



**CALL FOR PROPOSALS IN THE FRAMEWORK OF ESA ARTES'S SPACE
SYSTEMS FOR SAFETY & SECURITY (4S)**

**“CYBER SECURITY AS ENABLER FOR SECURE SATELLITE
COMMUNICATIONS AND RESILIENT APPLICATIONS”**

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Table of Contents

1. Introduction 4

1.1. Scope of the Document 4

1.2. References 4

1.3. Acronyms 5

2. Background and rationale 6

2.1. State of Play 6

2.2. Space Systems for Safety and Security (4S) Strategic Programme Line 6

2.3. Background of the Call for Proposals 8

3. Objectives and domains of the CfP 10

3.1. Objectives and principles 10

3.2. Cyber Secure Satellite Communications 11

3.3. Satellite Communications as an Enabler for a Cyber-Resilient Society 12

4. Submission Process 14

4.1. Overview 14

4.2. Step 1: Outline Proposal 15

4.3. Step 2: Full Proposal 16

4.4. Proposal Templates 17

4.5. Authorisation of Funding Letter from National Delegation(s) 18

4.6. Process Outcome 18

5. General Conditions 19

Annex A: ARTES 4.0 Technologies and Products development (AO 4-40001) Development Phases and Co-Funding Levels 21

Annex B: Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494) – Funding levels 23



1. INTRODUCTION

1.1. Scope of the Document

This document is the **Call for Proposals (CfP)** for **Cyber Security as Enabler for Secure Satellite Communications and Resilient Applications** initiated in the frame of the ESA ARTES Space Systems for Safety and Security (4S) Strategic Programme Line.

The document is structured as follows:

- Section 2 introduces the CfP background and rationale.
- Section 3 details the CfP objectives and domains of interest.
- Section 4 describes the Proposal submission process.
- Section 5 presents relevant conditions applicable to the CfP.
- Annex A describes the development phases and co-funding levels for the satcom technologies and products development related activities.
- Annex B describes the activities and co-funding levels for the downstream applications development related activities.

1.2. References

ARTES Programme: <https://artes.esa.int>

ARTES 4S Strategic Programme Line: <https://artes.esa.int/safety-and-security-4s>

ARTES 4.0 Technology and Product development related activities Outline Proposal templates: <https://artes.esa.int/documents>

ARTES Downstream Applications development related activities Outline Proposal templates: <https://business.esa.int/documents>

ARTES National Delegations contact points: <https://artes.esa.int/national-delegations>

1.3. Acronyms

ADS-B	Automatic Dependent Surveillance – Broadcast mode
AIS	Automatic Identification System
ARTES	Advanced Research in Telecommunications Systems
CfP	Call for Proposals
C&G	Competitiveness and Growth
DDoS	Distributed Denial of Service (attack)
ESA	European Space Agency
EU	European Union
GPL	Generic Programme Line
IoT	Internet of Things
IOT	In-Orbit Testing
IOV	In-Orbit Validation
IP	Internet Protocol
Satcom	Satellite Communications
SPL	Strategic Programme Line
TRL	Technology Readiness Level
VDES	VHF Data Exchange System
4S	Space Systems for Safety and Security
5G	Fifth-generation technology standard for broadband cellular networks

2. BACKGROUND AND RATIONALE

2.1. State of Play

Our society, economy, security, and sovereignty are increasingly depending on digital infrastructure and, more specifically, on communication networks. Any lack of coverage in some areas or loss of availability due to accidental or intentional disruption may result in negative consequences and widespread impact.

Hence, specific governmental attention is granted to communication services and networks required for essential governmental or institutional services (at national, regional, or local levels). Additionally, focus is also on supporting operations deemed critical in fields as varied as transport, finance, health, and energy production and distribution. Security and appropriate control of the design, manufacturing, and operations of communication services and networks are key requirements for resilience and sovereignty.

Today, communications rely mostly on terrestrial network solutions that tend to be more and more integrated (e.g., IP, 5G), which may significantly increase the impact of any disruption. Furthermore, the decrease of the overall presence of Europe and Canada in the design and manufacturing of these terrestrial network solutions can negatively impact the actual level of control by authorities and institutions on telecommunications infrastructure, leading to serious implications on European and Canadian safety, security, and sovereignty.

In this context, it is increasingly perceived that adding appropriately tailored secure **Next-Generation Satellite Communications (Satcom)** Systems components to the telecommunications infrastructure can substantially increase their resilience to various disruptions, supplement capacity, and ensure global coverage, while providing a stand-alone and highly secure space-based capability to convey the most critical and sensitive communications.

2.2. Space Systems for Safety and Security (4S) Strategic Programme Line

In 2019, ESA Member States decided to create the Strategic Programme Line (SPL) titled “Space Systems for Safety and Security (4S)” under the ESA programme titled Advanced

Research in Telecommunications Systems (ARTES). The objectives of the ARTES 4S SPL are to support the development of Next-Generation Satcom Systems aimed at **providing secure and safe communications solutions** for governmental/institutional and public-regulated services and to ensure the resilience of society’s critical digital infrastructure. Broadband connectivity as well as low data rate (e.g., ADS-B, AIS/VDES, IoT) solutions are considered. Relevant application areas are shown in the (non-exhaustive) figure below.



The ARTES 4S SPL supports the development of critical technologies, products, systems and services by ESA Member States’ Industry, in order to increase its competitiveness in the secure-satcom market and to promptly address near-term opportunities.

The availability of such solutions will not only unlock the implementation of strategic secure initiatives at national and EU level, but also will result in **commercial return for Industry** due to the number of opportunities in this domain, not only in Europe but also worldwide. These solutions can enable new products to be spun-off into the commercial market, thus increasing ESA Member States’ market competitiveness and share.

2.3. Background of the Call for Proposals

In an increasingly digital world, security and privacy concerns are becoming the driving market needs for institutions, consumers, and businesses. Satellite telecommunications have evolved from analogue electronics to digitised systems, which are increasingly using IP protocols, software-defined radios, digital payloads, onboard data processing, and cloud-based ground stations. Consequently, numerous space operations are moving from the physical layer to the software layer of cyberspace. This dependence on digital technologies and the growing use of COTS components have led to the extension of the attack surface throughout satellites' lifecycles. The recent attack against the KA-SAT GEO satellite network¹ has illustrated the need to strengthen satcom systems against cyber security events. To achieve sustained competitive advantages for the coming decade, the satcom industry must adopt innovative security technologies and state-of-the-art, security-by-design processes and procedures.

At the same time, satellite communications offer a unique alternative to the transmission of data through the terrestrial internet, where it can be more vulnerable to malicious attacks. With the development of optical communications, which offer increased robustness against interference, jamming, and eavesdropping, satcom systems and constellations will be even more secure and allow worldwide exchanges of data while bypassing the terrestrial internet. Used as a primary communication means or as backup to terrestrial networks, satcom systems can, thus, enhance the security of sensitive data transmissions and storage, or provide backup connectivity in case of cyber-attacks. This can benefit a wide range of verticals, such as the transport, financial, business, and governmental sectors.

The Call for Proposals “**Cyber Security as Enabler for Secure Satellite Communications and Resilient Applications**” initiated in the frame of the ESA ARTES 4S Strategic Programme Line is aimed at supporting Industry in addressing these needs and opportunities. The outcome will be the development of industry-driven innovative security related technologies, products,

¹ “ The War in Ukraine for a Space Cybersecurity Perspective” ESPI-Short-1-Final-Report.pdf
Page 8/23



systems, end-to-end infrastructures, and downstream services for the ultimate benefit of the society.

3. OBJECTIVES AND DOMAINS OF THE CFP

3.1. Objectives and principles

This CfP aims to foster the development of innovative satellite communications technologies, products and sub/systems as well as downstream applications, which may enhance the security of satellite communications systems and cyber resilience of society on earth.

The call is open to developments proposed by ESA Member States' industry in the areas of **ground, space, system, end-to-end infrastructures, and downstream applications**.

The sections 3.2 and 3.3 provide a list of technical areas and critical technologies, products, systems and applications targeted by the CfP. The list is not exhaustive, and the CfP is opened to additional and complementary developments to the ones provided below.

With this CfP, the Industry is invited to submit Proposals for new activities in relation to the target objectives and scope. This CfP is based on a non-competitive process: each proposal is evaluated independently (direct negotiation).

As it is key to have promising ideas rewarded quickly, **ESA commits to a timely review of Proposals**. Their submission and review process are described in subsequent sections.

ESA will co-fund the activity on behalf of its Member States. The maximum amount of co-funding will depend on the activity type and phase (i.e., Technology Readiness Level - TRL), the structure of the Industry, and the relevant National Delegation's decision. Specific co-funding related information is provided in the Annexes.

In addition to financial co-funding, ESA will bring its own experts along the activity to provide guidance and feedback on the proposed solution, the presented business case, and the performed technical activities.

In return, the Industry shall contribute the required level of private co-funding and shall develop the proposed solution/product/technology.

3.2. Cyber Secure Satellite Communications

The primary focus of the CfP is to support the development of **innovative security technologies, products and building blocks**, which will contribute to reduce vulnerabilities and attack surface of (future) satellite communication systems. Areas of interest are:

- Technologies for secure satellite communications and networks (e.g., DoS/DDoS protection, end-to-end security).
- Technologies for enhancing security in satellites and ground segments.
- Institutional and commercial traffic secure segregation.
- Integration with terrestrial networks security.
- Secure virtual separation architecture (including Software-Defined Networking for space communications).
- Cryptographic processing (quantum and non-quantum) and key distribution/management, for both the ground and space segment.
- Interference/jamming localisation and management, both on-board the space segment and for the ground segment (gateways and user terminals).
- Secure/cyber-secure cloudification/virtualisation for space applications (ground and space segment, user segments).
- Space security monitoring and detection in near-real-time of attacks and security breaches.
- Tools for security assessment of space systems and security testing environment.
- Tools for sharing of information (e.g., security threat intelligence for space systems, and other).
- Technologies for targeting emerging threats for multi-orbit/multi-systems.

This CfP is also open to the **“hardening” of existing satcom products and systems**, e.g., activities addressing the upgrading of current satcom products and systems with (additional) security requirements and their security assessment, testing, and validation.

The **security of the supply chain** is crucial for the security of satcom infrastructure. Therefore, this CfP also addresses this domain, considering, e.g., counterfeit detection solutions, authenticity verification mechanisms of components from subcontractor level (while during operation, i.e., remote attestation), and mitigation measures against supply-chain attacks, which are key areas for innovation.

3.3. Satellite Communications as an Enabler for a Cyber-Resilient Society

This CfP is in addition open to the development of technologies, products, systems, and downstream applications where satellite communications can play **an enabling role in enhancing the resilience of the society and economy**. The following use cases are considered:

- Quantum Key Distribution technologies, products and systems; services utilising Quantum Key Distribution in relevant markets.
- Secure routing of sensitive data via space, use of satellite communication as transport network for enhanced user privacy, space-based “cloud”.
- Satcom as a redundancy link in case of cyber event on critical terrestrial infrastructure and services.
- Detection and alerting of compromised critical terrestrial infrastructure and services via satcom.
- Use of secure satellite communications to/from, and cybersecurity for, machines and vehicles operating on land, sea, or air.
- Use of satellite optical links – but not QKD-based – to distribute cryptographic keys and establish secure communications.

- Where applicable, exploitation of emerging technologies and paradigms, such as artificial intelligence and deep learning, distributed ledger technology, zero-trust models, and internet-of-things, in support of cyber-secure systems enabled by satcom.

4. SUBMISSION PROCESS

4.1. Overview

This Call for Proposals is opened from **17 May 2023 to 18 August 2023²**.

This CfP is open to Industry residing within ESA Member States participating in the 4S Strategic Programme Line, i.e.: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal, Romania, Spain, Switzerland, United Kingdom and Canada.

For industry players interested in bidding, the procedure consists of submission of an **Outline Proposal** followed by submission of a **Full Proposal**, as detailed below.



Figure 1. CfP submission steps

Please note that ‘technologies and products’ and ‘downstream applications’ development related activities require different proposal templates and are submitted following different procedures, as described in the following sections.

The Industry may contact ESA (at ARTES-4S@esa.int) for further information or questions, or if support is needed to identify the most appropriate submission procedure and templates, at any time, including before Outline Proposal submission.

² Proposals submitted after the deadline of this CfP will be automatically conveyed to the call ‘ARTES 4.0 Technology and Product Developments Activity – Standard Call for Proposals’ (AO 4-40001) or ‘Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494)’, as relevant.

4.2. Step 1: Outline Proposal

The outline proposal shall address, as a minimum, the following aspects:

- Outline of the proposed 4S activity or activities.
- Objective(s) of the proposed activity.
- Description of innovative technology/application elements.
- Description of possible security aspects and relevant Security Risk Management.
- Design & Development Plan, IOT/IOV Approach, Demo Plan, as applicable.
- Business perspective.
- Industrial Organisation and Programme of Work.
- Funding Plan and cost estimates.

Outline Proposals for technologies and products related development activities shall be submitted to ARTES-4S@esa.int⁴ or otherwise if modified for AO4-40001.

Outline Proposals for downstream applications related activities shall be submitted to the [Open Space Innovation Platform - OSIP - Channel: OUTLINE PROPOSAL for ARTES DOWNSTREAM BUSINESS APPLICATIONS - FEASIBILITY STUDIES/DEMONSTRATION PROJECTS \(esa.int\)](#)^{5 6}

ESA will evaluate an Outline Proposal within 10 working days.

⁴ In line with the 'ARTES 4.0 Technology and Product Developments Activity – Standard Call for Proposals' (AO 4-40001)

⁵ In line with the Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494)

⁶ Please note that the submission of an APQ before the submission of the Outline Proposal, as defined in the Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494) is not required for this dedicated initiative.

The evaluation process is non-competitive, i.e., each proposal will be assessed individually on its own merits, based on the criteria mentioned below. For an Outline Proposal, the following evaluation criteria will be used:

1. Consortium experience in related product, system and/or service development.
2. Credibility and relevance of the technical solution wrt. CfP scope and objectives, addressed challenges, and implementation plan.
3. Credibility of the business case.
4. Management organisation, including management of risks / security handling.
5. Adequacy of cost and funding, value for money.

If the Outline Proposal is positively assessed, ESA will invite the Industry to proceed to the next step, i.e., to submit the Full Proposal.

4.3. Step 2: Full Proposal

Following the submission of the Outline Proposal, in case of a positive assessment from ESA, the bidder is invited by ESA to submit their Full Proposal along with the **Authorisation of Funding** from the relevant National Delegation(s), via ESA-star⁷, in line with the selected implementation process:

- For technologies and products related development activities, through the 'ARTES 4.0 Technologies and Products for C&G, Optical and Quantum Communication – ScyLight, Space Systems for Safety and Security (4S) and 5G/6G and Sustainable Connectivity Standard Call for Proposals' (AO 4-40001),
- For downstream applications related activities, through the Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494).

⁷ <https://esastar.sso.esa.int/>
Page 16/23

The Full Proposal, which is the consolidation of the Outline Proposal with a deeper level of detail, shall address, as a minimum, the following aspects, as applicable:

- Proposed 4S activity or activities.
- Objective(s) of the proposed activity.
- Description of innovative technology/applications elements.
- Design & Development Plan, IOT/IOV Approach, Demo Plan as applicable.
- Preliminary Security Risk Assessment, relevant both to the protection of the know-how developed during the activity implementation and to possible specific security aspects inherent to the proposed development.
- Business Plan highlighting the business perspective on global market and/or European institutional opportunities.
- Industrial Organisation and Programme of Work.
- Funding Plan and cost estimates.

Again, the evaluation process is non-competitive, i.e., each proposal will be assessed individually on its own merits.

For the Full Proposal, the standard evaluation criteria defined in AO 4-40001 and AO1-10494, as relevant, will be used.

4.4. Proposal Templates

- Outline Proposal templates for technologies and products related development activities are available at [Documents | ESA TIA](#) (from there, use “Templates for Co-Funded Technology and Product Developments”)⁸.
- Outline Proposal templates for downstream applications related activities are available at [Documents | ESA BASS](#) (from there, go to “SET OF TEMPLATES FOR BA Open Call for Proposals AO-10494” and under “Feasibility Studies” or “Demonstration Projects”, as applicable to your proposed activity”).

⁸ The ARTES Agile framework ([ARTES AGILE | ESA TIA](#)) is also available for this CfP. ARTES AGILE is a new initiative aimed at facilitating short term high-risk technology developments, critical in defining the scope and development of future products and services for the satcom sector and vital in assessing the viability of a product development plan. Please contact ESA if you wish to use this framework.

Full Proposal templates can be found on ESA-star⁹, as part of the tender documentation of AO 4-40001 and AO 1-10494, as relevant.

4.5. Authorisation of Funding Letter from National Delegation(s)

Formal authorisation from the National Delegation(s) of the companies involved **is required** for the proposed activity at the time of submission of the Full Proposal. Note that Full Proposals submitted without the Authorisation of Funding will not be admitted for evaluation.

Bidders are advised to initiate discussions with the relevant National Delegate(s) **as early as reasonably possible**. ESA suggests reaching out to the National Delegate(s) before submitting the Outline Proposal and informing ESA about their feedback at the time of Outline Proposal submission.

The address book of the National Delegates can be found here: <https://artes.esa.int/national-delegations>.

4.6. Process Outcome

Following a positive assessment by ESA and successful negotiations with the Industry, the proposed activity will be approved for implementation and a Contract will be made between the Industry and ESA.

⁹ <https://esastar.sso.esa.int/>
Page 18/23

5. 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 Outline Proposal or in the Full Proposal. Nevertheless, should it be considered necessary to share Classified Information with ESA in an Outline Proposal, the Agency should be notified beforehand so that mutual agreement can be reached on how to handle such information.

To avoid any confusion with Classified security markings, the unclassified protective marking used by the Tenderer in the Outline Proposal and Full Proposal shall not contain the terms "Restricted", "Confidential", or "Secret".

ESA is subject to a Personal Data Protection Framework and will process and protect personal data accordingly. Personal data provided in the Outline Proposal will be processed solely for the purposes of evaluating the outline proposal and, should the evaluation be successful, executing subsequent steps of the procurement process. Further information on personal data protection can be found in the Special Conditions of Tender of CfP 'ARTES 4.0 Technology and Product Developments Activity – Standard Call for Proposals' (AO 4-40001) and in the Special Conditions of Tender of CfP 'Downstream Applications in ARTES 4.0 Feasibility Studies/Demonstration Projects'.

Expenses incurred in the preparation and dispatch of the response to the CfP will **not** be reimbursed. This includes any expense connected with a potential dialogue phase.

This CfP does not bind ESA in any way to place a contract. ESA reserves the right to issue amendments to this CfP.

ESA does not intend to prioritise any element of the above 4S activities. ESA expects the industry to define its own priorities (for instance in line with its internal strategy plans). For the



same reason, ESA does not intend to prioritise particular domains of innovation in technology, product and service development. Consequently, this CfP provides the **opportunity for industry to propose an implementation in response to its own priorities** regarding the different activity areas and the theme as a whole. These priorities can be further consolidated during the dialogue phase.

Annex A: ARTES 4.0 Technologies and Products development (AO 4-40001) Development Phases and Co-Funding Levels

For Technologies and Products development activities, the following table lists the main activities and outcomes expected for each Development Phase (in line with AO 4-40001):

<i>Development Phase</i>	<i>Main Activities</i>	<i>Outcome</i>
Definition Phase	Technical studies, preparatory activities	Performance requirements defined, or system analysis completed
Technology Phase	Technical risk mitigation excluding any qualification or industrialisation.	Breadboard, prototype or Engineering Model (EM) Flight hardware for early in orbit test purposes.
Product Phase	Development, qualification, verification, and industrialisation	Space product: Engineering/Qualification Model (EQM) or similar
		Ground product: verified product in a non-operational environment, end-to-end infrastructure
Demonstration Phase	Space system: in-orbit validation/demonstration	Flight hardware, system demonstrations
	Ground product: validation in operational environment	Product validated in an operational environment, system demonstrations

The following table indicates the maximum co-funding level for each Development Phase (with associated TRLs) for various tenderer categories:

<i>Development Phase</i>	<i>Targeted TRL</i>	<i>ESA maximum Co-Funding Level</i>		
		Non-SME	SME	Universities or Research Institutes with no commercial interest in the product or system
Definition Phase		50%	80%	50% [up to 30% Development Phase cost]
Technology Phase	up to 4-6, depending on the technical risk	75%	80%	100% [up to 30% Development Phase cost]
Product Phase	up to 7	50%	80%	50% [up to 30% Development Phase cost]
Demonstration Phase	up to 8	50%	80%	50% [up to 30% Development Phase cost]

Annex B: Call for Proposals for Downstream Applications in ARTES 4.0 (under BASS, 4S, or 5G programme Lines) Feasibility Studies / demonstration projects (1-10494) – Funding levels.

Downstream Applications in ARTES 4.0 activities are organised around two main pillars:

1. Feasibility Studies that aim at assessing the technical feasibility and economic viability of new downstream services;
2. Demonstration Projects that aim at implementing and validating pre-operational downstream services in partnership with the users.

The following table indicates the maximum funding level for each type of activity for various tenderer categories (in . Funding levels noted for SMEs and Research Institutes are dependent upon the funding level authorised by the relevant national delegation:

	Feasibility Study	Demonstration Project
Activity Cost	max. 500'000 EUR (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 ¹⁰	80% of enterprise's cost	80% of enterprise's cost
Universities and Research Institutes with no commercial interest in product/service	max. 100% of institute's cost and max. 30% of activity cost	max. 100% of institute's cost and max. 30% of activity cost
Industry Co-Funding	Remaining part of the cost to carry out the activity	

¹⁰ Enterprises fulfilling the criteria defined in the European Commission Recommendation of 6 May 2003 (2003/361/EC) or as updated.