BSGN
Business in Space Growth Network

CATAPULT
Satellite Applications

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Advanced Materials & In-Orbit Manufacturing Accelerator

Live Industry Forum

Space-based R&D and Microgravity Manufacturing: State of Play and Outlook

Tuesday, 22 July 12:30 BST / 13:30 CEST

ISS NATIONAL LABORATORY

SPACE FORGE

Nanoracks
VOYAGER SPACE

TWI

Photocentric

SPACE CARGO UNLIMITED

SPACE PHARMA

REDWIRE

The Exploration Company

UKRI Science and Technology Facilities Council

Factories in Space

University of Glasgow

FLAWLESS PHOTONICS

ALATYR

esa BUSINESS INCUBATION CENTRE

BSGN
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Welcome and Opening

Francesco Liucci
BSGN Programme Lead,
Innovation Management Officer
ESA BSGN

Hamid Soorghali
Lead. Strategy & Consulting
Adv. Materials Accelerator Lead
Satellite Applications Catapult

- *Organisers introduction*
- *Webinar context and objectives*
- *Webinar sessions*
- *Overview of BSGN Initiative*

The Satellite Applications Catapult in Numbers

£700.3M
Total Private Sector Funding Secured By Supported Companies

508
Industry Collaborations

836
Smes Supported

111
International Projects

Over
£15M
Of Research and Development Facilities

242
Academic Collaborations

200
Employees

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A European-wide multidisciplinary accelerator dedicated to new materials and in-orbit engineering solutions

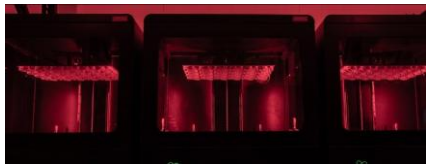
Accelerator at a glance

Generates, **co-funds** and **de-risks commercial projects** developing breakthrough materials and manufacturing solutions using in-orbit R&D and microgravity engineering platforms.

- Stimulates demand for commercial space services in LEO
- Support market-driven activities (commercial R&D)
- Engage new terrestrial actors who are neophytes in the space sector

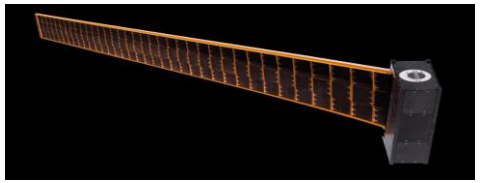
Current project portfolios

Photocentric



Developing an in-space R&D and production unit for space stations, capable of manufacturing silicon carbide components.

D-CUBED



Integrating in-orbit manufactured solution in productisation of roll-out solar arrays for LEO spacecrafts and small satellites.

Commercial Microgravity in an emerging segment of Space – enabled by new In-orbit Infrastructure – promising new avenues for product innovation to non-space industries

Space Industry Value Chain

Core Space

Systems

Ground

Launch

Space-enabled services

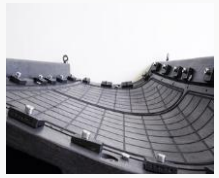
EO

Connectivity

Navigation

In-orbit markets (Emerging)

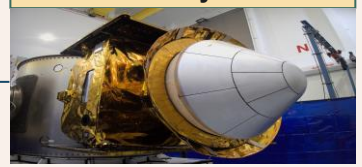
In-orbit services



In-orbit infrastructure

Space Stations

Free Flyers



Space Planes

In-space R&D & Manufacture

Advanced Materials

- Space-grade semiconductors and optical fibres (ZBLAN)
- Novel alloys, composites and cchemicals formulations

Bio Pharma

- Drug Discovery
- Bioprinting
- Protein Crystallisation

In-Space Assembly

- Large Structures
- Additive Manufacture
- Assembly Robotics

Focus of today

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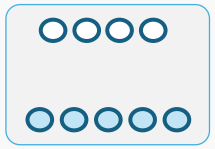
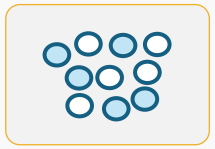
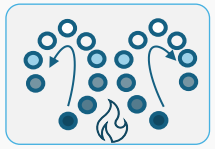
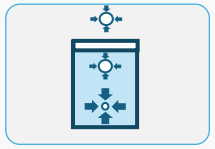
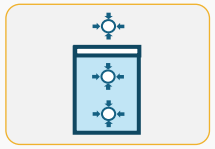
Advantages of space R&D and production

Microgravity

R&D Labs on **Earth**	R&D Labs in **Microgravity**	
		Weightlessness and absence of sedimentation
		Absence of thermal and buoyancy driven convection
		Absence hydrostatic pressure - diffusion become dominant
		Containerless processing

+

Extreme environment

- Vacuum (10 9 10 6 torr)
- Atomic oxygen (4.5 eV)
- Ionizing space radiation (0.3 Sv /
- Extreme temperatures (120 to +120 C)
- High speed micrometeorites (8 to 60 km/s)
- UV radiation

Alters diverse processes – such as crystal growth; fluid mixing; gas & liquid separation; heat transfer; solidification – that **are critical to scientific research** and **production process across advanced materials** and pharmaceutical industries

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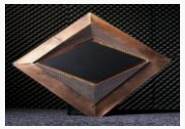
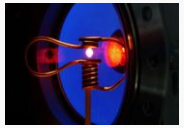
Microgravity translational impact on various materials

Translational benefits of space-based R&D on materials and materials processing

Materials made in space have properties such as increased purity, strength, and precision, offering distinct advantages over Earth-made materials.

	Metamaterials and low-mass materials	Precise fabrication of intricate structures, reduced structural limitations, and tailored properties
	Exotic glasses and fibers	Reduced crystallization, suppressed sedimentation, and improved material distribution
	Ceramics	Improved structural integrity, enhanced dimensional accuracy, and precise fabrication of delicate structures
	Super-Alloy Casting	High-temperature processing capabilities, improved alloy composition control, and unique material properties
	Containerless Processed Materials	Reduced contamination, eliminated erroneous reactions, homogeneous nucleation, and reduced segregation
	Multiphase Materials	Improved uniformity of meso-scale structuring, reduced defects, and improved mechanical, thermal, and transport properties

Industrial Crystal growth

- Microgravity enhances crystal growth – allow for larger crystals with improved uniformity, distribution, and altered morphology
- ***Semiconductor materials***
- ***Optico-electonic and photonic materials***
- Metal alloys
- Energy materials (perovskites and gallium nitride

Multi-phase materials systems

- Multiphase materials are particularly vulnerable to gravity-driven forces, leading to product defects that impact their performance and properties
- Alloys
- Ceramic composites
- Polymer blends
- Emulsions, surface materials

Microgravity can create diverse innovation opportunities in the watchmaking industry, from new alloys and advanced composites for components to unique coatings for finishes and innovative watch crystals

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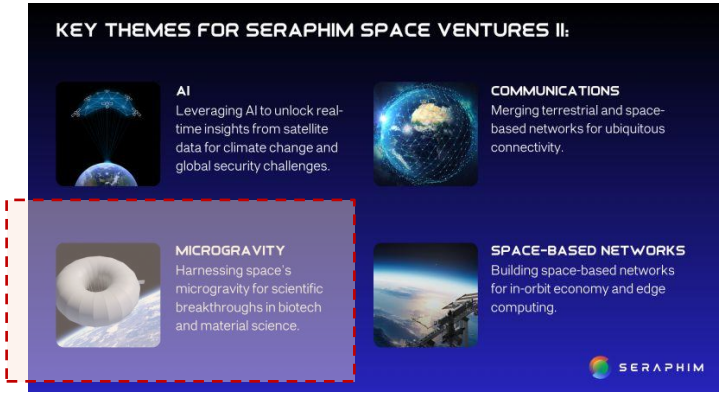
Context: The growing momentum

Growing recognition by Governments

Growing recognition in industry roadmaps and allocation of grants

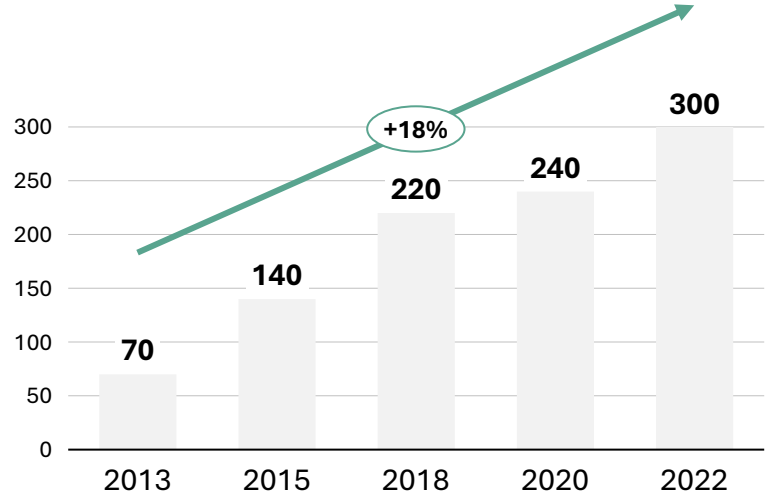
Both call for **continual institutional investments** for **commercial** exploitation in **microgravity environments**

Growing recognition by VCs



Growth opportunities on horizon

Rapidly **increasing the number patents** applications annually



McKinsey & Company

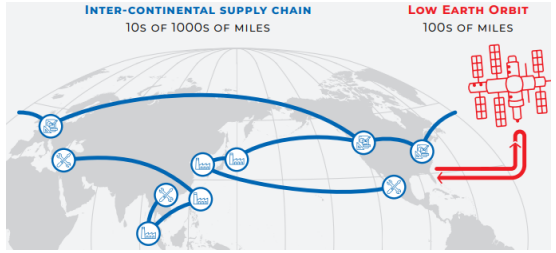
*Defines space-based R&D **as a new frontier** for driving **product innovation and differentiation** in **advanced materials** and **biopharma industries***

Estimates a **$7-10 billion** market by mid 2030s, by **capturing share of existing R&D spent**

Cross-industry Supply chain integration opportunities

Opportunities for:

- Integrating Space supply chain with that of the pharma and materials sectors
- catalysing new investment sources in the sector space economy



The growing momentum

Flawless Photonics now fabricating record-breaking lengths (over 11km) of high-value optical fibre.

Commercial ecosystem has more than doubled since 2022 – Factories in Space

A broadening user base, confirmed by a 71% increase in industry-led payloads on the ISS

Targeted progress in high-value semiconductors, evidenced by dedicated platforms like Redwire's semiconductor manufacturing platform and Intel/NASA partnership.

Butler University meta-analysis of over 160 orbital crystal growth experiments, is creating a strong evidence base for the entire industry

Formation of end-to-end commercial services, like the EVA partnership in Europe

Intensifying market pull from Earth

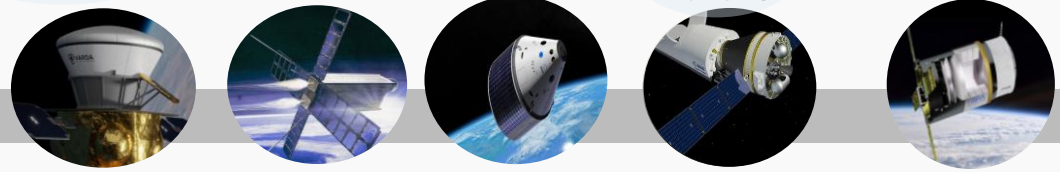
Democratising Access – The growth potential of In-orbit Materials R&D opportunities largely hinge on the development and expansion of the supply chain.

2023-2026 | **2027-2035** | **2035-2040**

International Space Station

- Limited in scope of experiments, facilities and relevant hardware
- Long waits for access
- Lack of sufficient automation

VARDA SPACE INDUSTRIES | SPACE FORGE | The Exploration Company | esa Space Rider | ATMOS



Potential new players | Potential new players

Emergence of First free-flying platforms – offering Earth-Return services

Planned Commercial Space stations

AXIOM SPACE | ORBITAL REEF | VOYAGER SPACE HOLDINGS

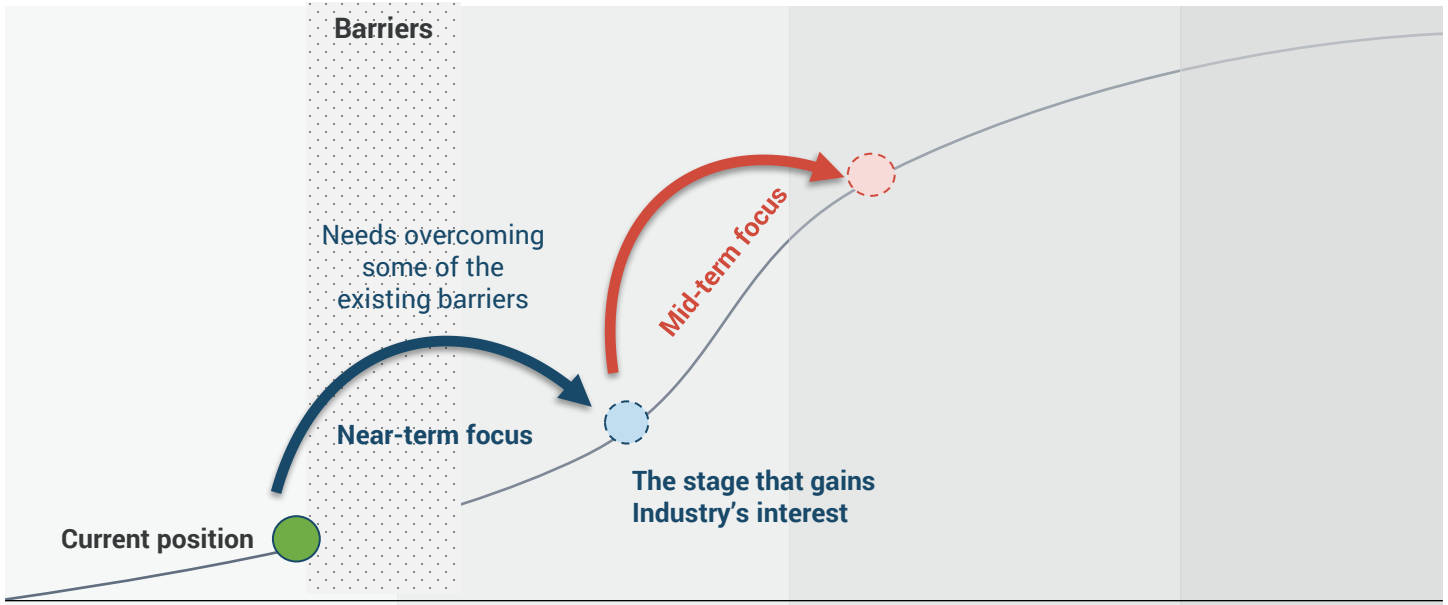
Potential new stations | Potential new stations

A fast-evolving commercial microgravity R&D service providers with differentiated services

ICECUBES | ALATYR | SPACEPHARMA | AEGIS AEROSPACE | BIOREACTOR EXPRESS | SIERRA SPACE | REDWIRE | SPACE TANGO | BIOSERVE | ORBITAL PARADIGM | CATAPULT Satellite Applications

The current status of in-orbit R&D and production and barriers to commercialisation

Adoption and market acceptance curve of Microgravity R&D as Innovation Platforms



Basic Research	Applied Research & development	Translational – product development	Wide adoption & acceptance
▪ Discovery / knowledge expansion ▪ Research driven by scientific quest rather than addressing specific needs	▪ Research customized as a response to a specific application challenge, supporting the business case for product development	▪ Translates applied research findings into new product development ▪ Mainly carried out by the industry	

Supply side barriers

- Supply side services and **capabilities till nascent and evolving**
- **Gaps in** enabling **technologies**
- High **costs**; long **procedures**
- **Regulatory** uncertainties and barriers

Demand side barriers

- **Limited awareness** of microgravity's benefits for innovation and product development
- **Limited** grant **funding** resulting in **short-term, fragmented projects** with little impact and tangible results
- Diluted **perception of complexity** in navigating microgravity R&D **platforms** or relevant **facilities**
- Know-how embedded in academia with a **lack of support frameworks** to support their translation and **spin-outs**
- **Different agendas** between academia & industry; **academic-driven** with isolated outcomes
- Lack of **specialised technicians** and talent

Over the next 4 hours, you'll hear from:

- Leading organisations who've participated in previous accelerator cohorts,
- National and European institutions enabling this ecosystem,
- And of course, from our colleagues at ESA, who are stewarding the BSGN initiative.

Sessions at a glance

Session 1: Trends, emerging dynamics and evolving landscape for Materials Innovation

- Demand and usage
- Infrastructure capability gaps
- Sector diversification
- Opportunity zones

Session 2: Research Translation into Commercial Ventures

- Breadth & depth of research
- Academic spinouts
- Tech transfer pathways
- Venture readiness gaps

Session 3: National & European Initiatives – market stimulation and innovation

- Market stimulation
- Lessons learnt
- Role of Accelerators
- Access infrastructure

Break – Spotlight: BSGN Accelerator Phase 2 Funding Call

- Call scope overview
- Application guidance
- Thematic areas
- Q&A with leads

Session 4: Commercial Services Platforms

- Breadth & depth of research
- Academic spinouts
- Tech transfer pathways
- Venture readiness gaps

Session 5: The Payload Development Journey

- Design to integration
- Engineering challenges
- Platform selection
- Non-space support

Closing Remarks

Microgravity R&D and manufacturing – at a glance

Space-Based R&D and Manufacturing

Commercial microgravity is an **emerging segment** of the space economy.

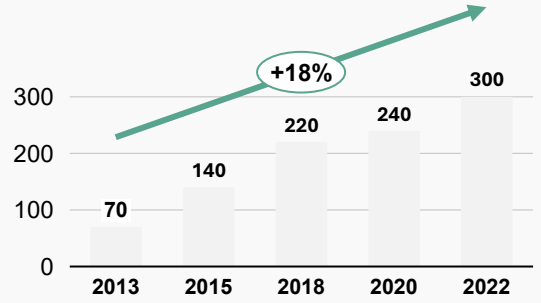
Microgravity platforms enable engineers to leverage unique space conditions for **cutting-edge R&D**, **product development**, and **IP generation**

McKinsey & Company

*"In-space R&D is a **new frontier** for driving **innovation** and **product differentiation** in advanced **materials** and **biopharma** industries"*

Is gaining significant attention

Rapidly **increasing technology patent** applications



Growing attention and investment by Venture Capitals

FOUNDERS FUND

LUX

SERAPHIM CAPITAL

Non-exhaustive

Including with multinationals

Innovative multinationals are using space based-R&D to:

- Discover new materials and processes for applications on Earth
- Address product development technical challenges
- Enhance existing products through novel insights and techniques gained from unique conditions

LAMBORGHINI

P&G Procter & Gamble

adidas

MERCK

Braskem

Non-exhaustive

esa

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The growth potential of In-space R&D and production is driven by the development and expansion of In-Orbit Infrastructure supply chain that is catering to the emerging comemrcial microgravity marketplace

2023-2026 | **2027-2035** | **2035-2040**

International Space Station

- Limited in scope of experiments, facilities and relevant hardware
- Long waits for access
- Lack of sufficient automation

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CATAPULT Satellite Applications

LOW EARTH ORBIT COMMERCIAL PLATFORMS VALUE CHAIN MAP

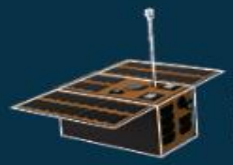
esa


SPACE RIDER


DREAM CHASER


THE FORGESTAR


NYX CAPSULE

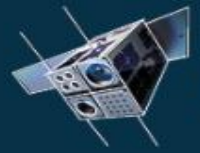

ISISPACE CUBESAT PLATFORM


ST-42


ROCKETLAB PHOTON


SPACEX STARSHIP


POLARIS

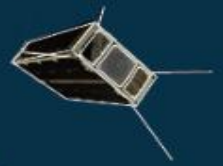

ENDUROSAT CUBESAT PLATFORM


RADIAN ONE


REV 1


LOFT ORBITAL PAYLOAD HUB SERVICE


SUSIE


GOMSPACE CUBESAT PLATFORM

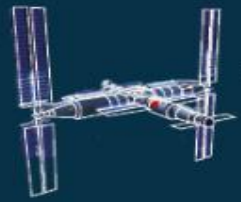

SPACEX DRAGON CAPSULE


STARLAB


NORTHROP GRUMAN SPACE STATION


ORBITAL REEF


AXIOM STATION

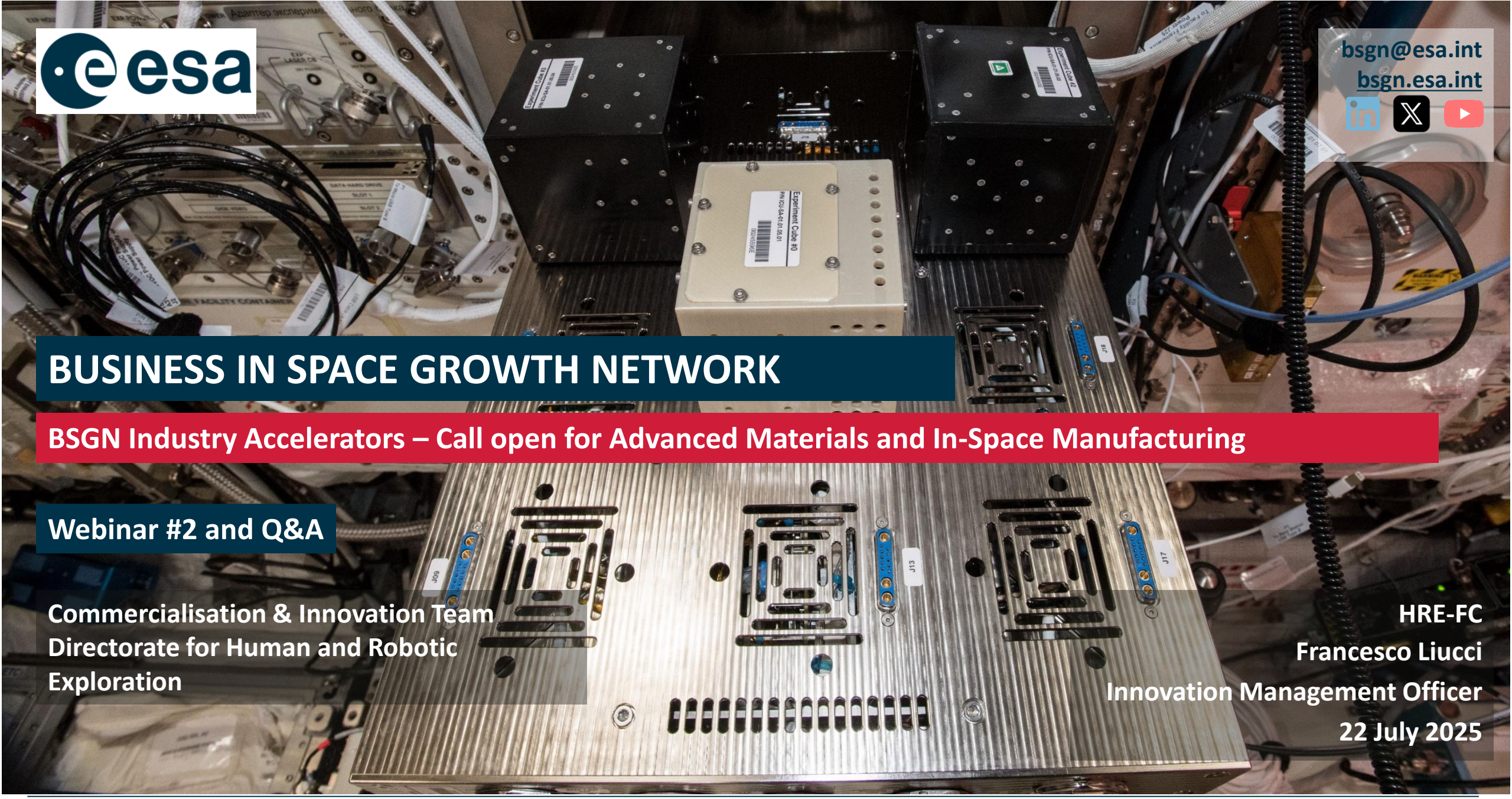

TIANGONG

INTERNATIONAL SPACE STATION

SATELLITES

FREE FLYERS

SPACE STATIONS



BUSINESS IN SPACE GROWTH NETWORK

BSGN Industry Accelerators – Call open for Advanced Materials and In-Space Manufacturing

Webinar #2 and Q&A

Commercialisation & Innovation Team
Directorate for Human and Robotic Exploration

HRE-FC
Francesco Liucci
Innovation Management Officer

22 July 2025

bsgn@esa.int
bsgn.esa.int

BSGN INDUSTRY ACCELERATORS

AGRICULTURE AND FOOD

LIFE SCIENCES

ADVANCED MATERIALS & MANUFACTURING

LUNAR SPACE RESOURCES

What Business in Space Growth Network (BSGN) stands for

BSGN
Business in Space Growth Network

- An ESA initiative **driving commercial use of space** (microgravity and space resources) to create impactful solutions **for Earth** and **future human and robotic exploration**
- Three Accelerators focused on supporting **commercial R&D in Low Earth Orbit (LEO)** Life Sciences, Advanced Materials & in-Space Manufacturing, Agri-food
- One Accelerator focused on **Lunar Space Resources**
- Catalyst for new markets and ecosystems in space, linking terrestrial industries with space-based opportunities

Catapult Open

Supporting commercial microgravity R&D

COMMITTMENT

PRIVATE INVESTMENT

INCENTIVE

CO-FUNDING

\+ Acceleration Services by BSGN Industry Accelerators

BSGN Business in Space Growth Network

DELIVERING

MEDES

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1 SPACEPHARMA

2 ICECUBES

3 SPACEPHARMA

4 The Exploration Company

5 SPACEPHARMA

6 Photocentric

7 DCUBED

8 YURI

9 ASTROBIOME®

ZePrion experiment ISS

PROMETHEUS LIFE TECHNOLOGIES

UGA Université Grenoble Alpes

ONETRECK

BioOrbit

Roche

SOPHIE'S BIONUTRIENTS

Phase 1 numbers

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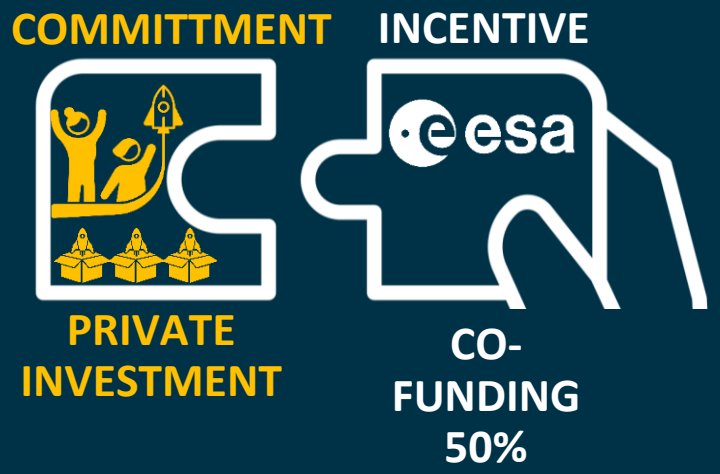
ACCELERATORS MODEL



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Acceleration Services delivered by BSGN Industry Accelerators
MANAGING PARTNERS

- **Nine commercial projects** have been supported by the BSGN Accelerators
- Two projects flown in 2025, 7 projects set to fly within next 2 years
- During Phase 1, via the BSGN Accelerators ESA has provided co-funding in excess of **€3M** (€2.3M from E3P, €732.7k from CIC) matched by **€2.3M** by private investment.

Phase 2: Extending network and impact

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Business in Space Growth Network

- **Increase the number of projects that successfully execute commercial R&D in microgravity**
- **Attract higher level of <u>private investment</u> in these markets and activities**
- **Establish industry-led programs with <u>large corporate players</u> (open innovation & challenge-driven)**
- **Scout and support projects that:**
  - Demonstrate **<u>new and scalable use cases</u>** (multiple in-orbit flights)
  - Have applications for both **<u>terrestrial markets and space exploration</u>**

BSGN Accelerator for Advanced Materials and In-Space Manufacturing

- Catapult manages the **ESA Business in Space Growth Network (BSGN) for Advanced Materials and In-Space Manufacturing Industry Accelerator**

- **Objectives of the Accelerator:**
  - **Stimulate the demand for commercial space services in LEO**
  - Support **market-driven activities** (commercial R&D)
  - Engage **new terrestrial actors** who are neophytes in the space sector

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Session 1: Trends and Emerging Dynamics

How demand, infrastructure, and platform usage are evolving — and where opportunity zones are emerging.

Rose M. Hernandez
Science Programme Director
ISS National Laboratory

Ken Savin
Chief Scientist
Redwire

Erik Kulu
Founder & Curator
Factories in Space

Hamid Soorghali
Lead. Strategy & Consulting
Satellite Applications Catapult

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Session 2: Research Translation into Commercial Ventures

Mechanisms and bottlenecks in translating institutional research into commercially viable microgravity ventures

Phil Carvil
Scientist, Head of Clusters
STFC

Advenit Makaya
Advanced Manufacturing Engineer
ESA

Vito Di Pietro
Senior Business Development Manager
TWI

Gilles Bailet
Lecturer in Space Technology
University of Glasgow

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Session 3: National & European Initiatives

Institutional initiatives and strategies to stimulate the microgravity market, capabilities and innovation pipelines

Mike Curtis
Head of ISAM
Satellite Applications Catapult

Carl Savage
Manager
ESA Business Incubation Centre, STFC

Francesco Liucci
BSGN Programme Lead, Innovation Management Officer
ESA BSGN

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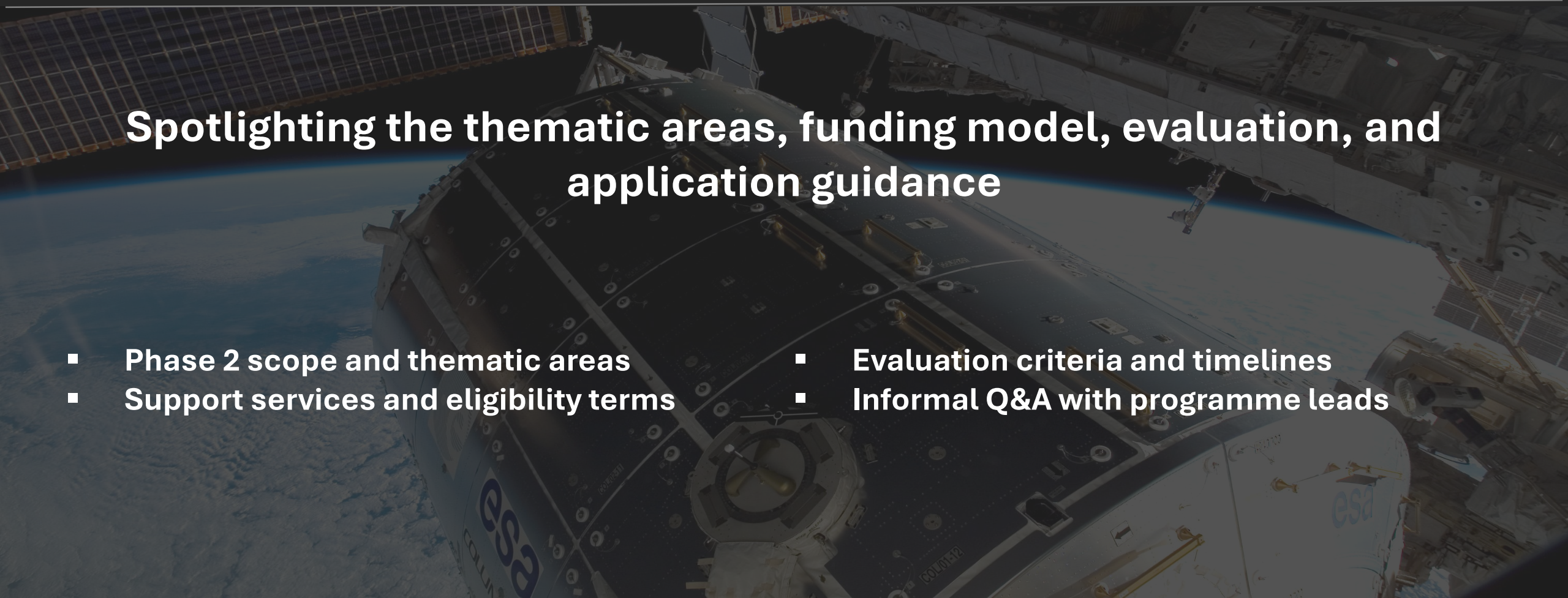
Break

Spotlight on BSGN Advanced Materials Funding Call



Spotlighting the thematic areas, funding model, evaluation, and application guidance

- Phase 2 scope and thematic areas
- Support services and eligibility terms
- Evaluation criteria and timelines
- Informal Q&A with programme leads

A European-wide multidisciplinary accelerator dedicated to new materials and in-orbit engineering solutions

Accelerator at a glance

Generates, **co-funds** and **de-risks commercial projects** developing breakthrough materials and manufacturing solutions using in-orbit R&D and microgravity engineering platforms.

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- Support market-driven activities (commercial R&D)
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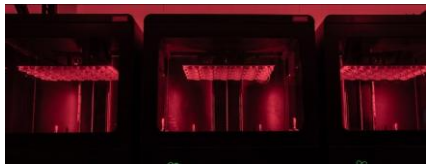
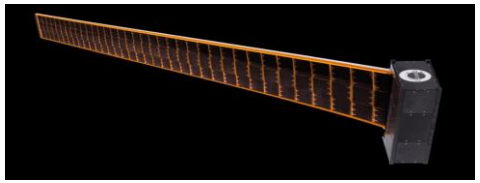
Alumni Cohort

Photocentric



Developing an in-space R&D and production unit for space stations, capable of manufacturing silicon carbide components.

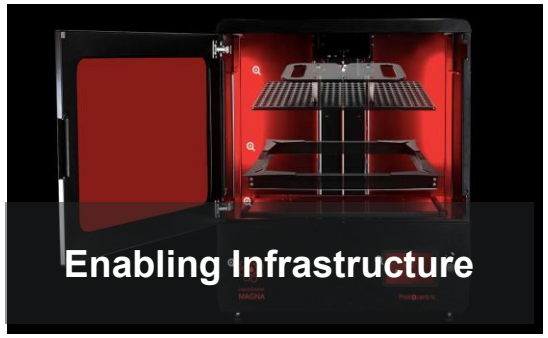
D-CUBED



Integrating in-orbit manufactured solution in productisation of roll-out solar arrays for LEO spacecrafts and small satellites.

Four thematic areas

- New materials for Earth R&D initiatives focused on improving purity, crystallisation, strength, or performance of advanced materials in microgravity.
- This includes semiconductors, composites, superconductors, quantum materials, functional nanomaterials and more.



- Onboard R&D hardware and facilities;
- Development or use of modular, autonomous, multi-user platforms for space-based research and processing.

- In-orbit testing of materials, components, or subsystems for performance validation, environmental durability, or certification readiness.

- Innovations that enable in-space production of satellite components, energy systems, or mission-critical infrastructure.
- Focus areas include solar arrays, telecommunications payloads, on-orbit assembly tools, and structural fabrication.

Who can apply and evaluation Criteria

Open to Commercial Entities in ESA member states

They can include startups, SMEs, scale-ups, corporates, and university spinouts that have incorporated.

The lead applicant must be a commercial organisation

Non-ESA co-funding to cover at least 50% of the project costs

Academic institutions may join as non-leading partners, contributing R&D capabilities or facilities.

Seven equably weighted criteria across three tracks:

Track 1: Solution–Market Fit

- Market alignment and commercial potential
- Differentiation, IP defensibility, use-case clarity

Track 2: Microgravity Rationale & Demonstration

- Why microgravity is essential
- Post-demo roadmap, user validation, TRL jump

Track 3: Team and Delivery Capability

- Team track record and execution realism
- Defined risks with clear mitigation strategies

CATAPULT
Satellite Applications

Timeline

June - August 2025

Idea Submission

Open until **31st August**

September – October 2025

Ideas Evaluation

End October – Early November 2025

Projects Selection Announcement

December 2025 – May 2026

Acceleration Technical, business and financial maturation

May 2026 - onwards

Co-funding from ESA

ESA CO-FUNDING OPTIONS

OPTION 1
Direct funding from Accelerator

- **800k€ already secured**
  Up to 50% of the total project costs
- Additional funding possible for more projects

OPTION 2
Redirection towards other relevant ESA co-funding tools

- Case-by-case basis
- In accordance with the rules of each specific ESA co-financing tool

Eligible costs

- Ground-based preparatory activities
- Payload design and development
- Flight planning, analytical integration,physical checkout, launch integration
- Delivery and operations
- Testing and validation with potential customers
- Market rollout

All eligible costs are for materials or services provided by entities based in ESA E3P Member States (from project/consortium or external entities)

Advanced Materials and In-orbit Manufacturing Accelerator 2025

esa

CATAPULT Satellite Applications

Image: ESA

BSGN
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Session 4: Commercial Services Platforms – Today and Post-ISS

How evolving platform capabilities, access models and service offerings are shaping the microgravity ecosystem in the ISS and post-ISS eras.

Sebastian Klaus
CEO and Founder
Atmos Space Cargo

Mathieu Goudot
Chief Revenue Officer
Space Cargo Unlimited

Neil Monteiro
Microgravity Research Manager
Space Forge

Joost van Tooren
Commercial Director
ALATYR

Victor Maier
VP Business Development
The Exploration Company

Francesco Liucci
BSGN Programme Lead, Innovation Management Officer
ESA BSGN

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Session 5: The Payload Development Journey

Unpacking the end-to-end process of designing, integrating, and flying R&D payloads — with a focus on challenges, lessons, and support provided by Commercial Service providers

Olga Moraru
Sr. Business Development Manager
Voyager Space

Amir Ghaffari
Lead Scientist
Photocentric

Alex Goodhand
Space Manufacturing Lead
Satellite Applications Catapult

Hubert Moser
Managing Director and CTO
Flawless Photonics

Daniel Campbell
UK Managing Director
Space Pharma

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Closing Remarks

Thank you for joining, over 24 countries were represented today.

A special thanks to all the panellists, moderators and the team for helping bring the webinar together, and to UKSA and techUK for their support.

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Satellite Applications Catapult Podcast Series

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