THE PROJECT

8 PARTNERS

ONE VISION

28 WEEKS

THE CAVUS TECHNOLOGY
THE KTM 1290 SUPER DUKE R IS A HIGH-PERFORMANCE MOTORCYCLE AND THEREFORE THE IDEAL APPLICATION FOR ULTRA-LIGHTWEIGHT HIGH-PERFORMANCE COMPONENTS.

CARBON COMPONENTS ARE ALREADY WIDELY USED IN MOTORSPORT. THE R.A.C.E. PROJECT NOW MADE AN IMPORTANT DEVELOPMENT STEP IN THE INDUSTRIALIZATION OF THE CAUS TECHNOLOGY FROM KTM TECHNOLOGIES, WHICH WILL ALLOW EVEN COMPLEX FIBRE COMPOSITE HOLLOW PARTS TO BE PRODUCED WITH THE AUTOMATED HIGH-PRESSURE RTM PROCESS. SUCH A STRUCTURAL COMPONENT IS THE SUPER DUKE R'S LICENSE PLATE HOLDER.

POWER: · 127 KW / 173 HP

DISPLACEMENT: · 1300 CCM

ENGINE: · 2 CYLINDER, 4 STROKE

TRANSMISSION: · 6-SPEED
CONCEPT OF PROJECT R.A.C.E.

SERIAL PRODUCTION MOTORCYCLE

INNOVATIVE PRODUCTION PROCESS:
THE CAVUS TECHNOLOGY

STRUCTURAL HOLLOW LIGHTWEIGHT COMPONENT:
- LICENSE PLATE HOLDER

PHOTO BY R. SCHEDL
FOR US, COMPETITIVE LIGHTWEIGHT CONSTRUCTION IS A CENTRAL FOCUS IN THE DEVELOPMENT OF HIGH-PERFORMANCE PRODUCTS. WITH AN INNOVATIVE TEAM, WE REALIZE PARTS IN NEW TECHNOLOGIES WHERE WE ARE CONSTANTLY PUSHING THE LIMITS OF WHAT IS POSSIBLE FOR OUR CUSTOMERS. WE AT KTM TECHNOLOGIES ALSO RELY ON POWERFUL PARTNERS FOR OUR DEVELOPMENT PROJECTS IN ORDER TO RETAIN OUR LEADING POSITION IN LIGHTWEIGHT CONSTRUCTION IN THE FUTURE.
CONSTRUCTION AND ANALYSIS

INTENSE COLLABORATION OF DESIGN & CONSTRUCTION FROM THE BEGINNING

INSIDE-OUT DESIGN

STRONG COOPERATION OF CONSTRUCTION & ANALYSIS FOR THE BEST PERFORMANCE

USING VARIOUS ANALYSIS TOOLS:
- FILLING SIMULATION
- STRUCTURAL SIMULATION
- BRAIDING SIMULATION
H2K Minerals is able to produce pressure-resistant complex geometries using sand. The sand cores will withstand an enormous injection pressure of up to 500 bar. The binder used is water-soluble. At the end of the process, it can be flushed out easily in an eco-friendly manner with regular water and without any use of solvents.

MAPUFACTURING METHODS:
- Rapid Prototyping
- Core Shooting

WATER SOLUBLE
NON-TOXIC
REUSABLE FILLER MATERIAL

TEMPERATURE RESISTANCE:
- Up to 330 °C

PRESSURE RESISTANCE:
- Up to 500 bar
BRAIDING

THE CARBON FIBRES ARE WOVEN AROUND THE SAND CORE IN A BRAIDING PROCESS. THE POSITION, ANGLE AND ORIENTATION OF EACH INDIVIDUAL FIBRE IS EXTREMELY IMPORTANT IN ORDER TO PROPERLY ABSORB FORCES THAT ARE ACTING ON THE PART.

FULLY AUTOMATED PRODUCTION PROCESS

LOAD OPTIMIZED FIBRE ORIENTATION
HIGH MATERIAL PERFORMANCE

HEAD OF COMPOSITE MATERIAL - INSTITUTE OF AIRCRAFT DESIGN (IFB)

AUTOMATIC ROBOT PATH GENERATION BASED ON BRAIDING SIMULATION

DR. STEFAN CAROSELLA
The R.A.C.E. Project is an excellent platform where high-speed PU-matrix materials such as Vitrox® can demonstrate their full performance. Self-releasing systems with outstanding mechanical properties combined with optimized curing times are the key to mass production with a short cycle time.
TOOL

To withstand the carbon fibres, the aim is to realize a robust and highly polished surface. This enables the production of high-quality components and surfaces. For this, the ability to demold and the injection points have to be chosen correctly.
For the first time in the R.A.C.E. project, Murfeldt Plastics is proud to present a sealing material that can withstand internal mould pressures of up to 200 bar for long periods and is still resistant to damage from residue materials or even carbon fibres.

ralf burghoff

Technical Assistant to the Management
Murfeldt Kunststoffe GmbH & Co. KG
Engel machines are characterized by highest precision, energy efficiency and reliability combined with our automation capabilities. They are the ideal basis for an effective mass production in the area of HP-RTM processing. We have integrated an Elast 400 into the production cell which is best suited for both automated and laboratory operation.

Matthias Mayr
Head of Application Engineering & Project Management
Center for Lightweight Composite Technologies - Engel Austria GmbH

11 Engels machines are characterized by highest precision, energy efficiency and reliability combined with our automation capabilities. They are the ideal basis for an effective mass production in the area of HP-RTM processing. We have integrated an Elast 400 into the production cell which is best suited for both automated and laboratory operation.
THE STREAMLINE MACHINE OFFERS A WIDE RANGE OF SPECIAL FEATURES WHICH SIGNIFICANTLY INFLUENCE THE HP-RTM PROCESS. PRESSURE CONTROL, SENSORS IN THE MIXHEAD OUTLET, HYDRAULICALLY CONTROLLED BACK-PRESSURE FUNCTION AND MOULD FILLING MONITORING – TO COMPENSATE FOR WEIGHT FLUCTUATIONS IN THE PREFORM - ARE ESSENTIAL TO THE PERFECT COMPONENT.

MOULD-FILLING WITH HIGH FIBRE CONTENT WITHIN SECONDS

HP-RTM PROCESSING SYSTEM FOR ALL COMMON MATRIX SYSTEMS:
- POLYURETHANE
- EPOXIDE RESIN
- POLYAMIDE 6

VACUUM ASSISTED EVACUATION OF THE MOULD AND DURING SHOT TO ACHIEVE THE RIGHT FLOW PATH

PROVEN HP-RTM MIXHEAD SYSTEMS WITH INTEGRATED INJECTION BLOCK FOR HOMOGENIZED RELEASE AGENT INJECTION

Karolin Jacobs

MECHANICAL DESIGN · HENNECKE GMBH
THE WHOLE PROCESS

DESIGNING  SIMULATING  MOULD MILLING

CORE MANUFACTURING  BRAIDING  PREFORM QUALITY CHECKING

SEALING  INJECTING  TRIMMING  DISSOLVING  ASSEMBLING
As the world’s biggest trade fair for the plastics industry, the K show brings together the key industry trends and areas of future development. The 2016 K show was the perfect setting for Hennecke to present the Project R.A.C.E.
THE FACTS

APPROVED PROCESSES

125 SEC CYCLE TIME

62% WEIGHT REDUCTION

100 BAR INMOULD PRESSURE
FACTS AND FEATURES OF THE PART

PREFORM
- PREFORM WEIGHT: 98 G
- PREFORM CYCLE TIME: 120 SEC
- NEAR NET-SHAPE BRAIDING

SAND CORE
- SAND CORE WEIGHT: 1,870 G
- SELF SEPARATING CORE-COMPONENTS
- UP TO 98% CORE MATERIAL CAN BE REUSED

MATRIX
- CYCLE TIME: 125 SEC
- LOW VISCOSITY UNTIL SNAP CURE
- TUNABLE REACTION KICK-OFF

PERFORMANCE PART
- WEIGHT OF FINAL PART: 226 G
- VISIBLE AND STRUCTURAL HOLLOW PART
- FUNCTIONAL INTEGRATION
FACTS AND FEATURES OF THE PROCESS

PRESS / AUTOMATION
- INTEGRATED COMMUNICATION TO ROBOT AND METERING MACHINE
- SPACE-SAVING PRODUCTION THANKS TO MINIMAL FOOTPRINT
- CLAMPING FORCE FROM 1,600KN TO 6,000KN

HIGH-PRESSURE INJECTION
- SHOT TIME: APPROX. 5 SEC
- CURING TIME: 120 SEC
- MOULD PRESSURE SENSOR
- POST-INJECTION CAPABILITY THROUGH POSITION ENCODER

SEALING
- HIGHLY RELIABLE 3-D GEOMETRIES & COMPLEX SHAPES MANUFACTURABLE
- PRESSURE RESISTANT UP TO 200 BAR

TOOL
- INTEGRATED EJECTORS & ROBOT POSITIONING SYSTEM
THE FUTURE

DISCOVER APPLICATIONS

NEW DESIGNS

COST EFFICIENCY

WEIGHT REDUCTION
FUTURE POTENTIALS

WHAT ABOUT YOUR PRODUCT IDEA?
THE PARTNERS

8 PARTNERS

4 COUNTRIES

21 SPECIALISTS

ONE TEAM
KTM TECHNOLOGIES - MEMBER OF THE KTM GROUP, EUROPE’S LEADING MOTORCYCLE OEM - IS AN INNOVATIVE ENGINEERING SPECIALIST FOR LIGHTWEIGHT DESIGN AND TECHNOLOGY DEVELOPMENT WITH LEADING EXPERIENCE ON CARBON FIBRE COMPOSITE TECHNOLOGY. KTM TECHNOLOGIES IS THINK-TANK AND INCUBATOR FOR INNOVATIONS WITH A STRONG FOCUS ON CONCEPT DEVELOPMENT AND WITH SPECIAL EXPERIENCE ON URBAN MOBILITY.
H2K MINERALS ACCOMPANIES YOU
FROM THE FIRST IDEA UP TO THE SERIES.
YOU CAN EXPECT AN ENVIRONMENTALLY FRIENDLY,
INNOVATIVE CASTING CHEMISTRY WITH A CLEAR FOCUS
ON CLEAN PRODUCTS, FOR EXAMPLE INORGANIC ADHESIVES
(BINDERS). WHILE USING THE LATEST CHEMICAL KNOW-HOW,
YOU CAN ALSO RELY ON A RICH, LONG TERM EXPERIENCE ON MACHINE-
DESIGN- AND PROCESS TECHNOLOGY OF THE CX-GROUP. THIS ALLOWS
US THE FREEDOM OF FIGURING OUT AND VALIDATING FANCY IDEAS.
AS OF 2017, H2K MINERALS OPERATES UNDER THE BRAND NAME REINSICHT.

WWW.REINSICHT.NET
THE INSTITUTE OF AIRCRAFT DESIGN (IFB) IS WORKING ON INTERESTING AND RELEVANT TOPICS IN FUNDAMENTAL AND APPLIED RESEARCH AS WELL AS IN EDUCATION IN THE DOMAINS OF AIRCRAFT DESIGN, LIGHTWEIGHT DESIGN, MANUFACTURING TECHNOLOGIES AND WIND ENERGY WEIGHT SAVING WITH CARBON COMPOSITES IS ONE MAIN TARGET OF THE IFB’S LIGHTWEIGHT DESIGN AND MANUFACTURING TECHNOLOGY RESEARCH AREA. IN ORDER TO ACHIEVE THAT, THE INSTITUTE PROVIDES THE DEVELOPMENT OF FAST ANALYTICAL CALCULATION PROCEDURES WHICH ARE ESPECIALLY USEFUL FOR PRELIMINARY DESIGN. THE RESEARCH AREA’S SECOND FOCUS IS ON THE SIMULATION AND DESIGN OF FIBRE REINFORCED PLASTICS (FRP) THROUGH THE WHOLE (DIGITAL) PROCESS CHAIN. THE IFB IS LOCATED WITHIN THE UNIVERSITY OF STUTTGART CAMPUS IN STUTTGART-VAHINGEN.
Huntsman is one of the world’s largest manufacturer and marketer of differentiated chemicals. Huntsman’s operating companies manufacture products for a variety of global industries, including chemicals, plastics, automotive, aviation, textiles, footwear, paints and coatings, construction, technology, agriculture, health care, detergent, personal care, furniture, appliances and packaging. Originally known for pioneering innovations in packaging and, later, for rapid and integrated growth in petrochemicals, Huntsman has approximately 15,000 employees and operates from multiple locations worldwide.
FOUNDED IN 1976, PERSICO GROUP IS AN ITALIAN PRIVATE COMPANY LOCATED IN NEMBO, CLOSE TO MILAN, ITALY. IT IS ENGAGED NOT ONLY IN THE AUTOMOTIVE AND MARINE MARKETS BUT ALSO IN OTHERS LIKE AGRICULTURE, TRUCKS, RECREATIVE, AND FURNITURE. IT IS A PROVIDER OF A FULL RANGE OF SERVICES: FROM CONCEPT TO DESIGN, ENGINEERING AND MANUFACTURING OF PROTOTYPES, MODELS, MOULDS, AUTOMATION SYSTEMS, TURNKEY PRODUCTION LINES AND YACHTS. PERSICO IS CUSTOMER-ORIENTED TO FIND TAILOR MADE SOLUTIONS THAT MEET THEIR EXPECTATION BOTH IN NEW PRODUCTION TECHNOLOGIES AND IN NEW MATERIALS. IT HAS SUBSIDIARY PRODUCTION PLANTS AND SALES UNITS IN THE USA AND CHINA TO SERVE ITS CUSTOMERS WORLDWIDE.

WWW.PERSICO.COM
MURTFELDT PRODUCTS ARE USED IN ALL SITUATIONS REQUIRING PACKAGING, FILLING, AND TRANSPORT SYSTEMS. THE DORTMUND-BASED COMPANY IS ONE OF THE WORLD’S LEADING MANUFACTURERS OF CHAIN AND BELT GUIDES, CHAIN TENSIONERS, AND GLIDE-ENABLING PLASTICS. MURTFELDT ALSO RESEARCHES AND DEVELOPS RAW MATERIALS AND ADDITIVES IN THE COMPANY’S OWN LABORATORIES, CONSTANTLY COMBINING THEM TO CREATE NEW PRODUCTS. THANKS TO DECADES OF MANUFACTURING COMPETENCE, MURTFELDT IS ABLE TO SUPPLY INDIVIDUAL, COST-OPTIMIZED SOLUTIONS SUCH AS READY-TO-INSTALL MACHINE PARTS AND PROFILES IN ACCORDANCE WITH CUSTOMER DRAWINGS IN ADDITION TO STANDARD PRODUCTS SUCH AS CHAIN GUIDES AND TENSIONERS.

WWW.MURTFELDT.DE
ENGEL IS THE WORLD’S LARGEST MANUFACTURER OF INJECTION MOULDING MACHINES AND A LEADER IN THE FIELD OF INJECTION MOULDING TECHNOLOGY. ENGEL’S INTEGRATED SYSTEMS SOLUTIONS INCLUDE INJECTION MOULDING MACHINERY, AUTOMATION, PROCESS TECHNOLOGY, SOFTWARE SOLUTIONS, TOOL DESIGN, TRAINING AND SERVICE. WITH 30 BRANCHES, 60 REPRESENTATIVES AND 9 PRODUCTION PLANTS, ENGEL OFFERS ITS CUSTOMERS OPTIMAL SUPPORT WORLDWIDE TO COMPETE AND SUCCEED WITH NEW TECHNOLOGIES AND LEADING-EDGE PRODUCTION SYSTEMS. THE AUSTRIA-BASED COMPANY IS 100% FAMILY OWNED AND HAS 5,800 EMPLOYEES WORLDWIDE.
FOR SEVEN DECADES, HENNECKE GMBH HAS BEEN DEVELOPING AND DESIGNING HIGH-CLASS MACHINE AND SYSTEMS TECHNOLOGY AS WELL AS PROCESS TECHNOLOGY FOR POLYURETHANE PROCESSING. THANKS TO INTENSIVE RESEARCH AND DEVELOPMENT WORK, HENNECKE IS ABLE TO OFFER INNOVATIVE SYSTEMS AND TECHNOLOGIES WITH HIGHLY ECONOMIC AND ECOLOGICAL BENEFITS TAILORED TO MEET INDUSTRY REQUIREMENTS IN A WIDE RANGE OF APPLICATIONS. TODAY, THERE IS HARDLY ANY POLYURETHANE-BASED PRODUCT IDEA THAT CANNOT BE REALIZED BY HENNECKE.
PROJECT PARTNERS

H2K MINERALS

Huntsman
Enriching lives through innovation

IFB Institut für Flugzeugbau
Universität Stuttgart

Murtfeldt
KUNSTSTOFFE

Hennecke
Polyurethane Technology

PERSICO