ESA introduction to Industry

- Purpose and Disclaimer
- Key Background information
  - ESA General Facts and Figures
  - ESA Budget Overview
  - Industrial Policy and Geo Return
- Structure and Organisation of ESA
  - ESA Organigram
  - The roles of Council, Boards and Delegates
  - The Procurement Process & IPR
- Technology
  - Harmonisation
  - Understanding AD and TD
- Hungary and New Member States
  - Hungary status summary
  - Hungary as New Member State
  - Generalised accession flow
- How to do business with ESA
- ESA Programmes

Purpose and Disclaimer

Purpose and Disclaimer

- This presentation is intended as an **overview and introduction** to ESA organisation and operation in a **simplified** manner.

- It is **intended for industry** as a help to 'understand the ESA world and way of functioning' so that you can **work more effectively with ESA**

- It is NOT either exhaustive nor comprehensive, rather provides a high level/ simplified introduction to each subject

- It does NOT replace or supersede any of the Agency's procedures, rules or formal documents.

It should be noted that things change on a daily basis and while every effort has been made to ensure the correctness of the information herein as of 01/01/2021, it may be incomplete or out of date in some areas.

Before we begin

- ESA uses a LOT (Loads Of These) TLA (Three Letter Acronyms).
- This can be like speaking a different language
- To help we have put together a booklet/ dictionary of the most common ones (see separate hand out and excel sheet)
- We have grouped acronyms by area (e.g. Boards, Programmes, Technical) for easier searching
- Don't be afraid to ask. If you don't know an acronym – chances are someone else doesn't either.

	A	B	C	D
1	**Category**	**Subject**	**Acronym**	**Title**
2	Admin	Contractual	CCN	Contract Change Notice
3	Admin	Defunct Directorate	D/HSF	(Former) Directorate of Human Spaceflight
4	Admin	Defunct Directorate	D/LEX	(Former) Directorate of Legal affairs and External Relations
5	Admin	Defunct Directorate	D/SRE	(Former) Directorate of Science and Robotic Exploration
6	Admin	Defunct Directorate	D/GAL	(Former) Directorate of the Galileo Programme and navigation related activities
7	Admin	Delegate Bodies	AFC	Administrative and Finance Committee
8	Admin	Delegate Bodies	DOSTAG	Data Operations Scientific & Technical Advisory Group
9	Admin	Delegate Bodies	PB-EO	Earth Observation Programme Board
10	Admin	Delegate Bodies	COUNCIL	ESA Ministerial Council
11	Admin	Delegate Bodies	EUB	Exploration and Utilisation Board
12	Admin	Delegate Bodies	PB-HME	Human Spaceflight Microgravity and Exploration Programme Board
13	Admin	Delegate Bodies	IPC	Industrial Policy Committee
14	Admin	Delegate Bodies	IRC	International Relations Committee
15	Admin	Delegate Bodies	JCB	Joint Board on Communication Satellite Programmes

ESA General Facts and Figures

ESA Legal Status

ESA is an **Intergovernmental Organisation** with a self-standing legal personality at international law

Through their ratification of the **ESA Convention**, a process generally involving their Parliament, Member States have incorporated the provisions of the ESA Convention into their respective domestic law systems

ESA is therefore **bound by its own set of rules and regulations**, and not directly by that of the individual Member States, or of other international organisation such as the European Union

ESA facts and figures

- Over 50 years of experience

- Eight sites/facilities in Europe, about 2300 staff

- Approx. 6.49 billion Euro budget

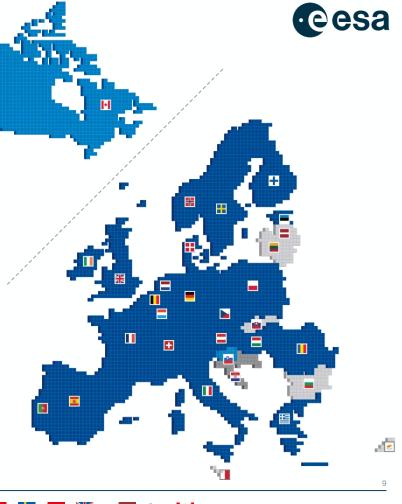- Over 80 satellites designed, tested and operated in flight

ESA facts and figures

ESA consists of:

22 Member States: AT, BE, CZ, DE, DK, EE, ES, FI, FR, IT, GR, **HU**, IE, LU, NL, PT, PL, RO, SE, UK plus Norway and Switzerland.

2 Associate Member States: Slovenia and Latvia

6 Cooperation Agreements: Bulgaria, Cyprus, Lithuania, Malta, Slovakia and Croatia. Of which 4 are part of the PECS (Bulgaria, Cyprus, Lithuania and Slovakia)

Canada also takes part in some programmes under a long-standing Cooperation Agreement.

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ESA facts and figures

ESA sites and facilities worldwide map showing locations:
- Salmijaervi (Kiruna)
- Moscow
- Brussels
- ECSAT (Harwell)
- ESTEC (Noordwijk)
- EAC (Cologne)
- ESA HQ (Paris)
- ESOC (Darmstadt)
- Oberpfaffenhofen
- Toulouse
- ESEC (Redu)
- ESAC (Madrid)
- ESRIN (Rome)
- Cebreros
- Washington
- Houston
- Maspalomas
- Santa Maria
- Kourou
- Malargüe
- New Norcia

Legend:
- ■ ESA sites
- ■ Offices
- ■ ESA Ground Station
- ■ ESA Ground Station + Offices
- ■ ESA sites + ESA Ground Station

Purpose of ESA

"To provide for and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications.**"

Article 2 of ESA Convention

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Key reasons for the creation of ESA

- To pool human, technical and financial resources for developing **large space missions**;

- To ensure an industrial policy to develop a **competitive and sustainable** European space **industry**

- To coordinate national, international and European space programs

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Basic Operating Principles of ESA (1/2)

- ESA is an R&D Agency whose key purpose is to develop space missions and **common** infrastructure and ensure a competitive European space industry

- The CONVENTION is ESA's 'law book' – it governs ESA

- ESA activities are of 2 kinds: mandatory (each Member State is obliged to contribute pro rata its GNP) and optional (each Member State chooses to contribute or not, and the level of its financial contribution).

- The mandatory activities include mostly ESA's Scientific Programme, common infrastructure and basic Technology activities. All other programmes (e.g. launchers, Earth observation, Telecoms, exploration, navigation, etc.) are optional.

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Basic Operating Principles of ESA (2/2)

- The development of ESA programmes (scientific missions, satellites, launchers, etc.) is managed by the ESA Executive and implemented by INDUSTRIAL teams.

- Industrial Teams are led by a Prime Contractor (Prime) and composed of Sub-Contractors

- Each Member State's industry participates in an equitable manner with regard to the financial contribution of the Member State (Geo-return)

- Science payloads are generally financed by National Funding (not ESA funding) and scientists carry out the research using the data from the spacecraft.

- Missions shall show a preference to the use of European industry and Launchers (Article VIII of ESA Convention)

Activities

ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity.

* Space science is a Mandatory Activity, all Member States contribute to it according to GNP. All other programmes are Optional, funded 'a la carte' by Participating States.

space science   **human spaceflight**   **exploration**

earth observation   **launchers**   **navigation**

operations   **technology**   **telecommunications**

Key Partners

- **Eumetstat**: Long term cooperation for developing meteorological satellites

- **EU**: For developing Galileo and the Sentinel satellites in the Copernicus programme

- **Telecoms suppliers and operators**: For developing new telecoms platforms and technology

- **National Programmes**: ESA also implements national programmes for those countries unable to do it themselves (e.g. through GSTP or Third Party agreements)

- **National Agencies (e.g. CNES, ASI, DLR, NASA, JAXA...)**: Partners on many missions (e.g. Alphasat, ISS participation...) and providers of scientific payloads

- **Industry**: For implementing our programmes and for sharing risks and investments on several programmes (ARTES, Ariane 6, etc.)
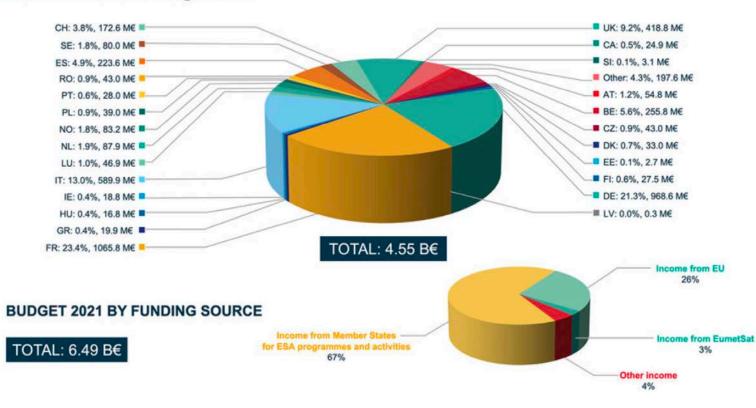
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ESA Budget Overview

BUDGET 2021
ESA Activities and Programmes

CH: 3.8%, 172.6 M€
SE: 1.8%, 80.0 M€
ES: 4.9%, 223.6 M€
RO: 0.9%, 43.0 M€
PT: 0.6%, 28.0 M€
PL: 0.9%, 39.0 M€
NO: 1.8%, 83.2 M€
NL: 1.9%, 87.9 M€
LU: 1.0%, 46.9 M€
IT: 13.0%, 589.9 M€
IE: 0.4%, 18.8 M€
HU: 0.4%, 16.8 M€
GR: 0.4%, 19.9 M€
FR: 23.4%, 1065.8 M€

UK: 9.2%, 418.8 M€
CA: 0.5%, 24.9 M€
SI: 0.1%, 3.1 M€
Other: 4.3%, 197.6 M€
AT: 1.2%, 54.8 M€
BE: 5.6%, 255.8 M€
CZ: 0.9%, 43.0 M€
DK: 0.7%, 33.0 M€
EE: 0.1%, 2.7 M€
FI: 0.6%, 27.5 M€
DE: 21.3%, 968.6 M€
LV: 0.0%, 0.3 M€

TOTAL: 4.55 B€

BUDGET 2021 BY FUNDING SOURCE

TOTAL: 6.49 B€

Income from Member States for ESA programmes and activities
67%

Income from EU
26%

Income from EumetSat
3%

Other income
4%

Source: https://www.esa.int/Newsroom/ESA_budget_2021

ESA BUDGET BY DOMAIN FOR 2021: 6.49 B€*

NAVIGATION
1123.8 M€, 18.9%

PRODEX
62.4 M€, 1.0%

SCIENTIFIC PROGRAMME
557.0 M€, 8.6%

SPACE TRANSPORTATION
1175.8 M€, 18.1%

BASIC ACTIVITIES
274.8 M€, 4.2%

ASSOCIATED WITH GENERAL BUDGET
262.1 M€, 4.0%

HUMAN AND ROBOTIC EXPLORATION
672.1 M€, 10.4%

TELECOM & INTEGRATED APPLICATIONS
436.5 M€, 6.7%

EARTH OBSERVATION
1439.9 M€, 22.2%

TECHNOLOGY SUPPORT
219.4 M€, 3.4%

EUROPEAN COOPERATING STATES AGREEMENT
1.7 M€, 0.0%

SPACE SAFETY
164.1 M€, 2.5%

*includes activities implemented for other institutional partners

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ESA Industrial Policy and Geo-Return Principle

ESA's industrial policy

About 85% of ESA's budget is spent on contracts with European industry.

ESA's industrial policy:

▪ Ensures that Member States get a **fair return** on their investment;

▪ Ensures programmes are implemented in a **cost effective** manner

▪ Improves world-wide **competitiveness** of European industry;

▪ Maintains and develops space technology;

▪ Exploits the advantages of free competitive bidding, except where incompatible with objectives of the industrial policy.

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ESA Industrial Policy has various aspects in addition to geo return!

- Integration of new Member States

- Joint work with (all) Member States

- Industrial audits

- Close dialogue with industry at all levels

- SME Policy, e.g.

    - Training and information

    - Specific AOs

    - Access to ESA technical expertise

- ESA Business Incubation and Technology Transfer Programme

Geo-Return Principle

ESA commits with each of its Member States to return their overall contribution in the form of industrial contracts in its different programmes, and this is monitored at the end of each review period (every 5 years).

The **guaranteed minimum** overall return applies to ESA activities overall, but geo-return is also calculated for domains of activities and for single programmes.

The success of this is monitored and reported via the **Geo-Return statistics** (aka **RC = Return coefficient**).

Calculating geo return

- **General Principle =>** A Member State's overall return coefficient is the ratio of its share of the value of all contracts awarded among all Member States and its total contributions statistics

- In practice, the actual contractual amounts are weighted with a **weighting factor** reflecting the "technological value" of the concerned activities and are compared to the "ideal" amounts calculated on the basis of the country's contribution scales in each programme. (see examples in coming slides)

- The same calculations apply to geo-return per domain and geo-return per programme.

Geo-Return Principle – Weighting Factors

Weighting factors are defined on the basis of the technological value of the activity e.g.

- Development/ operations: 1.0

- Launch complexes: 0.75

- Mechanical Ground segment: 0.5

- Launch Services: 0.25

- Manpower support: 0.25

- Site Services: 0

Geo-Return Principle – highest level

$$\text{Return Coefficient} = \frac{\text{Weighted share of the value of contracts to a country}}{\text{Countries share of the contributions to that programme}}$$

i.e. you get back in the proportion you pay in, once weights are taken into account

(The RC is a measure of how close your Weighted Commitments are to the ideal ratio which is the subscription ratio)

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Structure and Organisation of ESA
Finding your way around...

Structure and Organisation of ESA

1. ESA Organigram

2. The role of boards, council and delegates

3. The PROCUREMENT PROCESS

4. Intellectual Property Rights Policy

ESA Organigrams
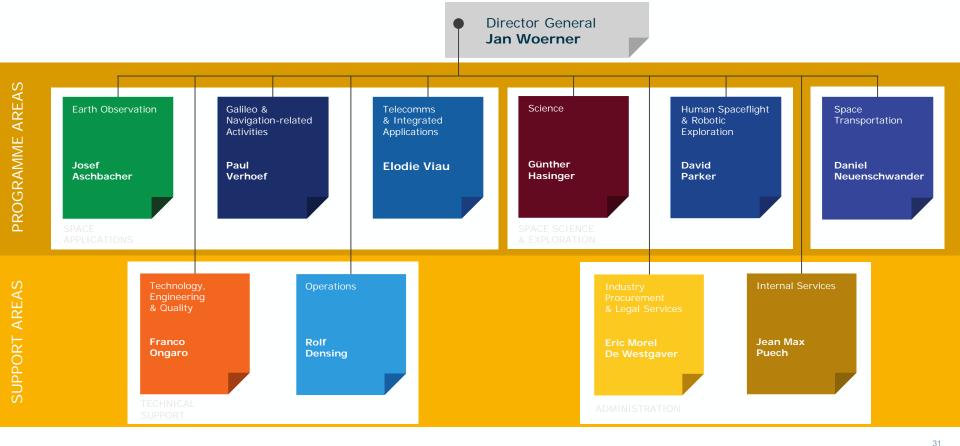
ESA Organigrams

- ESA is organised by Directorates, each headed by a Director who reports directly to the DG

- ESA has 10 Directorates each with a clear role

- 6 Program Directorates (D-EOP, D-SCI, D-NAV, D-HRE, D-STS, D-TIA)
  - These are responsible for the respective programs of: Earth Observation, Science, Navigation, Human Spaceflight and Robotic Exploration, Space Transportation and Telecommunications)

- 4 Support Directorates (D-TEC, D-OPS, D-IPL, D-HIF)
  - See next slide

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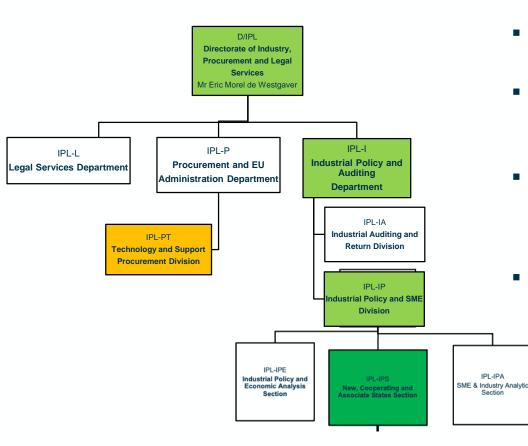
ESA directors as of 01/01/2021

Director General
Jan Woerner

PROGRAMME AREAS

Earth Observation

Josef Aschbacher

Galileo & Navigation-related Activities

Paul Verhoef

Telecomms & Integrated Applications

Elodie Viau

Science

Günther Hasinger

Human Spaceflight & Robotic Exploration

David Parker

Space Transportation

Daniel Neuenschwander

SPACE APPLICATIONS

SPACE SCIENCE & EXPLORATION

SUPPORT AREAS

Technology, Engineering & Quality

Franco Ongaro

Operations

Rolf Densing

Industry Procurement & Legal Services

Eric Morel De Westgaver

Internal Services

Jean Max Puech

TECHNICAL SUPPORT

ADMINISTRATION

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IPL-IP Org Chart (as of 01/01/2021)

- IPL-IPS is responsible for PECS, AM and IIS implementation
- Prime contact point for each country: Day to day questions from delegates and industry
- For Hungary:
  - Giuseppe d'Aquino
  - Stephane Combes
- IPL-IP also has SME, Socio-Economic and Industry analysis functions

The role of boards, council and delegates

Understanding how programmes and activities are approved

Structure and Organisation of ESA
ESA boards, Council and the role of Delegates

The ESA Convention structures the Agency around two organs:
- the Council
- the Director General (DG)
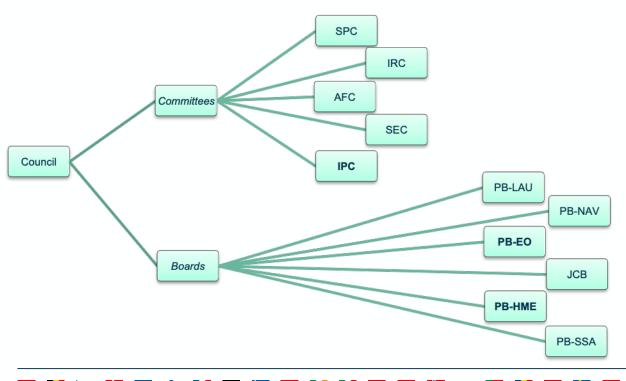
❑ The Council delegates a number of tasks to subordinate bodies (**Committees, Programme Boards**).

❑ Both Council and the subordinate bodies are made up of ESA (The Executive) and representatives of each Member State (Delegates)

❑ The work of the Council is regulated by the rules in the Convention which apply also to subordinate bodies (except AFC, IPC and in part JCB). These are augmented by standard practices that have been established with time.

Role and structure of subordinate bodies

To do its work, Council delegates a number of tasks to subordinate bodies:

→ **Committees** address Agency matters, composed of all Member States.

→ **Programme Boards** address programmes, composed of Participating States with the right to vote.

Horizontal Committees

AFC: dealing with administrative, financial and legal matters

IRC: dealing with international relations issues

IPC: dealing with approval of procurements and industrial policy

SPC: dealing with issues related to the ESA Science programme

SEC: Security Committee

Thematic Programme Boards

See next slide for details

ESA Subordinate Bodies – Thematic Boards

- **PB-LAU:** launcher/space transportation programme (STS directorate)

- **PB-HME:** human and robotic exploration programme (HRE)

- **JCB:** telecommunications and integrated applications programme (TIA)

- **PB-NAV:** navigation programmes (incl. EGNOS, Galileo)

- **PB-EO:** Earth Observation programme (incl. Copernicus)

- **PB-SSA:** Space Situational Awareness programme and now Space Safety Programme (S2P) (TEC, OPS)

The Delegates

Delegates represent their Government and their Industry in ESA.

- Represent the interests and views of the country (Government and Industry) at the ESA Programme Boards and Committees.

- Interact with national technical bodies preparing and supporting ESA programmes.

- Act as contact point with other delegates and industry.

- Ensure good two-way communication with their industry.

- Delegate approval is needed for many ESA activities – you need a good relationship with your delegates

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SUMMARY – USEFUL LINKS

Industry portal

https://www.esa.int/About_Us/Business_with_ESA/

ESA Organs and functioning

https://www.esa.int/About_Us/Law_at_ESA/ESA_s_organs_and_functioning

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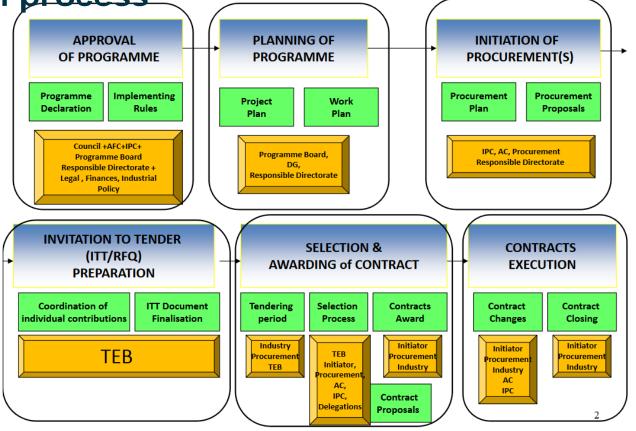
The Procurement Process

Simplified overview of the ESA procurement decision process

Procurement Principles

- ESA's procurements are to be conducted in a transparent, impartial, non-discriminatory manner and avoiding conflicts of interests.

- Competitive tendering is the principle, whilst non-competitive tendering is an exception that can only take place in certain circumstances as defined in the Procurement Regulations.

- Procurement Regulation regulates the execution of ESA activities and programmes

- Available to the Public (EMITS): ESA/REG/001 in "Reference Documentation/ Administrative Documents"

- The requirements contained therein have to be strictly followed by ESA staff and contractors involved in the Agency's procurement actions.

Intellectual Property Rights (IPR) Policy
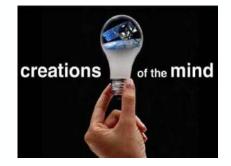
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ESA IPR Policy

The Policy aims at supporting and encouraging the development of European space industry.

General Principle of ESA's IPR Policy :

- Intellectual Property Rights developed **by ESA Staff, belong to ESA.**

- Intellectual Property Rights developed **under Contracts, belong to Contractor.**

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ESA IPR Policy

The Policy aims at supporting and encouraging the development of European space industry.

Central Objectives of ESA's IPR Policy are to encourage:

- Registration of IP from ESA contracts to better protect the contractor's and the Agency's interests;

- Exploitation of IP from ESA contracts, helping the generation of wealth and improving the competitive position of European industry on the worldwide market;

- Reconciliation of the commercial interests of the contractor with those of the Agency, Participating States, research organisations and third parties seeking access to IP.

- Clear identification of BIPR to protect the contractor

creations of the mind

ESA IPR Policy

- facilitating **exchange of scientific and technical information** (exceptions)

- wide **dissemination of scientific results**

- **securing rights of use** to protect ESA interests, those of ESA Member States and those of persons and bodies under their jurisdiction

- Useful link: ESA Industry and Intellectual Property Rights http://www.esa.int/ESA_Multimedia/Videos/2015/03/ESA_Industry_and_Intellectual_Property_Rights

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Technology

Harmonisation
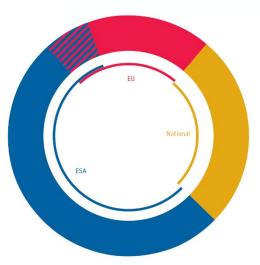
AN OPPORTUNITY...

- TO PROMOTE YOURSELF

- TO UNDERSTAND THE COMPETITIVE LANDSCAPE

- TO UNDERSTAND WHAT DEVELOPMENTS MAY BE COMING / NEEDED

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European Space Technology Harmonisation
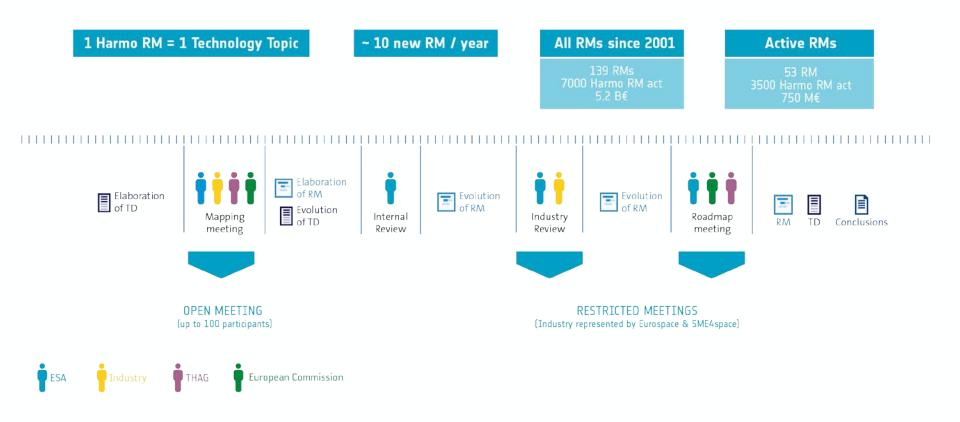
- Fill strategic gaps & minimise unnecessary duplications
- Consolidate European strategic capabilities
- Achieve a coordinated & committed European Space Technology policy & planning
- Contribute to ensuring continuity & coherence between technology & industrial policies

HARMONISATION: PARTICIPANTS

- ESA Member States and Associate Members
- ESA Cooperating States (ECS)
- European Commission
- European Defense Agency
- Eurospace & SME4space
- Industry and Research Organizations

EUROPEAN SPACE TECHNO R&D	800 M€ / Year
ESA TECHNO R&D	410 M€ / Year

7 % ESA Budget

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Harmonisation: From Mapping To Roadmap

1 Harmo RM = 1 Technology Topic

~ 10 new RM / year

All RMs since 2001
139 RMs
7000 Harmo RM act
5.2 B€

Active RMs
53 RM
3500 Harmo RM act
750 M€

Elaboration of TD

Mapping meeting

Elaboration of RM
Evolution of TD

Internal Review

Evolution of RM

Industry Review

Evolution of RM

Roadmap meeting

RM   TD   Conclusions

OPEN MEETING
(up to 100 participants)

RESTRICTED MEETINGS
(Industry represented by Eurospace & SME4space)

ESA   Industry   THAG   European Commission

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Harmonisation: Output

- Roadmaps

- Technical Dossier

- ESTMP (annually) => overview of technology R&D across Europe, including European harmonised roadmaps. It sets out a European vision of technology for the coming years to support decisions of European stakeholders on space technology development.

- A **special brochure edition of the ESTMP** was published just before the Space19+, which was held on 27-28 November 2019. The ESTMP Space19+ brochure edition is publicly accessible and can be found:

  http://www.esa.int/Enabling_Support/Space_Engineering_Technology/Technology_Harmonisation

- 2020 version should be available very soon !

  Hungarian participation in Harmonisation is strongly encouraged. It should be coordinated through the delegation

Any question related to the ESTMP can be sent by email to ESTMP@esa.int.

Understanding AD and TD

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AD and TD – Application Domain

- ESA categorises activities by Application Domains and Technical Domains.
- This is a way to help with harmonisation, coordination, analysis and reporting activities by application area and technology type
- The Application Domains (AD) are denoted be a number and correspond to the following areas or application:

  - **AD1 - Earth Observation (EO)**
  - **AD2 – Telecommunications (TEL)**
  - **AD3 – Navigation (NAV)**
  - **AD4 - Science (SCI)**
  - **AD5 – Exploration (EXP)**
  - **AD6 – Space Transportation (ST)**
  - **AD7 - Generic Technology and Techniques (GEN)**
  - **AD8 – Space Safety (S2P)**

AD and TD - Technical Domains

- The Technical Domains (TD) provide a greater resolution and are more complex than ADs because of the larger range of areas to cover. Each TD has also Sub-domains and Technology Groups

- TD format is : TD#-X-#, E.g. TD1-B-III is Onboard Data Systems, Data management sub-domain, Data Storage group.

- There are 26 TDs each with 1 to 8 sub-domains and up to 5 technology groups. The following slides list them all so that you have them for reference.

For reference the latest technology tree is publicly available at
https://www.esa.int/About_Us/ESA_Publications/STM-277_ESA_Technology_Tree

AD and TD - Technical Domains

TD	TECHNOLOGY DOMAIN
1	**Onboard Data Systems** Addresses both spacecraft data management and payload data processing and covers the hardware and software required for data acquisition, data processing, storage for both payload and spacecraft data, onboard networking and the space-link network layer and above.
2	**Space System Software** Addresses both space and ground segment. All basic techniques and technologies in the fields of software and Information Technology with respect to their application to space missions.
3	**Spacecraft Electrical Power** Addresses the techniques and technologies related to power system architecture, to power generation, distribution and conditioning and to energy storage.
4	**Spacecraft Environments and Effects and debris** Space environmental effects are limiting on all space missions and need to be assessed during all mission phases. Assessment requires the creation of environment models and the knowledge of effects, which is obtained by inflight measurement and testing.
5	**Space System Control** Covers the design and implementation of control systems for space applications. Includes AOCS for satellites; GNC for space vehicles and launchers; pointing acquisition and tracking systems for antennas, laser terminals, and line-of-sight stabilisation equipment.
6	**RF Systems, Payloads and Technologies** Covers all technologies and techniques operating in the RF domain related to satellite systems and networks, spacecraft payloads, instruments and specific ground equipment (see note below), for telecommunication, TT&C, navigation, Earth observation and space science, including security aspects. (Note 6-1: Technologies for control centres, TT&C and Earth Observation Payload Data Transmission Ground Stations and Ground Station Networks are covered in TD12)
7	**Electromagnetic Technologies and Techniques** Covers antennas and related technologies, wave interaction and propagation, and electromagnetic compatibility.
8	**System Design & Verification** Covers technology, methods and tools to support system engineering processes (specification, design, and verification) of space systems during the complete mission lifecycle (phases 0 to F). Focuses on reducing the schedule and/or cost of development of the space system (i.e. space and ground segment) whilst controlling quality and risk (mission success) to the required level. It covers new paradigms (e.g. model-based systems engineering), approaches and techniques for the development of space systems, which are mostly common to several service domains.
9	**Mission Operation and Ground Data Systems** Addresses aspects related to the control and operations of space system elements (satellites, transfer vehicles, orbiters, landers, probes, rovers, etc.) and related ground segments, addressing the technologies associated with supporting systems and tools.
10	**Flight Dynamics and GNSS** Comprises the activities related to the analysis and definition of trajectory aspects of space projects, known as mission analysis. It includes all operational ground activities related to the measurement and control of spacecraft orbit and attitude. Furthermore it deals with the provision of precise navigation services to both ground and space-based users and also the provision of the geodetic reference frame.
11	**Space Debris** Covering all aspects related to knowledge of the meteoroid and debris environment including space surveillance, databases, assessing debris risk levels for current and future missions, reentry of space objects, hyper velocity impacts and protection, and mitigation measures.
12	**Ground Station Systems and Networks** This domain covers all elements and knowhow required for engineering of the facilities that connect the space segment with control centres. The application range covers high performance deep-space stations to networks of small ground stations.

AD and TD - Technical Domains

| TD	TECHNOLOGY DOMAIN
13	**Automation, Telepresence & Robotics** Covers the specification, development, verification, operation and utilisation of space automation systems. Such systems include (1) space robot systems (comprising both arm-based systems for inspection, servicing and assembly of space system infrastructure or payloads and mobile robots for surface exploration on celestial bodies) and (2) space laboratory automation and payload control systems in manned and unmanned missions. (Note 13-1: Detailed mechanisms aspects are covered in TD15)
14	**Life & Physical Sciences** Covers all technological aspects related to instrumentation in support of life and physical sciences, and for ensuring delivery of a complete system (instrument) technology. The objective is an optimised scientific return, the emphasis being rather on a consistent system philosophy than on the development of component technologies. Also includes the technologies and techniques relating to planetary protection, both sterilisation methods and technologies, and also system technologies needed to monitor contaminants.
15	**Mechanisms** All devices with moving parts (e.g. actuators, hold-down & release devices, pointing mechanisms, deployable booms, thrust vector control mechanisms); associated specific disciplines (such as tribology and pyrotechnics) and tools (such as mechanism and magnetic simulations).
16	**Optics** Addresses technologies and techniques for systems, instruments and components, as well as design, engineering and verification methods, in the field of optics.
17	**Optoelectronics** Covers the development and application of technologies combining photonics (i.e. circuits handling photons) with electronics to achieve given functions.
18	**Aerothermodynamics** Dynamics of gases (physical processes & modelling), especially of atmospheric interactions with moving objects at high speed. It encompasses the whole spectrum from takeoff to landing, but also orbital ascent/descent, aeroheating and thermodynamics of propulsion.
19	**Propulsion**
20	**Structures** Technologies and methodologies related to design, analysis, manufacture and test of structures and mechanical systems for S/C, planetary infrastructures, habitats, launchers and reentry vehicles. Includes metallic and non-metallic structures such as advanced deployable structures (solar array, radiator, shield and antenna structures), highly-loaded structures, highly-stable structures and hot structures.
21	**Thermal** Covers all technologies needed for the thermal control of space systems.
22	**Environmental Control & Life Support (ECLS) and In Situ Resource Utilisation (ISRU)** Covers all technologies for controlling, maintaining and supporting human presence in space and the utilisation of local resources.
23	**EEE Components and Quality** Covers technologies related to the design, production and testing of EEE components which meet the performance and reliability requirements for use in onboard electric/electronic systems. (Note 23-1: This technology domain is concerned with quality issues; specific design issues are covered by the respective TD)
24	**Materials and Processes** Covers the materials mechanics and processes, their physical and chemical behaviour and the interaction with the operational environment through the S/C and ground infrastructure lifecycle. Furthermore, all manufacturing processes are covered.
25	**Quality, Dependability and Safety** Covers the quality, reliability, availability, maintainability and safety of space systems and their constituents (hardware, software and the human element). It also addresses methods and tools for the assessment and management of technical risks associated with space systems and their operations.
26	**OTHERS**

AD and TD Technical Domains
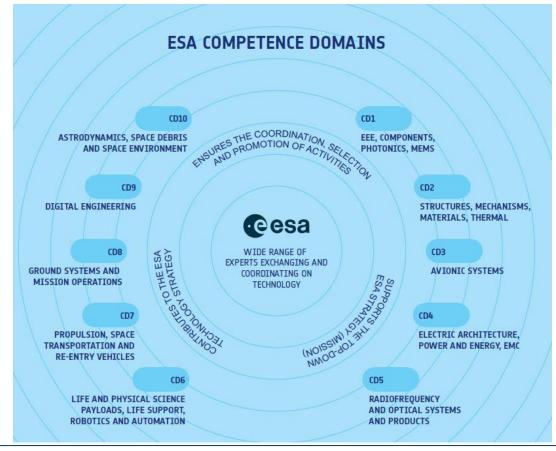
Example full TD – TD5

5	Space System Control					
	Covers the design and implementation of control systems for space applications. Includes AOCS for satellites; GNC for space vehicles and launchers; pointing acquisition and tracking systems for antennas, laser terminals, and line-of-sight stabilisation equipment.	A	Control Systems Engineering Covers system aspects and AOCS/GNC functional chain engineering.	I	AOCS/GNC Architecture Includes concept and mode definition, and selection and accommodation of sensors and actuators.
				II	Autonomy and FDIR Covers control-related aspects and implementation (with TD2 and TD9-B).
				III	Pointing Error Engineering Covers budget methodology and tools.
				IV	Control Requirements Engineering Includes software algorithm specification (with TD2) and sensor and actuator specification.
				V	Control Design and Verification Includes detailed analysis and performance verification on functional engineering simulators and avionic test benches.
		B	Control Systems Innovative Technologies Covers enabling technology developments dedicated to specific missions and generic applications.	I	GNC Technologies for Entry, Descent and Landing Covers GNC technology developments for aerobraking, precision landing, hazard avoidance, realtime guidance and navigation, specialised simulation tools and test beds.
				II	GNC Technologies for Cruise, Rendezvous and Docking or Capture Covers GNC technology developments for exploration as well as active debris removal.
				III	High Accuracy Pointing Technologies Covers technology developments in AOCS and pointing acquisition and tracking systems.
				IV	Competitive AOCS Technologies For commercial and generic applications, tackling cost reduction at all levels (design and verification effort, building-block approach, hybridisation of sensors, ...).
		C	Control Techniques and Tools Covers generic and advanced techniques dedicated to design analysis and verification.	I	Modelling Techniques Covers mathematical modelling and software model development for: satellite dynamics and environment, sensors and actuators, and software components.
				II	Advanced Control, Estimation & Optimisation Covers the development of efficient techniques and tools for design analysis and verification.
				III	Multidisciplinary Optimisation Includes the development of mathematical solvers and tools for concurrent optimisation of GNC-related aspects of the space vehicle and trajectory.
		D	AOCS/GNC Sensors and Actuators Covers the specification and development of generic and custom products based on mission and market needs.	I	AOCS/GNC Optical Sensors Startrackers, Sun and Earth sensors, optical navigation sensors. Includes detectors (with TD17-B), optics (with TD16), microelectronics (with TD1-C), electronics, image processing, software algorithms.
				II	AOCS/GNC Inertial and Magnetic Sensors Gyros, acceleros, IMUs, magnetometers. Includes MEMS, HRG, FOG technologies, control loops and hybridisation, microelectronics (with TD1-C), electronics.
				III	AOCS/GNC Inertial and Magnetic Actuators Reaction wheels, CMGs, magnetic torquers). Includes control loops, mechanisms & tribology (with TD15-F/G), power electronics (with TD3-D), microelectronics (with TD1-C).

ESA COMPETENCE DOMAINS

WIDE RANGE OF EXPERTS EXCHANGING AND COORDINATING ON TECHNOLOGY

ENSURES THE COORDINATION, SELECTION AND PROMOTION OF ACTIVITIES

SUPPORTS THE TOP-DOWN ESA STRATEGY (MISSION)

CONTRIBUTES TO THE ESA STRATEGY (TECHNOLOGY)

CD1 — EEE, COMPONENTS, PHOTONICS, MEMS

CD2 — STRUCTURES, MECHANISMS, MATERIALS, THERMAL

CD3 — AVIONIC SYSTEMS

CD4 — ELECTRIC ARCHITECTURE, POWER AND ENERGY, EMC

CD5 — RADIOFREQUENCY AND OPTICAL SYSTEMS AND PRODUCTS

CD6 — LIFE AND PHYSICAL SCIENCE PAYLOADS, LIFE SUPPORT, ROBOTICS AND AUTOMATION

CD7 — PROPULSION, SPACE TRANSPORTATION AND RE-ENTRY VEHICLES

CD8 — GROUND SYSTEMS AND MISSION OPERATIONS

CD9 — DIGITAL ENGINEERING

CD10 — ASTRODYNAMICS, SPACE DEBRIS AND SPACE ENVIRONMENT

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The Accession Flow

ESA path to Membership and Status

| In principle 5 years renewable | 5 years renewable | 7 years renewable | Transition 8 years, extend by up to 4 years |

Cooperation Agreement
- Malta (2012-2022)
- Croatia (2018-2023)

→ Exchange of information
→ Implementing arrangements for specific projects

Plan for European Cooperating States (PECS)
- *Latvia (2013-2020)*
- Lithuania (2014-2021)*
- Slovakia (2015-2022)*
- Bulgaria(2016-2022)**
- Cyprus (2017-2022)

→ Education and Technology development activities
→ No direct access to ESA tenders
→ Open Call Restricted Tenders
→ Further familiarisation with ESA working processes

Associate Member (AM)
- Slovenia (2016-2024)
- Latvia (2020 – 2027)
- *Lithuania (2021 – 2028)*

→ Participation in ESA optional programmes via competitive tenders
→ Requesting Party Activities

New Member State (NMS)
- Romania(2011-2023)
- *Poland (2012-2019)*
- Estonia (2015-2024)
- **Hungary (2015-2021)**

→ Participation in ESA mandatory and optional programmes
→ Integration Period with a dedicated Task Force
→ Industry Incentive Scheme (IIS): Open Call and Top Down Roadmaps

*PECS extended pending attempt to become AM
**Second 5 year PECS expected
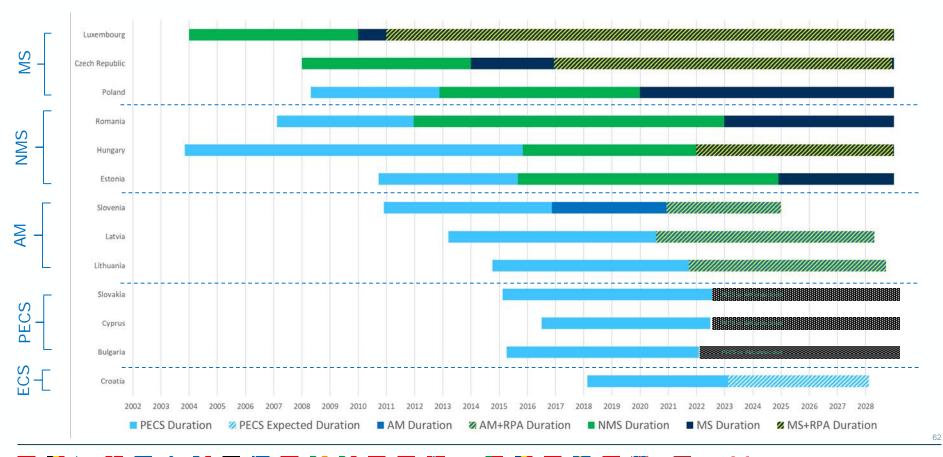
Generalised Accession Flow

- Only adopted in Dec 2018
- Applicable to states new to that step
- Steady increase in services and increased progress towards industry and towards Mandatory activities.
- Key assessment points (Country Status Reports)
- Increased durations over pre-Dec 2018
- No need to progress beyond any step – option to remain at that step
- Takes into account lessons learnt of last 15 years – aimed to ensure highest possibility of successful integration

PECS/AM/NMS Timeline

Plan for European Cooperating States (PECS)

→ PECS

→ Prepares ECS for Associate membership or full ESA membership through industrial and academic development, education and outreach activities.

→ Facilitates the participation of ECS in ESA scientific activities on the payload side

→ Programme management similar to NMS Industry Incentive Schemes since end 2011:
- Competitive Calls for Outline Proposals published in EMITS
- ESA Tender Evaluation Board (TEB)
- With reviews by experts from pertinent ESA Directorates
- After the TEB, a final programmatic review, to ensure alignment with national interests is carried out with the Delegation.

→ Annual reviews of the progress of the activities carried out in the ECS. Limited access to ESA Technical Officers

→ Involvement of other entities in existing member states (e.g. LSI/ potential customers….) is encouraged. Limited to a 'support' or 'customer' role and 20% of the total contract value.

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Associate Member States (AM)

→ 70% of NMS mandatory and full member contribution for AS over 7 year period, with a status review at the end of the period regarding possible progression to NMS and the option to remain an AS (review every 2-10 years).

→ **Participation in ESA Optional Programmes**. No voting rights on mandatory activities.

→ Optional "Incentive Scheme" through a **Requesting Party Activity (RPA) scheme**, up to 50% of the optional programme contribution but at a minimum 500 k€ per year. Aim is to ensure Geo-return in the optional programmes, prepare for mandatory programmes and prepare to subscribe to new optional programmes.

→ Goal is to allow the AM to participate in ESA optional programmes best suited to the capabilities already existing in the state, improving the chances of good return in mandatory programmes if the state eventually chooses to accede to full Member State status.

→ Approval process for activities through a TEB, the ESA+AM TF (as in PECS and NMS) and through consultation with the Industrial Policy Committee (IPC).

→ ESA provides consultation and support for companies, with training for industry and the delegation (e.g. proposal writing, ECSS standards etc.).

NMS Industrial Incentive Scheme (IIS)

→ 45% mandatory contribution for IIS during NMS transition (typically 5-8 yrs) with minimum of 500k Euro/ yr.

→ Goal of IIS is to adapt local industry to be competitive in the **space industry**, and integrate into ESA supply chain ensuring Geographical Return, especially for the **Mandatory programme**.

→ NMS-ESA Task Force oversees IIS, with representation from all ESA directorates

→ IIS follows a Bottom-Up (Open Call with standard ESA tools and procedures) or Top-Down (targeted activities with competition restricted to NMS) Approach

→ All activities pass through a TEB, with technical reviews by ESA and Programmatic assessment by NMS-ESA TF

→ IIS also includes:
- Training activities and briefings to industry
- Workshops and industry days
- Day-to-day assistance
- Debriefings to unsuccessful companies
- Measures to hire ESA staff and YGTs from the NMS

→ **Involvement of end customers/ partners (including LSI) is STRONGLY encouraged**

Requesting Party Activities (RPA)

Aim of a Member State or Associate Member's participation in RPA

- to **complement ESA optional programmes** with activities falling outside their nominal scope,

- to aid **implement** a holistic **national space policy**,

- to ensure wide **support to the country for space development** funding,

- to give the best chance of **securing the geographical return** from ESA programmes by **increasing the capabilities and experience** of national space industry to an appropriate level.

Typical Activity Types:

- Funding Low TRL preparatory activities (e.g. **TRL 1-3**) e.g. to prepare for entry to **new ESA programmes**;

- Flight opportunities/ demonstrations

- **Research and Development** (Technology Demonstrations to enter new Agency optional programmes, (**TRL 3-6**), i.e. excluding those programmes already subscribed to;

- **Industrial Process Development** and qualification/ certification which give competitive advantage, are specific to space and relevant to the Agency optional programmes;

- Downstream applications - entry into customers supply chain, TRL 5-8

- Space science payload funding (e.g. to contribute payloads to the Agency's science missions);

- Space science activities resulting in scientific papers

- Education: Building university courses to answer to national space industry needs and provide a ready, capable workforce;

Hungary as a NMS
- status summary

Hungary – general country overview

Integration process:
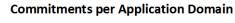
- PECS period: 2003-2015 (122 projects, 21 M€ of contracts)
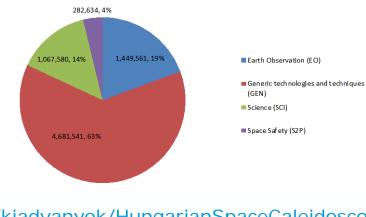
- NMS period: November 2015 – December 2021 (6 years)

  - Hungary Industry Incentive Scheme (HIIS): ~11 M€ of contracts

  - Open call: 16 submission deadlines/evaluations

  - 37 contracts

  - Space directory:

    https://www.mant.hu/kiadvanyok/HungarianSpaceCaleidoscope2020.pdf

Commitments per Application Domain

282,634, 4%
1,067,580, 14%
1,449,561, 19%
4,681,541, 63%

- Earth Observation (EO)
- Generic technologies and techniques (GEN)
- Science (SCI)
- Space Safety (S2P)
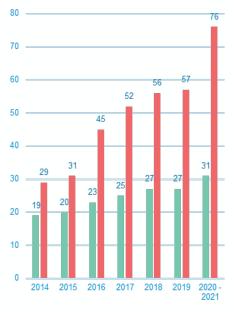
Growth in ESA STAR registrations since the accession to ESA

	2014	2015	2016	2017	2018	2019	2020-2021
Academia	19	20	23	25	27	27	31
Industry	29	31	45	52	56	57	76
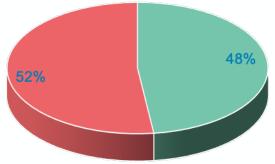
Hungary – IIS implementation status

HIIS Status

- Total Used Budget
- Available budget

32%
68%

Activities

- Ongoing Activities
- Closed Activities
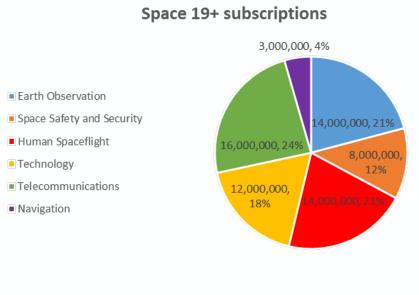
48%
52%

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Hungary – subscriptions at Space 19+

Space19+ Optional programme subscriptions

- EO – 14 M€
  - FutureEO   7M€
  - Copernicus segment 4   7M€
- S2P – 8 M€
  - Core activities   5.5M€
  - Lagrange mission   2M€
  - Hera   0.5M€
- HRE E3P – 14 M€
  - Humans in LEO   6M€
  - Humans beyond LEO   4M€
  - Mars Robotic Exploration   2M€
  - ExPeRT   2M€
- GSTP - 6 M€
  - Element 1   2M€
  - Element 2   2M€
  - Element 3   1M€

Space 19+ subscriptions

3,000,000, 4%

14,000,000, 21%

8,000,000, 12%

16,000,000, 24%

12,000,000, 18%

14,000,000, 21%

- Earth Observation
- Space Safety and Security
- Human Spaceflight
- Technology
- Telecommunications
- Navigation

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Hungary – subscriptions at Space 19+

Space19+ Optional programme subscriptions

- ARTES – 16 M€
    - Future Preparations   1M€
    - Core Competitiveness,   4M€
    - Business Applications   3M€
    - Space for 5G   2M€
    - 4S   3M€
    - Scylight   3M€
- NAVISP – 3 M€
    - Elements 1   1M€
    - Element 2   1M€
    - Element 3   1M€
- PRODEX – 8 M€

Space 19+ subscriptions

- Earth Observation
- Space Safety and Security
- Human Spaceflight
- Technology
- Telecommunications
- Navigation

3,000,000, 4%
14,000,000, 21%
8,000,000, 12%
14,000,000, 21%
12,000,000, 18%
16,000,000, 24%

How and Where to find information

→ THE EUROPEAN SPACE AGENCY
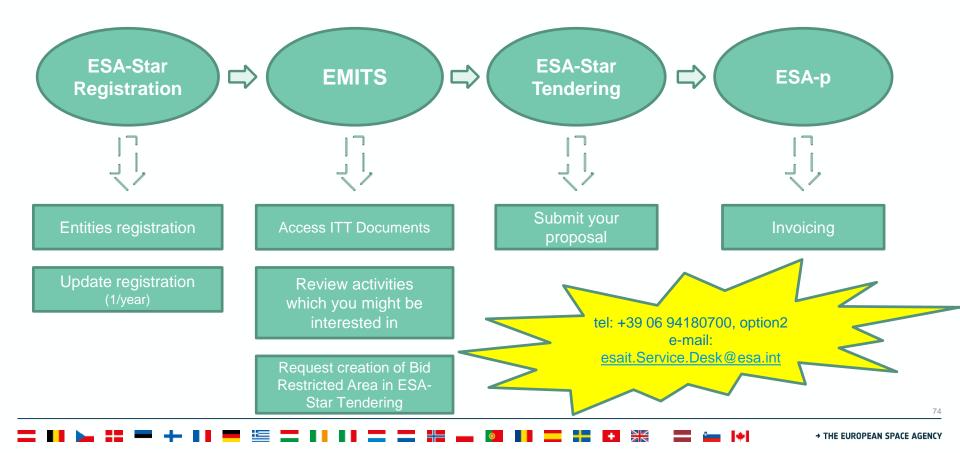
How and where to find information
ESA electronic procurement tools

ESA-Star Registration → **EMITS** → **ESA-Star Tendering** → **ESA-p**

ESA-Star Registration	EMITS	ESA-Star Tendering	ESA-p
Entities registration	Access ITT Documents	Submit your proposal	Invoicing
Update registration (1/year)	Review activities which you might be interested in		
	Request creation of Bid Restricted Area in ESA-Star Tendering		

tel: +39 06 94180700, option2
e-mail:
esait.Service.Desk@esa.int

How and where to find information

- **ESA Star** (https://esastar-emr.sso.esa.int/)

*ESA's online System for **Tendering** and **Registration** – is the electronic Tendering interface for ESA and its external partners.*

- **esa-star / Registration** (entity registration and management)
  - "Light" Registration: all transactions except contract award
  - "Full" Registration: contract award and invoicing
  - SME status claim and validation
- **esa-star / Tendering** (used for the tendering process)

> **All entities** wishing to do business with the Agency **MUST** register as "Potential Bidders"

- **EMITS** (http://emits.sso.esa.int/emits/owa/emits.main)

ESA's web-based system for publishing Invitation-to-Tenders (ITT).

- public part
- non-public part (including tendering documentation etc)

- **ESA-P** (esa-p.sso.esa.int)

  *ESA's portal for the supplier once a Contract is signed with ESA. It covers all financial aspects (invoicing/payments) => **access ONLY when you have a contract with ESA.***

How and where to find information
ESA Star - registration

ESA-STAR Registration (https://esastar-emr.sso.esa.int/)

Registration on **ESA-STAR** is a pre-requisite for all entities wishing to do business with ESA.

Without an **ESA-STAR** registration (ESA Entity Code) there is **NO** access to the ITT documents in **EMITS**.

User ID and password will be given to you after the **ESA-STAR** registration is validated by ESA.

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How and where to find information
ESA Star - registration

Click here to register or edit your registration

| ENTITIES | LOGIN | ESA Home Page | Industry Information | Entity Registration | Service Desk | Help |

Click on "new registration" and then on "start"

esa-star registration

extranet

| 15 Mar 2016 | ESA Home Page | EMITS | ESA Industry Portal | Contact Us | Help |

You may download the user manual on "Help"

Home

▶ New Registration

Start

Resume

Maintain Entity Information

ESA Entities Directory

NEW REGISTRATION

? Please select one of the two options:*

○ **?** A. I am an Entity that has the capacity as "legal entity"

○ **?** B. I am a Business Unit acting on behalf of a "legal entity", without being entitled to commit on contracts on my own

Close   Next Section

How and where to find information
ESA Star - registration

To become a "Registered Entity" with ESA (1/2):

1. The first step is to check whether your organisation is currently registered as an "Entity" and/or a "Business Unit" belonging to an existing Entity. A Business Unit shares the same VAT number with the main Legal Entity.

2. If not, you can register your entity by completing the ESA on-line questionnaire and submitting your entry for validation.Please mention if you have SME Status (Small and Medium sized Enterprises, definition from the EC). The status gives you access to certain procurement conditions.

How and where to find information
ESA Star - registration

To become a "Registered Entity" with ESA (2/2):

3. You may carry out your registration in 2 steps:
   - ❑ **"Light" registration** awarded after entity nationality verification.
   - ❑ Will grant access to all ESA-STAR and EMITS services (i.e Access ITT, upload offers you are allowed to bid for in relation to your entity nationality).
   - ❑ **"Full" registration:**
   - ❑ The award of ESA contracts requires a **"Full"** registration.

4. Once registration is validated, IDHelp will provide you details for accessing EMITS.

How and where to find information
ESA Star - registration

Registration in ESA-STAR is essential!

To register in ESA-STAR:

Go to https://esastar-emr.sso.esa.int/

Detailed information in:
https://esastar-emr.sso.esa.int/Account/Register

Support information in ESA-STAR Registration User Manual:
https://esastar-emr.sso.esa.int/Account/DownloadFile

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How and where to find information
EMITS – Electronic Mail Invitation to Tender System
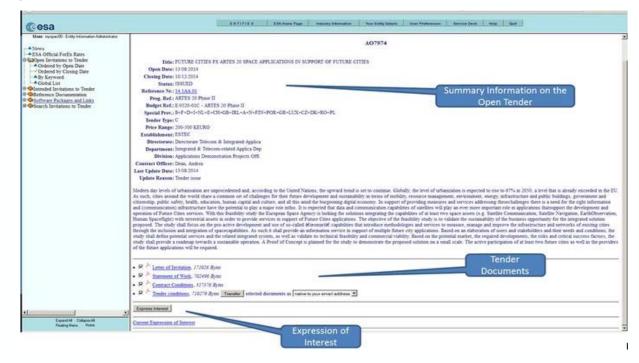
ESA's web-based system for publishing Invitation-to-Tenders (ITT). It includes:

- A list of **intended ITTs** for Open Competitions: potential Tenderers may declare their interest and see which companies did the same.

- Many technical, administrative and contractual standards and documents (e.g. PSS-A forms, ESA GCC, engineering standards etc).

- Open Competitive **ITTs**, Direct Negotiation and Restricted Competition

- Competitive ITTs published by other entities under ESA Best Practices scheme

- NEWS – Consultations to industry, Announcements, etc.

- Companies can see the tender documents in case :

  - Participating country in open competition,

  - Direct negotiation with the company,

  - For restricted tenders, if they are a company addressed by ESA.

How and where to find information
EMITS – Expression of Interest

To be notified of changes, updates and clarifications of the call, you MUST express your interest by ticking the appropriate box.

How and where to find information
EMITS – User Preferences

We advise you to set up your preferences regarding which ITT's you would like to be notified of:

Click here to set up your notifications preferences

How and where to find information
EMITS – User Preferences

How and where to find information
ESA Star - Tendering

ESA-STAR Tendering (https://esastar.sso.esa.int/)

Once you are registered in **ESA-STAR Registration**, you can access **EMITS**.

When you find an ITT in **EMITS** for which you want to bid, you need **ESA-STAR Tendering**

In **EMITS** you request the system to create a dedicated work area (the Bidder's Restricted Area in ESA-STAR) where you can:

1. submit clarification and extension requests up to the deadlines set by ESA.

2. upload and submit offers to ESA.

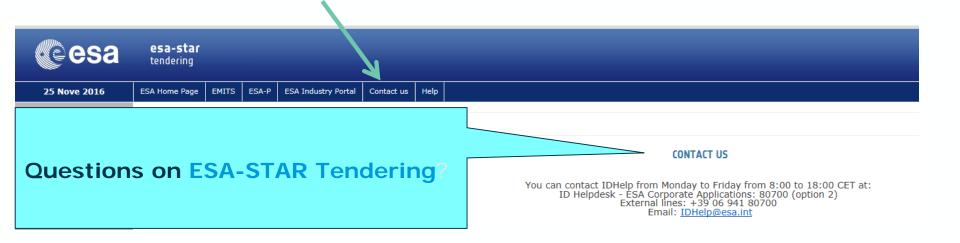3. recall your proposal at any time before the closing date.

Video: http://www.esa.int/spaceinvideos/Videos/2016/03/Bidder_Restricted_Area_creation_and_structure

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How and where to find information
ESA Star - Tendering

Video: http://www.esa.int/spaceinvideos/Videos/2016/03/Offer_Preparation_and_Submission

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Ways to prepare and other sources
Doing your homework….

- EMITS
    - Check EMITS regularly (all ITTs are announced via EMITS)
    - Technical documents, standards
    - Notifications preferences

- ESA Technical Officers and Technical support, country desk
    - Consultations
    - Technical support
    - Network/partners

- National Delegation
    - Access to ESA Programme documents (Work Plans)
    - Contact with ESA (country/industry – ESA)

- Industry Days (in ESA, in country, programme specific)

- Harmonisation (coordinated by Delegation)

- ESA conferences (state of the art, promotion, networking)

Do not hesitate to **contact ESA** if you have questions regarding planned ITTs (IITTs): this is allowed until the actual ITT is issued

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New esa star modules - esa match overview

esa-match: OBJECTIVES

- support entities in their **networking and visibility efforts** and help them **showcase their products, services and experience**
- **facilitate partnering, teaming and cooperation between companies,** especially SMEs, and key partners and customers
- **bring together (potentially unknown) products or services and (latent) needs**
- help entities to become involved in **ESA programmes** and **develop their space business**

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esa-match: ACCESS RIGHTS

- All entities registered in **esa-star Registration** from ESA Member States, Associate States, Cooperating States and EU Member States are provided with an "Entity Profile"
- The application is accessible to:
  - **Guest users**: without the need to log-in. Only the public part of esa-match is available (the public part of the esa-match Directory)
  - **esa-star registered entities and associated users** (access to the internal part of esa-match, including the Directory, the Marketspace, the Tenders area and the Match area)
- All entity users can view their entity details, search inside the list of all available ESA and industry tenders in open competition and find potential partners for a specific bid
- Users with the "**esa-match Responsible role**" can manage their entity's profile, define the level of visibility for their own company data to any other entity and to ESA and assign the "esa-match Conversation manager" role.
- Users with the "**esa-match Conversation manager role**" can manage the publication of an entity's Ads in the Marketspace as well as communications with other entities.

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esa-match: INTERNAL HOMEPAGE (for registered users)

➤ The internal part of the application can be accessed by **registered entity users**. A log-in is required.

esa-match: FEATURES (for registered users)

- **esa-match profile pages for each Business Unit + Legal Entity**
  - Competences & Capabilities
    - Technology Tree and Product Tree information (link to ECM, Harmonization tool)
    - Products and Services (incl. descriptions, multimedia resources, product sheets, etc)
    - Testing & Manufacturing facilities and labs
  - Experience (ESA contracts, other projects and studies [non-ESA]); Certifications
- **esa-match Directory**
  - to find entities. Option to filter, display them on a map, etc
- **Marketspace**
  - entities can place "ads" (and link them to tenders)
  - "I'm looking for" + "I offer"
- **Tenders area**
  - entities can search Tenders and ESA Interacts (new ESA Publication feature)
  - area to find suitable "matches" (depending on competences set, country, etc)
- **"Lounge area"** (communications area)
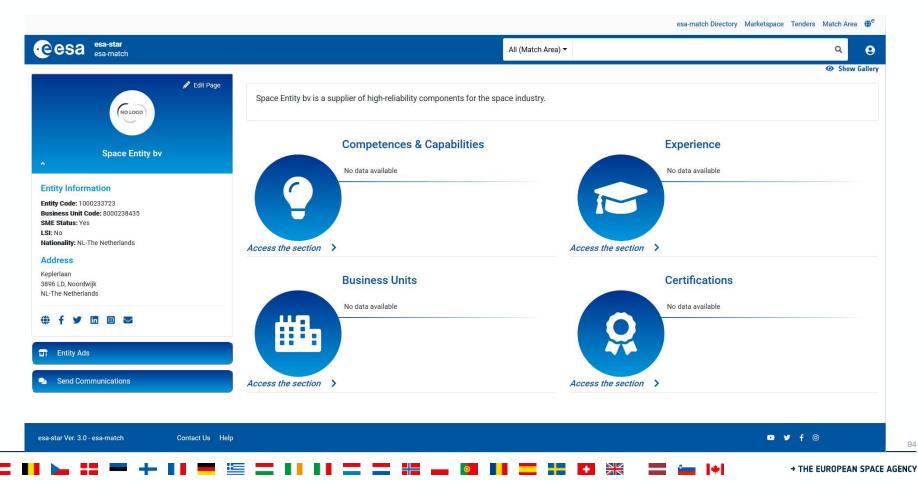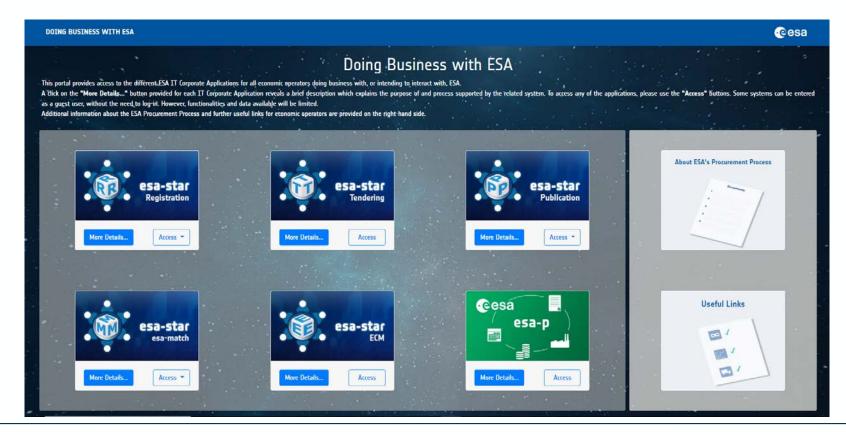 - for messages between industrial entities

esa-match Directory

Marketspace

Tenders

→ THE EUROPEAN SPACE AGENCY

esa-match: ENTITY PROFILE PAGE

esa-star
esa-match

All (Match Area) ▾

Show Gallery

✎ Edit Page

NO LOGO

Space Entity bv

Space Entity bv is a supplier of high-reliability components for the space industry.

Entity Information

Entity Code: 1000233723
Business Unit Code: 8000238435
SME Status: Yes
LSI: No
Nationality: NL-The Netherlands

Address

Keplerlaan
3896 LD, Noordwijk
NL-The Netherlands

🗖 Entity Ads

💬 Send Communications

Competences & Capabilities

No data available

Access the section ❯

Experience

No data available

Access the section ❯

Business Units

No data available

Access the section ❯

Certifications

No data available

Access the section ❯

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NEW PORTAL: DOING BUSINESS WITH ESA

→ Providing access to all IT Corporate Applications

TRAINING AND INFORMATION MATERIAL

- **Training materials** and a **user manual** will be available online at the go-live of the system

- **Introductory sessions** for industry will be offered as webinars in mid to late April 2021 after the system is live

→ **go-live of esa-match: 23 March 2021**

- more information is available here

- watch the esa-match animation here

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Esa match video

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Proposal writing
Check list

Proposal writing – common mistakes

During this presentation we will draw your attention to common mistakes and oversights in proposals. It is not a prescriptive 'do it like this' list and the material must be sensibly applied to your particular case.

There is no substitute for a good idea – this presentation will only help you to present your idea in a way it can be understood by reviewers.

This presentation will only help you to present your idea in a way it can be understood by reviewers.

Please ensure that your Proposal is compliant with the ITT conditions of tender and cover letter – each ITT can be different.

REMEMBER: ESA is only allowed to evaluate what is in the proposal – do not assume that the reviewers have "your common knowledge" or that "it is commonly known". We cannot evaluate intentions, "read in-between-the-lines" or guess what you mean. We are only allowed, outside of the proposal, to consult EMITS or other ESA internal information.

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Proposal writing – check list (open calls)

Technical Criteria

- Is your objective clearly stated, short and to the point?
- Are your requirements quantified and verifiable?
  - Will they show, when fulfilled, that the objective was achieved?
- Is your Baseline concept/ design well described?
- Does your program of work include all the needed design and development steps?
  - Does it include reviews, key testing and validation?
- Are the text, flowchart, Work Package Descriptions and Gantt chart consistent?
- Are your experience, key personnel and facilities described and tailored to the needs of your project?
  - In case of gaps in these, has a plan to acquire them been included?
- Is your WBS logically structured following the work flow?
  - Does it include a WP for management?
  - Does each company have separate (sub)Work Packages?
- Do your WPDs include sufficient detail to understand the full scope of the work?

Programmatic Criteria

- Have you chosen the right activity type among those of the cover letter?
- Do you meet the associated programmatic constraints? Have you identified which?
- Is your objective not a duplication of ESA planned or ongoing activity?

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Proposal writing – check list (open calls)

Management Criteria

- Is the management plan well defined?
  - Does it show how you manage your project, including subcontractor aspects?
  - Does it identify a single Project Manager in direct communication with ESA?
  - Are the role and responsibilities of all Key Personnel clear?
- Is your planning detailed enough?
  - Are the dependencies identified?
  - Does it match the WPD?
- Is the costing credible?
  - Are the hours justified by the described scope work in WPD?
  - Are all procurement items and trips well described and justified?
- Are the deliverables complete and well defined?

Contractual Criteria

- Have all elements been included (Cover Letter, PSS Forms) and signed?
- Are all the sections of the Proposal Template addressed, with no changes to the template and are you within the page limit?
- Are the IPR well addressed?
  - Is the BIPR described and are the effected deliverables listed?
  - Is it clearly described who will own the foreground IPR?

request a **debriefing** following an unsuccessful proposal submission: this will help to improve the quality of subsequent tenders

Business with ESA
Key web sites / contacts

For more information visit the ESA Industry and SME Portals:

www.esa.int/About_Us/Business_with_ESA

learninghub.esa.int

and/or follow us on Twitter: **@ESA, @ESAforSME**

Contact ESA's SME Policy Office : **SME-Office@esa.int**

Contact ESA's NMS Hungary contact points: **Giuseppe.daquino@esa.int, Stephane.combes@esa.int**

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ESA PROGRAMMES

ESA Programmes Overview and Hungary

Mandatory Activities

- Science Programme (CTP and Science missions)
- Basic activities (DPTD, TTP, SME, Education…)

Optional Programmes

- General Support Technology Programme (GSTP)
- **Advanced Research in Telecommunication Systems (ARTES)**
- Navigation Innovation and Support Programme (NAVISP)
- **Earth Observation (EOP)**
- **Space Safety (S2P)**
- PRODEX
- **European Exploration Envelope Programme (E3P)**

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TECHNOLOGY

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Technology Programmes: Objectives

- **Enabling** missions of ESA and national programmes by developing technology

- Supporting the **competitiveness** of European industry

- Fostering **innovation** by creating new products

- Improve European **technological non-dependence** and the availability of European sources for **critical technologies.**

- Facilitate **spin-in** from outside the space sector

ESA Technology Programme Landscape

	TDE	CTP	GSTP	ARTES CC	ARTES Scylight	Future EO	SciSpacE	ExPeRT	NAVISP	FLPP
TRL 9 — Actual system "flight proven" through successful mission operations										
TRL 8 — Actual system completed and accepted for flight ("flight qualified")										
TRL 7 — Model demonstrating the element performance for the operational environment										
TRL 6 — Model demonstrating the critical functions of the element in a relevant environment										
TRL 5 — Component and/or breadboard critical function verification in a relevant environment										
TRL 4 — Component and/or breadboard functional verification in laboratory environment										
TRL 3 — Analytical and experimental critical function and/or characteristic proof-of-concept										
TRL 2 — Technology concept and/or application formulated										
TRL 1 — Basic principle observed and reported										
	TDE	**CTP**	**GSTP**	**ARTES CC**	**ARTES Scylight**	**Future EO**	**SciSpacE**	**ExPeRT**	**NAVISP**	**FLPP**
Managed within ESA by	*TEC*	*SCI*	*TEC*	*TIA*	*TIA*	*EO*	*HRE*	*HRE*	*NAV*	*STS*

- **TDE** - Technology Development Element
- **CTP** - Science Core Technology Programme
- **GSTP** - General Support Technology Programme
- **ARTES Core Competitiveness** - Advanced Research in Telecommunications Systems
- **ARTES Scylight** – Secure and laser communication technology
- **Future EO** - Earth Observation Envelope Programme
- **SciSpacE** - Science in Space Environment
- **ExPeRT** - Exploration, Preparation, Research and Technology
- **NAVISP** – Navigation Innovation and Support Programme
- **FLPP** - Future Launchers Preparatory Programme

Basic activities

Optional (subscription based)

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Discovery, Preparation and Technology Development

- Part of **Basic Activities** in Mandatory Programme

- Discovery & Preparation funds studies to gather knowledge in **all areas of space technology and research**. Through these studies, it supports other ESA directorates, as well as ESA's future activities. For a variety of ideas and inputs, Discovery & Preparation encourages **small companies and universities** to participate in these studies, as a new view on old problems often triggers astonishing results.

- Discovery includes 3 types of activities:

    - **Studies**: precursor for technology development or to assess the feasibility of systems for space

    - **Early technology projects**: novel, low Technology Readiness Level activities of potential interest to space applications (ex ITI)

    - **Co-funded research** activities with Universities (ex NPI)

- Preparation includes **Mission studies**: pre-Phase A, feasibility studies or system studies to support the development of future missions.

- Discovery & Preparation publishes open invitations to tender in the EMITS system on a regular basis. Your ideas for new activities are also sought via the Open Space Innovation Platform (OSIP).

- **Technology Development** (ex-TRP) is workplan based (every 2 years): on EMITS, 2021-22

GSTP – GENERAL SUPPORT TECHNOLOGY PROGRAMME

GSTP: General Support Technology Programme

GSTP is a technology programme aiming at **bridging the development gap** between early technology and in-flight demonstration.

ESA Member States (all 22, but also Canada and Slovenia) contribute yearly about 200M€ to the GSTP programme.
GSTP has different elements with different implementing rules:

- Established work plan with publication of ITT
- Open call
- Mission project
- Fully funded
- Requiring co-funding

All GSTP projects, except the participation in mission projects requires a **written letter of support** from the Delegation authorising the economic operator to bid for that particular activity.

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GSTP – Overview (1)

- Part of **ESA's Optional Programmes**.

- Covering all technology disciplines and applications except Telecommunications (covered by the ARTES programmes).

- Started in 1993, and after its 6th period become officially a permanent programme.

- GSTP subscription since 2012 has totalled 1,570M€ million (incl. 438M€ at Space19+ !)

- Work plans, with yearly updates, and multiyear activities / frameworks (e.g. de-risk) / Announcement of Opportunity

The GSTP ensures that the right technology with the right maturity is available at the right time

GSTP **25** YEARS

GSTP EVOLUTION (1993-2020)

PROBA 2 (2009)
Active Pixel Sensor
BepiColombo (2018)

High Performance Green Propulsion

Common Procedure Language (ESSC)

TMA Telescope
Rapid Eye (2008), Proba V (2013)

MELISSA
Regenerative life support systems

Sloshsat FLEVO (2005)
Leon Processor
Alphasat (2013), Proba-V (2013),
Sentinels (from 2014) and
BepiColombo (2018)

Launcher Payload Separation System
Ariane 4 and 5

Autocorrelation Spectrometer Chip-Set
SMART (2003)

PROBA 1 (2001)
ERC32
Goce (2009), Sentinels (from 2014)

Advanced Crew Terminal
Columbus on ISS

Digital Signal Processor (DSP 21020)
ROSETTA (2004-2016)

EXPERT
European Experimental Re-entry
Testbed

VEGA TVC - Thrust Vector Control (2012)
GIOVE Test Receiver
GALILEO

MEMs Rate Sensor
CryoSat 2 2010

GPS POD
Sentinels (from 2014)

ANITA Gas Monitor (ISS)

SCOC3 System On a Chip

SMOS - MIRAS Instrument (2009)

PROBA V (2013)
AIS on ISS
Space Based Automatic Identification
System Receiver

Hybrid Low Cost Magnetometer
ADM-AEOLUS (2018)

Lightweight APS-based Star Tracker
BepiColombo

Nodding Mechanism on ISS

Nanomaterials Composites
Nanotube skeleton reinforcement

ETP - Energetic Particle Telescope
PROBA V (2013)

OPS-SAT (2018)
GAMIR Receiver
First with Galileo signal

White Thermal Coating
Solar Orbiter (2019)

CHEOPS (2018)
Development of the AIT and MOC

IBDM International Berthing and Docking Mechanism
ORION

EGS-CC (2019)
European Ground Systems Common Core

PROBA 3 (2020)

GOMX-3 (2015)
GOMX-4 (2018)
Friction Stir Welding Advanced Manufacturing
3D printing, surface engineering,
shaping, joining and assembly related
activities.

Digital Engineering
Structure optimization, structural
efficiency and progressive damage
prediction of fit-for-purpose
hardware using software tools.

Clean Space
Initiative for reduction of the
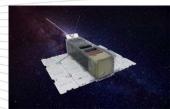environmental impact of space
activities.

Synergistic Air-Breathing Rocket Engine

Electric Propulsion Alternatives
Micro-colloid Thruster, IFM
Nano Thruster

QARMAN CubeSat
Reuse and upgrade of Space Antenna
Azores, Portugal

602 M€

500 M€

319.6 M€

296.2 M€

242.5 M€

119.8 M€

50.5 M€

| 1993 | 1996 | 1998 | 2000 | 2002 | 2004 | 2006 | 2008 | 2010 | 2013 | 2016 | 2018 | 2020 |

| GSTP-1 | GSTP-2 | GSTP-3 | GSTP-4 | GSTP-5 | GSTP |

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GSTP – Overview (3)

ELEMENT 1	ELEMENT 2	ELEMENT 3
Develop	**Make**	**Fly (Small Missions)**
Development of technologies and products from low TRL to qualification Platform, Payload, Ground Segment & Engineering tools	Market driven, industry initiated, co-funded direct negotiation activities for technology maturation leading to products	hosts projects such as satellites (for technology demonstration), ISS payloads, technology flight opportunities

Element 1- Work Plan

Element 1 - Frameworks

OSIP -> https://ideas.esa.int/

SCIENCE

ESA's pioneers of space science (1)

- **Hipparcos** (1989–93) first comprehensive star-mapper

- **IUE** (1978–96) longest-lived orbital ultraviolet observatory

- **Giotto** (1986) first close flyby of a comet nucleus

- **Ulysses** (1990–2008) first craft to fly over Sun's poles

- **ISO** (1995–8) first European infrared observatory

- **SMART-1** (2003–6) first European mission to the Moon

Hipparcos   IUE   Giotto   Ulysses   ISO   Smart-1

ESA's pioneers of space science (2)

- **Planck** (2009–13) detecting first light of Universe and looking back to the dawn of time

- **Herschel** (2009–13) unlocking the secrets of starbirth and galaxy formation and evolution

- **Venus Express** (2005–15) first global investigation of dynamic atmosphere of Venus

- **Rosetta** (2004–16) first long-term mission to study and land on a comet

Planck

Herschel

Venus Express

Rosetta

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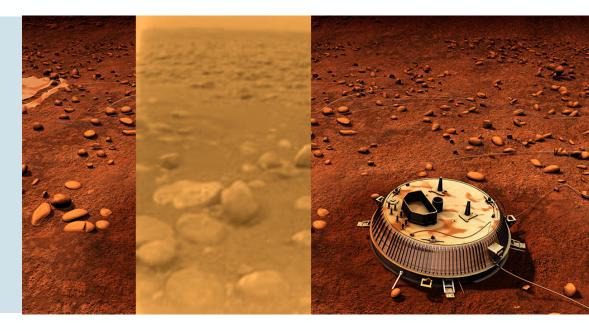
First landing on a world in the outer Solar System

On 14 January 2005, ESA's **Huygens** probe made the most distant landing ever, on Titan, the largest moon of Saturn (about 1427 million km from the Sun).

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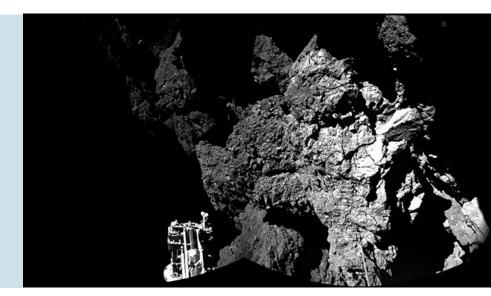
First rendezvous, orbit and soft-landing on a comet.

On 6 August 2014, ESA's **Rosetta** became the first spacecraft to rendezvous with a comet and, on 12 November, its Philae probe made the first soft-landing on a comet and returned data from the surface.

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Today's Science missions (1)

- **Hubble** (1990–) orbiting observatory for ultraviolet, visible and infrared astronomy (with NASA)

- **SOHO** (1995–) studying our Sun and its environment (with NASA)

- **XMM-Newton** (1999–) solving mysteries of the X-ray Universe

- **Cluster** (2000–) studying interaction between Sun and Earth's magnetosphere

- **Integral** (2002–) observing objects simultaneously in gamma rays, X-rays and visible light

Hubble   SOHO   XMM-Newton   Cluster   Integral

Today's Science missions (2)

- **Mars Express** (2003–) studying Mars, its moons and atmosphere from orbit

- **Gaia** (2013–) mapping a thousand million stars in our galaxy

- **LISA Pathfinder** (2015–) testing technologies to detect gravitational waves

- **BepiColombo** (2018 –) a satellite duo exploring Mercury (with JAXA)

Mars Express

Gaia

LISA Pathfinder

BepiColombo

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- **Cheops** (2019-) studying exoplanets around nearby bright stars

- **Solar Orbiter** (2020-) studying the Sun from close range

Cheops

Solar Orbiter

- **James Webb Space Telescope** (2021) studying the very distant Universe (with NASA/CSA)

- **Euclid** (2022) probing 'dark matter', 'dark energy' and the expanding Universe

- **JUICE** (2022) studying the ocean-bearing moons around Jupiter

James Webb Space Telescope - JWST

Euclid

JUICE

Upcoming missions (2)

- **Plato** (2026) searching for planets around nearby stars
- **Ariel** (2028) studying what the exoplanets are made of, how they formed and evolve
- **Athena** (2031) space telescope for studying the energetic Universe
- **Lisa** (2034) will be the first space-based gravitational wave observatory

Plato

Ariel

Athena

LISA

Human spaceflight and Robotic Exploration (HRE)

ExPeRT

CS#1:
Humans in LEO

CS#4:
Mars Robotic

SciSpacE

CS#2:
Humans beyond
LEO

CS#3:
Lunar Robotic

Cornerstone 1
International
Space Station

Cornerstone 2
Gateway

Cornerstone 3
Opportunity
missions

Cornerstone 4
Mars Sample Return
ExoMars

Earth
Return
Orbiter

Sample
Fetch
Rover

Moon
robotics
sample
return

Gateway

Sample
Container

Orion

ExoMars
Rover

Chinese space
station

430 km

384 400 km

60 - 400 million km

EUROPE'S EXPLORATION FOR THE MOON AND MARS

ESA awards €2 billion to European industry for the 2020s

esa

MARS

European Service Module/Orion

Gateway

MOON

Lunar Pathfinder

Esprit

I-HAB

International Space Station

Luna-27

Sample Fetch Rover

Columbus Laboratory

Prospect

European Large Logistics Lander

Earth Return Orbiter

European Exploration Envelope (E3P)
Lunar Gateway - International Habitat (I-HAB)
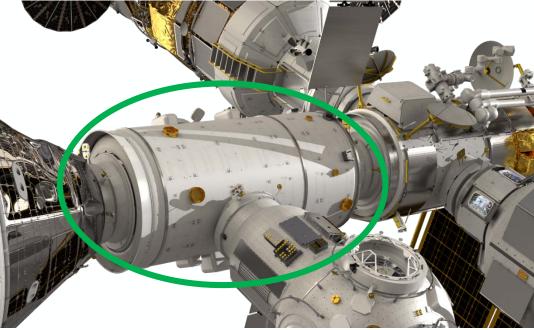
Function: Gateway habitable module with life support
systems and docking ports for visiting vehicles

Launch: 2026

Status: Phase B2

Prime: Thales Alenia Space (IT)

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Lunar Gateway - European System Providing Refuelling, Infrastructure, and Telecommunications (ESPRIT)

Function: Gateway communications and refuelling module providing viewing capability

Launch: 2027

Status: Phase B2

Prime: Thales Alenia Space (FR)

Lunar Gateway - Cis-Lunar Transfer Vehicle (CLTV)

Function: Ferry cargo and logistics (e.g. fuel) to the
Gateway, but also in LEO post-ISS scenarios

Launch: TBD (Ariane 64)

Status: Phase A/B1

Primes: TBD soon

Based on ATV technologies

Courtesy ADS

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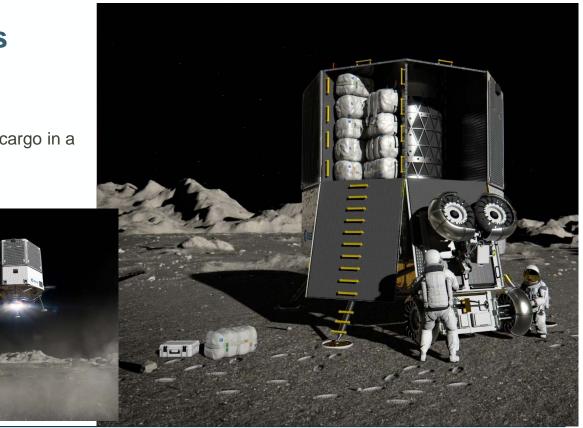
European Large Logistics Lander (EL3)

Function: Deliver scientific instruments and cargo in a human environment (Artemis)

Launch: TBD (Ariane 64)

Status: Phase A/B1

Primes: ADS (DE); TAS (IT)

Mars Sample Return - Earth Return Orbiter (ERO)

Function: Rendezvous and capture of the sample holding canister launched into martian orbit and bring them back to Earth; acting also as communications relay for the campaign

Launch: 2026 (Ariane 64)

Status: Phase B2

Prime: Airbus DS (FR)

39 m
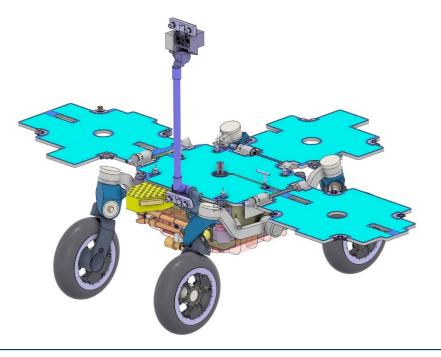
Mars Sample Return - Sample Fetch Rover

Function: Autonomous navigation to detect and pick up sample tubes collected by the NASA Perseverance rover to deliver tem on the NASA ascent launcher

Launch: 2026

Status: Phase B2

Prime: Airbus DS (UK)

European Exploration Envelope Programme (E3P)

SciSpacE – Science in Space Environment

Science in Space element of E3P supports research in ISS and non-ISS space platforms and analogue environments. Hence developing experiments and payloads for microgravity research, including procurement of suborbital launchers launched from Kiruna, parabolic flights, drop tower experiments, isolation and confinement studies, space radiation research.

How can you get involved?

https://www.esa.int/Our_Activities/Human_and_Robotic_Exploration/Research/Research_Announcements

European Exploration Envelope Programme (E3P)

ExPeRT – Exploration Preparation, Research and Technology

Allow Europe to be flexible and to adapt to a fast-evolving international exploration context:

- Ensure that future exploration missions, projects and associated technologies are well prepared and de-risked;

- Facilitate the selection process and the development of new exploration missions and projects by providing the adequate TRL 5 for the critical technologies;

- Contribute to establish new collaborations with international partners (both existing and new ones) to create future exploration opportunities;

- Identify European leadership and enabling independence and autonomy in Space

European Exploration Envelope Programme (E3P)

ExPeRT implements preparatory system studies and **technology development activities** for the 3 ESA exploration destinations

System studies and associated Technology development are an excellent entry point for SMEs (space and non-space)to engage with the challenges of space exploration

Technology themes fundamental for Exploration

1. Propulsion
2. Novel Energy Systems
3. Robotics and Mechanisms
4. Artificial Intelligence
5. Advanced Life Support Systems
6. In-Situ Manufacturing
7. Crew Health Management
8. Space Resources

9. Radiation Protection
10. Communication and Navigation
11. Subsurface Sampling/Deep Drilling
12. Guidance Navigation and Control
13. Avionics
14. (re-)Entry Descent and Landing
15. Thermal Control Systems
16. Mission Operations Data Systems

European Exploration Envelope Programme (E3P)

ExPeRT activities in the optional E3P are coordinated with the mandatory Technology Development Element programme (TDE), and the optional General Support Technology Programme (GSTP) through internal TECNET Working Groups

Thus exploration technologies can exploit **3 funding pillars**:

- TDE (ex-TRP): TRL1 -> TRL4 (technology push or mission pull)
- GSTP: TRL3 -> TRL9 (product competitiveness or market pull)
- ExPeRT: TRL3 -> TRL5/6 (mission Pull or core capability)

EARTH OBSERVATION
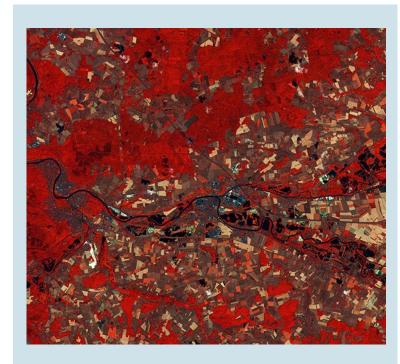
Pioneers in Earth observation

ESA has been dedicated to observing Earth from space ever since the launch of its first meteorological mission, **Meteosat-1** in 1977.

ERS-1 (1991–2000) and **ERS-2** (1995–2011) providing a wealth of invaluable data about Earth, its climate and changing environment.

Envisat (2002–12) the largest satellite ever built to monitor the environment, it provided continuous observation of Earth's surface, atmosphere, oceans and ice caps.

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Earth Explorers

These missions address critical and specific issues raised by the science community, while demonstrating the latest observing techniques.

- **GOCE** (2009–13) studying Earth's gravity field
- **SMOS** (2009–) studying Earth's water cycle
- **CryoSat-2** (2010–) studying Earth's ice cover
- **Swarm** (2013–) three satellites studying Earth's magnetic field
- **Aeolus** (2018) studying global winds
- **EarthCARE** (2022) studying Earth's clouds, aerosols and radiation (ESA/JAXA)
- **Biomass** (2022) studying Earth's carbon cycle
- **FLEX** (2024) studying photosynthesis
- **FORUM** (2025) measuring Earth's radiation budget
- **Earth Explorers 10** to be selected

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Meteorological missions

MTG

MetOp-SG

Developed in cooperation with ESA's partner, Eumetsat, as Europe's contribution to the World Meteorological Organization's space-based Global Observing System:

Meteosat Second Generation (2002-) – series of four satellites providing images of Earth from geostationary orbit.

Meteosat Third Generation (2021–) series of six geostationary satellites providing images (four satellites) and atmospheric sounding (two satellites).

MetOp (2006-) – series of three satellites providing operational meteorological observations from polar orbit.

MetOp Second Generation (2022–) two series of polar-orbiters, three satellites in each series, continuing and enhancing meteorological, oceanographic and climate monitoring observations from the first MetOp series.

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Copernicus space component: the Sentinels

- **Sentinel-1** – land and ocean services. Sentinel-1A launched in 2014/Sentinel-1B in 2016.

- **Sentinel-2** – land monitoring. Sentinel-2A launched in 2015/Sentinel-2B (2017).

- **Sentinel-3** – ocean forecasting, environmental and climate monitoring. Sentinel-3A launched in 2016. Sentinel-3B (2017).

- **Sentinel-4** – atmospheric monitoring payload (2019)

- **Sentinel-5** – atmospheric monitoring payload (2021)

- **Sentinel-5 Precursor** – atmospheric monitoring (2017)

- **Sentinel-6** – oceanography and climate studies (2020)

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Copernicus High Priority Candidate Mission (HPCM)
Initiative led by the European Commission, developed by ESA

- **CHIME:** Copernicus Hyperspectral Imaging Mission (Thales)
- **CIMR:** Copernicus Imaging Microwave Radiometer (Thales)
- **CO2M:** Copernicus Anthropogenic Carbon Dioxide Monitoring (OHB)
- **CRISTAL:** Copernicus Polar Ice and Snow Topography Altimeter (Airbus)
- **LSTM:** Copernicus Land Surface Temperature Monitoring (Airbus)
- **ROSE-L:** L-band Synthetic Aperture Radar (Thales)

TELECOMMUNICATIONS & INTEGRATED APPLICATIONS

A pioneer in telecoms

1968 – Europe started to develop communications satellites. The **Orbital Test Satellite** (OTS) was launched 10 years later. OTS, and its follow-up ECS, was used for more than 13 years by ESA and Eutelsat.

Olympus (1989–93) an experimental satellite, at the time of launch it was the largest civilian telecommunications satellite in the world.

Artemis (2001–) this multi-purpose telecommunications and technology demonstration satellite introduced a new range of telecommunication services to the world.

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Ensuring competitive and innovative industry
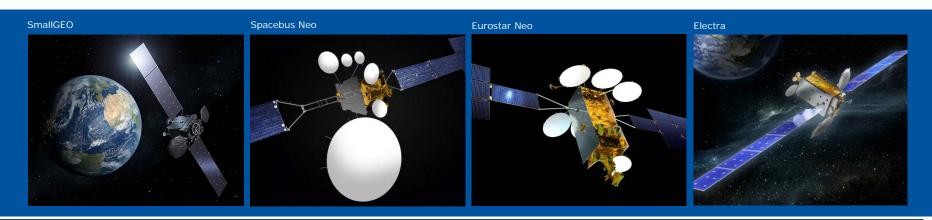
ESA's **Advanced Research in Telecommunications Systems** (ARTES) programme stimulates innovation and promotes the development of products, services and applications in partnership with industry.

- Helping European industry to stay at the leading edge of the highly competitive global market for satellite communications and applications;

- Supporting R&D and pioneering technical, commercial and operational approaches to bring new systems and solutions close to the point of market readiness;

- Building partnerships capable of creating wealth, jobs and new services for the citizens of Europe;

- Improving our daily lives across almost every market sector, from health to transport and from civil protection to energy and environmental services.

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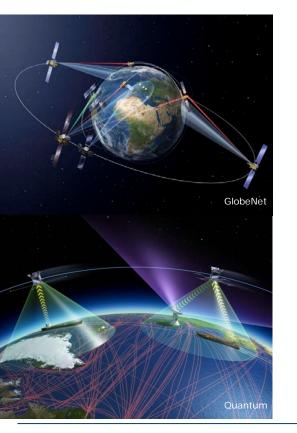# ARTES satellite platforms

- **SmallGEO** – for the 3-tonne market, with OHB (first launch on Hispasat's H36W-1, 2017)

- **Spacebus Neo** and **Eurostar Neo** – for the 3- to 6-tonne market, with Thales Alenia Space/Airbus D&S (first launches in 2020 and 2021)

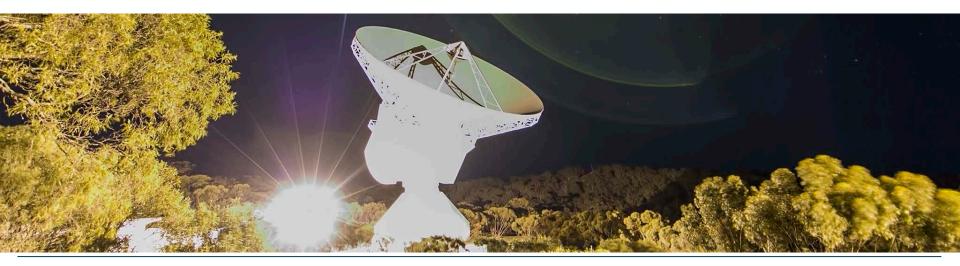- **Electra** – first fully electric propulsion OHB satellite, with SES (2021)

SmallGEO

Spacebus Neo

Eurostar Neo

Electra

ARTES innovation and new technology

GlobeNet

Quantum

- **EDRS** – the European Data Relay System, or 'SpaceDataHighway', that with its GlobeNet extension will make data gathered anywhere on Earth available in quasi-real time (EDRS-A launched in 2016; EDRS-C in 2019)

- **ScyLight** – optical communications capable of exchanging unprecedented amounts of data between satellites, aircraft and the ground (starting 2017)

- **Quantum** – in-orbit reprogrammable 'chameleon' satellite, with Eutelsat/Airbus D&S (2018)

- **ICE** – next-generation mobile satellite services, with Inmarsat (starting 2017)
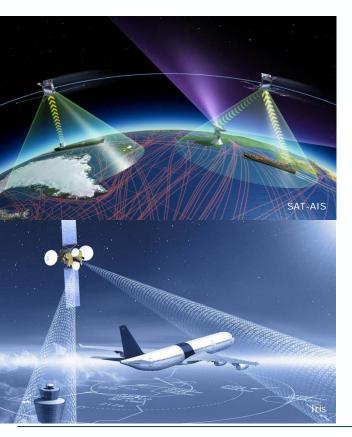
ARTES ground segment

- **ECO** – bringing affordable and reliable 'wi-fi' to low-income users in sub-Saharan Africa, with Avanti (2016–2021)

- **Indigo** – ground segment innovations, with Intelsat (2015–2018)

- **AIDAN** – ground segment for broadband and aviation, with ViaSat (starting 2017)

ARTES for new markets

SAT-AIS

Iris

- **SAT-AIS** – microsatellites will track seafaring vessels anywhere on Earth. ESAIL satellite launched in 2020.

- **Iris** – a new satellite-based data communication system as part of the Single European Skies Air Traffic Management Research project, with Inmarsat (precursor service, 2018–28)

- **ESA's Govsatcom Precursor** – secure and resilient European government communications, in coordination with the EC and EDA (service demonstration, 2017–20)

- **Pioneer** – helping new technologies and services obtain fast, low-cost in-orbit demonstration (starting 2017)

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ARTES Generic Programme Lines

ARTES Future Preparations (FP)	ARTES Advanced Technology (AT)	ARTES Competitiveness and Growth (C&G)	Business Applications and Space Solutions (BASS)
Strategy	Core Telecom Technology	Core world competitiveness	Integrated applications
Mission, system and General configuration studies to prepare and update ESA telecom programme	Development technologies and techniques (max to EM level). Flight and ground, system and equipment.	Development products to QM and in flight demonstration.	Awareness, studies, appl. Attracting new user communities. Services, establishing partnerships beyond space market
Call for Ideas, Yearly work plan	Call for Ideas, Yearly work plan	Permanently open AO	Permanently open (Feasibility studies, Demo projects) and specific competitive AO (Kickstart)
All ARTES participants	Participants in Element	Participants in Element	Participants in Element
Open	Open	Industry proposals, aligned with the commercial plan of industry Direct Negotiation	Open Competition and Direct Negotiation
100 % funded	100 % funded	50-75 % funded	50-100 % funded
	Letter of support	Letter of support	Letter of support

ARTES Strategic Programme Lines

ScyLight: SeCure and Laser communication Technology

Space based Optical and Quantum Communication Technology

Space Systems for Safety & Security (4S)

European satellite operators and manufacturing industry, to ensure that new levels of security, robustness and resilience become mandatory requirements of space-based communication solutions globally (linked to EU GOVSATCOM Programme).

European downstream industry and service providers, in delivering relevant space-based solutions and business models for innovative, economically sustainable downstream services addressing global security needs.
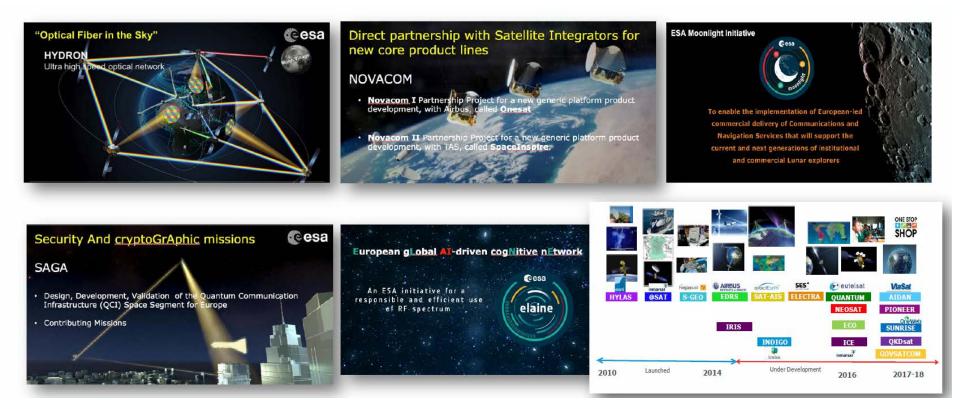
Space for 5G

to develop and demonstrate the added value that satellite brings to 5G.

→ All use procurement tools from Generic Programme Lines, specific workplans on EMITS

ARTES Partnership projects

"Optical Fiber in the Sky"

HYDRON
Ultra high speed optical network

Direct partnership with Satellite Integrators for new core product lines

NOVACOM

- **Novacom I** Partnership Project for a new generic platform product development, with Airbus, called **Onesat**

- **Novacom II** Partnership Project for a new generic platform product development, with TAS, called **SpaceInspire**.

ESA Moonlight Initiative

To enable the implementation of European-led commercial delivery of Communications and Navigation Services that will support the current and next generations of institutional and commercial Lunar explorers

Security And cryptoGrAphic missions

SAGA

- Design, Development, Validation of the Quantum Communication Infrastructure (QCI) Space Segment for Europe

- Contributing Missions

European gLobal AI-driven cogNitive nEtwork

An ESA initiative for a responsible and efficient use of RF spectrum

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NAVIGATION

Galileo: 'made in Europe'

Putting Europe at the forefront of this strategically and economically important sector, **Galileo** will provide a highly accurate, guaranteed global positioning service under civilian control.

Full Operational Capability – 18 satellites now in orbit. Deployment of remaining ground/space infrastructure ongoing (full system – 24 satellites, plus orbital spares to prevent interruption in service).
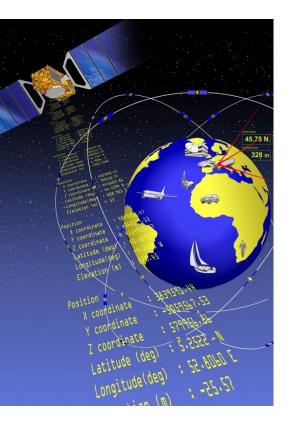
ESA is the system architect for Galileo, managing its design, development, procurement, deployment and validation on behalf of the EU. ESA will maintain this role, providing technical support to the European GNSS Agency, designated by the EC to run the system and provide Galileo services.

Dec 2016 – start of Galileo **Initial Services**, the first step towards full operational capability.

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EGNOS, Galileo applications and NAVISP

- Since 2010, **EGNOS** has been improving accuracy and augmenting GPS, offering safety-critical applications for aviation users.

- **Galileo** is expected to spawn a wide range of applications, based on positioning and timing for transport by road, rail, air and sea, infrastructure and public works management, agricultural and livestock management and tracking, e-banking and e-commerce.

- It will be a key asset for public services, such as rescue operations and crisis management.

- With the new ESA Navigation Innovation and Support Programme (**NAVISP**), research will focus on integration of space and terrestrial navigation and new ways to improve GNSS.

NAVISP Programme

- ESA continues supporting the generation of innovative Satellite navigation -and more broadly Positioning Navigation Timing (PNT) technologies and services- in the frame of ESA NAVISP programme aiming at positioning the European industry in the emerging worldwide commercial navigation market.

- The NAVISP programme is managed using ESA procurement rules.

- Up to 2016, ESA was investing average of €45m per year in the European GNSS evolution programme.

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NAVISP Programme Structure

	ELEMENT 1 [Innovation in Satellite Navigation]	ELEMENT 2 [Competitiveness]	ELEMENT 3 [Support to Member States]
Content	Analyses and developments linked to new and emerging design and operational concepts, techniques and technologies related to satellite navigation systems	Ad hoc technological & product developments and pre-operational activities along the whole satellite navigation value chain in support of the competitiveness of the industrial sector in the participating Member States	Support to MS national Programmes & Activities in satellite navigation and along the whole value chain
General principles for implementation of the activities	Competitive tender, 100% ESA funding on the basis of yearly work-plan adopted by PB NAV (fully coordinated with EC/GSA)	Continuous open call, unsolicited proposals, ESA co-funding, MS support letter	On request by MS, ad-hoc mechanism to be established on a case-by-case basis that ensures ESA's full costs are met
Lead for the definition of the activities	ESA	Industry	Member States

SPACE TRANSPORTATION

European Space Agency

The European launcher family

The **Ariane** and **Vega** launchers developed by ESA guarantee European autonomous access to space. Their development and successful exploitation is an example of how space challenges European industry and provides precious expertise.

Ariane is one of the most successful launcher series in the world. Complemented since 2011 by **Vega** and **Soyuz**, they are all launched from Europe's Spaceport in French Guiana.

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European launchers lift off from the Centre Spatial Guyanais (CSG), Kourou, in French Guiana.

The CSG launch range is co-funded by ESA and France and is operated by the French space agency CNES.

The launch infrastructure for the **Ariane 5**, **Vega** and **Soyuz** launchers at CSG is owned by ESA, maintained and operated by Arianespace, with the support of European industry.

European Ministers agreed at the Ministerial Council 2014 to develop **Ariane 6** and **Vega C.** These launchers will provide guaranteed access to space for Europe at a competitive price without requiring public sector support for commercial exploitation.
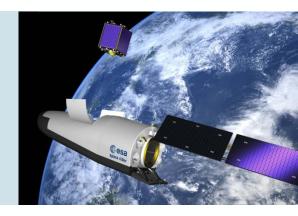
- Ariane 6 – modular three-stage launcher with two configurations, using two (A62) or four boosters (A64);

- Vega C – evolution of Vega with increased performance and same launch service cost;

- Common solid rocket motor for Ariane 6 boosters and Vega C first stage;

- New governance for Ariane 6 development and exploitation allocating increased roles and responsibilities to industry;

- Vega C and Ariane 6 first flights – 2021 and 2022.

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Launchers and technologies of the future

Space Rider

- An affordable, reusable, end-to-end integrated transport system offering Europe independent access to and from low Earth orbit.

- European opportunities for in-orbit validation of technologies.

- First launch on Vega C in 2021.

Future Launchers Preparatory Programme (FLPP)

New Economic Opportunities (NEO)...

1. Develop competitive technologies for future launchers that will:
   - include low development and production costs, and lower risks;
   - shorten the launcher development phase to less than 5 years.

2. Invest in a more diversified launcher development portfolio focusing on:
   - key technologies and new manufacturing processes;
   - integrated demonstration before transfer into orbit;
   - validating ultra-low cost engine demonstrator (Prometheus).

SAFETY &
SECURITY

Space Safety

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Space Safety

ESA's Space Safety Programme is working to **protect our planet** and ensure spaceflight remains **sustainable** by monitoring, warning and mitigating hazards from space.

ESA is working to ensure Europe can:

- Protect vital infrastructure in space and on the ground from extreme space weather events

- Sustain European spacecraft in orbit around Earth, ensuring they are resilient to the hazards of space debris

- Provide early warning for smaller yet still dangerous asteroids that might hit our planet, while developing the capacity to deflect larger asteroids well before they strike

Space Debris

As the **space debris** environment steadily worsens, ESA is ensuring future **sustainable utilisation of space** by developing the ability to avoid collisions, mitigate the occurrence of any new space debris and fostering a new European industrial capacity to conduct in-orbit servicing.
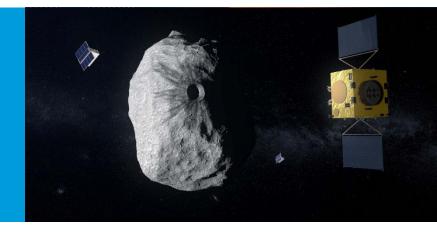
ESA's space debris resiliency efforts include developing and demonstrating:

- AI-based technology to enable automated collision avoidance
- New data-processing, cataloguing and automation tools shared with European partners
- Novel sensor and monitoring technology for radars, laser ranging and space-based optical sensors

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Planetary Defence

ESA is taking part in a global effort to **detect hazardous objects**, mitigate the risks from potential smaller impacts and develop the capacity to deflect large asteroids long before they might strike.
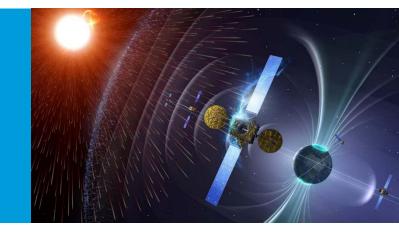
ESA's planetary defence resiliency activities include:

- Building and deploying a network of advanced, automated **Flyeye** telescopes to detect asteroids that might hit us
- Develop and deploy enhanced asteroid catalogue data services such as orbital information and physical properties

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Space Weather

ESA is working to **protect civil society** and critical European infrastructure on ground and in space against space weather hazards.

ESA's space weather resiliency activities include:

- Enhance the European Space Weather Service Network to detect and analyse the severity of space weather events, and provide timely, accurate and actionable information to end users
- Upgrade ESA's Space Weather Coordination Centre to provide tailored space-weather warnings and alerts to European entities and civil protection authorities

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