



ARTES 4.0 Generic Programme Line Business Applications - Space Solutions

“Commercial Applications of Space-Enabled Robotics – Transportation and Logistics”

THEMATIC CALL FOR PROPOSALS

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Table of ACRONYMS

AI	Artificial Intelligence
APQ	Activity Pitch Questionnaire
AoF	Authorisation of Funding
ARTES	Advanced Research in Telecommunications Systems
BASS	Business Applications and Space Solutions
DG	Director General
ESA	European Space Agency
FP	Full Proposal
OP	Outline Proposal
OSIP	Open Space Innovation Platform
SME	Small and Medium sized Enterprise
TIA	Directorate of Telecommunications and Integrated Applications

1. OVERVIEW

This document presents an overview of “Commercial Applications of Space-Enabled Robotics”, under the 2nd thematic area “Transportation and Logistics”, thematic call for proposals issued under the ARTES BASS, 5G and 4S programme lines. The call offers the opportunity to companies to bring forward their business propositions, which leverage space and advanced digital technologies for delivering sustainable solutions.

2. BACKGROUND AND RATIONALE

Recent advances in artificial intelligence and robotics have paved the way for new capabilities in transportation and logistics. Autonomous vehicles and trucks, delivery robots and drones, and uncrewed surface vessels offer avenues towards enhanced safety, sustainability, and commercial competitiveness in the transportation of passengers and goods. According to a study by the National Highway Traffic Safety Administration, the majority of road traffic accidents are caused by human error.ⁱ Autonomous vehicles have the potential to enable significant reductions in such human error, and road traffic accidents as a whole. Besides safety, there are expected to be further benefits including accessibility (i.e. for those unable to drive due to age or disability), convenience for passengers, traffic management, and more. Enhanced drone autonomy in logistics is expected to facilitate rapid and efficient transportation of goods, particularly in regions with terrain that is difficult for land transportation, such as island geography, dense, traffic-heavy urban environments, remote or inaccessible regions with poor road infrastructure, disaster-stricken areas, offshore platforms, and beyond. Uncrewed surface vessels may bring about cost-effective transportation of passengers and goods across waterways where alternatives are cost-prohibitive, inefficient, or less sustainable for the environment. Autonomous logistics robots offer opportunities for reducing the ecological footprint of alternatives while working to make human activities safer, more effective, and convenient through self-driving deliveries and transportation within industrial sites, campuses, and resorts.

As of writing, fully autonomous taxis operate in set zones within several cities in the U.S. and autonomous trucks have been trialled on public roads across the world, including in America, Europe, and China.^{ii iii iv} Drone solutions are increasingly being used for transportation of goods such as medical supplies, and several companies are advancing passenger drone solutions towards maturity.^{v vi} Autonomous watercraft have been demonstrated in Scandinavia, spanning container ships and ferry transits.^{vii viii} Robotic services for industrial site automation are already available on the market and their capabilities continuously evolving.

Nonetheless, in all instances, there remain challenges left to be overcome before large-scale adoption of autonomy across transport and logistics can be made manifest. These span establishment of coherent regulatory frameworks, proof of safety, technological challenges (e.g. for navigating complex environments), public acceptance, viable business models, cybersecurity risks and aspects related to liability and insurance.

New satellite capabilities are emerging and have the possibility to support the onset and uptake of autonomous systems in varied operational contexts. It is expected that satellite technology will aid service providers in addressing some of the aforementioned challenges, in particular those related to technology, safety, cybersecurity and regulatory adherence. Satellite-based services will play an important role in the navigation of autonomous systems, provision of situational awareness information through earth observation data, and ubiquitous connectivity via satellite communications constellations.

The aim of this initiative is to support companies in evaluating and creating commercially sustainable solutions in which satellite technology and data is used to support robotic and autonomous systems in transportation and logistics, to better facilitate the movement of passengers and/or goods. Targeted areas could relate to delivery services, public transportation, long-haul trucking, industrial settings, campus and controlled environments, short-sea shipping, inland waterway transport, and beyond. Autonomous services may relate to vehicles and robots on land, air, and sea.

3. OBJECTIVES OF THE CALL

This Call for Proposals invites proposals for feasibility studies and demonstration projects for services that combine the use of satellite technologies and robotics for downstream services.

Downstream services here refers to activities involving the utilisation of data and services provided by space assets. This includes satellite communication services, satellite earth observation data, satellite PNT (positioning, navigation, and timing) services, and other applications that leverage space-based technologies for various industries on Earth.

‘Robotics’ is here defined to include physical robots, autonomous drones, machines and vehicles, and precursory solutions or those that enable these (e.g. connectivity and navigation systems for autonomous vehicle services, connectivity solutions to enable tele-operated robotics, and beyond).

The main objectives of the Space-Enabled Robotics call are to:

- Enable and cultivate the study, development, and demonstration of innovative¹ services at the intersection of space-based services and robotic systems, to create an added-value in various industries. This made possible by integrating any of satellite communications, earth observation and/or positioning at the system or service level (i.e., integrated with the robotic system directly, or supporting the overall service).
- Utilise this combination of advanced technologies to improve industrial efficiency, productivity, operational safety, competitiveness, and generally tackle challenges in industry that could not otherwise be addressed without the unique complementarity

¹ Innovation could reflect the business model, technology, operational context, or a combination thereof.

- of these technologies.
- Support the adoption of satellite technology/data into robotic systems in the context of operational services such that the emergent design, development, and implementation constraints are identified, evaluated, and mitigated, to enable more rapid realisation and scaling-up of such services on Earth, into the future.
- Enable the creation of new markets and the establishment of novel business models permitted by this combination of technologies in the chosen sectors.

In accordance with the above, the objectives of this specific subtheme are to:

- Identify the most feasible and attractive commercial opportunities within transportation and logistics for the uptake of autonomous robotic systems, that enable positive societal impact.
- Establish the roadmap and associated constraints to operational deployment of services based on such autonomous robotic systems.
- Develop and demonstrate such services in pre-operational environments to showcase the perceived value propositions in the intended commercial setting.
- Support the eventual uptake of autonomous vehicles, drones, robots, and watercraft in operational settings in which they prove viable and offer significant benefits by way of enhanced safety, sustainability, accessibility, and commercial competitiveness.

4. SPACE ASSETS

Satellite technologies and data have a significant role to play within prospective services:

- **Satellite positioning** can provide coarse to high accuracy positioning information to robots, vehicles, machines, and drones operating in outdoor spaces. This can be used for navigation, geo- and timestamping of collected data, time-synchronisation of networked machines, and/or determination of speed and heading. Satellite positioning could be combined with inertial and alternative positioning techniques to support indoor-outdoor seamless localisation and marine robotics. Augmentation of GNSS can offer higher positioning accuracies for certain use-cases via solutions such as Galileo HAS (High Accuracy Service), RTK (Real-Time Kinematic) solutions, or otherwise, with the selection dependent on the service requirements.
- **Satellite communications** provides data, video and voice communications and may add value to applications implemented in the following service provision scenarios:
 - Environments that have inadequate, unreliable, compromised, or altogether absent mobile cellular connectivity.
 - Mobile services that operate across regions with varying cellular connectivity quality (good in certain areas, poor in others) and require continuous coverage and availability.
 - Services that have high security, robustness and resilience requirements may benefit from satellite communications for redundancy in compromised or unforeseen circumstances.
 - These may be pertinent for drone operations in rural areas, autonomous

vehicles, or operations of robotics in any of the above given circumstances. New developments in satellite communications may also be exploited, such as Low-Earth Orbit (LEO) Broadband satellite constellations, to enable certain services with demanding performance or cost constraints.

- **Satellite Earth Observation** - it is expected that satellite earth observation could support robotics solutions at the service level i.e., providing complementary or enabling datasets to support the activities of the autonomous systems. This could be through situational awareness data to support the navigation of a robot, or use of earth observation data to inform, initiate, or halt deployment of an autonomous system. Satellite earth observation data could refer to air quality measurements, thermal heat signatures, optical, radar, meteorology, or combinations thereof.
- **Spaceflight Technology Spin-Outs** – applications (on Earth) of robotics originally developed for use in space (and other astronomical objects) that also have commercial applications on Earth, i.e. Spaceflight Spin-Outs, are also considered eligible. This could relate to robotics developed for space, tele-robotic solutions and algorithms (perception, planning, control...) developed for autonomy of space robotics, or otherwise.

In all cases, the role of space technology and/or data in the service should be justified in comparison to non-space alternatives.

5. SCOPE OF THE CALL

The proposals submitted under this Call for Proposals shall address the Transportation and Logistics domain with innovative user-driven downstream services which rely on the combination of satellite technology/data (any of those mentioned above) and robotic systems.

The Bidder shall either address the (optional) use cases included in the Annexes ([available on the website](#)) or address other use cases and requirements related to Transportation and Logistics provided by other customers / users directly involved by the Bidder. In the latter case, support of those potential customers shall be evidenced in letters of interest to be attached to the Outline Proposal (the second step in the application process). Proposals under both options will be considered equally.

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 Proposals 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/user driven and present a strong sustainability potential.
 - Propose a service demonstrating the benefits of the utilisation of integrated space assets.
 - Include a viability analysis.

- 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/user driven (including user involvement and active participation in the project).
 - Propose a service demonstrating the benefits from the utilisation of space assets with clear potential to become commercially sustainable.
 - Provide a measurable socio-economic impact.
 - The Bidder shall involve in the project representatives from user communities, which shall take part in the pilot.

6. PROCUREMENT APPROACH

The proposals submitted in reply to the call shall be implemented in the context of ESA BASS, 5G and 4S programme lines of ARTES 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 the 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: [National Delegations | ESA Space Solutions](#)

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

- I. **for the ARTES 4.0 BASS Generic Programme Line - Component A:** Business Applications. To date, 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 have subscribed.
- II. **for the ARTES 4.0 5G Strategic Programme Line:** Austria, Belgium, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, the United Kingdom and Canada have subscribed.

- III. **for the ARTES 4.0 4S Strategic Programme Line:** Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, The Netherlands, Norway, Poland, Portugal, Romania, Spain, Switzerland, the United Kingdom and Canada have subscribed.

7. PROCESS AND SCHEDULE

It is planned for the call for proposals to be opened on 26th April 2024 until 26th June 2024, 13:00 CET.

7.1. Timeline and Procedure

Bidders can respond to this thematic call by submission of a short Activity Pitch Questionnaire within the above timeframe.

The Call is planned to be implemented according to the following stepwise approach:

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 Bidder shall not contact any of the stakeholders listed in the annexes on the webpage.

The Bidder shall NOT involve any of the stakeholders mentioned in the annexes in the bidding consortium neither as subcontractor nor as external service (including consultancy).

The completed Activity Pitch Questionnaire (APQ) shall be 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 can be submitted.

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

In **Step 2**, 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 subsequent proposal(s) which form the subsequent steps. 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.

In **Step 3**, 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 detail. The Bidder will be allowed 3 months from the APQ submission deadline to submission of their Outline Proposal. The Outline Proposal will be submitted on the OSIP platform under the channel [“Outline Proposal for ARTES Downstream Business Applications – Feasibility Studies/Demonstration Projects”](#).

In **Step 4**, 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 3 months from submission of their Outline Proposal to submit their Full Proposal on ESA-STAR.

In **Step 5**, the Bidder will submit a Full Proposal with the Authorisation of Funding (AoF) from the relevant National Delegation(s). 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 prior link.

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 Pitch, 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.

ⁱ [Crash Stats: Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey \(dot.gov\)](#)

ⁱⁱ [Ride-Hailing App - Make the Most of Your Drive - Waymo One](#)

ⁱⁱⁱ [Autonomous transport solutions | Scania Group](#)

^{iv} [TuSimple Completes First "Driver Out," Fully Autonomous Semi-Truck Run on Public Roads in China \(youtube.com\)](#)

^v [Global First: Autonomous Drone Gets Approval To Fly With Passengers \(forbes.com\)](#)

^{vi} [Skyports Completes Four-Week Medical Drone Trial In UK | Aviation Week Network](#)

^{vii} [Autonomous container ship Yara Birkeland sets sail | SWZ|Maritime \(swzmaritime.nl\)](#)

^{viii} [Self-driving electric commuter ferry takes to the water on its maiden voyage in Stockholm | Euronews](#)