

# Success built on cooperation



Focus Open 2016  
Gold



The construction equipment industry is undergoing significant changes as high-performance individual machines are being developed into systematically interacting, complex aggregates. Products range from robust excavator buckets to specific work tools with plug and play load alternators, from paper plans to digital BIM on construction sites. The scope of these changes does not only affect requirements regarding machines but especially the cabin as the workplace of the operator. Integral and interdisciplinary cabin concepts are required to ensure that these transformations really result in productivity gains and that quality and performance on construction sites are increased. These concepts are going to put the operator at the focus of processes, provide him with information advantages and assist him without obtruding. The objectives are: improved safety, ergonomics, fun and performance for the machine operator of the future.



# Science meets industry

The future trend in off-highway vehicles is efficient and first-rate systems integration in the scope of increasing digitalization of machines and cabins. This is reinforced by increasing demands regarding safety, ergonomics, efficiency and comfort, as well as by state-of-the-art styling and high recognition values in international markets.

How can these technological challenges be implemented in wheel loaders, excavators and other complex construction and agricultural vehicles?

This question was inherent in the collaboration between Prof. Jens Krzywinski from TU Dresden University of Technology and Fritz Schadeck, Vice President of the European market leader in cabin construction, Fritzmeier Cabs, from the very first time they met.

Their answer: intensive cooperation within an innovative group of OEM suppliers and renowned research institutions.

This was the hour of the birth of the CAB Concept Cluster.

Based on the theme of "Science meets industry", cluster members have merged the latest innovations in terms of technology and design into the model cabin Genius CAB.

"We are all benefitting from the positive synergies and the added value generated when expertise from science and daily practice converge. We live teamwork and place substantial emphasis on exchanging information, this has allowed us to promote the concept of integration and to bring this unique project to life," says Fritz Schadeck.

The Genius CAB has turned out to be a showcase project from the very beginning – a successful example in terms of basic research, visionary future concepts, and finally, practical implementation. The team at TU Dresden University of Technology was highly involved in the process from the early phases of conception. Simultaneously, the department of mechanical engineering supported the project with research work on trends across all industries regarding workplaces in and for mobile machines.

"This development project has yielded much more than just new impulses for integral systems.

We have constructed the Genius CAB as a real test vehicle. Thanks to the development of a stable network of industry partners, we have succeeded in optimally interlinking and expanding on findings of users and know-how regarding details," says Prof. Jens Krzywinski.



>> *jun. Prof. Dr. Jens Krzywinski*  
*TU Dresden*



>> *Fritz Schadeck*  
*Vice President | Fritzmeier Cabs*

Leading global innovators work hand in hand for the CAB Concept Cluster and contribute exceptional professional knowledge, intensive research and detailed know-how of customers needs in their specific market segments.



# Redefining customer benefits

The development of the customer-neutral innovation platform Genius CAB was implemented based on maximal systems integration, decreased development times and reduced costs by efficiently utilizing synergy effects.

Together all members of the cluster network cover a much stronger market than the individual companies on their own, with a stronger impact and a joint marketing concept.

Customers benefit from these synergies in many ways. The innovations of the Genius CAB ensure higher safety, maximum user-friendliness and operator comfort as well as improved maintenance.

The economic value added for the OEMs comprises much more than product benefits: they are offered the opportunity of final series implementation while risks remain limited and costs are reduced. They strengthen their own competitiveness in the market while simultaneously reducing the number of interfaces in the product.

One of the great challenges in the scope of cabin development was to meet various stakeholder requirements in terms of costs and quality. The Genius CAB met this objective in an unprecedented way.

>>Central points of interest of the OEMs are quality assurance, cost transparency, brand image and value of brand recognition, development of new brand values and preservation of their own corporate design.

>>Customers want high quality and safety with low maintenance costs, state-of-the-art components while all parts should be exchangeable, as well as the highest possible level of interconnectedness and control.

>>Work ergonomics, a pleasant atmosphere, minimal sensory overload, operator safety, integrated control function and accident prevention are the most important criteria for users.



>>Roland Ehrensberger  
Wheel loader driver | Max Bögl

„The driver's view is what counts, both toward the front and toward the rear. An additional camera system is ideal, but the window is and always will be of central importance for a cab – and with as much glass as possible!“



>>Stefan Prokosch  
Strategic Product Platforms |  
Linde Material Handling GmbH

„I was inspired to see how OEM suppliers form networks and integrate, and how they pool their skills and expertise so as to be able to independently develop highly efficient, complex products for customers. The Genius CAB is an excellent example of system integration performed at the supplier and features eye-catching innovations.“



>>Richard Honig  
Equipment Fleet Manager | Max Bögl

„The construction machine of the future uses corresponding integrated high tech systems to identify which employee is working on which machine and whether they have the necessary authorization and training to operate the machine. This helps prevent accidents.“



>>Peter Guttenberger  
Managing Director | VDBUM

„The construction sector depends on process optimization, economic efficiency, and productivity. The prime asset in the process is the employee. Maximum convenience, safety, easy operation of the machine – this is what makes the wheel loader driver proud of their job.“



"The Genius CAB is a great opportunity for Bosch to present itself as a supplier of vehicle systems and third-party systems for commercial vehicles and machines with state-of-the-art innovations. Together with our cluster partners we are increasing our experience in the scope of working. Thanks to our top-quality components and our systems expertise we are turning construction machines into safer, more efficient and cost-effective workplaces. To achieve these objectives we connect complex sub-systems with different interfaces and demonstrate to our customers the expertise of Bosch in sensor technology, intelligent networking and actuator technology."

>>Dr. Johannes-Jörg Rüger  
EVP of Bosch Commercial Vehicles & Off-Road



# Recognizing tomorrow's trends today

The CAB Concept Cluster was founded in 2014 and consists of 13 partners, including global players, innovative OEM suppliers, renowned scientific institutions, designers, industry associations, machinery hire companies and operators. They all have contributed their expertise and decades of experience to the development of the model cabin Genius CAB.

Cluster members include the companies AURORA, Bosch, Fritzmeier Systems, GRAMMER, HELLA, HYDAC, MEKRA Lang, SAVVY Telematic Systems, S.M.A. Metalltechnik, Lumod design agency, TU Dresden University of Technology, VDBUM association and Max Bögl. Their joint objective is to illustrate the incredible potential of efficient systems integration to OEMs in the construction and agricultural industry as well as manufacturers of the industrial forklift trucks.

The Genius CAB is a tangible vision of a groundbreaking wheel loader cabin based on knowledge networking, functional integration and a simultaneous process of development, featuring tomorrow's trends and today's customer requirements.

Innovations integrated in this project are setting new standards in global markets in terms of safety, intuitive operation, operator comfort, maintenance and design. The novel working environment and the HMI (human machine interface) ensure top-level ergonomic standards and process awareness for the user in the workplace.

The advantages of each individually integrated component are carefully coordinated with the added value of the other components.

What is more: all features developed serve specific user needs based on technology close to series production. The development of the Genius CAB is a pioneering achievement that was only realized thanks to the network and commitment of the most experienced and adept OEM suppliers and partners from science and industry.



"The best way to predict the future is to create it." an old saying goes. We at the CAB Concept Cluster have come together as a group of leaders and innovators and decided to create the future in our industry. The CCC is a team that strives to innovate our way into the future of the Off-Highway industry. Looking at the major global trends, both social, societal, work-place related and otherwise we have worked hard to create the workplace of the future of an operator in our industry, to create a workplace for multi-machine operations, to drive automation and autonomous work forward, to enable cloud-based management and productivity improvement. We have let creativity flourish, involved young apprentices, fully accredited universities, operators, asked fleet managers to question our ideas, giving us new insights."

>>Dr. Thomas Hiebaum  
Corporate Vice President of HELLA, Business Unit Global Off-Highway



# The diamond among the cabins

## An overview of innovations

The exterior and interior of the Genius CAB were developed and implemented in the scope of a multi-manufacturer styling concept, resulting in a unique overall appearance inspired by a polished diamond. The concept received the innovation award "bauma Innovationspreis 2016". Formative light lines that can be individually adjusted underline the unique branding.

"Human Centered Design" as guiding theme ensures maximum ergonomic comfort in the workplace thanks to the large dimensions of the interior. The glass cockpit with faceted window surfaces provides excellent vision.

Reduction and simplification: this is reflected in the modular construction of the exterior with the integrated structure with a "softcab" made up of special welded aluminium profiles which have led a 30 percent reduction in weight and the fitting EXO-ROPS/FOPS which is additionally placed above the cabin and is suitable for weight categories ranging from 10 to 50t.

The interior is equipped with a central touchscreen panel, which is integrated into the armrest of the adjustable seat along with the joystick. All functions and machine parameters that are controlled by the operator are centrally visible and adjustable even in adverse working conditions. An adaptive user interface collects the key parameters and ensures safe and expedient navigation.

Another novelty is the CAN network of all functions and components. A body computer constitutes the control center based on a complex, modular CAN matrix and processes all incoming and outgoing signals. Intelligent cloud technology registers operation and application times of operator and equipment, equipment status and records possible damages.

A mirror replacement system combined with a variable rear view camera surveillance system and interior displays greatly improve all-around visibility, especially in conditions of darkness. Ultrasonic sensors detect hazardous situations and obstacles in the vicinity. Individually controlled work lighting is used in excavation processes (dynamically) and without mobile lighting systems.

Air outlets together with the heating/air-conditioning system located on the side ensure outstanding climate control. The filter system equipped with RFID chips is easily accessible and improves the quality of maintenance.

### >> Maximum system integration and functionally linked innovations.

For example, in the exterior design of the Genius CAB the protection rails positioned in the blind spot of the A-posts not only function as part of the rollover protection cage, they also serve as handrails, cable conduits, signature elements and heat sinks for the worklights.



**One step ahead:** this is the corporate slogan with which the company, headquartered in Großhelfendorf in the Munich region, manufactures complete cabs cladding components and system assemblies, such as sliding windows and interior components for construction machines, agricultural machinery, as well as other off-highway vehicles. Our aim is always to offer global customers maximum safety, styling, ergonomics and driving comfort. In doing so, the sophisticated cab detail specialist relies on integrated systems, smart interfaces, new components, materials and production processes, such as metal, plastic and lightweight aluminium components. The company is part of the Fritzmeier Group, repeatedly named as one of the Bavarian Best 50 with around 2,800 employees throughout Europe.

# Experience a new way of integrating technology

The Genius CAB features a modular structure with a „soft cab“ made from welded aluminum special profiles and the EXO-ROPS/FOPS, which is attached over the cab as an add-on.

The aluminum cab structure offers the following advantages:

- Excellent formability and strength properties
- Good resistance to weather conditions and seawater
- Considerable reduction in mass compared with structural steels at a lower level of overlap

The EXO-ROPS/FOPS safety structure is a newly developed hybrid steel structure with bracing frame and grid elements that is securely screwed together with the machine chassis above the cab. It assumes the immediate protective function in the event of accidents. As of a predefined degree of deformation, the cab positioned below functions as an additional deformation element – which is why it is defined as a hybrid system. The EXO-ROPS can be adjusted depending on the machine weight. The soft cab remains unchanged. This guarantees as much ROPS as necessary for the Genius CAB, which saves investment costs. At the same time, the standalone cab is used in countries and in applications without ROPS/FOPS regulations.

A robust sunshade is located between the soft cab and the EXO-ROPS/FOPS and is electrically controlled via an innovative operator terminal in the cab. The exterior of the Genius CAB stands out thanks to its stylish modern design. The generous and deep front/side glazing guarantees an optimum all-round view for the driver, which users continuously rate as an important criterion for drivers of construction machinery.

Fully integrated into aluminum profiles, the LED headlamps and signature lights in the front and rear section and in the handles accentuate the cutting edge cab design. Distracting brackets and mounts disappear and prevent components moving off unintentionally.

The interior of the Genius CAB wins over users with the space that is provided. The elimination of the steering column enables the driver to experience a generous sense of space and thus the greatest possible added value in terms of ergonomics. The seat and the multifunction armrest guarantee easy and intuitive machine operation. When these properties are ensured, this boosts the alertness of the driver and therefore the safety factor. Experience a new way of integrating technology.



The **Genius CAB** is a modular structure consisting of an aluminum soft cab and a steel EXO-ROPS/FOPS.

Both make an impression with their cutting edge style. With regard to the exterior and interior styling, we attach the greatest importance to ergonomics and safety, the integration of components, and intuitive operation.

Softcab with ROPS up to 11t

Modular & additive EXO - ROPS / FOPS variably adapted to the weight of the machine



Fully integrated LED worklight



External A-pillar as a handrail with integrated signature lighting



Optimum view due to multi-panel windshield

External electrical sunshade >>



HELLA is a global, independent, family-owned company with approx. 32,000 employees at 100 locations in more than 35 countries. The HELLA Group develops and manufactures lighting and electronic components and systems for the automotive industry and also has one of the largest trade organizations for automotive parts, accessories, diagnosis, and services within Europe. Complete vehicle modules, air-conditioning systems and vehicle electrical systems are produced in joint venture companies. With more than 6,000 people working in research and development, HELLA is one of the most important innovation drivers on the market. In addition, with sales of approx. 5.8 billion Euros in fiscal year 2014/2015, the HELLA Group is one of the top 40 automotive suppliers in the world and one of the 100 largest German industrial companies.

# Next level of comfort and safety with smart light solutions

The aim of worklights is to provide the best possible illumination of the work area. The challenge in this regard is to prevent the driver being dazzled by reflections on the machine, and also to prevent third parties from being glared. This was the reason behind the development of LED worklights that are based around automotive matrix technology.

On a technical level, this function is implemented via the subdivision of the worklight into multiple units. Each segment is dimmed up or down according to the position of the bucket. The light beam can therefore be precisely controlled without mechanical devices and optimum light distribution can be implemented in the work area. With the integration of HELLA ZEROGLARE technology, a sharp cut-off line is used to prevent the dazzling of third parties. The Genius CAB takes system integration to a new level. The worklights are integrated into the structure of the cab. This provides outstanding protection, supports the heat dissipation of the LEDs, and makes installation more straightforward.

The SignatureLight lends the Genius CAB an impressive and striking appearance that underlines the brand identity.

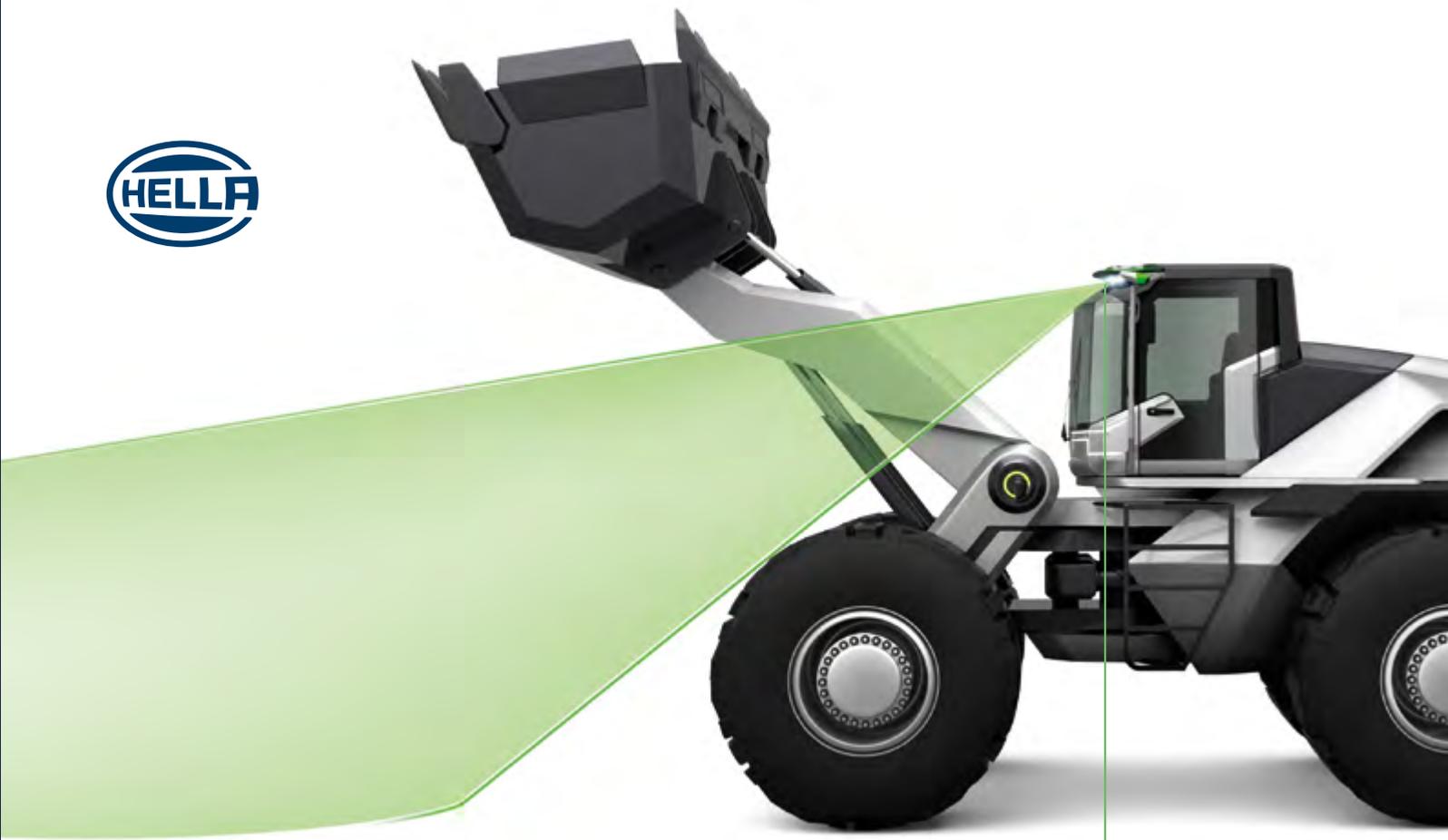
This involves the use of LED strip lights that are encased in a shockproof silicone body, along with signature modules that are integrated into the ROPS structure.

System integration also plays an important role with regard to the interior lighting. The integration not only applies to the ambient lighting and reading light functions, it also encompasses the access control display and the visual response of the ultra sonic sensors.

The radio key is specially developed for use in tough conditions. The signal sent to the actuator unlocks the cab door and the illuminated door handle indicates the current status – locked or unlocked. In addition, the HELLA transponder system joins forces with access management from SAVVY®. The wear-free measuring principle of the HELLA CIPOS sensor means that the robust electronic accelerator pedal is particularly suitable for frequently recurring small movements. A special rain-light sensor is also used: Developed for steeply sloped windshields, this controls the windshield wipers as well as the switch-on and switch-off of the light.



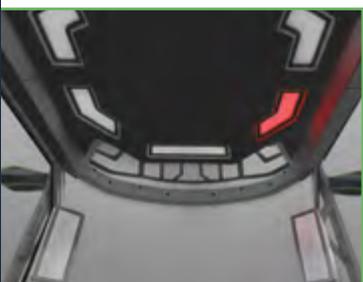
The Genius CAB reflects HELLA's broad product range. The LED worklights, signature light, interior lighting, vehicle key, transponder system, accelerator pedal, and rain-light sensor are integrated in terms of safety, comfort, and system integration.



Matrix beam technology



<< Intelligent interior lighting



Signature light and ambient light

Fully integrated LED worklights



**SAVVY Telematic Systems AG**, headquartered in Schaffhausen, Switzerland, is an M2M technology service provider specialised in telematics based business intelligence. SAVVY® combines hardware, software and process consulting expertise to provide comprehensive services for industrial and logistics companies. The aim is to increase added value in these companies through efficient work and logistics processes. SAVVY® links telematic system solutions for use in vehicles and machines with highly developed business intelligence technologies as well as customised communication services. The range of services also includes far-reaching process consulting and intelligent process design for all telematics based business processes. SAVVY® joined the INDUS Holding AG Group in May 2014 when IPETRONIK GmbH & Co. KG, a worldwide leader in mobile measurement technology, DAQ software, engineering services and test bench technology for the automotive industry and a member of the INDUS Group, acquired a majority interest in SAVVY®. >> [www.savvy-telematics.com](http://www.savvy-telematics.com)

# Operatingplace 4.0 safe and efficient

The operation of construction machinery is a challenging task that requires maximum concentration and must only be performed by specialist personnel with the requisite qualifications. The cloud based access and identity management from SAVVY® ensures maximum personal convenience and safety at the workstation.

The operator logs into the Genius CAB using the RFID key. When the personal user ID of the operator is recognized, the system not only allows access to the authorized vehicle functions, it also invites the operator to perform a customized configuration of the workstation that is stored in the user profile in a cloud. Once the configuration has been performed and stored via the operator terminal, the Genius CAB automatically configures the seat height, backrest inclination, and the intensity of the display lighting according to the personal preferences of the operator.

The user management and rights management enables highly differentiated configuration of user profiles in this regard. For example, it may be the case that multiple employees are able to move a unit to the respective operating site but only personnel with the appropriate qualifications are permitted to operate the unit on site.

The authentication and automatic comparison with the saved settings ensures that the SAVVY® technology not only protects against theft and misuse, but also saves time and improves the work ergonomics for increased productivity. In addition, the intelligent cloud technology also records the working times and operating times of the operators and the unit, registers the unit status, and reports potential damage.

The user friendly SAVVY® CAB app displays the individual roles and safety settings along with the allocation of rights. This means that machine owners can keep an eye on all the information that is relevant to them at all times.



The cloud based access and identity management from SAVVY® increases safety, productivity, and ergonomics at the workstation. Through the use of RFID and cloud technology, the solution enables smart access and identity management for the vehicle cab. It also records operating times and malfunctions, as well as preventing misuse.

**WHL 2096**

Responsible: xxx357 159 139  
 Position: 43.219482, 23.510248  
 Status: WORKING   
 Operating Hours: 7654 h   
 Next Service: 185 h   
 Fuel: 34% 



**WHL 2034**

Responsible: xxx456 852 789  
 Position: 49.171695, 1.506759  
 Status: LOCKED   
 Operating Hours: 5566 h   
 Next Service: 366h   
 Fuel: 83% 



**WHL 2145**

Responsible: xxx000 761 662  
 Position: 28.974846, 50.977427  
 Status: SERVICE   
 Operating Hours: 3659 h   
 Next Service: 0h   
 Fuel: 99% 



The **GRAMMER Group** is a leading global player in the automotive and commercial vehicle industry. GRAMMER specializes in the development and production of components and systems for automotive interiors as well as driver and passenger seats for utility and offroad vehicles. The Seating Systems Division comprises suspended driver seats for trucks and offroad vehicles as well as seats for trains and buses. In the Automotive Division, we supply headrests, armrests and center console systems to premium automakers and automotive system suppliers. Grammer is represented in 20 countries worldwide with a workforce of over 12,000 employees across its 30 subsidiaries. As innovation leader and trendsetter GRAMMER products and solutions stand for a maximum of comfort, ergonomics and safety.

# New standards in comfort and usability

GRAMMER AG provides an innovative and ergonomically optimized complete system consisting of a suspended driver seat, electronic multifunctional armrest, and multi-touch display. Development was focused solely on the needs of the driver, who can control all vehicle and convenience functions in an intuitive and ergonomic manner via the multifunctional armrest and the multi-touch display.

The newly designed driver seat boasts numerous electrically adjustable convenience features with a memory function. Via its connection to the CAN bus system of the vehicle, the seat can be automatically adjusted to the respective driver in advance by means of a driver detection system.

The large, clear multi-touch display offers convenient operation of a range of seat functions. In addition to this, the seat features a three-point belt with height adjustment, side contour adjustment, seat climate control, and even a massage function. The seat also opens up new options for customized interior design with its ambient light. The illuminated logo in the backrest and the luminous piping create a particularly pleasant atmosphere in the cab.

The newly developed electronic multifunctional armrest with a 12" multi-touch display can be used not only to make the settings for the seat and the vehicle control, but also to configure the important functions in the cab such as lighting and air conditioning.

For this purpose, GRAMMER collaborated with Dresden University of Technology to develop an innovative GUI (graphical user interface) for intuitive operation.

This enables all functions to be ergonomically designed around the driver in the best possible way.

The modular concept of the multifunctional armrest can be used to ensure customized installation of standard components such as joysticks and keypads.

This makes it possible to create a tailored HMI concept for every customer.

The newly designed joystick provides extremely convenient operation of the vehicle: The comfortable horizontal hand position with the ergonomically positioned control keypads for operation with the thumb and index finger reduce the need for awkward hand positions and thereby ensure greater productivity.

This can optionally be complemented by pressure switches with backlighting and rotary switches for the driver that are installed in the joystick handle.



Innovative and ergonomically optimized complete system consisting of a suspended driver seat with electrically configurable features, multifunctional armrest, and 12" multi-touch display for controlling all vehicle and convenience functions.

**Focus on what's important. >>  
All functions controlled via a central terminal.**



Illuminated logo for customized branding

<< 12" multi-touch display for innovative GUI

Luminous piping for particularly pleasant atmosphere

Newly designed joystick with ergonomic horizontal hand position



The **Bosch Group** improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is “Invented for life.” With more than 20 patent applications filed per working day, the company pursues the strategic goal of finding solutions for connected life.

The company’s Mobility Solutions business sector combines the group’s expertise in three mobility domains – automation, electrification, and connectivity – and offers its customers integrated mobility solutions. This aim also applies to its work as a systems supplier for commercial vehicles and mobile machinery. Bosch’s passion for ground-breaking technology and its many years of experience in the development and calibration of integrated electronic concepts find expression in the unprecedented design of its Genius CAB.

# Integration of innovative systems

The „electronic control“ working group in the development cluster is led by Robert Bosch GmbH. This is reflected in the components that it contributes:

**The body computer** enables the implementation of a centralized network architecture. It offers flexibility, functionality, and diagnostic options, and its use lowers the number of supply cables, relays, and fuses. This reduces the material costs and the number of potential fault sources.

The body computer enables customized programming and can therefore be individually adjusted in line with the application area. In the Genius CAB, the body computer performs central control of the sensors and actuators via CAN (J1939), LIN, or directly.

One example of this is the control of the **wiper direct drive**. This performs optimum adjustment to the environmental conditions by means of the dynamic adaptation of the wiper field and the homogeneous wiper movement. The freely programmable wiper parameters cover a diverse range of different cab versions without hardware modifications.

Bosch also demonstrates technical expertise with the **mirror replacement displays**, which form part of the mirror replacement system. The integration of the displays into the interior protects against soiling and damage (of the exterior mirror) in tough working environments. In addition, workstation safety is significantly increased as the blind spot is reduced in size.

The **ultrasound sensors** perform environment mapping that is not dependent on the lighting conditions. This enables a complete all-round view with direct visual feedback via the display and overhead lighting. The measuring distances can be defined for each sensor individually. The central user interface of the Genius CAB is our **display and terminal DI4-mid**, which can be ergonomically operated via the haptic elements or via the touchscreen. The DI4 is an operating unit with a 7 inch display that is intended for universal use and can be freely programmed using the Codesys V3.5 development environment.

Our **4THE5 joystick** is another interface that can be used to control driving functions, for example.



With our system expertise, we enable optimum interaction of the latest technology and thereby increase both safety and productivity in a professional environment.



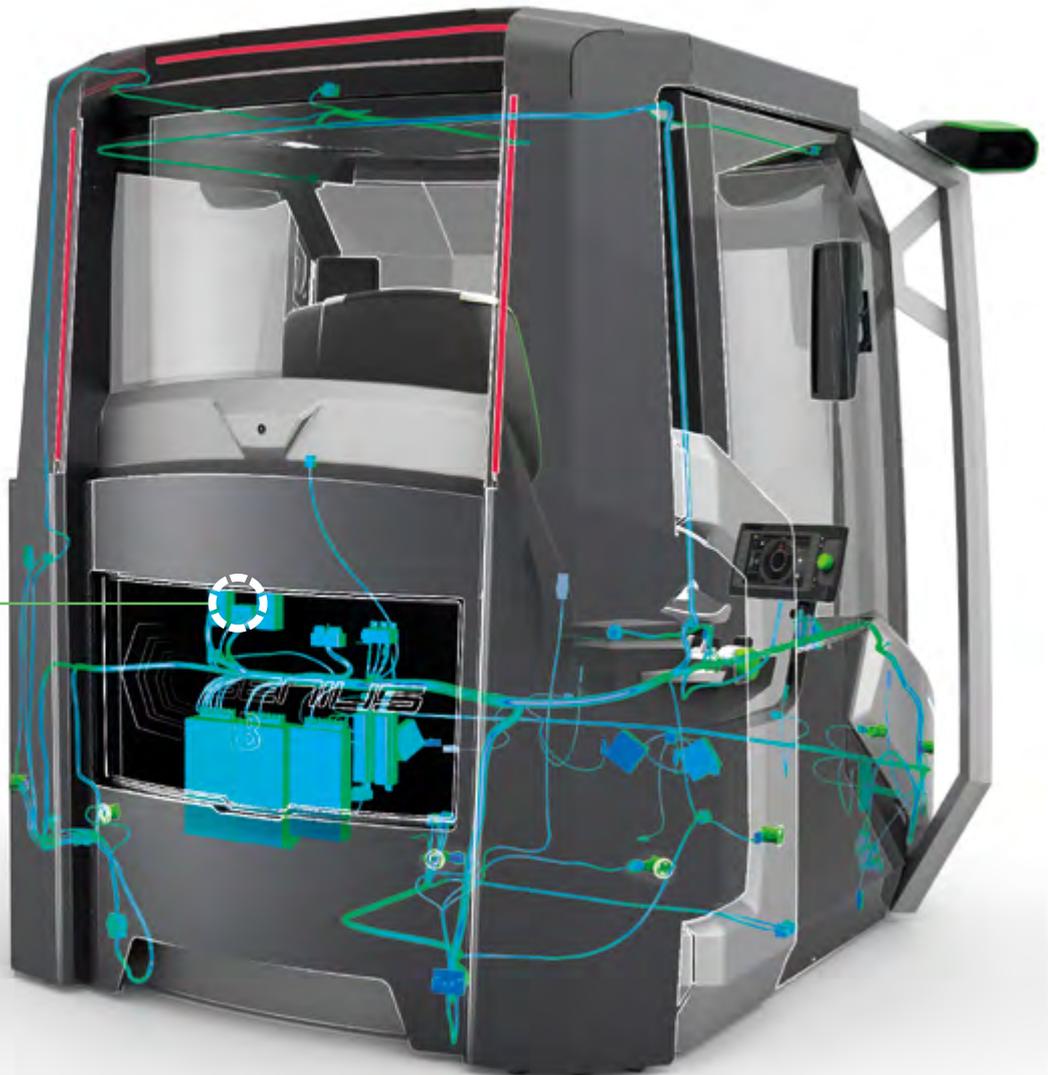
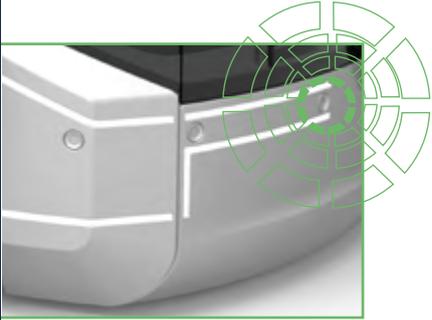
**BOSCH**

Invented for life



<< Ultrasound sensors  
not dependent on light

Dynamic wiper field  
adaptation via BCM



The body computer,  
the heart of the Genius CAB



In 1930 **AURORA** equipped the first Kaessbohrer Motor-Coach with heat. Since then we have continuously accepted the challenge of securing optimal climate conditions inside any vehicle or machine. The basis of our long-term future oriented success stems from dependable, well-engineered products and our reliable partners in both series production and service. Innovation is the motivation of AURORA. It is our impulse as an engineering driven company to develop reliable products with new ideas and to increase customer value. We know the complex and various conditions of use of customer vehicles, how to design to cost and to satisfy new requirements in a quick and flexible manner. Modern methods and tools are used up from early product development stages and over the whole product life time.

# Customized HVAC-solutions

Aurora specializes in customer specific developments with a high vertical range of proprietary HVAC components and systems. We provide customers with solutions that are tailored to the respective application and convenience-related requirements: In this regard, we distinguish between Economy, Comfort, and Premium requirements. A powerful and compact blower is a central factor in the successful implementation of effective heating, ventilation, and air conditioning. We offer roof ventilators, radial blowers, twin radial blowers, and axial blowers with an air performance from 100 to 2,000 m<sup>3</sup>/h. Our air nozzles are suitable for all installation situations and air ducts: Defrosting nozzles, round nozzles with a range of diameters, lockable and adjustable rectangular nozzles, and air grids with an optional filter. Various design and color options can optionally be introduced depending on the cab design.

AURORA offers a wide range of heat exchangers, evaporators, and condensers: Soldered aluminum flat tube heat exchangers are available in various dimensions for maximum power densities and challenging operating conditions. Robust servomotors for analog control of air flaps and water valves are available up to IP67.

We supply the servomotors with and without integrated control electronics to ensure minimum installation outlay. Single sided or double sided output is possible. This is suitable for separate or integrated installation. Our compact cock valves and disk valves for various pressure ratios are available with 15-28 mm connections and as a 3/2-way valve with an integrated T-piece. Mechanical and electrical actuation is available. Tube systems and tube/hose systems featuring conventional diameters and fittings are available in freely formed versions made from steel, brass, copper, and aluminum.

We offer mechanical, electrical, and fully automated control panels for all applications from Economy to Premium. Our heaters feature an output ranging from 2-15 kW, covering all installation options in commercial vehicles. They are available with optional accessories such as filters and nozzles for air distribution. We develop heating and air conditioning systems in close cooperation with our customers. Thanks to our many years of experience, we are familiar with the requirements and the application areas. Our solutions cover all installation situations and all requirements relating to performance and convenience.



#### **Vario modular HVAC unit:**

- Aluminum flat tube heat exchanger
- High power density
- High pressure resistance
- Powerful, quiet blower
- Installation space and weight reduced to minimum

#### **Disk water valve:**

- Pressure resistant up to 6 bar
- 2/2 or 3/2-way valve
- Electrical and mechanical options

#### **Central CAN controller:**

- Single area or multi area climate zone
- Modular structure
- Parameterizable and featuring diagnostic capability
- Minimal cabling



Powerful modular Vario HVAC unit



RD83 round nozzle for footwell and driver featuring refined ring



Vector nozzle for ideal windshield defrosting



CAN bus node with climate control software



3/2-way water valve for applications with bypass and high pressures

As an innovative automotive supplier, **S. M. A. Metalltechnik GmbH & Co KG** concentrates on the development, design and manufacture of advanced conduits for refrigerant, water, servo-cooling and lubricating oil in vehicles. At some time you must have already experienced the benefits, because among others, S. M. A. supplies technical innovations to all the major automotive companies. You will find our technical developments in numerous new model series. Find out more about us – and you will see for yourself: the fascination is in the details.

# The fascination is in the details

S.M.A. is your high performance partner when it comes to cables. Since being founded as Schick Müller Automobilkomponenten GmbH in the Swabian town of Backnang in 1990, the company has enjoyed success in Germany and abroad. In addition to operating a branch factory that was opened in 2010 in the Thuringian city of Halle an der Saale, S.M.A. has owned another subsidiary in the South African city of East London since 2000. S.M.A. employs around 1,000 staff worldwide, and is known above all for its collaboration with leading automotive manufacturers. S.M.A. has been part of Indus Holding AG since 2001. S.M.A. loves technical challenges. The development department translates high demands into sophisticated solutions. Customers are able to access a wealth of individual specialist knowledge in this regard. The inclusion of an internal heat exchanger (IHX) marks the first occasion that an efficiency boosting component of this nature has been used in a construction machine. The tube in tube design that was selected makes it possible to increase the effectiveness of the refrigerant circuit in a sustainable manner. We have been involved in the air conditioning of the cab since the Genius CAB was in the concept phase. At an early stage, this led to the idea of taking components that have undergone successful testing and deployment in the automotive sector and using them for this innovative product.

The use of high density connection technologies, along with refrigerant hoses featuring low loss and high flexibility, has made it possible to identify the very best solution for the Genius CAB. Thanks to the countercurrent principle in the IHX, additional energy is drawn off from the liquid refrigerant on the high pressure side upstream of the expansion valve. The liquid continues to cool. This enables the refrigerant to extract more energy in the evaporator, boosting the efficiency of the entire circuit. Energy is also supplied to the refrigerant, which is now in an expanded and gaseous state, on the suction side of the IHX.

This in turn has a positive effect on the refrigerant compressor. Efficient S.M.A. pipe systems ensure a pleasant atmosphere in the Genius CAB. An innovative pipe system featuring an integrated IHX internal heat exchanger will be presented for the first time at BAUMA 2016. In this application, this combination makes a contribution to increased levels of comfort while simultaneously reducing harmful CO<sub>2</sub> emissions.



## The advantages of the S. M. A. aluminum refrigerant pipes:

- Maximum system impermeability
- Increase in AC effectiveness
- Reduction in fuel consumption
- Contribution to a balanced climate in the Genius CAB



Automotive connection technology ensures complete tightness and easy assembly with SlimLine-EPDM Seals

Standard piping joints enable modular kits for optimised piping

Highly flexible, silenced, low permeation veneered refrigerant hoses

IHX-Profile out of aluminium supports the efficiency of the AC loop

Hose crimping with aluminium sleeves and EPDM seals

**HYDAC** was founded in 1963 as a company for hydraulic accessories and is today an internationally active company group with over 8000 employees, 50 branch offices and 500 trade and service partners world-wide. HYDAC components can be found in all areas of industrial and mobile hydraulics. The supply program includes hydraulic accumulators, fluid filters, coolers, controls/industrial valves, sensor systems, cylinders, pumps, mounting technology, armatures, Condition Monitoring and much more. Furthermore, HYDAC plans and supplies ready-for-use hydraulic control and drive systems, including electronic controls and regulators for mobile and stationary machines and plants for a wide array of industries. The high level of innovative strength, which is characterized by close collaboration with research institutes and universities, is also clearly reflected by the large number of HYDAC patents.

# CabinAirCare ultimate health at work

The aim of mobile work machines today is to increase output in a manner that is economical and conserves resources, but legal and social influences such as safety guidelines, emissions guidelines, and requirements relating to comfort and occupational safety also determine the technology and the appearance of the work units. The use of combustion engines is increasing around the world, leading to greater exposure to respirable ultra fine particles and nanoparticles in the ambient air – even despite tougher regulations relating to engines and emissions. This of course results in a high concentration of dangerous nanoparticles and other air pollutants in the vehicle interior, in work cabs, and in passenger areas. Depending on their size, the particles not only penetrate the lungs but are also able to enter the entire human body to a dangerous extent. Depending on the working environment, the dust that is raised may range from ultra fine particles and gases through to very high amounts of coarse dust. To ensure maximum performance, air filters must therefore undergo modular adjustments or it must be possible for them to be extended. In extreme cases such as working on landfill sites or working with asbestos, adapted gas filters are also stipulated.

In this regard, a properly certified driver's cab with a corresponding filter unit replaces the personal protective equipment (PPE) in the cab.

CabinAirCare provides optimum passenger protection against dust, nanodust, and application specific harmful gases without the need to make significant changes to the existing air conditioning unit or cab. To ensure that the climate inside the work cab is healthy and promotes efficiency, HYDAC offers a highly effective modular filter system that is easy to adjust to all the applications described. Depending on the expansion level, the filtration performance covers ultra fine particles, nanoparticles, and even gases.

End users profit from the particularly high level of health protection that is provided in all applications. For machine operators, there is therefore a low level of staff absence for reasons of illness. The electronic RFID monitoring of the filter soiling means that filter elements are now only replaced in the event that replacement is actually necessary. This means that the filter elements are used in a manner that conserves resources and is environmentally friendly. HYDAC CabinAirCare filters are also suitable for universal use, from normal cab air filtration through to special applications in the area of protective ventilation.

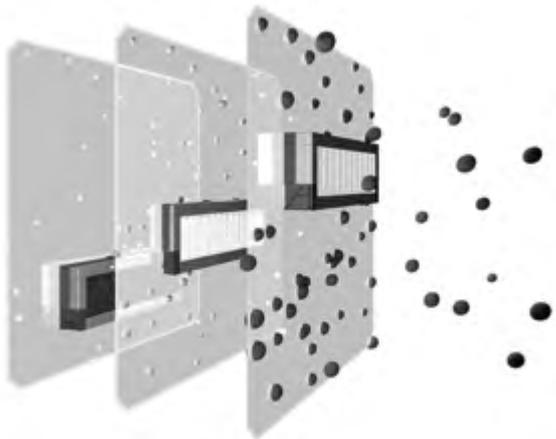


The modular **HYDAC CabinAirCare filters** are intended for universal use and can be adjusted to meet the specific requirements of the work machine in question. In this regard, the high quality filters provide the machine operator with optimum protection against dust, nanodust, and harmful gases that are hazardous to health.

**HYDAC**



Modular HYDAC CabinAirCare filter



0,001	0,01	0,1	1	10	100	10.000
nanoscale			particle size [µm]			
ultrafine dust			fine dust		grit	

Target area CabinAirCare

Area of influence classic air filter

The **MEKRA Lang Group** is a globally active family company and world market leader with more than 2500 employees at 19 sites in 14 countries around the world. At MEKRA innovation means solutions that offer our customers or their customers a noticeable added value (easier use, increased safety, long life leading to minimal warranty costs etc.). Utilizing our own development department, cooperation with highly competent partners and numerous patents, we are in a position to take innovations of a highly technical level to serial production and offer optimized solutions especially for the OFF ROAD market because we as a commercial vehicle specialist best know its requirements and applications.

# Future safety features ready for serial use

**MEKRA Lang** has unveiled two independent systems within the scope of the CCC project – the mirror replacement system (replacement of the conventional mirrors with cameras and monitors on both sides of the cab) and the rear view system (picture from a digital rear view camera is displayed on the operator terminal) – especially for the OFF-ROAD sector.

## **Mirror replacement system from technology leader**

Mirror replacement system from technology leader With camera/monitor systems that are not only able to expand the field of vision of the mirrors but can replace the mirrors in their entirety, MEKRA Lang is focused on forward looking technologies and customer specific adaptations and developments for the HEAVY DUTY sector in accordance with automotive standards.

As a specialist for the commercial vehicle market, we are familiar with the requirements and fields of use for HEAVY DUTY applications. As an OEM, you can expect the highest levels of quality from MEKRA camera/monitor systems for the purpose of mirror replacement: Depiction of the fields of vision required by lawmakers and stipulated in standards, high resolution and real time operation (minimal latency periods), depiction of objects in the size usually seen in the mirror,

true color depiction of objects and surroundings, full functionality in all lighting and weather conditions, and compliance with ISO 16505.

The mirror replacement system from the technology leader MEKRA Lang is also used in future trucks from renowned OEMs, for example, and enables an improved overview as well as better visibility in twilight and darkness, flexibility in terms of the mounting position, and a lack of sensitivity to shock and vibrations.

The system can focus on relevant sections of the picture by means of pan and zoom functions, and it can be integrated into a short range warning system.

MEKRA Lang guarantees proven and robust solutions especially for OFF-ROAD use, including guaranteed stable supply thanks to the benchmark production system!

## **Rear view camera system**

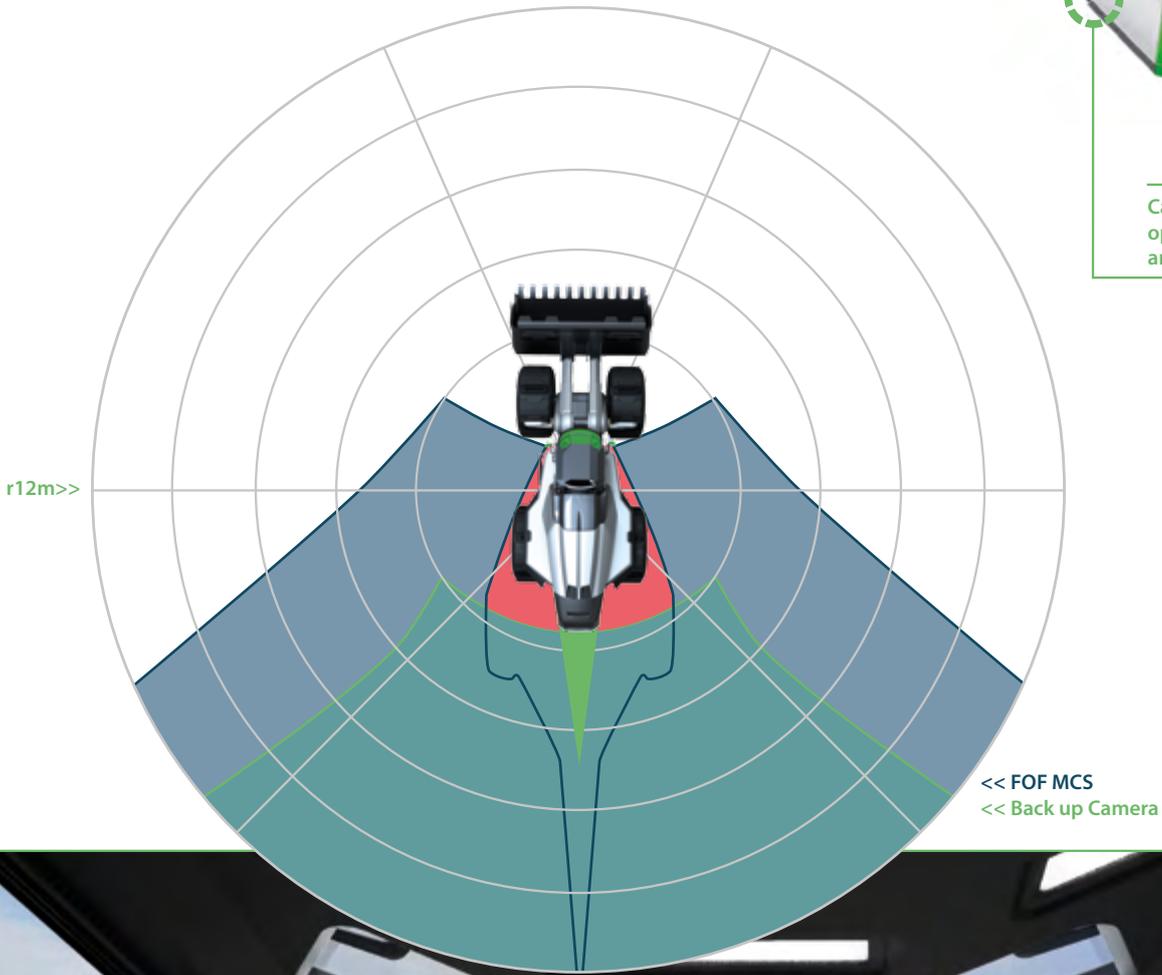
The digital MEKRA camera provides a brilliant picture for the rear area of the cab, featuring maximum sharpness and contrast. Optimum field of vision via perfectly chosen mounting position, adjustable camera bracket, and attuned opening angle of the lens. Suitable for use in every OFF-ROAD application thanks to the temperature range from -40°C to +85°C.



## **OFF-ROAD view made by MEKRA**

**Mirror replacement system:** Camera/monitor system in place of conventional mirrors. Cameras and monitors on both sides of the cab

**Rear view camera system:** Rear area monitoring using high resolution digital rear view camera and picture display on the terminal



Camera module for optimum viewing angle

Mirror replacement system in combination with Rear view camera system

The **Technische Universität Dresden**, is one of the top universities in Germany and Europe. With its five schools, it offers a broad scientific spectrum like only few universities in Germany.

The Junior Professorship for Industrial Design (TD) researches and develops novel and holistic solutions for professional machines focused on customized human-machine-interface for both mobile and stationary applications.

The Professorship of Construction Machines and Conveying Technology (TUD-BM) is engaged in the modeling and simulation of mobile machines.

The research findings are applied in interactive simulators with haptic controls.

# New era for cabs - how to develop a sustainable design/engineering process for cabs

The cabins of mobile working machines have to meet much more requirements than just ensure protection against weather and security for the operator. As mobile control rooms, cabins offer a professional workspace, from which the operator controls and monitors the complex processes and responds to the dynamic environment. This is crucial to ensure not only the safety of the driver himself but also of everybody else at the surrounding construction site.

The junior professorship for industrial design coordinated the development cluster during the initiation phase and developed a holistic cab design that fits the diverse requirements of the cluster partners. The cabin, designed for the use on wheel loaders, is based on the advanced technologies of the project partners. This takes into account both the field of view optimization and weight reduction using optimized aluminum profiles instead of steel for the soft cab structure as well as the constructive and service-friendly integration of functions in the interior. The developed interaction concept uses a comprehensive network of all controllable components via intuitive and multimodal information transfer and control.

The safety concept that has been developed virtually expands the driver's field of vision with a network of camera sensors and ultrasound sensors. The measurement data from these is immediately analyzed and, in the event of danger, transmitted to the machine operator via several channels of perception using the available output units. In this way, the position of and distance from obstacles is communicated via the central operator terminal and general hazardous situations are visualized according to the direction using the light emitting textiles in the roof cladding. The Chair of Construction Machines contributed to the development of the CAN communication for the electronic components. In cooperation with the developers of the CCC partners, CAN messages were specified and compiled in a DBC file. The actual communication was implemented on the basis of this database. The advantage of this is the transparency and consistency in the definition of the messages and signals. The messages from all control units can be viewed by all parties involved. This makes it easier to identify and correct errors such as address conflicts. The depiction in a format that can be processed by a computer also enables flexible integration into the various development processes of the partners.

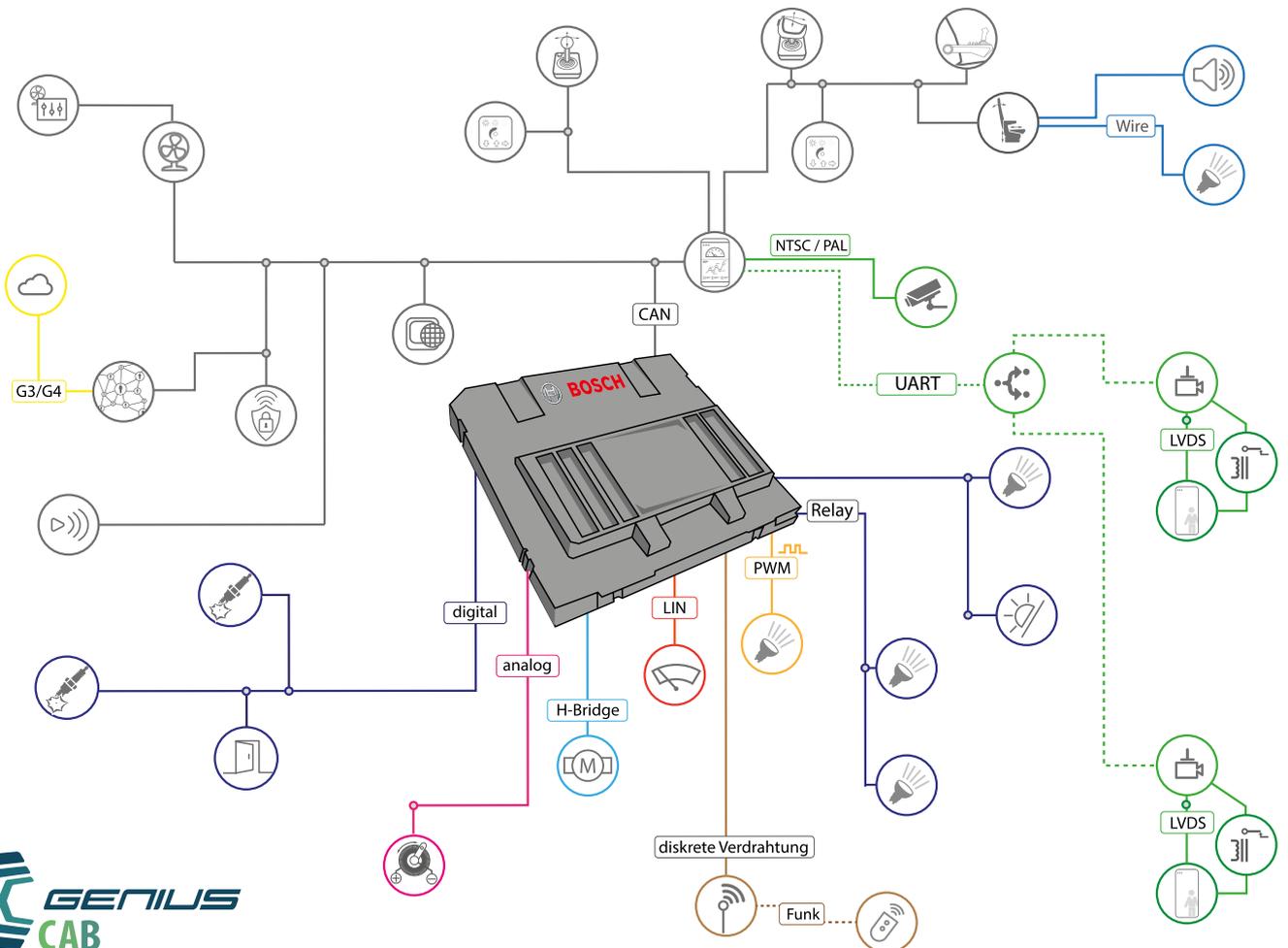


The **Genius CAB** stands for the targeted integration of design services into the product definition phase. The concepts that have been implemented include the integrated EXO-ROPS/FOPS structure, the multimodal safety concept, the ergonomic, maintenance optimized cab interior, and the development of the graphic man-machine interface.

**It has also been possible to implement the smart interlinking of all function modules and their connection to the BCM, as well as the corresponding development of the CAN definition.**



TECHNISCHE  
UNIVERSITÄT  
DRESDEN



**Lumod GmbH** is a design agency with a focus on industrial design and branding. With an international customer base, over 10 years of experience, and having introduced a number of products to series production – not only in the off-highway sector – it is an aspiring international agency. Starting out from the product, which is the most important information carrier and makes the brand values comprehensible, Lumod supports brand development through strategic design. In product development, there is a particular focus on the optimization of value for money. Ensuring cost efficiency in production while simultaneously achieving maximum brand performance is decisive for a sustainable corporate strategy. In this regard, industrial design is at the center of the innovation process and uses learned methods to generate products with added value as a result of innovative capability and brand power.

# How design creates extraordinary value for users, customers & brands

The Genius CAB of the Cab Concept Cluster is an excellent demonstration of how design can act as a driver of innovation when it is appreciated that industrial design is a multi-sensory development process that is aimed at achieving maximum overall performance through the moderation and motivation of all parties involved.

This concept of the design driven, unique cooperation of the CCC partners, which was pursued from the start, enabled the smart integration of numerous future oriented solutions into the overall system. This is because all parties involved always had their eye on the shared goal of a cab that is consistently designed around the operator and provides major cost benefits as a result of the collective rethinking of all key system components. Under the guiding principle of human centered design, the Genius CAB puts people at the center – almost literally.

It encompasses the operator with its generously dimensioned interior and ensures increased operational safety and efficiency thanks to coherent control logic and an uncompromising focus on the user.

This succeeds not only due to clear information management and a reduction to the essentials – for example, there is now only one central touch monitor – but also thanks to the emotional appeal that follows the trend of cocooning and takes account of the individual's need for protection and wellbeing.

Inspired by a cut diamond in a robust setting the additive, modular EXO-ROPS/FOPS carries together with the add-on plastic cladding the glass cockpit with its faceted windows.

The even balance of the solid structural elements and the large scale glass panels caters to the need for protection and also offers improved visibility.

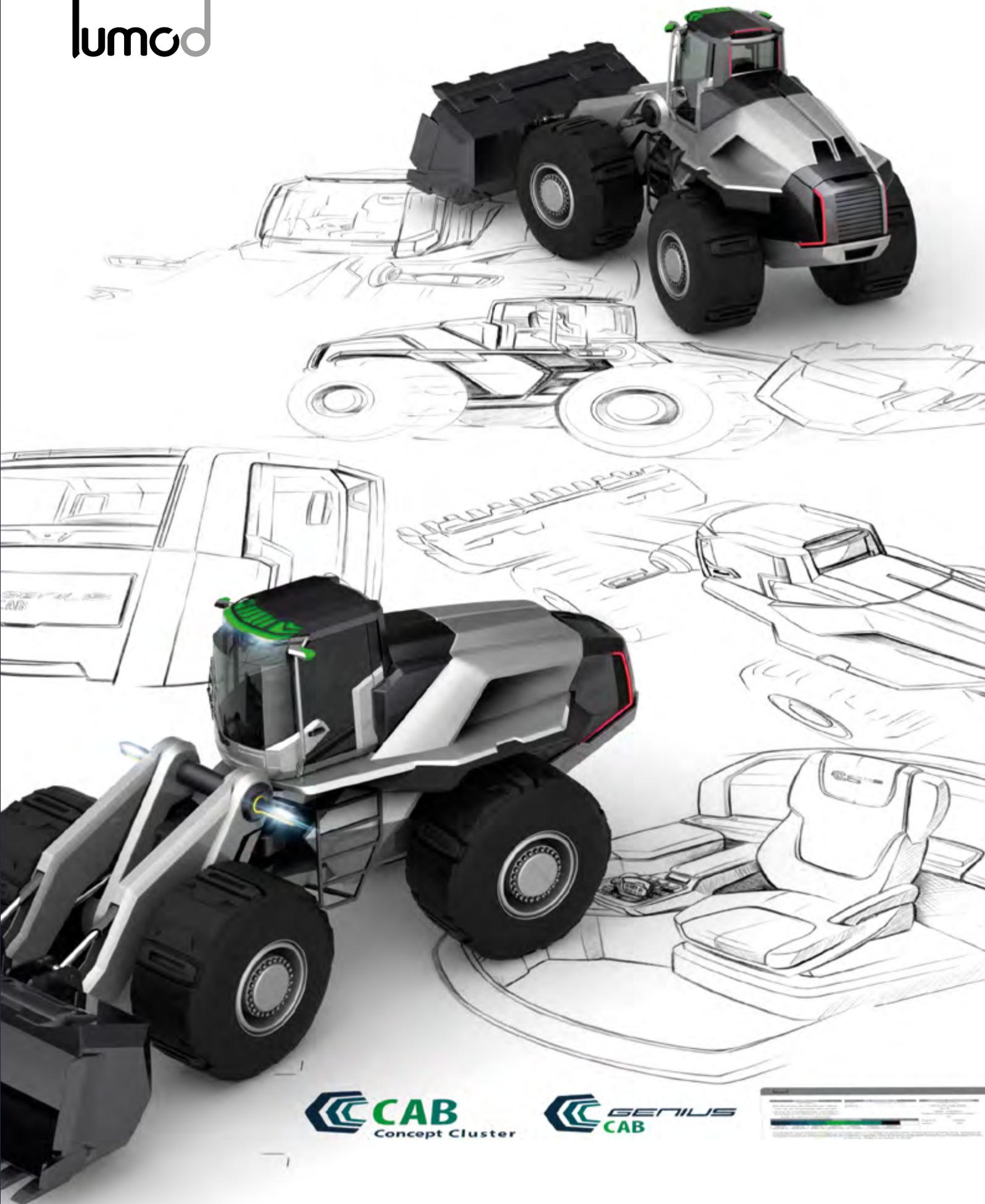
System integration is also highly important in the design of the exterior. For example, the protection rails positioned in the blind spot of the A-posts not only function as part of the rollover protection cage, they also serve as handrails, cable conduits, and heat sink for the integrated matrix beam worklights and as Signature element with the LED lighting.

This is just one of the brand-building elements that help OEMs to differentiate in a cost-effective way.



With its unmistakable silhouette and proportion, the Genius CAB visualizes its innovative capability and underlines its brand shaping character. After all, brand awareness is also becoming increasingly important in the off-highway sector.

# lumod



 **CAB**  
Concept Cluster

 **GENIUS**  
CAB

Item	Value
1	100%
2	100%
3	100%
4	100%
5	100%
6	100%
7	100%
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48	100%
49	100%
50	100%

# The CAB Concept Cluster

The CAB Concept Cluster is a network of global players, innovative OEM suppliers, renowned scientific institutions, designers, industry associations, machinery hire companies and operators.

Cluster members include the companies AURORA, Bosch, Fritzmeier Systems, GRAMMER, HELLA, HYDAC, MEKRA Lang, SAVVY Telematic Systems, S.M.A. Metalltechnik, Lumod design agency, TU Dresden University of Technology, VDBUM association and Max Bögl.

Their joint objective is to illustrate the incredible potential of efficient systems integration to OEMs in the construction and agricultural industry as well as manufacturers of the industrial forklift trucks.

In just 18 months, cluster partners have developed and implemented the customer-neutral innovation platform Genius CAB.

The model cabin received the innovation award "bauma Innovationspreis 2016" in the category "Design" and the VDBUM advancement award for "Industry Developments".

The extensive scope of technological innovations integrated in one cabin is unprecedented. The innovations integrated by the cluster partners are setting new standards in global markets in terms of design, safety, operation, operator comfort and maintenance.

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Gold



Verband der Baubranche,  
Umwelt- und Maschinenteknik e.V.

VDBUM-FÖRDERPREIS  
FÜR HERAUSRAGENDE  
PROJEKTE 2016





„The Genius CAB is more than just a cab! The major innovation is not in the detail, which remains as perfect as ever, but in the way it combines to form a whole. The users were integrated into this process from the start. That’s how you build success!“

>>Prof. Dr.-Ing. Jan Scholten  
Managing Director IBAF GmbH  
Member of the Board of VDBUM

„Thanks to the consolidated expertise from scientists and practitioners, their team spirit and the continuous exchange of knowledge and experience in our network, we have been able to demonstrate to the OEMs of the off-highway industry the enormous potential of effective system integration. We continually pushed the envelope of the integration concept and have created a unique project that carries considerable weight in the international markets.“

>>Georg Fritzmeier  
Owner  
Fritzmeier Group