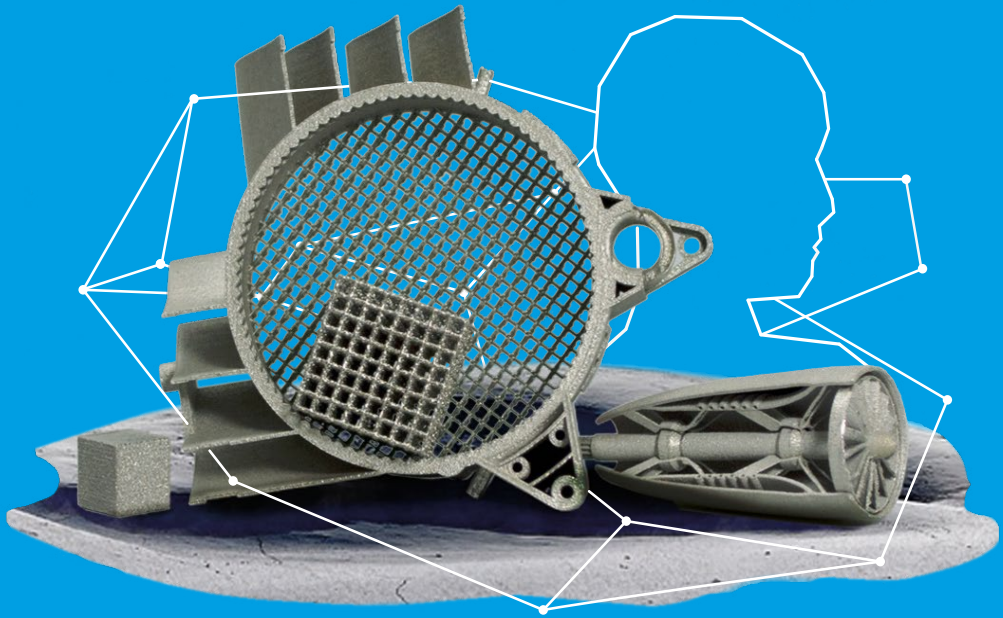
WWW.AGENT3D.DE

# Printing new worlds.



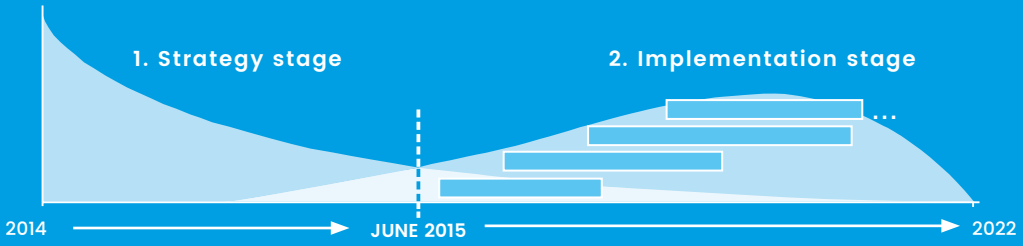
AGENT3D

ADDITIV GENERATIVE FERTIGUNG

MISSION

# Printing new worlds.

Leading research institutions, industrial players and SMEs from the consortium AGENT-3D as a strategic alliance for research, innovation and growth. It is their joint aim to ensure that Germany maintains technological leadership in the primary fields of Additive Manufacturing.




The implementation of the objectives takes place in two phases:

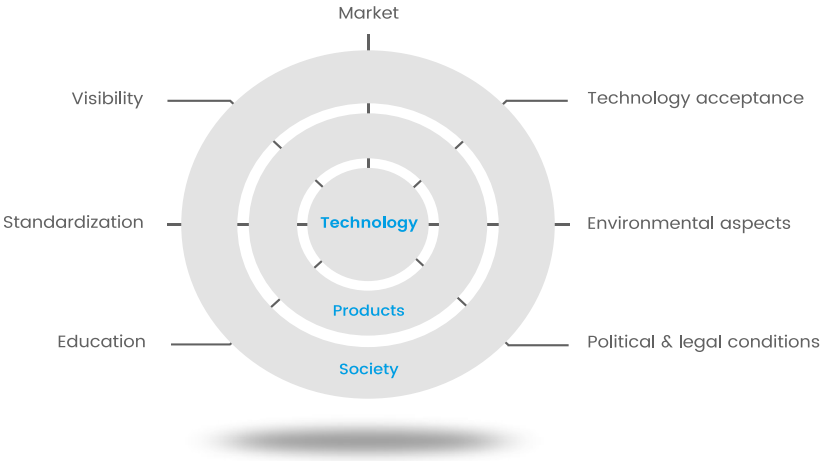
**Strategy stage:**
In the first section of the funding phase, the project consortiums will develop their innovation strategies. To this end the consortium partners will pinpoint their joint challenges, improve the partner structure and formulate a roadmap showing in detail the various milestones, strategies and planned development steps for the next years. An advisory board of recognized experts will be appointed to accompany the consortium for the entire funding period. The board will investigate the strategic orientation and the project progress, and, furthermore, will decide on whether the proposed projects are eligible for funding.

**Implementation stage:**
After the initial evaluation, the project consortiums will launch the second stage of the funding phase. Here the focus will be on the implementation of measures. In parallel, Zwanzig20 will demand the highest possible degree of transparency and openness while providing funding. Strategy and measures are to be constantly adapted to reflect technical advances and market demands. The incorporation of new partners is explicitly desired.

ROADMAP

# Eyes firmly on.

The development focus of AGENT-3D is on product, technology and society.




The AGENT-3D consortium attaches great importance to the target elements developed jointly at the beginning of the strategy phase.

- **Paradigm shift in production**
  – substitution of conventional processes
- **Individualized production**
  – demand-driven, centralized/decentralized
- **Relocation of production to Germany**
- **Individualized production**
- **Window to the outside**
  – recognition and acceptance
- **Synergies through transdisciplinary networking of skills**
- **Applications and markets**
- **Ecological footprint**

PROCESSES

# Taking control.

The following **Additive Manufacturing processes** are used within the network:

- Powder bed processes (SLM, EBM),
- Ink- and paste-based printing,
- Laser metal deposition with powder,
- Laser metal deposition with wire,
- Stereolithography,
- Hybrid Manufacturing,
- Fused Filament Fabrication,
- Arc-based processes,

as well as process **monitoring and non-destructive testing** for quality management.

MATERIALS

# Intelligently combined.

Material production must reflect the increased usage of Additive Manufacturing processes and has to offer tailored material solutions.

- **Multi-material concepts**
  Combining completely different classes of materials in one single component or the option of three-dimensional gradient areas throughout the entire component
- **Future-oriented materials for Additive Manufacturing**
  Especially in the area of metal and ceramic materials
- **Functional materials**
  Equipping components with additional specifications

PARTNERS

# Together we can achieve great results.

The AGENT-3D consortium is a strategic alliance formed by leading research institutions, industrial players and SMEs for research, innovation and growth.

Their common goal is to develop Additive Manufacturing into the key technology of Industry 4.0. This project creates a strong network for the region of the new federal states. The cross-sector competencies of the various partners include materials technology, manufacturing processes, machining as well as systems design, control technology and design.

Your industry isn't represented yet? Want to make use of our expertise?
**Become a partner! More information at www.agent3d.de**

## SELECTION OF PARTNERS



































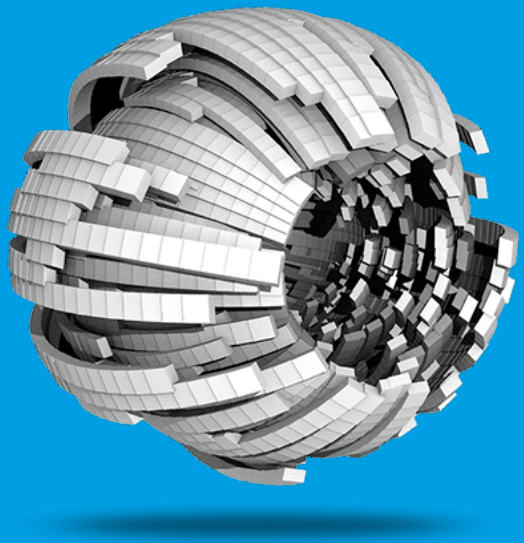




PROJECTS

# Up and running.

The AGENT-3D project is based on the implementation of diverse individual projects. The strategy project forms the basis for project ideas. The goal is the systematic implementation of their roadmap.



## Basic project

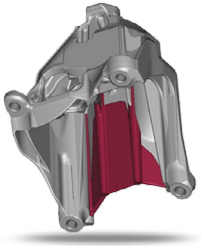

The **basic project** is an important bridge between the strategy and the technology projects. The detailed results of a stakeholder analysis gained in the strategic process are used to define socio-political, economic, business, technological and legal framework conditions and to reveal ways to positively influence these factors. AGENT-3D_Basis generates important basic findings with a focus on interdisciplinary application, to then be employed in the subsequent collaborative project. The five topics of AGENT-3D_Basis are:

- Impact of socio-economic factors on the development opportunities of Additive Manufacturing,
- Copyright/patent law, product liability,
- New pathways of construction and design,
- Process reliability, materials and quality management.

## Measuring and testing

The **measuring and testing center** for Additive Manufacturing guarantees continual growth in expertise in test and measurement engineering for additive manufactured components. The described investments serve as a basis for future collaborative projects to tackle technological problems, which can be solved in secure environments using appropriate test equipment and comprehensive software. Clearly, dedicated software and test equipment are needed to achieve a better understanding of the processes, data and materials. Based on these, standard parameters will be determined for testing equipment and software in order to develop the data stream and industrially applicable routines for the various stages in the process chain (engineering, preparation, production and quality test) in future technology projects. Partners can use a CT or optical 3D scanner, for example.

## CastAutoGen

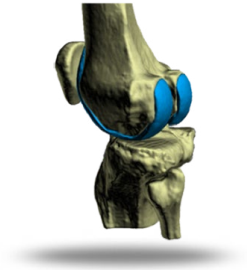


The technology project **"Development of a hybrid production processchain of cast generation for automotive applications"** (CastAutoGen) aims at the development and industrial introduction of processes for the innovative, combined production of castings and additive procedures for applications, especially in automobile and vehicle construction. The basic technological and scientific expertise to be developed in this project should also be transferable to other industrial sectors. Results will be implemented in two demonstrators: on the one hand, functional components produced by Additive Manufacturing will be integrated directly into a die-cast component by full or partial casting; on the other hand, functional geometric areas will be built up by additive methods on a die-cast component.

## elF

The aim of **"Additive Manufacturing Technologies for Integration of Electronic Functionalities"** (elF) is to realize the Additive Manufacturing of three-dimensional components with integrated electrical and converter functionalities of multi-material systems in one device or process. The results are compounds of previously unprocessed (or hard to process) materials in which sensory elements can be integrated depending on requirements. The dispenser printing method is one such robust Additive Manufacturing technology, which is flexible in use and supports the integration of electric functionalities. Based on this technology, a complete plant for the entire process chain can be developed. Preliminary laboratory prototypes can be created for three chosen applications: "printed electrical conduction paths", "sensors and converter" and "thermo electrics".

## EXPERTEB



The technology project **"Expert system for the design and manufacture of endoprostheses using electron beam melting"** (EXPERTEB) aims at the automated development of patient-specific prostheses and implants using modern, computer-aided routines and algorithms. Based on the patient's digital image data and supported by artificial intelligence, the expert system is expected to deliver optimal design proposals practically automatically. Today's custom-made products are associated with high development costs: Although the production by Additive Manufacturing is relatively low-cost , it first requires the creation of complex virtual 3D models. In addition to automation and improved user support to accelerate and simplify the manufacturing process of endoprostheses, a further step will be model optimization.

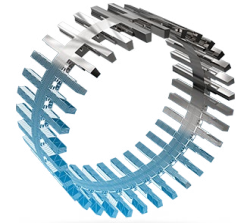
## FunGeoS

The project **"Functional geometry structures – construction principles for Additive Manufacturing"** (FunGeoS) aims at the development and industrial implementation of additive manufactured structures for various industrial applications. The geometrical structures should enable novel functions such as extreme strength-to-weight-ratios with optimal flow of forces, excellent heat transfer, filtration as well as integrated supply and disposal of gaseous and fluid technical media. The intention is to consider every imaginable and practical characteristic and type of functional structure. For example microstructures, regular lattice/ framework structures, homogeneous, graded and auxetic or locally non-uniform structures, macrostructures including bionic or topologically optimized structures.

## HERTZ


The aim of the project **"High-frequency systems for wireless communication and radar systems with Additive Manufacturing"** (HERTZ) is to test the use of additive-generative manufacturing in the field of integrated circuit technology for the production of passive elements such as antennas and lens structures on Si chips in the µm range. 5G communication systems require much higher data rates. This in turn means higher transmission frequencies. However, at very high frequencies, there are significant signal losses between heterogeneous assemblies such as antennas and semiconductor chips. One approach is to integrate the antennas directly on the chip. Additive Manufacturing permits a highly varied geometry and thus an increase in efficiency and directivity.

## Hybrid+

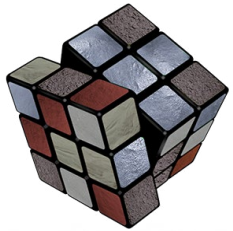


The overall goal of the project **"Simulation-based characterization of hybrid manufactured components for series production"** (Hybrid+) is the creation of a comprehensive and precise model for the description and targeted parameterization of hybrid laser powder buildup welding, thereby to improve the design of quality assurance chains before production and to optimize the process. Based on two nozzle geometries, the nozzle-specific impact on component quality will be investigated in this hybrid manufacturing process. The aim is to minimize thermally-induced stresses and distortions and simultaneously to study how these are affected by buildup rates, energy input, the shift between Subtractive and Additive Manufacturing as well as process speed.

## IMProVe

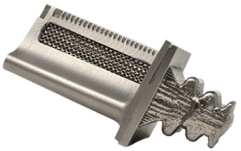
Based on the original objectives and the goals described in the roadmap 2.0 of AGENT-3D, **"Innovative materials, systems and procedures by overcoming process constraints in Additive Manufacturing"** (IMPRoVe) aims to minimize and eliminate cost and production restrictions as well as promote a major expansion in the industrial applications of Additive Manufacturing. The proposed solution is hybrid machining, a combination of Additive Manufacturing with conventional or additive manufactured semi-finished products. New pathways will be revealed through representative industry prototypes, which will be technologically and economically evaluated with respect to their potentials and limitations. Based on the technogical importance of powder bed processes and buildup welding in terms of Additive Manufacturing with metals, the figure systematizes the solution area.

## MultiBeAM



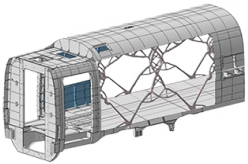
The aim of the technology project **"Multi-material processing using Additive Manufacturing"** (MulitBeAM) is the creation of completely new multi-material components in the combinations metal-metal, metal-ceramic and ceramic-ceramic/plastic. This means redesigning the technology and processes of generative powder bed and nozzle-based processes (e.g. laser metal deposition, selective laser melting and printing). The material composition and thus its properties are varied during processing by means of targeted process-oriented mixing of various powder-, wire- and paste-based components. Multi-material concepts are indispensable for the high-tech sectors of aerospace, energy, optics and medical technology. These are all represented in the project with a wide variety of applications, from custom-made surgical instruments and dental implants to the next highly efficient generation of turbines and propulsion units.

## QualiPro



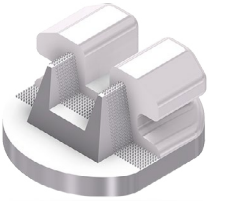
The project **"Quality management for safe and robust Additive Manufacturing"** (QualiPro) aims to develop clear quality assurance routines along the additive process chain. This should create the basis for the certification of additive technologies and help establish a framework for cooperation in the value-added network. Among other things, competitive factors such as cost, time, quality, process efficiency and flexibility are taken into account. The main focus of the project is powder bed-based selective laser melting. A continuous stream of data is gathered along the additive process chain, and this data is linked with the realized component quality. Findings will be studied to derive measures to optimize the Additive Manufacturing process. The end goal is to identify application-oriented solutions that enable robust series production.

## TopoGross



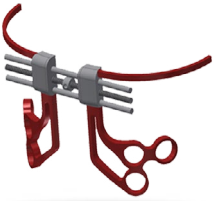
The research project **"Additive Manufacturing of topologically optimized large components"** (TopoGross) aims at improving the production and implementation of modern lightweight construction concepts with additional functional integration. The object of investigation is the Additive Manufacturing of load-bearing stiffening elements on a large side wall by means of laser powder buildup welding. In this way, conventional geometric limitations are overcome and it is possible to meet current demands for customized designs while reducing material outlays, the number of production steps and storage costs.

## MikroDent



The technology project **"Sophisticated Additive Manufacturing of metal-polymer components for the dental industry"** (MikroDent) comprises the development of plastic-metal hybrid components using structures created on a metallic joining partner by Additive Manufacturing methods for use in orthodontics. This can replace monolithic components, which until now have generally been used for dental treatments. The advantages of metal are its high strength and low manufacturing costs. Plastics and ceramics, on the other hand, have a higher aesthetic value and better antimicrobial properties. In order to exploit the advantages of each material, the surface of a metallic core will be enhanced by means of a plastic coating. This is achieved using Additive Manufacturing methods to create surface structures on a metallic joining partner.

## 3D ossseo-distrakt

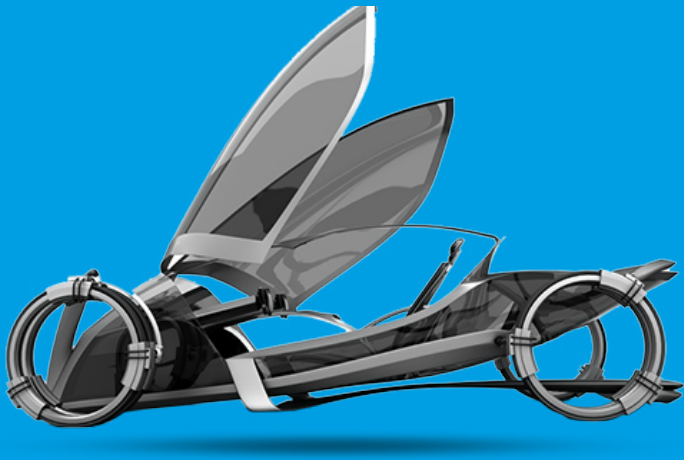


The project **"Osseo-distraction using 3D-generated customized titanium systems"** (3D osseo-distrakt) comprises the development of a fully digital workflow with the aim of additively manufacturing a tailor-made distractor to extend the mandible as well as virtual 3D diagnostics and therapy planning. Based on 3D patient data, the distractor is to be digitally matched preoperatively to the individual jaw anatomy. The procedure presented in this project represents an optimization of the conventional manual and semi-digital process chain. It avoids the disadvantages of the previous procedure, such as longer operating times and the susceptibility of distractor fracture due to intraoperative adjustments. Further, it also allows an exact intraoperative placement, defined as a function of the previously determined force vectors.

NEWS

# 3D today. And tomorrow.

We are constantly working on new projects. For **upcoming events** and **project results** visit our homepage **WWW.AGENT3D.DE**.



CONSORTIUM

# AGENT-3D

**Consortium members:** 125 partners (as of April 2018)

**Overall duration of the funding programme:** 2014–2022

**Contact:**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