

# Highlights 2017

INNOspace  
MASTERS

## Space 4.0 New ideas for the next space generation

The competition is embedded in DLR Space Administration's INNOspace® initiative, which promotes innovation and new markets.

Operator



Federal Ministry  
for Economic Affairs  
and Energy



Partners



Organiser





## INTRO

The key technologies brought forth by the space industry continue to drive innovation as we enter a future marked by increasing digitalisation and automation. Ground-breaking developments can be expected in a number of areas, especially in microelectronics, software, and smart materials. Meanwhile, global stakeholders are emerging in new constellations and presenting innovative business ideas and commercialisation concepts for the space sector. In doing so, they are helping to promote the development of integrated value chains that are capable of manufacturing versatile subsystems and components in cost-effective ways. This is resulting in compelling opportunities to expand into new markets not only for aerospace companies, but for those in more conventional leading industries and midsize supplier firms, as well.

Under the theme “Space 4.0”, the second INNOspace Masters competition embarked on a search for new ideas and concepts designed to address the space industry’s current challenges and offer potential innovative solutions. In doing so, it succeeded in building on the success it achieved in the previous year.



Dr Gerd Gruppe  
Member of the DLR Executive Board  
German Aerospace Center (DLR), Space Administration

With both the quality of the project ideas and concepts entered and the wide range of topics covered, the relevance of the competition is underscored. The Space Administration of the German Aerospace Center (DLR) is the operator of this competition. I am thrilled with this positive response and looking forward to advancing the ideas received along with the other INNOspace Masters partners. I congratulate all of this year’s winners and finalists. At the same time, my sincere thanks go out to Airbus Defence & Space and Germany’s ESA Business Incubation Centres (BICs) in Bavaria and Darmstadt for their support. Furthermore, I want to thank Anwendungszentrum GmbH Oberpfaffenhofen (AZO) for doing such an excellent job of organising the INNOspace Masters competition.



## INNOSPACE INITIATIVE



Space is an important driver of innovation for Germany and a key to open new markets. In order to use and exploit the innovation potential and cross-industry technology synergies more goal-oriented and efficiently, the Space Administration of the German Aerospace Center has launched the INNOspace® initiative in 2013.

INNOspace® is an initiative in the framework of the Federal Ministry for Economic Affairs and Energy (BMWi) “National Programme for Space and Innovation” and part of the German government’s new high-tech strategy since 2014. In close coordination with the BMWi as well as with various federal states, INNOspace® comprises the following instruments:

- › Interdisciplinary symposia to initiate cooperation projects
- › Expert and user workshops on “new markets” and networking
- › Promoting innovation and transfer projects with funds from the National Programme
- › Ideas competition INNOspace Masters in cooperation with the German ESA BICs and Airbus Defence and Space
- › The mobile INNOspaceEXPO “ALL.täglich!” for efficient public presentation of space applications in everyday life
- › Website [www.dlr-innospace.de](http://www.dlr-innospace.de)





## PRIZE CATEGORIES



Space Administration

- Increased flexibility and modularisation in production processes
- Platform concepts, cyber-physical production systems
- Intelligent and standardised components
- Improvements and new developments in NDI quality assurance methods



- Progress in the commercialisation of space
- Development of innovative system elements and components



- New business models for satellite payloads
- Efficient launch concepts and ridesharing
- Automation, robotics, and troubleshooting in manufacturing
- New standards for processes and interfaces



Business Models for User Needs

**Pre-competition phase**  
Research, development, demonstrators

Companies (especially SMEs), universities, and non-university research institutions

Verifiable applications are eligible for up to EUR 400,000 in funding support for proposal  
Opportunities to obtain follow-up support within the DLR network



**Initial phase**

Proof of market, near-to-market prototypes

SMEs, startups, research teams, students

Application support for one of the two ESA BICs (across five locations) in Germany and EUR 50,000 in funding if successful  
Access to Europe-wide expert networks and consulting services

**Operational and integration phase**  
Technologies, systems, services & solutions

Large-scale enterprises, SMEs, startups

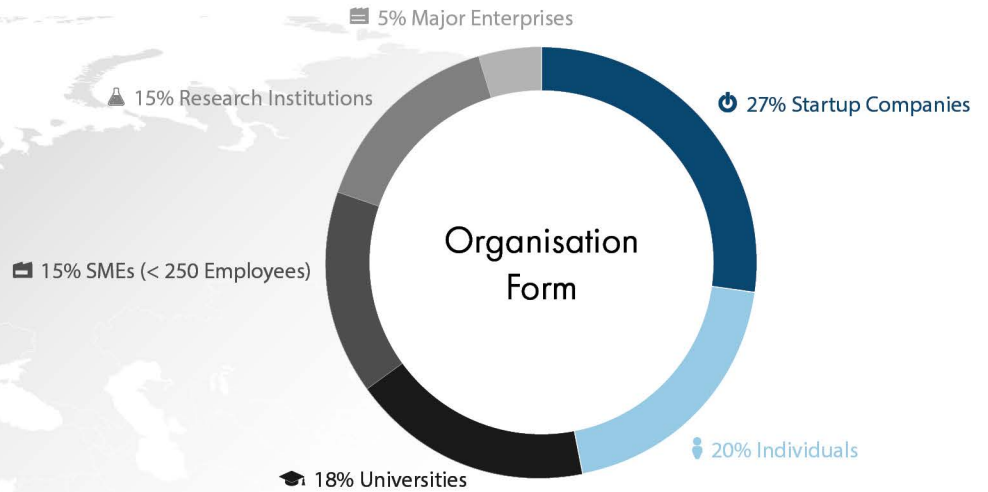
Tailored support package with access to expertise, application for Airbus incubation and investment, and opportunity to become an Airbus partner and supplier  
Preparation of joint proposal for public funding

Utilisation & Application Phase

## STATISTICS

The INNOspace Masters 2017 addressed European companies, startups, universities and non-university research institutions. Overall, 146 participants with 66 team entries from ten different countries took part in the ideas competition.

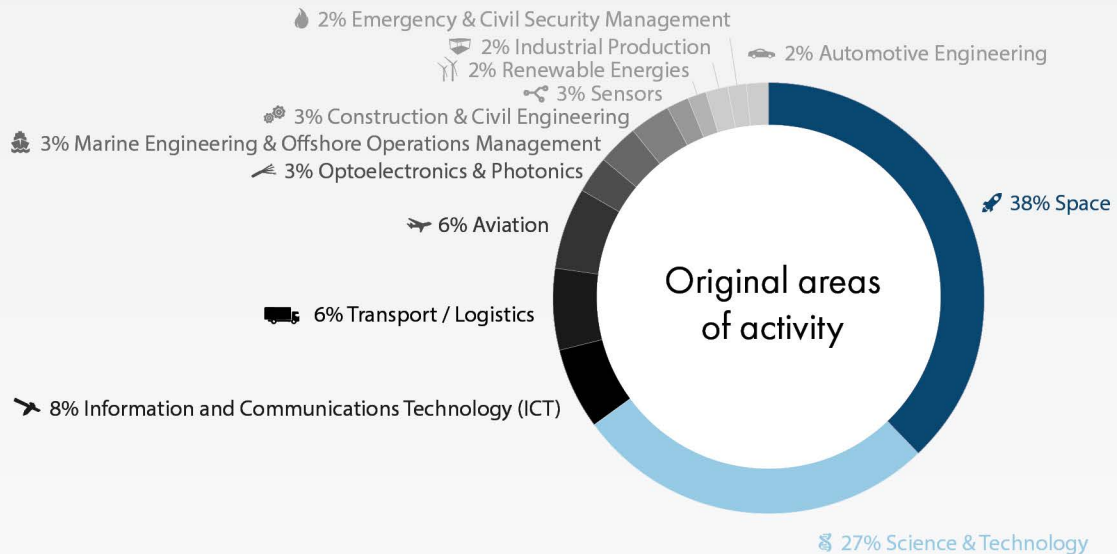
10 participating countries





## STATISTICS

The second INNOspace Masters ideas competition called for projects that involve forward-looking transfers of technologies and expertise from other industries to the space sector ("spin-in") as well as transfers from the space sector into non-space industries ("spin-off"). The INNOspace Masters 2017 has affirmed once again the growing importance of technology development in other sectors for space.



# „Space 4.0“ – Challenge by the DLR Space Administration

The aerospace sector finds itself in a transitional phase. New production and manufacturing processes, as well as the increasing digitalisation, offer new opportunities and possibilities for new business models.

## CHALLENGE

The DLR Space Administration was looking for ideas and new concepts which offer innovative solutions to current challenges of the space sector. The following fields were specifically addressed:

Industrialisation of more flexible production processes, modular platform concepts, intelligent components, the use of standard components, and improved nondestructive inspection (NDI) methods in quality assurance.



**DLR**

Space Administration

## PRIZE

- › In case of successful application, receipt of a grant from the “National Programme for Space and Innovation” as an individual or joint project
- › Up to EUR 400,000 in funding for each project of the three finalists



Cooperation Partners:



## Wall#E: Fibre-Reinforced Spacecraft Walls for Storing Energy

The idea behind Wall#E involves integrating energy storage functions into the support structures of spacecraft, which will significantly reduce the mass and volume of satellites without sacrificing performance. To this end, Wall#E utilises fibre-reinforced structures (which enjoy more and more popularity in aerospace engineering) infiltrated with innovative solid-state battery materials. While this project's initial focus is on satellites, the underlying concept can easily be adapted to launch systems, space stations, and ground-based e-mobility applications.

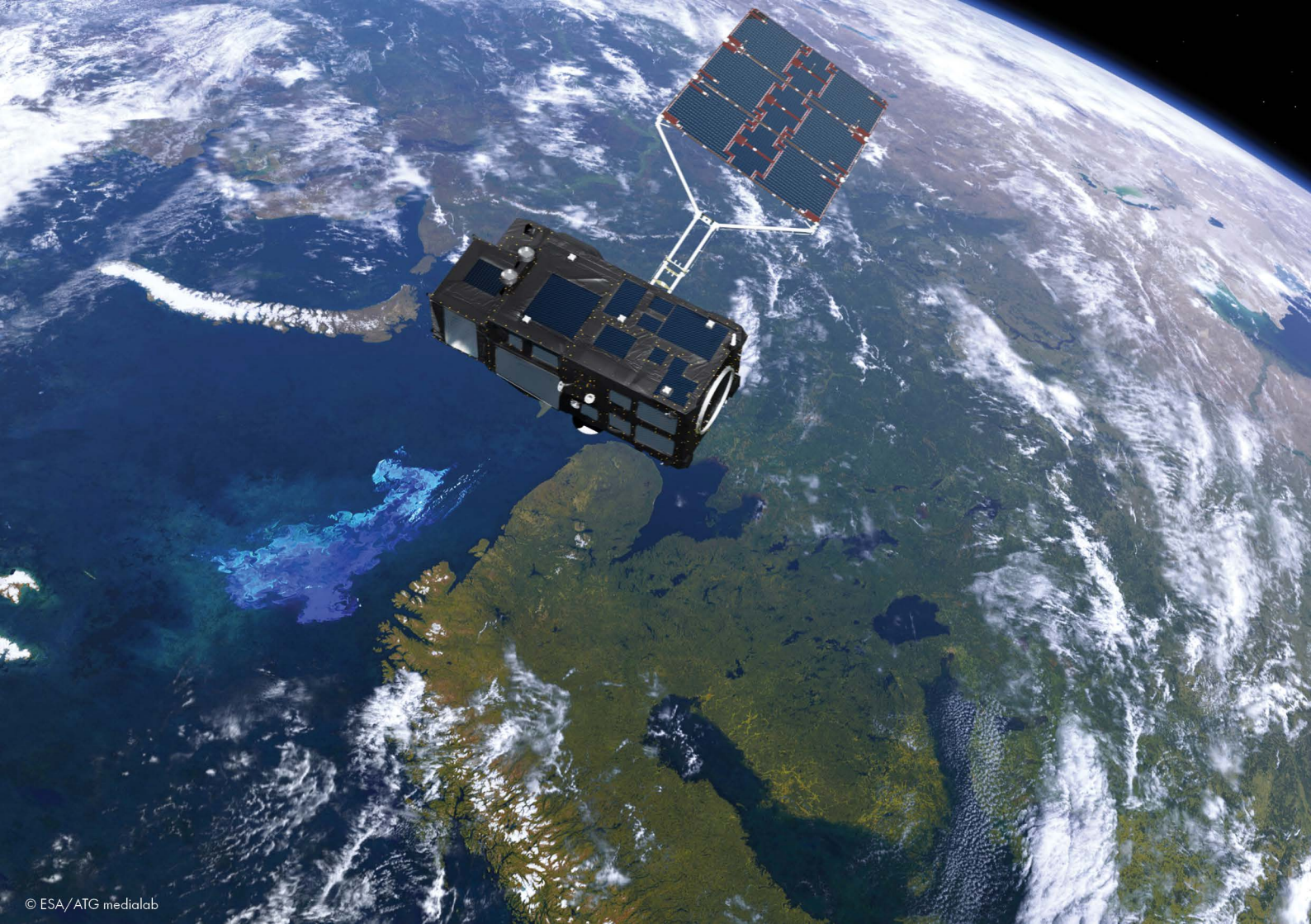
Benefits:

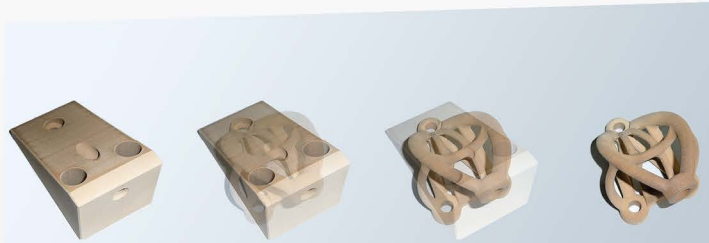
- › Reduced satellite mass
- › Simpler, more compact constructions
- › Lower costs of development/launch



TU Braunschweig – Institute of  
Space Systems  
Brunswick, Germany  
Prof Dr-Ing Enrico Stoll  
[www.space-systems.eu](http://www.space-systems.eu)  
[e.stoll@tu-bs.de](mailto:e.stoll@tu-bs.de)







Lightweight design of an existing component created using 3D-printing techniques

© Rauch CNC Manufaktur GmbH&CoKG

 **Fraunhofer**  
IST

Cooperation Partners:



## Additive Manufacturing for Space Using High-Performance Polymers

AMPFORS (Additive Manufacturing of Polymer Parts for Space) is seeking to replace the metal structural components used for space applications with lightweight polymer parts. These parts are produced by means of additive manufacturing, which is also known as 3D printing. To compensate for their lower mechanical stability compared to metal, the polymer components are then outfitted with a metallic layer to form a “sandwich” composite. AMPFORS plans to use both the high-performance polymer PEEK and the less expensive material polyamide (PA). In addition to the space sector, this project’s key markets include aircraft manufacturing, mechanical engineering, tool-making, and medical equipment production.

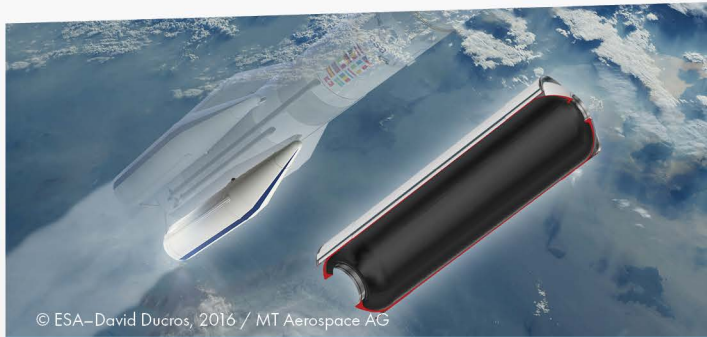
Benefits:

- › Makes satellite structures up to 20% lighter and up to 50% less expensive
- › Incorporation of metal coatings improve the mechanical, electrical, and thermal properties of polymers; also prevents the emission of water and monomers
- › Additive Manufacturing process speeds up component design and production



Fraunhofer IST  
Brunswick, Germany  
Dr Andreas Dietz  
[www.ist.fraunhofer.de](http://www.ist.fraunhofer.de)  
[andreas.dietz@ist.fraunhofer.de](mailto:andreas.dietz@ist.fraunhofer.de)





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Cooperation Partner:



## Flow Front Detection with Fibre-Optic Sensors in the Rotating Infusion Process for CFRP (carbon-fiber-reinforced polymer) Components

In the boosters of the Ariane-6 launch vehicle MT Aerospace AG of Augsburg, Germany, is producing some of the space industry's largest CFRP components. Measuring around 12 metres long and 3.4 metres in diameter, these parts are manufactured using a vacuum infusion process in which dry carbon fibres are wound around a form and then submerged in resin. Intelligent sensors are needed to monitor the flow front of the resin as it is introduced and optimise the overall process. For this purpose, MT Aerospace AG is now working with Fraunhofer LBF on incorporating glass fibre sensors into its components during the winding phase. During infusion, each component has to be turned slowly in an oven. This delicate step is where the sensors monitor the distribution of the resin.

Benefits:

- › Digitalised manufacturing optimises the process while reducing costs
- › Visualisation of previously hidden processes and corresponding digital controls provide for increased process stability
- › Information gained from sensors makes it possible to automate the flow of resin and ensure quality and repeatability
- › Process data also improves control and accelerates ramp-up to serial production, which makes the company more competitive



Fraunhofer LBF  
Darmstadt, Germany  
Martin Lehmann  
[www.lbf.fraunhofer.de](http://www.lbf.fraunhofer.de)  
[martin.lehmann@lbf.fraunhofer.de](mailto:martin.lehmann@lbf.fraunhofer.de)

## Airbus Defence and Space Challenge

Global economies are at the onset of a fourth industrial revolution. The ongoing process of digitalisation means a radical change for traditional value chains and the opportunity of new products, services and business models along a new supply chain of the commercial space industry.

### CHALLENGE

Airbus Defence and Space was seeking for new products, and business models all along the value chain in the commercial aerospace industry. Thereby, the focus was on application-based development and utilisation of platforms, payloads, and launch opportunities.



### PRIZE

- The winner receives a tailored package of advisory and support services:
- › Direct access to Airbus Defence and Space in-house expertise, expert networks and procurement organisation
  - › Support for the application for the BizLab Accelerator
  - › Support for the application for the Airbus Venture Fund
  - › Analytical assessment of payloads and (sub-)systems, with the opportunity for a subsequent physical accommodation study, testing, and preparation of a mission proposal



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## MSP: Advanced Modular Production of Microsatellites

To keep up with the emerging requirements of mass production, mega-constellations and formations of microsatellites one needs innovative test concepts and production processes. Modern manufacturing techniques from the realm of Industry 4.0 can open the door to significant productivity gains in high-volume satellite production. The Zentrum für Telematik e.V. (Würzburg) is working on transferring new methods and tools for satellite production into the space sector. The submitted idea is specifically geared towards human-robot collaboration based on the use of a lightweight robot.

Benefits:

- › Integrated testing and production systems increase lot sizes and quality
- › Modularisation and standardisation in electronic production reduces overall system complexity, which also simplifies the production process
- › Testing based on smart components reduces production costs

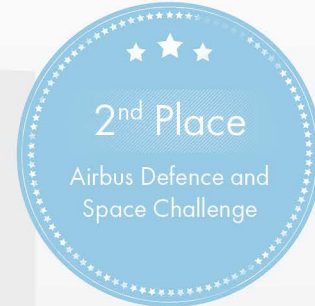


Zentrum für Telematik (ZfT)  
Würzburg, Germany  
Prof Dr Klaus Schilling  
[www.telematik-zentrum.de](http://www.telematik-zentrum.de)  
[info@telematik-zentrum.de](mailto:info@telematik-zentrum.de)





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## SPUTNIC-Piezo: Spacewheel Unbalance Termination with Intelligent Control of Piezoactuators

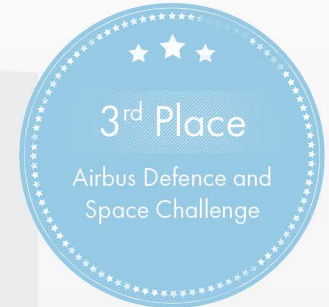
Manufacturing tolerances and the related imbalances in reaction wheels lead to vibrations in satellite structures. These vibrations are detrimental to the performance of sensitive payloads such as telescopes and cameras, which can produce poor image quality as a result (see illustration). SPUTNIC technology combines piezoelectric actuators with conventional ball-bearings to support rotating wheels. Since the unbalanced wheel is allowed to spin on its main axis of inertia, SPUTNIC's sophisticated control algorithm nearly eliminates all imbalance vibrations. This innovation not only reduces the stress on components to increase their useful life; it also enables sensitive payloads to reach their full potential.

### Benefits:

- › Eliminates vibrations in reaction wheels
- › Enables sensitive payloads to achieve optimal performance
- › Simple, lightweight structure with low energy consumption
- › Failsafe design enables reaction wheels to remain functional even when system is inactive



TU Darmstadt – Institute for  
Mechatronic Systems in  
Mechanical Engineering (IMS)  
Darmstadt, Germany  
Stefan Heindel  
[www.ims.tu-darmstadt.de](http://www.ims.tu-darmstadt.de)  
[info@ims.tu-darmstadt.de](mailto:info@ims.tu-darmstadt.de)



## iBus – Standard Intermediate Power Bus Interface

SPACE IC produces highly integrated and versatile microchips for efficient power conversion. In satellite payloads, these chips help solve the power interface problem which electronic modules face. Individual power interfaces limit the reusability of these modules and make power distribution systems both complicated and inflexible. This is where the Standard Intermediate Power Bus Interface comes into play, which SPACE IC is going to define along with experts in power management. A standard interface of this kind will aid satellite payload manufacturers in increasing efficiency and flexibility of power distribution while reducing complexity and costs.

Benefits:

- › Flexible, efficient power distribution
- › Simplified development and production
- › Improved reusability and risk reduction
- › Multiple cost-reduction effects, from reduced weight and effort to mass production



SPACE IC GmbH  
Hanover, Germany  
Volodymyr Burkhay  
[www.space-ic.com](http://www.space-ic.com)  
[info@space-ic.com](mailto:info@space-ic.com)

## ESA BIC Startup Challenge

The space sector creates innovations, but has also begun to profit from technical advancements achieved “on the ground” in a variety of industries.

### CHALLENGE

The European Space Agency’s two business incubators in Germany (ESA BIC Darmstadt and ESA BIC Bavaria) – with support from OHB System AG – were searching for new business ideas and models optimising processes, components or subsystems in the aerospace industry and also improving the efficiency and customer orientation of this sector at large.



**business  
incubation  
centre**

Challenge supported by



### PRIZE

The winner receives a tailor-made package of advisory and support services:

- › Assistance in transforming the business concept into a viable business plan
- › Support of the application in either one of Germany’s two ESA BIC facilities. If accepted, you will benefit from EUR 50,000 in funding
- › Access to the Europe-wide network of experts, which can assist in both, technological and business-related aspects
- › Consulting services by OHB System AG to create a viable business plan



 **BAKE IN SPACE**

Cooperation Partners:



Relotius  
Engineering



## Bake In Space

The objective of Bake in Space is to make fresh bread – in this case, common German rolls – aboard the International Space Station (ISS). To that end, the project is building a space-ready oven that will be capable of baking a dough mixture designed for this unique weightless environment. The idea is to use this endeavour as a stepping-stone to providing fresh food that will benefit the wellbeing and general quality of life of those living and working in space. Bake in Space is leveraging the business opportunities afforded by the commercialisation of the ISS and is contributing directly to NASA and ESA's goals for the long-term exploration efforts of humankind.

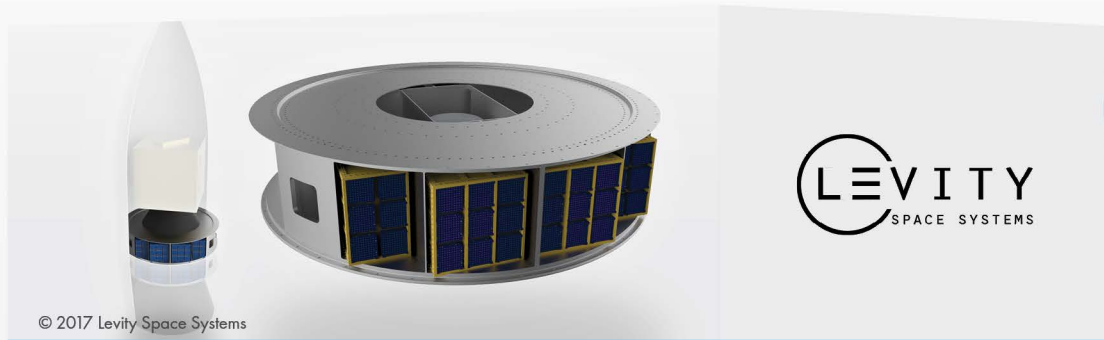
Benefits:

- › Bulk dough packages for future astronaut missions (also suitable as unique gifts for people on Earth)
- › Branded products for space conferences and other events
- › Oven will be made available on a pay-per-use basis to other researchers interested in exploring its uses on the ISS
- › Project will generate spin-off IP and products that could be used for B2B and B2C activities on Earth



Bake in Space GmbH  
Bremen, Germany  
Sebastian D. Marcu  
[www.bakein.space](http://www.bakein.space)  
[sebastian@bakein.space](mailto:sebastian@bakein.space)





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## MESA: Improving Europe's Access to Space

In the next decade, Europe will need a replacement for the International Space Station (ISS) – a new environment in which payloads can be tested in microgravity and the extreme conditions of space. Levity Space System has set its sights on providing public and private institutions with frequent, affordable access to space. MESA – Europe's first modular and stackable satellite structure – is designed to facilitate microsatellite launches, in-orbit demonstrations, and the hosting of experiments. It will be launched as a secondary payload between the upper stage and primary payload of the Arianespace launch vehicles VEGA-C+ and -E.

Benefits:

- › Flexible, modular structures for space transports
- › Sustainable R&D in space in the post-ISS era
- › Turnkey launch solutions and microsatellite deployment in constellations
- › MESA subsystems capable of transporting technologies and experiments directly from labs into space



Levity Space Systems  
Aachen, Germany  
Andres Lüdeke  
[www.levity.space](http://www.levity.space)  
[andres.luedeke@levity.space](mailto:andres.luedeke@levity.space)





## EXPERTS

### Challenge by the DLR Space Administration

#### Dr Michael Brockamp

Scientific Expert, Department of Innovation & New Markets  
DLR Space Administration

#### Dr Thomas Driebe

Head of Physical Sciences Program,  
Department of Microgravity Research and Life Sciences  
DLR Space Administration

#### Dr Susanne Heckrodt

Scientific Expert, Department of Launchers  
DLR Space Administration

#### Dr Klaus Hermanns

Scientific Expert, Department of Innovation & New Markets  
DLR Space Administration

#### Dr Anke Pagels-Kerp

Head of Department of Space Science  
DLR Space Administration

#### Philipp Reißaus

Project Manager – Engineering (Project Risk Rating)  
Munich Re

#### Johannes Schmidt

Executive Board Office Aachen  
EurA AG

#### Peter Seige

Consultant for Space  
Seige Consult

#### Prof Dr Andreas Timmermann

Managing Director & Chairman of the Executive Board  
Berlin-Brandenburg Aerospace Allianz e.V. & Otto Lilienthal Foundation

#### Dr Peter Vits

State Coordinator for Space Activities  
Free Hanseatic City of Bremen

#### Dr Alexander Weiß

Scientific Expert, Department of Space Strategy and Program  
DLR Space Administration

#### Dr Franziska Zeitler

Head of Department of Innovation & New Markets  
DLR Space Administration

## Airbus Defence and Space Challenge

### Goetz Anspach von Broecker

Key Account Manager German Space Research Institutions and ESA Technology  
Programs Research & Technology – Public Funding & Associations  
Airbus Defence and Space

### Prof Dr Jens Eickhoff

Future Programs – Innovation, Design to Industrialization and NewSpace-Programs  
Airbus Defence and Space  
Professor for satellite systems and satellite operation  
University Stuttgart

### Wolf-Peter Foth

Teamlead at “Future Projects & Business Development”  
Airbus Defence and Space

### Ulrich Kuebler

Strategy Space System  
Airbus Defence and Space

### Julian Raatschen

Innovation Management  
Airbus Defence and Space

### Guido Schwartz

Senior Innovation & Business Development Manager  
Airbus Defence and Space

### Dr Georg Willich

Head of Space Research & Development Germany  
Airbus Defence and Space

### Dr Helmut Zaglauer

Architect Advanced Systems  
Airbus Defence and Space

## ESA BIC Startup Challenge (supported by OHB)

### Stefanie Herrmann

Chief Financial Officer  
Anwendungszentrum GmbH Oberpfaffenhofen

### Robert Klarner

Head of Technology Marketing Branch Office Oberpfaffenhofen  
German Aerospace Center (DLR)

### Ulrich Kübler

Strategy Space System  
Airbus Defence and Space

### Thorsten Rudolph

Managing Director  
Anwendungszentrum GmbH Oberpfaffenhofen

### Peter Seige

Consultant for Space  
Seige Consult

### Timo Stuffer

Director Business Development  
OHB-System AG/OHB SE

### Dr Frank Zimmermann

Managing Director & Incubation Manager ESA BIC Darmstadt  
cesah GmbH Centre for Satellite Navigation Hesse

## Contact

Dr Franziska Zeitler  
Head of Department of Innovation & New Markets  
DLR Space Administration  
Mail: [franziska.zeitler@dlr.de](mailto:franziska.zeitler@dlr.de)

Dr Christin Bindl  
Project Management INNOspace Masters  
Phone: +49 (0) 8105/7727722  
Mail: [christin.bindl@azo-space.com](mailto:christin.bindl@azo-space.com)

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GET READY FOR THE  
NEXT CHALLENGE

**The INNOspace Masters 2018**

will call for ideas  
from 16 October 2017 – 31 January 2018 at  
[www.innospace-masters.com](http://www.innospace-masters.com)

SAVE THE DATE  
KICK-OFF EVENT

**INNOspace Masters 2018: Sept/Oct 2017**

in line with the IAP-Workshop  
[www.german-iap-ambassador.de](http://www.german-iap-ambassador.de)