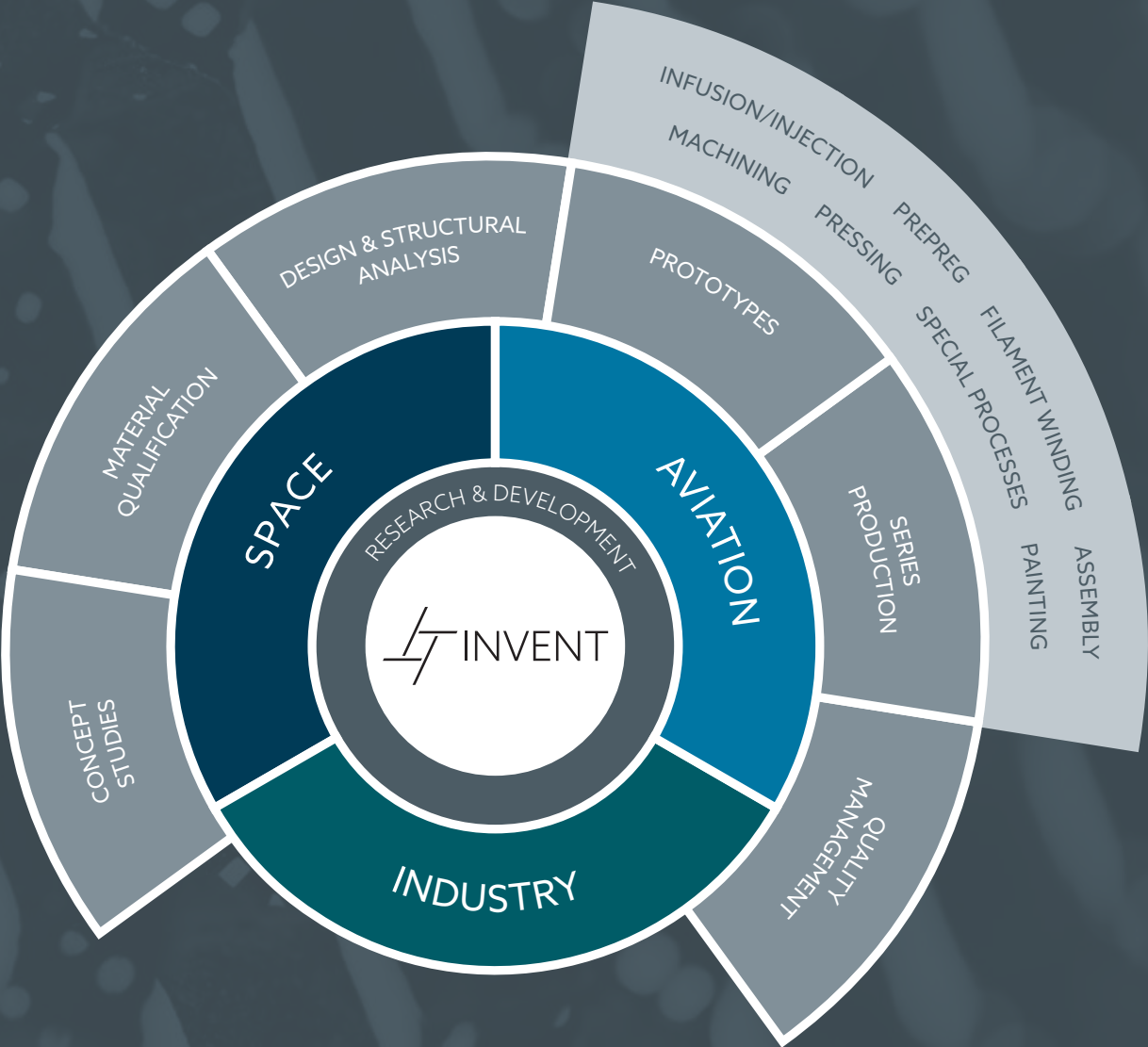




PASSION FOR COMPOSITES

COMPETENCIES & BUSINESS UNITS



PASSION FOR COMPOSITES

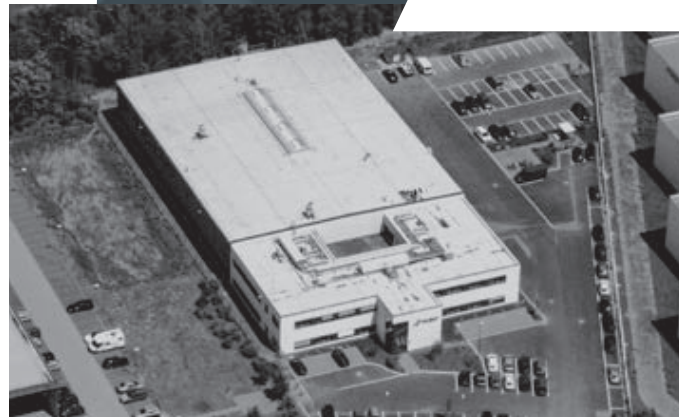
SPECIALISED, CUSTOMISED AND QUALIFIED LIGHTWEIGHT STRUCTURES

In order to shape a more sustainable future, there is already an increasing demand for high-tech fibre composite products which address both ecological and economic issues. Fibre composites, such as carbon-fibre reinforced plastics (CFRP) or glass-fibre reinforced plastics (GFRP), are examples of such materials. These materials meet the toughest of requirements even under extreme conditions.

We have been active in the field of fibre composite technology for over 23 years now.

INVENT is established and recognised as lightweight construction specialist for innovative fibre composite technologies. Our products are used in the aerospace, mechanical engineering, automotive, rail and ship-building industries. We are an EN 9100 and Nadcap certified company, developing and producing high precision structural components since 1996. Our designers and engineers work closely together with our customers, to create the best product for their specific requirements. We offer our customers a complete end to end package from a single source, covering the design, development, production, assembly and testing of the product.

We have many in-house specialized processes and competencies, allowing us to offer a comprehensive range of services. Building on our considerable operational heritage and the company pillars, reliability, precision, flexibility and quality, we meet the markets needs for specialized, customised and qualified lightweight structures.





SPACE

LIGHT. PRECISE. QUALIFIED.

Bespoke products and series parts for space applications are one of our core businesses. Broad heritage has been gained in development and production of more than 10.000 flying spacecraft parts - covering all common spacecraft structural elements.

Space is one of the main fields of application for the core competence of INVENT, lightweight fibre composite construction. Due to the harsh operating environment, it places particularly demanding and specific requirements on materials and manufacturing processes.

With modern machinery, a certified quality management system and many years of experience, we are optimally positioned for the development, manufacturing, assembly, integration, testing and qualification of sophisticated hardware for satellites, space probes and other spacecrafts. The product spectrum ranges from metal and fibre composite components to complex multi-material structural assemblies and their qualification. The joining elements made of titanium, invar or aluminium are produced in the company's own machining department.

In order to push our technical competences, we implement ambitious research and development projects together with our partners. These focus primarily on material development, design, 3D printing, multifunctional structures and testing of functional demonstrators and prototypes for space environment.

The product portfolio includes structural panels with CFRP or aluminium face sheets, support structures, cylinders, struts and booms, antenna components, thermal hardware (that is particularly thermally conductive or insulating) as well as thermo-elastically stable materials and assemblies such as the carbon fibre honeycomb CCORE® developed by INVENT.

References (a selection): ExoMars TGO, Sentinel 1, 2, 4, 5P & 5, Solar Orbiter, EUCLID, eROSITA, ELECTRA, Galileo FOC, Heinrich Hertz, Meteosat Third Generation (MTG), MetOp-SG, BepiColombo, SWARM, JUICE, TerraSAR-X and TanDEM-X.





AVIATION

CERTIFIED. RELIABLE. IN SERIES.

At INVENT, our customers have rated us as an experienced tier-1 supplier with continuous 100% D1 performance. Since 1996, with strong bonds to the German aviation industry legacy, we have spread our wings and have become a global supplier, ranging from serial deliveries to customized developments.

Since the company was founded, INVENT GmbH has been active in the aviation sector. In its day, carbon-reinforced plastic cladding elements were produced by injection technology for the Dornier Do 328 Jet.

Today, INVENT components fly worldwide in the aircraft and helicopter programmes of various manufacturers. In addition to series production, we offer the manufacturing of specimens and structures for test programmes, prototype development and customer-specific modifications.

Fibre composites are indispensable in aircraft and lightweight construction. They can be used to achieve the desired stiffness, strength and extraordinary corrosion resistance at low weight. On request, components made of fibre composites and multi-material mixes can be developed individually according to customer specifications. The focus is on aircraft and helicopters, which are individually equipped, with mounts for cameras or additional tanks, etc.

Tool development and the manufacturing of components along the value chain are carried out in-house. We are also available to make adjustments for the structure of existing aircrafts. This is commonly done by directly moulding the existing connection areas for tool creation or by retrofitting the components on site.

References (a selection): Airbus A320, A330, A350, A380; Embraer Phenom 100, 300; Dornier Do 228, Do 328-100 (Turbo Prop), Do 328-300 (Jet); NHI NH 90; edm aerotec CoAX 2D; national and international research programmes.





INDUSTRY

LIGHTWEIGHT STRUCTURES FOR DEMANDING APPLICATIONS.

From stringent geometric stability within temperature fluctuations, highly dynamic applications to functional and sensor integrations in the manufacturing process – we find individual solution for your specific needs.

Activities and application examples in the industry business unit, include maritime, medical and military applications, development contributions for automotive and rail transport, industrial plant components, precision structures, series production of DuraAct® piezoceramic transducers, industrial development of new material systems and manufacturing processes, development and production of biocomposites and special applications with shape variability (morphing).

We provide our customers with bespoke industrial solutions. Our many years of experience in the lightweight construction market enable us to respond with state-of-the-art solutions to the increasingly complex requirements placed on new lightweight products.

Design and manufacturing are very closely interconnected in our company. We offer an extensive range of services: comprehensive consulting, concept studies, component qualification and the realization of structures that can be produced in small and medium quantities in a prototypical manner.

References: military applications, measurement equipment, DuraAct®





RESEARCH AND DEVELOPMENT

INVENT. LITERALLY.

The R&D division drives the technological advance of the company not only in composites but with a strong interdisciplinary approach. Novel technologies are developed across all sectors – aiming to bring the lightweight potential to new applications and to rethink existing ones.

Technological competence in all aspects of lightweight construction is our foundation, which is why we have been relying on intensive research and development in all business fields. We work closely with research institutes, universities and development departments of renowned companies. We participate in projects and funding programmes of the Federal Ministries for Economic Affairs and Energy (BMWi) and Education and Research (BMBF) as well as internationally in the European Research Framework Programme 7, Horizon 2020 and JU CleanSky2.

The focus is on current and future-oriented topics in the field of structural and functional materials, process and plant development, innovative sensors and actuators, functional integration and new, previously unrealized components. New technologies will also be made commercially viable.

From aerospace to automotive and rail transport applications as well as plant components - we prove our expertise in the initiation, planning and implementation of federal, national and EU-wide joint projects

with our own competence team. We can look back on many years of experience, both as consortium leaders and as partners, and have our own competent administration for the various types of projects.

*INVENT IS **THE** DEVELOPMENT PARTNER FOR CUSTOMERS LOOKING FOR INNOVATIVE SOLUTIONS TO TECHNICAL COMPOSITE CHALLENGES.*





SERVICES

PRODUCT DEVELOPMENT AND MANUFACTURE.

Experience, agility and adaptability – INVENT's services are tailorable to meet requirements, large or small. From conception to product realisation, INVENT can provide years of experience to the complete product lifecycle, either in its entirety or in specific selected, parts.

PRODUCT DEVELOPMENT

We offer comprehensive development and realization of fibre-reinforced composites and lightweight products. This covers the conception through design and dimensioning to the qualification of prototypes and finally into series production. Depending on the customers' requirements, one or more links in the development chain can be offered as a service or as a complete package.

CONCEPTION

The core tasks for the development of fibre-reinforced composite products include the development of construction methods, fibre-reinforced composite design, structural analysis methods and the selection of suitable fibres and matrix semi-finished products.

DESIGN

Fibre-reinforced composites are materials that can be constructed as required. We achieve the component properties specifically by selecting the fibre material and the optimal orientation of the fibres. In this way, we achieve better material utilization for lighter and more efficient structures. Equally important in the design of fibre composites is the connection to the surrounding structures, e.g. through metallic components such as inserts and brackets.

We can draw on a wide range of different integration solutions that have been developed, implemented and qualified for both aerospace and industrial applications.

ANALYSIS

Due to numerous influencing variables, the structural analysis of high-performance fibre composites requires special know-how. This knowledge includes static verification methods, dynamic analyses and stability calculations. The common aim is to optimise the structures in terms of mass and function. Both analytical and numerical methods are used.

QUALIFICATION

Materials and construction methods used in product development must be qualified in order to demonstrate compliance with the specification. Over the years we have managed and successfully completed numerous qualification programmes. This includes test programmes for the verification



of special or new fibre composite materials and processes, in particular for space and aviation applications. We further qualify entire components and assemblies against the specific requirements.

MANUFACTURE

Since 1996 our motivated employees have been working on individual solutions for customers from Europe, Asia and the Middle East. The focus is primarily on fibre composite structures as customer-specific prototypes and series components. INVENT has an extensive machine park for the manufacturing and processing of its products. Our broad portfolio guarantees maximum flexibility with very high quality standards and customer-oriented implementation.

PRODUCTION PORTFOLIO

FIBRES/SEMI-FINISHED FIBRE PRODUCTS

The selection of fibres, semi-finished fibre products – such as fabrics or scrims – as well as the resin matrix, can be matched according to requirements.

AUTOCLAVE TECHNOLOGY

Three hot-air autoclaves form the heart of the production process. Combined with a certified clean room, the systems are ideally suited for the manufacturing of components for the aerospace industry.

FILAMENT WINDING

With CNC-controlled, heatable or coolable winding machines cylinders and struts as well as other components made of fibre composites are produced.

MACHINING

CNC-controlled milling machines enable the machining of fibre composites and metal alloys with the highest demands on tolerances, surfaces and purity.

PAINT SHOP

The coating of fibre composite components is demanding, especially in combination with special coatings for optical systems, thermal insulation or erosion protection. INVENT is qualified for special paintings in aviation and space applications.

ASSEMBLY

Assembly work can be carried out in clean rooms and specific integration rooms with optimum ambient conditions.

QUALITY ASSURANCE

In our in-house test laboratory, witness samples and finished components undergo a wide variety of inspections for quality assurance. Both, destructive and non-destructive methods are applied.



QUALITY MANAGEMENT

ROBUST. CUSTOMER-ORIENTED.

Quality management and quality assurance - basis for the fulfilment of the high demands in our business units and core of the continuous improvement process of INVENT.

The realization of complex component structures and the constant expansion of the product range place high demands on quality management and quality assurance. This applies in particular to the development and series production of fibre composite structures for the aerospace industry. Robust, transparent processes and procedures as well as their continuous monitoring and improvement are the basis for high product quality. Thus, we attach great importance to regular employee training, detailed process documentation, continuous process improvements, certified systems and production equipment and ongoing investment in state-of-the-art manufacturing technologies and facilities.

The basis for the implementation of the INVENT quality concept is an integrated quality management system certified according to DIN EN 9100. Internal and external quality audits guarantee the highest standards. The continuous improvement process and regular audits involving customers and employees

are the basis for the continuous optimisation of our quality management system.

Since 2014 we have also had Nadcap accreditation for fibre composite production.



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