning away from the EU's CAP and introducing new schemes like the Environmental Land Management (ELM) to incentivise sustainable practices.

Innovative agricultural monitoring services and solutions are needed to enhance various aspects of agricultural management. The Dossier which has been recently published on the BASS Activities relating to Agriculture in the last 10 years has emphasised the need of creating new services which conserve biodiversity, preserve natural resources while creating commercial opportunities for the agri sector and new technologies can be an added value in this process. For example, leveraging hyperspectral data could enable improved crop classification accuracy, enabling more precise identification of different grass types and mixed crops. Accurate mapping of carbon-rich soils is essential for reducing greenhouse gas emissions and differentiating between deciduous and coniferous trees supports afforestation projects. Monitoring catch crop growth ensures sufficient plant cover, while enhanced soil property maps facilitate better fertiliser management. Additionally, mapping areas with the highest emissions of greenhouse gases from soils, using soil moisture data to monitor flooded farmlands, and determining the presence and extent of grazing animals on specific parcels are vital for effective land use management. Classifying tree species in forests aids sustainable forestry practices and categorising the ratio between bare soil and plant cover ensures compliance with environmental regulations. Together, these advancements contribute to a more sustainable and efficient agricultural sector.

The market for agricultural monitoring and management solutions is growing due to increasing food demand, precision farming techniques, and technologies like AI, IoT, and big data[2]. These technologies enable real-time monitoring of crops, soil, and weather, optimising resource

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[1] https://agriculture.ec.europa.eu/overview-vision-agriculture-food/vision-agriculture-and-food_en
[2] https://www.fortunebusinessinsights.com/farm-management-software-market-110388

allocation and reducing waste. Governments are promoting agricultural modernisation through funding and support for technology adoption. The global smart agriculture market is expected to grow significantly in the coming years. In Europe, the smart agriculture market is projected to reach USD 9916 million by 2030[3], driven by government support and increased awareness among farmers. The European market is expected to be the second largest globally, with significant growth in farm management software.

Advanced agricultural monitoring and management solutions offer economic benefits and business opportunities by leveraging satellite technologies and data analytics. These solutions enhance crop classification, soil property mapping, greenhouse gas emission reduction, and afforestation monitoring, leading to increased productivity, cost savings, and access to subsidies.

3. OBJECTIVES OF THE CALL

The objective of this call for proposals is to support the development and deployment of innovative agricultural monitoring and management services that promote sustainable farming practices and ensure regulatory compliance. These services are intended to support a wide range of stakeholders, including farmers, agricultural businesses, government agencies, and environmental organisations dedicated to sustainable farming practices and regulatory compliance. The initial areas of interest include, but are not limited to, the following:

Crop Classification

Advanced data analysis can improve the classification of grass types and mixed crops. Existing methods treat grass as one category, and mixed crops—where different crops grow together—are difficult to analyse. The aim is to differentiate grass species and mixed crops for better agricultural management and regulatory compliance.

Soil Property Mapping

Accurate soil property maps are crucial for managing fertilisation and understanding soil health. Enhancing the mapping of soil properties, such as clay content and organic matter, can help in determining the appropriate amount of fertiliser to use and understanding the soil's capacity to retain nutrients, ultimately leading to better agricultural practices and reduced environmental impact

Greenhouse Gas Emission Mapping

Mapping areas with high emissions of greenhouse gases from soils, particularly in drained peatlands, is essential for carbon emission reduction strategies. Using advanced data analysis techniques to identify these areas accurately can support initiatives to reduce emissions by targeting the right soils for conservation and management.

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[3] https://straitsresearch.com/report/europe-smart-agriculture-market#:~:text=The%20Europe%20smart%20agriculture%20market,farmers%20during%20the%20projection%20period.

→ THE EUROPEAN SPACE AGENCY

Peatland Delineation

Mapping carbon-rich soils accurately is crucial for emission reduction. Enhanced soil delineation, which involves mapping and identifying types of soil within a specific area, helps identify the areas that should be exempt from farming, reducing greenhouse gas emissions. Identifying peatlands correctly can lead to farmers avoiding rotational farming in these areas, which is particularly relevant in countries with extensive agricultural land, such as Denmark.

Afforestation Monitoring

Monitoring afforestation projects and existing forests involves classifying tree species and assessing biomass and carbon uptake. Differentiating between deciduous and coniferous trees and measuring the carbon sequestration potential of afforestation efforts can help in managing forest resources and supporting environmental conservation initiatives

Bare Soil and Plant Cover Ratio

Determining the ratio of bare soil to plant cover is important for compliance with regulations that require sufficient plant cover. Using data analysis techniques to assess this ratio accurately, particularly for catch crops that are grown in the autumn to prevent nutrient runoff, can help in ensuring that agricultural practices meet environmental standards.

Catch Crop Monitoring

Catch crops are grown to capture residual nutrients, prevent soil erosion, and improve soil health during off-seasons. They help reduce nutrient runoff, maintain soil integrity, and enhance land fertility. Typically planted after main crops are harvested, catch crops can include grasses, legumes, and cover crops that stabilise the soil and absorb excess nutrients. Monitoring these crops is crucial for maintaining soil health and complying with agricultural regulations. Advanced data analysis helps assess growth, coverage, and health of catch crops accurately, aiding in informed agricultural decisions and subsidy allocations. Consistent data collection enables efficient monitoring of large areas.

Grazing Activity Detection

Monitoring grazing activities and livestock presence is essential for verifying compliance with grazing regulations and land use policies. Using data analysis techniques to detect grazing events and the presence of livestock can help in managing land use and ensuring adherence to regulations. This is particularly challenging for extensive grazing, which has a nature-like signature and is harder to detect.

Management of Buffer Zones Surrounding Water Bodies

Maintaining buffer zones around water bodies is crucial for protecting water quality and preventing contamination from agricultural runoff. These buffer zones act as barriers that filter out pollutants, sediments, and nutrients before they reach water bodies. Implementing and monitoring buffer zones can help in preserving aquatic ecosystems and ensuring compliance with environmental regulations such as the CAP.

Risk Assessment

THE EUROPEAN SPACE AGENCY

Risk assessment is a critical process for evaluating and managing risks associated with agricultural practices. By leveraging advanced data analytics, weather monitoring, and historical agricultural data, it is possible to enhance the ability to assess and mitigate risks effectively. This comprehensive approach provides actionable insights, improves the speed of response, and offers a better overview of potential risks.

4. SPACE ASSETS AND DIGITAL TECNOLOGIES

Satellite and digital technologies are crucial for improving agricultural monitoring and management.

Satellite Earth Observation (SatEO): Satellite Earth Observation (satEO) provides critical data for agricultural and environmental monitoring, resource management, and policy-making. For example, hyperspectral and multispectral satellite data, including data from the upcoming CHIME mission, can identify crops, differentiate crop or tree types, and provide insights on crop health. It can analyse soil conditions, provide insights on soil properties, and highlight soil contents. SatEO can monitor changes over time, like crop growth, vegetation changes, or changes in land use. SatEO data can also be used to monitor greenhouse gas emissions indicating their source and levels. SatEO provides data on soil moisture levels and flood extents, which are crucial for managing irrigation, predicting droughts, and responding to flood events.

Data collected from drones and in-situ sensors can be integrated with other remote sensing data to provide comprehensive insights into crop health, soil conditions, and overall farm management. Drones operating Beyond Visual Line of Sight (BVLOS) can cover large areas and collect high-resolution imagery and data for crop monitoring, soil analysis, and field mapping.

Global Navigation Satellite Systems (GNSS): GNSS, such as GPS and Galileo, are crucial for precision agriculture. They provide accurate geolocation of agricultural parcels, facilitating precise monitoring and management of crops. Autonomous farming equipment, including self-driving tractors and harvesters, rely on satellite navigation for accurate operation, enabling tasks such as planting, weeding, and harvesting with high precision. BVLOS drones also depend on satellite navigation for accurate positioning and navigation, ensuring safe and efficient operation in remote or challenging environments.

Satellite Communication (SatCom): Satellite communications enhance the efficiency and reliability of data transmission for agricultural monitoring. Real-time connectivity enables the seamless transfer of large datasets from remote sensing satellites to ground stations and end-users, ensuring timely access to critical information for decision-making and compliance monitoring. Satellite communications support the integration of IoT devices in agriculture, facilitating the collection and transmission of field data for improved crop management and resource optimisation. Additionally, autonomous farming equipment BVLOS drones benefit from satellite communications for data exchange and operational coordination.

Digital Twins (DTs): Digital twins can significantly enhance agricultural monitoring and management by creating virtual replicas of physical farming environments. These digital models integrate data from satellite earth observation, satellite navigation, and satellite communications to provide a comprehensive and dynamic representation of agricultural fields. Digital twins enable real-time monitoring, simulation, and analysis of crop health, soil conditions, and farm operations, allowing for predictive insights and optimised decision-making. By leveraging digital twins, farmers can test different scenarios, assess the impact of various interventions, and improve overall farm management practices.

Drones: Drones enhance satEO data with high-resolution aerial insights into crop health, growth, and development, identifying issues like pests and diseases for targeted action. They use satellite communication for real-time data transmission and remote control, enabling operators to adjust flight plans and react to changing conditions. Satellite navigation ensures precise operations such as spraying, planting, and harvesting, reducing waste and increasing efficiency. These technologies help farmers reduce costs and promote sustainable practices.

Autonomous farming equipment: Autonomous farming equipment, such as self-driving tractors and harvesters, can increase efficiency, reducing labour costs, and improving crop yields. Satellite navigation is essential for these systems, providing precise positioning and guidance. Satellite navigation enables autonomous equipment to navigate complex agricultural landscapes, avoid obstacles, and optimise routes. By leveraging satellite navigation, autonomous farming equipment can operate with increased precision and efficiency, reducing the need for human intervention and improving overall productivity.

IoT sensors: IoT sensors are being increasingly used in agriculture to collect data on field conditions, such as soil moisture, temperature, and crop health. These sensors can transmit data via satellite communication in areas with limited cellular coverage, enabling real-time monitoring and decision-making. Satnav can also be used to geotag sensor data, providing spatial context and enabling more precise management of agricultural resources. By integrating IoT sensors with satcom and satnav, farmers can gain valuable insights into their operations, optimise resource allocation, and improve crop yields.

5. SCOPE OF THE CALL

The proposals submitted under this Call for Proposal (CfP) shall target innovative and user-driven services which rely on advanced digital and space-based technologies. The proposals shall leverage target opportunities in the agricultural sector related to environmental sustainability, efficiency, and regulatory compliance.

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 **23 May 2025** and will remain open until **29 August 2025**, 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".

8. 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.