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Backing visionary entrepreneurs

Challenges for Circular Economy & Sustainable Living in Space and on Earth

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European Innovation Council and SME Agency

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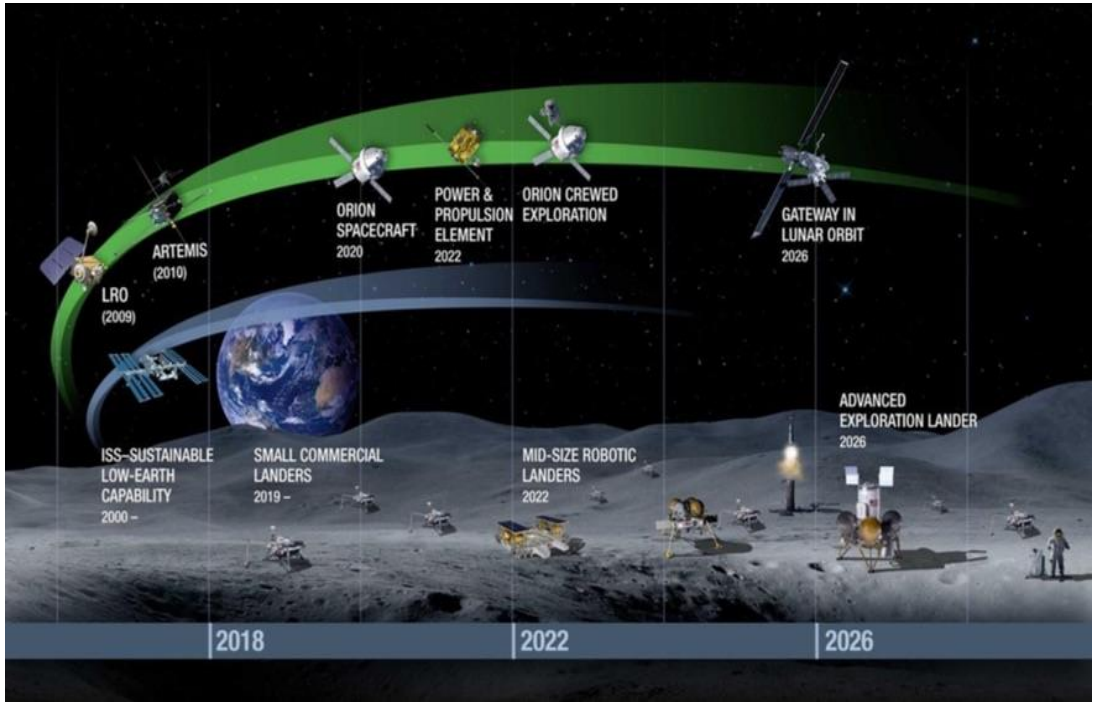
Introduction

- EIC Introduction
- EIC and ESA white paper initiative
- Initial results
- Next steps



Courtesy: NASA

Horizon Europe Structure

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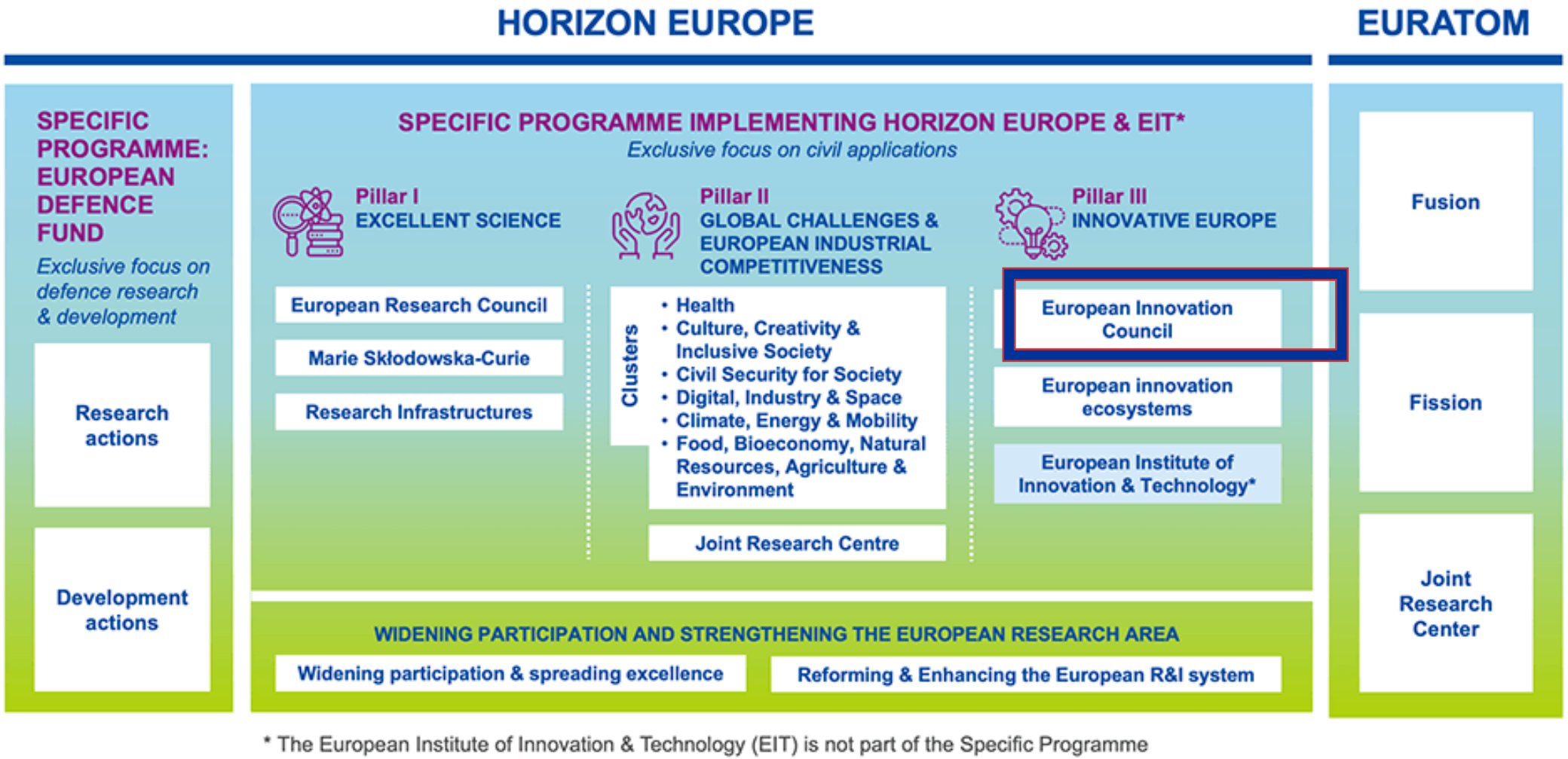

* The European Institute of Innovation & Technology (EIT) is not part of the Specific Programme

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Europe's most ambitious innovation initiative

- **€10 billion** programme to identify, develop and scale up breakthrough technologies and disruptive innovations in Europe
- **Unique** in the world to combine research on emerging technologies with Accelerator for start-ups, SMEs and scale-ups
- EIC set to become **largest deep-tech investor** in Europe (over €3 billion)
- Enhances the **European innovation ecosystem** (partnerships with EIT, ERC, etc)
- **First work Programme** adopted 18 March 2021, €1.5 billion
- **Second Work Programme** adopted 7 February 2022, **€1.7 billion**
- **Third Work Programme** will be adopted in the end of November 2022

Impacts of the pilot: EIC Pathfinder projects and Accelerator companies in all main fields of breakthrough

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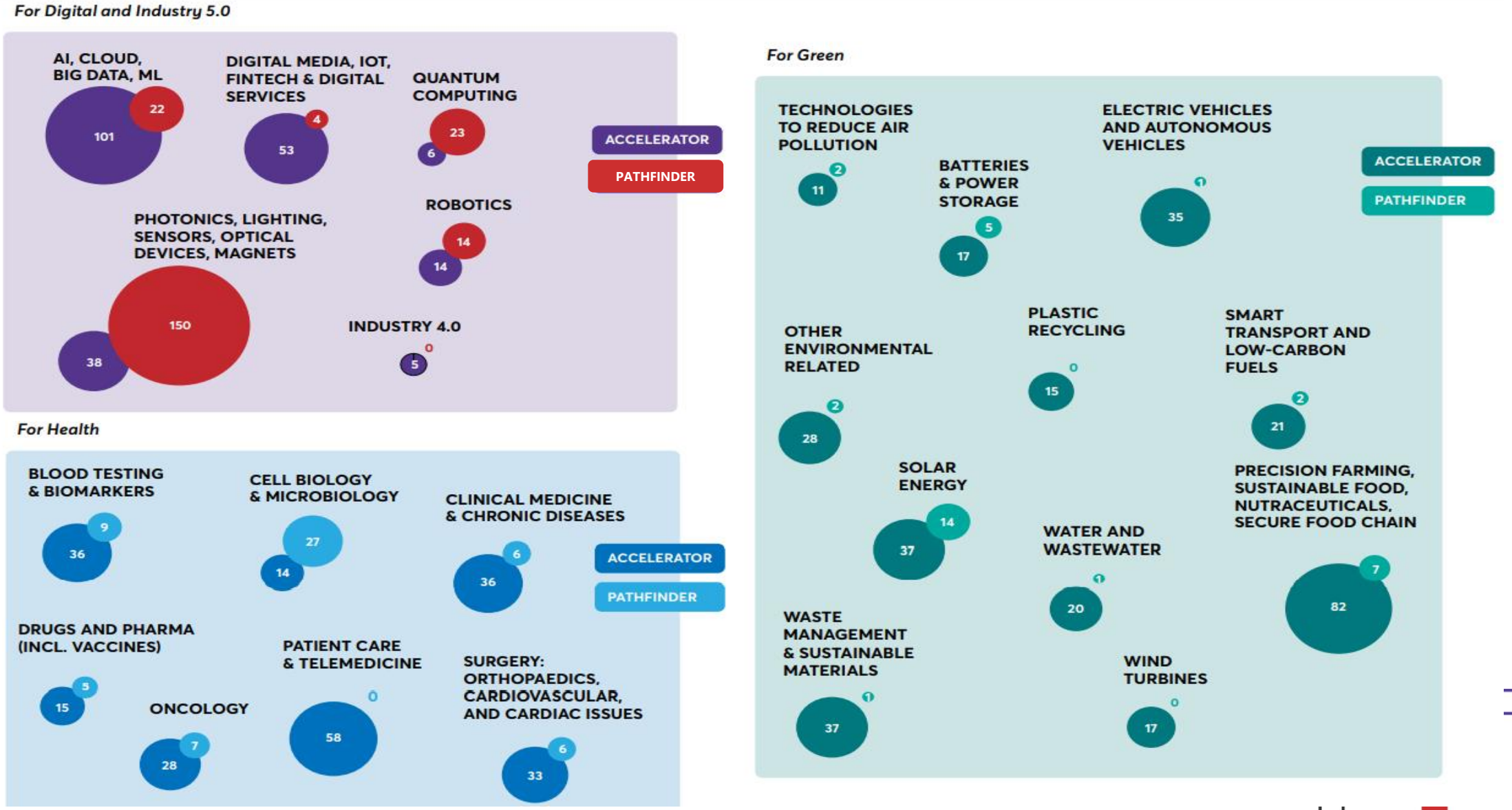

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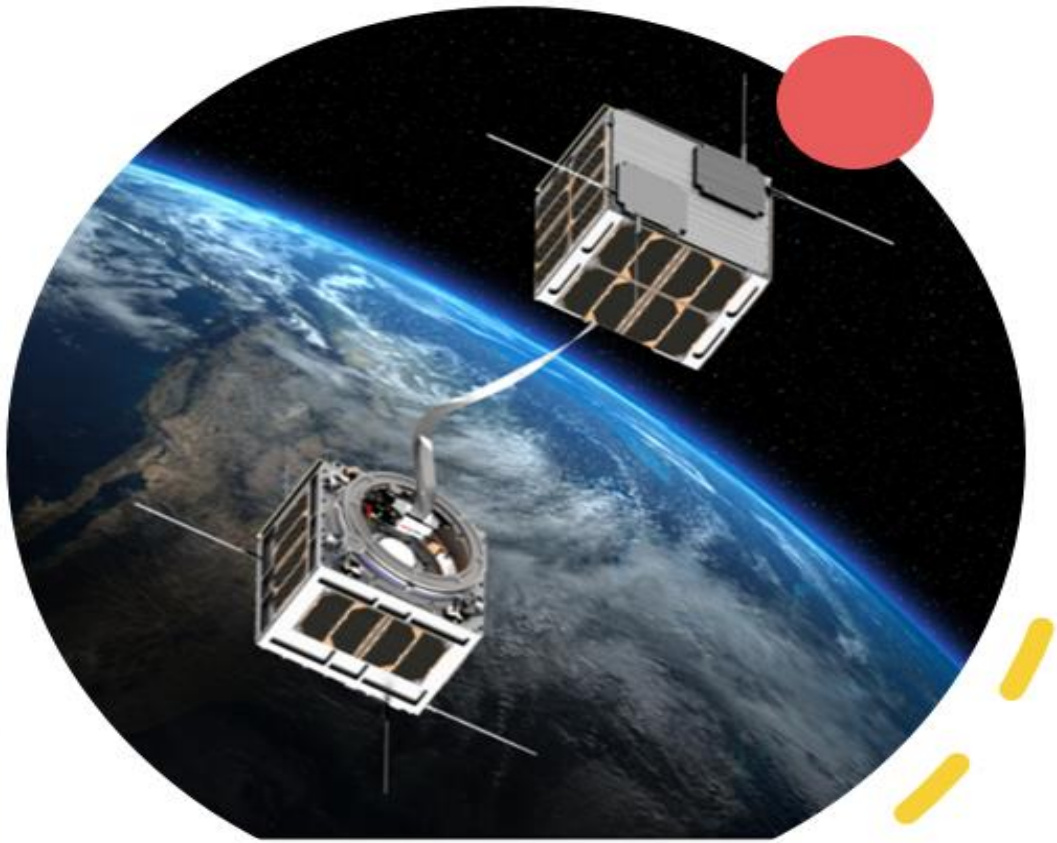
EIC support to space SMEs & start-ups

EIC objective is to identify, develop and deploy high risk innovations with a focus on breakthrough market creation and deep tech innovations

The EIC supports breakthrough technologies and game changing innovations for space SMEs and start-ups

Funding their disruptive/high-risk ideas and supporting them in the process of disruptive innovation, demonstration and commercialization with transversal EIC Pathfinder, Transition and Accelerator programs



Courtesy: E.T.Pack project

EIC Programs

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EIC Pathfinder

For advanced research on breakthrough / game-changing technologies

Pathfinder Open: bottom-up approach; no predefined topics

Pathfinder Challenges: top-down challenge-driven calls for tackling specific issues by portfolios of projects

EIC Transition

For transforming research results into innovation opportunities;

follow up results from EIC Pathfinder and ERC Proof of Concept

Transition Open: no topic prescription

Transition Challenges: selected challenges

EIC Accelerator

For individual companies to develop and scale up breakthrough innovations with high risk and high impact

Accelerator Open: no topic prescription

Accelerator Challenges: selected challenges

Grant Funding, Equity Funding

- Booster Grants
- Fast Track scheme
- Business Acceleration Services

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EIC Programs

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,

Objectives

- To establish a community of innovators and scientists on circularity both for Space and from Space to Earth;
- To present the vision and position of this community – on how circular challenges can be met and what technological, innovation, market building blocks are needed.
- To utilize this vision for a deep-tech roadmap which could unlock public funding for key activities and building blocks;
- To facilitate the transition of circular technologies from Space to Earth and vice-versa.

Courtesy: ESA

EIC and ESA white paper initiative - Part I

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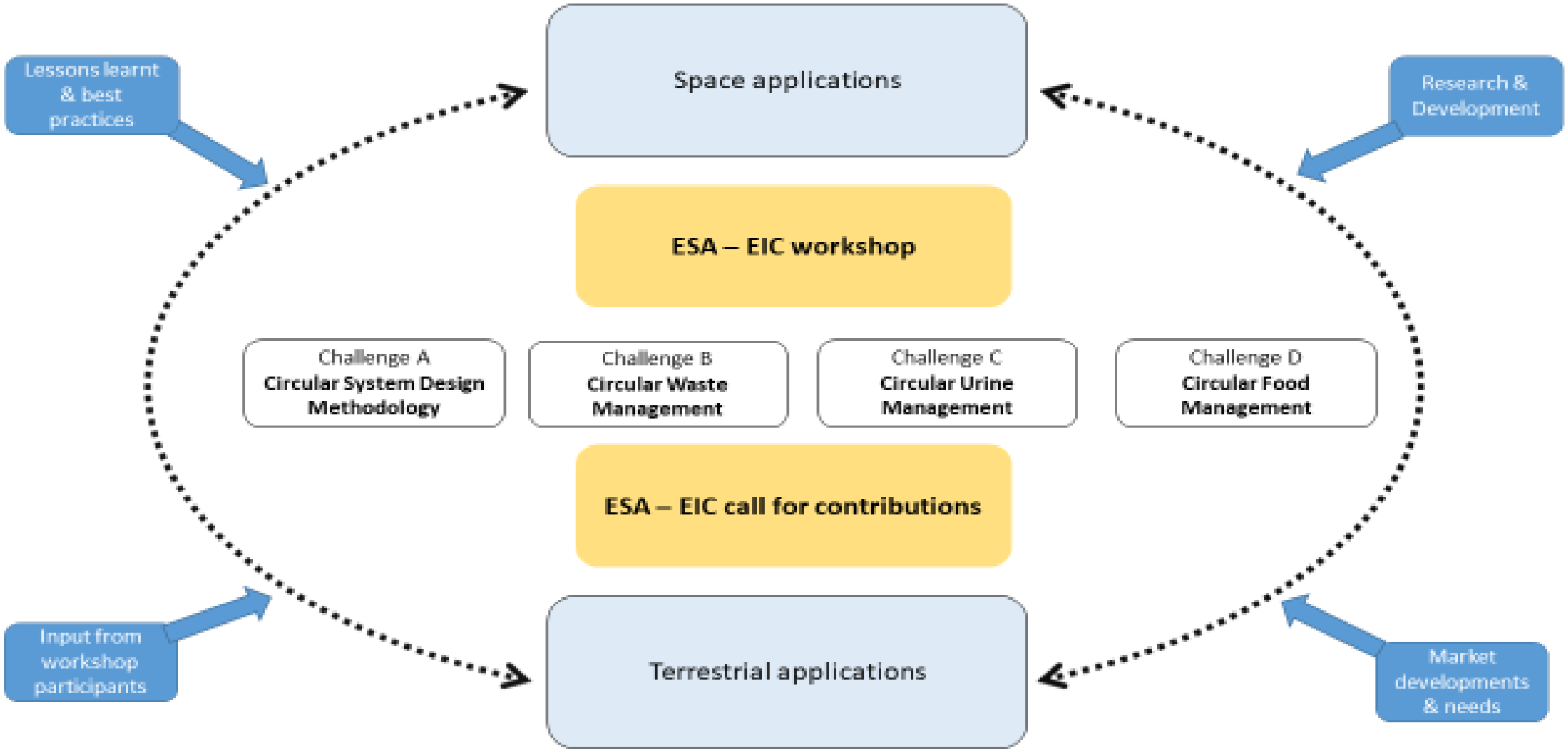
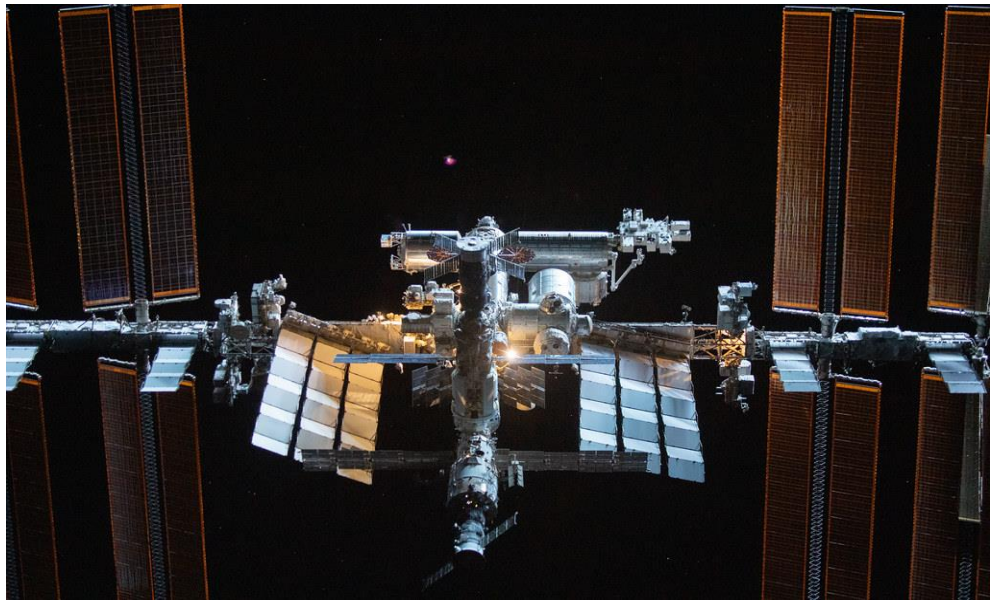


EIC and ESA white paper initiative - Part II

- EIC and the ESA jointly selected and consolidated the results in a White Paper
- 74 proposals received
- 31 selected based on the criterion of completeness, innovation potential and excellence of the contributions
- Joint workshop on 13 May 2022
- Parallel workshops for 4 challenges



Courtesy: ESA

Criteria for proposal selection

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1) Innovation Potential
   - Impact on selected challenge
   - Potential to address space and non-space applications/market
   - Strategic relevance and urgency

2) Excellence of Contribution
   - Conveying the expertise of the author and the beneficial impact of their participation to the strategic workshop
   - Comparative added value of the innovation
   - Identified risks and opportunities

3) Completeness of proposal

Courtesy: ESA

Challenge A- Circular System Design

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Technology Gaps

- Due to the complexity of space systems and terrestrial circular economy models, the design approaches require further iteration, harmonization and operational implementation in order to advance into respective methodologies.
- Multiple disciplines among process and chemical engineering, bioengineering, geoengineering, and recycling technology will no longer be approached as an assembly of “sub-systems” but as interaction of “processes”.

Future Innovation Potential

- The evaluation of technologies for specific circular or closed-loop designs could benefit from standardized methodologies, e.g., a common classification of differing "families" of circular systems;
- Synergies of system design derived from space to terrestrial applications requires further study.

Market Enablers

- The domain would benefit from increasing awareness and interest for circular solutions in terrestrial applications;
- The domain would benefit from funding and support for demonstration cases in high TRL.

Challenge B - Circular Waste Management

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Technology Gaps

- Waste management will rely on detailed analysis on the end-product value and valorisation process demands to generate optimal recycling options for specific products, while avoiding a conflict of waste streams;
- Detailed waste characterization is needed due to the complexity and variability of waste and valorisation requirements;
- Emerging technologies for high valorisation applications, such as organic acids, biopolymers and others require further research and development to mature and implement them in full scale;
- Waste as secondary raw material could be investigated further;
- The use of hydrothermal processes for organic matter conversion requires further research and development to reach stable long-term operation and maturity;
- Implementation of circular processes in full scale is needed and requires further development & funding;
- The analysis on scalability of processes and solutions constitutes a major constraint for this.

Future Innovation Potential

- In the context of enzymatic treatments, the use of mixed-culture processes seem to provide advantages when dealing with complex waste streams;
- Advanced, miniaturized, robust, cost-effective monitoring solutions could benefit all processes for waste management, potentially leveraging on IoT (sensors analysing waste or process conditions).

Market Enablers

- Self-sustainable and robust business models need to be investigated for circular waste management, e.g. industrial symbiosis.

Challenge C – Circular Urine Management

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Technology Gaps

- Urine separation, collection and valorisation would benefit from increased adoption;
- Holistic impact studies to assess the impact of urine separation also for current centralized wastewater treatment plants.

Future Innovation Potential

- Dedicated urban development & sustainable building design to increase the uptake of urine separation and treatment could open an new market for such designers and providers.

Market Enablers

- Enable viable market conditions for urine separation by incentivizing the implementation of such technologies in suitable and significant locations;
- Standardization for source separation;
- In conclusion, customer acceptability would be facilitated by the setting up of a European harmonized framework that would recognize the infrastructure benefits of urine treatment and give a return to the building owners that will use them (i.e. exemption on wastewater treatment charges). In fact, the diversion of urine constituents (nutrients and micropollutants) is beneficial for sewer corrosion and for centralized wastewate treatment.

Challenge D – Circular Food Management

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Technology Gaps

- Simplification of technologies regarding micobial, funal and micoalgal processing technologies;
- Advanced and safe processes for biocontamination control;
- Optimization of facilities with regards to efficiency, surface/volume ratio and production of high-quality food
- Advancements in Nitrogen recovery and processing strategies for fertilizers;
- Research and demonstrators to show crop growth strategies being compatible with relevant surface conditions;
- Research on regolith-based substrates and compatibility for crop cultivation;
- Utilization of insect species in valorisation processes for plastic waste and faecal wastes.

Future Innovation Potential

- Advancing water and nitrogen recovery in combination with food production strategies (creating a loop between waste, urine and food);
- Additive manufacturing using biomass / bioplastic;
- Real-time monitoring and remote control of crop growth including plant analysis;
- Advancements in adaptive greenhouse technologies could provide benefits for food production chambers in space as well as greenhouses and vertical farming on Earth.

Market Enablers

- Research, development and demonstration opportunities focussed on installation and operation of circular food systems and infrastructure;
- Incentivising the commercialisation of circular foods both in regulatory and economic sense.

Next Steps

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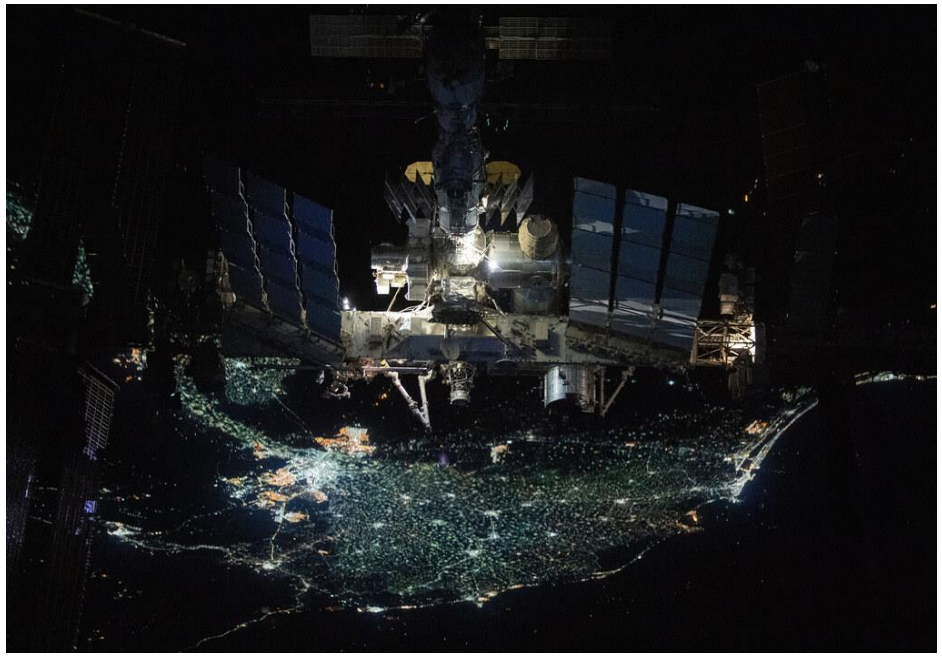
Harmonization Process

- Authors to address questions and add finalize references -25/11/2022
- Identifying additional synergies between the space & terrestrial applications- 25/11/2022
- Shortening text – 25/11/2022
- Adding images – 25/11/2022
- Publication of the White paper -7th and 8th of December 2022



Courtesy: ESA

Acknowledgments

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Courtesy: ESA

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Thank you!

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