European Innovation Council

Backing visionary entrepreneurs

The role of Programme Managers

Stela Tkatchova
EIC Programme Manager for Space Systems

08/06/2023

European Innovation Council and SME Agency

Horizon Europe Structure

European Innovation Council

HORIZON EUROPE

SPECIFIC PROGRAMME: EUROPEAN DEFENCE FUND

Exclusive focus on defence research & development

- Research actions
- Development actions

SPECIFIC PROGRAMME IMPLEMENTING HORIZON EUROPE & EIT*

Exclusive focus on civil applications

Pillar I
EXCELLENT SCIENCE

- European Research Council
- Marie Skłodowska-Curie
- Research Infrastructures

Pillar II
GLOBAL CHALLENGES & EUROPEAN INDUSTRIAL COMPETITIVENESS

Clusters

- Health
- Culture, Creativity & Inclusive Society
- Civil Security for Society
- Digital, Industry & Space
- Climate, Energy & Mobility
- Food, Bioeconomy, Natural Resources, Agriculture & Environment

Joint Research Centre

Pillar III
INNOVATIVE EUROPE

- European Innovation Council
- European innovation ecosystems
- European Institute of Innovation & Technology*

WIDENING PARTICIPATION AND STRENGTHENING THE EUROPEAN RESEARCH AREA

- Widening participation & spreading excellence
- Reforming & Enhancing the European R&I system

EURATOM

- Fusion
- Fission
- Joint Research Center

* The European Institute of Innovation & Technology (EIT) is not part of the Specific Programme

EIC Programs

European Innovation Council

Pathfinder (TRL1-4)
- **For consortia**
- Early stage research on breakthrough technologies
- **Grants up to €3/4 million**

Transition (TRL 4-6)
- **For consortia and single entities**
- Technology maturation from proof of concept to validation
- Business & market readiness
- **Grants up to €2.5 million**

Accelerator (TRL 6-9)
- **For individual SMEs**
- Development & scale up of deep-tech/ disruptive innovations by startups/ SMEs
- Blended finance (**grants up to €2.5 million; equity investment up to €15 million or above**)

- Focus on **breakthrough, game-changing, market-creating, deep-tech**
- **Mainly bottom up** complemented by targeted funding on strategic technologies/ challenges
- Steered by **EIC Board** of leading innovators (entrepreneurs, investors, researchers, ecosystem)
- **Business Acceleration Services** (coaches/ mentors, corporates, investors, ecosystem)
- **Pro-active management** (roadmaps, reviews, re-orientations, etc) with **EIC Programme Managers**
- **Fast track access** to Accelerator for results from EIT, EIC Pathfinder,

Programme Manager Mission

European Innovation Council

- EIC Programme Managers provide the high-profile expertise within key thematic domains.
- PM **identifies, develops, implements** and **promotes** technological visions and **nurtures** potential **market-driven innovations**

Courtesy: ESA

Programme Manager Activities

- Topics proposals for the WP challenges
- Pro-active Portfolio management
- Collaborations within the EC
- Collaboration with external stakeholders
- Consolidating EIC beneficiaries needs

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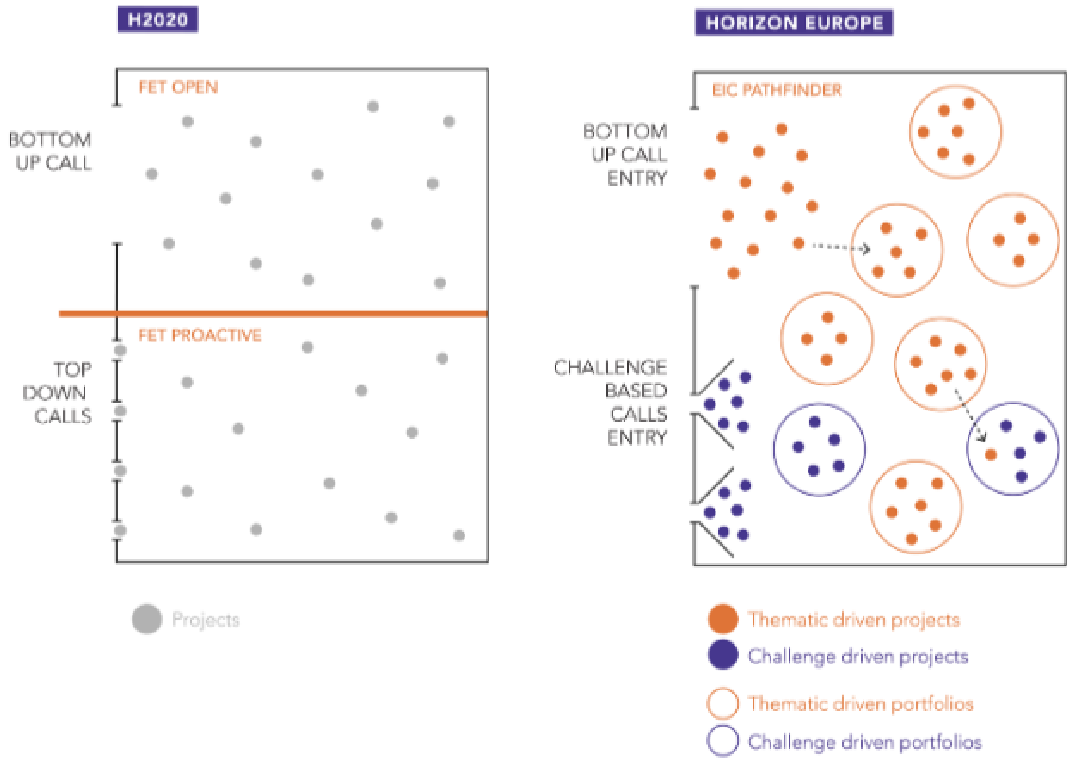
Pro-active portfolio management

- Creates a PO Team
- Identify project synergies
- Projects direct support
- Thematic portfolio meeting
- WG creation

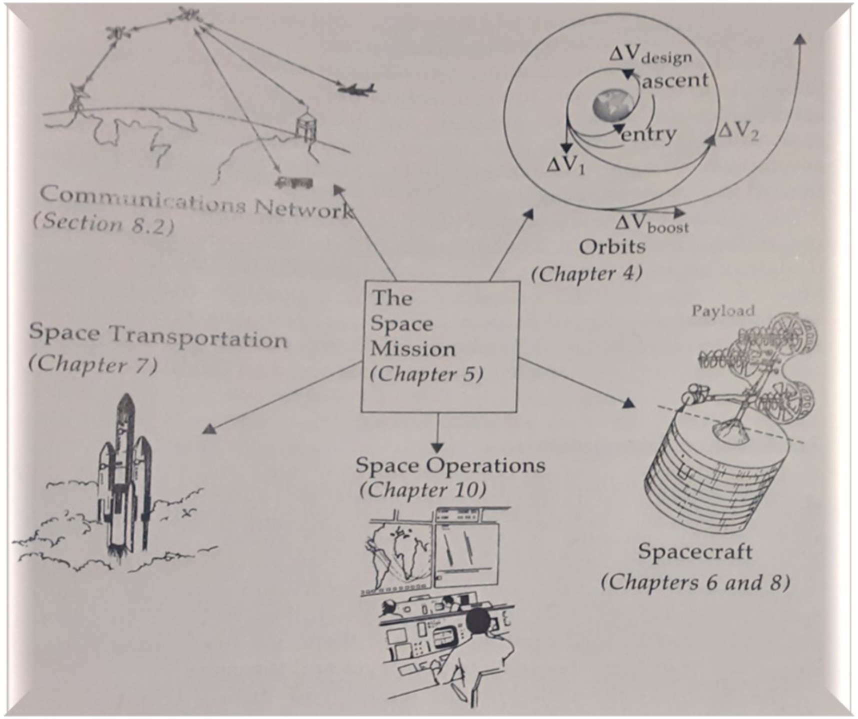


Courtesy: EIC Implementing the pro-active management of the EIC pathfinder for breakthrough technologies & innovations- Independent Expert Report

EIC role and space portfolio

- EIC funds game-changing innovations and high-risk ideas of SMEs & start-ups

- The EIC supports them in the process of high-risk innovation, demonstration and commercialization with transversal EIC Pathfinder, Transition and Accelerator programs

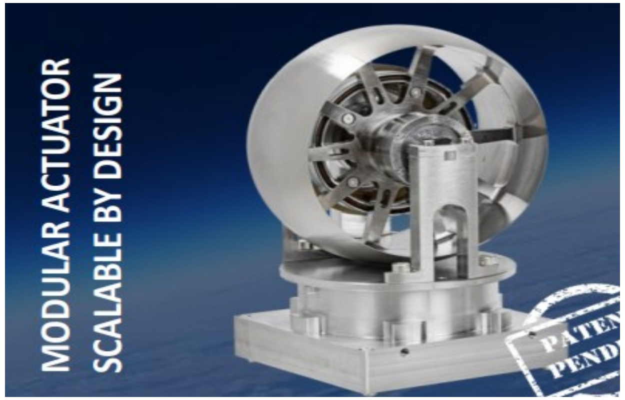


Courtesy: ISU, Keys to Space

EIC Space Projects Examples

- **Space Debris Sustainability** - E. T. PACK- F (Active Debris Removal with EDT tethers), CASSIOPEE(Space debris monitoring), Endurance (In Orbit Servicing)and Aurora Plasma Breaks (Active Debris Removal)
- **Enabling Space Technologies** – MEESST, SATAGILITY GO2Market (actuators launched on the 15/04/2023), EMBRACE II (iodine propulsion launched on the 15/04/2023)
- **Earth Observations & Meteorology** - CropCloud, HIVE, EOinTime, SKYFORA

Courtesy: E.T.Pack-F project – EIC Transition



Courtesy: SATAGILITY - GO2Market – EIC Accelerator , VEOWARE

Courtesy: EMBRACE II-EIC Accelerator, THRUST ME

Courtesy: CASSIOPEE-EIC Accelerator, Share My Space

Global recognition of EIC Space projects

European Innovation Council

Space tethers focus on deorbit and debris mitigation

BY SVEN G. BILÉN

The **Space Tethers Technical Committee** focuses on the development and use of tether-based technology for space systems.

The European Innovation Council in September awarded 2.5 million euros ($2.4 million) to the **E.T.PACK Initiative** through its EIC Transition program, which funds the maturation of novel technologies to bring them to market. Electrodynamic Tether Technology for Passive Consumable-less Deorbit Kit-Fly, or E.T.PACK-F, is the natural continuation of the European Commission-funded E.T.PACK project, which concluded in November after developing a prototype of a 12U, 24-kilogram deorbit device based on electrodynamic tether technology. With an orbital demonstration flight planned for 2025, the goal of E.T.PACK-F is to design, manufacture and test a flight-ready deorbit system, which will include an aluminum tape tether about 2 centimeters wide and 500 meters long for electrodynamic drag propulsion and stabilization. The E.T.PACK-F consortium is coordinated by the Universidad Carlos III de Madrid, with collaborators from the University of Padova, the Technical University of Dresden, the Spanish company SENER Aeroespacial and German startup Rocket Factory Augsburg.

During the year, researchers at **Northwestern Polytechnical University** in China prepared for an early 2023 launch of a tethered cubesat from a Long March CZ-3 upper stage. The space tether would minimize the risk that the cubesat will become space debris upon mission conclusion, as it will remain connected to the upper stage and burn up along with the upper stage during reentry. The China Academy of Space Technology funded the Beijing Institute of Spacecraft System Engineering to develop the design of a probe for planetoid sampling via a flexible space tether.

In October, work was completed on cross verification and benchmarking of five different electrodynamic-tether simulation codes for investigating electrodynamic-tether dynamics and performance. Researchers from the **Japan Aerospace Exploration Agency, Pennsylvania State University, Universidad Carlos III de Madrid, Universitá degli Studi di Padova, the University of Michigan and York University** ran their codes, which incorporate tether models with different fidelities and computational costs, under different scenarios that represent a range of possible missions. The benchmarking showed broad agreement in simulation results and that the various codes can be leveraged to support tethered mission planning and operations.

Researchers at **University of Strathclyde** in the United Kingdom completed in June their study of symmetrically and unsymmetrically loaded motorized momentum-exchange tethers for Earth-moon transfers. Unsymmetrical loading occurs when there are different payload masses at the two ends of the rotating tether system, which could be due to unexpected payload loss or failure to retrieve. Although mass symmetry is highly desirable both dynamically and logistically, the researchers demonstrated how the system could be restored and characterized this for circular and eccentric orbits.

Researchers at the **University at Buffalo** investigated system elements for tether-based orbital debris mitigation through two grants from the U.S. National Science Foundation awarded in May and August 2021. Applying optimization and machine-learning techniques, they demonstrated reliable operation of tether-and-net capture mechanisms for active debris removal. They are also developing estimation and control for the post-capture phase of such a mission. In April, they reported on how to estimate the inertial parameters of tethered uncooperative space debris, meaning one attached to an electrodynamic tether that mission controllers are unable to command to maneuver.

Through a project funded in January by the European Space Agency, the **Universidad Carlos III de Madrid** and collaborators **University of Padova, Dresden University of Technology, and SENER Aeroespacial** throughout the year carried out research and development activities to combine electrodynamic tether and thin-film solar cells technologies into a single device. The manufacturing and testing activities, corroborated by modeling and simulation, demonstrated that adding thin film solar cells on one side of a bare tape-like tether enhances the power generation capabilities and boosts the deorbit performance of tethered systems. ★

▼ The European Innovation Council funded development of an electrodynamic tether, shown here in an artist's rendering, that is scheduled to be tested on orbit in 2025.

SENER Aeroespacial

aerospaceamerica.aiaa.org | DECEMBER 2022 | 73

WP2023 Space Challenges

Methodology for space topics selection

European Innovation Council

PM knowledge of the European Space Industry

EIC projects
ERC PoC
Horizon signals

Pillar II- Horizon projects

SRIA
DG DEFIs & Space

GAPS

Guiding Principles-Pathfinder

- Ambitious science/radically new technology
- Innovation (TRL)/Safety & Reliability
- Risk Assessment
- EU tech sovereignty

Guiding Principles-Transition

- Mature Innovation (TRL)/Safety & Reliability
- Initial analysis of the potential markets
- Proof of Concept (PoC)
- EU tech sovereignty

Guiding Principles - Accelerator

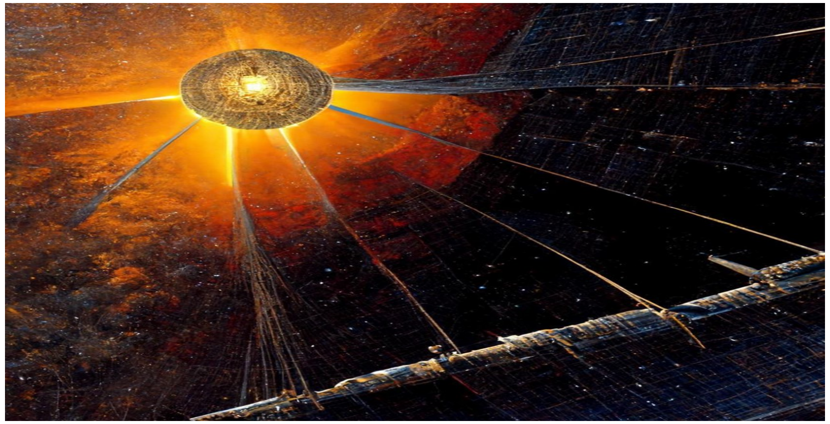
- Innovation (TRL)/Safety & Reliability
- Time to market/New markets creation/Economies of Scale
- Risk Assessment
- EU tech sovereignty

WP2023 Space Challenges-Opportunities

- **EIC Pathfinder (TRL 1-4)** - In-space solar energy harvesting for innovative space applications

  Preparing for the long-term Future

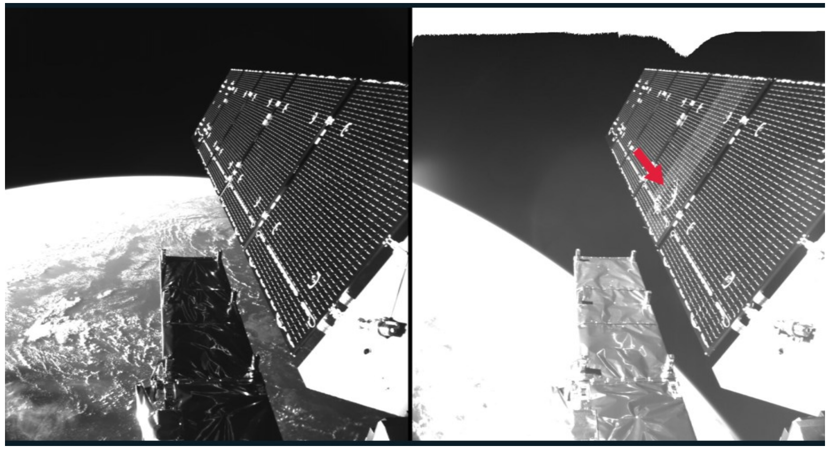
  Indicative budget 32M Euros



- **EIC Accelerator (TRL6-9)** - Customer-driven, innovative space technologies and services

  Future market opportunities

  Indicative budget 65M Euros



Courtesy: Copernicus - Sentinel 1, ESA

EIC WP 2023 deadlines and budgets

European Innovation Council

Accelerator

	Deadlines	Budget
Open	21st June 2023 4th October 2023	~€611m (~grant/equity)
Challenges	7 June 2023 4 October 2023	~€523.5m (~grant/equity)

Pathfinder

	Deadline	Budget
Open	7 March 2023	~€179.50m
Challenges	18 October 2023	~€163.50m

Transition

	Deadline	Budget
Open	12 April 2023	~€67.86m
Challenges	27 September 2023	~€60.5m

EIC Pathfinder

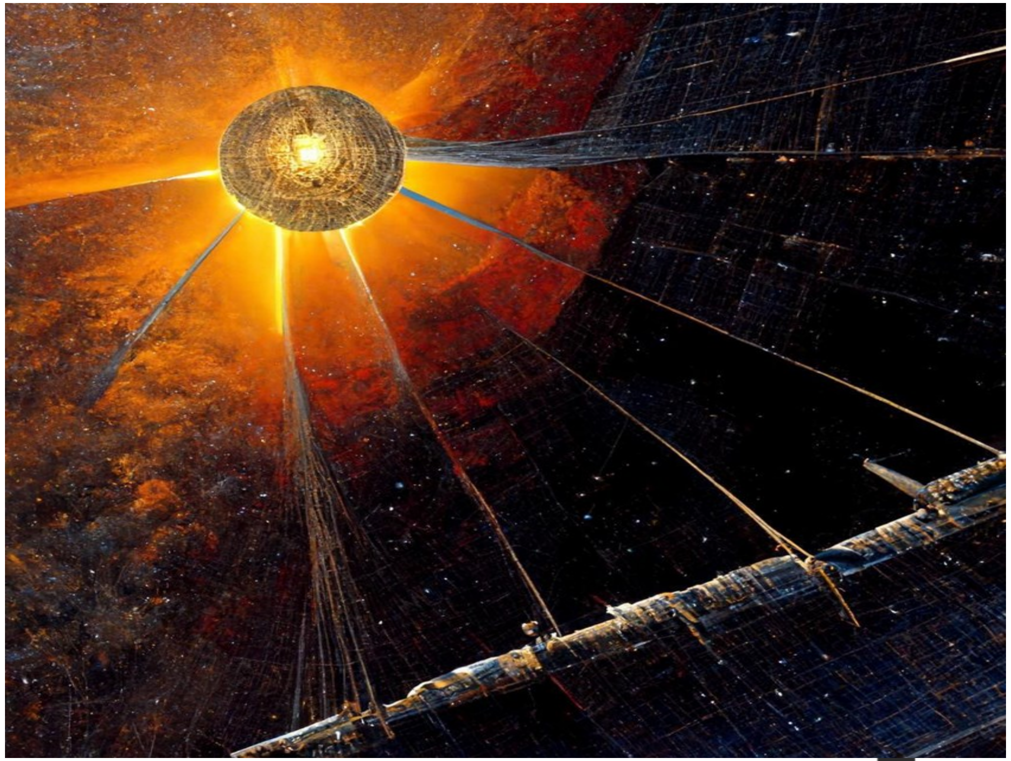
In-space solar energy harvesting for innovative space applications (TRL1-4)

In-space solar energy harvesting for innovative space applications

Goal

The development of concepts and technologies required for in-space energy harvesting and transmission, and of novel propulsion technologies that will use such harvested energy.

- Scalable solutions for in-orbit efficient solar energy collection and storage
- Conversion of DC-to – RF of the harvested energy in a form appropriate for transmission at long distances in empty space
- Efficient Wireless Power Transmission (WPT) of the transformed energy between in-space s/c and various stations in orbit
- Innovative green propulsion solutions for in-space mobility, resulting into low cost or eco-friendly innovative concepts



EIC Space Portfolio Considerations - In-space solar energy harvesting for innovative space applications

- Category I - Collection, conversion and transmission (CCT)
- Category II - In-space green propulsion for IOS, ISAM, ADR and EoL

SPP1: Collection

SPP2: Conversion

SPP3: Wireless Power Transmission

SPP4: In-space green propulsion

Shared components or potential complementarities among projects

Category I - In-space solar energy harvesting for innovative space applications

European Innovation Council

- Collection, conversion and transmission (CCT)

Collection	Conversion	Wireless Power Transmission
Antenna's On- board s/c PV panels PV solar cells above 35% Thin-films Solar cells based on CIGS On-board batteries Transparent antennas Modular solar concentrators Advanced solar arrays for SEP	High efficiency conversion from DC to RF, RF to DC or light to DC Rectennas	Microwave WPT (e.g. antenna) Optical WPT (e.g. Laser)

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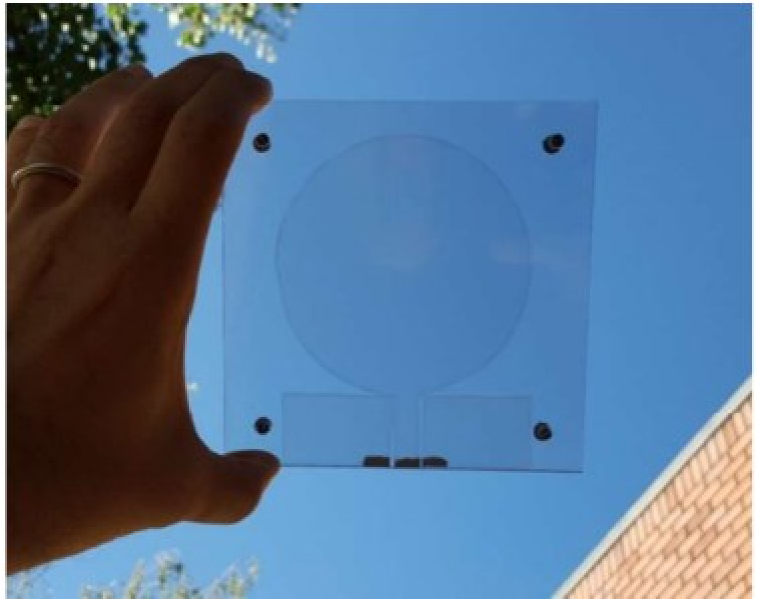
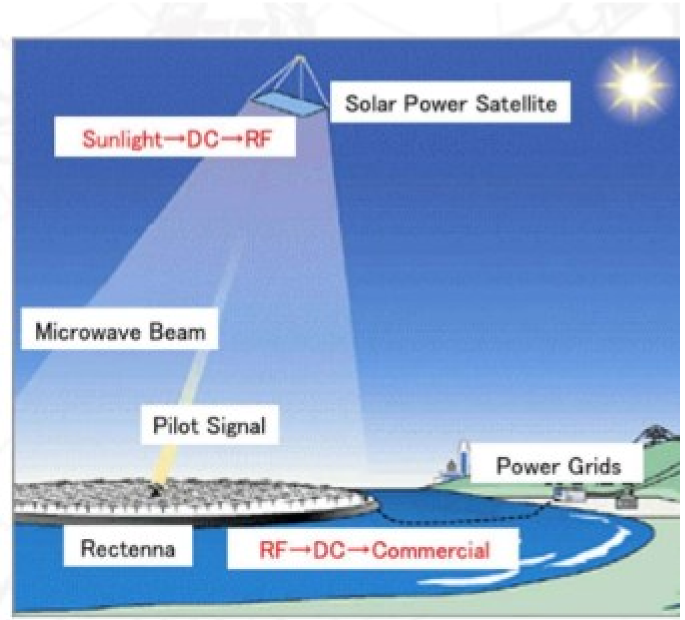
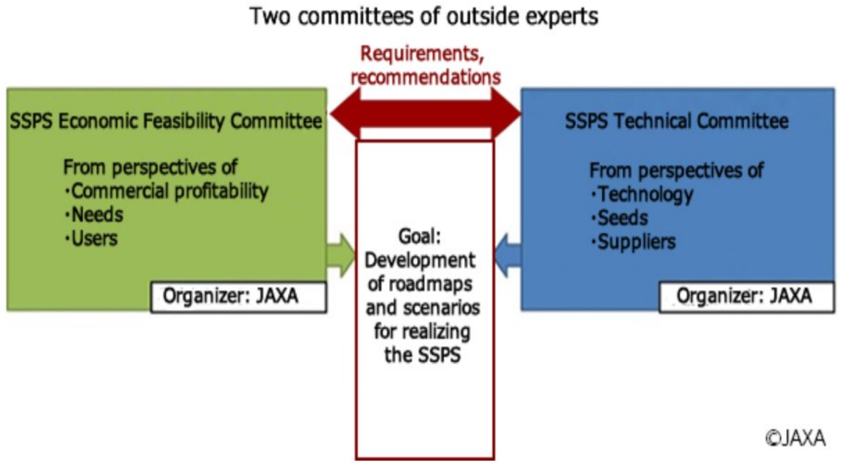
Category I CCT - Some Examples

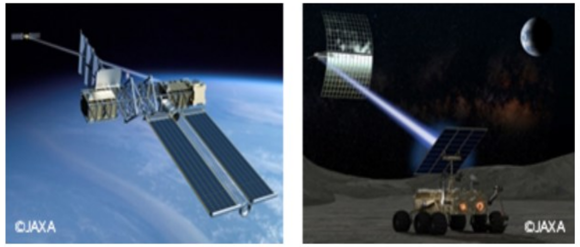


Courtesy: NanoWeb Transperant Antennas



Courtesy: Sasaki, Tanaka, Maki

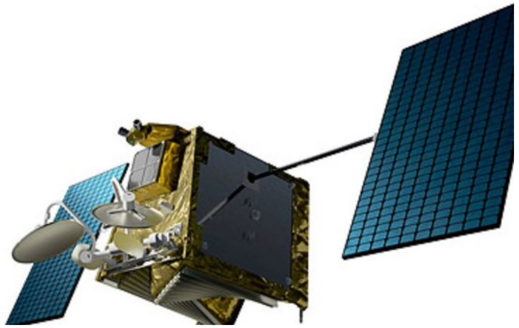




An example of a small SSPS using lasers

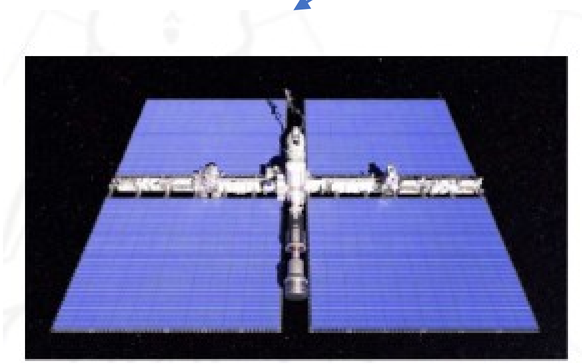
Courtesy: JAXA, inter-orbit energy transfer and planetary exploration mission concepts

Category I CCT - Examples



Courtesy: OneWeb

LEO orbit



Courtesy: ASU

Courtesy: Astrobotic WPT for lunar rover

Category II - In-space solar energy harvesting for innovative space applications

- In-space green propulsion for IOS, ISAM, ADR and EoL

In-space green propulsion

Solar Electric Propulsion
Solar sails
Water-based propulsion using electrolysis
Laser propulsion
Microwave propulsion

Reduced propellant → Reduced mass

Courtesy: NASA Pathfinder Technology Demonstrator-1 spacecraft, demonstrating a water-based propulsion system in low-Earth orbit.

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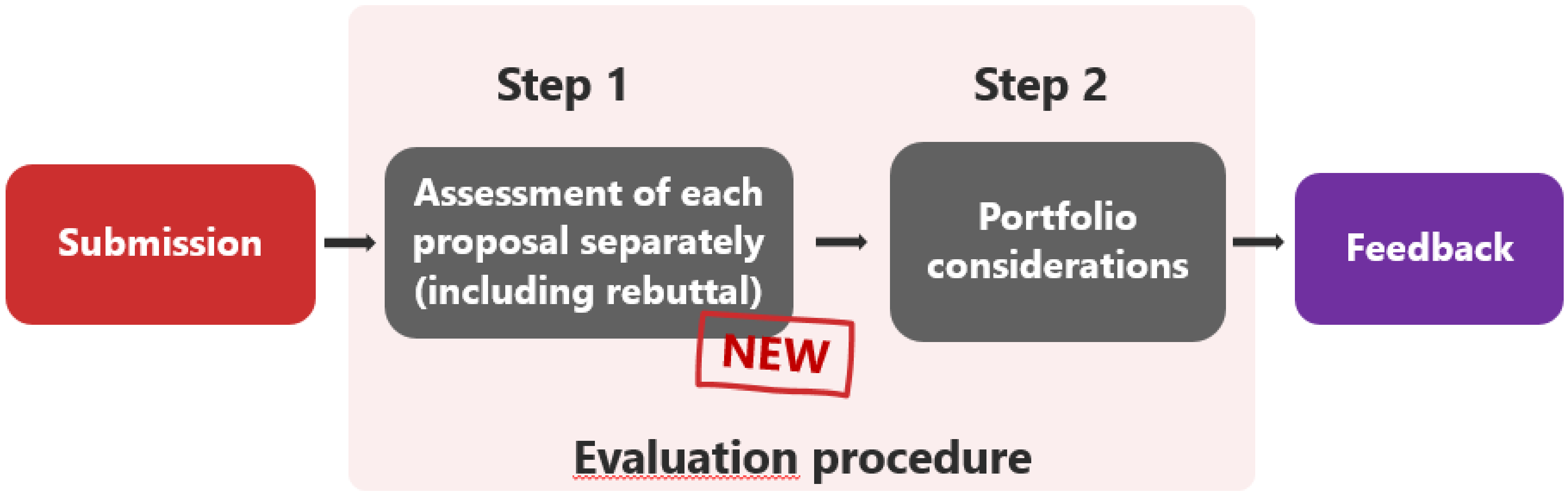
How does the EIC decide if your proposal will be funded?



EIC Space Portfolio aspects

European Innovation Council

In your proposal add a dedicated WP for ***portfolio activities*** with at least ***10 person months***

- Barriers to strategic autonomy/technology non-dependence
- Communicate key outcomes of research work
- Market analysis – initial stakeholders mapping
- Innovative space applications for in-space solar energy use (e.g. ISAM, ADR, EoL, etc.)
- Early commercialisation
- Access to research labs/test facilities
- Access to non-EU markets and customers
- IOD/IOV activities in case of TRL5/6

Pathfinder calls 2023 – Summary table

European Innovation Council

	Pathfinder Open	Pathfinder Challenges
Total budget	**€179.5 million**	**€163.5 million**
Proposals (indicative)	Up to €3 million	Up to €4 million
Funding rate	100% of eligible costs	100% of eligible costs
Opening	10 January 2023	20 June 2023
Deadline	**7 March 2023** at 17.00 CET	**18 October 2023** at 17.00 CET
Length of proposal	17-page proposal (part B)	25-page proposal (part B)
Applicants	**Consortia** min. 3 partners from 3 different Memer States /Associated Countries (of which at least 1 partner in a Member State)	**Consortia:** • If 2 partners: from different MS/AC, • Min 3 partners from 3 different MS/AC (of which at least 1 partner in a MS) **Single legal entities** in a MS/AC

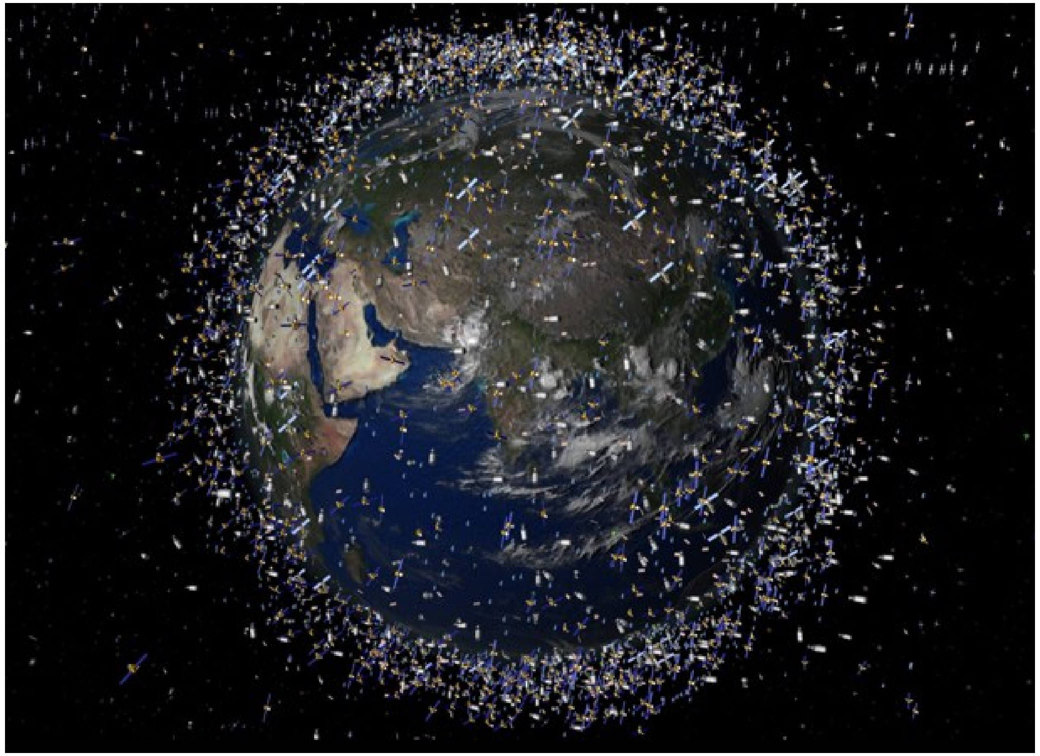
EIC Accelerator

“Customer Driven” innovative space technologies and services (TRL6-9)

How do we develop interoperable, scalable, affordable and cost-effective solutions in order to protect EU space infrastructure?

Rockets launched	6.250	(100%)
Rockets still in Space	1.990	(32%)
Satellites launched	13.630	(100%)
Satellites functioning	6.600	(48%)
Dead Satellites in Space	2.250	(17%)
Space objects mass	10.100 tonnes	
Frangmentation events	630+	
Debris tracked	32.070	
Debris >10 cm	36.500	
Debris 1 -10 cm	1 million	
Debris 0.1-1cm	130 millions	

source ESA updated at August 2022



Courtesy: Slide prepared by Lorenzo Tarabini, E.T.Pack-F project coordinator - EIC Transition

Accelerator (TRL6-9) - “Customer driven” innovative technologies and services

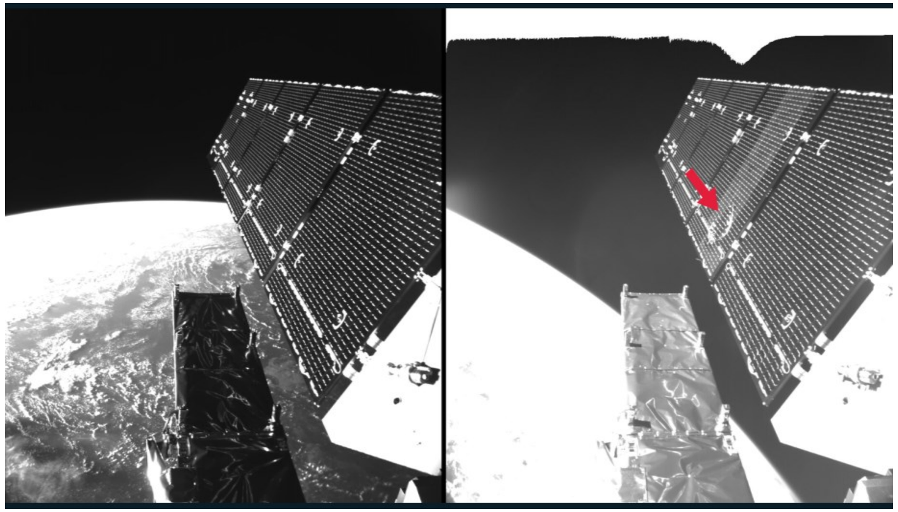
European Innovation Council

Goal

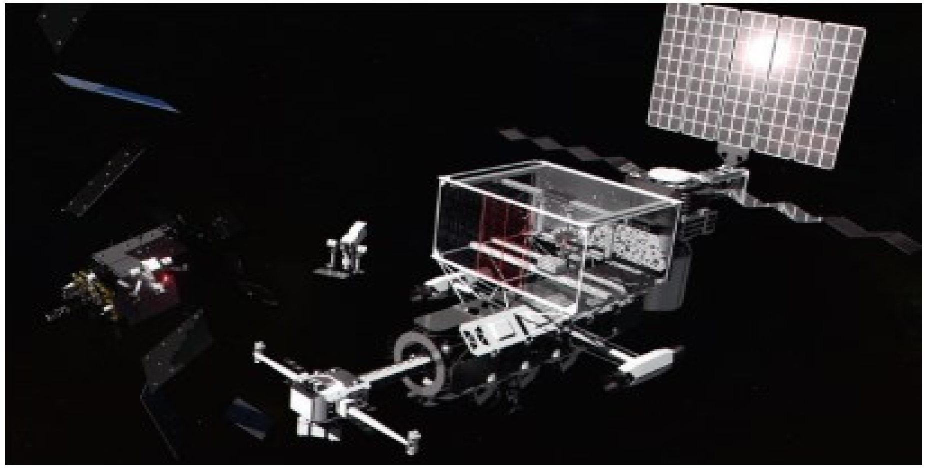
To encourage the emergence of **innovative**, **interoperable**, **scalable**, and **autonomous “customer-driven”** innovative space technologies

Scope/ specific objectives

- To inspect spacecraft in orbit, to augment satellite capabilities and resilience;
- To develop autonomous and in-space collision avoidance capabilities e.g., use of AI/ML for collision avoidance manoeuvres, space debris positioning data, etc. and develop in-space mobility propulsion capabilities;
- To collect space debris with a view for recycling, recovering and transforming purposes (e.g. microgravity platform).



Courtesy: Copernicus - Sentinel 1, ESA



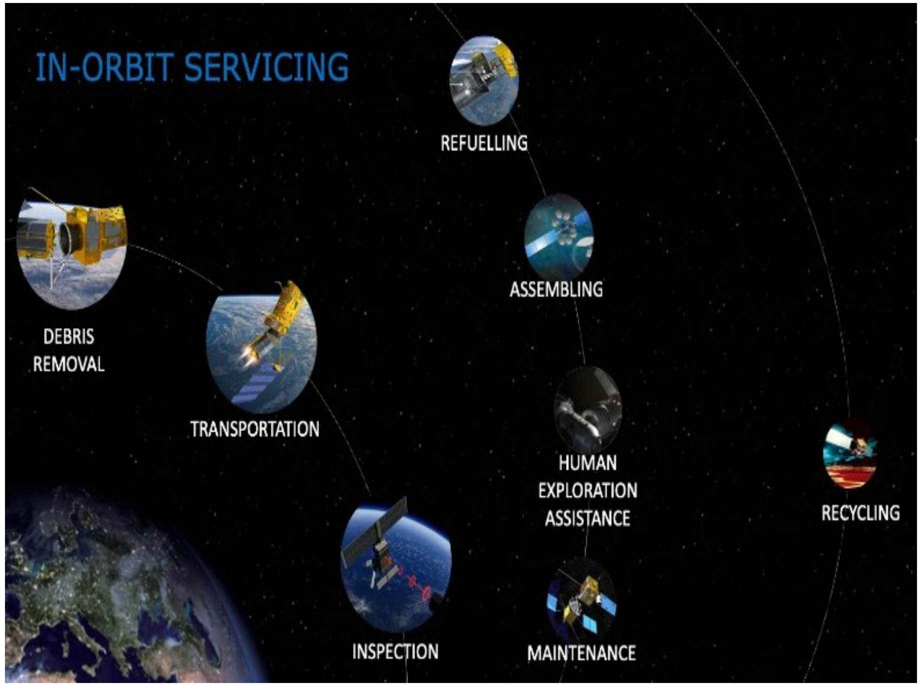
Courtesy: JAXA Recycling Plant concept image

Accelerator (TRL6-9) - “Customer driven” innovative technologies and services

European Innovation Council

Scope/ specific objectives

- To further mature self-assembly of spacecraft in orbit with different applications (e.g. in-orbit, cis-lunar exploration, Earth observation, space debris inspection, space situational awareness, etc.);
- To design and construct a R&I low Earth orbit unmanned platform assembled in orbit and to host in-orbit microgravity experiments or collect/re-use space debris considering and make use of a sustainable, modular concept for the platform and its operation;
- To scale up disruptive innovations for space situational awareness (SSA), in-space logistics, EO, navigation, SATCOM and others.



Courtesy: ESA

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"Customer driven" innovative technologies and services

- Some examples of customer-driven = commercial or institutional end users

Spacecraft Inspection	Collision avoidance	Collect, recover and transform space debris
Tracking, locating & describing s/c,(distance & close inspection) Collection of information of s/c anomalies (e.g. antenna deployment anomalies) and p/l ones SSA data for SST and RPO operations, etc.	AI/ML for collision avoidance Space debris positioning data for RPO On-board processing capabilities for debris detection For IOS, ADR, EoL Unexpected s/c rescuing activities	Space debris collection Autonomous Robotic Servicers/Arms/Tools S/C or components recycling, recovering& transformation purposes(e.g. mg platforms) Space Welding

"Customer driven" innovative technologies and services

- Some examples – In Orbit Servicing (IOS), Active Debris Removal (ADR), End-of-Life (EoL) for cooperative and non-cooperative objects

In orbit servicing, Active debris removal, EoL	In-space Assembly & Manufacturing	Microgravity platforms
Augment s/c or external p/l capabilities & resilience Refuelling Orbit raising In-space docking P/L, antenna's, components replacement or repair Robotic servicing with modular, interoperable or scalable parts Modular payloads Satellite upgrade	Self- assembly with smallsats, cubesats, etc. GNC capabilities Modular satellites assembly Multi-material manufacturing Materials separation	Design & construct LEO unmanned robotic platform Self-assembled autonomous platform To host internal/external p/l To service smallsats or even cubesats To collect re-use space debris

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EIC Future Space Portfolio for Accelerator projects

SP 1: Spacecraft Inspection

SP2: Collision avoidance

SP3: Collect, recover and re-use space debris

SP4: In orbit servicing, Active debris removal, EoL

SP5: In-space Assembly & Manufacturing

SP6: Microgravity platforms

EIC Accelerator – Evaluation in 4 steps

European Innovation Council

1 You have an idea

You have a disruptive or deep tech **idea** with a potential to **scale up &** you need **financial support**

Tell us your story in 5 pages

2 Prepare the proposal

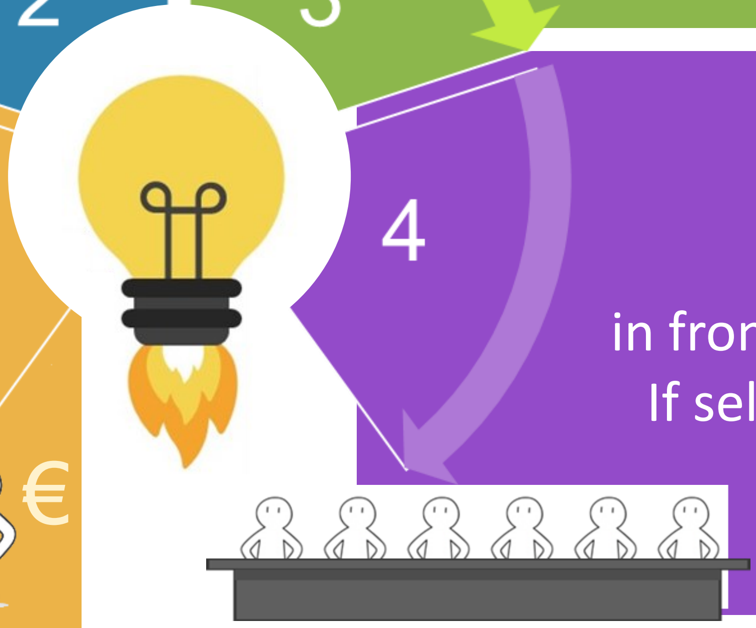
We will help **you** to prepare your **business plan** and draft a **proposal** with AI tool and coaching

3 Submit

You submit your full **proposal** which will be **assessed** by Remote evaluators

4 Pitch to jury

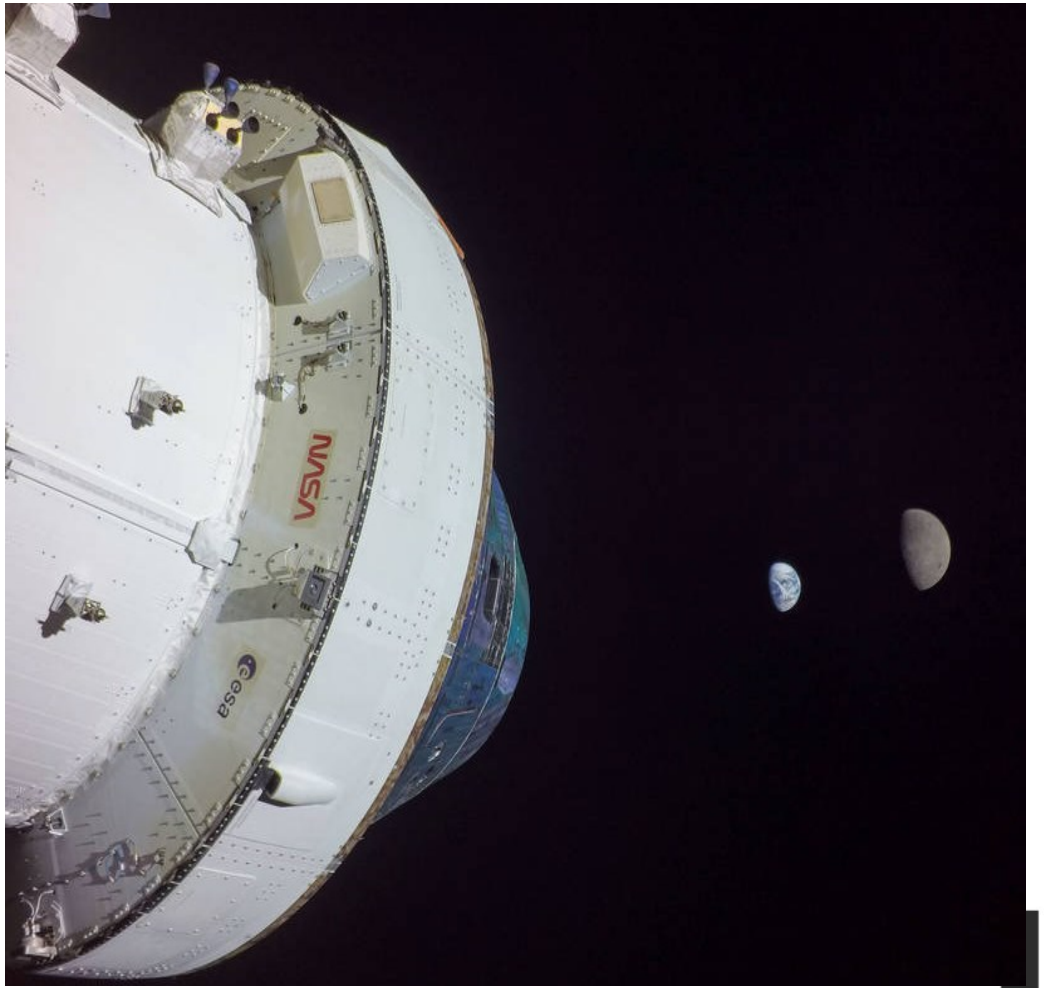
Pitch your innovation in front of EIC Jury Members. If selected, you will sign the **contract**



Conclusions

European Innovation Council

- **WP 2023 -** EIC 2023 work programme (europa.eu)
- **Info Space Days 26/01/2023 Pathfinder-** EIC Pathfinder Challenge: In-space solar energy harvesting for innovative space applications - Information day (europa.eu)
- **Portfolio Considerations** - Challenge Guide Space 2023_v2.pdf (europa.eu)
- **Info Space Days 26/01/2023 Accelerator -** EIC Accelerator space challenge - information day (europa.eu)
- **WP2023 Info Day** - European Innovation Council online Info Day - Work Programme 2023 - 13 December 2022 (europa.eu)
- **EIC Horizon scanning** for space signals for future EIC WP - EUSurvey - Survey (europa.eu)



Courtesy: NASA Orion image taken the 28/11/2022, imagery of the Earth and Moon together from its distant lunar orbit, including this image on Nov. 28, 2022, taken from camera on one of the spacecraft's solar array wings.

Thank you!
Q&A session