ARRK

Engineering Division

Full-scale Composite Development

From idea to production

ARRK Group at a glance

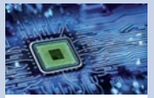
The **ARRK Group** is an international group of companies based in Japan. Its 20 member companies and over 3,500 employees worldwide are active in the fields of Engineering, Prototyping, Tooling and Low Volume Production. This cooperation allows us to develop complete modules and components with a holistic approach to the product development process. For 70 years, the ARRK Group has assisted companies from a wide variety of industrial sectors with the integral development of new products or the optimization of existing ones.

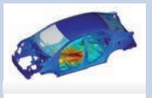
Since the beginning of 2018, the global ARRK Corporation has been a consolidated subsidiary of the **Mitsui Chemicals Group**. Both companies will mutually put each other's technologies to use for achieving continued growth in the global market. ARRK will be able to apply the materials expertise of Mitsui Chemicals, utilizing its diverse lineup of products and materials technologies in carrying out design, prototyping and analytical activities.

ARRK brings together highly qualified specialists in order to provide customers with top technical know-how. Our experts use the latest technologies to deliver an outstanding service in terms of quality, precision and promptness.

Engineering Portfolio

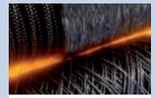
We support you in 14 Centers of Competence


ELECTRONICS & SOFTWARE


CAE


MATERIAL


ACOUSTICS


COMPOSITE


CAR BODY


POWERTRAIN


CHASSIS


INTERIOR & EXTERIOR


OPTICAL SYSTEMS


PASSIVE SAFETY


THERMAL MANAGEMENT

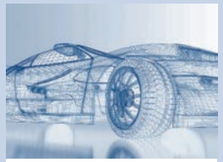

WORKSHOPS & TEST BENCHES


AEROSPACE

ARRK Facts

- International technology group
- Founded 1948
- Turnover 418 Mio. €
- Worldwide > 3,500 employees
- More than 20 companies in 15 countries
- Listed on the Tokyo Stock Exchange

ARRK Divisions


ENGINEERING


PROTOTYPING


TOOLING


LOW VOLUME PRODUCTION

ARRK Engineering

The **ARRK Engineering Division** is an essential part of the international ARRK Group and specialized in all services relating to product development. In our Centers of Competence – Electronics & Software, CAE, Material, Acoustics, Composite, Car Body, Powertrain, Chassis, Interior & Exterior, Optical Systems, Passive Safety, Thermal Management, Workshops & Test Benches and Aerospace – we are developing as a long-time strategic partner products for our customers. Together with our ARRK sister companies, we implement product development from virtual engineering to prototypes and low volume production.

The facilities of the globally active ARRK Engineering Division are located in Germany, Romania, the UK, Japan and China. Headquarters of the Engineering Division is the Munich location of P+Z Engineering GmbH. ARRK Engineering currently employs more than 1,000 people.

Our **CoC Composite** focuses on the full-scale development of products made from fiber-reinforced materials. Our competence includes consultation, concept elaboration and product development right through to the production of tools and components. In the interests of accelerated, cutting-edge knowledge building and intensive development in this future-oriented key technology, ARRK Engineering joined the association Carbon Composites e.V. back in 2012, and the leading-edge cluster MAI Carbon shortly afterwards. We are therefore part of a competence network consisting of scientists and small, medium and large-scale companies.

Full-scale Composite Development

Whether at the start of your idea or in a later phase, the ARRK Engineering Division supports you throughout the entire product development process. To produce optimal synergies, we combine our strengths in the following areas:

Consulting & Draft

- Requirements analysis
- Conception, concept analysis and evaluation
- Definition of production technologies and materials
- Development expertise in all areas of the vehicle (car body, powertrain, chassis, interior, etc.) as well as in aerospace and mechanical engineering

Configuration & Design

- Fiber-appropriate design of highly integrative components
- Production-ready design for diverse manufacturing processes and multi-material design
- Selection and design of material-appropriate joining processes

with CATIA V5, Siemens NX

Material & Testing

- Material testing (quasi-static, dynamic, thermal, acoustic)
- Creation of material datasheets and material cards

Simulation & Analysis

- Material characterization in CAE
- Method development and design strategy
- Simulation (crash & crushing, strength, fatigue, NVH, acoustics, multi-body, CFD)
- Lay-up, layer optimization and draping simulation
- Evaluation of results and component optimization

with ANSA, HyperMesh, MSC Patran/Nastran, Abaqus, Ansys, Pamcrash, LS-Dyna, Radioss/Optistruct, Theseus-FE

Concept development > **Series development** > **Prototyping & Testing** > **Production & Series supervision**

Composite Manufacture

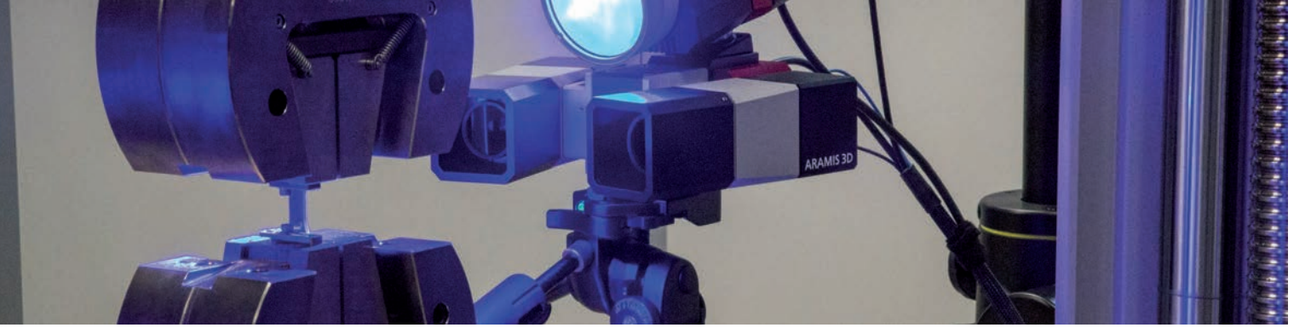
In cooperation with our ARRK affiliated companies, we offer you:

Tools and production systems

- Mold filling simulation
- Tool development
- Production of prototype and series tools
- Optimization of handling and production systems

Production

- Production and process documents (layer cuttings, laser projection data, ply books)
- Fluidic and thermal optimization of manufacturing processes
- Design and functional prototypes (SLS, SLA, polyjet, CNC milling, vacuum casting, block modeling, etc.)
- Low volume production (preforming, prepreg autoclave, resin infusion, injection molding, thermoforming of organo sheets, surface treatment, assembly etc.)



Material Lab

Material cards and material data sheets – milestones for new development

We support the development of components or subsystems also from the material perspective: From material selection and static, dynamic as well as thermochemical testing, right through to comprehensive identification of characteristics, and specification of CAE material cards used by us or our customers in structural CAE design. In addition, we help automotive manufacturers and their suppliers to comply with statutory directives in the field of material usage and material bans.

Material Testing

We are able to determine a variety of characteristic values for composites, plastics and adhesives as well as metals, for example:

Thermo-chemical

- Fiber volume content
- Filler content
- Degree of cure
- Thermal expansion
- Glass transition temperature
- Viscosity
- Gel point

Mechanical

- Material moduli
- Compressive strength
- Tensile strength
- Max. shear deformation
- Impact value

Our machinery includes different types of inspection and test equipment such as:

- High-speed testing machine Zwick HTM 16020
- Testing machine UPM Z250
- Thermochemical analysis from Netzsch

Material Characterization in CAE

Through close collaboration between our materials laboratory and the simulation department, we can offer our customers a comprehensive solution and adapt both the material model and the test program to the needs of our customers. With this procedure, we achieve forecast-capable material cards, which can for example be used to predict crash behavior via simulation.

Reference Project – Composite Gearbox

In a joint research project by the European ARRK companies, the participating partners not only demonstrated the synergies of the ARRK corporate group but also developed a future-oriented concept for an exemplary hybrid component.

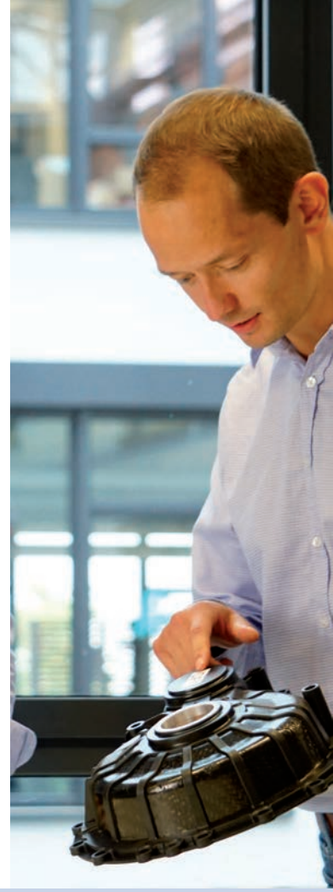
This is a **composite gearbox housing** based on a Smart Fortwo Electric Drive gearbox. ARRK was able to cover the entire, simulation-driven development process from concept phase through to prototype manufacture and testing.

The result of this cooperation is an optimized component on the basis of a CF organo sheet, which is locally reinforced along the main load paths with thermoplastic CF-UD tapes. In a downstream process, reinforcement ribs, bearing seat holders and other components are added by overmolding on using glass fiber-reinforced thermoplastic.

Process steps:

1. Stacking of organo sheet and UD tape
2. Heating up the stack (infrared)
3. Forming using a stamping tool
4. Trimming using water jet cutting
5. Overmolding of the formed semi-finished product and the metal inserts
6. Post-processing of the functional areas to guarantee the shape and positional tolerances

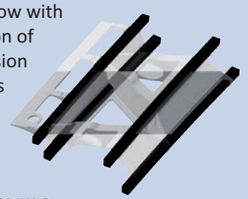
ARRK Engineering was responsible for drafting, design and structural simulation, including topology and layer optimization. The manufacture, including process simulation, was carried out at the ARRK affiliate Shaper's.



Further reference projects (selection)

Partner at MAI Skelett / Multi-Skelett

Roof bow with skeleton of pultrusion profiles



Quelle: BMW Group

BMW i3 & i8

Simulation of the CFRP passenger cell

CFRTP Suspension Arm

Internal R&D project

We are your global partner

Development support with offices in the following countries

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We help your projects thrive.
Get in touch!

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