ESA BIC Application Template – Incubation Proposal, v5.1, 25/01/2024

ESA BIC Bavaria - Issue B, 19/02/2024

Incubation Proposal

**[Name of the Company]**

**[Address of the Company or of the Entrepreneur]**

**[Reference Period of Incubation]**

Author: <…>

Date: <DD/MM/YYYY>

Reference: <XXXX>, Issue <…> Version <…>

[Before each paragraph, you will find “writing tips”. Please use these questions as guidelines.

Please limit this Incubation Proposal to maximum 10 pages including cover page and any annexes. Don’t change or reduce the font size.]

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# 1. Activity Proposal

## 1.1 Milestone and Task Planning

Writing Tips

[Please provide an overview of the schedule including duration of tasks and a planning of the mandatory milestones:

* Kick-Off (KO),
* Progress Meeting 1 (PM1) (ca. one month after kick-off)
* Mid Term Review (MTR), and
* Final Review (FR).

Identify at which point of time each task begins and ends. All tasks defined in the planning shall be specified in detail in the Task Descriptions below.

For this, please use the PLAN table contained in the Excel file attached to this application package and insert below. Please note that the table is not meant as a recommendation of how to plan the work, but merely an example of how it can be illustrated. Please ask the ESA BIC for advice if needed.

The maximum duration of the incubation is 24 months.]

Text



Fig.: Milestone Planning [example]

## 1.2 Task Descriptions

Writing Tips

[In this section a detailed description of each Task shall be provided. These Tasks are the core of the business incubation. Therefore, please include tasks both related to business, intellectual property, and technical activities. When you break down the overall business incubation activity, please limit yourself to a manageable structure.

Please note that the space connection should be a fundamental part of the proposed incubation activity. For a “downstream” activity this means that the Incubation Proposal should include clearly defined tasks about how the space based data, space technology, etc. is going to be integrated, further developed, or similarly, and how the related market will be developed. Similarly, for an “upstream” the Incubation Proposal should cover the related key technical and business activities.

Please provide task descriptions for **all** work you intend to do during incubation, not only for work related to using the incentive. If the tasks to carry out require additional resources (e.g. financing in addition to the incentive), please make this clear in the funding table below. Explain how all activities together contribute to the goal of your company.

For each Task, please provide a table containing a detailed description using the template below. Identify the responsible person, input, objective, and output. Use Sub-tasks to detail the activities further. One or several tasks shall contain an outputs that qualifies as “deliverable” according to the Draft Incubation Contract, see also the separate section below..

The task descriptions, and especially the sub-tasks, should be detailed and specific enough for the evaluators of your proposal to understand in detail what activities will take place and how these contribute to the development of the technology and the business. They also serve as a way for the ESA BIC to monitor progress of your company and as a detailed work plan during incubation. Therefore, describe not only what you will do, but also what the intended result is. For development activities, describe how you are going to validate and verify the outcome.

In the costs overview, which also serves as an expenditure plan for the incentive and other sources of funding, explain which costs you expect to have (3rd party costs, not own working hours etc.) and from which sources they are financed. In case you plan to use the incentive to pay for internal costs (provided this is allowed under the incubation contract), then also provide information on personnel category, number of hours, and internal hourly rates are required. Please respect the any restrictions related to the ESA incentive as described in the draft incubation contract.]

Text

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Task # …** [name]  **Responsible: [name]**  **Inputs:** [e.g. output of previous tasks, results of a tests campaign, reference of publication, …  **Objective:** [describe **what** should be achieved by the end of the task and define what a successful outcome is]  **Sub-Tasks** [describe in detail what work should be performed, e.g. which steps need to be taken in order to reach the objective]   1. … 2. … 3. …   **Costs**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Sub-task | Type of expense/Supplier etc. | ESA incentive (EUR) | Local incentive (EUR) | Total of other sources (EUR) | |  |  |  |  |  | |  |  |  |  |  | | Total (EUR) |  |  |  |  |   **Output:** [e.g. Design Document, Software, Hardware prototype, Test Results, Market analysis, …] |

Tab.: Task Description

## 1.3 Deliverables to the ESA BIC

Writing Tips

[Please provide a detailed description of which deliverables will be available and provided to the ESA BIC at the mandatory milestones PM1, MTR and FR. As a minimum, the following is required:

* PM1:
  + Finalised incubation proposal (including any updates agreed upon at the negotiation or subsequently)
  + Updated business plan including any changes made after applying to the ESA BIC
* MTR:
  + MTR report using the template to be provided
  + Updated business plan
* FR:
  + FR report using the template to be provided
  + Final business plan
  + Deliverable item

The ESA BIC may also request additional or other deliverables to be done.

Regarding “deliverable item”:

* The ESA BIC will discuss with successful applicants which “deliverable items” are suitable and can be agreed upon. Nevertheless, a proposal should be provided.
* This should be hardware, software, a prototype, demonstrations etc. that qualify as deliverable according to the Draft Incubation Contract.
* The ESA BIC will use this both for demonstration purposes and for verifying the use of incentive according to the incubation proposal (or as subsequently agreed).
* All deliverables should be agreed upon during contract negotiation and should be specified either in the incubation contract or in minutes of the negotiation.]

# Management

Writing Tips

[Please provide a description of how you are going to manage the work during the incubation period. Describe specific challenges and how you will address them.]

Text

# 3. FINANCING and Funding Request

Writing Tips

[Please, describe in detail how the company will be financed during incubation. In particular, explain which sources of financing will be used until the company can generate sufficient revenues. Note any restrictions related to the ESA incentive and that most of this funding may be paid in terms *after* the costs have been made. If applicable, explain how the company’s own staff will be paid and from which sources.

In the table Funding Split below, please provide per task the estimated split of the costs into “External costs” (services or products provided by third parties) and, “Internal costs”. Also indicate which sources will cover these costs.

The funding sources are normally divided into (see the draft incubation contact for details):

* The **ESA incentive** is limited to 25 kEUR. can be used for any purpose linked with the objectives of the incubation. As a general rule, it has to be spent in the country of the ESA BIC where you are applying. This incentive does not have to be paid back. Please refer to the Draft Incubation Contract for more details.
* The **local incentive** is limited to 25 kEUR and is provided by local sources (so-called “local co-funding”), where specific funding rules may apply. For guidance, please contact the individual ESA BIC that you apply to before you submit the application.
* **Loan Request**: If supported by your local ESA BIC, you may optionally request a bank loan (or other funding mechanism) prior to or during incubation. For this purpose, some ESA BICs have agreed “loan” schemes with local partner banks or financial institutions. The application is part of the ESA BIC application. For the point of contact of the local financing partner, please contact the ESA BIC you apply for. In the table Funding Split, please provide what amount you plan to request as a loan (or other funding source), where the maximum is 50 kEUR.
* **Other Sources:** Please specify additional financial sources such as financial support provided by investors, etc. as well as company/entrepreneur own/self-funding. Please specify the other funding sources.

Please ensure that “Total Costs” match “Total Funding”.

In the column “Experts”, please provide a distribution of the Technical Support or IPR/Legal support requested across the defined tasks - on top of the incentive. Note, the number of support hours available per applicant may differ for individual ESA BICs. For guidance, please contact the ESA BIC that you apply to before you submit the application.

Please use the FUNDING table contained in the Excel file attached to this application and insert this below.]

Text



Tab.: Funding Split

# 4. Support Request

## 4.1 Technical and IPR Support

Writing Tips

[Please define in your own words, what type of Technical or Legal/IPR Support you request from the ESA BIC in order to develop your product/service. Technical support is typically provided as advisory support and is typically related to the use of space technology, data with space origin or methodologies developed within the space engineering domain. Sometimes access to facilities is available as technical support. IPR support is typically related to patents and other intellectual properties. Note, the support provider may differ for individual ESA BICs. For guidance, please contact the individual ESA BIC that you apply to before you submit the application.]

Text

## 4.2 Business Support

Writing Tips

[Please define in your own words, what type of Business Support you request from the ESA BIC in order to establish and grow your company. Such support is typically provided through coaching and training. Note, the support provider may differ for individual ESA BICs as well as the number of support hours available per applicant. For guidance, please contact the individual ESA BIC that you apply for before you submit the application.]

Text

## 4.3 Office Support

Writing Tips

[Please define the number of desk places and further requirements such as laboratory space. Please note, that you will typically be required to rent office or lab space, while common facilities at the ESA BIC may be provided free of charge during incubation, such as meeting rooms. For guidance, please contact the individual ESA BIC that you apply to before you submit the application.]

Text

# Additional Information about Partners of ESA BIC Bavaria

**Oberpfaffenhofen / DLR:**

**INTRODUCTION**

At DLR site Oberpfaffenhofen about 1700 employees work in the areas mission operations for manned and unmanned spaceflight activities including GALILEO, remote sensing, high frequency and radar technologies, atmospheric physics, communications, navigation, robotics and mechatronics.

DLR Department Technology Marketing is present at all DLR sites in Germany screening and evaluating research competences and results of more than 30 institutes. Together with the scientists we develop ideas for new products and services which may have potentials for a new business to be a basis for startups.

DLR will increase the opportunities to create new spin-offs by getting ideas for new products from several space related research institutions spread all over Germany. This will demonstrate the social and economical benefits from manned and unmanned spaceflight and space research activities.

**OVERVIEW**

DLR cross-functional core competencies as drivers to the market

|  |
| --- |
| **Technical domains** |
| * High performance materials and structures |
| * Coatings |
| * Robotics and Mechatronics |
| * Commercial satellite applications |
| * Intelligent traffics systems and driver assistance |
| * Simulation, analysis and detection methods |
| * Energy transformation and combustion |
| * Solar systems, layout and dimensioning |
| * Cooling systems |
| * Acoustics |
| * Optical systems |

DLR technical expertise for the product generation process

|  |
| --- |
| **Steps to realization** |
| * Applied Research |
| * Specification |
| * Prototyping |
| * Verification, Simulation and Testing |
| * Product Development and Design |
| * Deployment |

**DLR Oberpfaffenhofen site core activities**

|  |  |
| --- | --- |
| **Technical Domains** | **mark core fields of interest** |
| **Remote Sensing Technology** |  |
| * Algorithms and processors for SAR (Synthetic Aperture Radar) * Generation of Digital Elevation Models (DEM), environmental and traffic monitoring, marine remote sensing * Retrieval of information (image analysis, optical pattern recognition photogrammetry, interpretation of high resolution optical satellite data, 3-dimensional mapping) * Spectrometric sounding of the atmosphere |
| **Remote Sensing Data Center** |  |
| * Research, development and services for airborne and satellite-based earth observation * Reception from data of earth observation satellites from stationary antenna facilities and transportable receiving systems * Long-term archiving in the National Remote Sensing Data Library * Rapid mapping * User services like Center for Satellite based Crisis Information (ZKI) and GeoVisualization Center (GeoVIS) * Acting on behalf of ESA as data and processing center for European and international earth observation missions |
| **Robotics and Mechatronics** |  |
| * Systems and components as intelligent mechanism for aircraft, spaceflight and medicine * Integration of mechanics, electronics and information technology * Interdisciplinary, multi-physical modelling, computer-aided optimisation and simulation * Spaceflight: Development of remote control, partly autonomous robot systems and robonauts for orbital services and exploration * Aeronautics: Design tools for robust flight control systems and energy optimisation * Vehicle technology: Mechtronic concepts, drive-by-wire * 3-dimensional man-machine interfaces |

|  |  |
| --- | --- |
| **Communications and Navigation** |  |
| * New systems and methods for radio transmission and positioning * Satellite-based communications, broadcasting multimedia contents * Internet connection of satellites, airplanes and remote areas * High-rate data communication between satellite and ground by optical free-space transmission methods * Satellite navigation: Safety-critical applications requiring a reliable positioning and timing information, research in systematic errors and effects of the ionosphere * Verification of GALILEO with a network of worldwide signal data measurement * Development of security critical solutions e.g. for airplane approach and landing phase |
| **Microwaves and Radar** |  |
| * Development and advancement of high resolution radars and microwave radiometer (ground-based, airborne and satellite-based) * Applications in remote sensing, aeronautics, traffic monitoring, reconnaissance and security * Operation, calibration and performance monitoring for satellites (TerraSAR-X, Tandem-X) and experimental airplane E-SAR * Hard- and software for active and passive microwave sensors * Research in radar signatures and microwave propagation |
| **Atmospheric Physics** |  |
| * LIDAR (Light detection and ranging) technologies development, testing * Aeronautics: Climate impact, cloud physical and chemical processes, weather information * Sensor development for trace gases and aerosols |
| **Flight Operations** |  |
| * Flying platforms for scientific research * Environmental and climatic measurement campaigns * Sensor systems for atmospheric data acquisition and calibration |
| **Space Operations** |  |
| * Mission control for German spaceflight programmes * Satellite missions in earth observation and communications * Autonomous navigation and mission planning systems * In-orbit servicing * Mobile high-altitude research rocket-base |

Table : DLR Technical Expertise in Oberpfaffenhofen

**Nürnberg / Fraunhofer IIS:**

**INTRODUCTION**

The Fraunhofer Institute for Integrated Circuits IIS conducts contract research for national as well as international industry and public authorities. Fraunhofer Institute for Integrated Circuits IIS with its headquarters in Erlangen and further locations in Nürnberg, Fürth and Dresden today ranks first among the Fraunhofer Institutes in terms of headcount and industrial revenues.

800 employees work in the areas microelectronics, information techno­logy, telecommunications, high frequency and radar technologies, audio and multimedia, digital broadcasting, imaging and X-ray technology, medical techno­logy, navi­gation and logistics as well as the automation of mechanical and plant engineering.

The Fraunhofer IIS has consolidated its positioning, navigation and identification expertise within a single research unit in Nuremberg, where more than 135 employees (engineers and computer scientists) in five departments pool a wide array of skills. Technology solutions range from wireless sensor networks and adaptive antennas to satellite navigation systems, including GPS, EGNOS, GALILEO and GLONASS. Over 10 different IIS positioning technologies can be adapted, advanced, and combined to produce tailor-made prototypes and systems.

Navigation, communication and identification technologies as well as all other technologies of Fraunhofer IIS may have potentials for new products and can be the technological basis for a startup company.

**OVERVIEW**

Core Competencies of Fraunhofer IIS

|  |
| --- |
| **Technical domains** |
| * Audio and Multimedia |
| * Imaging Systems |
| * Digital Broadcasting Systems |
| * Embedded Communication |
| * IC-Design |
| * Logistics, Supply Chain Services |
| * Energy management and Energy Harvesting |
| * Positioning and Navigation |
| * Medical Technology |
| * Optical inspection Systems |
| * X-RayTechnology |
| * Virtual ASIC Foundry |
| * Robotics |

Fraunhofer IIS support in the product generation process

|  |
| --- |
| **Steps to realization** |
| * Applied Research |
| * Requirements and Specification |
| * Feasibility Studies |
| * Prototyping and Demonstrator Development |
| * Verification, Simulation and Testing |
| * Product Development and Design |
| * Application and Service Development |
| * Market Studies |

**Fraunhofer IIS general offering for ESA BIC entrepreneurs in Nürnberg**

|  |  |
| --- | --- |
| **Technical Domains** | **mark fields of interest** |
| **Position and Navigation** |  |
| GNSS Satellite Navigation Systems for GPS/Galileo/GLONASS/EGNOS |  |
| Navigation software development for GPS/Galileo/GLONASS/EGNOS |  |
| High precision localization systems (cm-range) |  |
| Inertial sensor systems |  |
| Sensor fusion technologies, multi-sensor platforms |  |
| Time-of-flight measurements |  |
| Received signal strength indication by WLAN, GSM, UMTS |  |
| Autarkic WLAN positioning |  |
| Multicell radio networks |  |
| Sensor Fusion |  |
| Environment Modelling |  |
| Angle of arrival technology |  |
| Sensor networks s-net®-Technology |  |
| Event detection software |  |
| **Hardware and Sensor Development** |  |
| Development of high-precision GNSS navigation antenna (3G+C) |  |
| Antenna design |  |
| Antenna measurement |  |
| Design of embedded systems |  |
| HallinOne®-Technology for 3-D magnetic field sensors |  |
| ASIC design |  |
| Sensor design |  |
| Condition monitoring |  |
| System level design |  |

|  |  |
| --- | --- |
| **Communication** |  |
| DECT communication |  |
| UWB ultra-wide-band radio communication |  |
| UMTS, GSM |  |
| Telemetric systems with high band width and high range |  |
| s-net® communication protocol for distributed wireless multi-hop sensor networks |  |
| WLAN applications |  |
| Multi-standard transceivers |  |
| Software-defined radio systems |  |
| Thermo-electric radio sensors |  |
| **Identification** |  |
| RFID |  |
| Embedded RFID systems in metallic objects |  |
| Intelligent objects |  |
| Optimization solutions and tools for supply chain managements |  |
| Platforms for integration of different communication and positioning technologies |  |
| Supply chain technologies |  |
| Software platforms |  |
| Asset tracking technologies and systems |  |
| Design of efficient logistics workflow (hardware, software-based) |  |
| **Energy Management** |  |
| Energy Harvesting technologies (thermal, vibration, kinetic etc.) |  |
| Development of energy harvesting systems |  |
| Data logging for energy management systems |  |
| Battery management systems |  |
| Development of energy-efficient components for communication and positioning application as well as smart metering and asset tracking |  |
| Power management systems and communication technologies for smart grid applications |  |
| **Embedded systems** |  |
| Hardware and software design |  |
| Integration Platform |  |
| Miniaturization technologies |  |
| Energy-efficient design |  |

|  |  |
| --- | --- |
| **Test an Application Center L.I.N.K.** |  |
| Combination of realistic application conditions and environment and technologically reliable test environments on (1400 sqm indoor, 14.000 sqm outdoor area) |  |
| State-of-the-art test equipment and technology for test of localization, identification, communication and energy management technologies |  |
| Practice and field test facility with indoor, outdoor testing areas |  |
| Test course for all sorts of vehicles e.g. trucks, electric and motor cars, fork lifts and pallet carriers etc. |  |
| Test and Application labs |  |
| **Services and consulting** |  |
| Consulting and design for evaluation, selection of application related technologies |  |
| Development and consulting for services based on these technologies |  |
| Market studies, potential technology analysis, analysis of targeted groups etc. |  |

Table : Fraunhofer IIS Technical Expertise in Nürnberg

**Ottobrunn / AIRBUS DS:**

**INTRODUCTION**

Airbus Defence and Space is one of the three Divisions of the Airbus Group and Europe’s Number 1 defence and space company. It is the world’s second largest space company and one of the top 10 defence companies globally with revenues of around €14 billion per year and approx. 40.000 employees. The Chief Executive Officer of Airbus Defence and Space is Bernhard Gerwert. Airbus Defence and Space puts a strong focus on core businesses: Space, Military Aircraft, Missiles and related systems and services.

Electronics, headed by Thomas Müller, provides high-performance equipment for system integrators that serve both Airbus Defence and Space within the Airbus Group and external customers worldwide. Products are mainly for the civil, defence and security markets and cover ground, maritime, airborne and space applications. Key products include radars and IFF systems, electronic warfare devices, avionics, space platform electronics, space payload electronics as well as optronic sensors.

The aerospace hub of Ottobrunn and its newly constructed Ludwig Bölkow Campus offer an ideal setting for new companies to grow in collaboration with research and development.

**OVERVIEW**

**Core Competencies of AIRBUS Defence and Space**

|  |
| --- |
| **Competencies** |
| * Military Aircraft |
| * Communication, Intelligence and Security |
| * Space Systems |
| * Electronics |

**AIRBUS Defence and Space Electronics support in the product generation process**

|  |
| --- |
| **Steps to realization** |
| * Research & Development |
| * Specification |
| * Design |
| * Prototyping, Verification, Simulation and Test |
| * Product development and Qualification |
| * In-orbit Test |

**AIRBUS Defence and Space Electronics general offering for ESA BIC entrepreneurs in Ottobrunn**

|  |  |
| --- | --- |
| **Technical Domains** | **mark core fields of interest** |
| **Platform Electronics – GNSS Receivers** |  |
| * Algorithms * Design * Prototyping * Simulation & Test * Manufacturing |
| **Platform Electronics – Timing Subsystems** |  |
| * Atomic Clock Electronics and Clock Monitoring Systems * Algorithms * Design * Validation * Manufacturing |
| **Platform Electronics – FPGA and ASIC Design** |  |
| * Algorithms * Implementation & Test |
| **Platform Electronics – On-board Computer and Mass Memory** |  |
| * Algorithms * Design * Manufacturing |
| **Solar Array Center** |  |
| * Solar Arrays for Telecom, Navigation, Earth Observation and Science Missions * Design * Qualification * Production |
| **Electronics Manufacturing** |  |
| * Manufacturing of space equipment |

**Neubiberg / Universität der Bundeswehr München (UniBw M):**

**INTRODUCTION**

The Universität der Bundeswehr München (UniBw M) is one of the two universities of the Bundeswehr in Germany. As an exceptional campus university and research center, UniBw M offers its researchers and partners excellent conditions for research and development, scientific work and it is an important innovation driver for future promising ideas, knowledge and technology transfer (especially for startup promotion). It has excellent research facilities and high-tech laboratories directly on campus, a modern infrastructure - which promotes a lively and innovative research culture - and numerous opportunities to implement innovation.

UniBw M has ten faculties and five research institutes which focus strongly on Defense Security, Space Defense, Space Technology Exploitation, New Space Technologies, Military Aviation, Navigation and Communication Systems, Mobility and Sustainability.

UniBw M has some of the best facilities and expertise in Europe in the fields of aerospace, space communications and satellite research and development. This is an important prerequisite for the research work and the already existing university-internal cooperations. The joint success is evident from the large number of projects for e.g. ESA, NASA, DLR, the German Armed Forces, the Federal Ministries of Defense and Economic Affairs and Energy, as well as for industry.

The Aerospace Research Hub of UniBw M offers an ideal environment for new companies that want to grow in collaboration with research and development.

**Core Competencies of UniBw M**

|  |  |
| --- | --- |
| Mission design and satellite technology | RI SPACE |
| Satellite communication | RI SPACE |
| Satellite navigation | RI SPACE |
| Engineering Mathematics | RI SPACE |
| Mobile antenna systems | RI SPACE |
| Plasma technology | RI SPACE |
| GNSS systems | RI SPACE |
| Adaptive automation/autonomy | RI MARC |
| Cognitive architectures/AI/ML | RI MARC |
| Human-Automation-Integration | RI MARC |
| Mission Management | RI MARC |
| Operator/Pilot Assistance | RI MARC |
| UAV Automation/Autonomy | RI MARC |
| Electrolytic production and storage of hydrogen | RI MOVE |
| Optimized mobility and traffic management | RI MOVE |
| Implementation of fully and partially autonomous vehicles | RI MOVE |
| Development of CO2-neutral energy sources | RI MOVE |
| Data Science | RI CODE |
| Data protection and compliance | RI CODE |
| Digital Forensics | RI CODE |
| E-Health | RI CODE |
| Formal Methods for Securing Things | RI CODE |
| Hardening of IT systems | RI CODE |
| Airborne cybersecurity enhancement | RI CODE |
| Secure software development | RI CODE |
| Consulting and design for evaluation, selection of application related technologies | founders@unibw |
| Development and consulting for services based on these technologies | founders@unibw |
| Market studies, potential technology analysis, analysis of targeted groups | founders@unibw |
| Financial planning and SWOT analysis | founders@unibw |
| Design and prototyping | founders@unibw |
| Network of laboratories on science and technology | founders@unibw |

Table 1: UniBw M Technical Expertise

\*MARC = Military Aviation Research Center

\*MOVE = Modern Vehicles

\*RI = Research Institute

**UniBw M supports in the product generation process**

|  |
| --- |
| State of the art research |
| Applied research |
| Requirements and specifications |
| Feasibility studies |
| Prototyping and demonstrator development |
| Verification, simulation and testing |
| Product development and design |
| Application and service development |
| Market studies |

Table 2: Product development process

**UniBw M general offerings for ESA BIC entrepreneurs in Neubiberg**

|  |  |
| --- | --- |
| **Technical Domains** | **mark fields of interest** |
| Reference and test facility for satellite communication technology |  |
| fully equipped satellite ground station for research, development, and over-the-air testing |  |
| Test, measurement, and analysis equipment for all common frequency ranges |  |
| Thermal vacuum chamber with solar simulator, IR camera system and mass spectrometer |  |
| Cleanroom |  |
| Vibration tests |  |
| Landing and formation flight simulation based on quadrocopters |  |
| Mission and system simulation software packages |  |
| Test stand for electric propulsion systems |  |
| GNSS software receiver/simulator with sensor fusion |  |
| RF laboratory for GNSS signal generation |  |
| GNSS constellation simulator (hardware simulator), commercial GNSS receivers |  |
| Parabolic antenna for satellite signal analysis |  |
| Inertial measurement units (RLG, FOG, MEMS) and commercial analysis software |  |
| Optical reference systems (3D scanner, multi station) |  |
| LiDAR measurement units |  |
| Programmable multicopter and rotating arms for reference movements |  |
| Various software tools (signal processing, positioning) |  |
| Software packages for solving optimization problems (sequential quadratic optimization, interior point method, semi-smooth Newton method) |  |
| Software for solving optimal control problems and parameter identification problems based on shooting and collocation methods for optimal control problems and trajectory optimization problems, respectively, with extensions for online control tasks using model predictive control |  |
| Trimble GNSS system for accurate outdoor positioning |  |
| highly accurate indoor GPS system NIKON iGPS |  |
| Robotics lab with HTC Vive and Nexonar positioning systems and various robot systems (KUKA youBot, KINOVA Mico, mobile robots, quadrocopters) |  |
| Automated vehicle-in-the-loop with GNSS-based control that couples real driving with a virtual real-time simulation environment |  |
| High-tech research laboratory for additive manufacturing |  |
| Consulting and design for evaluation, selection of application related technologies |  |
| Market studies, potential technology analysis, analysis of targeted groups |  |
| Financial planning and SWOT analysis |  |

Table 3: General offerings for ESA BIC entrepreneurs

**Würzburg / The three startup centers (Die drei Gründerzentren)**

**INTRODUCTION**

The three startup centers in Würzburg combine their individual strengths to offer innovative and motivative founders the perfect place to turn their ideas into flourishing businesses.

Startups within this unique entrepreneurship ecosystem have access to following offerings

* high-quality office spaces,
* spacious seminar and workshop rooms,
* a makerspace or a manufacturing hall to produce their prototypes,
* advice from experienced business coaches
* supportive trainings in various business themes
* an extensive network in science, business, industry, and the capital market

Each of the three startup centers focuses different fields of application and startups phases. Together they have special know-how in the fields of: Aerospace, Technology, Robotic, Automation, Industry 4.0, Design Thinking, Digitalization and Life Science. And they can support startups from early-stage until they grow-up. These leads to a higher diversity within the intern startup scene which is a great chance for each startup in the ecosystem to gain new perspectives and new inspirations for their own business ideas.

The ESA BIC Bavaria startups will have special access to experts in the field of Aerospace with special focus on small satellites and related fields. These experts are from organizations and startups of our network.

**Zentrum für Telematik (ZFT)**

The ZfT is an independent research organization addressing key technologies in the future oriented fields: Industry 4.0, Internet of Things, Digitalization, Mobile Robots and Spacecraft Systems. Due to its automation department, ZfT hosts several robots supporting satellite integration. The space technology department focusses on spacecraft mission analyses and operations, satellite networks and formations as well as exploitation of their application potential in various scientific application fields, in particular in geosciences and telecommunications. In particular, ZfT addresses innovative “New Space” approaches to distributed, networked multi-satellite systems. The research focus on small satellite formations achieved European-wide reputation, as documented by international awards and research prices.

Based on that expertise, ZfT received responsibility for design and implementation of nano-satellite missions: NetSat, QUBE, TOM, CloudCT, Space Factory 4.0. The Center for Telematics (ZfT) and the European Space Agency (ESA) cooperate in the ESA\_Lab@ZfT on joint research at small satellites, formations of satellites, autonomous and remote operations, “Artificial Intelligence”, innovative control and information processing technologies, as well as production automation approaches for large quantities of satellites.

**Breunig Aerospace**

Breunig Aerospace was founded as an engineering consultancy in 2017. Since then, the company is steadily growing into a full-stack partner for complex technological products and systems providing the R&D capabilities and specialized solutions our customers require.

The central themes of activities are exploration- and transportation systems which are represented in the current project portfolio by several contracts dealing with astrophysical telescopes and space science missions (ATHENA, LISA) as well as the ongoing development of electric propulsion solutions for aerial applications.

The company is cultivating a profile of multidisciplinary capabilities with special focus and in-depth know-how in the areas of opto-mechanics, electric-propulsion, and AIVT procedures aspiring a vertical integration form early concept studies through design and analysis to prototyping and qualification.

Breunig Aerospace is collaborating with national and international space agencies, renown research institutions and long-standing European aircraft manufactures whilst also being committed to develop cutting edge solutions and technologies in the more regional area of Unterfranken, away from the prime established Aerospace centres.

**OVERVIEW**

Core competencies

|  |
| --- |
| **Technical domains** |
| * Optomechanics |
| * Space Optics |
| * Electric Propulsion |
| * Battery Systems |
| * Assembly, Integration and Verification |
| * Certification (EASA) |
| * Composite Parts and Materials |

Breunig technical expertise for the product generation process

|  |
| --- |
| **Steps to realizations** |
| * Requirements Engineering * Product Design CAD/CAM |
| * FEM Analysis * Ray Tracing of optical systems |
| * Design Optimization * Prototyping (CNC milling, turning, 3d printing, composite manufacturing) |
| * Load Testing * Vacuum Testing |
| * Environmental Test Campaigns (via Partners) |
| * Flight testing of equipment |

**Breunig Aerospace Würzburg site core activities**

|  |  |
| --- | --- |
| **Technical Domains** | **mark core fields of interest** |
| **Space Optics and Optomechanical Systems** |  |
| * Design and Analysis of optomechanical systems * Design of precision interface components (bipods, flexures, kinematic mounts) * performance studies and trade-offs |
| **Aerial Electric Propulsion Systems** |  |
| * Battery Module Design and Assembly * Propeller Design, Manufacturing and Test * Avionics development * CS-22 Certification of Electric Propulsion Systems * Ground and Flight Testing |
| **AIVT and Automation** |  |
| * Optical Metrology Systems * Load Testing * Strain Gauge based metrology * Vacuum testing * Data Acquisition and Control for medium and large-scale test facilities |
| **Other Services and Consulting** |  |
| * Prototyping of metal, and composite parts * Education and training in advanced engineering topics * Development of custom simulation and analysis tools |

**INDTact**

**Information will be added soon.**

**ZAE**

**Information will be added soon**

Choosing Würzburg for the ESA BIC Bavaria program gives your startup access to the whole range of knowledge and offerings from the three startup centers and the partners within their network. As well as to an open-minded, familiar, and supportive entrepreneurship ecosystem in one of the most beautiful cities in Bavaria.