THE MAGAZINE FOR INDUSTRIAL VEHICLE TECHNOLOGY, DESIGN & ENGINEERING

iVT Industrial Vehicle Technology International

MARCH 2019 VOL. 27 No. 1

www.iVTinternational.com

Published by UKi Media & Events

MARCH 2019

iVT INTERNATIONAL
INDUSTRIAL VEHICLE TECHNOLOGY

SHOW PREVIEW

bauma

The most exciting new vehicle and component launches in Munich this April

page 100

GOING ELECTRIC

Keestrack prepares to unveil a solar machine

Volvo CE's pilot project and new electric range

PREPARE FOR THE

CONNECTED REVOLUTION

TELEMATICS IS COMING OF AGE WITH OPEN ARCHITECTURE APPS ENSURING CROSS-BRAND COMPATIBILITY. ARE YOU READY?

TECHNOLOGY TRENDS

Control the future

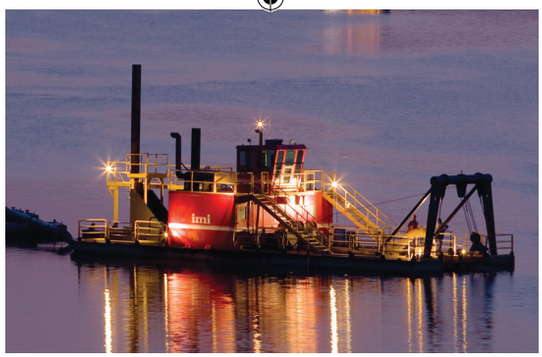
Semi-autonomous systems are putting high-end machines ahead of the pack

DEMOLITION SPECIAL

Breakthrough ideas

New machines designed to destroy, and concepts for tomorrow

www.iVTinternational.com



TWIN DISC®

TWIN DISC CAN MAKE YOUR BUSINESS BETTER

Since 1918 Twin Disc continually has invented, engineered and manufactured better ways to convert power to productivity. We've improved the performance and reliability of rugged-service machines and heavy-duty off-road vehicles. Twin Disc products are the critical link between raw power and getting the job done.

This century of real-world application experience means we know, understand and develop products to fit our customers' needs. And we provide responsive worldwide product support to keep our customers in business.

TRANSMISSIONS

TORQUE CONVERTERS

CLUTCHES

PUMP DRIVES

HYDRAULIC POWER TAKE-OFFS

ELECTRONIC CONTROLS

Whether you're buying new or refitting, spec Twin Disc. You'll benefit from our experience.

For design assistance or to find the perfect product for your application, eMail ***Andy@twindisc.com***

WWW.TWINDISC.COM

CONTENTS

COVER STORY **p34**

BUILDING APPS

Why a new era of communication is breaking down barriers between rival construction vehicle OEMs

p42

p72

REGULARS

FEATURES

Vol. 27 No. 1

Editor Tom Stone (*tom.stone@ukimediaevents.com*)
Deputy Editor Rachelle Harry
Assistant Editor James Allen

Production Editor Alex Bradley
Chief Sub Editor Andrew Pickering
Deputy Production Editor Nick Shepherd
Senior Sub Editor Christine Velarde
Sub Editor Alasdair Morton
Art Director Craig Marshall
Design Andy Bass, Anna Davie, Louise Green, Patrick MacKenzie, James Sutcliffe, Nicola Turner, Julie Welby, Ben White
Head of Production and Logistics Ian Donovan
Deputy Production Manager Robyn Murrell
Production Team Carole Doran, Bethany Gill, Frank Millard, George Spreckley
Advertising Sales Manager
Kevin Barrett (*kevin.barrett@ukimediaevents.com*)
Advertising Coordinator
Michael Briant (*michael.briant@ukimediaevents.com*)
Circulation Manager Adam Frost
adam.frost@ukimediaevents.com

Managing Director Graham Johnson
Chairman and CEO Tony Robinson

iVT International USPS 018-627 is published quarterly, in February, June, September and November. Annual subscription price is US$120/£90. Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th St, Jamaica, NY 11434. Periodicals postage paid at Jamaica, NY 11431.
US Postmaster: send address changes to *iVT International* c/o Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, NY, 11434.
Subscription records are held at UKi Media & Events, Abinger House, Church St, Dorking, Surrey, RH4 1DF, UK. Air Business is acting as our mailing agent.

SUBSCRIPTIONS
If you wish to cancel your subscription to this magazine please email datachanges@ukimediaevents.com. For more information about our GDPR-compliant privacy policy, please visit www.ukimediaevents.com/policies.php#privacy. You can also write to UKi Media & Events, Abinger House, Church St, Dorking, RH4 1DF, UK, to cancel your subscription or request a copy of our privacy policy.

ISSN 1471-115X (Print)
ISSN 2397-6349 (Online)

Published by UKi MEDIA & EVENTS

UKi Media & Events,
Abinger House, Church Street,
Dorking, Surrey, RH4 1DF, UK
Tel: +44 1306 743744
Fax: +44 1306 742525
Ed. fax: +44 1306 887546

UKi Media & Events is a division of UKIP Media & Events Ltd

Printed by William Gibbons, Willenhall, West Midlands, WV13 3XT, UK
Average net circulation for the period January 1 to December 31, 2018: 10,320

Member of the Audit Bureau of Circulations

CONTENTS: **PRODUCTS & SERVICES**

FOREWORD

This issue we're going big! For starters, this is the biggest quarterly edition of *iVT* we have ever published. And it features a preview of the biggest trade fair, not just in the off-highway vehicle industry, but in any industry in the world. Bauma Munich is nothing if not big. A record-breaking 600,000 visitors are expected this year from all around the globe (219 countries were represented at the last edition in 2016) to take in the vehicles and technology on display from more than 3,400 exhibitors. It would take over 118 days for one person to see the whole thing (that's if you spent only five minutes on each stand and didn't stop for food or sleep).

But Bauma is only on for one week. While having virtually the whole construction vehicle industry together in one place is certainly exciting and full of business potential, it can also be exhausting and overwhelming. That's why it's important to plan your visit, and that's why, from page 100, you'll find our guide to all the unmissable highlights of the event for anyone involved in machine design, including all the key vehicle launches and component breakthroughs. It turns out, that in order to make sense of something big, it's necessary to go small, with a more focused vision – which makes us wonder, is bigger always better?

The industry has recently seen a trend toward smaller vehicles, driven in part by the race to launch electric machines. Electric mini-excavators have been popping up from a variety of OEMs, including Bobcat (more on page 164) and JCB. Meanwhile, Volvo CE is promising to unveil a set of fully electric vehicles at Bauma (see page 129), which will replace diesel equivalents at the smallest end of its range. Furthermore, much of the talk in the agricultural sector is not about bigger tractors and combines, but of miniature swarms (as we investigated in *iVT* September 2018) that will be able to perform tasks in a more accurate, targeted manner.

So, while the sheer might and muscle of industrial vehicles means it's easy to be seduced by the 'bigger is better' mantra, perhaps it's time for a new maxim – 'smaller is the future'. It's an ethos that fits well with a new event in the industry calendar, iVT Expo, which was held in Cologne, Germany, in February. Never intended to compete directly with the comprehensive scale of Bauma and Agritechnica, here instead is a gathering specifically for OEM designers and Tier 1 suppliers. Already industry-leading in the quality and depth of its four conference streams, which are focused on cutting-edge research from key experts, it also has an industry-only exhibition floor, which features the suppliers OEMs need to meet, in a space where it's easy to find them, that's not overrun by OEM customers and casual vehicle fans. But you don't need to take my word for it, turn the page to find out what some of the speakers, exhibitors and visitors thought of it. Here at *iVT* we are already looking forward to next year.

But back in 2019, it's time for the big one. See you in Munich… if I can get to you!

Tom Stone, editor, iVT International

Coming up in the June issue of *iVT*

In-vehicle electronics advancements • Fluid power developments and innovations • New vehicle launches and concepts • Advanced Lift-truck Technology supplement

WE MAXIMIZE UPTIME

F36 Stage V.
A specialized engine designed to provide sustainable and innovative solutions for all construction needs.

VISIT FPT INDUSTRIAL AT **BAUMA 2019**
APRIL 8-14, MUNICH
HALL A4 - STAND 115

Learn more at fptindustrial.com - Follow us on social media channels

The Curtis Difference

The Most Advanced Electric Vehicle Technology

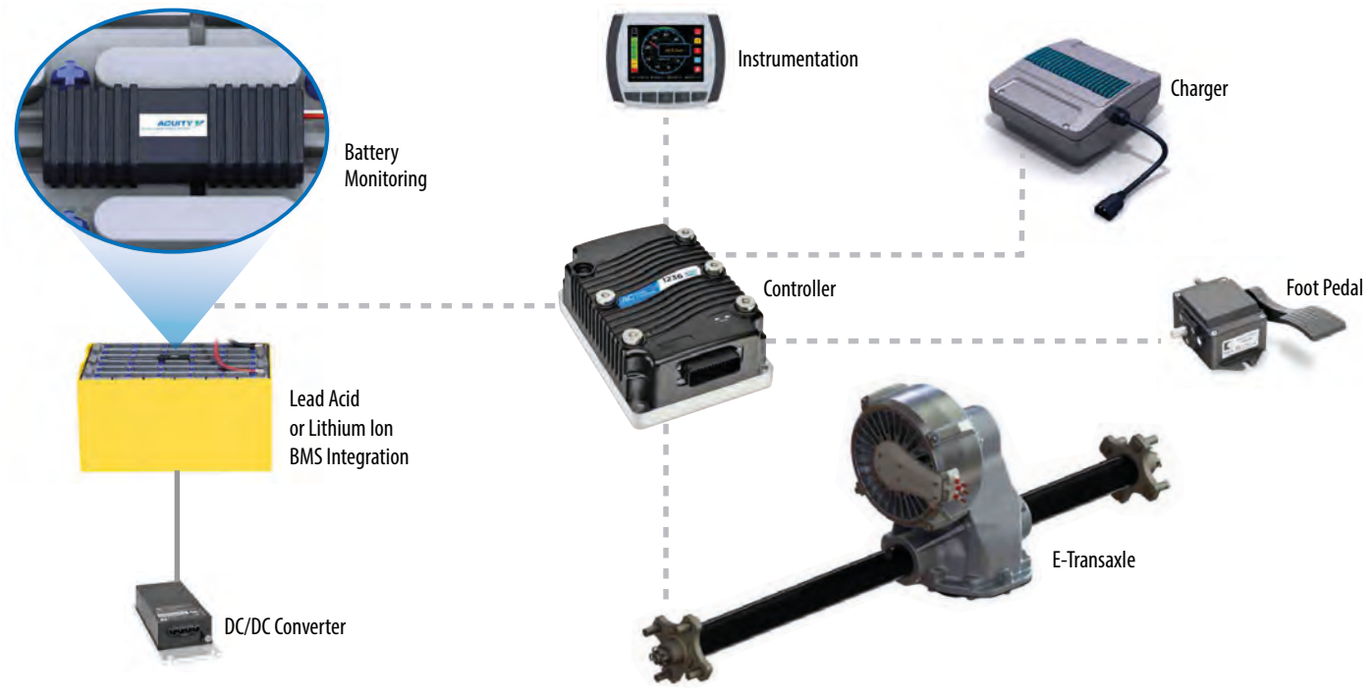
Major electric vehicle OEMs worldwide rely on Curtis to make their vehicles best-in-class because Curtis motor speed controllers and vehicle control systems set the industry standard, with nearly 60 years of innovation and leadership in product excellence. Highly reliable Curtis products are available in a range of models suitable for every industrial truck application. Our sophisticated integrated electric vehicle systems are packed with cutting edge features and functions that make vehicle design simple. From color LCD displays to foot pedals and joysticks, sensors, CAN I/O modules and motor speed controllers for traction, steering and hydraulic pumps, Curtis provides all the system components needed. The unique Curtis motor auto-characterization routine, configurable CANopen profiles and proprietary Vehicle Control Language (VCL) application software help OEMs to achieve maximum vehicle performance with minimum effort.

The Curtis Difference

You feel it when you drive it

The Curtis Difference

True Engineering Partnership



Highly reliable Curtis products are available in a range of models suitable for all types of industrial electric vehicle applications. Our sophisticated integrated electric vehicle systems are packed with cutting edge features and functions that make vehicle design simple. From colour LCD displays to foot pedals and joysticks, sensors, CAN I/O modules and motor speed controllers for traction, steering and hydraulic pumps, Curtis provides all the system components needed. The unique Curtis motor auto-characterization routine, configurable CAN protocols and proprietary Vehicle Control Language (VCL) application software help OEMs to achieve maximum vehicle performance with minimum effort.

That's the Curtis difference. You feel it when you drive it.

www.curtisinstruments.com

CURTIS

iVT EXPO

INDUSTRIAL VEHICLE ENGINEERING & DESIGN EXPO AND CONFERENCES

iVT AUTONOMOUS Industrial Vehicle Technology

iVT electric & hybrid industrial vehicle technology

iVT Industrial Vehicle CAB DESIGN & TECHNOLOGY

iVT Industrial Vehicle POWERTRAIN TECHNOLOGY

Success stories

IT WASN'T JUST *iVT* STAFF WHO WERE CELEBRATING FOLLOWING THE IMPRESSIVE DEBUT OF OUR FIRST EVER EXPO – ATTENDEES, EXHIBITORS AND SPEAKERS WERE ALSO BUZZING AS THEY REFLECTED ON A SUCCESSFUL TWO DAYS EXCHANGING IDEAS, MAKING CONTACTS AND DISCOVERING MORE ABOUT THE LATEST INDUSTRIAL VEHICLE TECHNOLOGY

Following the success of the Electric & Hybrid and Autonomous Industrial Vehicle Technology conferences that have been running since 2016, in February 2019 two further conference streams – covering the subjects of Powertrain and Cab Design – were staged for the first time, alongside a brand new exhibition dedicated to the off-highway vehicle industry's leading Tier 1 suppliers, taking the event to a whole new level. Over the course of the two-day event, the halls of Koelnmesse, Cologne, Germany, welcomed OEM designers, academics, industry association chiefs and component manufacturers, seeking the latest research, innovations and technological solutions. The exhibition's tight focus and industry-only entrance policy ensured two intensive days of meaningful business discussion between vendors, OEM engineers, designers and decision makers, who welcomed the convenience of being able to find so many relevant technologies all under one roof. Here we present just a few impressions from some of the participants and take a look at some highlights from each of the four conference streams.

CAB DESIGN **FUTURE**

The Cab Design & Technology Conference featured presentations from various members of the CAB Concept Cluster, including Fritzmeier Cabs and Dresden University, as well as Volvo Construction Equipment, Preh, and many more.

CAB Concept Cluster members were able to give the first announcement about ambitions for the new HMI Cluster project, which is working to create a unified HMI for all construction vehicles. The HMI Cluster will explore the possibilities of augmented reality systems, which would allow machine operators to visualize 'unseen' aspects of their working environment via VR. It will also look at gesture-based control and remote systems, the conference was told.

"Work is also underway to create a completely new digital workspace to steer control and monitor swarms," Prof. Jens Krzywinksi, head of industrial design engineering at the University of Dresden, Germany, told the conference. More details of the HMI Cluster project will revealed at Bauma.

Other presentations, such as that from Michael Jendis of Preh, looked at a fully adaptable multimodal HMI concept that is already fully developed. It uses haptic feedback to make flat touchscreens feel like real switches and buttons. "It's a multi-usable input – a mutimodal HMI that shows what the adaptive HMI can actually look like," Jendis told *iVT*.

Other subjects covered included everything from detailed techniques for reducing noise levels in cabins (Blanchford Acoustics, USA) to overall design concepts (Volvo CE) and managing multipartner projects effectively with simultaneous design techniques (Lumod).

SPEAKER

"It is an amazing event. There are a lot of experts in cab design. You can share information; you can share trends. I really like it very much. Thanks for organizing it."

Alexandra Herrmann, director of communications, Fritzmeier Cabs

VISITOR

"My primary focus has been the conferences, where there have been a lot of interesting presentations. For me, it's been a good opportunity to meet new people for business. As a component manufacturer, we will definitely think about having our own booth next year, as we see an opportunity to meet our customers here."

JÜRGEN SCHWARZ, HEAD OF CONTROL SYSTEMS, GEBRUEDER FREI, GERMANY

SPEAKER

"I think the big value of events like this is to really get relevant industry people to have a more holistic strategic dialog, rather than discussing figures and facts and technology curves – for that you can send a PDF!"

Gustavo Guerra, design director, Volvo Construction Equipment, Sweden

EXHIBITOR

"iVT Expo has really surpassed our expectations. The quality of the customer traffic coming to our stand has really been great. The show has really stood out to us in comparison with others, because at other bigger shows the quality of the leads and the people coming to our stand is just not the same. There tend to be too many distractions at big shows, I find. Because this is so much smaller, it's more concentrated, and as a result the quality is much higher than it would be at other shows. That's a real plus for us. We're definitely looking to come back next year and I'm excited to see what it's going to bring us."

RACHEL TILBROOK, MARKETING MANAGER, KAB SEATING, UK

EXHIBITOR

"The Expo has been very interesting, with lots of companies providing new technology, and we have had some very good discussions with visitors, particularly about our new Stage V engines, and our new China IV emission handling technologies."

JARNO RATIA, PRODUCT MANAGEMENT DIRECTOR, AGCO POWER INC, FINLAND

POWERTRAIN **REVOLUTION**

Each of the conference streams held lively panel discussions in which speakers were able to debate some of the key issues facing the industry. At the end of Day 1 the Powertrain debate was particularly well attended as it combined speakers from both the Powertrain and the Hybrid & Electric conference streams.

The discussion highlighted the fact that the move to some level of electrification in virtually all types of off-highway machinery means that traditional components may become obsolete.

John Bennett, chief technology officer at Tier 1 supplier Meritor, said, "We make axles, brakes, driveline suspension and various other drivetrain components. We have been very active in electrification because we can see a day when our core content could become obsolete – and we are trying to prevent that. But it's also an opportunity for growth.

"We're developing new products integrating the electric motor into the axle itself and we're developing a platform of e-axles in anticipation of the market ultimately shifting from a remote motor configuration to an integrated motor configuration."

As these new technologies are developed, OEMs are seeing increasing pressure on testing and validation cycles. It was for this reason that Philip Scarth, head of basic technologies at FPT, who was also on the panel, advocated an increase in virtual testing.

"I think the area we need to be a lot more solid on is virtualization," said Scarth. "Physical testing is very good, but it's not always practical given the level of complexity. We really need to put a lot more effort into simulation of the complete system, including the whole vehicle where possible. This is the only way that I see it being possible to move forward in a reasonable way."

SPEAKER

"I did a comparison between ICE and hybrids, and full electric, where we looked at costs and some of the issues with charging. So it was quite a big debate. There's no one solution for every situation; it depends on the application. It's great that we can bring together quite a diverse range of people from different parts of the community. Together we can work toward a great solution to reduce global emissions and decarbonize."

Colin Garner, professor of applied thermodynamics, Loughborough University, UK

SPEAKER

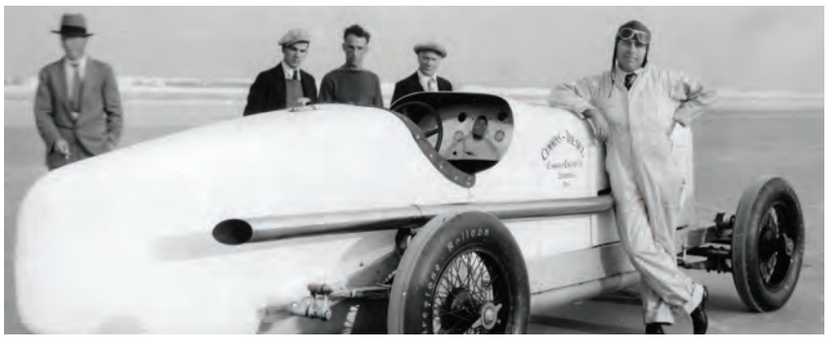
"It's important to get together to discuss the future of ICE. Because if we don't, the mass media often only picks up the easy part of the story. And this is the difficulty, the nuances and the challenges that are truly important as we think about how to reduce our carbon dioxide emissions as we enable a thriving society."

Larry Fromm, executive vice president, Achates Power, USA

VISITOR

"I came because I'm interested in powertrain developments and autonomous vehicles. As a vehicle developer, it's been interesting to come and get the latest news about what is going on in the vehicle component industry, and what the current developments are."

THOMAS FEDDE, ADVANCED ENGINEERING MANAGER, CLASS TRACTOR, GERMANY



PROVIDING INNOVATIVE POWER SOLUTIONS FOR 100 YEARS, AND COUNTING.

For 100 years, we have defined ourselves by our unwavering values and promise of innovation and dependability. We have led our industry by consistently turning challenges into opportunities. In the next 100 years, we will continue to defy boundaries and unleash our ingenuity in a world hungry for new power solutions.

See how we're challenging the impossible at Bauma 2019, Hall A4.325.

Cummins 100
CHALLENGE THE IMPOSSIBLE

YouTube

Box 3005, Columbus, IN 47202-3005 U.S.A

cummins.com

SPEAKER

"The leaders in hybrid technologies normally come from the passenger car industry, but other industries are now catching up – and they're getting more advanced. Electrification is going fast, so it's important for us to be here so that we can know about this and see how we can improve our products and services to accommodate all industries."

Lars Fredriksson, business VP for simulation driven innovation, Altair Engineering, Germany

EXHIBITOR

"The quality of visitors is very high. We didn't get any pen collectors or those just looking for bags and goodies. All the people we've seen are potentially new customers or existing customers with new projects. It's been far beyond our expectations, particularly for the size of the show, to have as many leads as we have received. It was a far better show for us than Agritechnica, for instance. The overall feeling on the quality of the leads is really good."

RONALD DE JEU, ACCOUNT MANAGER, WÜRTH ELETRONIK, GERMANY

HYBRID DESIGN **TECHNIQUES**

The Electric & Hybrid Industrial Vehicle Conference uncovered some unifying trends across the industry – a key one being an overall move to more modular design techniques.

Several of the speakers, who included representatives from Hyster-Yale, Poclain Hydraulics, Bucher Hydraulics, AVL Tractor Engineering and Siemens, referred to modular techniques as one of the keys to solving the increasingly complex design challenges engineers now face.

"One interesting idea discussed at this event was around the idea of building multifunctional devices – completely reshaping how you design an industrial vehicle," said Bill Van Amberg, executive vice president of Calstart, who moderated several sessions. "Instead of doing unique designs for every single vehicle, with low-utilization components, people are looking at how to modular systems can do multiple jobs but with a centralized modular powerpack. That could be a hybrid or an electric system.

"We're also seeing innovation in core components. So if we're going to integrate a hybrid or electric system, then let's fundamentally increase the efficiency of the hydraulics. Or let's design an optimized electric motor and then build a whole system around it. The industry is getting very focused.

"Now is a time of opportunity. So what do we need to do to go beyond ICE technology and design whole new systems around electrified architectures? With the new thinking that goes into modular systems, we're also looking at how the core components work together."

VISITOR

"We manufacture custom electric motors – giving OEMs their exact requirements. It's good to be here networking and meeting other people in the business. It's giving us knowledge and understanding of who else is in the business. It's a very good event. I will come to the next one."

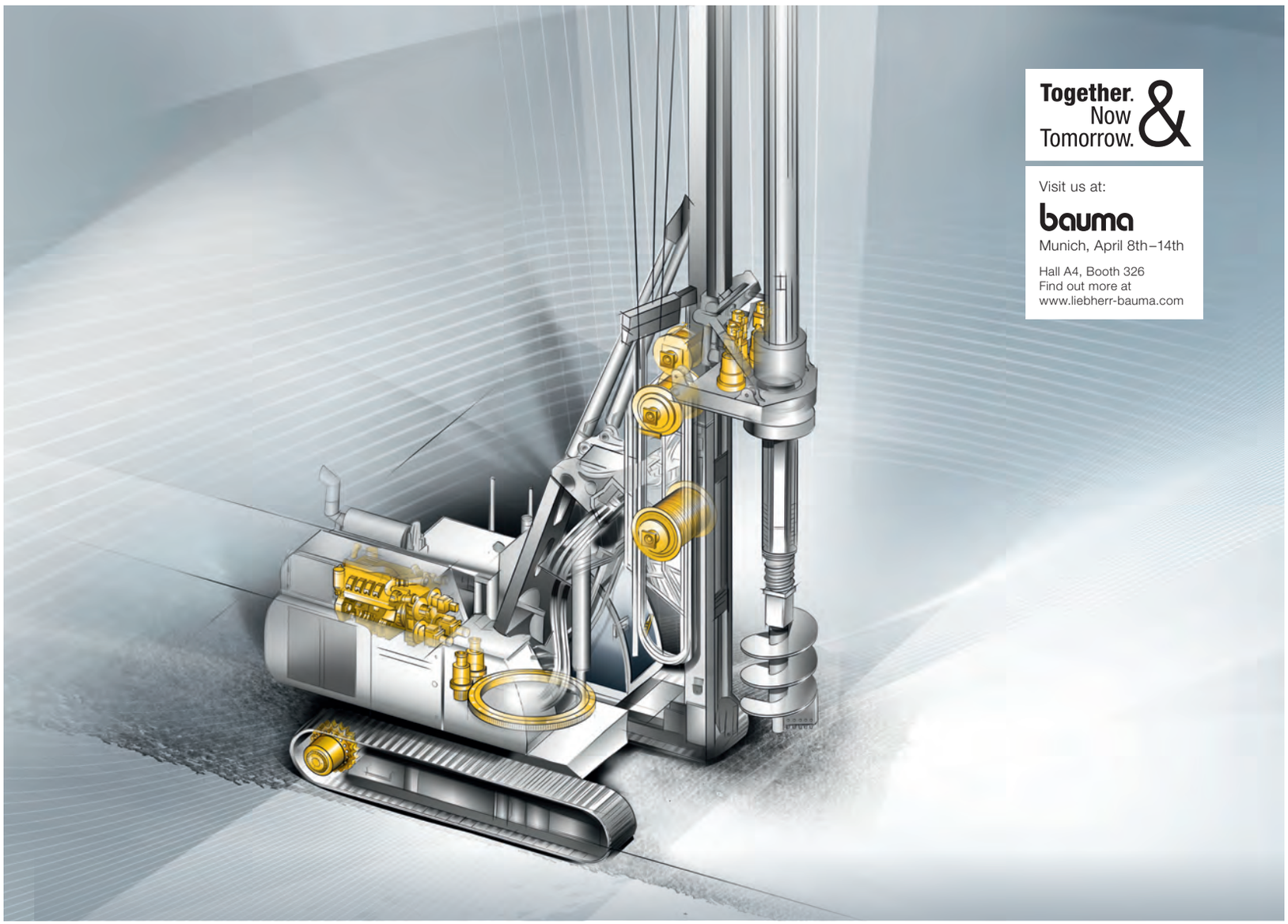
MICHAEL PETERS,
MONTEVIDEO TECHNOLOGY, USA

SPEAKER

"iVT Expo has the right level of engagement for people who are building products, who need to share ideas and look at what the trends are – and find partners. It helps engineers and designers understand what's emerging in the supply chain, so it's a tremendously valuable event."

Bill van Amberg, executive vice president, Calstart, USA

Components for Your Equipment.



A strong partner for the construction and mining industry

Components by Liebherr perform a wide range of different drive tasks in various applications in the fields of construction and mining. Examples include travel drives in crawler vehicles, slewing bearings in excavators, diesel engines in cranes and hydraulic piston pumps and motors in pipeline machines.

Liebherr-Components AG
Postfach 222
5415 Nussbaumen AG, Schweiz
Tel.: +41 56 296 43 00
E-Mail: info.cos@liebherr.com
www.liebherr.com

LIEBHERR
Components

VISITOR

"Here you can find the right people in the right spot together, and as it is not as big as Bauma or Agritechnica, it's easier to make the contacts that we are interested in for our business, which is automation solutions for agriculture and construction markets."

STEFAN TAXER, MOBILE AUTOMATION PRODUCT MANAGER, B&R INDUSTRIAL, AUSTRIA

SPEAKER

"I presented on Volvo's Electric Site research project, which includes some fully automated vehicles. There has been a very good level of interest – good discussions and good questions. I was also very interested in the other presentations, which fitted well with the overall themes."

Uwe Müller, chief project manager, Electric Site, Volvo Construction Equipment

SPEAKER

"This is a really good event. It completely fulfilled my expectations and the feedback I got from my presentation was really good. The great value is in exchanging ideas. It's always about networking and getting new contacts and showing people what you're capable of."

Wanja S Steinmaier, managing director, Lumod, Germany

AUTONOMOUS **BY DESIGN**

The Autonomous Industrial Vehicle Technology Conference featured speakers from CNH Industrial, Danfoss, Husco, the University of Warwick, Topcon and Elektrobit, to name but a few. Delegates were able to dip in and out of the different conference streams using just one pass, and the autonomous vehicle event attracted a particularly large number of experts from other disciplines.

"The panel discussions at the conferences have been very interesting," said Peter Reuterberg, chief designer for Volvo CE. "In particular I enjoyed a discussion on autonomy regarding liability issues; it was very illuminating."

Reuterberg's Volvo CE colleague Uwe Müller gave a popular presentation on the autonomous aspects of the OEM's Electric Site pilot project, which ran for several weeks at the end of 2018, in collaboration with Skanska, on a location just outside Gothenburg – Vikan Kross, Sweden's largest quarry.

Müller explained how the project involved eight HX2 autonomous, battery-electric load carriers, which transport material from a primary mobile crusher to a secondary static crusher. The HX2s have a vision system that enables them to detect humans and obstacles in their vicinity, but there were also emergency safety systems in place. All the vehicles on the site (autonomous and manually driven) were connected to a local wi-fi network, with all operators and controllers empowered to hit an emergency stop button that would bring the entire fleet to an immediate standstill. The wi-fi network was kept completely closed for reasons of cybersecurity. To find out what happened when *iVT* visited the Electric Site project, turn to page 72 for our full report.

EXHIBITOR

"It's been very good. We've had some very interesting conversations – with good OEM discussions in particular, so for us the quality was brilliant. We're looking forward to next year."

DANIEL MAGNUS, MARKETING MANAGER, SONTHEIM INDUSTRIE ELEKTRONIK GMBH, GERMANY

bauma
HALL A4, BOOTH 225

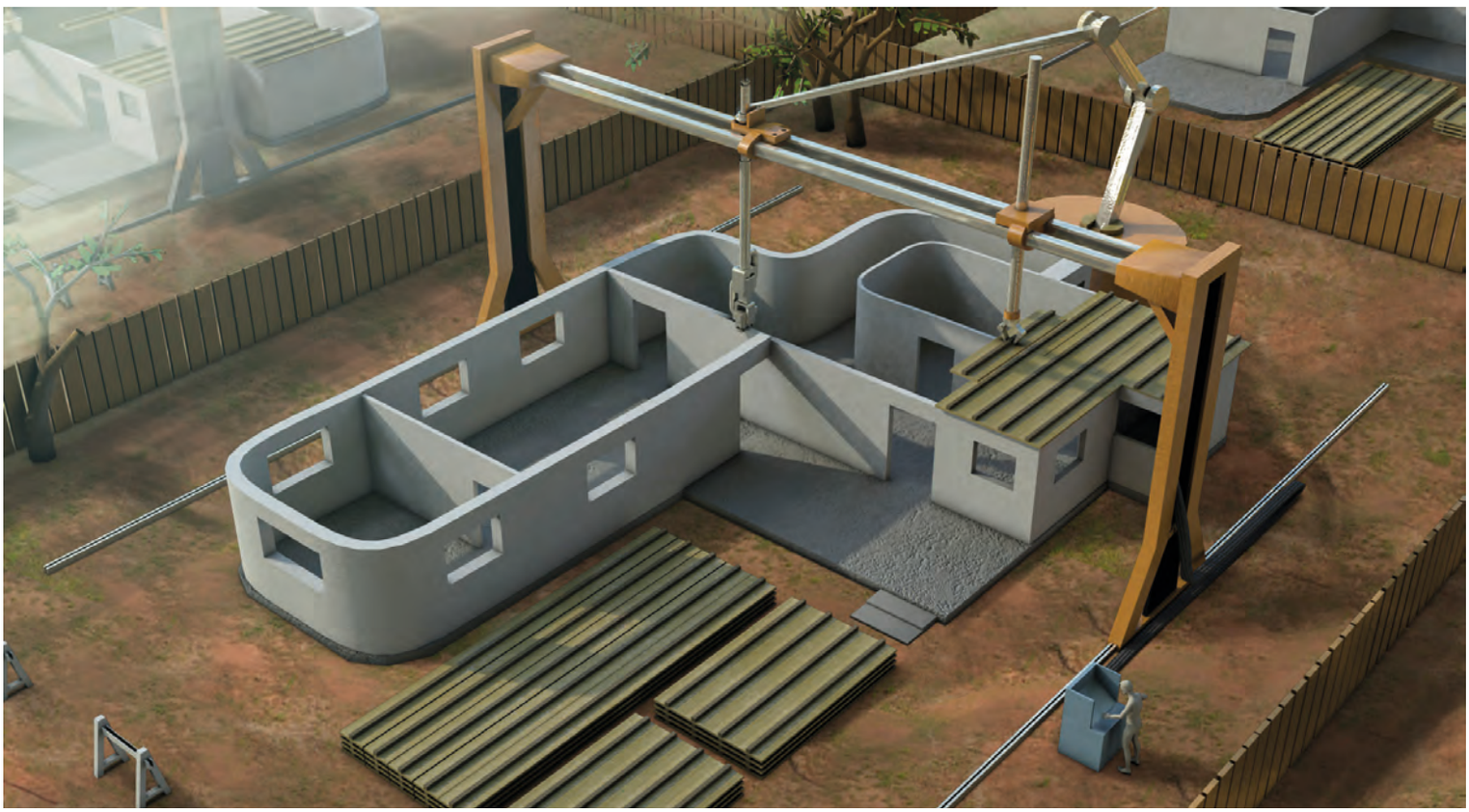
KOHLERPOWER.IT

~~AVOID~~ ATTACK

It's time to defeat downtime. Our new KDI engines are loaded with maximum power and torque, **so you never have to stop.** They're also ultra compact and equipped with KOHLER® Flex technology — a suite of integrated engine systems that allows you to meet every emission standard on earth, including Stage V. The future of power is here.
BE UNSTOPPABLE.

KOHLER®
IN POWER. SINCE 1920.

Home help



PROGRESSIONS IN **3D PRINTING AND BIM TECHNIQUES** ARE SHAKING UP THE HOUSE-BUILDING INDUSTRY

A proven 3D-printing house building approach that reduces the need for traditional construction vehicles will be presented at Bauma this year. With the assistance of a Konecranes hoist crane, Umdasch Group Ventures' solution uses building information modeling (BIM) techniques to enable its additive manufacturing hardware to produce a completed house.

An entire concrete shell of the building can be printed in a single day with the walls being formed layer by layer until a computer-controlled crane finishes off the work with the insertion of the floors and ceilings.

An accompanying mobile precast factory can be transported and ready to operate at a location within four weeks, thereby enabling the mass production of prefabricated elements of the building project.

By doing this on-site, the transporting of the material and other logistics processes are optimized, offering considerable savings in time and costs.

ABOVE: **In the future, additive manufacturing could significantly reduce the cost of construction**

ABOVE: **A concept example of a 3D-printed house**

Thanks to the high efficiency of the process, between 250,000m² and 350,000m² (260,977ft² and 418,596ft²) of high-quality finished parts can be manufactured per site each year, equating to more than 1,000 houses of 45m² each (54ft²) being produced.

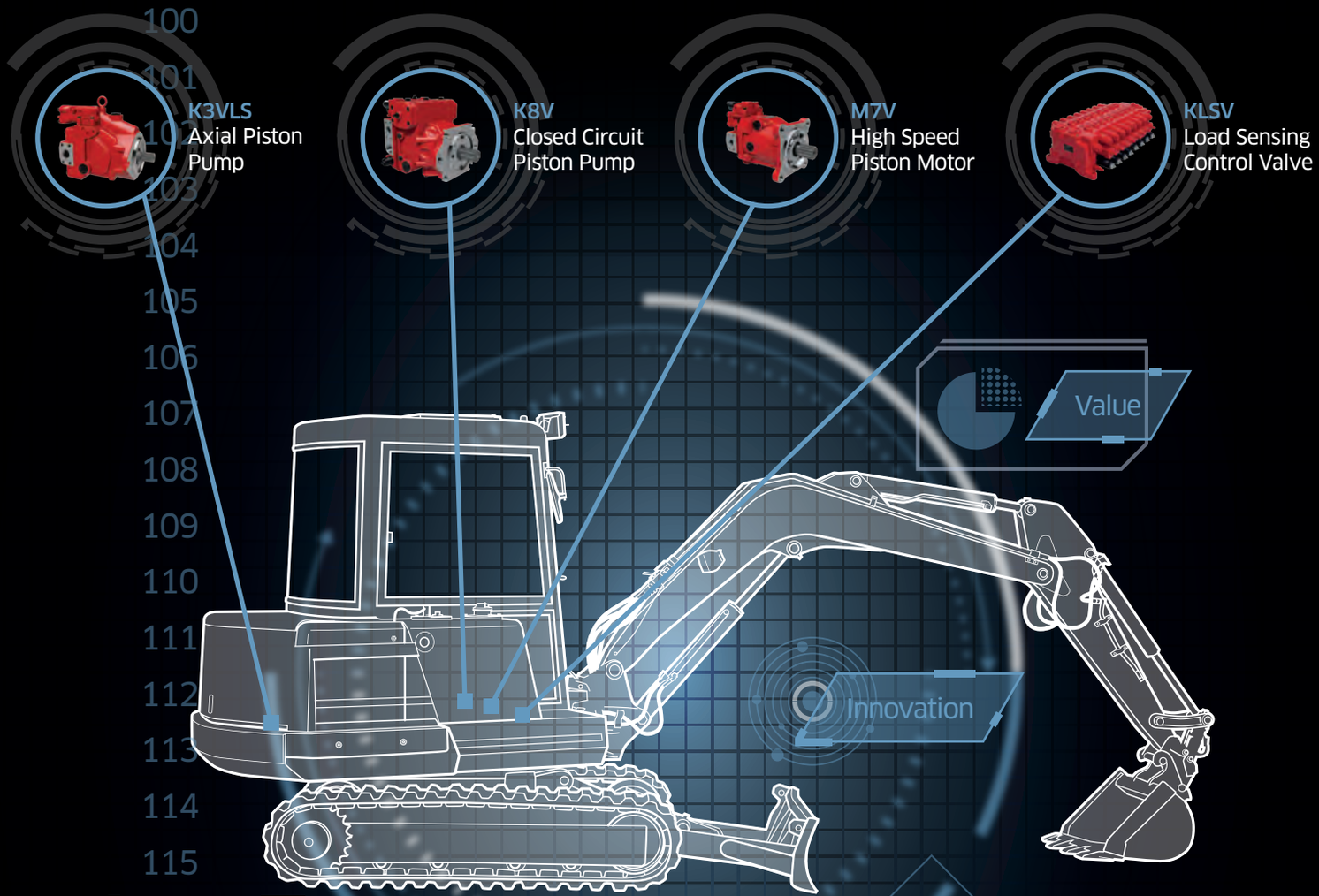
"We see ourselves as game-changers and future designers," said Werner H Bittner, managing director of Umdasch Group Ventures. "We deal exclusively with potentially disruptive business models in order to provide answers to important global challenges."

The new developments are intended to offer customers in the construction industry completely new solutions and to revolutionize construction processes.

It is expected that the finished products will either be distributed by the Umdasch Group Ventures or in the portfolio of a sister company. **iVT**

From Austria to Australia, Singapore to South Africa, wherever you are in the world, our products are ready for any challenge you throw at them. You can count on us.

100 years of reliability, built-in.



Visit us at Bauma 2019
Hall A4, Stand No. 202

Contact us: sales@kpm-uk.co.uk

www.kpm-eu.com

Kawasaki
Powering your potential

100th ANNIVERSARY

AGRICULTURAL OUTLOOK

Buoyant Brazil

HIGH DEMAND FOR **AGRISHOW 2019** IS LEADING ORGANIZERS TO BELIEVE IT COULD BE THE BIGGEST IN THE EVENT'S 26-YEAR HISTORY

159,000
Visitors to Agrishow 2018

Agrishow is South America's largest agricultural trade fair

Optimistic expectations for Brazil's upcoming harvest and the new government's desire to promote the agricultural industry are being reflected in a surge in reservations for Agrishow 2019. As much as 90% of floor space for South America's largest agricultural trade show has already been booked.

With doors to the fair not opening until April 29, organizers are envisaging that the 26th Agrishow could be the biggest in the event's history. Last year's event saw 159,000 visitors attend with 800 brands from 83 countries exhibiting across 520,000m² (5,600,000ft²) of exhibition area.

Agrishow executive director Liliane Bortoluci said, "In preliminary consultations with the traditional exhibitors, everyone's perception is that there will be a historical record in the sales of machinery, implements, vehicles and inputs, as a result of the confidence and general business recovery environment that has settled in Brazil more recently."

The encouraging early signs for the show feed into a wider positive position that Brazil's agricultural industry is currently enjoying. Possessing approximately 251,000,000ha (620,000,000 acres) of arable land, grain-planted space in the country is expected to grow for the ninth consecutive year, with sales for related machinery likely to exceed current estimates. Additionally, the industry's key leaders have received assurances from the newly elected Bolsonaro government about future agribusiness support, reducing concerns that were previously expressed.

Rural marketing strategist Luiz Tejon said, "The vocation for entrepreneurship and cooperativity in Brazilian agriculture has already been proved. With confidence restored, the segment is able to perform well in its role as the most important nation in guaranteeing the world's food security."

Agrishow 2019 will take place between April 29 and May 3 at the Rodovia Antônio Duarte Nogueira, in Ribeirão Preto, Brazil.

251 million
Brazil's arable land in hectares (620 million acres)

Trust the Experts.

Whichever your machine is, we put a cab on it.

Since 1966, OEMs entrust **Siac** for reliable, comfortable **cabins** and **driving units.**

bauma **Visit us at Hall A6.226**

Siac

Via Bergamo, 10 – 24040 Pontirolo Nuovo (BG) – Italy

www.siac-cab.eu

AGRICULTURAL OUTLOOK

Rice robot

A SEMI-AUTONOMOUS RICE TRANSPLANTER DEVELOPED BY **YANMAR** IS SIMPLIFYING AN ARDUOUS TASK AND SOLVING THE ISSUE OF SKILLED LABOR SHORTAGES

Yanmar is making rice transplanting easier with the launch of a semi-autonomous, high-precision vehicle capable of assisting with the task. The expectation is that approximately 200 units of the diesel-powered, high-seedling density YR8D autonomous transplanter will be sold in the first year, after its launch last month.

Designed to simplify rice seedling planting operations and reduce operator fatigue, the vehicle can autonomously perform straight-line planting as well as a 180° turn at the end of the field.

"Many stages of rice farming, and farming in general, include laborious or difficult operations that are ripe for the benefits that autonomous technology offers," says Shigemi Hidaka, executive engineering officer and divisional manager of the advanced development division at Yanmar Agribusiness Company. "One of Yanmar's primary goals is to ease the burden on the farmer, and autonomous technology is one way of doing that."

In recent years Japan has seen a trend toward both consolidation of smaller farms into larger ones, and a fall in farmer numbers together with an aging of the farming population, resulting in labor shortages in agricultural communities.

37 l
The capacity of the YR8D's fuel tank (9.7 US gallons)

Yanmar hopes to alleviate skills shortages with the use of geolocation and automation technologies that will enable the rice transplanter to ease the burden of long working hours and enable highly accurate planting.

"The auto-transplanter was also developed to enable a relatively unskilled operator to plant a paddy easily with only minimal training," says Hidaka.

The 18-month project was not without its challenges, explains Hidaka: "Though driving autonomously in a straight line is relatively straightforward for vehicles on a road, the surface under the mud of a rice paddy cannot be seen and may be uneven or obstructed. A further challenge was securing the necessary planting accuracy requirements [depth, spacing, etc] under autonomous conditions.

"At present, while the vehicle is fully autonomous for planting, a human operator is still needed to replenish the seedlings from trays at the side of the vehicle – further automation of this aspect is the subject of future research."

The vehicle has two modes of operation. In Linear Mode, the transplanter moves forward autonomously in a straight line, with turns

ABOVE: **A touchscreen enables the operator to set autonomous functions**

FAR LEFT: **The waterlogged nature of paddy fields makes driving in a straight line a skilled task, but one the YR8D can automate**

1.5-6cm
Planting depth (0.6-2.3in)

200
Expected sales of the auto-transplanter over the next 12 months

handled manually by the operator. In Auto Mode, the equipment not only drives itself in a straight line, but also handles the necessary turns. The two modes enable various types of work, depending on the skill of the operator and the conditions in the paddy.

Using the company's proprietary autonomous driving technology and priced between ¥3.9m and ¥5.5m (US$35,387 to US$49,611) before tax, the vehicle is only available in Japan.

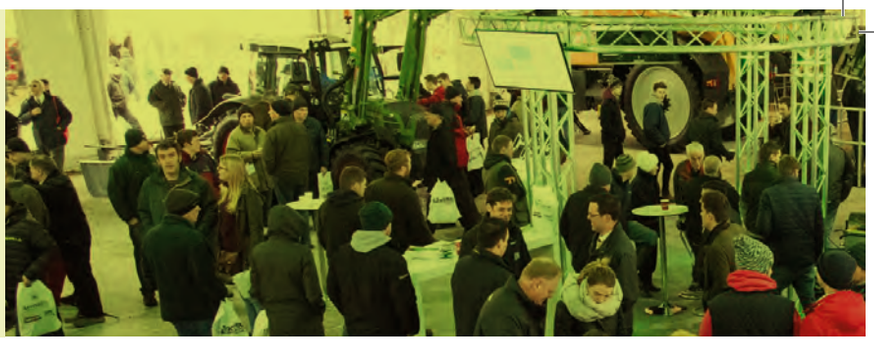
The auto-transplanter extends the number of automated off-highway vehicles developed by the company, with the existing Auto and Robot tractors Yanmar released earlier in the year as part of its SmartPilot autonomous driving technology series.

With a standardized control unit, the company's engineers were able to develop a highly accurate autonomous operation by modifying the technology specifically for the rice transplanter. **iVT**

WHAT'S NEW LAMMA'19

THE UK'S LEADING FARM MACHINERY, EQUIPMENT & SERVICES SHOW

HEADLINE SPONSOR: ASSET FINANCE PARTNERS AFP



Six of the best at LAMMA 2019

THE UK'S LEADING AGRICULTURAL MACHINERY SHOW WAS STAGED INDOORS FOR THE FIRST TIME, WHEN THE NEC IN BIRMINGHAM HOSTED THE EVENT IN JANUARY. THESE ARE SOME OF THE MOST EYE-CATCHING VEHICLES *iVT* SAW ON DISPLAY

1

ARMATRAC
1254 LUX CRD4

The Turkish manufacturer has been slowly building a solid reputation for itself in the production of farming machinery. Launched to the world at Italy's EIMA in Bologna late last year, Lamma was the first opportunity for UK audiences to see the company's latest tractor in the flesh. The 1254 Lux CRD4 is equipped with a reliable Deutz Tier 4 Final engine and a transmission, axle and power shuttle from major Tier 1 supplier ZF. Fitted with a luxurious seat, the ergonomic cab provides good visibility while a number of power turn-off features and a hydraulic trailer brake mean the vehicle provides good performance without excessive fuel consumption.

2

NEW JCB **CAB**

JCB's already impressive range of telescopic handlers received a boost with the launch of a completely redesigned cab. The operator space has been increased by 12% and there is 60% more storage room. With the windshield and roof made from a single piece of curved glass, visibility has also been improved, while four wipers sweep up to 92% of the glass to ensure a clear view at all times. The fully clad interior and rubber door seals mean noise has been reduced by 50% to 69dB(A) and entering and exiting the cab is simplified with an adjustable push-away steering column. The launch of the new cab at Lamma came ahead of the announcement of the all-new Loadall range, which you can read more about on page 80.

3

MANITOU **2700V**

With much fanfare and even a little Champagne, Manitou chose Lamma to publicly reveal for the first time what the previously Mustang-branded skid-steer loaders look like now repackaged as Manitou machines. The 2700V comes equipped with a Stage 3B engine providing a maximum power output of 72hp. With an unladen weight of 3.7 metric tons, the vehicle has a 1,225kg (2,700 lb) rated capacity. Design features keep maintenance simple with a large rear hood and raising cab, and the cab itself has a large door for ease of access and customizable controls based on the operator's preferences. The compact vehicle has a turning radius of 1.7m and its vertical lift arm design provides a maximum reach of 0.8m.

4

FENDT **IDEAL 9T**

Having the largest grain tank and longest rotors in the combine industry, Fendt's behemoth towered over the crowds attending Lamma. Coming in three models, Fendt brought the largest of the trio to the show. Equipped with a high-performance MAN engine, it is capable of producing a maximum of 647hp (482kW). Developed from scratch, the machine has an unload rate of six bushels a second, and clever sensor technology fitted to the rotors keeps the operator informed about the capacity status of the threshing unit as well as detecting the flow of grain. In combination with a grain-quality camera, the sensors also provide accurate information on grain losses, cracked grain percentages and grain purity, to be displayed on a 10.4in screen in the cab.

5

KRONE **BIG M 450**

"A big, self-propelled mower conditioner," is how Krone UK's marketing and product manager, James Duggleby, described the massive machine to *iVT* at Lamma. Making its first appearance on UK soil, the 'big' in Big M 450 is not without merit. The custom-built, standalone forage harvester is powered by a six-cylinder, Liebherr D946 A7-04 engine. With a 12-liter capacity, the unit delivers a maximum output of 449hp (334kW), enabling the vehicle to reach a top speed of 40km/h (25mph) at 1,250rpm. The fuel-efficient Stage IV engine uses selective catalytic reduction (SCR) technology, injecting urea into the exhaust stream for a cleaner combustion. Automatic engine control monitors the engine speed, tailoring it to the current load on the mowers to ensure fuel consumption is kept to a minimum. In spite of its colossal working width of 9.95m (32ft), the Big M 450 has a tight turning radius thanks in part to the rear wishbone suspension, which also ensures a smoother ride on the field.

6

DEUTZ-FAHR **5D 5080 KEYLINE**

Making its first appearance on UK soil, the economical 5D 5080 tractor is an important model for the Deutz-Fahr business. A range of engine-based technologies help the vehicle's three-cylinder, displacement-optimized FARMotion unit reduce harmful emissions. Specially developed for the agricultural industry, the engine includes a monitoring system that lets the driver set, store and recall the most appropriate engine speed for the job at hand. An onboard diesel oxidation catalyst reduces NO_x and hydrocarbon emissions, and an optimized power curve also reduces consumption by maintaining lower engine speeds with maximum torque. Capable of a maximum speed of 40km/h (25mph) at 1,870rpm, the all-wheel drive vehicle has wet disc brakes on all four wheels, with the operator able to quickly select which are engaged for greater control. The four-wheel drive system and 100% differential lock can be electrohydraulically operated at the touch of a button. **iVT**


BRINGING YOUR EQUIPMENT TO LIFE
READY TO RUN STAGE V
Power your ingenuity with John Deere engines and drivetrain components.
You work hard to develop innovative OEM equipment. John Deere knows how important it is to provide engines and drivetrain components that live up to that potential. Delivering nothing less than we're willing to install in our own equipment. That's why John Deere is the perfect power source for your equipment.
bauma
Hall A4 / Stand 139
JOHN DEERE
JohnDeere.com/JDPower

Local hero

GROWING UP IN MOTHERWELL, SCOTLAND, AND STUDYING ENGINEERING, **PAUL DOUGLAS** WAS, AT THE VERY START OF HIS CAREER, INEXORABLY DRAWN TO THE OFF-HIGHWAY PRODUCTION FACILITY THAT IS PART OF THE LIFE OF HIS HOMETOWN. HE HAS SPENT TIME AWAY, BUT HAS ALWAYS COME BACK. AND NOW, AS MANAGING DIRECTOR OF TEREX TRUCKS, HE LOOKS AS IF HE'S IN FOR THE LONG HAUL. *iVT* MEETS THE REGION'S INDUSTRIAL VEHICLE FRONTMAN, AND FINDS OUT WHY HE'S ON THE LOOKOUT FOR THE SUPERSTARS OF THE FUTURE

Terex Trucks **timeline**

1950
Euclid Great Britain was formed in Motherwell, Scotland, as a subsidiary of the Euclid Company of Ohio and began the development and manufacture of off-highway trucks

1953
Euclid Road Machinery Company bought by General Motors

1954
The 1,000th truck is built in Scotland

1961
The 4000th scraper rolls off the line

1968
GM divests the Euclid brand and the remaining earth-moving division is renamed Terex – from the Latin 'terra' (earth) and 'rex' (king) and 33 Series trucks were introduced (above)

1974
Terex launches new trucks, including the Terex Titan and the popular R17 (below)

1982
Launch of the first-ever Terex articulated dump truck – the 3204 (above). Designed, tested and manufactured in Motherwell

1987
Terex becomes independent from General Motors

In Motherwell, on the outskirts of Glasgow, Scotland, is an off-highway vehicle manufacturing facility with a rich history. It was here in 1950 that US industrial vehicle OEM Euclid opened its first UK factory.

It was a shrewd move that took advantage of the government grants being offered to help rebuild post-war Britain and established a manufacturing base in a key enterprise zone, close to big steelworks in Ravenscraig. Fellow US industrial firms Honeywell and Cummins also set up factories in the area around the same time.

Via subsequent acquisitions, mergers and divestments, Euclid's direct descendent Terex Trucks – headquartered at the Motherwell plant – now finds itself as a division of Volvo Construction Equipment. But it is still making the same class of machines that were first built on this location 69 years ago – off-highway haulers.

"YOUNGER ENGINEERS ON THE TEAM WOULD BE VERY HAPPY TO LET A DESIGN FLY JUST HAVING DONE THE DIGITAL EVALUATION. BUT THE WISER, OLDER ONES SAY, 'NO, WE'LL STILL BUILD A PROTOTYPE'"
Paul Douglas, MD, Terex Trucks

ABOVE: **The Art Deco frontage of the original Euclid Great Britain building can be seen in the first picture in the timeline. This building is still in use today as a parts warehouse for Terex Trucks**

The man with a plan

In 1986 an event occurred that went on to have a huge bearing on the OEM's direction, though it would have seemed of only limited importance at the time – a local boy joined the company as an engineer. The significance was that this was Paul Douglas, the man who is now the company's managing director.

"I started from college straight into this industry and actually into this company as a graduate engineer," Douglas tells *iVT* as we sit in the company's customer suite, a stone's throw from the original art deco Euclid building, still in use today for parts storage. His career since that time has taken him away from Motherwell for stints at Komatsu and bus builder Alexander Dennis, but in between he has returned to his home turf.

It was halfway through his current, third stint at Terex (which began in 2011) that, as general manager, he helped steer the company through the 2014 acquisition by Volvo Group, before being appointed managing director

1992
Terex bought by North West Engineering from GM and Terex Corporation formed

1998
TA (TA30 below) and TR range (TR45 above) launched with the distinctive new white Terex livery

2002
Generation 7 trucks (above) introduced with the 1,000th Generation 7 Platinum (below) rolling off the line in 2005

2009
Launch of the Generation 8 articulated trucks, nomenclature of TA25 to TA250, TA30 changed to TA300 and TA40 to TA400

2011
Ninth generation of haulers launched with Scania engines (TA400, above right)

2014
Volvo Group acquire the off-highway truck product line from Terex Corporation and Terex Trucks, a division of Volvo Construction Equipment, is formed

2019
Terex Trucks managing director Paul Douglas meets *iVT* editor Tom Stone (below). Among other things they discuss the latest updates to the 10th-generation TA300 (for more on this see page 86)

of Terex Trucks and vice president of rigid haulers in 2017.

Coming from an engineering background, Douglas has a deep understanding of off-highway vehicle design and the way it has evolved over the years, and his enthusiasm remains undimmed. A broad grin barely leaves his face as he talks rapidly, in soft Glaswegian tones, about the industry he knows and loves so well.

"There have been some real advances in technology," he says. "Firstly around operator safety and comfort. The operator station has become much more car-like – very comfortable and safe, with low noise and luxuries like air-con. When you go back 30-plus years ago a lot of those features were missing – even comfortable seats were not regarded as necessary! Generally product safety has really moved on. There have been a lot of advances in mechanical and hydraulic safety, and in recent times many electronic safety advances such as surround view systems."

The other area in which Douglas has seen big changes is in environmental protection, both through reducing emissions (in some cases to zero through electrification) and extending the life of vehicles. Both of which he expects to see continue to evolve at a rapid pace in years to come.

Teamwork

Douglas's clear understanding of the way in which his vehicles are designed not only helps him appreciate the challenges facing his team, but also puts him at an advantage when talking to customers and dealers. "Engineering knowledge means I can look at what the customer expects a machine to do and know the best way for it to do it. I know how a product should interact with other machines, which is an advantage."

But his background isn't always a bonus. Sometimes, he admits, it means he finds himself itching to get overly involved with the design process "much to the chagrin of my engineering director! I no longer work in engineering every day, so I have to let the experts make the key decisions and recommendations."

But that's not so say Douglas is shy of giving his opinion, especially when it comes to the value of real-world testing. "These days you can do much of your testing and validation in the digital environment, and the younger engineers on the team would be very happy to let it fly just having done the digital evaluation. But the

Paul Douglas on Bauma:
"One of the best things about going to big shows is you get opportunity to meet the customers and dealers you know – and the ones you don't know. You also get to see what the competition is up to, and promote your own products. So there is real value."

bauma 2019
APRIL 8-14 • MUNICH
Terex Trucks
Hall FN, Stand 720/9

RESTORING THE PAST

Outside Terex Trucks' HQ is a vintage vehicle – a 1973 Terex R-17 hauler. But all is not quite as it seems. This is not an immaculately preserved piece of company history; rather it is a restoration job that was completed only last year.

"Three years ago we tasked our apprentices with bringing this vehicle back to life," Paul Hudson, operations director for Terex Trucks, tells *iVT* as he gives us a tour of the factory. "It was found in an old quarry up in Aberdeenshire. It had been used for harvesting seaweed, so it had been up to its axles in seawater and it was a complete wreck, with a lot of salt damage. So we said, 'Right guys, you need to bring that back to life and get it running.' And they did!

"They had to fabricate some of the parts and find new solutions for upholstering the seats. Most of the drawings didn't exist, so they had draw plans. It was a really good project, not just from an engineering perspective, but because it gave them exposure to other parts of the business they weren't used to – like purchasing and supply chain. They had to negotiate with the production manager for a slot to get painting done. And of course they missed deadlines, so they had to explain why and get it back on track.

"It had to be restored exactly as it had been when new. And with that came some problems because a lot of the parts were unavailable. Luckily there's a Cummins facility about five miles from here and they have an apprenticeship program as well, so they worked together. For example, the radiator at the front you can't buy anymore, but they managed to find a guy in a garage who restores old racing cars and he made it for them. They had to build a lot of the other components, too – for example there's a new door on it that you can spot. The whole project went from technical drawing all the way through fabrication and electrical engineering. It was a great."

Furthermore, as fate would have it, six of the team who worked on the vehicle when it rolled off the Motherwell production line in 1973 were still on staff. "They were apprentices at the time and actually worked on this serial number," says Hudson. "So we teamed them up and that was great, too. The old guys passing their skills on to the new generation."

wiser, older ones say, 'No, we'll still build a prototype.' There is nothing better than putting a machine in the hands of a customer and letting them use it on a day-to-day basis, because they will always find something the engineer didn't think of. And that gives us a chance to do a revision loop, which we've used for all our vehicles – and we'll do it again with the next one."

New hauler

Terex Trucks is currently in the early stages of planning its next generation of articulated haulers and, with the firm backing of Volvo CE, it looks to being one of the brand's most important ranges for many years. "By the end of Q1 2019 will have we'll have set our stall out in terms of what we're going to do, what the change areas will be and what this future product should look like," says Douglas. "It's exciting because we've been investing in the articulated hauler platform for several years – but this is going to be a step change. It's a bigger investment than normal."

This will be interesting news for anyone who assumed that Volvo's acquisition of Terex was simply about expanding into the rigid hauler market (the rigid built in Motherwell was recently rebranded as a Volvo) and might mean the discontinuation of the articulated haulers made there. It's a reasonable assumption given that Volvo CE already has its own range of articulated haulers. But Douglas is clear that the two ranges occupy different segments of the market.

"Our articulated haulers occupy what we would describe as the 'value brand' segment. The Volvo product is quite sophisticated. It has a lot of systems – electronics and control management. We will not be adopting all those features – we will keep very clearly differentiated platforms. Our customers are after a simple, reliable product with performance competitiveness, but not necessarily sophisticated machine systems."

ABOVE: **Terex Trucks operations director Paul Hudson with a restored 1973 R-17 hauler at the firm's Motherwell HQ**

Douglas admits that, as technologies become cheaper to make, advanced features currently only available on high-end machines may become more viable at the value end of the market. However, he's also clear that customer requirements come first. "It has to add something to how the customer uses a product," says Douglas. "There is a danger in this industry that engineers and product managers sometimes specify the product they would like see, rather than what the customer actually wants. The people that use these products are very savvy business people – they're prepared to make investments, but there needs to be return on that investment."

"IT'S EXCITING BECAUSE WE'VE BEEN INVESTING IN THE ARTICULATED HAULER PLATFORM FOR SEVERAL YEARS – BUT THIS IS GOING TO BE A STEP CHANGE. IT'S A BIGGER INVESTMENT THAN NORMAL"

Paul Douglas

Points of difference

But keeping the different platforms isn't just about having different control options for the operator,

Feel the heartbeat of hydraulic efficiency.

Find us at bauma 2019 Hall A3, Booth 244

DynaVIS
More Power • Less Fuel

Hydraulic fluids are the lifeblood of hydraulic systems in construction equipment. Fluids formulated with Evonik´s DYNAVIS® technology have been tested and proven to increase productivity by 5-15%, ensuring maximum power and efficiency. Save energy. Protect valuable equipment. Enhance performance.

Discover how DYNAVIS® technology can help move more material per day.
www.evonik.com/oil-additives

EVONIK
POWER TO CREATE

THE MAN BEHIND THE HAULERS

Paul Douglas has a lifelong passion for music, which helps him relax when he occasionally gets time off from his hectic work schedule. Growing up in the local area, he remembers his first ever gig at Glasgow's legendary Barrowlands venue. "I was 14 and sneaked into a Simple Minds concert," he laughs. "That's how long they've been around – it was nearly 40 years ago!

"I love live music events. I used to be a DJ when I was younger. That was before laptops and even before CDs. "DJing in the old days of vinyl, you'd need a vehicle the size of one of ours just to move your equipment around! You just need a laptop now."

And today Douglas still makes time to catch bands whenever he can. He says he's more likely to be found at a gig than watching something on TV. The most recent band he saw was 1980s new wave pop stars Hipsway. "They're back again and have been doing some small local gigs," says Douglas. "They were very good."

despite the potential economies of scale in sharing components with Volvo CE. Douglas says this is not a direction that's being planned, either. "We are not going to use Volvo engines or components – we are really trying to keep them as separate platforms. And there are pros and cons to doing that. There would be benefits in sharing some of the components in terms of volume coming out of factories. But there are benefits for having a completely different platform, too."

Suppliers of the future

So where will parts for Terex Trucks come from in the future? For some components there's a trend for OEMs to bring manufacturing in house. But Douglas points out that outsourcing is still key, particularly for smaller OEMs. Rather than being a trend in one direction or another he sees it as a balancing act that is assessed almost on a monthly basis in the constant drive to optimize cost and efficiency. And often, bringing components in house is much easier said than done.

"The constant question is, do you make it or do you buy it?" says Douglas. "The problems with making are capacity, technology and knowledge-based experience. So a lot of companies, like those that do casting or hydraulic technology, for example, have gone away now. We gave up those capabilities in this country and they moved to Eastern Europe, China or India, and they've been gone for quite a few years now. When you then decide you want to bring that back in house or back local, you find that the capability is not there or the knowledge-based experience is not there. So it's very difficult. The other thing is that the investment to start making some of these things – for example, if you decide you want to make axles again – is huge. It's one of the reasons it's very hard to repatriate some of these items that we've previously decided to outsource.

"And this discussion expands into something even more challenging, which is the very difficult battle for talent. Trying to find the right skills and competences in the available local workforce is very difficult."

"WE'RE NOW GETTING APPLICATIONS FROM THOSE WE WOULD DESCRIBE AS THE CREAM OF THE HUNDREDS OF YOUNG PEOPLE IN THIS AREA"

Paul Douglas

Superstars of the future

Terex Trucks is fortunate, at least, in that the area around the Motherwell factory has kept some of its industrial identity, and nearby universities and colleges have more of an engineering slant than is typically found elsewhere in the UK, so perhaps the future will hold a Terex Trucks workforce with a wider range of skills. Indeed, Douglas is looking forward to a future when there will not only be greater opportunity for in-house component manufacturing, but also connected, automated and electrified systems being developed at speed. In this future a more skilled workforce will be a key strength for any OEM – and now he has some big-name help with the task of making this dream become a reality.

"The Volvo brand has been a huge plus," says Douglas. "It's a globally recognized brand and we've certainly noticed in the local area, in Scotland, and across the whole of the UK, that awareness of who we are and what we do has suddenly stepped up, now that there's a Volvo sign above the door. But even before Volvo acquired us, we have been on a journey to try to re-engage with local communities, local authorities, schools, colleges and academia to tell them who we are what we do, and that we should be working more closely together.

"We've been taking apprentices every year for the past eight or so years. But we're now getting applications from those we would describe as the cream of the hundreds and hundreds of young people in this area. We are now seeing the top class of students wanting to come and work here, because they came here on a school visit, or on a science and technology project. So it's really good."

It doesn't take too big a leap of imagination to picture one of these young engineers joining Terex Trucks today as the Paul Douglas of tomorrow. **iVT**

Defy physics. Control boom bounce

Reduce boom oscillation up to 75% and settling time up to 90%.

Experience a whole new level of performance and control

Eaton's boom stability control is active damping technology that improves:

Performance:

A 90% reduction in settling time enables faster point-to-point movement and greater placement accuracy.

Productivity:

A 75% reduction in end-effect displacement improves productivity without a loss in quality.

Stability:

Provides superior control to augment operator skills and significantly reduce shock, persistent and roading disturbances.

Safety:

Provides superior stability for the safety of those working from or around the boom.
This technology also enables active ride control on off-highway equipment such as wheel loaders and excavators, backhoes and telehandlers.
The system can predict and smooth roading disturbances to improve operator comfort, enable increased driving speeds and reduce shaking of the boom or bucket, thereby minimizing loss of material.

EATON
Powering Business Worldwide

PLATFORM FLEXIBLE

Eaton's boom stability control technology is a platform-flexible solution that can be customized for:
Concrete pump trucks, Aerial work platforms, Fire rescue vehicles, Concrete and agricultural sprayers, Hydraulically controlled cranes, Telehandlers, Other boom-equipped machinery
Eaton's boom stability control technology:
Competitive advantage, delivered.

To learn more or to discuss a specific application, email EatonDMC@eaton.com

Meet and experience our boom stability technology at Bauma, April 8-14 2019, Munich, Hall A5, Stand 423

PAUL WILLIS, IVT INTERNATIONAL

THE CONNECTED REVOLUTION IS TAKING HOLD IN THE CONSTRUCTION VEHICLE INDUSTRY. NOW, AS WELL AS DESIGNING MACHINES, OEMs MUST CONSIDER DEVELOPING SMARTPHONE APPS TO ENHANCE THEIR VEHICLES' CONNECTIONS WITH EACH OTHER AND EVEN HELP THEM COMMUNICATE WITH RIVAL BRANDS

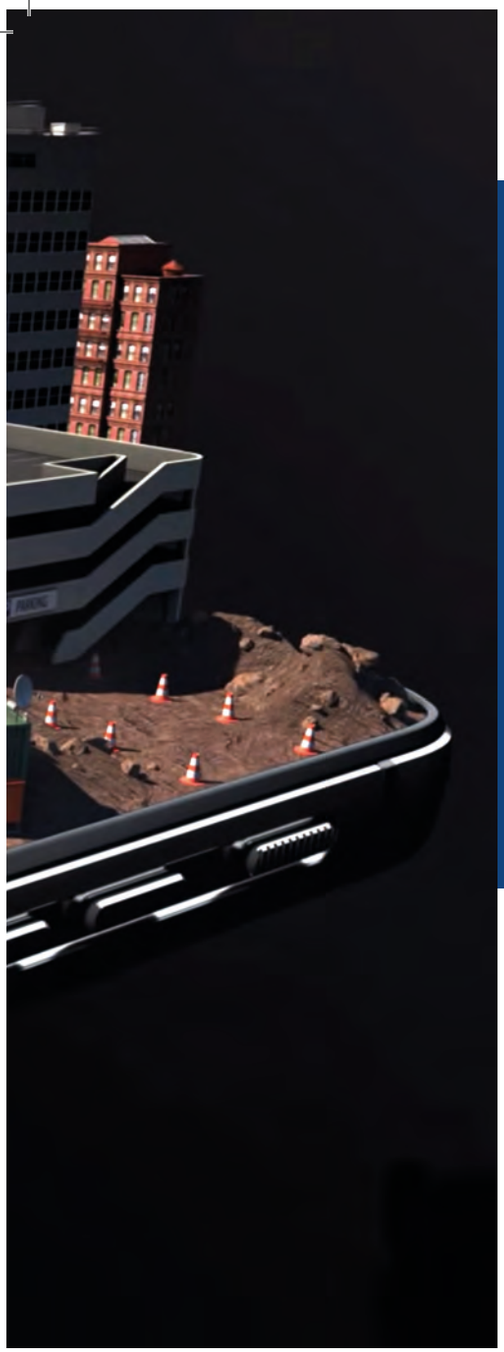
Building apps

Smartphone apps have become part of everyday life – by the end of 2018 there were nearly 5.5 million apps available for download across the two main platforms, Android and Apple. There is hardly a part of our lives that doesn't have an app to assist it, and this is also true in the construction industry.

"The general population is becoming increasingly dependent on apps and this translates over to construction," says Andy Brown, digital and technology team leader at Caterpillar. "The Cat App is leveraging that dependency and providing customers with a mobile product in the palm of their hand."

"THE TYPE OF INFORMATION WE GET IS DEPENDENT ON WHICH TYPE OF LINK DEVICE IS ON THE MACHINE AND WHAT DATAPOINTS OTHER OEMs OFFER"

Andy Brown, digital and technology team leader, Caterpillar



BESPOKE, DIGITIZED VEHICLE INSPECTIONS

Many new construction apps are meant to replace processes that were once done on paper. But what happens if the process doesn't match the way the app works?

"Most apps are preconfigured to work a particular way," says Alex Bakman, founder of Snappii apps. "The solutions tend to be proscriptive. In other words, you have to adapt your way of working to fit how the app is set up."

But this can be off-putting for those who don't want to change what they see as a winning formula.

"I was talking recently to a customer in Germany who does about 800 heavy equipment inspections annually," says Bakman. "They've been in the business for 35 years and have an approach that works for them and they don't want to change it."

Conveniently, Snappii's suite of apps – which includes several for industrial vehicle inspection – can be customized to the client's needs without the need for any coding.

The customization is done on Snappii's website, which enables the client to upload a PDF of their current inspection form.

"It's then just a question of digitizing your process by filling in the fields for the specific components of the machine that you check as part of your inspection regime," says Bakman. "What used to take two to three hours to do can now be done in a few minutes."

MAIN IMAGE: **Worksite managers are able to oversee their operations remotely via Cat apps**

ABOVE: **Snappii offers a service tailored to users' requirements**

BELOW: **Successful apps are reducing the need for paperwork**

Launched last November, the Cat App is a lightweight telematics tool designed to help customers manage their equipment. It displays telematics information (hours, location, etc) received from the telematics device on the machine known as the Product Link.

"Cat customers have daily concerns, ranging from employee arrival times to the weather," says Brown. "The Cat App was designed to provide answers to questions such as: Where are my machines? Are my machines healthy? Do I have a service coming up?"

The key to the slick usability of the app is that it only displays a small subset of the data available. "The beauty of the Cat App is its simplicity," says Brown. "It's important to note that the app is scratching the surface of what Caterpillar's telematics services offer."

Nevertheless the app has incorporated additional functions beyond traditional telematics, such as its Secure Start feature. This enables the Cat App to act as a digital key to start newer-model machines. "Not only does this provide owners and operators with a convenient way to start their machine, but it also reveals who is operating a machine via what's known as Operator ID," explains Brown.

The app is the latest in a number created by Caterpillar to help its customers manage a range of vehicle issues including inspection, fleet management and even bucket configuration.

Everybody 'appy?

Another major OEM rolling out connected services across its range is French material handling specialist Manitou. "We already have connected machines," says Manitou's communications officer, Franck Lethorey. "What is new this year is we will be connecting machines as standard. Every new order machine will now be connected."

Alongside this initiative Manitou is launching new services. Its IV (Interactive View) desktop tool will tap into the data coming off machines to offer fast, accurate machine diagnostics to optimize maintenance and decrease downtime. It even has the ability to offer guidance and support via virtual reality techniques. It promises to help dealers and rental companies manage and maintain their fleets more effectively.

Crucially all Manitou connected services will have an open API architecture, which means its data will be fully compatible across brands, making managing fleets of vehicles from multiple OEMs, on any type of management software, much easier for fleet managers. "There will be no problem in compatibility with already existing software at rental companies," says Lethorey. "Our idea is really to help rental and say you don't have to change your existing system. You can process the data with any system."

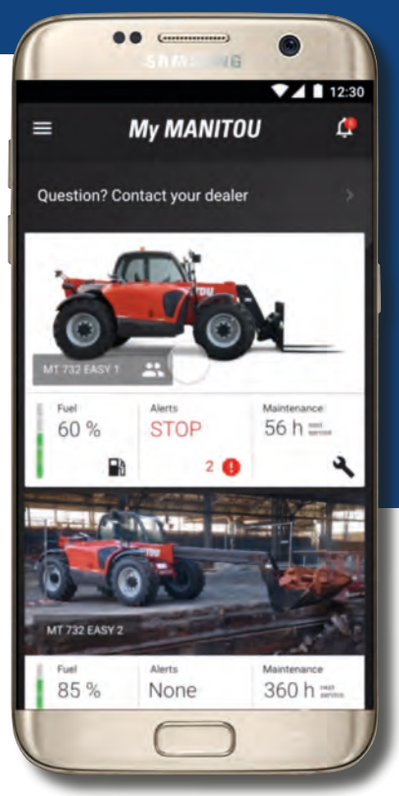
RIGHT: **The Cat App incorporates more than typical telematics info**

THE RIGHT DEVICE FOR IN-VEHICLE USE

Before you can download an app you first need a device that it will work on. For machine and vehicle operators, the job of finding the right phone means factoring in the conditions they will be working in. Construction sites can of course be dangerous places, and finding a device that will be durable enough to withstand the environment is no easy task.

Fortunately a growing number of phone makers, as well as some construction industry insiders like Caterpillar, have begun to take notice of this niche market, producing a range of phones and tablets designed specifically with industry needs in mind.

The first clue to a phone or tablet's durability is its ingress protection (IP) rating, which rates the device's environmental endurance. This will tell you whether it is waterproof, dustproof and shockproof. Some of the highest IP-rated devices can withstand being dropped six feet or being soaked by a powerful jet of water. Two other useful attributes to look for are a display that is readable in direct sunlight and a touchscreen that can be used with gloves or wet fingers.



LEFT: **The MyManitou app will be launched at Bauma 2019**

And, of course, what suite of connected vehicle services would be complete without an app? As we go to press, Manitou is currently putting the finishing touches to its new smartphone-based offering, with plans to launch the MyManitou app at Bauma Munich in April. "It is our ambition to have a new global application where the user will find all relevant information in real time – the condition of the machine, the location, all the rental papers, rental contract, user guide, maintenance contract… everything will be in this application," says Lethorey. "You will also be able find contact information for dealers easily. The new application has come about thanks to our connected machines."

Many other OEMs have also been busying themselves creating apps. This January the crane manufacturer Haulotte launched a new version of its maintenance and troubleshooting app Haulotte Diag.

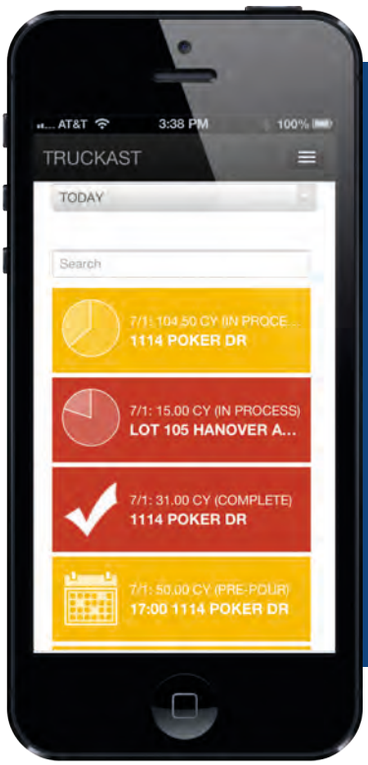
This was followed a few weeks later by the latest app from rival crane manufacturer Manitowoc. Known as the Boom Length Selector App, it allows users to select specific parameters including boom and jib length combinations, building heights and boom radii, to determine the best crane setup for a specific lift.

Working together

In this new, connected, digital world, it's increasingly important that OEMs work together. Increased transparency seems to be a hallmark of the app boom. Like Manitou, Caterpillar is working toward cross-compatibility. The Cat App can visualize telematics information "regardless of brand", says Brown. This interoperability is an unusual development in an industry in which OEMs have traditionally remained guarded about their data.

"The type of information we get is dependent on which type of link device is on the machine and what datapoints other OEMs offer," says Brown. "When it comes to visualizing these datapoints, the Cat App leverages an industry-leading map provider and assets can be viewed on an interactive Google Map that can be seen in both the fleet map view and the specific asset view."

Global engine maker Perkins, also recently launched an app of its own. The My Engine App, provides engine-specific information such as build lists, series and model data, as well as access to a parts book and a database of local Perkins distributors. The app has already been downloaded by more than 150,000 customers, according to Perkins parts product manager Ian Bradford.



LEFT: **Truckast seeks to resolve avoidable conflict between concrete producers and contractors**

CONNECTING COMMERCIAL VEHICLES

Industrial vehicle OEMs may well be able to learn lessons from some of the app services that have been put into place in the commercial vehicle sector. Truckast is an app designed to facilitate concrete deliveries to jobsites.

President Karl Van Gils says the app's development process began simply: "We came up with 10 app ideas for how to solve problems in the industry and Truckast got voted number one by all the companies we showed them to."

The problem Truckast was created to solve was tension that existed in the industry between concrete producers and contractors, says Van Gils.

"Before Truckast there were all these avoidable conflicts," he says. "There might be a small contractor waiting for a concrete delivery, but in the meantime the producer is contacted by a bigger contractor and he gives them the first contractor's order because it's better for him financially. The contractors got wise to this practice and to counteract it they started over-ordering concrete.

"Truckast gets rid of a lot of that conflict by introducing transparency into the equation."

The app works by leveraging technology on the truck itself. Many concrete trucks today are fitted with asset management technology that allows producers to monitor the truck's location and what it is doing.

Through software platforms like Track-it, drivers can time-stamp the truck's status via a tablet in the cabin. Data on when it is loading, or when it's en route to the jobsite, or when it has completed its pour is recorded in real time and delivered back to a dispatch system. Truckast takes the time-stamp data and displays it in the app for the producer and contractor to see.

Van Gils says, "A lot of the time the contractor has this gut feeling that they are not being well served. For example, they might think the concrete truck is late, whereas it's already parked around the corner where they can't see it. The app exposes all that data to the contractor so they can be reassured."

"We are watching the popularity of all our digital products grow with each passing day," he says.

Digitizing the workplace

One goal successful construction industry apps have in common is the need to get rid of paperwork by digitizing processes that previously would have been done by pen and paper. Caterpillar, for example, has a vehicle inspection app, Cat Inspect, which allows users to download and complete predefined inspection tasks entirely digitally.

"The most popular apps are those that solve real customer problems," says Brown. "Cat Inspect has a very respectable user population and retention rate. It's easy to use and allows customers to download and complete inspections and include additional information such as pictures, comments and ratings. With machine-specific preventive maintenance checklists, performing recommended services at the appropriate intervals has never been easier. Customers will never lose another paper inspection and can complete and share their inspections electronically. Essentially this solved what used to be a very manual and cumbersome process by digitizing that experience."

Another app developer, Snappii, has created several vehicle inspection apps that do, more or less, the same thing. Meanwhile the popular project-management app Fieldwire can seamlessly integrate plans, blueprints and photos from the jobsite into the platform, saving time by digitizing processes that previously would have been done by pen and paper.

But the switch to digital has not come without resistance. A 2016 study of the global construction industry by McKinsey and Company found that 'it has not yet embraced new digital technologies that need up-front investment, even if the long-term benefits are significant.'

However, Fieldwire's marketing head Zachary Reiss-Davis thinks attitudes are changing: "Everyone has become much more comfortable with viewing things on mobile devices," he says. "We get much less kickback than we did a few years ago from people in the industry over the disappearance of clipboards."

It's been forecast for decades, but now, at least in construction, the era of the paperless workplace may finally be upon us. **iVT**

"WE GET MUCH LESS KICKBACK THAN WE DID A FEW YEARS AGO FROM PEOPLE IN THE INDUSTRY OVER THE DISAPPEARANCE OF CLIPBOARDS"

Zachary Reiss-Davis, marketing head, Fieldwire

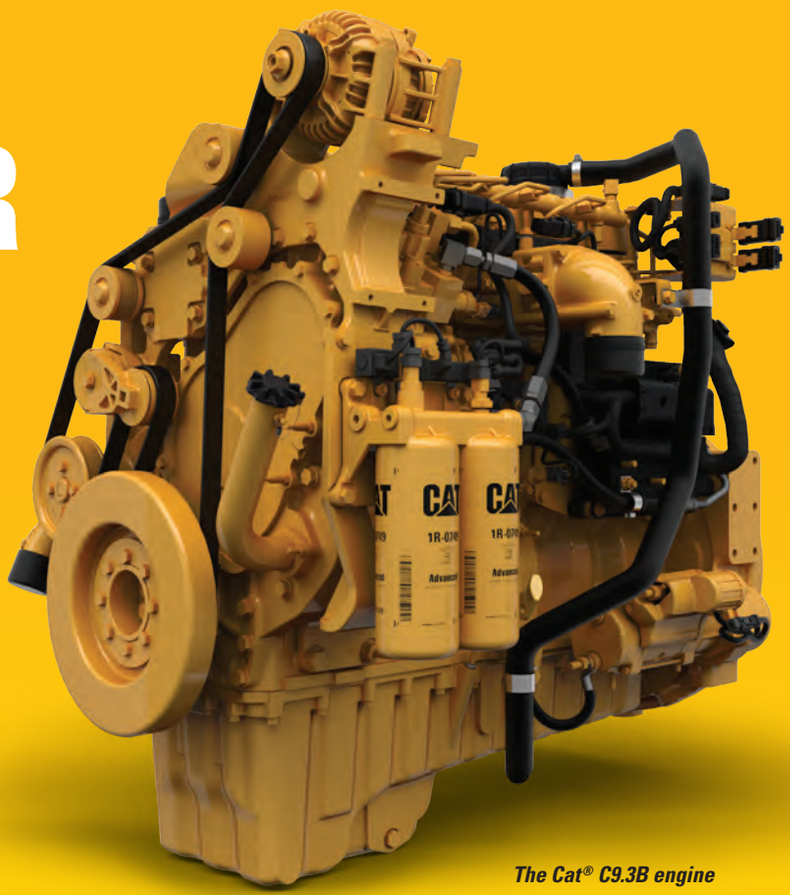
On the Web

Watch a video of the Cat App in action at **www.iVTinternational.com/catapp**

GET MORE FROM YOUR ENGINE

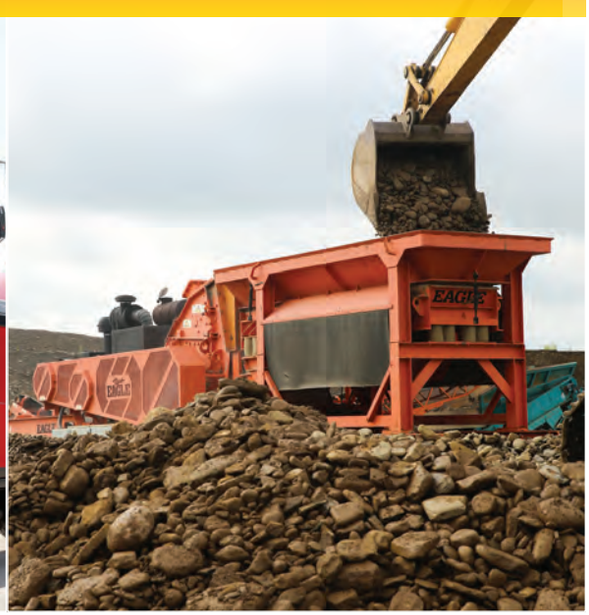
The Cat® C9.3B combines a new high pressure common rail fuel system and advanced aftertreatment technology to produce 340 kW of power. With exceptional power density, the C9.3B allows for platform downsizing while maintaining reliability and durability. Our focus is locked on maximizing performance with simpler engine systems and reduced installation complexity through modular, flexible designs.

Caterpillar offers power solutions certified to meet EU Stage V and U.S. EPA Tier 4 Final standards for all ranges of applications and power requirements.



The Cat® C9.3B engine

For more information, contact your local Cat dealer or visit cat.com/c93b.



CAT®

JACK ROPER, IVT INTERNATIONAL

AS CONSTRUCTION BOOMS, THE SHORTAGE OF SKILLED LABOR IS REALLY BEGINNING TO BITE. THE INDUSTRY NEEDS MACHINES THAT CAN ASSIST INEXPERIENCED OPERATORS AND EVEN IMPROVE THE ACCURACY OF SKILLED ONES. AS WE ENTER THE ERA OF MACHINE CONTROL, CAN ANY OEM AFFORD TO IGNORE ITS POSSIBILITIES ANY LONGER?

Control the

future

80%
Average increase in digging accuracy when using machine control in an excavator

Machine control on excavators is becoming a standard expectation during the planning of major construction projects, so contractors offering machines without the technology may soon face a choice between retrofitting an aftermarket solution or losing out on business and being left behind in terms of economy and performance. A few leading OEMs have already brought factory-fitted systems to market and now Hitachi is the latest to join this club, with the release of the ZX210X-6, its first European excavator with machine control. It promises a step change in productivity, with Hitachi reporting efficiency gains of 30-50% using onboard 3D models.

Whereas machine guidance or indicate-only systems merely provide operators with a visual guide to follow via an in-cab monitor, a machine control system assumes direct control of the boom and bucket for semi-automation of the excavator's front end. Two-dimensional machine control systems allow precise grading to a certain depth across a single plane, which can be achieved with sensors mounted along the excavator's linkage, rotating lasers used to monitor depth and some on-site staking still required. Three-dimensional machine control, providing semi-autonomous performance of more complex work, depends on GNSS receivers collecting positioning data from satellite constellations in space, with a fixed base-station on the jobsite providing real-time corrections.

MAIN: **Hitachi's ZX210X-6 excavator is equipped with the latest machine control systems**

ABOVE: **Receding slopes can be cut much faster with automated machine control**

"BIM IS CHANGING OUR INDUSTRY. WHERE THE MACHINE WAS ONCE PRIMARILY JUST AN EXCAVATION TOOL, NOW IT'S PART OF A BIGGER PROCESS"

Wilbert Blom, product manager, Hitachi

How does it work?

"What makes machine control possible is having a correction source tied to something real," explains Jon McKendry, market segment manager at Trimble. "We're using the same satellites as a phone, which is rated to a 10m [33ft] radius. But to get guidance to a machine we need information in a 3cm [1.2in] radius. Earth is rotating, the satellites are moving and we're dynamically figuring out where we are. Ionospheric and tropospheric effects distort the corrections from satellites in space, and triangulation on the device isn't good enough. But a GNSS receiver placed over a known coordinate, such as a landmark or survey point, can determine a real-time correction between where the satellites say the machine is and where it actually is."

WHAT'S IN THE HITACHI ZX210X-6?

Billed as Hitachi's most technologically advanced excavator, the ZX210X-6 is a versatile 23 metric ton machine featuring machine control developed in partnership with Trimble. In what is a European first for the company, sensors mounted on the body, boom, arm and bucket work together with a hydraulic control unit featuring an electromagnetic valve.

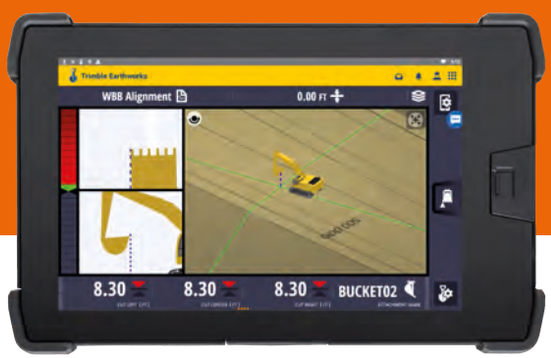
To facilitate 3D automatics, excavator position and orientation are ascertained via two GNSS satellite receivers mounted to the rear of the cab, while on-site base stations provide real-time corrections. The system can follow target surfaces from 3D civil engineering design data, which can be downloaded by the machine from the internet or installed using a USB device.

"Machine control means semi-automated excavation, supporting the skills of the operator during slope filling, leveling or digging of trenches," explains Hitachi product manager Wilbert Blom. "One great feature is overcut protection: once set, the machine prevents the bucket edge from passing a predetermined position." This enhances safety, for instance preventing inadvertent cutting of buried cables. It also optimizes performance in repetitive tasks, increasing efficiency by an estimated 30-50%, thus reducing both running costs and emissions. Bucket angle retention also enables slope finishing with fewer movements. A 10in touchscreen monitor with smartphone-style controls allows a rotatable 360° view of the machine as well as a three-way split-screen display.

LEFT: **The HMI monitor has a three-way split screen**

BELOW: **Efficiency gains of up to 50% can be achieved with machine control**

"Apart from the machine control, it is still the 210 machine – one of our most popular models and a real jack of all trades," Blom continues. It features Hitachi's unique TRIAS three-pump hydraulic system for fine precision work, which, Blom believes, continues to give Hitachi the edge over competitive machines, including those that have adopted electrohydraulic controls. "We've seen a tendency toward electric levers, but at the moment our engineers remain convinced that hydraulic controls offer better controllability and joy in working with the machine than electric," he concludes.



RIGHT: **A 360° rotatable view of the machine is available**

This, in a nutshell, is real-time kinematics (RTK).

Trimble has developed machine control solutions supporting semi-automation for over 25 excavators of different brands. Gravity or angle-based sensors used in earlier systems have been replaced by inertial measurement unit (IMU) sensors located on the boom, stick and bucket, out from the cab along the excavator's linkage. They tell the system where each component is, relative to GNSS receivers on the counterweight, providing a dynamic real-time position for the entire excavator. Dual-GNSS uses two receivers for improved heading of the linkage, since the slightest inaccuracy can be significant and lead to potentially costly errors in an excavator with a 10m (33ft) reach.

BIM-enabled machines

The need for machine control has grown in response to the advent of building information modeling (BIM) data in project design. "With increased adoption, there has been an emphasis on constructible models," McKendry explains. "The 3D model the engineer creates uses real coordinates, it's in the right place in the real world and the slopes represented are accurate in the constructible model."

"WHAT MAKES MACHINE CONTROL POSSIBLE IS HAVING A CORRECTION SOURCE TIED TO SOMETHING REAL... WE NEED INFORMATION IN A 3CM RADIUS"

Jon McKendry, market segment manager, Trimble

The Hitachi ZX210X-6 can download BIM data (converted via Trimble Business Centre) from the internet and then, using automatic machine control, dig precisely to surfaces in a digital model, without the need for operator intervention. This is transforming the way construction works, with industrial vehicles becoming precisely calibrated modules in a digital design-build workflow continuum.

"It's changing our industry," says Hitachi product manager Wilbert Blom. "Where the machine was once primarily just an excavation tool, now it's part of a bigger process."

In Japan, Hitachi has seen an opportunity to offer an expanding range of integrated services including design, site analysis, productivity reports and documentation reaching across the timeline of a project. But while the new continuum may allow OEMs to become much more than mere machine vendors, it imposes fresh demands on dealer and service networks.

"We and our distributors need to make the step into new territory and learn what BIM is and how it will work on the jobsite," continues Blom. "There's also a completely different trouble-shooting process. If it doesn't work, is it the machine, the system or the satellite receivers?

"On a job that demands 3D design, if the system doesn't work, then effectively your machine is down. That's a big challenge for the service guys."

Efficiency revolution

But the improvements on offer promise manifold compensation. In an Australian productivity study conducted by Trimble, the time taken to dig a 50m (164ft) long batter (receding slope) was cut from 36 to 16 minutes with automated machine control, while scanning the surface with a total station revealed the operator had gone from 45% to 99% on-grade accuracy within a 3cm (1.2in) margin of error.

A second Trimble study in Denmark found a low-skilled operator using machine control in automatic mode to be 17% faster and 80% more accurate than an experienced operator working in 'indicate only' mode. Given the experience needed to achieve proficiency with excavators, this has major implications for an industry facing a skills shortage crisis. "The skills may change," Blom speculates. "Maybe you won't need years of experience in leveling a site to the centimeter, but you will need to set up the machine, manage the system and work with design data."

"IF YOU'RE WORKING WITH GOVERNMENT AUTHORITIES, IT'S MANDATORY THAT YOU HAVE MACHINE GUIDANCE OR CONTROL"

Wilbert Blom, product manager, Hitachi

"Even on an excavator with a regular boom and bucket, leaving a really smooth finish requires significant time spent in the cab," adds McKendry. "The last decade has seen a rise in advanced attachments such as tiltrotators. Instead of just being able to curl, open and close, the bucket can tilt 45° side-to-side and rotate 360°, making machines more versatile but also harder to operate. There's a lot of added value in having a tiltrotator – reduced track-wear, reduced material consumption and increased operator efficiency." Automating functions means operators can have the efficiency of complex attachments without having to spend years learning how to use them.

99%
on-grade accuracy within a 3cm (1.2in) margin of error

ABOVE: **Dual-GNSS receivers improve the heading accuracy of the linkage**

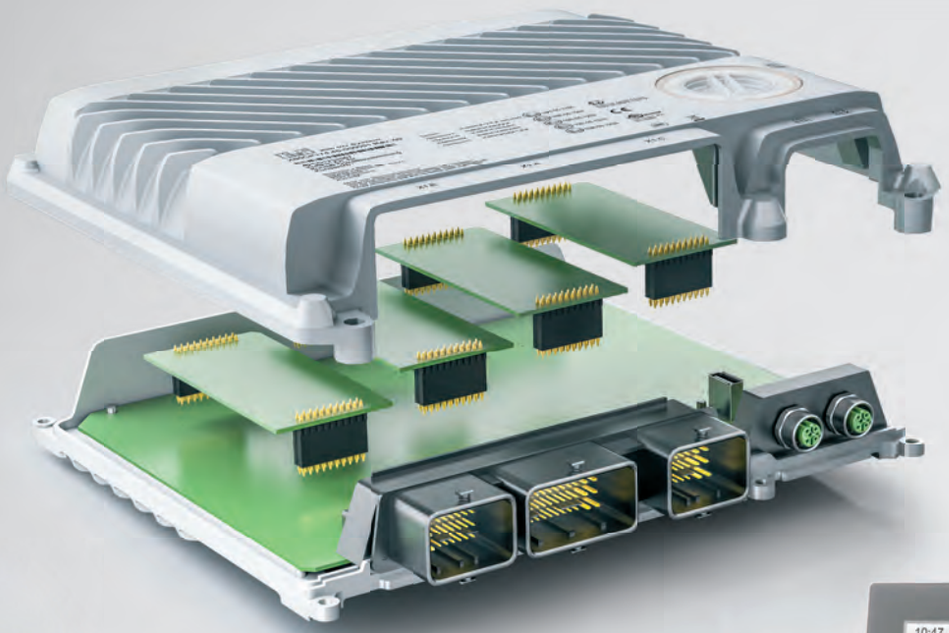
FAR LEFT: **Demand for machine control units has increased significantly**

LEFT: **Automated features can make up for skill shortages in the industry**

bauma
April 8-14, 2019
Visit us!
Hall A2 / Booth 127

COMPLETELY INTEGRATED AUTOMATION FOR MOBILE MACHINERY

Complete portfolio: www.br-automation.com/mobile-automation



- Easy handling
- Integrated safety
- Faster development

OPC UA open SAFETY mapp TECHNOLOGY

PERFECTION IN AUTOMATION
A MEMBER OF THE ABB GROUP

B&R

Though the era of machine control has clearly arrived, it is not very evenly distributed, and market penetration varies widely around the world.

"Based on the Jeff Bezos Diffusion of Innovation curve, excavator technology in the USA is still in the early-adopter stage – under 20% but somewhat over 5%," says McKendry. "Sweden, where technology is over 85%, is in the laggard stage – if you don't have the technology, you're not getting work." Hitachi's European offering reflects recent progress in Japan, which has seen a big government push in promoting iConstruction. "If you're working with government authorities, it's mandatory that you have machine guidance or control," Blom explains.

While factory-fitted machine control makes sense for customers who need to employ the technology continuously, it may not represent the most cost-effective option for everyone.

"It's not uncommon to see a customer equip a large number of machines with a basic 2D functionality and then move the 3D components from machine to machine, depending on application," McKendry reveals.

"One day you might need 3D control on a 50-ton excavator digging a pit for a storm water pump, but the next day the same machine might be in a quarry, just loading trucks, so you put the 3D technology on a 20-ton excavator doing a batter alongside a road project. That portability and flexibility in the aftermarket helps customers leverage technology and increase use."

The future is 3D

For the foreseeable future, then, OEMs and vendors will continue to furnish a spectrum of solutions. But ultimately, 3D machine control looks set to become increasingly ubiquitous as the case for its use grows more compelling.

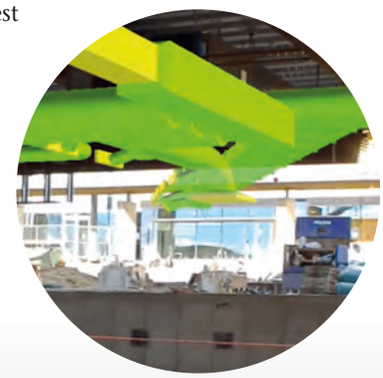
"Studies show huge efficiency, productivity and accuracy gains for both novices and experts using automatics in all types of applications," concludes McKendry. "If your machine is capable of using automatics, it's in your best interests to do that." **iVT**

bauma 2019
APRIL 8-14, 2019 • MUNICH

Hitachi
Hall FN, Stand 718

Trimble
Hall A2, Stand 437

On the Web
Watch the Hitachi's ZX210X-6 in action at
www.iVTinternational.com/hitachi



RIGHT: **Augmented reality is enabling engineers to manipulate hologram data**

AUGMENTED FUTURE?

3D design data is transforming construction, allowing vehicles with machine control to autonomously cut and fill to target surfaces from a constructible model. Now these digital models are beginning to couple and merge with the real-world physical environments they represent, by virtue of mixed reality. One solution, Trimble Connect for HoloLens, enables engineers wearing a hard hat with mixed reality goggles to view and manipulate holographic design data superimposed on an actual job site. But could this technology one day dovetail with excavator control, allowing operators to see the project they are building superimposed on the reality in front of them?

"We're trying to understand the best way of showing augmented reality to operators in a machine space," says Trimble market segment manager Jon McKendry. "As a first step, our Earthworks grade control platform shows a heat map of the whole project with real-time cut and fill values. The operator can look at the display and think, 'Everything red, I need to cut down to grade; everything blue, I need to fill to grade.' We also have a handheld device that does augmented reality, which we believe has potential to penetrate the construction market."

Automation of excavator functions may ultimately lead to a focus not just on assisting operators in performing the right work, but also in preventing them from doing the wrong work – something already creeping into government mandates and machine control platforms, UK government sources told *iVT*. There is language in the bids for Phase 1 of HS2 – the planned London to Birmingham rail link – requiring safety system integration, on the machine level, to prevent an operator raising a boom too high into an elevated transmission line or crossing a live traffic or rail line. As countries like the UK drive ahead in stipulating such requirements, machine control is likely to become increasingly indispensable.

Setting the new BENCHMARK in mobile controls.

See the next generation of mobile automation – the highest performance in controllers and displays for construction machinery.

Hannover Messe, 1 to 5 April 2019, hall 9, stand D36
Bauma Munich, 8 to 14 April 2019, hall A2, stand 203

ifm.com

JAMES GORDON, IVT INTERNATIONAL

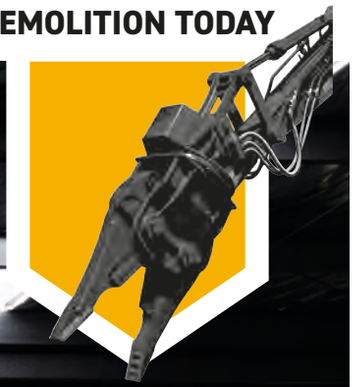
DEMOLITION IS ONE OF THE MOST DANGEROUS JOBS ON ANY CONSTRUCTION SITE, WHICH IS WHY SMALL, REMOTE-CONTROL VEHICLES ARE LEADING THE CHARGE IN A NEW ERA OF INNOVATION

Appetite for

The term Industry 4.0 defines a bright new age where smart machinery is increasingly more connected in cyber-physical systems. The majority of demolition vehicles were designed and built during the third industrial revolution, meaning they rarely take full advantage of such systems. But innovative OEMs are blazing a new trail. Brokk, a Swedish demolition robot manufacturer, is one. Last year, it launched four new models at the Intermat exhibition in Paris. The Brokk 170, 200, 300 and 520D robots embrace three cutting-edge technological concepts, including SmartPower, SmartRemote and SmartDesign.

These new machines help to improve efficiency and productivity with data-centric technologies. The new B300 model, for example, has an electric motor and state-of-the-art power management software, which helps to maximize hydraulic power output. It is capable of delivering an additional 12kW more power than its predecessor, the Brokk 260. Using real-time sensor technology, its integrated power management software is constantly monitoring the working environment, which it feeds back to the robot. It is then able to adjust the motor speed to surrounding temperature conditions.

But perhaps the most exciting development in Brokk's armory is the smart remote operating system, which Tobias Nordin, engineer at Brokk, says "allows all Brokk robots

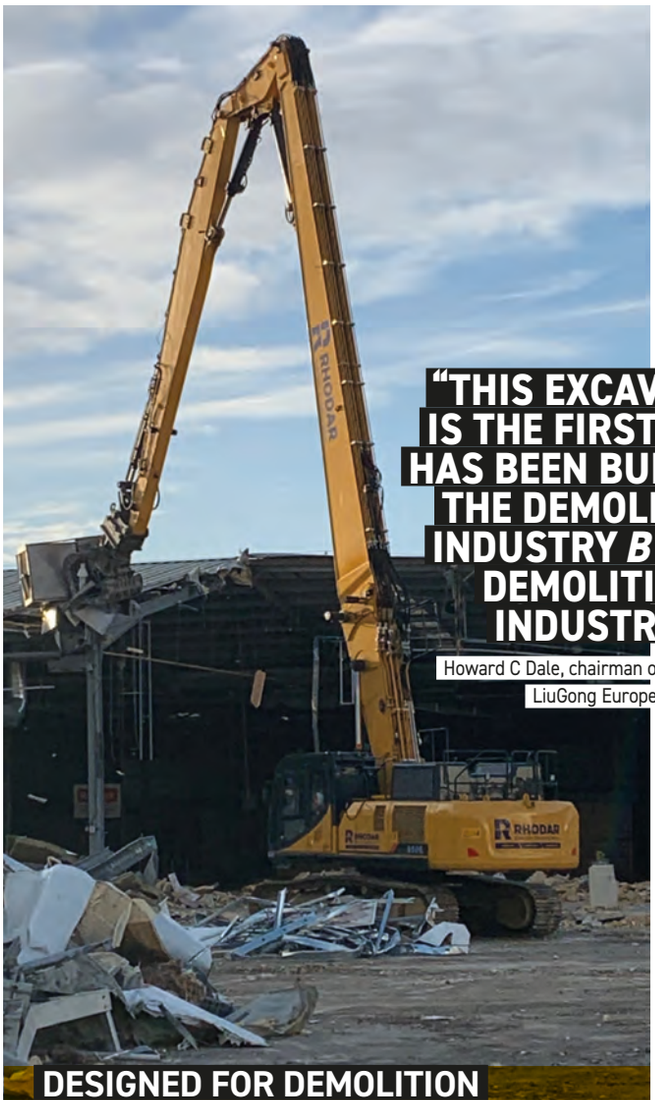


"IT'S VITAL THAT THE NEXT GENERATION OF TECHNOLOGY IS EQUIPPED WITH THE FASTEST, MOST RELIABLE COMMUNICATIONS TECHNOLOGY"

Tobias Nordin, engineer, Brokk

Brokk's latest demolition robots rely on data-centric technologies

destruction



"THIS EXCAVATOR IS THE FIRST THAT HAS BEEN BUILT *FOR* THE DEMOLITION INDUSTRY *BY* THE DEMOLITION INDUSTRY"

Howard C Dale, chairman of the board, LiuGong Europe

DESIGNED FOR DEMOLITION

With margins in the demolition industry in Europe growing tighter, the machinery used on sites must be "malleable and multipurposed", says Howard C Dale, chairman of the board for LiuGong Europe.

China's largest construction equipment manufacturing company, LiuGong, has listened to customer feedback and acted on it.

Joint collaboration with Kocurek UK, which specializes in adapting traditional excavators for demolition purposes and manufacturing the specialized attachments, has paved the way for important specifications on the LiuGong 950E, making it extremely versatile. But for Dale it's not only its improved stability and stronger 30m-long (98ft) reach boom that stands out.

Dale explains, "This excavator is the first one that has been built *by* the demolition industry *for* the demolition industry. We've manufactured it very much with the customer in mind. This is an industry-leading demolition excavator, which can also be used for non-specialist work. So, imagine you're a site manager, and you've completed all of the demolition work for the day. But, there's still some clean-up work that needs to be done. What do you do? Bring in a standard machine, of course. Not only is this a drain on your time, but it's also a drain on resources, not to mention profits. But anyone using the 950 doesn't have to worry, as they can simply remove the entire demolition arm and replace with a standard arm. And best of all, the changeover takes less than 30 minutes."

Dale says that the excavator has been designed and built with operator comfort and safety as a top priority.

"The front windshield of the cab contains five-layer laminated glass, as does the glass in the roof. To improve the operator's vision, we've also installed a tilted cabin and standard rearview cameras, which means that the operator can focus 100% on the job," he adds.

LiuGong's 950E will get its official launch at Bauma 2019.

to be operated on from a distance of up to 300m [985ft]" and can function in the harshest operating environments. Nordin explains that the robots use leading-edge "professional-grade radio technology, with frequency hopping capability" which "resists interference and makes it highly reliable".

"Owing to the hazards that miners and those working in the demolition sector face, we think both industries would greatly benefit from more autonomous machines, which we are already producing," he continues. "However, it's vital that the next-generation technology is equipped with the fastest, most reliable, communications technology. With this in mind, we've recently been testing 5G technology using our largest robot, the Brokk 800, in a mine."

Working with Boliden Mineral AB, engineers tested the remote operating capabilities of the Brokk 800 by deploying it 400m (1,312ft) below ground.

"5G can process data much faster than 4G and is therefore much more responsive – whether it's deployed in a mine or on a demolition site," says Nordin. "It also opens the door to new operator assistance technologies. For example, for this particular trial, our engineers carried out tests from a room using 3D screens and 3D glasses and were able to control the robots safely and efficiently."

Brokk also experimented with virtual reality headsets for controlling its robots, but found that such technology could create a feeling of disorientation in operators, so 3D glasses are the preferred option at present.

Connected future

Dr Paul Hampton, an academic with a wealth of industrial expertise, suggests that incorporating next-generation remote operating technology "represents a significant step forward" as Industry 4.0 takes hold. He explains, "Having consulted with the demolition industry, I see remote technologies, which have long been used in various industries, as a potential game-changer. For example, the city of Shenzhen in China has already developed much smaller robotic vehicles and robots equipped with high-level cameras and sensors that can be sent into highly complex and restricted locations. Instead of demolishing the building, they painstakingly remove IT infrastructure throughout the entire building, while also preventing the build-up of static. This entire operation would have been impossible without remote operating technology."

"HAVING CONSULTED WITH THE DEMOLITION INDUSTRY, I SEE REMOTE TECHNOLOGIES, WHICH HAVE LONG BEEN USED IN VARIOUS INDUSTRIES, AS A POTENTIAL GAME-CHANGER"

Dr Paul Hampton, department head, School of Architecture and Built Environment, University of Wolverhampton, UK

DEMOLITION TODAY

Dr Hampton, who heads the School of Architecture and Built Environment at the University of Wolverhampton, UK, also thinks that remote technologies are becoming more intuitive for younger generations. "A recent study revealed that millennials and younger generations are much more dexterous than current operators because they've grown up using smartphones and tablets, which require advanced eye/thumb coordination," he says. "Having acquired these skills at an early age, they are perfectly positioned to seamlessly adapt to the next-generation systems. Importantly, this is just the beginning and organizations within Silicon Valley are already testing the technology of the future."

Another trend among more traditional, manually operated machines in the demolition sector is size reduction. Take Kobelco Construction Machinery, for example. The Japanese OEM recently launched the SK140SRD and the SK350DLC-10, two of the manufacturer's smallest-ever demolition and recycling machines.

Commenting on increased demand for the SK350DLC-10 in Europe, Kobelco Construction Machinery Europe's product manager, Peter Stuijt, says, "Customer feedback on the Kobelco SK400DLC-10 and SK550DLC-10 has been very positive, but we found that there was also a demand for a smaller version. The SK350DLC-10 may be smaller, but there is no compromise on technology."

ABOVE: **The Bobcat E10e electric excavator**

BELOW: **The SK350DLC-10 is one of Kobelco's smallest demolition models**

720mm
The width of Bobcat's new electric mini-excavator (28in). Find out more on page 164

Electrified future

Meanwhile, at the very smallest end of the scale, OEMs are developing fully electric mini-excavators – suitable for indoor demolition jobs where tailpipe emissions are extremely harmful. Bobcat, for example, will be presenting a fully electric, 1 metric ton mini-excavator at Bauma this year.

The new E10e is based on the company's successful diesel E10, which has sold more than 10,000 units. With a width of 720mm (28in), no emissions, low-noise operation and a ZTS profile, the machine can easily pass through standard doors, as well as enter and exit typical lifts.

Bobcat spokesperson Christian Ruppel told *iVT*, "Demolition is one of the E10e's main applications. The battery fits in the E10 frame and can be charged during lunch breaks to last the whole day – very important for customers."

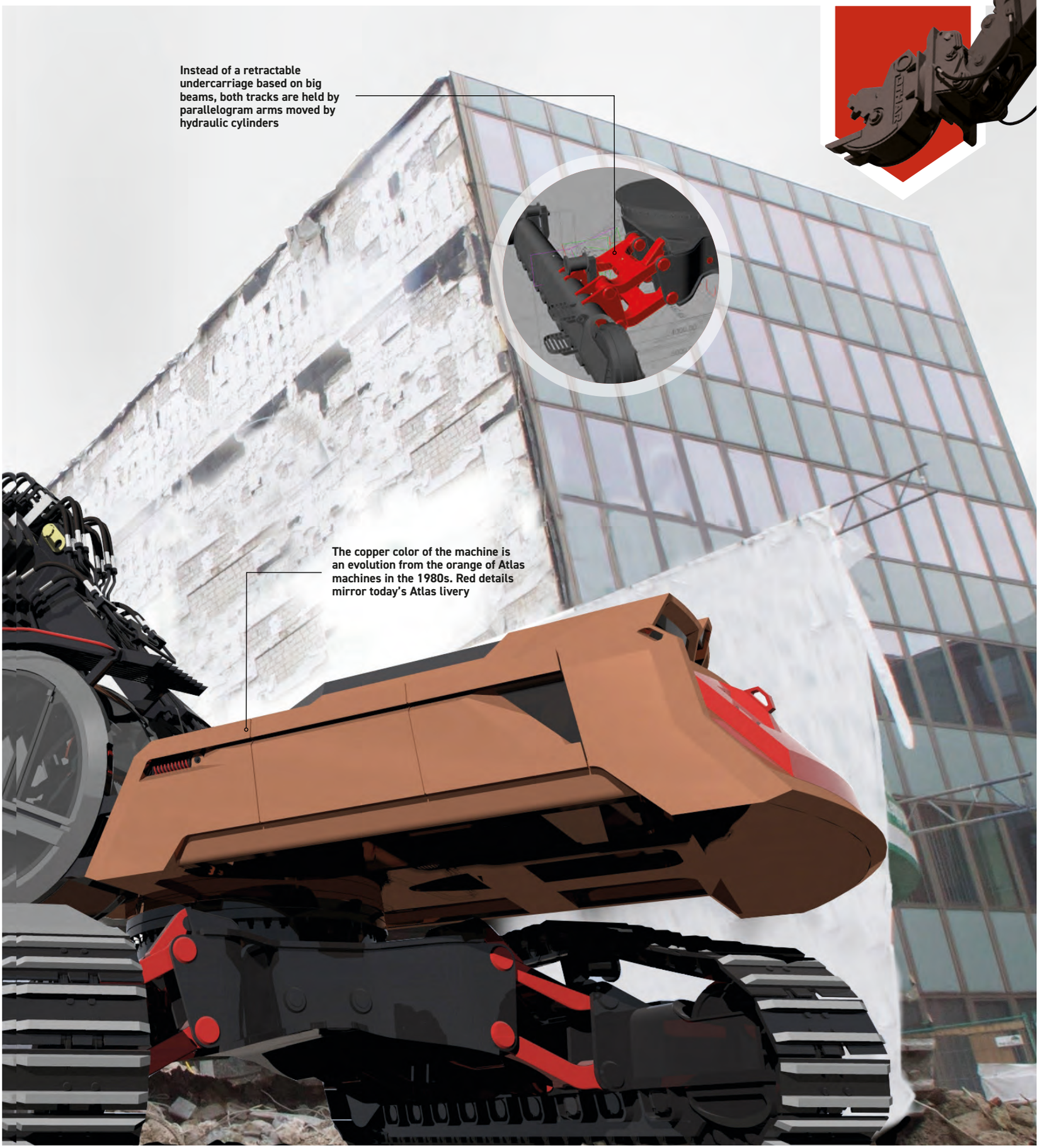
While electrification and remote operations are already changing the demolition machine industry, looking to the future, Dr Hampton perceives a need for greater connectivity. "There needs to be much more interaction between architects, developers and demolition contractors if we are to enjoy the benefits of 4.0 innovation," he says. "The industry must adopt a holistic approach – cradle-to-cradle thinking. For example, if those involved in demolition were invited into the pre-construction planning phases, they could advise clients and developers on the most cost-effective way of deconstruction instead of razing a building to the ground. This would be a win-win scenario for everybody including the OEMs, as it would give them greater visibility and insight regarding the niche technology needed to carry out deconstruction in a safe, efficient and profitable manner." **iVT**


BONDIOLI
& PAVESI
Professionals in motion
BPAdvertising
bondioli-pavesi.com

ALBERTO SECO AND TOM STONE, IVT INTERNATIONAL

THE GREAT DESTROYER

NAMED AFTER ATTILA THE HUN'S HORSE, ALBERTO SECO'S NEW CONCEPT HIGH-REACH EXCAVATOR, OTHAR, HAS THE VERSATILITY AND DESTRUCTIVE POWER TO LAY ANY STRUCTURE TO WASTE


Instead of a retractable undercarriage based on big beams, both tracks are held by parallelogram arms moved by hydraulic cylinders
The copper color of the machine is an evolution from the orange of Atlas machines in the 1980s. Red details mirror today's Atlas livery

DEMOLITION TOMORROW

This concept demolition excavator – the Othar – is a brand-new idea from industrial designer Alberto Seco. It takes some of its inspiration from machines once made by the German OEM Atlas, known for its telescopic cranes and excavators. It even shares nomenclature – Attila was a brand under which Atlas marketed its excavators in Scandinavia. In legend, Othar was Attila the Hun's horse.

The largest models from Atlas, beginning with the AB 1702 D, had a telescopic extension arm, which Seco has doubled into a telescopic boom and stick.

Atlas longitudinally mounted its Deutz engines in the center of the chassis, as was immediately apparent from the shape of the hood. Of his new concept, Seco says, "I have managed to create a longitudinal shape covering the transversely mounted, water-cooled engine of this concept excavator. The benefit is lower panels on the sides of the hood, improving visibility and also performance of cameras."

All rounder

The distinctive round cab on the Othar takes its inspiration from other sources. One of the first excavators to use a round windshield was created by Hydromac in 1979 (see back page).

About 15 years later, Kobelco began to sell the award-winning Mark V Series of excavators featuring a rounded windshield. Again, it looked very modern and covered another innovative interior.

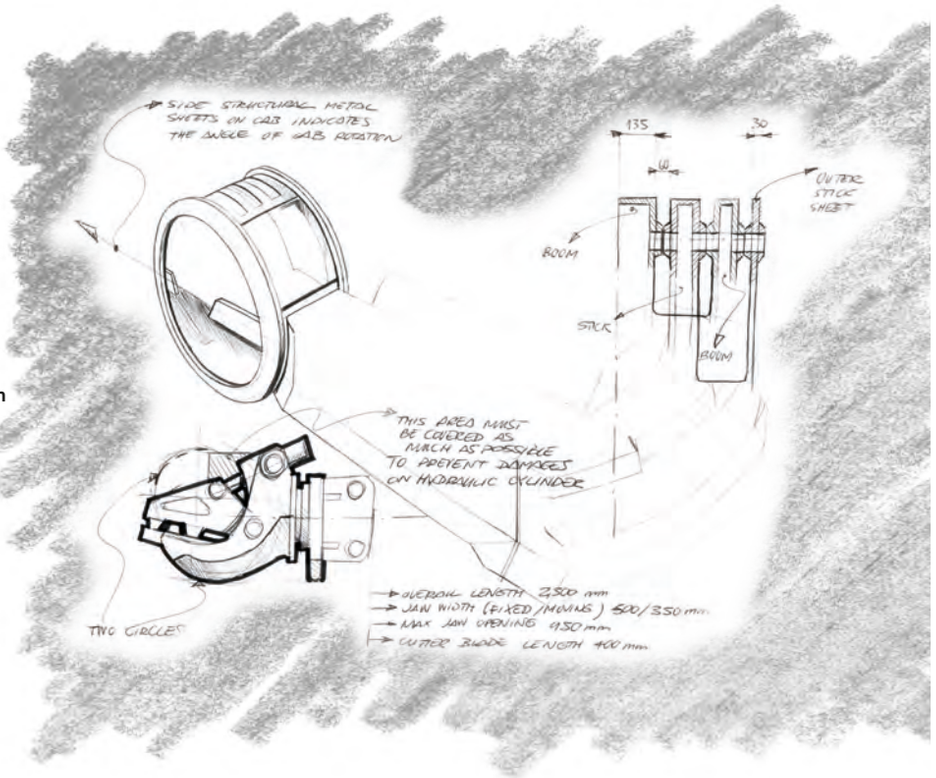
In the second half of the 1990s, Samsung Heavy Industries designed a more geometric cab with round windshield for its second series of excavators, just before being bought by Volvo Group.

Now the Othar has taken the idea of a curved windshield one stage further by creating a completely round cab – an innovation that has also been seen in several other concept designs in the past few years, such as Mike Turner's Antares Ant, originally created for *iVT*'s Design Challenge series. "Completing the circle to make a round cab seems to be a

RIGHT: **Seco's initial sketches for the Othar, including the round cab and demolition jaw attachment**

BELOW: **The boom on the Othar incorporates a setting stand that unfolds and enables mounting and dismounting for transportation, or change from ME (mass excavation) mode to HR (high reach) mode or vice versa**

BOTTOM: **The Anteras Ant concept vehicle, published in *iVT* June 2009, designed by Mike Turner, also featured a round cab**



INSPIRATION BEHIND THE MACHINE

"One Friday afternoon in the early 1980s, I remember watching as the nursing home opposite my house was being demolished," says industrial designer Alberto Seco, the man responsible for the Othar concept design. "Through the dust I just could see a metal claw ripping the façade of the five-story building. The nearly 100-year-old building in Bilbao was falling without resistance and I did not know what kind of equipment was so easily demolishing it."

The 1970s was the decade that revealed the hydraulic excavator as a more versatile piece of equipment than the previously dominant wheel loaders. European brands like Poclain and Orenstein & Koppel became very popular and since they had longer arms than loaders, they were also used as rock-breakers on demolition sites. But most of these brands did not explore high-reach designs and lacked the necessary protection systems for minimum safety guarantees in demolition. Larger buildings were demolished by a wrecking ball, which were effective against masonry, but not easily controlled and thus not a very safe method.

"On Saturday morning, with half the building already demolished, I could see that the machine doing the work was an orange Atlas AB 1602 D LC," says Seco. "It was not bigger than a 90CK or an RH6 HD, and was much smaller than what I, as a kid, had expected of a machine with such destructive capabilities. Its secret was the combination of a 5m length extension attached to the stick and a strut that allowed the two-piece boom to turn it into a straight boom. A generous FOPS [falling object protective structure] wrapped the windshields and the roof of the cab.

"On the following week, the Atlas began to load a couple of old Spanish Pegaso trucks that contrasted with the piece of German 'high tech'. The dump trucks revealed to us that the equipment belonged to Agustin Prudencio, a Madrid-headquartered earthmoving and demolition company. They worked on the site for several weeks using the Poclain, Fiat-Allis, Caterpillar and Guria plant belonging to the local company Viuda de Sáinz, which was in charge of the excavation for the new nursing home. For two years my balcony was like the press terrace at the Caterpillar Malaga Demonstration & Learning Center; my personal urban sketching look-out to draw excavators. It was clearly unavoidable that my high-reach concept excavator would be influenced by these memories."

BELOW: **During the 1960s, Seco's father performed demolition in a Cat 977H: "No FOPS, no ROPS and sometimes not even a helmet!"**

MIDDLE: **An old Atlas AB 1602 D LC, a key inspiration for Othar**

BOTTOM: **The Othar in mass excavation mode**

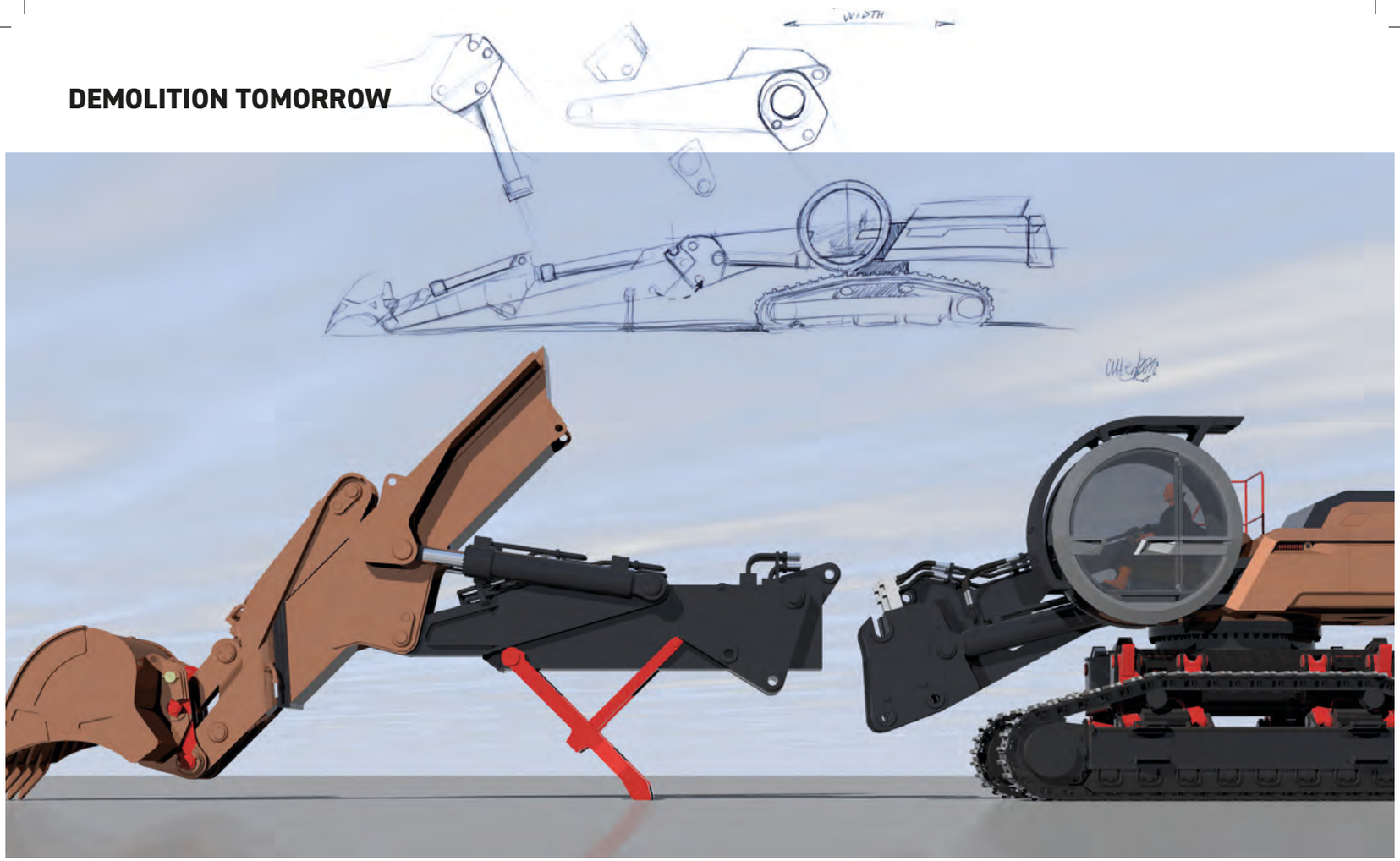
smart solution, not just for stylistic reasons, but it will also offer a robust capsule for an excavator," says Seco.

Full tilt

Having a round cab means greater functionality can be designed into the excavator. The design language behind a round cab naturally led Seco to build in a turning movement around its center, which helps to enhance visibility and reduce operator fatigue and neck strain on the high-reach jobs that would be the machine's main function. Thanks to this innovative design, the turning movement of the round cab could be extended from the 30° of standard hydraulically tilting cabs of current high-reach excavators, up to 45° to reach the higher view points without physical effort.

Furthermore, the round cab would help to improve visibility for works below ground level. "Digging a ditch usually leads to the operator standing up to see the bucket," says Seco. "This round cab design would also allow a tilting angle up to 30° downward, to see the lower point." This feature would be especially useful for difficult-to-access underground areas. The operator would be kept safe thanks to a four-point seatbelt.

The sliding movement of the cab would be based on a rack and pinion mechanism. Two electric motors/ gears (pinion) attached to the cab posts and placed in a 90° arc would move on an internal structure (rack) linked to the chassis of the excavator. The cab structure would lay on a couple of hydraulic dampening mounts to reduce vibration; and on a pair of independent upper-suspension cylinders to minimize big shocks.



"DIGGING A DITCH USUALLY LEADS TO THE OPERATOR STANDING UP TO SEE THE BUCKET. THE ROUND CAB DESIGN WOULD ALLOW A TILTING ANGLE UP TO 30° DOWNWARD, TO SEE THE LOWER POINT [THE CAB WOULD ALSO TILT 45° UPWARD]"

Alberto Seco, industrial designer

Quick checking of the status of these cylinders could be done through a small window on the left-hand side panels of the hood.

Versatile equipment

The Othar HR excavator is a multipurpose demolition machine that offers two configurations: ME (mass excavation) or HR (high reach), with one main set of equipment and just one light change by tilting the boom around the main pin to get it straight (HR) or curved (ME), which is made easier by a built-in setting stand incorporated into the boom.

The equipment consists of two pieces: a boom and a stick, with both being telescopic for a wide working range from high to middle elevations without having to dismount and mount another boom.

In the high-reach mode, the boom length reaches 21m (69ft) and the stick length 12.5m (41ft). Thus, with the four sections of boom and the three sections of stick extended, the maximum pin height would be 35m (112ft), with the tool's maximum weight of 4 metric tons.

While in mass-excavation mode, the boom length reduces itself to 8.5m (28ft) and the stick length to 3m (10ft).

A quick coupler makes it easy to mount different attachments to serve the typical duties that are performed on demolition sites: pulverizer, rotating crusher, multiprocessor, hydraulic hammer, multigrapper and buckets.

Undercarriage

Instead of a the common retractable undercarriage based on big beams, both tracks are held by parallelogram arms moved by hydraulic cylinders to set an overall 5m (16ft) width on the working mode, or 4m (13ft) width on the transport mode. Hydraulic cylinders are covered by the undercarriage central structure, helping to avoid any damage.

This concept excavator would mount a 5 metric ton removable counterweight that could be dismounted once the equipment has been dismounted for reducing size and weight to enable easier transportation. **iVT**

THE SCIENCE OF SEATING, *PERFECTED.*

NEXUS: The latest innovation from Sears Seating.

When it comes to providing ergonomic, hardworking and proven seating solutions, we never settle. Our products not only provide unmatched comfort, but are also designed to increase productivity and uptime. ***When it comes to your seating, we settle for nothing less than perfection.***

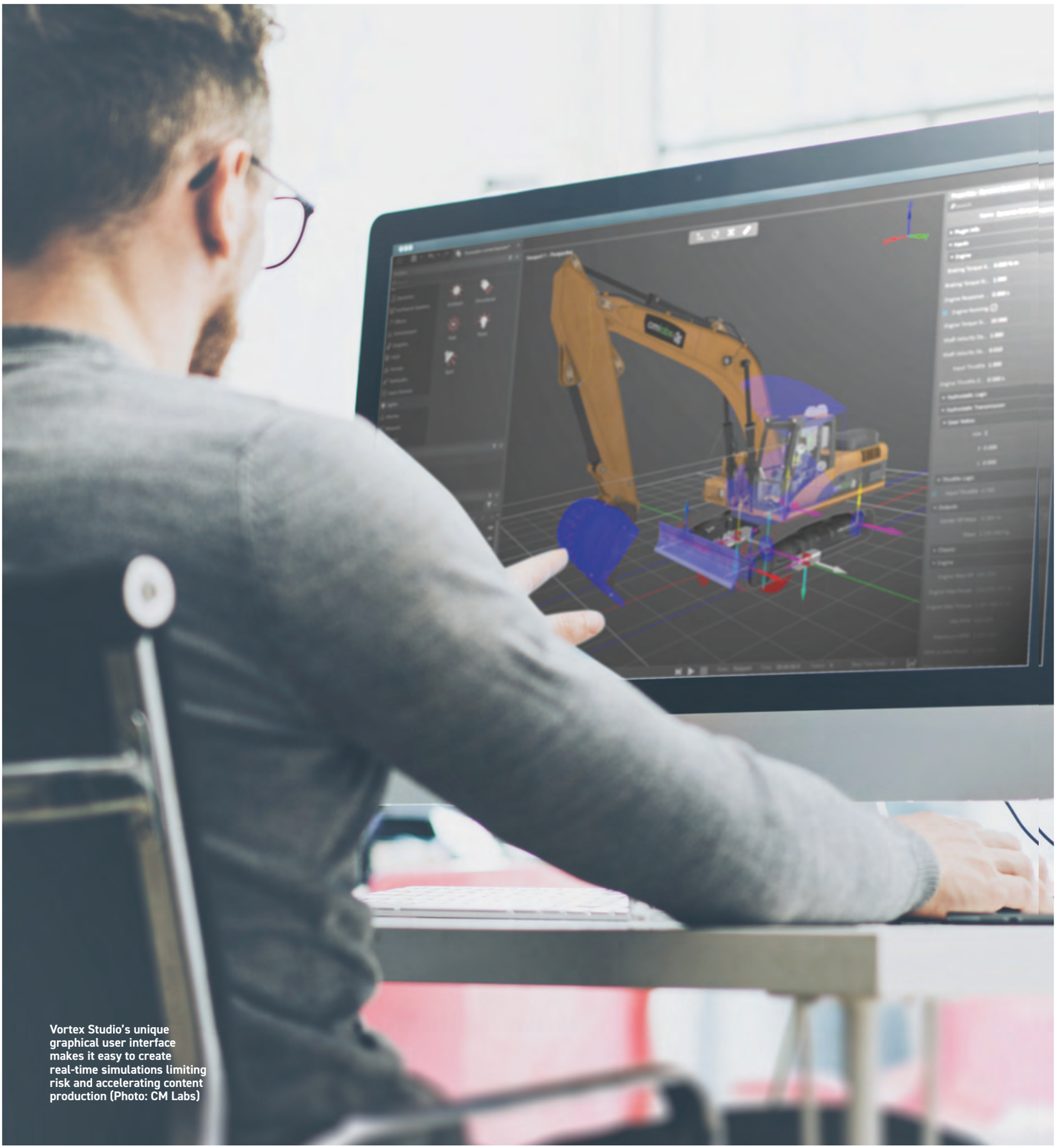
See the difference for yourself.

Bauma Exhibit | April 2019
Hall A6, Stand 518

SEARS SEATING

searsseating.com | info@searsseating.com

WORK HARD. WORK COMFORTABLY.



Vortex Studio's unique graphical user interface makes it easy to create real-time simulations limiting risk and accelerating content production (Photo: CM Labs)

How to build an industrial vehicle

PART 2

Better design faster

IN THE SECOND PART OF OUR *HOW TO BUILD AN INDUSTRIAL VEHICLE* SERIES WE LOOK AT HOW, ONCE IDEAS ARE DECIDED UPON, THE LATEST CUTTING-EDGE SOFTWARE AND TECHNIQUES CAN BE USED TO ENSURE THE ENGINEERING PROCESS IS ACCELERATED – EVEN AS DESIGNS BECOME MORE COMPLEX

Traditionally the development of vehicles and machines was organized like a relay race: when the mechanical design was done, the engineers handed over to their colleagues responsible for the drivetrain. Finally electrical designers and software programmers became involved, followed by the specialists for purchasing, quality control and production.

Nowadays the process looks totally different, at least in the R&D departments of innovative vehicle manufacturers. “It is much more effective to switch to a simultaneous design process,” says Andreas Baier, partner at Porsche Consulting. “This includes the definition of tasks and the building of cross-functional project teams across different business units.” This requires, of course, a dedicated team governance as well as a clear understanding of the responsibilities and the structure of the different teams.

Simultaneous engineering allows a more holistic engineering process, at the same time cutting costs because specialists from other areas, such as purchasing and production, are involved in an earlier stage – a modular design of machines, drives and components facilitates this. And the extensive use of simulation tools reduces – according to the motto ´first time right´ – the time necessary for prototyping and testing loops.

Speeding ahead

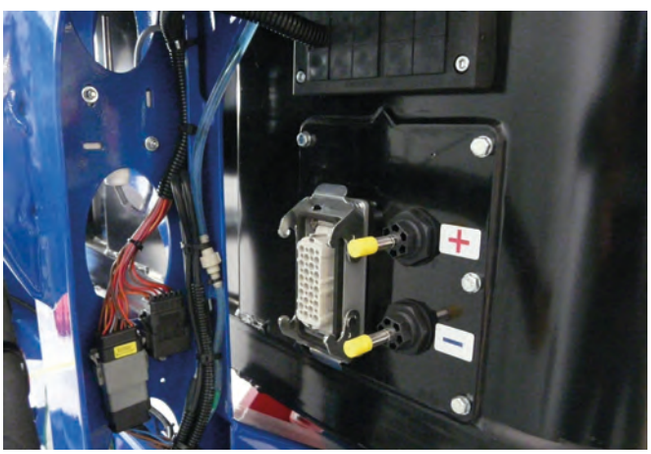
A leading German manufacturer of agricultural machines has – with the support of Porsche Consulting – recently implemented a simultaneous design process. The result, Baier explains, is impressive: “Our customer complained about long time-to-market intervals and gradually eroding margins because target costs ran out of control in the course of the R&D and production process. We have now established a new process, with clearly defined roles and measurable deliverables in between milestones. The main tasks are fulfilled by interdisciplinary simultaneous engineering teams who work on different detail levels – from the complete machine down to the drivetrain and, on the bottom level, components like brakes, couplings and fasteners.”

Thus, the complete product creation process (PCP) was streamlined. The results: accelerated time-to-market, reduced development and production costs, and increased product quality.

The basic principles of this kind of reorganization of the engineering process are derived from – as one might guess when a Porsche company is involved – the automotive industry. When designing the new Porsche 911, for example, 35 cross-functional teams were involved. But, according to Baier, this principle is not limited to

“MANUFACTURERS OF MOBILE MACHINES ARE WELL ADVISED TO MAKE USE OF SIMULTANEOUS ENGINEERING”

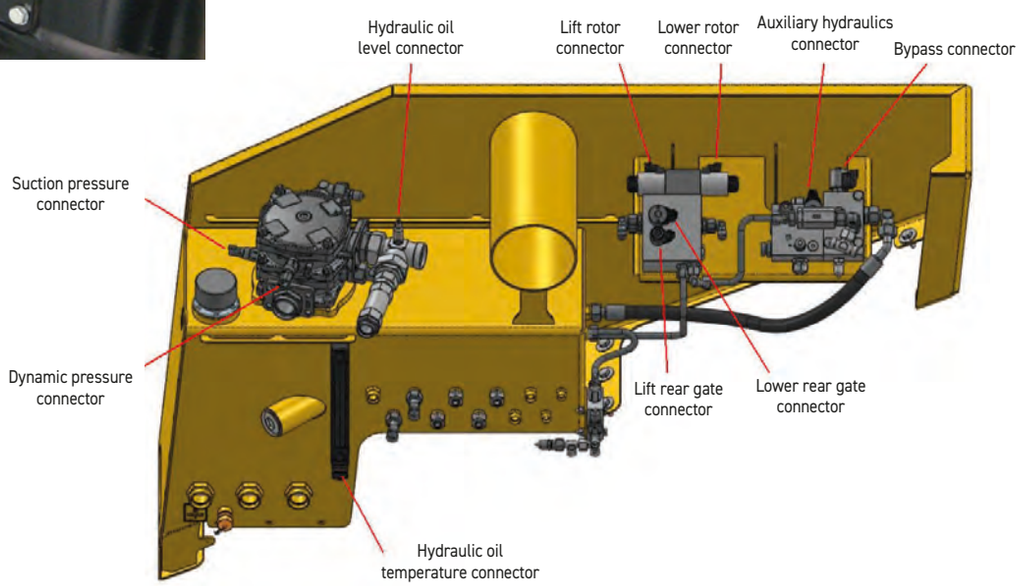
Andreas Baier, partner, Porsche Consulting



ABOVE: **Plug-in connectors remove the need for harnesses**

BELOW: **No need for wiring: In this mobile machine, the electrical modules are easily connected with plug-in connectors. The Eplan platform supports this kind of modularization**

BELOW: **Standardized hydroelectric modules save on time and costs**



ABOVE: **CM Labs simulation software can be used for testing machines in a virtual environment**

"OUR SIMULATION SOFTWARE CAN BE USED THROUGHOUT THE COMPLETE DEVELOPMENT CYCLE OF THE VEHICLE"

Marc-Alexandre Vézina, product manager, CM Labs

the big players: "Smaller manufacturers of mobile machines are also well advised to include, for instance, their quality and production experts in the development of new vehicles as early as possible."

Modularity to reduce complexity

In a different project for a manufacturer of mobile drilling equipment, Porsche Consulting has found a way to reduce the number of hydraulic valve blocks for the complete machine range from double-digits to just one basic block and two add-on blocks when certain options require it. This saves time and cost in engineering and – even more so – production.

In cases like these it takes not only clever consulting and brain work, but also advanced software to reach the manufacturer's goals. An example: a manufacturer of mobile machines for a niche application has opted for modularization, creating modules for electrical components with the help of the Eplan CAD platform for electrical engineering. Each functional electrical unit, such as cockpit, working device, hydraulic tank, basic framework and engine unit, has been standardized in this way, and the physical modules are easily connected via plug-in connectors. So there is no need for an individually designed harness, and electrical installation takes next to no time. Furthermore the control units have also decentralized and are now installed as close as possible to the modules they control.

There are clever software tools within the Eplan CAD platform that define the prerequisites for such modularization, resulting in less installation effort. At the same time, on the project side, laborious engineering detail is replaced by simple configuration. The electrical engineer just clicks in the customer's options, such as a camera, electrical mirror adjustment or irrigation module in Eplan's Cogineer software, and the circuit diagram is automatically generated in the background. The use of intelligent CAD software means engineers have more time for 'real' engineering.

Designing in virtual reality

It might at first sound strange that tools for developing computer games have influenced the development of mobile machines. But in fact simulation is not so far removed from gaming. That is why, 18 years ago, several engineers in this business developed simulation software for off-road vehicles in different fields like construction, defense and robotics – and founded CM Labs Simulation Inc. in Montreal, Canada.

At first, the Vortex Studio software was used for training the operators. This is still an important function, but today the platform offers in-depth intelligence to engineers as well. "Vortex Studio can be used throughout the development cycle of the vehicle – from the exploration of design ideas to system level engineering," says Marc-Alexandre

"VORTEX STUDIO IS OFTEN USED IN ITERATION CYCLES TO OPTIMIZE MACHINE DESIGN"

Drew Carruthers, director of training solutions, CM Labs

Vézina, product manager at CM Labs. "After the design is complete, the platform is the ideal basis for training and marketing purposes. And during the life of the vehicle, the manufacturer can always add information to the model to echo the status of the real machine. This is an important issue: optimizing existing machines to review performance and suitability." Vortex Studio acts as a test environment for a vehicle's digital twin, and it accompanies (and facilitates) the birth of the real machine.

Mixing simulation and reality

Of course, the data for the twin needs to be generated first. "When creating the simulation model, we start with all available engineering information: specs, CAD drawings, engineering tests, etc," says Vézina. "Then we create a model that is extremely close to reality. This is true for major factors such as engine power and surface area, but it is also true for details such as the thickness of a cable, the delay it takes to shift gears or the slack on a piece of rope given a certain load. If the data is provided to us, we can simulate it."

The data is able to simulate the control of the real vehicle. "For example, one manufacturer had to design a large crane," recalls Vézina. "We built a simulation using all the drawings and data from the design group, and they loaded it onto the PLC [programmable logic controller] – the 'brain' of the crane – to validate their algorithms." This helped accelerate software development and had a positive side effect: "When the validation was complete, the customer had a simulator for training that was absolutely accurate to its designs because the same computer is driving the real crane."

Accelerating the design process

With these functions, Vortex Studio is – according to CM Labs – a powerful tool to accelerate the design process of mobile machines. "It means the design team is able to react more quickly to market changes and customer demands," says Drew Carruthers, director of training solutions at CM Labs. "This is why many engineers and their CEOs are passionate about simulation."

For this reason, Vortex Studio is often used in iteration cycles to optimize machine design: "The engineer can easily change, for instance, positions, materials and components. He can stiffen the suspension or change the ride height. In general, he can really tune the machine to get the best performance and experience. And when this virtual work is finished, he can use these insights to design the nuts and bolts of the machine."

The simulation also facilitates simultaneous engineering. As Vézina explains, "You can design virtual modules and insert 'real' engineering data and CAD drawings when they are ready. So you can parallel – and accelerate – the design process." **iVT**

bauma 2019
APRIL 8-14 • MUNICH

CM Labs
Hall C2, Stand 127

SIMULATION LAUNCHES AT BAUMA 2019

CM Labs Simulations will be releasing a host of new training technologies at Bauma 2019. Its new augmented reality (AR) application will make it possible to bring a virtual mobile crane right into a classroom, where trainees can interact with it, conduct walkarounds, and learn the fundamentals of machine inspection.

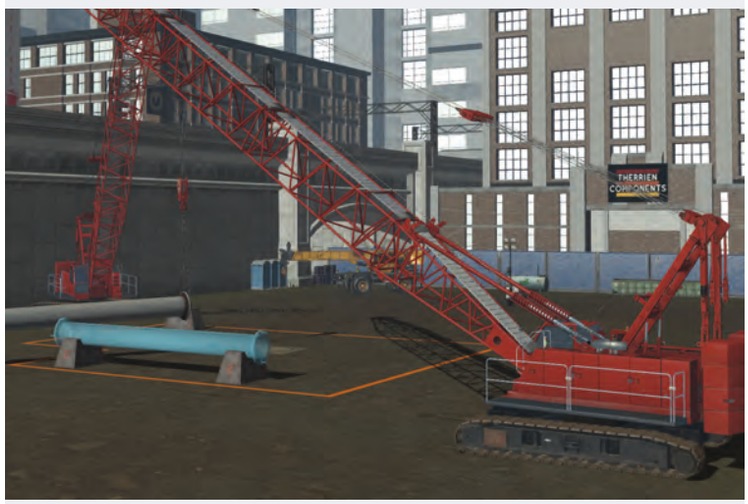
Once trainees are familiar with the equipment, they can get behind the controls of a simulator and work through the training curriculum or focus on specific operator skills.

Two training simulators will be on display at CM Labs' booth: the immersive Vortex Advantage and the desktop Vortex Edge Plus. Both simulators can run CM Labs' full catalog of lifting and earthmoving training packs, including multiple machine types.

These simulators are designed to run independently, or as part of a unique tandem lift operation that will be on display for the first time at Bauma 2019, allowing two trainees to work simultaneously and cooperatively to complete a crawler crane lifting exercise.

In addition CM Labs will be displaying its Signalperson Training Station, which allows a third team member to provide hand signals to the operators, while a fourth team member can supervise the operation or inject challenges using the Instructor Operating Station.

"The impact of today's training simulators goes far beyond equipment and controls familiarization," says Drew Carruthers of CM Labs. "With full team training, each member of the team is fully engaged in developing skills and best practice techniques, while also acquiring the collaboration skills that are vital to safety and efficiency on the worksite."



ABOVE: **One of the virtual environments that visitors will be able to experience on the CM Labs stand at Bauma**

On the Web

You can read *Ideas Machines (Part 1 of How To Build An Industrial Vehicle)* in our 2019 Off-Highway Annual **www.iVTinternational.com/online-magazines**

Faster
easier to connect.

MultiGrease

MultiGrease

MultiFaster with a special coupling for central lubrication systems and an electrical connector included.

fastercouplings.com

SAUL WORDSWORTH, IVT INTERNATIONAL

It's ELECTR

AFTER MANY MONTHS DEVELOPING PROTOTYPE MACHINES, VOLVO CE HAS PROVED ITS CONCEPTS IN THE WORLD'S FIRST SEMI-AUTONOMOUS, ELECTRIC WORKSITE

Global warming is occurring at an alarming rate, driving environmental changes across the planet. The window for slowdown is narrow – and narrowing quickly. The time to act is now.

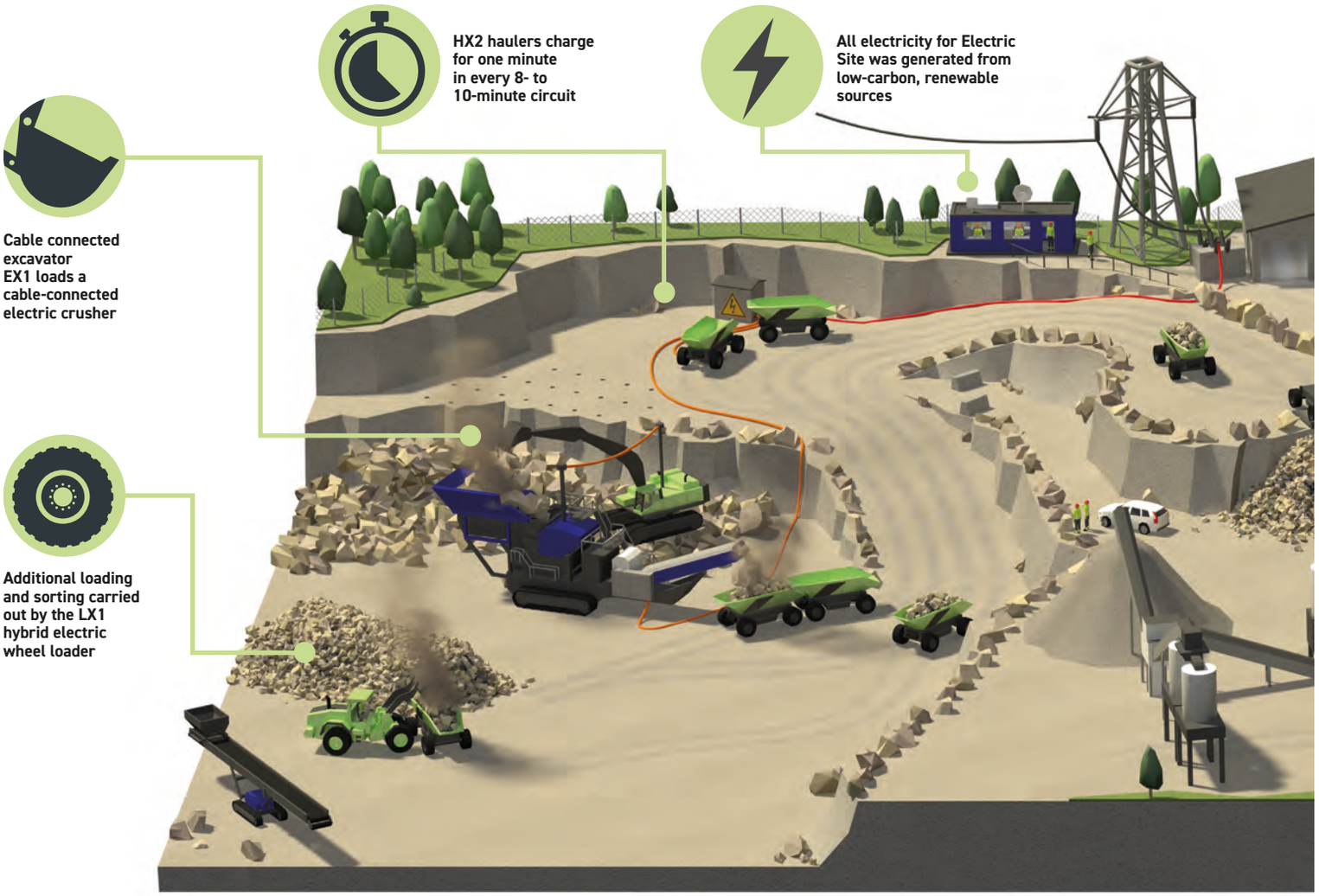
"Construction and building contribute around 40% of carbon emissions in the world," says Melker Jernberg, president of Volvo CE. "We are part of the problem but we also want to be a significant part of the solution."

IFYING!

98%

Reduction in carbon emissions

VOLVO ELECTRIC SITE



BELOW: **There are eight electric, autonomous haulers operating at the Electric Site**

This awareness has driven Volvo, in collaboration with Skanska, toward the creation and development of Electric Site, the world's first electric vehicle land site at Sweden's largest quarry, Vikan Cross, just outside Gothenburg. By replacing its traditional diesel machines with electric, sometimes autonomous, vehicles, Volvo's test site has set a marker for the future of the construction sector.

"Running a pilot like this was a no-brainer for us," says Jernberg. "We did it both for reasons of sustainability and also for business. The foundation of Electric Site will make us more productive, bring us closer together and improve our way of working. We love to buy and sell machines, but we need to build for the future."

The classic setup

Vikan Cross quarry has been in operation since the 1960s and produces around 6,000 metric tons of stone material a day for building and road construction projects.

"In the classic arrangement all machines ran on diesel," says Uwe Müller, chief project manager for Electric Site at Volvo CE. "We blasted rock and loaded it with an excavator into a mobile crusher, and from there we used a wheel loader to pick it up again. The wheel loader then put it on dump trucks or stockpiled it onto a buffer. Diesel is very flexible, and this was a flexible operation."

Such flexibility meant a low demand for planning and costly infrastructure investment, but the downside was the excessive burning of fuel. Until the trial, diesel consumption was over 3,000 liters a day – expensive in both financial and environmental terms.

"With a very flexible operation like that you can trade away efficiency," says Andreas Sunesson, project manager with Skanska.

The pilot

In September 2018 Volvo and Skanska began the switch from this traditional arrangement to an electric, part-autonomous setup, electrifying each transport stage in the quarry, from excavation and primary crushing to transport and secondary crushing.

"The diesel dump trucks were removed and replaced with eight

A total of eight fully autonomous, fully electric HX2 haulers are operated at Electric Site

7T

Base weight of the HX2, with a load capacity of 15 metric tons

THE HX2

The HX2 is a fully electric, battery-driven, autonomous, bidirectional hauler with a load capacity of 15 metric tons and a base machine weight of 7 metric tons. It has an electric motor with a rated power of 110kW (148hp) on each axle, both of which are driven by the vehicle's 8.9kWh lithium-ion battery pack, providing four-wheel drive, complemented by a four-wheel steering system. A hydraulic system is used for the steering and bucket tilting actuators. The HX2 is also fitted with a vision system, which allows it to detect all obstacles close by. A total of eight HX2s are deployed at the electric site.

"This is the world's first battery-electric dumper," says Eric Ohlin, Volvo technology lead for Electric Site. "Compared with a normal truck or hauler the ratio of empty to full weight – from 7 to 22 metric tons – is exceptional. We programmed it with a GPS route that's like a railroad track. The dumper follows the GPS over the charging stations once every cycle and runs the exact same route to the centimeter. Generally speaking batteries are heavy, expensive and problematic from the environmental aspect so we try to keep ours as small as possible, which means regular charging.

"During the 8- to 10-minute trip, one minute is spent over the charging station. As part of its circuit it must ascend an incline of over 10%. An ordinary truck would not be able to achieve this."

BELOW: **The site relies on 40% fewer operators than it used to when run manually**

70%

Reduction in energy costs

fully battery-electric autonomous HX2 dump trucks," says Müller (see *The HX2* sidebar on page 85). "The next step was to replace the big diesel wheel loader with a smaller hybrid-electric wheel loader. Finally, we also electrified the crusher. By removing diesel engines from the vehicles, halving the treatment section and taking out the cab and cab comfort, you are left with much smaller, simpler and lighter machines. This means the ratio between load capacity and machine weight can double. It should also be noted that we use carbon neutral electricity rather than electricity generated by burning fossil fuels."

Wi-fi dependent

The system took a few weeks to mature but in the last month of the 10-week trial Volvo and Skanska followed the working shifts previously in place at the quarry.

"Every day is a 5:45am start and we are trying to maximize production as far as possible," says Eric Ohlin, Volvo technology lead for the Electric Site project.

During *iVT*'s visit to the site at Vikan Cross, Ohlin commented, "All the machines are connected to a wi-fi network. They communicate to a server that tells them what to do, and they share information between each other through the server and also via the site management system. The only downside is the complexity of the project. If, for instance, the wi-fi goes down, then we have a problem, but this is rare. You will have seen a couple of stops today, the odd glitch, a small problem with one of the charging stations, but generally the system is working extremely well."

Results

After 10 weeks, Electric Site had a staggering 98% reduction in carbon emissions, a 70% reduction in energy costs and a 40% reduction in operator costs. Considering the target for emissions reduction was 95%, this is to be applauded. Overall the collaboration between the two OEMs has seen a reduction in diesel use at the site from 3,000 liters per day to just 64 liters. This equates to a daily fall in CO_2 emissions from nearly 9 metric tons to 106kg (234 lb). Such results are in keeping with both companies' goals of halving their carbon footprint by 2030, and achieving full carbon neutrality by 2045. They also chime with Volvo's vision of worksites that are 10 times more efficient than they are today, with a complete absence of accidents and emissions.

"Vikan Cross is an excellent work environment, with less noise, greater safety and fewer staff," says Müller. "In the morning we are able to reduce the number of operators required from five to three. Then in the afternoon, which is more focused on stockpiling, from two to one. Overall that's an operator saving of 40%. Meanwhile electric motor noise is reduced, while safety is also boosted because we've removed operators from the really dangerous jobs."

The Volvo machines used during the trial phase are prototypes, and

THE LX1

Volvo's prototype hybrid-electric wheel loader is designed to organize piles of material on-site. The LX1 boasts a driveline consisting of electrically driven hydraulics, electric drive motors, an energy storage system and a significantly smaller diesel engine, all of which facilitate a substantial gain in fuel efficiency. The prototype is almost all new parts based on a new design and can do the work of a far larger wheel loader.

"The LX wheel loader weighs 23 metric tons and has a working load capacity of almost 10 metric tons in the bucket," says Ohlin. "For its weight it has huge production capabilities. It's a series hybrid, meaning it is small for its 3.6-liter diesel engine, which only works as a generator charging a battery. We have an electric motor on each of the hubs and the hydraulics are also electrified. We have shown the LX in previous projects but this time we have performed some modifications. Specifically we changed the battery and equipped it with a lot of communication equipment that we need to incorporate into the site management system."

23T
Weight of the LX1, with a working load of nearly 10 metric tons

ABOVE: **There is an electric motor on each of the LX1's hubs**

LEFT: **Uwe Müller, chief project manager for Volvo CE's Electric Site**

70T

The operating weight of the EX1 dual-powered excavator

THE EX1

The EX1 is a 70 metric ton dual-powered, cable-connected excavator prototype. It has a 4.5m³ (160ft³) bucket and a 16-liter diesel engine. The base machine is a Volvo EC750 crawler that has been modernized to incorporate an electric motor. When plugged in, it becomes is a zero-emissions excavator.

"For this machine we selected a dual motor concept," says Ohlin. "It has an electric motor but we kept the diesel. The disadvantage of electric mobility is flexibility impairment. If we run it on electricity we need to have the cables connected, which limits its action range. When it needs to do a longer movement, for instance when blasting, then we switch to the diesel engine. During a normal working day, when it is dedicated to loading the primary crusher, then it can run fully electric via the cable connection."

until they are in full development their final price will be unknown. They are likely to be more expensive to buy than their diesel equivalents but should work out significantly cheaper on total cost of ownership. In terms of future efficiency and emissions, the trial has been viewed as a big win by all concerned and serves as a glimpse of what is possible in the future.

BELOW: **The dumpers use GPS to navigate the work site and be recharged**

"Over 10 weeks we've made incredible progress, learned a lot and seen huge potential in the Electric Site solution's environmental, efficiency, safety and cost benefits," says Müller. "In fact we have decided that we want to learn more, so we have extended our test period with Skanska. The results we have seen so far confirm that this research project is a step toward transforming the quarry and aggregates industry and creating emission-free quarries."

"A mixture of perspectives and competences has really made this possible," says Anders Danielsson, president and CEO of Skanska. "We've ended up with all these people from two different companies. The partnership rests on the shared values of the two companies and working in the project you can really feel values pointing in the same direction. We need a greater push on sustainable solutions. The power of this partnership will make these goals a reality." **iVT**

40%

Reduction in overall labor costs

On the Web

See video footage from the Electric Site at **www.iVTinternational.com/electricsite**


The future belongs to those bold enough to shape it
Hall
A3.125
& Hall A2.103
For some, the future is a far off place. But for those who are passionate about smarter and more sustainable solutions, Danfoss is already there — making sure you're prepared for what's next in industrial vehicles. Like ergonomic cabin design. Electrification. The Industrial Internet of Things. Connected solutions. And autonomous operation. Because we're driving the digital transformation of the off-highway industry and take a fully comprehensive approach, Danfoss is ready to help you take on challenges you haven't even seen yet. With ideas and innovations the world has only begun to imagine.
bauma
APRIL 8-14, 2019, MUNICH
Stop by our main booth in Hall A3.125 and in bauma Digital Hall A2.103 so we can start collaborating on your tomorrow – today.
ENGINEERING TOMORROW
Danfoss

RACHELLE HARRY, IVT INTERNATIONAL

New heights

THE NEW SERIES III IS JCB'S FINEST RANGE OF AGRICULTURAL LOADALLS TO DATE. WITH FEATURES INCLUDING A STATE-OF-THE-ART CAB AND DUAL TECH TRANSMISSION, THE VEHICLES ARE SET TO BE GO-TO MACHINES FOR ANY AGRICULTURAL APPLICATION

JCB prides itself on having created the Loadall telescopic handler 41 years ago. It was a hit with farmers because it provides mechanized materials handling, so improving the productivity and cost-effectiveness of operations. Since 1978, JCB has continuously enhanced the Loadall design with its latest engines, smart hydraulics and advanced transmissions.

This year, JCB is launching its new Series III Loadall range comprising six agricultural telescopic handlers. The release follows five years of research and development, and an investment of £8m (US$10.3m).

Four of these new machines have up to 200kg (441 lb) increased load capacity compared with their predecessors. Each model is respectively named according to its lift performance: the 538-60 can lift 6m (19.7ft), the 532-70 can lift 7m (23ft) and the 536-95 can lift 9.5m (31ft).

Other new models in the range are the 560-80, which has an 8m (26ft) lift height and 6 metric ton lift capacity – the same as its predecessor; and the 536-70 LP, which has a low-profile cab for low-height farming applications.

Each model will be available in Agri, Agri Plus, Agri Super and Agri Pro variants and will have different features and equipment options for different agricultural applications.

The Series III Loadalls have been subjected to thousands of hours of customer evaluation, 50,000 hours of operator testing and 10,000 hours of machine testing, including shaker rigs, door slam rigs, and climatic chamber testing.

New features of the Series III agricultural Loadalls are a result of the company's extensive research and feedback from its buyers. "We go out and talk to our customers," says Tim Burnhope, chief innovation and growth officer at JCB. "We've learned that to be a good innovator,

US$10.3m
The amount JCB invested on the Series III Loadall

ABOVE AND INSET: **The new cab now has 12% more space than its predecessor**

you have to listen and write down the responses.

"We also use technologies such as GoPro cameras – we film how the machines are used, and how people climb into and out of them. As a company, we are never content. We keep on asking, how can we make our machines even better?"

For the cost-conscious customer

Importantly, with its new vehicle range JCB wanted to deliver fuel efficiency to cost-conscious farmers. It has done this with its 4.4-liter and 4.8-liter EcoMax engines that have been at the heart of its agricultural Loadalls for the past 10 years. Thanks to LiveLink tracking telematics, which have tracked and analyzed nearly 2.5 million machine hours from farms around the world, JCB has managed to achieve a fuel efficiency of 5.97 liters per hour. This translates to up to 15% less fuel usage than its predecessor.

The vehicles also use JCB's AgriPro dual technology VT (variable transmission) gearboxes, which operate with both hydrostatic/powershift transmissions, both of which are capable of delivering up to 40km/h (25mph). This enables the vehicles to be driven with hydrostatic transmission combined with the benefits of powershift transmission. "We talk to our customers and ask them what their biggest challenges are," says Burnhope. "Comments from farmers, such as 'Farms are getting bigger' and 'We're traveling more distances in our machines', inspired us to create our tech VT gearbox."

"AS A COMPANY WE ARE NEVER CONTENT. WE KEEP ON ASKING: HOW CAN WE MAKE OUR MACHINES EVEN BETTER?"

Tim Burnhope, chief innovation officer, JCB

To maximize productivity in its Loadalls, JCB has included its smart regenerating hydraulics, which enable JCB machine booms to be lowered quickly and safely, thereby maximizing productivity.

"Combine JCB's smart hydraulics, its latest drivetrain and its EcoMax engines, and the result is one of the safest telehandlers in the world," says Burnhope. "Series III vehicles feature JCB's patented, adaptive load control system that controls hydraulic operation to ensure optimum machine stability at all times. All this innovation is neatly packaged within the machines' robust steel structures with their one-piece chassis to maximize strength."

Capacious cab

Arguably, one of the most appealing features of the Series III agricultural Loadalls is the Command Plus cab.

THE FULL RANGE

JCB's new Series III Loadall range consists of six new models to suit a variety of agricultural applications

532-70
Max. lift height:
7m
Max. lift capacity:
3.2 metric tons
Max. engine power:
TBC

536-95
Max. lift height:
9.5m
Max. lift capacity:
3.6 metric tons
Max. engine power:
TBC

538-60
Max. lift height:
6m
Max. lift capacity:
3.8 metric tons
Max. engine power:
TBC

542-70
Max. lift height:
7m
Max. lift capacity:
4.2 metric tons
Max. engine power:
TBC

560-80
Max. lift height:
8m
Max. lift capacity:
6 metric tons
Max. engine power:
TBC

ABOVE: **The new JCB Loadall range builds on over 40 years of heritage – the first ever model was launched in 1977**

"We have developed a Loadall cab that isn't just comfortable and roomy – it puts the operator in complete control," says Burnhope. "We spent endless hours improving the cab environment because operators spend endless hours in them."

Impressive statistics

First announced in January 2019, the Command Plus cab racks up impressive stats. The structure has more width and depth increasing volume by 12% compared with its predecessor. Entry/exit space is improved with an adjustable steering column that can be pushed away by the operator, and locked into a memorized working position.

There is now 60% more dedicated storage space inside the cab. This includes more holders for the operator's personal items, as well as lift-out bins, ultimately enabling the driver to operate the machine in a more spacious environment.

Cab comfort is enhanced with temperature regulation. A rapid de-mist and defrost function enables operators to quickly clear the screen of frost and mist – 66% faster than older cabs – and completely new air-conditioning and auto climate controls, with a 10% increased airflow, means multiple temperature settings can be remembered according to user profiles.

For consistency, the new cab features JCB's Command Position controls. This standard feature allows drivers to easily transition from old JCB vehicles to new models.

With regard to the cab's front screen redesign to increase visibility by 14% upward, compared with its predecessor, Burnhope says, "A single-radius sheet of curved glass would have been the simplest solution, but was rejected because it brought the windshield too close to the driver's face, so we opted for a more sophisticated solution: a multiradius design that maintains a sense of spaciousness behind the wheel without distorting the view out, and provides a continuous field of vision from the low-set bottom edge of the glass to the top edge above the operator's head."

Visibility is also enhanced, especially to the right side of the cab, thanks to the Loadalls' compact engine cover and low-set boom. With clear visibility, the machines can be used safely and productively.

JCB had already received UK orders for the Series III range ahead of its March 2019 release date. Adrian Hall, general manager for Loadall global growth at JCB, says, "This is a pan-European machine, but by the end of the first half of 2019, we'll be extending sales to markets such as Australia, New Zealand and North America."

JCB expects the 538-60 Agri Super, available for £85,323 (US$109,726) will be the most popular, in terms of sales figures, for livestock applications. Meanwhile, the 542-70 Agri Super, which will sell at £93,139 (US$119,777), will be most commonly used for arable applications. **iVT**

SOLUTIONS for EXTREME ENVIRONMENTS

bauma
APRIL 8-14, 2019 MUNICH

Come to visit us:
Halle A5 Booth 309

E-FANS for SMART ENGINE COOLING SOLUTIONS

Sealed, High Performance, Heavy Duty Brushless Fans & Blowers

Spal provides the market with a wide range of high performance brushless fans and blower, specially designed to meet new generation cooling systems requirements in the off highway industry.
Spal can be a strong and reliable partner in order to increase the systems efficiency in your advanced vehicle design.

Main applications:

- Engine cooling
- Auxiliary and After Threatment cooling
- Engine bay ventilation
- Multi-fans array solutions
- HVAC
- Battery and Electronic cooling

Product features:

- Heavy Duty design
- High vibration and shock resistance
- IP6K9K and IP68 sealed motors
- Integrated fully sealed electronic board
- Extreme lifespan

60TH ANNIVERSARY 1959-2019
SPAL AUTOMOTIVE

INNOVATION & TECHNOLOGY

SPAL AUTOMOTIVE
Via Per Carpi, 26/B - 42015 Correggio - Italy
info@spalautomotive.com - www.spalautomotive.com

MICHAEL DONLEVY, IVT INTERNATIONAL

Dirt rider

THE TA300 ARTICULATED HAULER FROM TEREX TRUCKS HAS JUST BEEN UPDATED WITH A WEALTH OF FRESH ENHANCEMENTS, INCLUDING A COMPLETELY NEW TRANSMISSION, TO ENABLE IT TO POWER THROUGH THE STICKIEST OF SITUATIONS, AHEAD OF THE COMPETITION

276kW
Gross power from Scania DC9 engine (370hp)

Terex Trucks's TA300 articulated hauler was already a serious piece of equipment, but the latest update to the Generation 10 model, which will be showcased at Bauma in Munich this April, has a host of all-new features that makes it faster and more efficient, and reduces service intervals and cost of ownership.

Scott Pollock, product manager at Terex Trucks, had a checklist to tick off with the upgraded machine. "We have four customer requirements – I call them customer buckets – and they remain the same whenever we're developing a product: cost of ownership and performance, productivity, serviceability and operator comfort," he says.

"Obviously it's important to keep the cost of ownership down, and fuel is the number-one priority, with servicing dovetailing into that. Then we look at productivity – this is a six-wheel-drive product that really we call a muck shifter, working axle-deep on ground clearing on major construction sites such as waterways, airports, and so on.

"Productivity links to service access, because we want to minimize the downtime, and therefore maximize uptime. That's then tied into cost of operation, so we need to offer long component lifespans to keep the machine running," he adds.

Operator comfort sounds cosy but it's an important factor in terms of safety, performance and confidence in the vehicle to get the job done. Generation 10 features independent front suspension as

The Generation 10 vehicle features independent front suspension

17.5m³
Heaped capacity (111ft³)

4,000hr
Service intervals – up from 1,000 in previous model

standard, as well as fully enclosed, oil-cooled multidisc brakes to increase safety and stability.

"Productivity was already intact," says Pollock. "The TA300 weighs 28 metric tons, and the rim pull, tractive effort and speed were already important factors. A lot of the improvements were about performance and operator comfort, and we believe we're class-leading for rim pull on this product due to the collaboration between the engine, gearbox and drivetrain gear reduction. Those rim pull characteristics, supported by cross-axle differential locks, will get you out of sticky situations."

Rim pull – the amount of effort that the truck can exert to move the wheels – is one of the most important considerations on a machine such as the TA300.

"We normally have a 2% rolling resistance to overcome, but with mud you could be talking 10%, plus incline," says Pollock. "To be efficient, to maintain speed and productivity, you're looking to overcome 25-30% total resistance, which is the incline plus ground resistance. We've got around 35,000kg [77,000 lb] force available at the wheel. This truck will climb a wall, basically!"

Operator comfort also extends to inside the fully tilting cab, and the latest model has a number of upgrades in this department, too.

"We've insulated the cab, which now has pressurized properties to help with noise levels and pollution, to minimize the ingress dust and dampness," says Pollock. "It also helps maintain insulation so that in cold countries you'll stay warm, while we also have a new air-conditioning system to stay cool in hot conditions."

The technology doesn't end there, as the cab also features a tilt/telescopic steering

"WE'VE INSULATED THE CAB, WHICH NOW HAS PRESSURIZED PROPERTIES TO HELP WITH NOISE LEVELS AND POLLUTION, TO MINIMIZE THE INGRESS DUST AND DAMPNESS"

Scott Pollock, product manager, Terex Trucks

SAFIM
Brakes On

BRAKING WITH YOU,
EVER SINCE 1977!

Braking Efficiency | Complying With Mother Regulation
Respecting Environment | Customized Solution

FIND US AT

bauma AGRITECHNICA THE WORLD'S NO.

SAFIM S.p.a | Via D. Livingstone 6 41123 Modena (Italy)
info@safim.it | www.safim.it

bauma 2019
APRIL 8-14 • MUNICH
Terex Trucks
Hall FN, Stand 720/9

55km/h
Top speed (34mph)

MAIN: **Improved fuel usage is one result of the gear ratio spread now being closer**
INSET: **Weighing 28 metric tons, the TA300 offers 35,000kg of force at the wheel**

wheel, an air-suspension seat and anti-vibration mounts. Maintenance is aided by ground-level test points, an electronically raised hood, and a full suite of on-dash diagnostic and machine health check readouts.

Operator comfort doesn't mean relaxing in the cab, however, and crucially Terex Trucks has introduced a new transmission system.

"This was a running change, as last September we moved to the new ZF EP320 range, which gives us eight forward gears and four reverse, where it was six and three before," says Pollock.

"Based on our four customer requirements, this transmission gives us extended service intervals, reduced downtime and cost of operation. We've gone from 1,000 hours of regular servicing to 4,000 hours, helped by filtration and the types of modern fluids we're using inside the transmission."

The extra gears also bring benefits in terms of fuel consumption to help further reduce the cost of ownership.

"The spread of gears is closer, so there are no massive jumps between ratios. That means you're not revving to 2,100rpm before changing gear," says Pollock. "A smaller spread minimizes fuel consumption, and we've calculated that there's a 5% fuel reduction from the previous model to the new model, purely from the characteristics of the new gear ratio setup."

There are two final considerations that are vital in the construction field. "The red line that then runs through all of our customer requirements is obviously safety compliance," says Pollock. "Then there's the environmental aspect as well."

Globally compliant emissions

The TA300 is globally emissions compliant, meeting the requirements of EU and North American legislation without the need for a diesel particulate filter. "We're dropping less oil because, again, we're changing the oil every 4,000 hours, compared with every 1,000 before," Pollock adds.

"There's 55 liters of oil in the gearbox that we used to dispose of after every 1,000 hours. Increasing it to 4,000 hours means, on average, it needs to be changed every two years now. It's a nomadic machine – it may do 60 hours one week and 20 hours the next week, depending on what contract it's on. But that's the average, and it's a big leap." **iVT**

"THE SPREAD OF GEARS IS CLOSER, SO THERE ARE NO MASSIVE JUMPS BETWEEN RATIOS. THAT MEANS YOU'RE NOT REVVING TO 2,100RPM BEFORE CHANGING GEAR"

Scott Pollock, product manager, Terex Trucks

Read our exclusive interview with Terex Trucks managing director Paul Douglas on page 26

The complete Control in the palm of your Hand

SLIMTITAN

7” rugged touch screen display

M-CLUSTER

Deep innovation on traditional cluster

DASHCONTROL

Ergonomic and multifunction CANBUS control encoder

KEYCAN

Modular CANBUS keypad

The new line of Ama Instruments devices has been engineered for all applications requiring compact and maximum versatility along with high performance and structural strenght. Thanks to its innovative and minimal design, the whole range of instruments by Ama Instruments fits different applications perfectly.

ama INSTRUMENTS

VISIT US AT bauma

HALL A6
STAND 512

AMA INSTRUMENTS - Via Repubblica, 7
41011 Campogalliano (MO), Italy

T. +39 0522 636911
F. +39 0522 695753

www.amainstruments.it
info@amainstruments.it

The Curtis Difference

We make it easy

Design engineers of electric and hybrid vehicles who require energy efficient control of PMAC or AC induction motors now have it easier than ever. The new Curtis dual-microprocessor AC Motor Controller Model 1239E offers a highly cost-effective combination of superb power and torque, smooth performance and expansive functionality – and is remarkably easy to use.

Easy from A to Z

Curtis will support your engineering team at every step in the vehicle's development from initial prototype design through to production release.

Easy to Integrate

Suitable for electric and hybrid vehicles with a maximum battery voltage of 170V. Incorporates an isolation barrier for 12V logic and an isolated CANbus port.

Easy to Program

The proprietary Curtis VCL (Vehicle Control Language) allows vehicle developers to utilize all available I/O and create custom logic functions.

Easy to Configure

Configurable CANbus connection allows high-speed communication with Battery Management Systems and Vehicle Control Systems.

Easy and Versatile Control

The Curtis Model 1239E is able to control Synchronous PMAC and Induction motors for pump, traction and on-engine hybrid applications.

See for yourself. We are ready to help you.

www.curtisinstruments.com

CURTIS

e series

The Curtis Difference

You feel it when you drive it

ELIZABETH TOWNSEND, CURTIS INSTRUMENTS

Electric evolution

"IT'S NOT JUST DIFFERENT – IT'S UNIQUE": HOW ONE MAN'S VISION CHANGED THE OFF-HIGHWAY INDUSTRY BY DELIVERING ECOVOLVE, THE WORLD'S FIRST PEDESTRIAN-OPERATED ELECTRIC DUMPER

RIGHT: **The electric dumper is powered by an AC motor controller**

1,500kg
Maximum load of the largest model, the Ecovolve ED1500 (3,307 lb)

Engineers in the Republic of Ireland are brimming with ideas and innovation, and Sean Breen epitomizes this entrepreneurial spirit. Having spent most of his working life in the construction and demolition sector, Breen's lightbulb moment came to him when he identified a gap in the market for an electric-powered dumper.

Throughout his 10-year ownership of Ireland's largest electric plant hire company, Ecoplant, based in Ballybrittas, County Laois, Breen has gathered a wealth of expertise on plant hire equipment such as floor and wall saws, diggers, compactors and remote-control demolition machines. While working on various contracts around Europe, descaling concrete kilns for example, he observed that once the plug-in power tools had done their very efficient job, the only way to

bauma 2019
APRIL 8-14, 2019 • MUNICH

Curtis Instruments
Hall B5, Stand 214

Ecovolve
Hall FN, Stand 1118/7

11hp
Maximum power output of the ED1500 (8kW). The ED800 and 1000 are 7hp (5kW)

remove the debris was to rely on a much more unwieldy and centuries-old combination of tough manual labor, scaffolding planks and wheelbarrows.

"We needed a cleaner, emissions-free way of getting waste off-site and into the removal skip and I looked at the possibility of using electric forklifts or mortar bins on pallet trucks," says Breen, "but even with these it was a slow and laborious process. And using machines not 100% designed for the job never has a satisfactory outcome – small forklifts, for example, can't cope with rubble-strewn surfaces. So I went in search of a low-profile electric dumper but was amazed to find that there was nothing of the kind on the market. I thought to myself, 'You'd better go and invent one!'"

This was a few years ago, but Breen and other colleagues in the industry were convinced he was onto a winner concept-wise, particularly as the move toward electric power was already gaining pace in the construction sector. But it was a steep learning curve for Breen, who had not anticipated the workload that goes into developing a brand-new product and bringing it to market. He also realized that he was going to need expert help to get the project off the ground.

"I WENT IN SEARCH OF A LOW-PROFILE ELECTRIC DUMPER BUT WAS AMAZED TO FIND THAT THERE WAS NOTHING OF THE KIND ON THE MARKET. I THOUGHT TO MYSELF, 'YOU'D BETTER GO AND INVENT ONE!'"

Sean Breen, managing director, Ecovolve

A collaborative effort

"Due to my experience, I knew what I wanted from a design and hardware point of view and the features I wanted to incorporate," says Breen. "I was basically looking at a combination of a pallet truck and high-tip dumper, with three wheels to guarantee maneuverability and lower energy consumption compared with a four-wheel model. It needed to be of compact size with a small turning circle to access doorways and underground sites and to work under low ceilings, with a steering system designed to avoid marking floors after operation. Low noise, fume-free and versatile indoor and outdoor operation were also on the wish list."

Armed with a blueprint for the newly named Ecovolve, Breen contacted the government agency Enterprise Ireland, which put him in touch with Ray Teehan (Selective Engineering Ltd) and Dublin City University (DCU) Invent, which works with Irish and multinational companies to identify new product opportunities. This led to a meeting

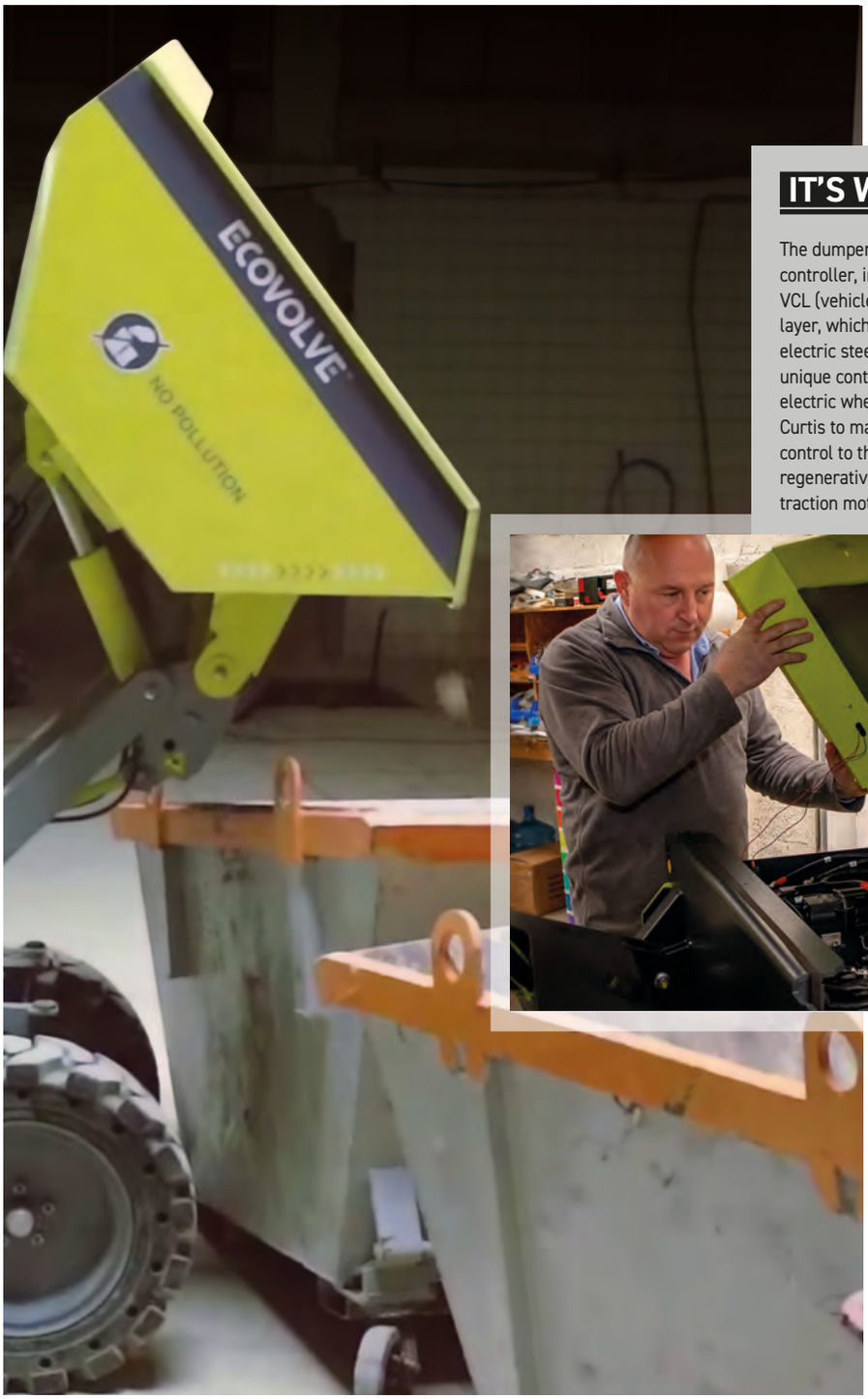
IT'S WHAT'S INSIDE THAT COUNTS

The dumper uses a Curtis AC motor controller, incorporating the proprietary VCL (vehicle control language) application layer, which enables the easy integration of electric steering, battery management and unique control of proportional controlled electric wheel brakes. The VCL enabled Curtis to map the proportional wheel brake control to the automatically controlled regenerative braking current used for the traction motor. The steering controller enables dynamic control depending on dumper speed and mode selection. The steer-by-wire components, including tiller head control and steering sensors, are standard stock items from the huge range of EV components that are held by Curtis in Northampton, UK.

Any new product in the construction sector needs to adhere to stringent safety standards and ensure ergonomic and therefore stress-free operation, and the Ecovolve range more than meets the current criteria. Having access to the steered wheel position via the 1222 CANbus messaging enables dynamic reduction of the traction speed when turning, automatically reducing the risk of loss of control or stability. The industry-proven tiller control gives traction and hydraulic control at the touch of a button or lever. This makes for an intuitive drive and reduces driver fatigue. Sensors on the truck's platform are read by the master controller and change the speed of the truck to accommodate walk-behind or ride-on operation.

On the Web

Watch the Ecovolve ED1000 in action at **www.iVTinternational.com/ed1000**



MAIN IMAGE: **The emissions-free dumper is ideal for indoor use**

INSET LEFT: **The brainchild of the Ecovolve is managing director Sean Breen**

BELOW LEFT: **The machine is the only low-profile electric dumper of its type available today**

with Kerry Green and David Wilkes from Curtis Instruments, which had been recommended to Breen by a German manufacturer of rear-wheel-drive units used on other pieces of equipment. "I knew I was going to need input from electric vehicle specialists," says Breen, "and the initial meetings with Curtis proved to be very positive. There were other companies willing to supply certain individual components, but I wanted to deal with a partner such as Curtis that could build a complete package, tailor-made to our specific requirements for this unique product, and I didn't consider an off-the-shelf product to be viable."

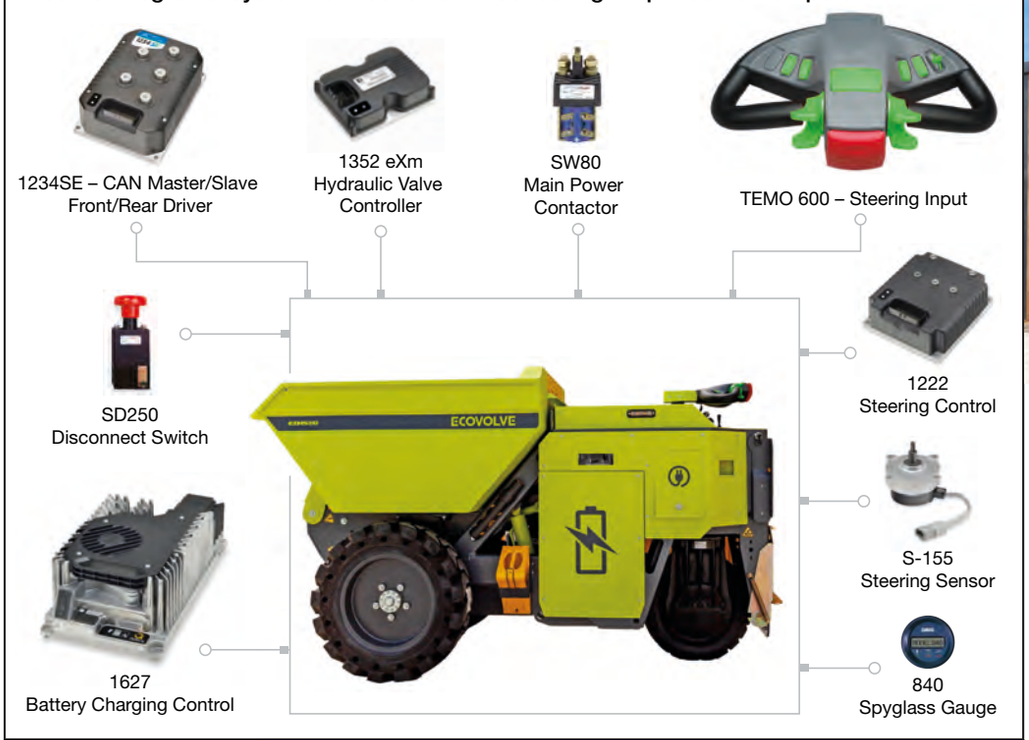
Beginning the build

After building an 'empty shell' prototype, Breen got together with the engineering support team from Curtis Instruments, who set about designing the systems required to get the Ecovolve operational. "This is when we realized this could all actually work," says Breen. "Many projects end up running out of steam, but thanks to Curtis's industry knowledge, technical support, and the willingness of the staff to put in the time and effort, we managed to move from concept to reality."

"From our point of view, we like to get involved in a new project as early as possible," says Kerry Green, director of European support engineering for Curtis. "This makes it easier to streamline the process from the beginning and avoid a customer going down potential blind alleys before having to retrace their steps. We advised Sean on the optimal system components, to meet performance and cost, and then designed the entire traction, electric steering and battery management control system for the Ecovolve dumper.

"A major advantage from a customer's point of view is that as well as identifying and supplying the required components, we also write

Curtis Integrated System for Ecovolve ED Series High-Tip Electric Dumpers



"A MAJOR ADVANTAGE FROM A CUSTOMER'S POINT OF VIEW IS THAT AS WELL AS IDENTIFYING AND SUPPLYING THE REQUIRED COMPONENTS, WE ALSO WRITE AND SUPPLY THE SYSTEM APPLICATION SOFTWARE"

Kerry Green, director of European support engineering, Curtis Instruments

ABOVE: **The electric steering and hydraulics are controlled by system application software**

and supply the system application software, which integrates the hardware and software of the entire vehicle control system and plays a key role in managing the electric steering and hydraulic control functionality. It is the interplay between components, the software and application layers that enable new products like this to come to life and stand out with unique features."

Real-world deployment

The successful collaboration between Breen and Curtis resulted in the 1 metric ton capacity Ecovolve Electric Dumper model ED 1000 being launched in 2015. The first ED 1000 was used during the construction of Crossrail in London, where it worked in the narrow confines of newly created tunnels. This was the perfect construction project for Ecovolve to prove its worth in an environment where IC-powered equipment is not allowed. The tight turning circle of just 1.65m (5.4ft) enabled the operator to maneuver easily around rubble and other equipment.

Two further models were subsequently added to the range: a lighter-weight ED 800; and the higher-capacity ED1500, which was unveiled at Bauma Munich in 2016. The ED1500 employs a constant all-wheel-drive system with electric power steering using drive-by-wire technology. For this model, a second AC traction controller is used that is a CAN slave to the master traction controller. The use of the Curtis Dual Drive technology using the integral CANbus considerably reduces the wiring and increases machine safety, while also calculating the electronic differential for the wheel speeds.

The smallest model is less than 1m (3.3ft) wide, the largest less than 1.2m (3.9ft), making the entire range ideal for work in tight spaces. The high-frequency battery chargers use advanced battery management algorithms to ensure optimum efficiency and low-cost operation, providing enough power for a whole shift on an eight-hour charge for the ED800 and 10 hours for the ED1500.

Ecovolve's products are working on refurbishment projects, hospitals, department stores, cold storage facilities, food processing factories and shopping malls, mainly in the UK and the USA, but also further afield in such far-flung locations as Australia and Dubai. As well as still running his original plant hire business, Breen is devoting a lot of energy to promoting Ecovolve at various trade fairs around the world and is recruiting new dealers to spread the word on these clean, green, electric machines.

"My industry needs to embrace electric power and I am very pleased with the response we have had to this unique new product," says Breen. "A lot of credit must go to Curtis, as without their know-how, this project could well still be at the drawing board stage." **iVT**

Elizabeth Townsend is a technical writer based in Leamington Spa, UK. liz@avenue-pr.co.uk

bauma
Hall A4, Stand 249

Eberspächer & Kalori: Your strong partners for heating and cooling

We at Eberspächer are significantly expanding our expertise as a thermal management system supplier by acquiring climate control specialist Kalori SAS – after all, effective vehicle climate control comprises both heating and cooling components. Our larger product portfolio will offer you all services for comprehensive climate control in driver's cabs and transport compartments, as well as engine pre-heating, from a single source – for construction, agricultural and forestry machinery and many other applications. Worldwide.

Eberspächer climate control products – the right temperature for every requirement.

A WORLD OF COMFORT

Eberspächer

www.eberspaecher-climate.com

bauma 2019

ON APRIL 8-14, THE CONSTRUCTION VEHICLE WORLD WILL DESCEND ON MUNICH FOR THE WORLD'S LARGEST CONSTRUCTION TRADE FAIR – BAUMA. THIS YEAR ORGANIZERS ARE CONFIDENTLY PREDICTING VISITOR NUMBERS WILL EXCEED 600,000 FOR THE FIRST TIME. BUT HOW CAN YOU POSSIBLY MAKE SENSE OF IT ALL? THE ANSWER LIES OVER THE NEXT 75 PAGES, WHICH WILL GUIDE YOU TO THE VERY BEST NEW VEHICLES AND COMPONENTS ON DISPLAY. SEE YOU IN GERMANY!

Global vill

age

RACHELLE HARRY, IVT INTERNATIONAL

Get ready for bauma

IN THE RUN-UP TO THE MAIN EVENT, EXHIBITION DIRECTOR MAREILE KÄSTNER EXPLAINS HOW THE CONSTRUCTION TRADE FAIR WILL HELP TO ADDRESS TOPICAL ISSUES SUCH AS DIGITIZATION AND THE SKILLS SHORTAGE – AND WHY ALL ATTENDEES SHOULD VISIT THE SELFIE TOWER!

As construction industry professionals eagerly await the Bauma 2019 trade fair, *iVT* caught up with its organizers to find out why this year's event is set to be bigger and better than the last show in 2016.

"I'm very excited about this year's Bauma event – and optimistic," says Mareile Kästner, exhibition director for Bauma Munich. The event, which runs every three years, is taking place from April 8-14, 2019, at the Messe München trade halls in Munich, Germany.

"The industry is booming and this is reflected in the growth of Bauma," says Kästner. "We expect the event to set new benchmarks for the industry in 2019. With two new halls and optimized layout planning of the outdoor areas, Bauma will now take up an area of 614,000m² [6,610,000ft²]. The 2016 event took place across 605,000m² [6,512,000ft²]."

This increase in size is due to the high floor space demand from exhibitors, as well as changes that are taking place in the industry.

"We're expecting approximately 3,500 exhibitors from almost 60 countries to attend – that's almost 100 more than in 2016," says Kästner. In addition to exhibitor numbers, 2019 visitor figures are expected to exceed previous years too. "We want to pass the 600,000 visitors mark to retain our title as the world's biggest construction trade fair."

This year, exhibitors will also be coming from an increasing number of countries. By way of comparison, in 2016 37% of exhibitors were from Germany and 63% were from the rest of the world. The top five exhibiting countries outside Germany were Italy, China, Turkey, the UK and the USA.

"This year we have also optimized the event's structure so that visitors can easily find their way around," says Kästner. "Construction machinery will be extended to five halls, we will have a new lifting equipment area in Hall C4, and formwork and scaffolding will now be in Hall B3 and in the large north outdoor area. Digital topics from the industry will be shown separately in Hall A2."

New features

This year's Bauma will include new highlights for visitors to attend. One such feature is the virtual reality experience in Hall B0 that will bring a construction site right into the trade fair. In addition, "visitors should scale the Selfie Tower in the northern part of the outdoor exhibition area to enjoy the view of the site", says Kästner. "I will definitely be taking part in that!"

If that's not enough – and if April seems too long to wait until the event commences – future attendees can visit www.bauma.de/trade-fair/at-the-fair/webcam to watch the progress of the show's setup.

At Bauma 2019, the largest outdoor exhibitor space has once again been claimed by Liebherr,

“BAUMA IS MORE THAN JUST AN EXHIBITION. IT IS WITHOUT DOUBT THE MOST IMPORTANT CONSTRUCTION INDUSTRY TRADE FAIR IN THE WORLD”

Mareile Kästner, exhibition director, Bauma Munich

600,000

The approximate number of visitors expected to attend Bauma

2019 INNOVATION AWARDS

Who’s been nominated?

The winners in each category of the Bauma 2019 Innovation Awards will be announced during the event.

MACHINES

Herrenknecht AG
Innovation: E-Power Pipe

Liebherr-Werk Biberach GmbH
Innovation: 370 EC-B Fibre

Wirtgen
Innovation: Large milling machine with Mill Assist

COMPONENT AND DIGITAL SYSTEMS

Bomag
Innovation: Bomag Ion Dust Shield

Doka GmbH
Innovation: DokaXact – the positioning system for wall formwork

Moba Mobile Automation
Innovation: AVE-TM Layer Thickness Measurement

CONSTRUCTION WORK

Bauer Spezialtiefbau
Innovation: B-project

Max Bögl Stiftung & Co. Worldwide
Innovation: The Mobile Fabrication

Ed. Züblin, Direktion Stuttgart
Innovation: Innovative construction techniques for building in the future

RESEARCH AND SCIENCE

TU Bergakademie Freiberg, Institut für Aufbereitungsmaschinen
Innovation: Conti-E-Impulse Comminution

TU München, Lehrstuhl Materialfluss und Logistik
Innovation: Driver guidance 4.0

Karlsruher Institut für Technologie (KIT)
Innovation: Defined removal of highly reinforced concrete

DESIGN

Liebherr-Hydraulikbagger
Innovation: INTUSI (INTeractive USer Interface)

Mecalac Construction Equipment UK
Innovation: Mecalac TV1200

Tracto-Technik & Co
Innovation: Design HDD-System Drill 2019

63%
of Bauma exhibitors come from outside Germany

closely followed by Wirtgen and John Deere. The largest indoor exhibitor space – at 9,000m² (97,000ft²) – will be occupied by Caterpillar.

Awards and presentations

Keeping with tradition, Bauma will once again host an Innovation Awards ceremony. The awards initiative, run by Bauma and key trade associations, will recognize sustainable, cost-effective construction developments that contribute to energy and resource efficiency and/or the humanization of the workplace.

Throughout the duration of the event, winners of the 2019 Innovation Awards (see the full list of nominees on the previous page) will go on to give presentations as part of Bauma's forum program, which is organized by the VDMA (Construction Equipment and Plant Engineering Association) and Messe München. Academics and experts in the construction sector will also give presentations on ideas from collaborative projects that are in operation with industry partners.

"Of course, major trends in the industry, such as BIM [building information modeling], electric mobility and automation will also play an important role in our forum sessions," says Kästner. "And there will be a special focus on mining.

"Moreover, interesting markets will be highlighted to reflect the potential for new business in the region. And finally, applications that use new technologies will be demonstrated."

ABOVE: **Bauma 2019 is expected to have more exhibitors and visitors attending than the 2016 event (pictured)**

iVT 10 BEST NEW VEHICLES AT BAUMA

Over the next 71 pages, we've selected 10 of the best new vehicles that will be on display at Bauma, with other key exhibitor highlights

As well as providing visitors with networking and business opportunities and informative speaker sessions, Bauma will also enable attendees to experience growth and pioneering changes in the industry first-hand.

"It's the event that sets the future direction of the industry," says Kästner. "Bauma is more than just an exhibition. It is without doubt the most important trade fair worldwide for the construction machinery industry."

Industry challenges

Key challenges facing the industry include the shortage of skilled labor, especially in industrialized countries. "Bauma's special Think Big exhibition, presented in the ICM [Internationales Congress Center], will address this topic by presenting information on apprentice-level industry jobs," says Kästner.

In addition to the tightening of environmental laws and regulations, Bauma will recognize and discuss these issues, and explore ways that they can be overcome.

"Changes in the market are reflected in the Bauma trade fair platform. Digitization as a social megatrend is, of course, reflected in the construction machinery, construction material systems and mining sectors."

Yet with the industry developing so quickly, and with Bauma taking place only once every three years, how can the event remain topical – and what can we expect to see at Bauma 2022?

"The experiences that we as organizers will gain during Bauma 2019, as well as the feedback that we will receive from our customers, are extremely important to us," says Kästner. "Planning for the next show will commence the day after Bauma 2019 has finished.

"We are constantly developing our fairs and in fact a few ideas have already been noted for Bauma 2022. But at this stage it's too early to forecast how these challenges will be addressed in three years' time."

Stage V performance
where you need it most

Visit us at

bauma

Hall A4, Booth 336

The **new Perkins® Syncro** engine offers a range of flexible and modular 2.8 and 3.6 litre platforms (45 to 100 kW).

With compact engine mounted aftertreatment, this allows Original Equipment Manufacturers to reduce their engineering and total machine cost.

With you
at every stage

www.perkins.com/stagev

Perkins®

THE HEART OF EVERY GREAT MACHINE

Next-generation hybrid

Komatsu's Bauma stand will feature at least 12 new machines, among a 30-strong line-up. The new launches will include wheel loaders, mini- and midi-excavators, both tracked and wheeled, rigid haulers, and even a backhoe loader – the WB93R-8. But perhaps the most significant will be its all-new HB215LC-3 hybrid crawler excavator.

It was 10 years ago that Komastu launched its very first, iconic, hybrid excavator. The new machine demonstrates the OEM's ongoing commitment to hybrid technology and features Komatsu's most advanced hybrid and powertrain technologies to date, along with an EU Stage IV Komatsu SAA4D107E-3 engine delivering 110kW (148hp), and featuring a selective catalytic reduction (SCR) system with AdBlue to reduce NO_X emissions in line with regulations.

Komatsu's unique hybrid system uses an electric swing motor/generator. The hydraulic power normally needed by the swing system is instead available to power the boom, arm and bucket, helping to improve productivity.

The energy from swing deceleration, which would normally go unused, is captured and stored in an ultra-capacitor for use by the electric swing motor or engine-mounted motor/generator to assist engine acceleration.

"The new HB215LC-3 offers upgraded hybrid and total-vehicle-control systems, to help customers reduce their fuel consumption by more than 20% and improve operating performance, compared with a non-hybrid excavator," says Koenraad Staels, product manager at Komatsu Europe.

bauma 2019
APRIL 8-14 • MUNICH
Komatsu
Hall FM, Stand 713/1

01
ENGINES

bauma 2019
APRIL 8-14 • MUNICH

John Deere Power Systems
Hall A4, Stand 139

AFTERTREATMENT AT STAGE V

Becoming informed about new technology can help ease the transition to Stage V. Many of the relevant technologies have been implemented in both the on- and off-highway markets for some time.

John Deere Power Systems has been employing diesel particulate filter (DPF) technology since Interim Tier 4/Stage IIIB and now has more than one billion hours of experience using DPF in the field.

During those hours, the John Deere engineering team gathered feedback regarding wet hydrocarbon on the DOC exhaust entry (inhibiting the proper amount of heat needed to be generated), low DOC inlet temperature caused by long idle periods or cyclic loading, and operators overriding or disabling automatic regeneration.

John Deere addressed these issues by developing improved exhaust temperature management systems, performance recalibrations, and exhaust insulation to prevent wet hydrocarbon build-up. John Deere also introduced calibrations tailored for burn load, idle and cold ambient conditions to address low DOC inlet temperatures. Lastly, it made regeneration cycles more transparent. This allows the system to run through the cleaning processes without intervention.

John Deere has systematically adopted new technologies and integrated them with field-proven solutions to meet each emission regulatory level, which has led to a DPF solution that is capable of complying with the requirements indicated in the European Commission's emissions regulations.

Currently DPF is the only commercially available particulate filter technology that enables manufacturers to meet Stage V emission requirements. John Deere Power Systems will showcase the technology at Bauma Munich.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **502**

VARIABLE-SPEED FAN DRIVES

For construction customers, gensets are an essential source of power, but can contribute to a unique set of challenges in regard to noise and environmental impact. As most generator sets run at a constant speed regardless of load, the radiator cooling fan is driven directly by the engine. As a result, the fan rotates as fast as the engine and is the primary cause of noise output.

Genpower, a purveyor of rental generator sets for the construction industry, offers generators ranging from 20-2,000kVA, which allows it to accommodate most permanent and rental generator applications. Although the company uses John Deere Tier 3/Stage III A engines, which feature lower carbon dioxide and nitrogen oxide emissions, and sound levels as low as 51dBA, it wanted to bring the noise generation level down even lower.

Genpower teamed up with NPS Diesel to identify ways to reduce generator noise. As a solution, the company installed a Horton variable-speed fan drive, which rotates only as fast as is required to provide engine cooling. Other than in high-load or high-ambient-temperature conditions, the fan runs at a lower speed, resulting in lower noise.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **503**

bauma 2019
APRIL 8-14 • MUNICH

Horton
Hall A4, Stand 245

INNOVATIVE, RELIABLE AND IoT-READY

Hatz will present a milestone in engine development at Bauma 2019. The company will focus on its customer-, application- and service-oriented strategy and present the world's first electronically controlled fuel-injection system and digital control unit for single-cylinder diesel engines in the industrial sector.

Hatz is the first to bridge the gap between today's mechanically controlled engines and the requirements of modern, digitized companies. With its E1 technology, Hatz enables light equipment – mobile lighting towers or generators, for example – to be propelled into the era of the Internet of Things (IoT). The preconditions for digital solutions in this equipment class are thus achieved for the first time. With this technological basis, the phase of solution adaptation to the needs of machine manufacturers and owners, as well as international service organizations, begins at Bauma.

With the E1 technology, Hatz continues its tradition of innovative developments, which the engine specialist has demonstrated most impressively since the start of the 20th century. This includes, for example, the flat seat injector (a significant development in the history of diesel engines), the first diesel engine made of light metal, the progress achieved toward the world's most powerful single-cylinder diesel, 90% sound insulation, and the first industrial diesel following the downsizing principle.

"In all these developments, the quality and ease-of-handling of the engines are harmonized with the needs of the customer and the user. With our new E1 technology, Hatz offers a platform for the next logical step, for the first time integrating machines with small engines into the advancing world of digitization," says Bernhard Richter-Schützeneder, director of sales and marketing at Hatz.

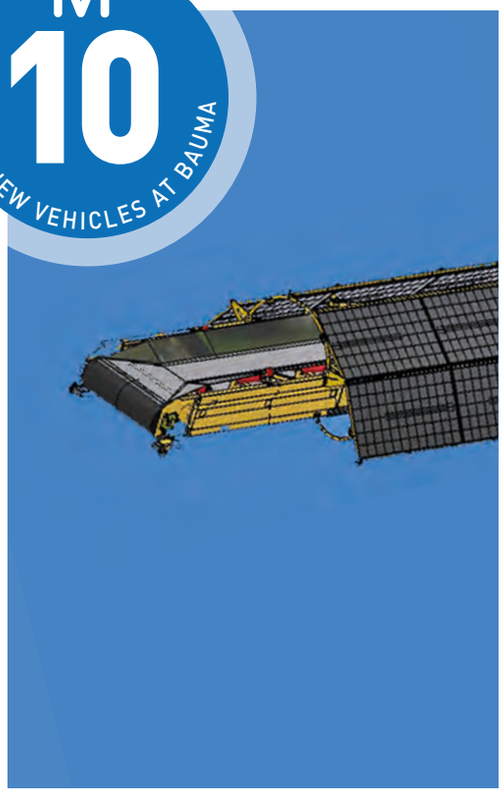
In addition to the air-cooled B and D-series, with E1 technology up to 12kW (16hp), the flagship 3H50TICD and 4H50TICD models of the water-cooled H-series – up to 55kW (74hp) – are also enabled for integration into IoT platforms.

In addition to the electronically controlled B- and D-series with E1 technology, the H-series models and the engines in the mechanically controlled B-, D-, G-, L- and M-series are compliant with EU Stage V and US EPA Tier 4 Final. Consequently, Hatz offers a complete range of engines for use in countries with strict emissions regulations.

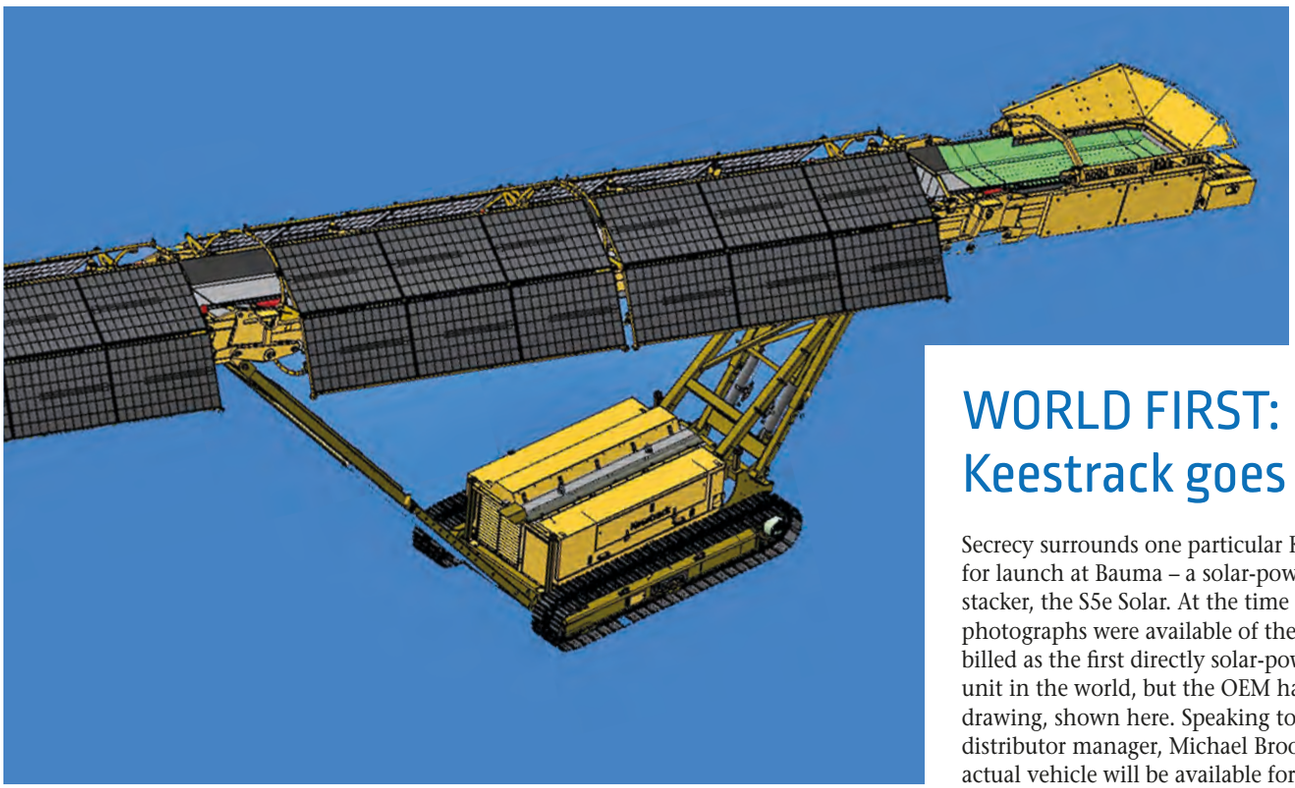
Another Hatz Bauma highlight is the new HDS2 diagnostics solution for electronically regulated engines. HDS2 offers machine operators and partner companies a reliable and convenient way of recording engine data, as well as rapid maintenance and diagnostics, including repair and troubleshooting instructions.

Visitors to Bauma 2019 will find Hatz in Hall A4, Stand 449. In addition to the stand, the company will also be presenting demonstration engines and machines in action on outdoor area 34A.3. This includes engines with the new E1 technology and the use of HDS2.

iVT 10 BEST NEW VEHICLES AT BAUMA



138,929
Number of visitors to Bauma 2016 from the mining sector



bauma 2019
APRIL 8-14 • MUNICH
Keestrack
Hall FN, Stand 1017/1

WORLD FIRST: Keestrack goes solar!

Secrecy surrounds one particular Keestrack vehicle set for launch at Bauma – a solar-powered track-mounted stacker, the S5e Solar. At the time of going to press, no photographs were available of the machine, which is billed as the first directly solar-powered mobile-processing unit in the world, but the OEM had released a detailed drawing, shown here. Speaking to *iVT*, Keetrack's global distributor manager, Michael Brookshaw, guaranteed the actual vehicle will be available for visitors to examine up close in Munich, adding that the company's stand would have a real 'wow factor'.

What Keestrack *has* revealed about the S5e Solar is that it will have a 'sun sail' of photovoltaic panels that will span the length and breadth of the vehicle's 23m (75ft) long conveyor belt. These will generate a maximum 9kWh of power that will feed the system battery with a capacity of 23kWh, installed on the chassis. The conveyor belt (22kW) and the tracks (2 x 15kW) will be directly electrically driven and an electric pump unit (2 x 15kW) will supply the hydraulic lifting cylinders. But the machine will not have to rely solely on solar power in order to function – if there is insufficient photovoltaic power due to poor weather or heavy use, the system can be powered or recharged via available external sources, such as upstream diesel-electric crushers and screens, or via mains plug-in.

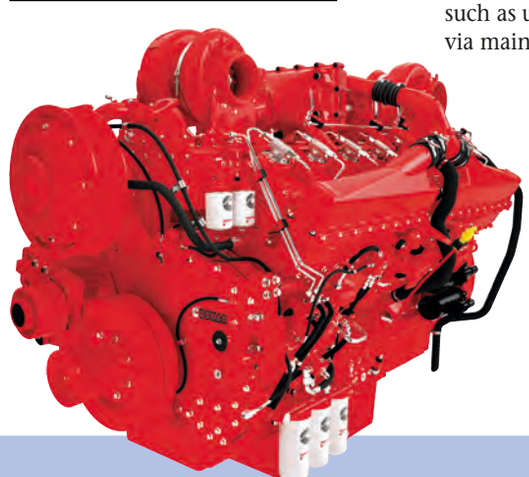
A CENTURY OF ENGINES

Cummins will celebrate its centenary year at Bauma 2019 with a full range of product technologies, including Stage V ultra-clean diesel, electric, hybrid and battery power, displayed on Stand A4.325.

Since unveiling its Stage V construction engines at Bauma 2016, Cummins has achieved more machine installations than at Stage IV, with customers benefitting from product technologies that deliver on average up to 10% more torque and 20% more power (75–321kW/100–430hp range).

Stage V is the first European emissions regulation to impact engines above 560kW (750hp) and Cummins will debut its QSK60 Stage V engine for mining applications at Bauma 2019. The QSK60 comprises a redesigned power cylinder, optimized wastegate turbocharging, and improved crankcase breather system, which works to keep particulate matter below Stage V levels. Cummins' proven modular SCR system reduces NO_x to the required level.

With ratings from 1,398-2,125kW (1,875-2,850hp), the QSK60 is available for excavators and dump trucks, with proven durability of close to 4.2 million liters (1.1 million US gallons) to overhaul.



bauma 2019
APRIL 8-14 • MUNICH
Cummins
Hall A4, Stand 325

ELECTRICAL AND MECHANICAL **HYBRID ENGINE**

Kohler will be presenting the K-HEM (Kohler Hybrid Energy Module) hybrid electrical and mechanical combined power generation unit at Bauma 2019.

In light of the changes that the Stage V emissions directive brought to the off-road applications sector on January 1, 2019, Kohler has added a product to its array that is capable of meeting the new needs of equipment manufacturers in the construction sector.

A variety of energy sources are available on the market. Rather than investigate their different applications and individual characteristics in order to set them up in competition with each other, Kohler has chosen to integrate them, to pair them with each other, so as to reap all their potential value.

This is the philosophy behind K-HEM, the unit that generates power using a combination of a KDW 1003 18-kW diesel engine, compliant with Stage V standards and without DPF, and a 48V electric generator that guarantees 15kW of peak power and 9kW of continuous power.

This means that the unit is capable of providing over 30kW without the need for exhaust gas aftertreatment systems. What's more, K-HEM can operate as a generator for energy accumulation systems.

The features that the K-HEM hybrid unit offers have been designed to satisfy the needs of all those types of equipment that are distinguished by intermittent duty operation cycles that call for power peaks (welders, mowers, tractors with implements, etc) and machines that chiefly run continuous low-load operation cycles (aerial platforms, forklifts, etc), which prevents them from reaching the temperatures necessary for passive regeneration to occur inside the particulate filter.

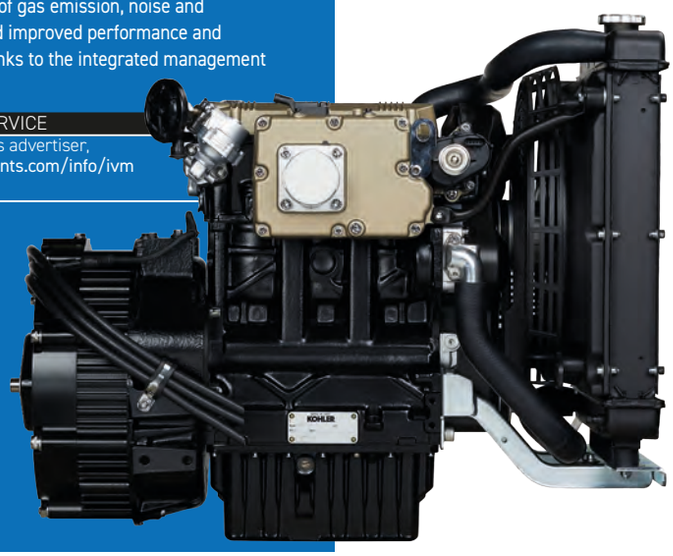
With K-HEM, the power base is provided by the combustion engine, while the power peaks are guaranteed by the electric engine. This system, which complies with the limits laid down in Stage V standards, makes it possible for machines to avoid derating and guarantees high productivity levels. Indeed, the built-in master control unit enables users to monitor and manage working modes and transitions based on their needs.

All this translates into lighter, more compact and better-performing machines than in the past, capable of exploiting all the benefits arising from the integration of mechanical power and electric power: less complex engines; an absence of aftertreatment systems; the ability to store and use excess energy produced thanks to the built-in alternator; energy recovery during braking and exhaust phases; the ability to manage operations using the master control unit; reduction of gas emission, noise and consumption rates; and improved performance and power modulation, thanks to the integrated management of each operation.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **506**

bauma 2019
APRIL 8-14 • MUNICH

Kohler Engines
Hall A4, Stand 225



bauma 2019
APRIL 8-14 • MUNICH

FPT Industrial
Hall A4, Stand 115

A FUTURE OF CONNECTED ENGINES

Smart equipment is the future of the industry and **FPT Industrial** is working in this direction. With the launch of its telematics solution kit, the brand can enable remote monitoring and diagnosis, equipment tracking and fast support. Now it's possible to move from a reactive approach to proactive management of the equipment. In the past, fault management was carried out through component analysis only after an issue occurred, while today assistance can be more effective and engine maintenance can be better managed.

The FPT Industrial telematics kit is easy to install and collects data via the existing vehicular diagnostic ports, sending all information via GSM to a centralized cloud storage. The GSM connection allows users to receive and monitor engine parameters and alerts. Moreover, engine connectivity means it is possible to acquire real-time data from a diverse range of applications, empowering knowledge development and improving customer care. Understanding how machines are used is a further step toward better customer care. It means it is possible to tailor solutions to real customer needs, potentially refining them during the machine's lifetime.

FPT Industrial offers customer service, 24 hours a day, 365 days a year, supporting dealers, service points, OEMs and end-users worldwide. Find out more about the company's latest innovations at Bauma Munich.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **507**

Variable speed fan drives tailored to fit your engine. Perfectly.

Horton has all the capabilities of a global manufacturer with the customer support of a local partner. That means whatever your need, Horton can customize your variable speed fan drive to make sure you're maximizing fuel savings, noise reduction, and getting the most out of your engine. To learn more about Horton's innovative portfolio of fans and variable speed fan drives, visit **HortonOffHighway.com** or email **Contact@Hortonww.com**

HORTON

martin williams

Group Creative Director: **Steve Casey**
Art Director/Designer: **Rio Sponslier**
Copywriter: **Jacob Guenther**
Photo Source: **Shutterstock, Getty Images**
Retoucher: **Ryan Moede**
Prepress: **MW**
Art Producer: **Liz Wingate**
Account Manager: **Jack Beck**
Print Producer: **Bill Schneck**
Project Manager: **Mikki Berscheit**
Production Artist: **Sarah Folkmann**

Horton: **Off Road Ag Ad**
"Variable speed fan drives..."
Pub: **iVT International**

Color: 4/C
BL: 221mm x 281mm
TR: 215mm x 275mm
LV: 195mm x 255mm

Martin Williams Job No: 1HRT8130_Off_EQ35

LASER IS 100%

APPROVALS

DATE	PROOFREADER	PRINT PRODUCER
ART DIRECTOR/ DESIGNER	ACCOUNT MANAGER	PROJECT MANAGER
COPYWRITER	INTERACTION PLANNER	CLIENT

iVT 10 BEST NEW VEHICLES AT BAUMA

bauma 2019
APRIL 8-14 • MUNICH

Caterpillar
Hall FM, Stand 60B.3

Caterpillar aims high

Caterpillar will display a grand total of 64 machines at Bauma – 20 of them new introductions. The over-arching theme, 'Rewrite the Rules', is intended to emphasize the renewed efficiencies and profitability that equipment users gain when partnering with Caterpillar – embodied by three key benefits: choice, connectivity and fuel efficiency.

Key launches for Caterpillar include the new D6 model dozers, and leading the bunch is the Cat D6 XE – the world's first high-drive electric drive dozer. The D6 XE is said to offer up to 35% better fuel efficiency than its D6T predecessor, along with greater productivity levels.

The next-generation electric drive technology means there are no gears to shift, which means operators experience extremely quick earth-moving ability with constant power to the ground, greater agility and faster cycle times.

A choice of Cat Connect Grade technology features adds to ease of operation by helping saving time, material and operator effort.

Caterpillar has also promised the vehicle will feature reduced service times and maintenance costs, and will be available in a broad choice of configurations with updated technologies for next-level versatility and performance.

The powertrain consists of the electric drive, a Cat C9.3B diesel engine, delivering 215hp (161kW), double-reduction planetary final drives and a hydraulic reversing fan. Overall, the machine is expected to emit 23% less CO_2 than its predecessor, the D6T.

ENGINE AND BATTERY **THERMAL MANAGEMENT**

Enterex International's Engineering Centers are focusing on developing innovation and differentiation to provide performance and cost improvement for customers. A substantial amount of R&D is carried out to study and further improve material technologies and designs of thermal management systems – this is crucial considering the off-highway vehicle heat transfer technology.

Challenging operational conditions, which can combine shock and vibration loads and possibility for corrosion, make it necessary to design the cooling system among other components so that it has the ability to perform its required function under stated conditions for a specified period of time. The early integration of concepts such as maintainability and reliability to design are essential.

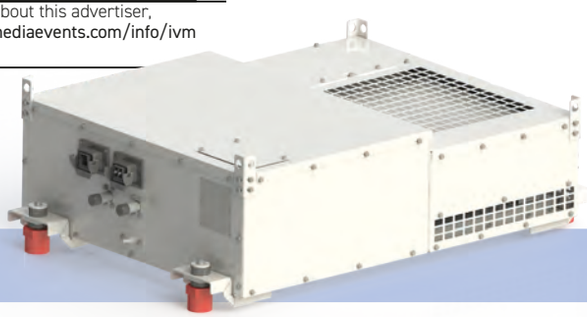
Field reliability experience, along with cumulative damage intelligence, is used to link field conditions to component-specific lab testing. As a result, structural design and strategies around strain reduction and stress minimization enable specific combinations of alloys and component selections to be used in challenging heat exchanger applications.

Enterex has also developed innovative battery thermal management systems, ensuring an optimum thermal working environment and temperature distribution – both having clear impact on battery power and battery life.

Enterex is also launching digitally enhanced tools and data analytics to improve asset lifetime management – thus maximizing asset uptime and minimizing unplanned downtime. Sensor data can be analyzed by artificial neural networks and machine intelligence algorithms. Data analysis enables users to identify preliminary symptoms of upcoming faults, such as leakages, blockages and hydraulics faults.

This is key information for designers and managers aiming to serve the customer. Thermal management in electric vehicles is significant and more demanding than it is for a combustion engine vehicle. Therefore, optimizing the thermal management system for performance and efficiency is an extremely important task.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **508**

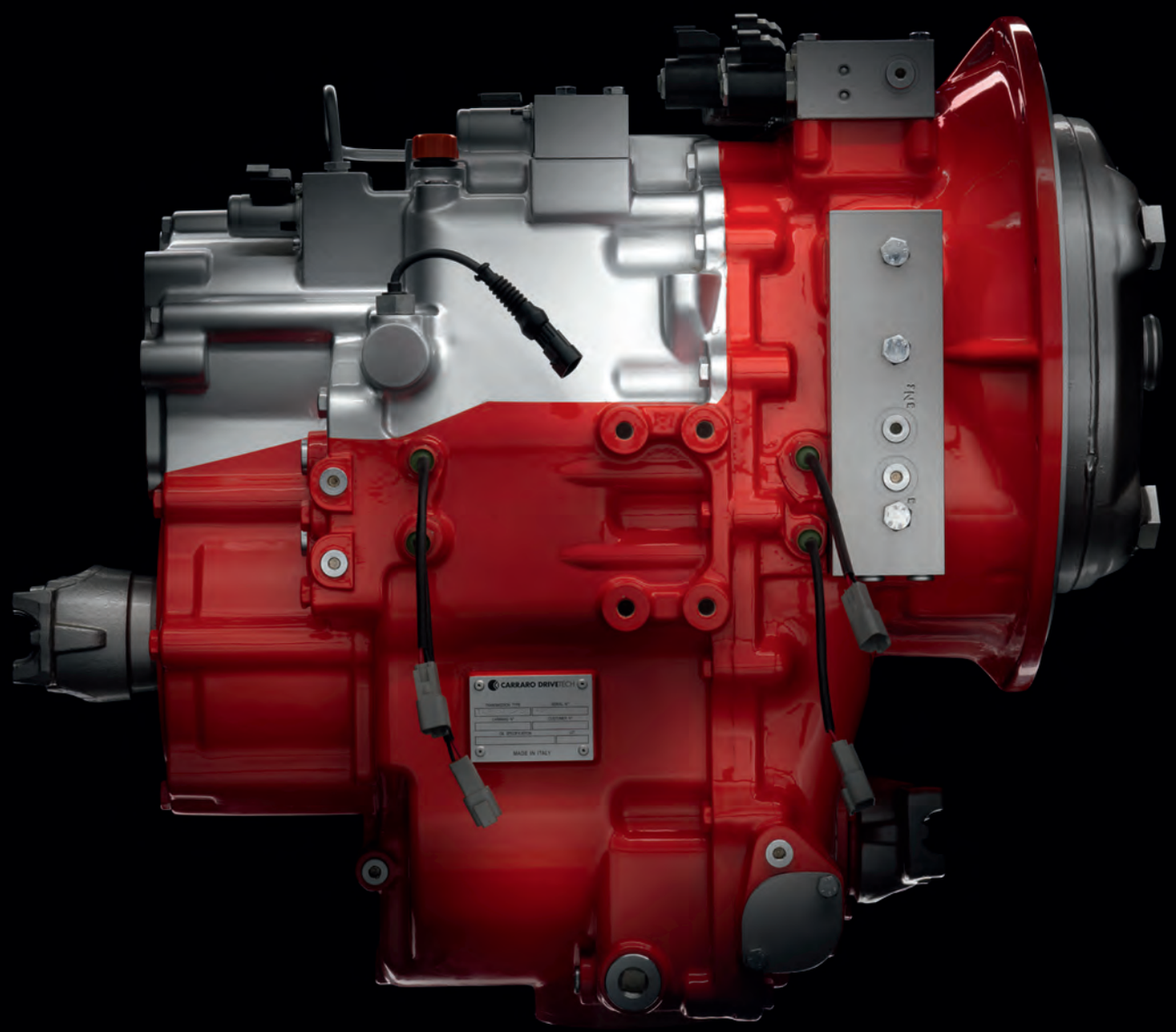


bauma 2019
APRIL 8-14 • MUNICH

Enterex
Hall C1, Stand 429

We know how to do it

Components, Drivelines, Tractors.



bauma

Hall A3, Stand 325

CARRARO

carraro.com

2019 INNOVATION AWARDS

Steering-wheel free

The humble steering wheel. By most, it is seen as crucial in order for any vehicle to maneuver safely and with precision. In fact, it's such a fundamental mobile machine element, that it's difficult to imagine a vehicle – in particular, an industrial vehicle – without one. If a vehicle could somehow function and be steered without an entire steering column, what benefits would this bring? The answer lies with Mecalac's new 'steering wheel-less' compaction roller.

The new TV1200 is controlled with a joystick located on the right console. Thanks to the absence of a steering wheel, the driver's view of the path ahead is completely unobstructed. Access to the vehicle is noticeably easier and space in the seating area is significantly improved, compared with traditional vehicles.

"Compaction rollers normally have a big steering column in the middle," says Benoit Fénéon, product marketing engineer at Mecalac. "This causes problems with accessibility, because the operator has to twist their body to get on. By removing the steering column, the operator has clear access to the machine.

"We have also designed a new user interface that places important vehicle information in front of the driver's eyes. The final result is that the driver is at the center of the machine architecture."

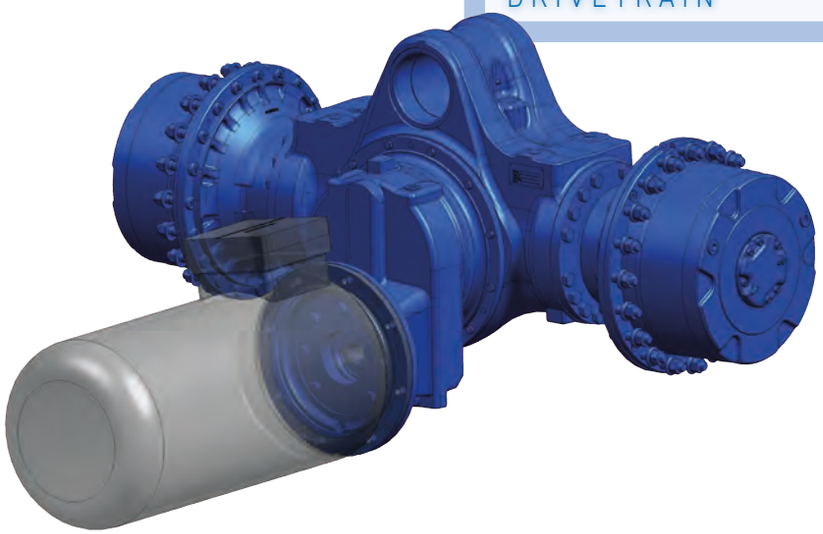
The TV1200 has been nominated for a Bauma 2019 Innovation Award.

bauma 2019
APRIL 8-14 • MUNICH
Mecalac
Hall FN, Stand 919/1

02
DRIVETRAIN

bauma 2019
APRIL 8-14 • MUNICH
NAF Axles
Hall A3, Stand 203

HEAVY-DUTY **DIFFERENTIAL CRANE AXLES**



For more than 50 years, **NAF Axles** has been a specialist in high-performance, heavy-duty drivelines. It presents its newly developed range of directly driven electric axles for crane applications.

The range's design is based on NAF's modular system, which guarantees high flexibility to fulfill customers' needs, as well as providing cost-efficient custom-made solutions.

Presently, the covered load range is 20–70 tons – and this is realized with three axle sizes. Due to NAF's modular system, various solutions in regard to load, width, etc, can be designed.

The driveline is fully encased, to reduce the need for maintenance and prolong its lifespan, compared with legacy systems that have an outside chain drive.

The axles can be equipped with a service and parking brake, a differential lock, and a pivoting point below and above to attach them to the frame.

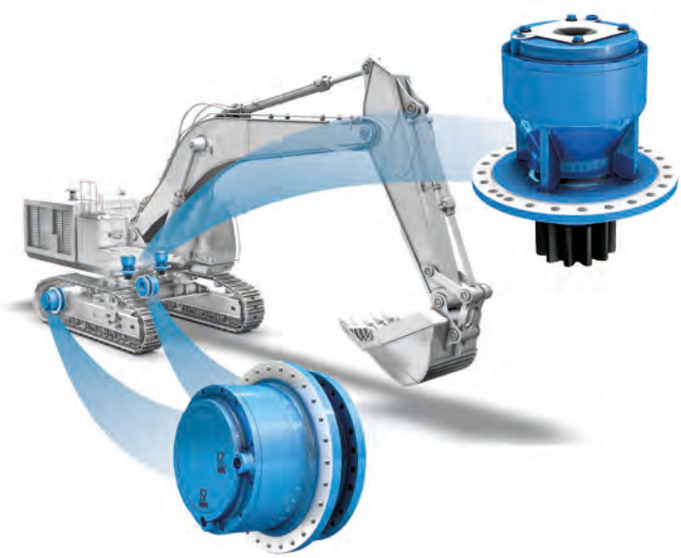
Single- or dual-tire use is feasible depending on environmental conditions and the area of application.

NAF Axles can be modified to be used in 'conventional' hydrostatic drivelines.

The axles are currently used in various harbor crane applications, as well as in rubber tire gantry cranes for container handling or in industrial yards.

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **509**

bauma 2019
APRIL 8-14 • MUNICH
Comer Industries
Hall A3, Stand 225



NEW SYSTEMS ON DISPLAY

Headquartered in Reggiolo, Italy, **Comer Industries** has a strong global presence. The organization is a leader in the design and production of advanced engineering systems and mechatronic solutions for power transmission. Comer Industries supplies its solutions to major manufacturers of agricultural equipment, construction vehicles and renewable energy applications worldwide.

With the opening of its new 15,000m² (161,458ft²) production plant in Pinghu, south of Shanghai, in China, Comer Industries will be able to respond to the demand of the growing Asian market.

As well as creating equipment for major construction applications, Comer Industries is now specifically addressing the excavator segment with its extended range of solutions. As a long-time supplier of high-quality planetary drives, Comer Industries has recently expanded its product range to a include a line of purpose-built slew and wheel drives ideal for the mobile industrial equipment market. Drawing from decades of experience in the high-volume wind turbine pitch and yaw drive markets, Comer Industries' proven technology behind its modular planetary drives is already used in applications such as mobile, tower, crawler and deck cranes, stackers, reclaimers, drilling machines and concrete pumps.

Comer Industries has launched a new series of products perfectly tailored to tracked industrial vehicles – in particular, excavators.

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **510**

SHOWCASING **FANS AND BLOWERS**

bauma 2019
APRIL 8-14 • MUNICH
Spal Automotive
Hall A5, Stand 309

Having worked very closely with major OEMs for many years, **Spal Automotive**, the Italian e-fan and blowers manufacturer, has gained a great deal of experience in heavy-duty applications. The company has been able to translate this into a product range dedicated to the off-highway market. Its products have been designed to meet the most stringent standards for performance and durability.

Together with a selection of fans and blowers, with both brush and brushless motors, Spal will also display its new 1.2kW BLDC fan with a 465mm-diameter blade. The entire display is applicable for work in harsh and extreme environments, and features heavy-duty design, high resistance to vibration, IP68 and IP6K9K certification, slinger hub fan blades for working in dirty conditions, optimized control strategy, low noise, and multiple other features. All products have been designed, tested and manufactured at Spal Automotive's headquarters and plant in Correggio, Italy.

This year, Spal is also celebrating its 60th anniversary. Visit the company at Bauma to talk to its team about distributed electrical cooling systems and to find the right solution for your next-generation cooling systems.

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **511**

bauma 2019
APRIL 8-14 • MUNICH
Twin Disc
Hall C3, Stand 539

POWERING FIREFIGHTING VEHICLES

Twin Disc designs, manufactures and sells marine and heavy-duty, off-highway power transmission equipment. Products offered include: marine transmissions, surface drives, propellers and boat management systems, as well as power-shift transmissions, hydraulic torque converters, power take-offs, industrial clutches, and control systems.
The organization supplies technologies for firefighting services at some of the largest airports in the USA.

Rosenbauer, the world's largest manufacturer of firefighting technology and equipment, builds the Panther Aircraft Rescue and Firefighting (ARFF) vehicles that serve airports including George Bush Intercontinental Airport in Houston, and Los Angeles Airport.

The Panther ARFF vehicles are now equipped with Twin Disc products: the TAD81-4001 8-speed transmission, which meets all of the performance and acceleration requirements for multi-ton vehicles; the TDEC-500 electronic control system, which helps to smooth out the shifts between gears, as well as limiting the torque capacity in high-torque engines in situations where the transmission could be overpowered; and the 8MLW-1758-1 Twin Disc 17in (43cm) torque converter, which accommodates the use of an ultra-high-pressure fire pump without affecting performance.

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **512**

A SOLUTION FOR **HYBRID BACKHOE LOADERS**

The 610X range of wheel drives with electric motors, designed and developed by **Bonfiglioli**, has been specifically created for use with hybrid backhoe loaders. Bonfiglioli 610X is a 2-speed, hydraulically operated drive with dynamic electronic speed shifting and with an integrated parking and service brake. This compact and complete solution means electric motors can be perfectly optimized. Thanks to the integrated speed shift, it always operates at the range speed that guarantees maximum efficiency.

In 2017, Huddig, a leading backhoe loader manufacturer in Sweden, chose this solution on each of the special four-wheel tractions of its new hybrid backhoe loader. A single drive is capable of reaching an output torque of 40,000Nm and is driven by a liquid-cooled 30kW electric motor. The independent control of each wheel allows for better driving of backhoe loaders on slippery surfaces.

The Bonfiglioli 610X drives also increase the precision of the machine that they are operating in, making it easier to maneuver in tight spaces, such as in building sites located in urban areas. Following Huddig's request, Bonfiglioli also designed the four drives to operate quietly.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **513**

bauma 2019
APRIL 8-14 • MUNICH
Bonfiglioli
Hall A3, Stand 337

EXPANDING INTO CHINA

KTR has opened a new cooler production plant in Jiaxing, China. Multimedia coolers for mobile machines and oil/air coolers for stationary hydraulics will be manufactured there.

The development of the first prototypes in the new manufacturing hall covered an area of approximately 9,000m² (96,875ft²).

KTR has invested in state-of-the-art machinery for its new plant. The company expects that 200 tons of aluminium per month will be used in multimedia coolers in construction and agricultural machinery or oil/air coolers in stationary hydraulics.

"In this plant, we will be in a position to produce batches – even small ones – via highly automated processes and at a consistently high-quality level," said Nicola Warning, KRT CEO. "A prerequisite is the close cooperation of KTR's design engineers and developers at its headquarters with its manufacturing specialists in Jiaxing. Engineering of the high-performance coolers will take place in Rheine, Germany, and manufacturing will exclusively take place in Jiaxing."

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **514**

bauma 2019
APRIL 8-14 • MUNICH
KTR
Hall A4, Stand 145

POWERFUL PRODUCTS

After years of development and testing, **PMP** is ready to showcase its latest achievements at Bauma Munich 2019. As well as creating high-tech and high-performance products, the company will now also offer reliable integrated systems and complete solutions designed and developed for specific applications.

PMP will exhibit a range of products at its Bauma stand. Its integrated system for bulldozers comprises a PMC 18.000 gearbox with an integrated PMH MKV 180 hydraulic motor and a PMH P 180 hydraulic pump.

Also on display will be products for tandem rollers: PMH P55 tandem hydraulic pumps; PMCI 2000 travel drives with integrated hydraulic motors; and a PMH MCF 30 hydraulic motor. PMP's aerial platform products showcased will include: PMCI 2000 travel drives with an integrated hydraulic motor; the PMH P35 hydraulic pump; and the PMR 2000 with integrated electric motor.

For mixer trucks, the PMB gearbox with integrated hydraulic motor and PMH P55 hydraulic pump will be shown. Gearboxes with integrated electric motors for forklifts will be displayed too. PMP is a pioneer in working toward a future that combines mechanical, hydraulic and electric.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **515**

bauma 2019
APRIL 8-14 • MUNICH
PMP Promec
Hall A4, Stand 150

1,420+
Journalists and media representatives from 47 countries will be present at the event

bauma 2019
APRIL 8-14 • MUNICH
Vimoter
Hall A4, Stand 144

BRAKES, CYLINDERS AND PEDALS

Brake products for industrial vehicles are at the heart of **Vimoter**'s business. Since 1978, the company has been a globally recognized leader in the design and manufacture of braking systems for agricultural, materials handling and construction vehicles, as well as for a diverse range of industrial applications.

Vimoter's full-system product offering provides its customers with a wide range of standard products and customized solutions to meet their specific requirements. The company's engineers are committed to creating new designs and working prototypes whenever requested, including the brake pedals with pre-assembled master-cylinders.

Vimoter first collects machine and/or vehicle information to determine the most suitable master cylinder for it. Once the valve has been selected, the company makes sure that the pedal is properly designed in order for it to operate in the best conditions.

Finite element method (FEM) analysis is carried out, and following this, the most suitable surface protection treatments are applied, subject to the customer's approval.

The next phase is the production of prototypes that have been subjected to internal fatigue testing.

Another factor that makes Vimoter's work unique is its ability to supply customized solutions, even in relatively small quantities.

The company's modern manufacturing and control operations ensure that it is able to provide its customers with highly reliable products.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **516**

CONTROLLING HIGH TEMPERATURES

In the event of a fire in construction and mining machines, the place where it has started is usually the engine compartment. Root causes could be the high surface temperatures in components such as turbochargers, manifolds and exhaust systems that can reach up to 750°C (1,382°F), as well as the presence of flammable materials such as hydraulic fuels.

There is a movement toward electromobility and alternative drives powered by lithium-ion batteries. Alternative drives offer impressive benefits, but their design requires special fire protection measures to ensure that they are safe when used.

Studies recommend that OEMs minimize possible thermal risks as early as at the design stage. Thermally insulating hot surfaces is ideal.

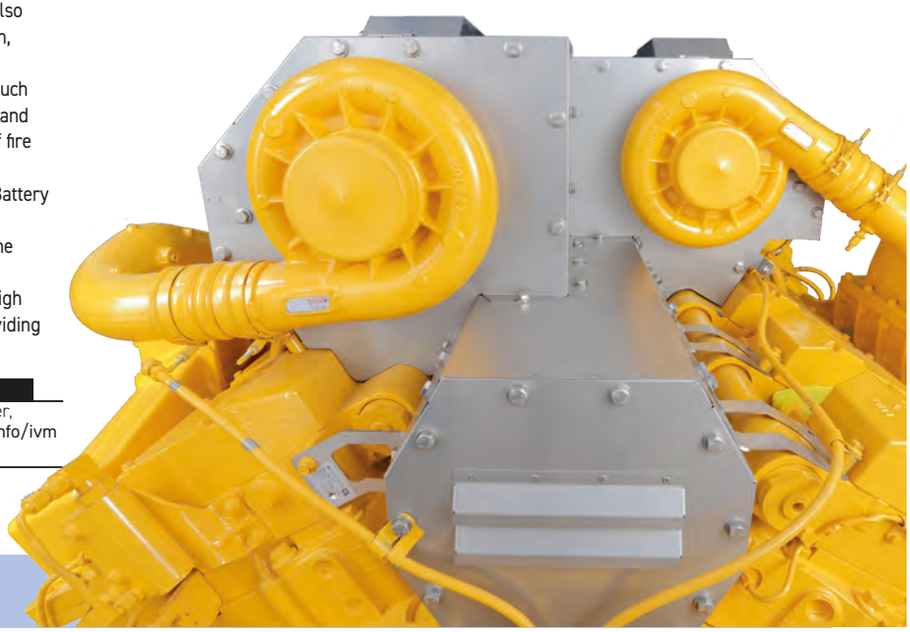
For many years, **Thermamax** has offered insulation systems that efficiently fulfill this task.

Tmax-Insulation Claddings, also available as a retrofitting solution, reduce surface temperatures by encapsulating hot components, such as turbochargers, exhaust pipes and manifolds. As a result, the risk of fire is drastically reduced.

The newly developed Tmax-Battery Housing for lithium-ion systems protects the environment from the effects of thermal runaway, and the battery against the risks of high ambient temperatures, thus providing maximum safety.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **517**

bauma 2019
APRIL 8-14 • MUNICH
Thermamax
Hall A4, Stand 345

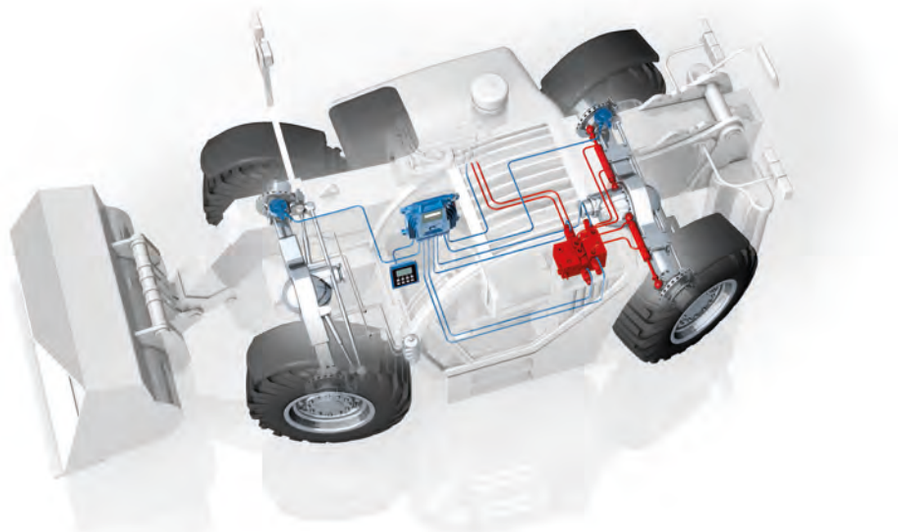


WOLFGANG STADIE

Steering into the future

bauma 2019
APRIL 8-14 • MUNICH
Mobil Elektronik
Hall A3, Booth 115

ONE WAY TO GET A COMPETITIVE ADVANTAGE IN THE CROWDED TWO-AXLE OFF-HIGHWAY VEHICLE MARKET IS TO INSTALL ELECTROHYDRAULIC STEERING – TRADITIONALLY ONLY OFFERED IN LARGER MACHINES, BUT NOW POSSIBLE IN LOWER WEIGHT CLASSES



Electrohydraulic steering systems for rear axles have been standard in commercial vehicles and complex construction machinery for many years. In the case of commercial vehicles, the use of electrohydraulic auxiliary steering is primarily to ensure compliance with the legal requirements. Complex construction machines, such as mobile cranes, must also meet very high requirements for maneuverability, which can only be achieved using electrohydraulic auxiliary steering.

Steering modes such as crab steering, manual steering intervention or automatic rear swing out suppression are standard here, as is the complete power decoupling of the rear axles from the front axle.

Simple construction machines, such as two-axle loaders, usually have hydrostatic front-axle steering (e.g. Orbitrol) and often already rear-axle steering. However, as this is purely hydraulic and may only be switched on manually on the construction site, application possibilities, flexibility and opportunities to enhance operator comfort are very limited.

Mobil Elektronik from Langenbrettach, Germany, has committed itself to providing these smaller vehicles with the same features that are already standard in mobile cranes, with easy, convenient operation. The steering mode can be changed at any wheel position. The synchronization of the axles with each other, using Ackermann steering geometry, is done automatically.

The well-established EHLA Plus auxiliary steering system complies with the requirements of ECE R79 Annex 6, so that it can be approved for use on public roads. This can also be an important prerequisite for smaller construction machines.

The steering system constantly monitors itself. System faults are reliably detected and the driver is informed accordingly. The controllability of the vehicle is always ensured via a defined fallback level.

Assistance features of the EHLA Plus steering system also increase driving stability and safety.

New components

Mobil Elektronik has revised some components of the EHLA Plus steering system to make it attractive for smaller, two-axle vehicles. A newly developed generation of steering safety computers is used. IP Code IP6K9K cabinets mean they can be mounted outside the cabin, where extreme conditions prevail.

Hydraulic components have also been updated to create a compact proportional hydraulic unit with all necessary valves integrated, resulting in less tubing, fewer components and reduced assembly time.

Construction site advantages

EHLA Plus comes into its own on construction sites. Many steering modes are available to maneuver the vehicle in different situations, such as all-wheel steering, crab steering, manual steering of the rear axle, and automatic rear swing-out suppression, which is achieved by means of the rear axle turning later than the front axle. This cannot be achieved with a purely hydraulic steering system.

Flexibility and convenience

In contrast to purely hydraulic steering, the use of electronics makes it possible for individual steering modes, as well as the entire steering system, to be adjusted to the vehicle type or customer requirements. This means that regardless of wheelbases, tire sizes and wheel loads, the components to be installed, such as steering cylinder and steering lever arm, are always the same – a clear advantage in purchasing, logistics and replacement parts management.

The steering modes can either be selected via a Mobil Elektronik control panel, or alternatively via an existing terminal in the vehicle, which is connected to the steering safety computer via CAN.

Further cost savings

The automatic hydraulic centering and locking of the rear axle in exact straight-ahead position when driving on public roads ensures optimum directional stability with minimum tire wear. This is particularly beneficial for rental vehicles.

The hydraulic supply for the rear axle steered with EHLA Plus is provided from the vehicle's power unit. The rear axle steering is completely decoupled from the front axle steering, hydraulically and mechanically. In addition to driving comfort and safety advantages, this also offers cost benefits. The hydrostatic steering (Orbitrol) of the front axle can be designed smaller depending on the required power.

Competitive advantages

The higher costs for the components of the steering system are more than compensated for by savings in mechanical components, shorter assembly times and, above all, by the many operational advantages.

With EHLA Plus, vehicles can be considerably upgraded, leading to competitive advantages for the vehicle manufacturer. **iVT**

Wolfgang Stadie is head of sales and marketing for Mobil Elektronik GmbH

JEFF HERRIN AND MORTEN CLAUSEN

bauma 2019
APRIL 8-14 • MUNICH
Danfoss Power Solutions
Hall A3, Stand 125

Design made easy

RAPID TECHNOLOGICAL DEVELOPMENTS IN THE OFF-HIGHWAY INDUSTRY MEAN MANUFACTURERS MUST INVEST IN ELECTRIC, CONNECTED OR AUTONOMOUS SOLUTIONS TO STAY AHEAD OF THE GAME

The landscape of the off-highway industry is changing. In the past five to eight years, new technologies have emerged that are driving innovation and thoroughly changing the way the industry operates.

From one end, regulations continue to tighten – on emissions, noise, functional safety and others – which requires new, viable solutions to achieve these goals. On the other end, there's a higher expectation for return on investment in off-highway applications. Competition among OEMs is increasing, which places additional emphasis on improving profitability.

These pressures result in solutions that allow machines to be more productive, more efficient and more operator-friendly. The conversation around machine design today is synonymous with emerging technologies, including electrification, the Industrial Internet of Things (IIoT) and autonomous capabilities.

Industry-changing machines

These new technologies are already producing machines that will greatly change the industry. For example, Pon Equipment – a subsidiary of Caterpillar – utilized the Danfoss designed and manufactured Editron electric drivetrain system to develop a fully battery-operated 25-ton electric excavator in 2018. The machine can operate for up to seven hours on a single battery charge under nominal load, produces zero emissions and is significantly quieter than former models.

Of course, there's a learning curve any time new technology is introduced. However, what we're experiencing now is a result of two fundamental technology shifts. One is the shift from hydraulic to electric controls, which leads to increased use of software and digitization. The other is the path to zero-emissions vehicles, which drives electrification and the development of energy-efficient systems.

While it will take years for the transition to more electric solutions to fully take shape, the implications on the industry are immediate. System integrators have spent years building their expertise in hydraulics, which doesn't translate when designing electrics. This means that many OEMs need to adapt quickly with a completely new skill set or run the risk of getting left behind.

ABOVE: **Danfoss Editron can provide an excavator with seven hours operation on a single charge**

At the same time, expectations surrounding how quickly OEMs can get their machines to market have skyrocketed with the rise of digitization. If they can't keep up with the latest simulation tools and design software, competitors could announce the third or fourth generation of their machine while they're finishing the first one.

The complexity of these technologies presents another hurdle. It's almost impossible to gain a comprehensive understanding of all the new software when it changes so rapidly.

Some industry estimates predict roughly two-thirds of today's hydraulic components are mechanically controlled. Yet within the next 5 to 10 years that amount will instead be controlled by software.

Outsource for success

The pace and level of this kind of fundamental change is simply not sustainable for small to midsize OEMs with limited resources. Instead, there are good alternatives for them to source the right tools and capabilities to help ease this transition – let someone else focus on the software and feature development so that they can focus on building the machine.

There's no escaping change. Investing in the right areas now can help OEMs keep pace with that change. And with so many new technologies right around the corner, the software space is where a business model can truly be future-proofed.

One of the most important things OEMs can do in the coming year is spend time creating a roadmap for how they will evolve with the industry. They need to take the time to think through new technologies and competencies and identify where it makes sense to invest in-house or partner up.

It's not only a strategic move to find a long-term partner who can assist in implementing the latest technology – it's a smart move. OEMs who adopt a partner model moving forward will be the ones who can implement new solutions – whether it's traditional hydraulic technology or future electrification solutions – the fastest and most effectively. It could mean the difference between being an industry leader or another trend follower. **iVT**

Jeff Herrin is vice president of R&D, and Morten Clausen is senior director of integrated solutions at Danfoss Power Solutions

POWER TRANSMISSION
FLUID POWER
Divisions

bauma

VISIT US AT **BAUMA 2019**
MUNICH, GERMANY, 8-14.4
HALL **A4**, STALL NO. **150**

COMPLETE SOLUTIONS
FROM A SINGLE SUPPLIER

PMP Industries group
ITALY | INDIA | CHINA | MALAYSIA | USA | BRAZIL
www.pmp-industries.com | sales@pmp-industries.com

Applications image for illustration purpose only.

PMP INDUSTRIES
THE APPLICATION SPECIALIST

INNOVATION LINES

As a result of almost 60 years of experience in the earthmoving sector, **Stucchi** has been able to evolve its products to suit the needs of the market. In recent years, there has been an increasing need to connect hydraulic lines in order to achieve higher flow rates. To meet this requirement, Stucchi has developed two new, innovative solutions.

The BM is a new multi-connection that can guarantee flow rates of 750 l/min and operating pressures up to 420 bar. Its new connection system enables it to have more compact dimensions than standard solutions.

The Saturn 5 can be applied to high flow type skid steers equipped with functionality-adding attachments. Next to the three hydraulic lines (size ¾in (1.90cm) pressure, return and size ⅜in (0.95cm) drain) there are two additional ½in lines (1.27cm). The Saturn 5 Stucchi solution is a casting block that integrates five lines, thus avoiding the connection of rigid pipes and various fittings. Its benefits include reduced installation time, compactness and being leak-proof. Stucchi will be presenting its new solutions, as well as news, at Bauma 2019.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **520**

bauma 2019
APRIL 8-14 • MUNICH
Stucchi
Hall A4, Stand 213

iVT 10 BEST NEW VEHICLES AT BAUMA

bauma 2019
APRIL 8-14 • MUNICH
Terex Trucks
Hall FN, Stand 720/9

New and improved

Terex Trucks will exhibit its updated TA300 Generation 10 articulated hauler, built for use in the toughest applications such as in quarries and construction sites. The new vehicle has a new transmission and improved fuel efficiency, greater operator comfort and extended oil maintenance intervals, compared with its predecessor.

To learn more about the TA300: turn to page 86 for our full case study of this robust machine.

03
FLUID POWER

BETTER **CONNECTIONS**

With more than 65 years of experience in the hydraulics industry, **Faster** has designed and manufactured over 500 million quick-release couplings and has registered more than 80 patents. The company's product portfolio includes three main product areas: standalone quick-release hydraulic couplings; casting solutions; and MultiFaster. The latter, patented in 1994, has become a trademark in the business and in the past 25 years it has evolved so much so that Faster's MultiFaster range now include more than 50 different products.

This year, Faster has moved even further in this field, introducing the MultiGrease, a unique MultiFaster with a special dedicated line for central lubrication systems, one integrated electrical connector (seven pins), and two hydraulic lines ½in (mobile part with male couplings 3FFNP series, connectable under pressure). The special grease coupling mounted on the fixed plate of the MultiFaster allows for the circulation of the lubricant and so, when the MultiFaster is disconnected, the grease flows back thanks to its internal shunt system.

This special cartridge for central lubrication systems allows for grease circulation on board the machine, even when a non-lubricated bucket is in use. The grease cartridge can be installed in all the existing range of Faster multi-connections to turn a MultiFaster into a MultiGrease.

The MultiGrease will be one of the products that Faster will present at the Bauma exhibition in April.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **521**

bauma 2019
APRIL 8-14 • MUNICH
Faster
Hall A3, Stand 439

58
The number of countries represented by Bauma 2016 exhibitors

bauma 2019
APRIL 8-14 • MUNICH
HydraForce
Hall A4, Stand 450

SPACE-SAVING CONTROL

HydraForce's two, new multifunction hydraulic cartridge valves can conserve space inside machinery, while ensuring priority flow for critical machine functions such as braking and steering.

When using the FR10-E40F pressure-compensated flow regulator and the UPCV10-40 pressure unloading valve in conjunction with a hydraulic accumulator, operators can control priority flow in their machinery and be assured of adequate pressure at all times for brakes or steering.

Once the accumulator is charged, the UPCV valve – a piloted pressure-unloading valve with an integrated check valve – automatically unloads the hydraulic pressure to make it available for ancillary functions. The use of these two multifunction valves reduces the number of cavities needed in the manifold, reducing its size by approximately 21%.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **522**

iVT 10 BEST NEW VEHICLES AT BAUMA

bauma 2019
APRIL 8-14 • MUNICH
Bomag
Hall FS, Stand 10008/1

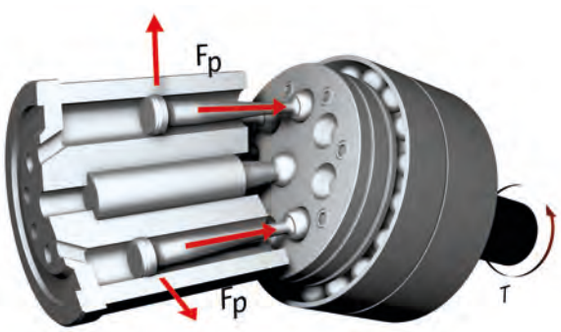
Efficient hybrid compaction power

At Bauma, Bomag will showcase its new BE 174 AP tandem roller. An innovative feature of the roller is that it has been fitted with a hydraulic accumulator capable of powering it during short-term peak loads. It achieves this by balancing up to 100Nm and 20W of power directly onto the crankshaft. This BE 174 AP differs from conventional rollers, which are typically powered by the engine during peak loads for a short time, for example when switching on vibration or for acceleration. For the rest of their operation time, conventional roller engines run at partial-load operation, which is not particularly energy efficient. With Bomag's innovative hybrid solution, the engine only powers the base load, while peak loads are powered hydraulically. The new machine is fitted with an optimized, Stage V-compliant Kubota engine for minimal heat loss and maximum efficiency. When tested in the field using Bomag Telematics, the BE 174 AP was found to deliver fuel savings of up to 20%.

OPTIMIZATION URGENTLY REQUIRED

Current hydraulic pumps and motors are proven components when coupled with diesel engines. However, in relation to the particular requirements of variable-speed drives such as those used in battery-electric vehicles to reduce CO_2 emissions, they reveal fundamental weaknesses. They were not developed for this purpose and subsequently are not efficient enough.

Their inadequate efficiency results in power losses that are an additional load on the electric motor. This means that expensive battery capacity is transformed into useless heat. Axial piston pumps are noisy – so much so, that if diesel engines are replaced with quiet electric motors, the noise becomes noticeable. This is a situation that end users do not accept. At high pressure, variable-speed pumps require a minimum speed to prevent wear. The 350 bar pressure that is common in mobile machines cannot be attained with simple external gear pumps. In the case of hydraulic motors, particularly those that use a swashplate design, the starting characteristic in the lowest speed range is less than ideal. This can cause problems with the operation of hoist winches, for example. One drawback where minimizing the installation envelope is concerned is the large roller bearings that are needed to absorb the high non-compensated forces of bent-axis motors. **Bucher Hydraulics** believes that there is an urgent need for optimization in relation to efficiency, noise and variable speeds, in order to meet the requirements of the future.



bauma 2019
APRIL 8-14 • MUNICH
Bucher Hydraulics
Hall A3, Stand 103

SYSTEMS-FOCUSED SOLUTIONS

Poclain Hydraulics is bringing even more value to its customers by strengthening its offering of full systems. The company is leveraging its efforts through a strategic restructuring of its organization in order to focus on system solutions.

At Bauma 2019, Poclain Hydraulics will showcase its CreepDrive system, which has a new dedicated motor and pumps from the company's high-performance product range.

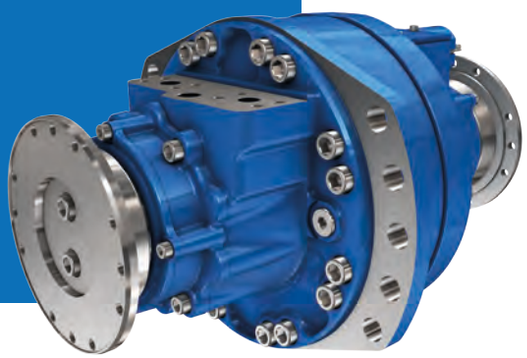
The CreepDrive system has a hybrid mechanical-hydraulic transmission that enables vehicles to work at very low constant speeds regardless of the engine speed, providing auxiliary systems with the power that they need to perform effectively. When the system is disengaged, the vehicle is able to drive at speeds suitable for open roads, with no mechanical transmission efficiency losses.

The CreepDrive offering contains two motors, a range of pumps, and a plug-and-play control kit, which includes CANbus communication.

The new motor offers two speeds over a wide range of displacements. Other new features include a reinforced shift cylinder and shaft seals, as well as an extremely robust design. This new motor supersedes the existing motor by offering double the speed and triple the torque.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **524**

bauma 2019
APRIL 8-14 • MUNICH
Poclain Hydraulics
Hall A3, Stand 536



iVT 10 BEST NEW VEHICLES AT BAUMA

bauma 2019
APRIL 8-14 • MUNICH
Volvo CE
Hall C6, Stand 213

A fully electric future

Volvo CE has announced that from 2020, it will be going electric with its Volvo-branded compact excavators and compact wheel loaders. This unique move makes Volvo CE a pioneer in moving toward an electric future. Volvo CE will unveil its first two electric machines at Bauma.

Keeping in-line with its 'Excavators For Any Challenge', Volvo CE will also showcase numerous new models. The EC300E and the EC220E crawler excavators feature Volvo's Active Control automated boom and bucket movements for a more efficient digging process.

Other new excavators that will be launched at the show include the EC200E 20-ton crawler excavator, the EC15-EC20E compact excavators, and the EC750E high-reach demolition excavator.

Also at Bauma, Volvo CE and its sister companies Volvo Penta, Volvo Trucks and Volvo Financial Services, will present a live, interactive event called Building Tomorrow at its 2,293m² (24,682ft²) indoor and 5,870m² (63,184ft²) outdoor areas. Building Tomorrow will showcase the company's latest machines – 50 in total – and integrated services.

PAOLO FONTANA & JØRGEN PETER TODSEN

bauma 2019
APRIL 8-14 • MUNICH

PistonPower
Hall A3, Stand 130

Disruptive innovation

WHAT IF YOU COULD AMPLIFY HYDRAULIC FORCE WITHOUT ADDING ANY EXTRA BULK TO YOUR VEHICLE? A GROUNDBREAKING INNOVATION ENABLES YOU TO DO JUST THAT, HELPING TO IMPROVE THE OVERALL EFFECTIVENESS OF ANY MACHINE

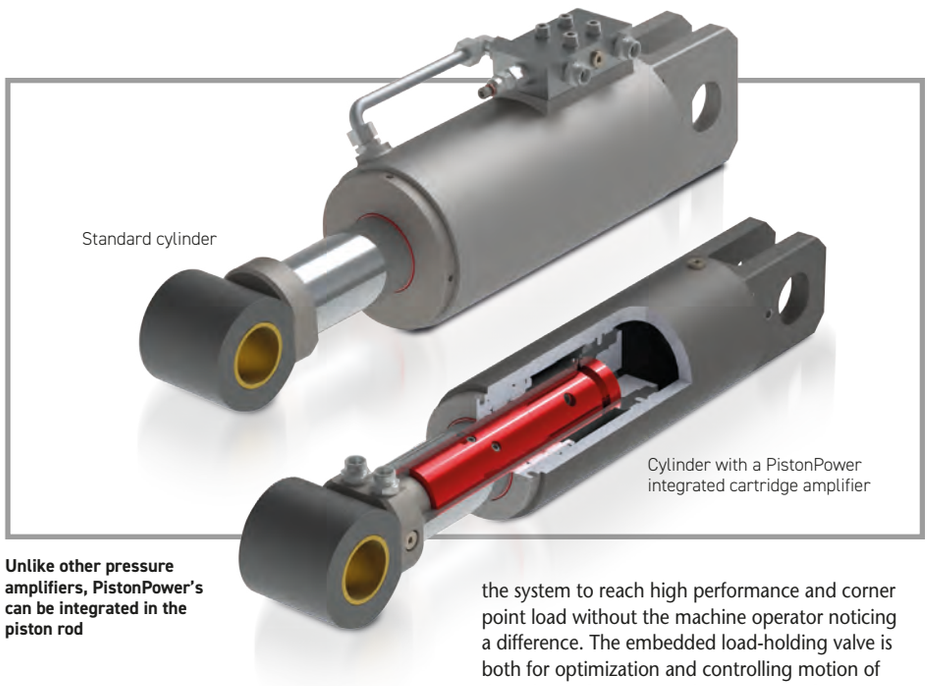
The innovative PistonPower Cartridge Amplifier enables OEMs to design hydraulic systems at pressure levels below 200 bar, even on very large scale off-highway machinery. It is integrated directly into the machine and amplifies the pressure in the cylinder. This means that the diesel engine can always run at an optimum level, therefore helping to lower fuel consumption. All vehicles in the off-highway industry can benefit from the integrated PistonPower Cartridge Amplifier in the cylinder. The technology enables vehicles to operate without having a centralized high-pressure hydraulic system. PistonPower's bespoke solution for this market is generating particular interest from the demolition sector.

Traditional designs use a centralized hydraulic system distributing high-pressure system flow to each function on the machine. Increasingly higher force and power than ever before are required for modern off-highway machinery. The central system is normally designed to be able to reach the 'corner point' of performance on any function on the machine. In most working cycles, a hydraulic system reaches this corner point in a single-digit percentage of the power cycle, and yet the diesel engine and its complete system must be built and designed for high pump and main-system pressure, so that it remains capable of reaching the corner point at any time. This increases energy consumption and cost because of the need for high-pressure system components, which require more maintenance.

The PistonPower Cartridge Amplifier is integrated in the cylinder without the need for external connector hoses. It allows pressure and force to be increased while reducing the size and weight of the machine, which can therefore be leaner and more agile.

What's inside?

Using pistons with different surface areas is a basic and well-known way of improving pressure amplification. What makes the Cartridge Amplifier unique is that it has the amplification pistons, the necessary activation valving, as well as a unique bypass flow and over-center valve, all installed in a small compact unit. This unit contains the complete system, ready to install in a hydraulic cylinder.



Unlike other pressure amplifiers, PistonPower's can be integrated in the piston rod

The Cartridge Amplifier's world-first compact design makes it easy for any cylinder manufacturer to integrate. Several high-pressure amplifier solutions targeting niche markets are available, but no one has ever integrated all the valves and the complete oscillating amplification in one easy-to-install cartridge in the piston rod; instead it has tended to be provided as an external solution. The PistonPower high-pressure cartridge amplifier is the only solution on the market available as a single-unit cartridge.

How does it work?

The PistonPower cartridge amplifier is an oscillating pressure amplifier system integrated within the piston rod, creating high pressure any time it is required. At low workload, when high speed is desired, the main pump flow goes through a bypass channel and load-holding valve – directly into the cylinder. In this case, the velocity of the cylinder is high.

The amplification starts automatically when the load on the cylinder exceeds a certain level defined by the system designer. It also optimizes the system to reach high performance and corner point load without the machine operator noticing a difference. The embedded load-holding valve is both for optimization and controlling motion of the cylinder function, and serves as a safety load-hold feature built into the PistonPower Cartridge Amplifier system.

Efficiency by design

When the system pressure is doubled inside the cylinder, the same force can be achieved with a 30% smaller diameter. PistonPower worked closely with cylinder manufacturers to understand the impact of high pressure on the size of the cylinder, the dimensions and the cost of material. To better understand the possibilities, those interested can access an interactive calculator at pistonpower.eu.

PistonPower solutions are currently used in a variety of shears and crushers. The solution specifically made for the demolition market will be launched at Bauma 2019, and there has already been interest from demolition companies in Italy, the Netherlands and Germany. The majority of PistonPower's seven separate patents have been granted. **iVT**

Paolo Fontana is CEO and Jørgen Peter Todsen is CTO at PistonPower GmbH

JIRI FOUKNER

bauma 2019
APRIL 8-14 • MUNICH

Eaton
Hall A5, Stand 423

A new level of control

A COMBINATION OF THE LATEST ADVANCED MOBILE VALVE, CONTROL AND SOFTWARE TECHNOLOGIES CAN SOLVE EVEN THE MOST COMPLEX OF MACHINE CHALLENGES, IN A SHORT PERIOD OF TIME

Boom trucks are used to transfer concrete during the construction of high-rise buildings and other difficult to access structures. Typical boom lengths can range from under 20m (66ft) to over 60m (197ft). However, as boom length increases, operational challenges on the machine may also become more apparent.

To explain further, as the boom is maneuvering and pumping concrete, it tends to oscillate because of its mechanical flexibility and the compression of hydraulic oil in the cylinders. To address the oscillation, additional workers are often required to hold the boom-tip hose, and the concrete pumping speed is also decreased. These actions reduce machine productivity and increase the safety risk for operators.

Intelligent booms

The key to overcoming this challenge lies in so-called smart valve technology. Valves such as Eaton's CMA electrohydraulic mobile valve with independent metering, for instance, offer onboard intelligence that addresses the concrete boom oscillation issue.

Fully integrated pressure sensors and precise position feedback enable the valve to provide smooth and accurate flow control above and beyond commodity hydraulic valves. Additionally, the onboard sensing – coupled with independent metering capability and Eaton's proprietary boom stability control algorithm – enables the valve to counteract the induced oscillations in the boom. As a result, the valve provides the boom stabilizing function without any external sensors, ensuring the system is simple to integrate.

For instance, when it comes to setting up communications between a machine-level supervisory controller and electrohydraulic components, Eaton's Pro-FX technology can help. Featuring easy-to-use software and a robust library of pre-programmed development tools, Pro-FX streamlines application development and simplifies hardware setup, empowering users to build safer, smarter machines more quickly. Pro-FX is an open platform that uses industry-standard languages and protocols.

Operators can use an Eaton OMNEX remote wireless controller to control the boom position. Here, the OMNEX base unit transmits operator commands via a J1939 CANbus to an HFX CAN-based supervisory controller. The HFX leverages the integrated OMNEX libraries to process operator commands and, in turn, translate them into CMA valve commands. Valve commands are block packaged by the library and transmitted to the CMA valve via the same CANbus.

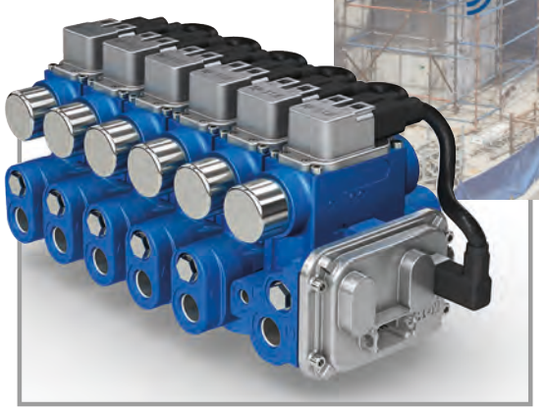
Getting the most from in-vehicle technology

In short, the onboard intelligence and control capabilities available within the CMA valve are the key enabling technologies for the whole boom stability control (BSC) system to function. Importantly, the components included in the system are flexible and can leverage existing OE sensors, controllers and valves if they meet the necessary requirements. In conjunction with Pro-FX tools, the boom counterbalance valves and manifolds are from Eaton's portfolio of screw-in cartridge valves.

Ultimately, end users want machines that can intelligently sense and dynamically respond to conditions as they change – automating critical decision making to achieve better safety, performance and productivity.

Eaton's BSC system provides a 90% reduction in boom settling time and a 75% reduction in tip movement during pumping operations. This performance enables the boom to be positioned more easily and without significant effort from workers. Moreover, reducing the oscillation enables operators to increase productivity and expedite construction.

Further common applications that can benefit from this technology include refuse trucks, telehandlers, all-terrain cranes, utility trucks, grapples, aerial lifts, drill rigs, excavators, roof bolters, snow groomers, paving machines and reach stackers. **iVT**



ABOVE: **Eaton products combine to ensure construction sites are productive and safe**

LEFT: **The electrohydraulic mobile valve includes independent metering**

Jiri Foukner is product manager of advanced controls/ Pro-FX, EMEA, at Eaton

FREDRIK LOTHIGIUS & JUTTA ETZKORN

Intelligent testing tools

bauma 2019
APRIL 8-14 • MUNICH
Parker
Hall A4, Stand 215

IN MOBILE HYDRAULICS IT IS VITAL FOR CYLINDERS, MOTORS, PUMPS, VALVES, HOSES, PIPES, SCREW CONNECTIONS AND MULTICOUPLINGS TO FUNCTION WITH ABSOLUTE RELIABILITY, RIGHT DOWN TO THE SEALS

The new Serviceman Plus from Parker Hannifin is a testing tool that carries out proactive maintenance to meet high safety requirements in machinery.

With the help of modern mobile hydraulic systems monitoring, every service technician can arrange for maintenance in good time and thus save on costs. The Serviceman Plus measuring system detects irregularities and creeping changes in hydraulics systems. It is available in an analog design or as a CANbus-capable device, detects irregularities and creeping changes, and records key parameters (pressure, temperature, flow and rotational speed) for the reliable and economical operation of hydraulic systems.

Preventive maintenance

Jutta Etzkorn, product manager for Parker Hannifin's Serviceman Plus, says, "The Serviceman Plus is perfect for tasks relating to mobile hydraulics, especially the CANbus version. The measuring system offers the benefit of minimal wiring and quicker testing. The reliability of the measurement is another key benefit: while the risk of interference increases with every meter of cable for analog data transmission and cable lengths of 10-15m [33-49ft] are barely possible, the Parker Hannifin CANbus allows cable lengths of up to 50m [164ft]." The minimal wiring effort with up to three sensors on a bus line also saves time and money. In addition, digital data transmission gives high resistance to interference and provides reliable measurement data even under critical environmental conditions.

The Serviceman is suitable for use in tough construction site conditions, thanks to its robust housing and an oil-resistant rubber cover that resist impact and moisture. When used with CANbus connectors, the CANbus model has a protection class of IP67. In addition, the device's simple and clear operator guidance contributes to it obtaining reliable measurements.

With the Serviceman Plus, the time-consuming process of configuring sensors is eliminated. "Operators can simply plug in the sensor or bus cable and measure immediately," says Etzkorn.

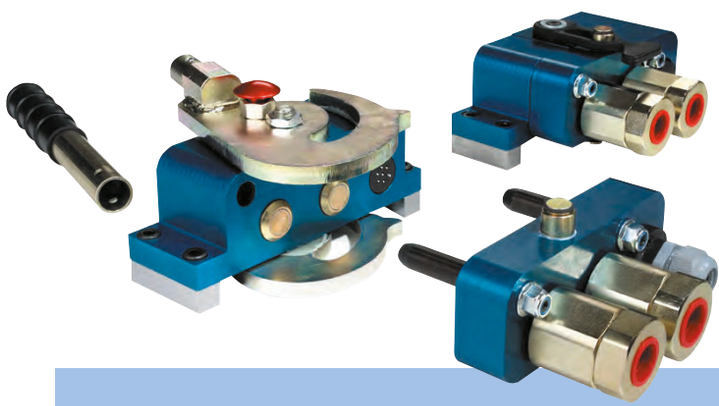
Measurement ranges acquired by the Serviceman Plus are automatically scaled and the measured value is shown in the display. The device shows hydraulic pressures, temperatures and flow values, as well as pressure differences and hydraulic power. Information about the lithium-ion battery – which can operate for up to eight hours – is also displayed.

Measurements can be saved on the integrated nano-USB stick with the push of a button. In addition to measured values, minimum and maximum values are also permanently stored. This function ensures that information related to dangerous pressure spikes is not lost due of a lack of memory capacity.

Permanently installed measurement systems cannot replace independent validation using mobile systems. Hydraulic measurement systems integrated by the manufacturer in general cover only the normal demands of the hydraulics. With mobile measurement technology, a system can be adjusted with much greater precision. The Serviceman Plus documents the configuration data including measurement curves to show developments or comparisons. Only mobile measuring systems help to detect creeping nested differences.

Perfect connections

Multi-Line, Parker multi-couplings with flat face technology have low spillage, less ingress of air and prevent contamination into the circuit. They can connect/disconnect up to six connections in a simple step and they require very low maintenance. They are also protected by their metallic dust cap and support plate. The multi-couplings can be fitted with an electrical connector with up to 14 poles. The pressure eliminator is standard on the nipple plate in order to connect under residual pressure. Multi-Line couplings are available as different options: C-Line compact with two lines; C-line standard with four lines; and one version with six lines. All versions are ready for use with the external 14-pole electrical connector. The compact version comes with a detachable lever and with some versions, is also adjustable. The C-Line standard has a large selection of fixed or removable locking l evers, so that the right configuration can be found at every installation point. **iVT**



ABOVE RIGHT: **The Parker Hannifin Serviceman Plus offers outstanding reliability in taking measurements**

LEFT: **The C-Line compact is the ideal solution for wheel loaders and other construction machinery**

Fredrik Lothigius and Jutta Etzkorn are product managers at Parker Hannifin

NADJA KOENIG

Secure connections

bauma 2019
APRIL 8-14 • MUNICH
Stauff
Hall A4, Stand 212

A NEW RANGE OF FLAT-FACE, QUICK-RELEASE COUPLINGS HAS BEEN DESIGNED ESPECIALLY FOR USE IN CONSTRUCTION MACHINERY

Stauff's presentation at Bauma will focus on its expanded FF series of quick-release couplings. Their design is based on the requirements of machinery used in the construction industry.

The FF quick-release coupling series connects the hydraulic circuit of a construction machine to the consuming units on different attachments. The couplings provide an important prerequisite for enabling a construction machine to carry out a variety of different tasks.

The FF series is designed as a flat-face coupling and it is suitable for use in adverse ambient conditions. The series is very easy to clean, and during coupling it prevents dust and dirt from entering into the hydraulic system and air inclusions. At most, connecting and releasing the couplings produces an oil film on the face side of the two halves.

ABOVE: **Compared with FH couplings, FF couplings performed better when subjected to impulse testing**
RIGHT: **FF couplings are made from steel and have a zinc-nickel finish**

Higher flow rate, higher safety figures

Compared with the previous FH series, the FF series offers a higher flow rate with the same component size, therefore providing more hydraulic power for attached devices. The FF impulse and burst tests also achieved better results, compared with the FH series. Nominal figures for maximum pressure (350/400 bar) remain the same, offering greater safety.

Range expansion for Bauma 2019

Three nominal diameters of the FF series – 10mm, 12mm and 19mm (0.4in, 0.5in and 0.7in) – were launched in 2017. They are used by leading manufacturers and have proven to be highly successful. The range has now been completed with nominal diameters of 6mm, 16mm, 25mm and 38mm (0.2in, 0.6in, 1.0in and 1.5in). These couplings will be presented at Bauma 2019 for the first time and they will be launch to the market in the autumn of 2019.

Large selection of connection variants

The FF series is available with different connection options, including the most common variants with internal thread. The connections are permanently attached to the coupling or female connector – and this further contributes to the connections' high level of safety, because the risk of leaking is reduced. With regard to the seals, users can choose between NBR (Buna-N) and other materials such as FPM (Viton).

Additional safety from interlock

Integrated interlocking is another safety feature of the new series. After connecting the coupling halves, the operator can firmly lock the loose element with a 90° rotation. The coupling sleeve can then no longer be released just by pulling it back. This inadvertently makes the release of the coupling impossible. Upon request, the coupling can also be ordered without interlocking.

Another advantage of the flat-face coupling, compared with a simpler threaded one, is that the coupling halves can be rotated against each other axially. This means that torques from the hose have no negative impact on the connection.

Customized on request

The in-house development off the FF range and production are essential prerequisites for the high level of quality of the flat-face couplings. The customer can also make use of the Stauff Line service to order fully configured hoses with FF couplings.

Despite the excellent performance figures and the additional function of the FF series, the price remains competitive. This was an important component of the range's performance specification.

Advantages over other coupling designs

Stauff also expanded the FF series because manufacturers of construction machinery and associated attachments in particular have recognized the benefits of quick-release couplings. Such advantages include: high level of reliability, flexibility, ergonomic operation, no air inclusion during coupling and robustness against soiling. With the expanded FF range, manufacturers can benefit from high flow rates and a high-quality level when using larger nominal diameters. **iVT**

Nadja Koenig is product manager, Couplings, at Stauff

JÜRG SCHNEIDER

bauma 2019
APRIL 8-14 • MUNICH
Wandfluh
Hall A3, Stand 350

Smooth lifting and lowering

HOW CAN RAPID LIFTING AND LOWERING FUNCTIONS BE OPTIMALLY CONTROLLED IN ALL LOADING SYSTEMS? PROPORTIONAL THROTTLE AND FLOW CONTROL VALVES IN A WIDE RANGE OF SIZES AND EXECUTIONS ARE AN IDEAL SOLUTION

Hydraulics are commonly involved with the lifting and lowering of loads. In the case of modern forklift concepts, on small- and medium-sized industrial trucks, lifting is directly controlled by the pump speed. With this, independence of the load is achieved to a great extent.

Independence of the load is even more important when lowering than when lifting. The manufacturer of the forklift truck has to ensure that a maximum speed is not exceeded under any circumstances. On the other hand, even with the fork unloaded, achieving this speed limit is desirable to assure high productivity with the device. One further requirement is good resolution in the range of lower speeds. This is necessary to be able to put down loads sensitively and to pick them up accurately.

Proportional flow control valves

A 2/2-way poppet valve is used exclusively for the task of leakage-free load holding. The actual lowering of the load takes place through a throttle or 2-way flow control valve proportionally adjusted by a solenoid. For smaller forklift trucks with lowering speeds of 25 l/min, M22 sized throttle valves and flow control valves are ideal. In contrast to simple throttle valves, flow control valves have an integrated pressure compensator. This ensures a constant flow volume (lowering speed) independent of the load.

For larger forklift trucks, M33 valves are used at up to 80 l/min. The adjusting of valves with the system is very important, particularly for reach trucks with several cylinders. A large load should be able to be controlled optimally over a height of several meters, practically in free fall.

If the proportional valve cannot control the changes of load, then there will be undesired oscillation during the lowering movement. Manufacturers call this a 'bouncing effect'. The proportional valves must be adapted according to the number and size of the cylinders, the length of hose and the other hydraulic elements. If, for the first type of vehicle, a DNPPM33 proportional throttle valve (pictured top left) is the optimal valve, for the other forklift truck it is the QNPPM33 flow control valve (top right) with additional internal damping systems.

ABOVE: **The DNPPM33 proportional throttle valve (left) and QNPPM33 flow control valve (right) reduce bouncing in lowering**

RIGHT: **An example application for the use of hydraulics**

BELOW: **The smaller QSPPU10 (left) and QSPPM33 (right) all-in-one proportional valves integrate three functions into one**

Seat-tight flow control valves

There are two all-in-one valves available, depending on the size of the forklift truck. The smaller QSPPU10 valve (far left) with a UNF10 cavity is able to regulate oil flows of around 35 l/min, whereas the larger QSPPM33 valve (left) sensitively controls over 100 l/min.

As the QSPPU10 and QSPPM33 combine three functions into one valve, no additional valves need to be mounted. Additional load-holding and speed-limiting valves can be dispensed with. This has a positive effect on both costs and function. The fewer elements there are in a system, the better the control of movement because there is less bouncing. In addition, a flexible electrical valve actuation offers further possibility for optimization.

Electric control is carried out through conventional, commercially available proportional electronics with pulse-width modulation (PWM) current control. In doing so, the current control ensures that the valve always works the same way, independent of the temperature. Wandfluh has 40+ years of experience in the production of valve electronics and offers a wide range of analog and digital control electronics.

As a result of the wide diversity of hydraulic systems in lifting and lowering functions, there is a wide selection of valves available, ranging from simple throttle valves to damped flow-control valves and load-compensated, seat-tight flow control valves. The range of variation in specialized proportional technology can guarantee the correct choice of proportional hydraulic valve so that smooth lifting and lowering is ensured in every mode of operation. **iVT**

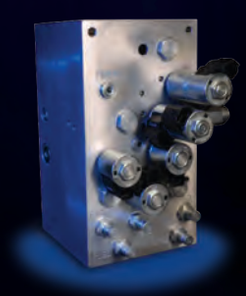
Jürg Schneider is head of marketing and sales at Wandfluh

YOUR REPUTATION RIDES

ON EVERY COMPONENT WE MAKE

We understand that performance and reliability are vital to your success. You can depend on HydraForce to design and manufacture the highest-quality cartridge valves, manifolds and electrohydraulic controls. Our goal is to ensure your machines operate flawlessly – day after rugged day.

Schedule your one-on-one consultation at **HydraForce.com**



HydraForce®
POWER FORWARD®

bauma
MUNICH
Hall A4 / Booth 450

LINCOLNSHIRE, IL, USA 847-793-2300 | BIRMINGHAM, UK 44 121 333 1800 | CHANGZHOU, CHINA 86 519 6988 1200 | SÃO PAULO, BRAZIL 55 11 4786 4555

JOHN BOOTE

bauma 2019
APRIL 8-14 • MUNICH
Kawasaki Precision Machinery
Hall A4, Stand 202

Excavator hydraulics

MANUFACTURERS ARE DRAWING ON MULTIPLE DECADES OF EXPERIENCE TO DEVELOP FUEL-EFFICIENT HYDRAULIC COMPONENTS SPECIFICALLY FOR EXCAVATORS, PREPARING THE VEHICLES FOR FUTURE TECHNOLOGICAL TRENDS

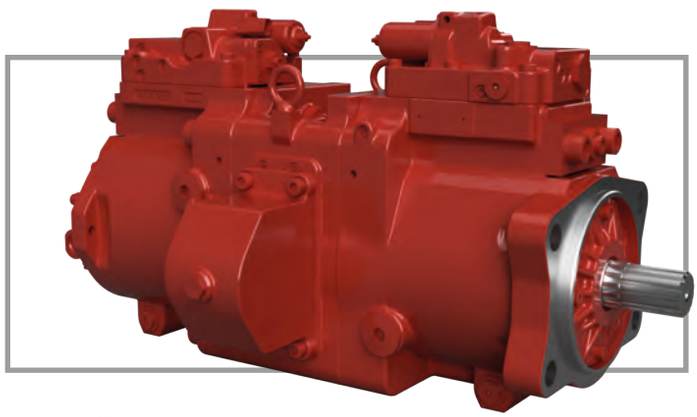
In 1967 Kawasaki was able to draw on 60 years of hydraulic component expertise to design and manufacture hydraulic components for the first excavator to be built in Japan. These products have been continually developed over the years and can now be found in hundreds of thousands of such machines around the world.

Using its experience of optimizing hydraulic systems for excavators, Kawasaki has now developed the latest generation of components that integrate hydraulics and electronics to provide the efficiency, reliability and precision control needed to meet the environmental, safety and productivity demands of the modern construction industry.

In addition to its current class-leading excavator hydraulic solutions, Kawasaki has now introduced a hydraulic system for ICT excavators. Initially available for machines in the 20- to 30-ton class, the system comprises a K7V series pump with electric displacement control, KC-MB series electronic control unit, KMX-RBE series main control valve with electrohydraulic actuation and ERU series joysticks and foot pedal controllers with CANbus interface.

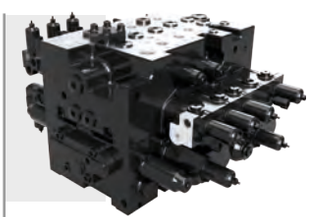
The system enables the use of 2D excavator machine control, which provides semi-automatic machine control for tasks such as ground levelling, excavation plane setting and slope grading by single lever operation. With the addition of third-party GNSS sensors and controllers, the Kawasaki system can be used for 3D machine control design grades.

In addition to the machine control benefits, the Kawasaki system provides electronic control of the pump, ensuring the most fuel-efficient operation of the machine.



LEFT: **The K7V pump was designed using simulation technology**

ABOVE: **The ERU-series joysticks offer a variety of handle switch options**



ABOVE: **The KMX15RBE is intended for excavator systems**

ABOVE: **The KCMB20 keeps the engine controller efficient**

Purpose-built technology

The KC-MB electronic control unit is designed specifically for excavator systems and enables communication with the engine controller to keep it working at optimum efficiency.

The KMX-RBE series of main control valves are similarly designed specifically for excavator systems and have been developed using CFD analysis to optimize the fluid flow path through the valve, therefore minimizing pressure drops and resulting in improved efficiency of the hydraulic system. While Kawasaki has previously provided systems with electrohydraulic control, it has been achieved using a main control valve with hydraulic pilot actuation of each service with electric control signals from the machine's joysticks converted to hydraulic pilot signals via solenoid valves in a manifold block.

The KMX-RBE series eliminates the need for such an intermediate device by incorporating the solenoid valves directly into the main control valve, thereby providing a simpler and more efficient installation.

The K7V series of tandem variable displacement axial piston pumps has been designed using the latest simulation technology to produce a rotating group with optimized geometry to provide maximum efficiency.

The 400 bar-rated rotating group also incorporates features to minimize pressure pulsation and therefore reduce noise. By replacing the hydromechanical torque-limiting controller usually used on excavator pumps with an electric displacement controller, the K7V125 can be integrated into the electrical positive-control system.

The operator interface completes the excavator control system and comes in the form of the ERU2 electric hand controls and ERUP electric foot pedal controls, both of which come available with a CANbus interface.

The ERU2 has a range of handle switch options available and has the same return mechanism as the Kawasaki PV48K hydraulic pilot valves many excavator operators will be familiar with.

By developing this system for ICT machines, and as machines develop further with autonomous control and alternative power sources, Kawasaki will continue its tradition of being at the forefront of excavator technology. **iVT**

John Boote is a sales and marketing manager at Kawasaki Precision Machinery UK

HANNOVER MESSE

Hall 021
Stand B28 1

HANNOVER MESSE MDA
April 1/5 2019

bauma 2019

Hall A4
Stand 213

BAUMA
April 8/14 2019

Stucchi®

Visit our website
stucchigroup.com

HANS JÜRGEN GELLER

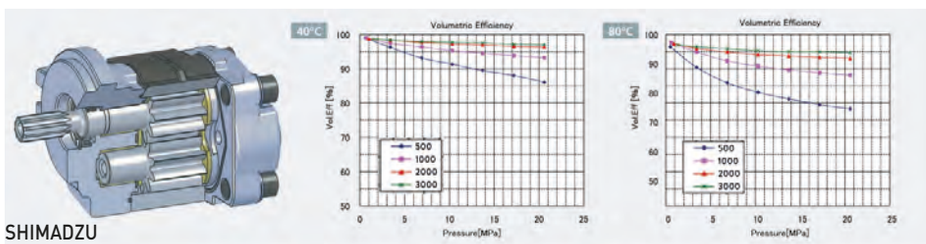
bauma 2019
APRIL 8-14 • MUNICH
Shimadzu
Hall A4, Stand 151A

Designed around sound

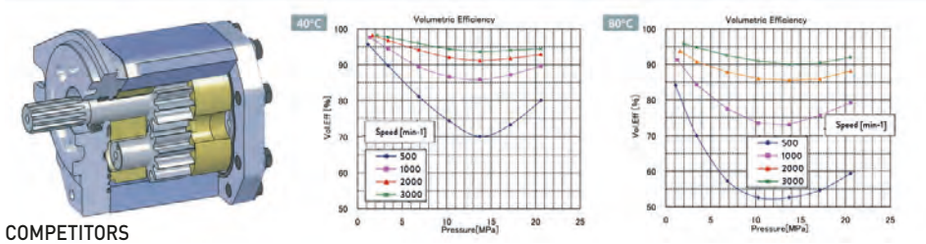
EXTERNAL GEAR PUMPS ARE COMMONLY USED IN FORKLIFT TRUCKS AND CONSTRUCTION AND AGRICULTURAL MACHINES. ONE NEW PUMP HAS SPECIFICALLY BEEN CREATED TO SOUND AGREEABLE TO HUMAN EARS

RIGHT: **The Serenade pump was specially designed to emit a pleasant sound when in use**

BELOW: **A performance comparison between Shimadzu's Serenade pump and competitors' pumps**



SHIMADZU



COMPETITORS

Japanese company Shimadzu Group, headquartered in Kyoto, is known for developing analytical and measuring instruments, medical systems, optical and laser devices, aircraft equipment and industrial machinery. The Shimadzu Fluidics Systems division of the company has been developing hydraulic components for more than half a century. Serenade is its new, high-efficiency, low-noise external gear pump that produces a comfortable, pleasant tone.

Serenade is based on the design of the company's existing no-backlash, low-pulsation pump. However, as the name suggests, Serenade emphasizes more of an auditory sensation for human ears, rather than being simply evaluated by A-weighted decibel levels (dB).

By performing sound-quality experiments from multiple perspectives, the internal components were redesigned to create a pleasant sound from the optimized tuning of precise clearances.

This contributes to the improved sound quality of the entire hydraulic system, as well as the more pleasant sound of the pump itself.

A beneficial design

Serenade is not only focused on its comfortable sound, but also has unique technical advantages. Its cast-iron body has stronger durability than an aluminum body and it maintains stable performance at any temperature.

Since a cast-iron body has a similar thermal expansion coefficient to the internal steel gears, the volumetric efficiency deteriorates less through internal oil leakage when the temperature increases. And when temperature decreases, a cast-iron body does not shrink as much as an aluminum body, preventing additional shaving process from occurring and maintaining higher volumetric efficiency.

Furthermore, the cast-iron body enables the use of screw fittings up to the maximum hydraulic pressures, while aluminum pump housings would typically crack above 21MPa. Its side plate pump design separates the axial gap compensation from the radial load carrying bushings.

Typical aluminum pumps use bushing blocks that must move under load to compensate their axial gaps. However, Shimadzu pumps carry the load on the bushings in the pump housing, as well as in the mounting flange – and these pumps compensate the axial gaps with 'floating' side plates. Therefore, the two functions are separated, and the pump is more robust. One benefit of Shimadzu's pumps is that they can be started from zero RPM against the load holding valve.

The friction between the gears' axial surfaces and the axial gap compensation component is, with the Shimadzu side plates, reduced and the mechanical efficiency improved.

Cast-iron housings and metal side plates are much harder than the usual aluminum bushing blocks and aluminum pump housings. Shimadzu's floating side plates for axial gap compensation are made from a specially developed metal alloy. This makes the Shimadzu pump less sensitive to contamination compared with the 'soft' bushing blocks of aluminum pumps.

Overall, the shafts and bushings are wider and larger than those typically used in the aluminum pumps. The lower surface pressures can increase their lifespans and provide higher safety tolerances.

Shimadzu's run-in pressures are the maximum allowed peak pressures and do not lose high volumetric efficiencies during normal use. In addition, this design is also less sensitive to contamination than typical aluminum pumps.

Known for their robustness, Shimadzu's new Serenade external gear pumps are commonly used in forklift trucks, as well as construction, agricultural and other off-highway machines. They are also among the most robust hydraulic pumps in their class, according to validity testing in harsh conditions. **iVT**

Hans Jürgen Geller is European sales manager for Shimadzu Fluidics Systems Division

MICHAEL BRAND

bauma 2019
APRIL 8-14 • MUNICH
Bosch Rexroth
Hall A3, Stand 327

Software for hydraulics

DIGITAL CONTROLLERS ADJUST VARIABLE DISPLACEMENT PUMPS TO SUIT VARIOUS TASKS IN MOBILE WORKING MACHINES

In order to comply with stricter exhaust gas standards for mobile machines, manufacturers are relying on electronified work hydraulics. With the electronified open circuit (EOC) that was specially developed for use in mobile working machines, Bosch Rexroth has revealed a concept that takes advantage of the hydraulic properties of pumps backed up with electronics and software, as well as reducing system costs and engineering outlay.

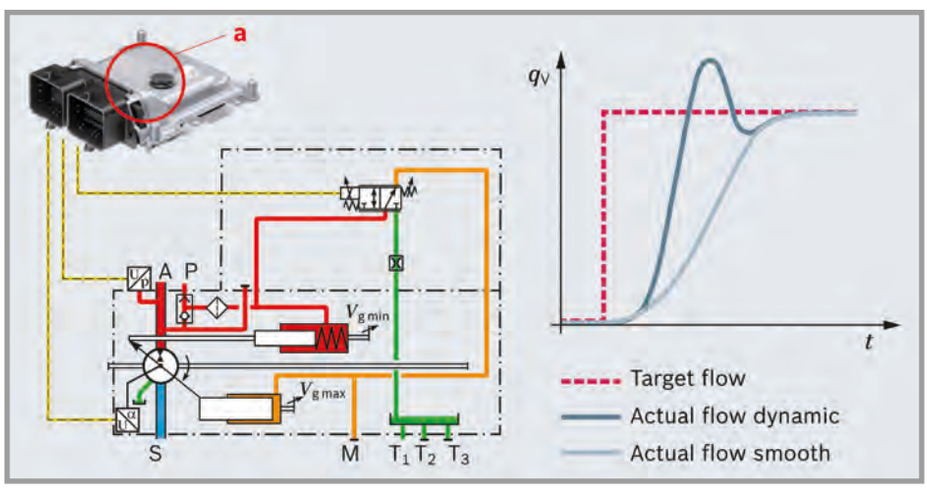
Depending on the particular application, the variable displacement pumps currently used in the open circuit for the work hydraulics of mobile working machines have various controllers – for example, quantity specification, pressure control or torque limitation. These controllers usually have a hydraulic design and only some of them are electronically overridden. The fact that they are hydromechanically complex means that interactions between the controller axes occur when they work in parallel.

Electronic hydraulic actuating element

Bosch Rexroth's EOC takes over all previous hydraulic tasks and at the same time provides scope for new functions. The developers at Rexroth have opted for an entirely new control approach by using a specially developed single-axis electronically controllable hydraulic actuating element. All control and regulating tasks are performed by an electronic control system, exclusively via software. Changes are made via software parameters. This electronic control concept achieves a high level of dynamics thanks to the optimized reaction times of each individual link in the process chain and as a result of the software. This means that the EOC approach follows the maximum simplicity-maximum dynamics principle. Communication with the vehicle control system and other control devices takes place via a CANbus.

ABOVE: **EOCs enhance machine functionality**

BELOW: **A modification of the dynamics of an EOC pump with the help of software parameters (a)**



Increased efficiency

Hydraulic systems work with pressure differences between the pump and loads. They maintain or stabilize the functions in the subsupply – for example, power or oil quantity, but also generate power losses. EOC reduces these pressure differences. Together with the smaller losses in the pump controller itself and the elimination of controller combinations, the electronified solution increases the efficiency of the overall function by up to 20%. EOC also enables more precise use of power capacity and thus higher productivity. As a result, OEMs can achieve greater productivity with the same engine power. EOC is also ideal for use in hybrid or purely electric drive solutions and it is suitable for higher performance levels.

The EOC's controller dynamics make it possible to limit the pump pressure dynamically. As a result, function-dependent pressure modulation via operator specifications or time is possible during operation. All in all, a combination of flow control with variable pressure limitation enables intuitive operation; this has already proved its worth in Rexroth's virtual bleed-off (VBO), pQ-Control and the load-sensing electrohydraulic flow matching (EFM) solution. As a result of this, open center control that has proved successful in excavators can be replicated with a closed center solution without power losses when accelerating the slew drive unit and without losses in neutral circulation. Manufacturers can therefore improve the efficiency of their machines.

Seeing components increase availability

With the new solution, sensors continuously record the operating states of the pump. As a result, it becomes a 'seeing' component that detects wear before it causes a breakdown. Machine manufacturers can process and store the data internally in the vehicle. This condition monitoring is the prerequisite for data-based services including predictive maintenance. In addition, manufacturers can update the EOC software if necessary or activate extra functions.

Bosch Rexroth shows how the EOC can be used to take advantage of the hydraulic properties and to back these up with electronics and software. Shifting the hardware variance to the software enables standardization of pumps across entire ranges. As a result, EOC reduces system costs and the time needed for optimization. To ensure future viability, it also fits into existing and future hybrid and electric drive systems. **iVT**

Michael Brand is project manager for electronfication at Bosch Rexroth

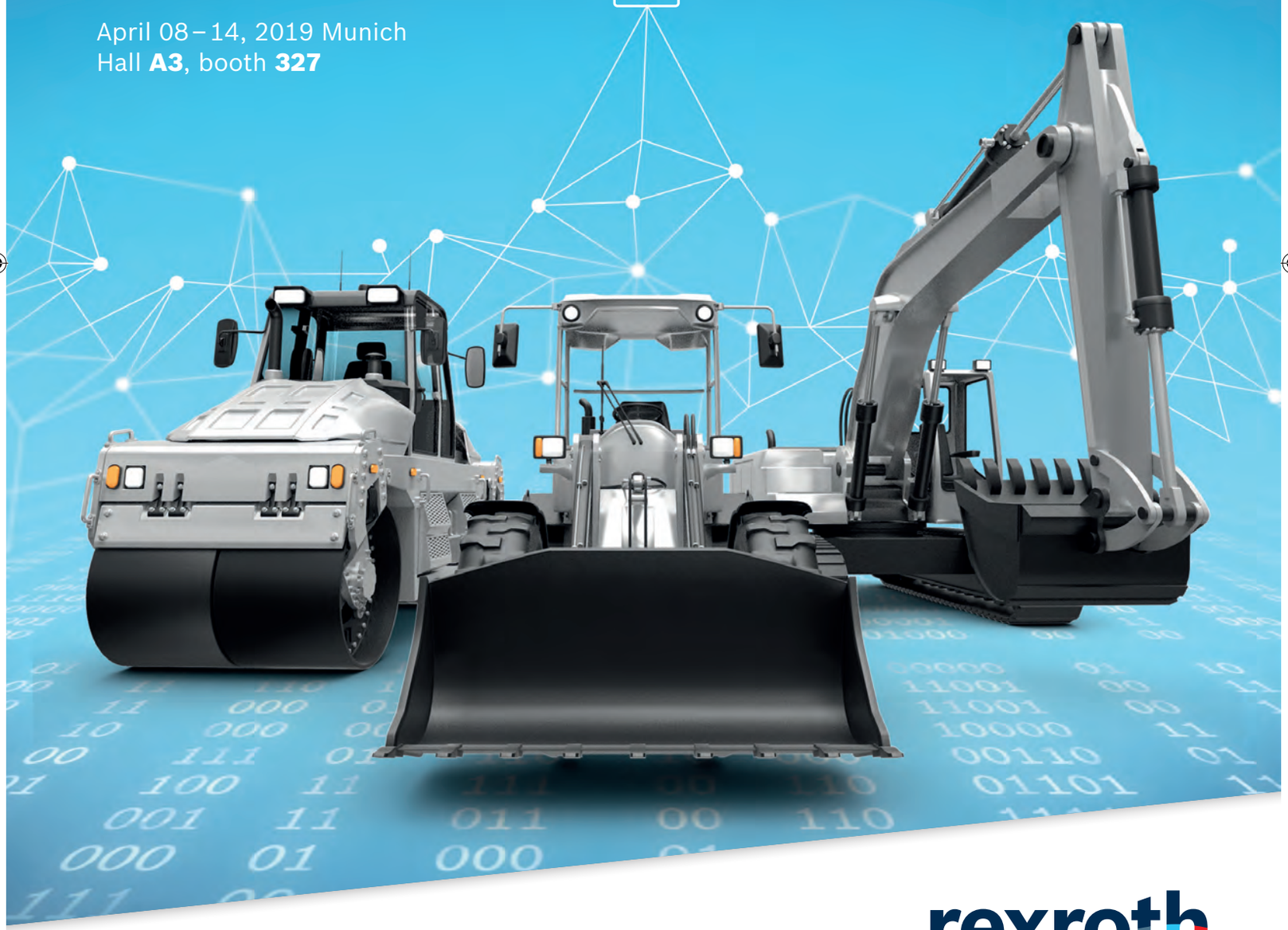
Transforming Mobile Machines

Now. Next. Beyond.

Smarter mobile machines by combining data with hydraulics?
Come visit us and explore more.

bauma

April 08 – 14, 2019 Munich
Hall **A3**, booth **327**



www.boschrexroth.com/bauma
www.boschrexroth.com/mobile-hydraulics

rexroth
A Bosch Company

NEXT-GENERATION **DISPLAY CONTROLLERS**

Liebherr will present its new generation of display controllers: the DC5 family. In addition to being used as a high-resolution display, the customizable DC5s with touchscreens can be used as programmable input devices. Liebherr's fifth-generation display controllers are based on a high-capacity i.MX6 processor and a Linux/Yocto software environment. Rated up to IP6K5, the DC5 display controllers are ideally suited to the demanding operational conditions of mobile machinery – from construction and agricultural machinery to materials handling.

The DC5 portfolio comprises 7in (18cm), 9in (23cm) and 12in (20.5cm) variants, and interfaces such as Ethernet, CAN or Bluetooth can be easily integrated. A built-in speaker can provide the driver with audio data, such as beeps.

Optical bonding combines display, touch sensor and protective glass to create robust, compact units. This high-quality bonding technology ensures that the displays are suited to the challenges of demanding operational conditions. The controllers are able to function at temperatures from -30°C to 70°C (-22°F to 158°F). Optical bonding also ensures that the units are waterproof and dustproof.

The DC5 controllers offer significant advantages in terms of comfort, with their increased touch functionality and high legibility, even when used in strong sunlight.

DC5 users can configure various parameters such as design, display size and quality, computing power and interfaces.

This customization element allows OEMs to meet the specific requirements of their machines and get the most of their user interface. If required, even more functionality can be integrated directly into the display controller, such as satellite navigation or mobile communications. This provides additional function options in the system architecture.

In addition to displaying operational parameters and camera images, the DC5 display controllers qualify as a visibility aid in accordance with DIN EN ISO 16001:2016. They can also be used as control computers.

The integrated PCAP touchscreen transforms the displays into programmable input devices.

Every day, in many industries worldwide, tens of thousands of Liebherr displays reliably supply operators with information.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **533**

bauma 2019
APRIL 8-14 • MUNICH
Liebherr
Hall ICM, Stand 308

SHOCK-PROOF TILT SENSORS

Curtiss-Wright's Industrial division will be using its stand at Bauma 2019 to promote a portfolio of products designed to work in the most challenging of specialty construction vehicle environments.

The range includes a new series of dual-axis, vibration-tolerant tilt sensors that offers an optimal combination of performance, safety and cost in dynamic applications.

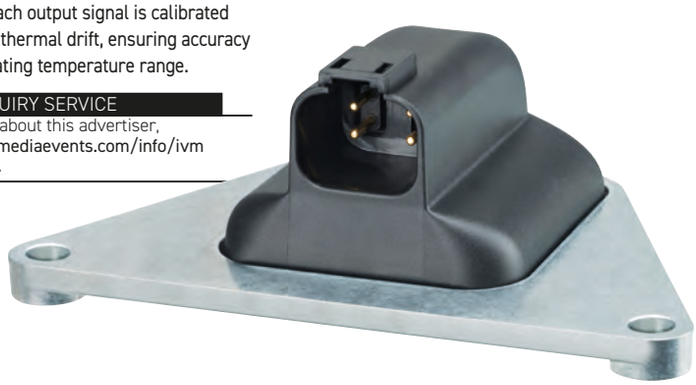
With the ANSI A92.20 standard for mobile elevating work platforms (MEWPs) approved and released in 2018, every MEWP operating on slopes must be fitted with an alarm and safety cutout for tilt angles beyond the safe working limit.

Curtiss-Wright's VTS series of vibration-tolerant tilt sensors uses the latest inertial measurement unit (IMU) technology and fast-acting software algorithms to filter out disturbances caused by vibration and vehicle motion. This provides output stability without the measurement delays usually associated with heavily damped, traditional sensing methods.

The VTS series sensor feeds output data over CANbus using the SAE J1939 protocol, with each measurement axis having two sensing elements, which are constantly compared to ensure correct operation. If an error is detected, its condition is communicated to the host electronics to ensure a safe operating situation is assumed. Additionally each output signal is calibrated to account for thermal drift, ensuring accuracy over the operating temperature range.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **534**

bauma 2019
APRIL 8-14 • MUNICH
Curtiss-Wright
Hall A4, Stand 421



03
ELECTRONICS

TOOL RECOGNITION FOR **MACHINE CONTROL**

Based on **SVAB**'s Quantum Tool Recognition system, Leica Geosystems and SVAB are releasing a new productivity tool for iXE3 and iGW3 machine control solutions. Tool Recognition is a system that automatically detects the work tool that is connected to and being used on construction machines via BLE (Bluetooth low energy).

Thanks to this system, when changing work tools, the machine operator no longer needs to manually change settings in their Leica Geosystems machine control solution. It can now be done automatically instead. The driver will also get a warning if a work tool without a tool recognition module is selected. This minimizes the risk of using the wrong bucket, which could cause over- or under-digging and subsequent costs. As well as directly supporting the attached tools, Tool Recognition also supports standard tilt buckets and detachable tilt rotators.

The Tool Recognition system also integrates and automates functions that are important for the operator's work.

Marcus Grevelshøj, product manager for excavator and wheel loader solutions at Leica Geosystems, explains how the new solution can help the industry to become more efficient by removing the need for manual settings. "Some operators change their machine's bucket several times a day. Tool Recognition eliminates the risk of human error occurring as a result," he says. "The integration with the machine control solution means that the operator only needs to focus on one panel at any given time."

Fredrik Eriksson, CEO of SVAB, adds: "Tool Recognition sets a new standard that takes advantage of the information about which work tool is connected to the machine in use. We are very proud to announce that Leica Geosystems now is compatible with the system."

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **535**

bauma 2019
APRIL 8-14 • MUNICH
SVAB
Hall C5, Stand 136

FLEXIBLE CONTROL SYSTEM ARCHITECTURES

Digitization, electrification and tightening functional safety requirements are just a few of the challenges that machine manufacturers are facing. In practice, this means that OEMs are under pressure to shorten the time-to-market for new solutions.

As well as this, OEMs' customers still expect easy maintenance and longevity of spare parts. This fact especially concerns the brains of the machine – the control system.

Designing the optimum machine control system architecture is challenging. Different architectures have their own benefits and there are many things to consider in the design. Distributing the inputs/outputs (I/O) close to sensors and actuators, and minimizing the wiring through moving joints, are easy decisions to make. A more difficult decision is whether to have centralized or decentralized intelligence in the control system. Should the manufacturer choose one programmable 'master' unit with CANopen I/O slaves or several programmable I/O control units connected with CANbus?

Epec offers control systems for different machine architectures. The company has programmable logic controllers (PLCs) for distributed and centralized systems, solutions for functional safety, and new master and slave products with varying I/O capability for modular solutions. Long product life and availability are key design principles for all Epec products.

READER INQUIRY SERVICE
To learn more about this advertiser,
visit www.ukimediaevents.com/info/ivm
Quote Ref: **536**

bauma 2019
APRIL 8-14 • MUNICH
Epec
Hall A4, Stand 426

TOTAL VEHICLE **CONTROL**

Highly sophisticated construction and industrial vehicles need to acquire and control lots of data in order to function optimally. **Makersan** has created a distinguished, rugged human-machine interface (HMI) that connects the operator and the machine.

The HMI features a bright, sunlight readable 1,000cd/m², 800x480 pixel high-resolution 7in (18cm) display that can be mounted horizontally or vertically and can be installed as either a standalone system or mounted to a dashboard. The HMI is versatile and can be used in a wide range of mobile applications. It has two CANbus ports and 14 configurable analog/digital, frequency/resistive inputs/outputs. The device can be can be programmed with Makcon or C++, icons, colors and/or indicators, and its time and interface language can be configured by user. Less than two seconds of booth time ensures immediate readiness.

The HMI casing provides IP67 protection, as well as resistance to voltages that are too high and protection against reversed voltage polarity. Makersan's robust rotary keypad manipulator also has these protections. The rotary knob has RGB LED ring lighting for direction indication, and in addition to the push option, has a patent-pending pull action for simple navigation.

Both devices have gone through rigorous testing and both can communicate through CANopen and CAN J1939.

bauma 2019
APRIL 8-14 • MUNICH
Makersan
Hall A2, Stand 411

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **537**

A COMPLETE **PRODUCT PORTFOLIO**

Amphenol Tuchel Industrial is pleased to announce its new product releases, specially designed for harsh environments and the heavy-duty equipment market. These connector series are fully compatible with existing market standard products.

The AT and ATM Series have expanded the BoardLock Series to include flanged, flangeless, 180° straight and 90° right angle, wire-to-board PCB connectors.

Built on the proven reliability of the A Series technology, these improved connectors, together with the also brand-new Armor IPX enclosure boxes and headers, enable Amphenol to offer a full product portfolio for applications that require direct PCB termination. Another exciting highlight to the A Series is the expansion of Amphenol's DuraMate Series. New contact arrangements and accessories for shell size 18 and 24 connectors have been added, as well as the DuraMate AHDM metal circular connector series. These products are a perfect completion of the portfolio and are fully compatible with the Deutsch HD30 Series.

The A-Series product line offers 1 to 47 pins per connector with currents up to 100A.

Visit Amphenol's booth at Bauma to see its range of high-power connectors that can handle up to 500A and 1,000V.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **538**

bauma 2019
APRIL 8-14 • MUNICH
Amphenol Tuchel Industrial
Hall A5, Stand 549

MEASURING DISPLACEMENT AND INCLINATION

Displacement and inclination positions need to be determined in many mobile machine applications. Even if the variables need to be measured at the same spot of the machine, usually two different sensors need to be applied to capture both parameters. In such cases, a combined measurement of the variables in one sensor can save costs and installation space, as well as cabling and installation work.

At Bauma, **ASM Sensors** will present a sensor that offers a combined displacement and inclination measurement for industrial machine and vehicle applications that are used in harsh environments, for example, telescopic crane outriggers.

The PosiTape extension sensor WBT61 measures displacement using a high-tech stainless-steel tape, which is durable enough to be used in challenging environments, such as in ice and dirt. It can be repeatedly deflected, even in opposite directions, without the tape's lifetime being affected. Inclination is measured with an integrated inclination sensor element based on micro-electromechanical systems (MEMS) technology.

The PosiTape WBT61 sensor can measure linear positions up to 4,000mm (13ft) and inclination between +/-180° with two axes. Available digital outputs are CANopen and CAN SAE J1939. The standard linearity of the displacement sensor element is +/- 0.10 %. The sensor offers a protection class of IP67 or IP69. For safety applications, the sensor is available with redundant systems.

READER INQUIRY SERVICE
To learn more about this advertiser, visit ukimediaevents.com/info/ivm
Quote Ref: **539**

bauma 2019
APRIL 8-14 • MUNICH
ASM Sensors
Hall 2, Stand 225

583,736
Visitors to Bauma 2016

NEW WIRE-ACTUATED **ENCODERS**

At Bauma 2019 **Siko** will unveil two wire-actuated encoders to the public for the first time: the SG61 and the SG121.

The encoders are not only compact – making them ideal for use in intralogistics, mobile machines and stationery machine construction – but they are sturdy and flexible too. The SG61 can measure lengths of up to 6m (19.5ft) and the SG121 has a reach of 12m (39ft).

The encoders have an installation depth of just 70 x 85 x 105mm (2.7 x 3.3 x 4in). Their robust aluminum housing, coupled with impact-resistant plastic, can survive even the harshest of operating conditions. The dust-, water- and shock-resistant sensors can operate at temperatures from -40°C/°F to 80°C (176°F). For outdoor applications, Siko has also released a version of the sensors that has integrated water drain holes. The outdoor versions prevent water that has penetrated the sensor from freezing, thus increasing the service life.

The flexible 58mm (2.2in) flange system inside both of the new wire-actuated encoders can be used with almost any interface. Users can select the interface appropriate for their application.

The SG61 and the SG121 are suitable for reliable position detection and can help improve safety.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **540**

bauma 2019
APRIL 8-14 • MUNICH
Siko
Hall A4, Stand 421

Control the future

The ZX210X-6 is **Hitachi**'s most technologically advanced excavator, and will be on display at Bauma. Key features include state-of-the-art machine control developed in partnership with Trimble.

Turn to page 42 to find out more about this vehicle, as well as how other OEMs are introducing machine control to help their customers bridge the skills gap.

bauma 2019
APRIL 8-14 • MUNICH
Hitachi
Hall FN, Stand 718

iVT 10 BEST NEW VEHICLES AT BAUMA

A ROBUST, AFFORDABLE **DISPLAY**

Specializing in the development and production of technology for off-highway vehicles, German company **Bauser** offers flexible and affordable displays that can be customized to suit user requirements.

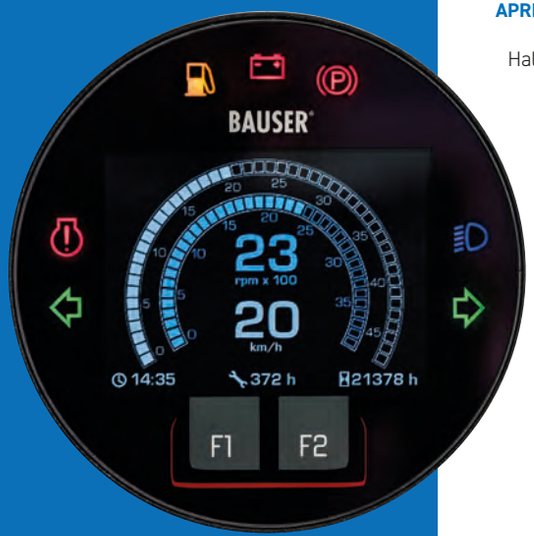
Type 819.TFT is a color TFT LC display that is capable of holding several LED warning lamps. Two optional buttons can be added for setting the time and date, or scrolling through the menu screens.

The design of the human-machine interface (HMI) is simple, clear and customizable. The operator can use bar graphs, digits, symbols or text outputs. Graphic 320x240 pixels can be used for a variety of visualization purposes, including error codes or warnings from the machine's electronic control unit (ECU), speed indication in miles or kilometers per hour, temperature values, and machine operation and service hours. Type 819.TFT comprises 26 connector pins (optionally super- sealed). It can be used for digital inputs, analog sensors, digital outputs and communicating via CANbus.

The CANbus communication is capable of working with standardized protocols such as CANopen and/or SAE J1939.

Type 819.TFT's optional extras include a custom front fascia, custom colored HMI, integrated audible alarm (approximately 85dB) and a real-time clock. It is operational in rough environments at temperatures of -30°C to +85°C (-22°F to 185°F).

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **541**



bauma 2019
APRIL 8-14 • MUNICH
Bauser
Hall A5, Stand 238

219
The number of countries represented by Bauma 2016 visitors

bauma 2019
APRIL 8-14 • MUNICH
MTS Sensor
Hall A2, Stand 313

DYNAMIC MEASUREMENTS, **HIGH PRECISION**

MTS Sensors is recognized as an industry leader in sensing technologies and solutions.

Its Temposonics sensors enable high-precision and dynamic position measurement in state-of-the-art automation and safety-relevant applications.

With a versatile and ever-increasing product portfolio, MTS Sensors cooperates closely with its customers to optimize performance and reduce downtimes. Outstanding quality associated with practical know-how ensures that customers achieve utmost productivity and success. Continuous research, development and production of sensor systems constantly enable new solutions for measuring tasks in the industrial, mobile hydraulics, and process technology fields to be created.

The absolute, linear position sensors provided by MTS Sensors rely on the company's proprietary Temposonics magnetostrictive technology, which can determine position with a high level of precision and robustness.

MTS Sensors' customers can rely on more safety, comfort and machine availability with sensors that have been specially designed for stroke measurement in hydraulic cylinders and which have the highest robustness against shock and vibration. MTS Sensors' latest sensor solutions will be presented at Bauma 2019.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **542**

A VERSATILE **THREE-GAUGE CLUSTER**

Maximatecc has added a compact three-gauge instrument cluster to its extensive line of gauges and instrument clusters. Designed for monitoring engine performance on heavy equipment and special industrial vehicles, it can operate in three input modes: pure J1939, pure analog, and analog hybrid J1939. When connected to a J1939 network, the device can support communication speeds up to 500Kbps.

The device can be fully customized for specific applications to show information from either J1939 or analog sources. In addition, the 2.7in (67cm) sunlight-readable display can show up to four additional parameters and engine control unit (ECU) messages. Eighteen LED warning lights can be triggered by analog, J193 or digital inputs. Four backlit pushbuttons allow direct communication with the ECU. In addition, white LED backlighting, glass lens with anti-fog and anti-scratch treatment, and IP67/65 sealing, makes this cluster an ideal choice for use in harsh environments.

Maximatecc and AST offer a broad portfolio of engine monitoring products, including instrument clusters, gauges, hour-meters, senders, sensors, and more. These high-quality devices are trusted by OEMs around the world and are used in applications involving vibration, shock and high exposure to moisture. Custom versions with specific interfaces, labeling, hardware, and more, can be developed for specific applications. Maximatecc products are supported by a global network of distributors and systems integrators.

Visit Maximatecc's stand at Bauma to learn more about three-gauge instrument cluster and/or its other engine monitoring products for heavy-duty applications.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **543**

3,425
The number of exhibitors at Bauma 2016

bauma 2019
APRIL 8-14 • MUNICH
Maximatecc
Hall A2, Stand 326

POWERFUL, RUGGED DISPLAYS

Enovation Controls has unveiled the new Murphy PowerView 500 and PowerView 700 glass-front industrial displays. Designed for rugged equipment of all shapes and sizes, the new 5in (13cm) PV500 and 7in (18cm) PV700 are ideal human-machine interface (HMI) displays for any engine-driven application.

The new displays join Murphy's existing 10.6in (27cm) PV1100 and ultra-wide 12.3in (31cm) PV1200 to form the new family of PowerView glass-front displays. Built with high brightness and optically bonded LCDs, PowerView glass-front displays deliver best-in-class sunlight viewability. The glass surface also delivers exceptionally clear images with high-precision touch sensor performance for finger and glove touches with great scratch resistance. This powerful family of displays comes equipped with a high-performance processor to deliver seamless full-color graphics, animations and video playback, for a rich user experience.

PowerView glass-front displays are the latest addition to Murphy's expansive product portfolio that includes PowerView tactile-button displays and PowerCore industrial engine controllers and panels. Visit Enovation Controls at Bauma to learn about its latest display and control offerings.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **544**

bauma 2019
APRIL 8-14 • MUNICH
Enovation Controls
Hall A4, Stand 509

FINN McGUIRK

bauma 2019
APRIL 8-14 • MUNICH
CrossControl
Hall A2, Stand 326

Reimagining telematics

A VERSATILE TELEMATICS AND CONNECTIVITY PLATFORM IS ENABLING IN-CAB DISPLAYS, CONTROLLERS OR DEDICATED TELEMATICS MODULES TO BE DEPLOYED, SO THAT OPTIMIZED IOT SOLUTIONS CAN BE REALIZED FOR A WIDE RANGE OF APPLICATIONS

LEFT: **The CCpilot VI can be used as an in-cab display for operator support systems, as well as a connectivity gateway for telematics**

BELOW: **The CrossFire IX is an I/O device for hydraulics control with data logging and wireless connectivity features**

For its latest iteration of telematics, CrossControl has looked to the heavens to reimagine what its devices are capable of, in what marketing manager Mats Kjellberg is calling "the HMI of things" (human machine interface of things). The changes create a dynamic infrastructure that enables cross-device functionality and collaboration.

The fully fledged telematics platform from CrossControl includes Smart Connect, which makes machine system information available to a smart device; and Enterprise Connect, which is a cloud service that connects machines and clients in order to aggregate key performance indicators for the whole fleet.

Wireless smartphone interaction

Working with manufacturers of hydraulic systems, CrossControl has developed additional support for its CrossFire IX, a compact I/O device tailor-made for hydraulic controls, enabling the device to be used as a datalogger and wirelessly interact with a smartphone.

This creates a range of uses for HMIs in the form of different smartphone apps that can support operators and service technicians. These apps can include diagnostics, usage statistics and HMI tools.

By leveraging smartphone cloud connectivity, lean telematics solutions have been achieved by CrossControl, making system data available to fleet owners as well as to the OEM, supporting great savings in service activities.

This pairing of a 'headless' HMI and a smart device opens up an entirely new realm of applications in areas where more traditional offerings struggled to find a permanent home. Some implement manufacturers have chosen to use the CrossControl solutions for handling the in-vehicle controls, managing the cloud services via existing infrastructure.

These customers have benefited from the open software platform that CrossControl devices come with, offering great freedom in designing the functionality that each application calls for.

Moving data from the app to the cloud

Using the newest device in the CrossControl display line-up, the CCpilot VI, a 3.5in (8.89cm) display featuring a dual-chip Bluetooth and BLE (Bluetooth low energy) transmitter, clients are able to efficiently channel machine data from their app to the cloud, while still offering an in-vehicle display and control solution – one device serving a multitude of functions.

Broader connectivity implications

Beyond the cab, this increased connectivity has broader implications, as Ken Lindfors, product manager for software platforms at CrossControl, explains: "The problem we were asked to solve was how to let the OEMs and their customers monitor, diagnose and control a whole fleet of machines. Enterprise Connect is the solution."

Both OEMs and end users are increasingly familiar with the IoT, and they rightly expect suppliers to understand their changing needs. CrossControl has been working in this area for a long time and this latest iteration helps to meet the needs of both groups.

"Now that almost everyone has a smart device – usually in their pocket – it expands what we are able to offer to the market," adds Lindfors.

CrossControl can supply routing and geo-fencing protection to the end user, while offering controlled datalogging to both groups.

Information harvesting

This expanded data logging, as Markus Wallmyr, researcher at Mälardalen University Sweden, explains, is where the game really changes.

"Data harvesting can revolutionize how an OEM builds a machine from the ground up," he says. "A combination of diagnostics, error logs, mechanical part prognostics, driver behavior and productivity data can fundamentally change the way they understand their machines". Testing used to feature a small sample size of machines over a limited period. But now, with access to this new wealth of information, there is an almost limitless scope for insight into what equates to hundreds of thousands of hours of on-site testing and results. "The trends and recent advancements that we are seeing in this area are really interesting" says Wallmyr.

With the complete telematics platform available from CrossControl, OEMs can see their equipment perform like never before, and revolutionize their products, rather than following trends. **iVT**

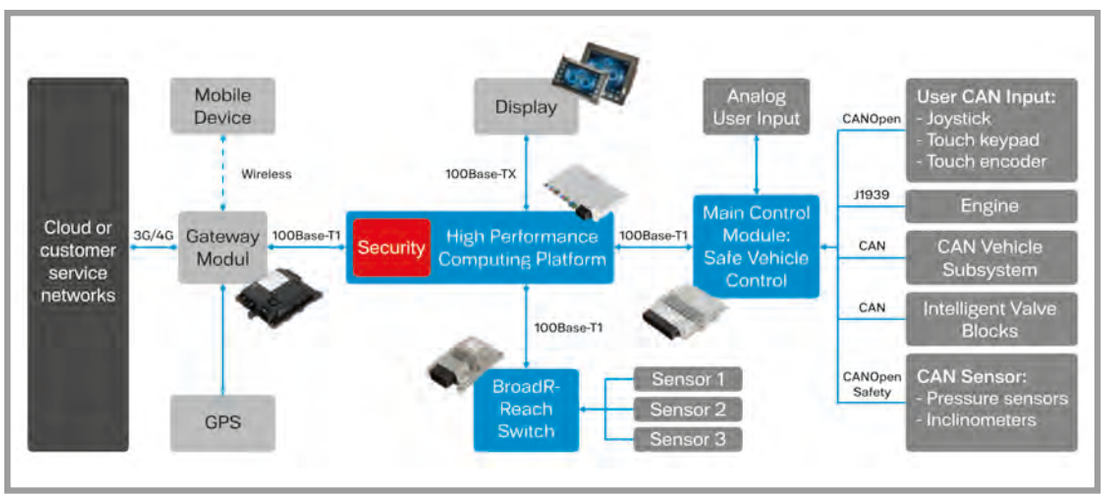
Finn McGuirk is a content marketing associate, at CrossControl

ANDREAS LOCATELLI

Preparing for autonomy

bauma 2019
APRIL 8-14 • MUNICH
TTControl
Hall A3, Stand 550

THE DEMAND FOR AUTONOMOUS OPERATIONS IN THE OFF-HIGHWAY INDUSTRY IS INCREASING. TO MEET THIS NEED, HIGH SAFETY STANDARDS MUST BE CONSIDERED AND IN-VEHICLE ARCHITECTURES NEED TO BE REDEVELOPED



LEFT: **A high-performance computing platform joins sensors and other control units on a vehicle**

The technology required for autonomous operation in the mobile machinery sector can improve safety and productivity, as well as address operator and skills shortages in related industries. TTControl, a joint venture of TTTech and Hydac International, is working toward the incremental introduction of automation in mobile machinery.

Assistance categories

As a first step toward autonomous mobile machinery, high-performance computing platforms and sensors are required to assist operators by providing visual and/or acoustic signals to guide them. Types of assistance will vary from industry to industry and from application to application, but a basic set of sample assistance categories can be defined, such as:

- Safety assistance: Obstacle recognition and people detection in the area surrounding the machine;
- Guidance: Overlaying optimal path/work action on the vehicle display to guide the operator;
- Virtual boundaries: Limiting the machine's actions, so that potential errors do not cause harm or damage to the operator or people in the machine's surrounding areas.

Advanced operator assistance requires a smart human-machine interface (HMI) to communicate with the operator in a bifunctional way. The next generation of TTControl's robust operator interfaces is designed to meet the requirements of an advanced off-highway operator assistance system. Features such as four simultaneous video streams, hardware-accelerated 3D animations, user inputs through multitouch-capable screens and acoustic feedback via integrated loudspeaker, ensure operators can safely and efficiently drive the machine. An extensive range of interfaces and a display size of 12.1in (30.7cm) allow them to be used in a range of applications.

TTControl will present its third display generation at Bauma 2019 in Munich, Germany.

To increase machine productivity and efficiency, accurate information about the machine and its equipment is crucial. In order to collect various kinds of data such as CAN-based messages, engine data, GPS-based location and movement information TTControl provides a complete out-of-the-box connectivity solution. The TTConnect Cloud Service includes TTConnect Wave – the ruggedized IoT gateway – as well as access to the TTConnect Cloud. The service enables OEMs of mobile machinery and fleet owners to access machine data remotely on any device that is connected to the internet. It therefore ensures complete machine management, data analysis and operational cost savings.

In the future, multiple or even all operator tasks will be taken over by the automated machiner. This advanced level of automation will only be possible through complex sets of sensors for environment perception, such as stereo cameras and lidars. The enormous amount of collected classified data will be handled via deep learning algorithms that are able to recognize obstacles or other objects during the working process. The high data rate and computing power required to process the information obtained by these sensors in real time has stimulated discussion about new network and control architectures for mobile machinery.

Experts at TTControl expect any new vehicle architecture to include a central high-performance computing platform connected via an Ethernet interface to sensors and other control units in the machine. The graphic above shows an example of such an in-vehicle architecture.

The autonomous future of mobile machinery

There is still a long way to go until mobile machinery operation is fully autonomous.

"In the short term, autonomous vehicles will operate within restricted areas only," says Andreas Locatelli, product manager of autonomous operations at TTControl. "Nevertheless, this brings enormous benefits for mobile machinery OEMs in terms of productivity and efficiency. Heading toward full autonomy in the long run will certainly be linked to an even higher safety level of mobile machinery." **iVT**

Andreas Locatelli is product manager of advanced driver assistance systems and autonomous operations at TTControl

CARMEN KLINGLER-DEISEROTH

Safety for mobile machines

bauma 2019
APRIL 8-14 • MUNICH
B&R
Hall A2, Stand 127

OFF-HIGHWAY OEMs ARE FINDING BENEFITS IN OUTSOURCING THE TASK OF MEETING THE EUROPEAN MACHINERY DIRECTIVE REQUIREMENTS ON SAFETY

The evolving market requirements for mobile machinery can no longer be met with mechanical solutions. As a result, off-highway vehicles are becoming increasingly automated. That means implementing things like cloud connectivity, and autonomous or semi-autonomous processes.

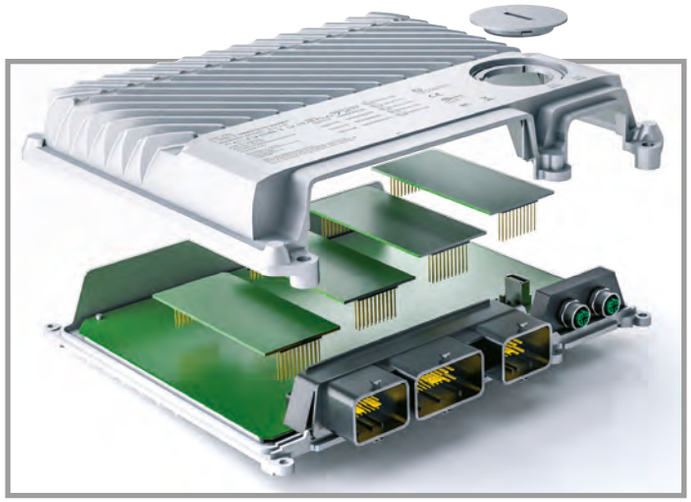
One of many examples of automated processes are drive-by-wire systems, which transmit information from the gas pedal electrically instead of mechanically. These systems offer many advantages, but are not without risk. "A malfunction while driving could cause a serious accident," notes Stefan Taxer, B&R's product manager for mobile automation. Safety technology is therefore critical for the drive system.

Identifying the safety level

But how does the manufacturer of a mobile machine know which requirements a safety solution must meet? First, they must determine whether the application falls under the jurisdiction of the European Machinery Directive, which is the case for nearly every mobile machine built today. "The Machinery Directive requires manufacturers to carry out a hazard analysis and risk assessment using a risk graph in order to determine the necessary level for the safety function," explains Taxer. Mobile machinery must generally achieve safety integrity level SIL 2 and performance level PL c. The exact performance level required can be determined through a risk assessment specified in ISO 13489-1.

Achieving these safety levels is no problem using programmable safety technology. "Nevertheless, many manufacturers shy away from programmable safety technology because they consider it too complex," says Taxer. He explains that this does not have to be the case – using the B&R system as an example: "For a wide variety of safety functions, there are software blocks available that are pre-certified by TÜV. The task of safety programming is thus reduced to simple configuration and linking of the safe software blocks via ladder diagram. The OEM then only has to prove to TÜV that this work has been carried out in accordance with the guidelines for safe development. This drastically reduces complexity, workload and certification time."

The hardware to go with B&R's programmable safety technology is the X90 safety control and I/O system. The performance of the controller is scalable over a wide range and can be supplemented with functions such as additional I/Os, interfaces or vibration-based condition monitoring. The housing is extremely robust and features IP67K protection. Thanks to the modular design of the X90 controller, it's easy to add additional functions – such as interfaces, condition monitoring or, in the future, PLe-rated safe I/Os.



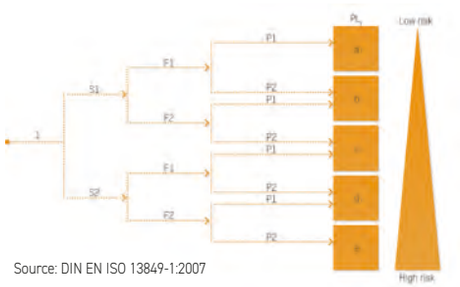
LEFT: **Additional functions can be easily integrated in B&R's modular X90**

BELOW: **A flow chart for assessing risk as specified in ISO 13849-1**
S1 Reversible injury
S2 Irreversible injury/ death

F1 Rare or brief exposure to hazard
F2 Frequent exposure to hazard (multiple times per shift)

P1 Possible to avoid or limit damage
P2 Virtually impossible to avoid or limit damage

PL Performance level



Source: DIN EN ISO 13849-1:2007

Future-proof technology

As a technology partner, B&R goes to great lengths to ensure that its platforms are future-proof. If the safety requirements increase to SIL 3 or PL e, for example, there would be no need to redesign the hardware. The controller is already designed to support PL e. "In that case, we'll simply develop a new option board with the corresponding I/Os that meet PL e requirements," says Taxer. This board can then be easily integrated into the X90 controller.

B&R also takes great care to ensure that interaction between the standard and safety-related components of a machine application is future-proof. The user can imagine the safety solution as a protective shell around the standard machine application. "As long as all the parameters stay within their limits, everything is fine. If a value strays outside its limits, the safety controller takes over and guides the machine into the defined safe state," explains Taxer. When you modify or expand the machine application, there's no need to make any changes to the protective shell. "That means there is no need for re-validation or re-certification," says Taxer.

The Machinery Directive is gaining significance for off-highway OEMs due to increasing levels of automation. Automation specialist B&R has 10 years of experience in the field of functional safety and in implementing industrial directives. This experience applies equally well to the agricultural, construction and municipal sectors. "With our comprehensive hardware and software platform and easy-to-configure engineering modules, we are the ideal technology partner for developing mobile machinery safety solutions," says Taxer. **iVT**

Carmen Klingler-Deiseroth is a freelance journalist

ARNAUD WENDLING

More than just a display

bauma 2019
APRIL 8-14 • MUNICH
Würth Elektronik
Hall A5, Stand 248

CUTTING-EDGE ELECTRONIC COMPONENTS ARE ESSENTIAL FOR THE CORRECT FUNCTIONING OF OFF-HIGHWAY VEHICLES

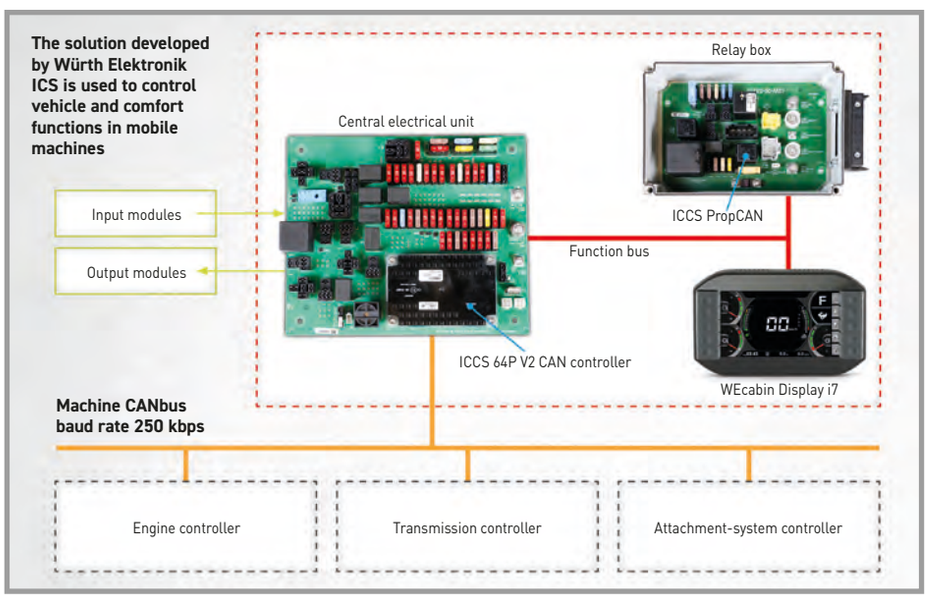
To develop its new generation of wheel loaders, Komatsu Germany has integrated an intelligent central electrical unit and a relay box from Würth Elektronik ICS to upgrade the user-friendliness and functionality of its product.

The construction machine developers at Komatsu's German site had been using a cost-effective, robust panel with an LCD for several generations of machines. However, this gradually became no longer fit for purpose. "For example, errors that trigger a power reduction in the combustion engine must be displayed as a consequence of the new emission regulations," says Carlo Struß, a group leader of construction at Komatsu.

A convincing offer

In 2016, Komatsu decided to search for the right solution for a new display as part of the WA100M-8 compact wheel loader project. At the same time, Würth Elektronik ICS brought its new product, WEcabin Display i7, to the market and presented it to Komatsu. Specially developed for mobile machines and commercial vehicles, the robust display features a wide selection of interfaces. With an ARM (Acorn RISC machine) Cortex-A8 processor with 512MB RAM, 4GB flash drive, and a Linux-based operating system, it is powerful enough for complex controlling tasks and features a sophisticated GUI.

BELOW: **Komatsu Germany has installed a central electrical unit, display and relay box from Würth Elektronik ICS into its WA100M-8 compact wheel loaders**



In the evaluation of the display, alongside technical criteria, the external appearance, and similar reference applications, the issue of software design also came up. The fact that Würth Elektronik ICS offered this as an additional service was decisive in Komatsu's decision to commission the project. The GUI was adapted to the design requirements and the user interface is available in 15 languages. There are 10 function buttons that can be used to operate the WEcabin Display i7.

"I presented the display as part of a system solution for power distribution and control," says Roland Unverricht, sales representative at Würth Elektronik ICS. "Even though Komatsu didn't have any problems with its previous wiring harness solution for vehicle electrical systems, the switching to our PCB-based solution was included in the evaluation."

System components

At the same time as designing the Komatsu display, experts at Würth Elektronik ICS also developed a central electrical unit and relay box for the construction equipment manufacturer. The new relay box and central electrical unit replaced the previous hard-wired solution throughout the entire system and reduced the assembly time. The relay box is installed in the battery compartment. It contains different fuses and relays that switch and protect the starter, glow plug and battery, as well as an ICCS PropCAN relay to control the hydraulic cooling fan. A central electrical unit with an ICCS 64P V2 CAN controller manages and protects different functions and establishes the connection to the display. Komatsu was able to downsize the wiring harness considerably thanks to the new solution.

Successful series launch

The WA100M-8 compact wheel loader was presented at two specialist trade fairs in September 2018, and Würth Elektronik ICS was pleased with Komatsu's feedback regarding the compact wheel loader's first public appearances. Trade show attendees considered the display in the cabin to be an impressive sign of the new machines' high quality. **iVT**

Arnaud Wendling is product manager for ICCS and HMI product lines at Würth Elektronik ICS

STEFANO CASARI

Multiple display solution

bauma 2019
APRIL 8-14 • MUNICH
MTA
Hall A2, Stand 627

INDUSTRIAL VEHICLE OEMs CAN STREAMLINE MACHINE DESIGNS BY INSTALLING A SINGLE COMPUTER THAT IS ABLE TO HANDLE MULTIDISPLAY SYSTEMS, INCLUDING 360° SURROUND VIEW, ON A CHOICE OF TWO OPERATING PLATFORMS

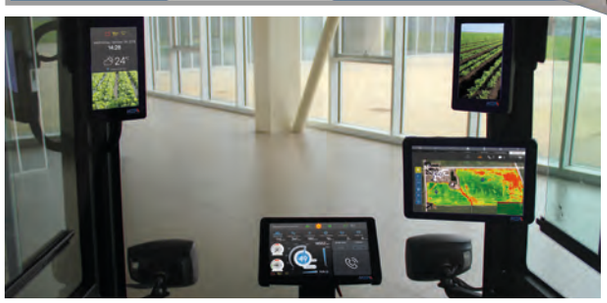
Following trends in the automotive industry, off-highway OEMs are increasingly asking their Tier 1 suppliers to provide them with systems able to control multiple displays, or to connect to operations centers in order to activate, monitor and operate features or implements connected to the vehicle. This approach represents an attempt to meet users' needs, as it helps to dramatically reduce operating costs and downtime during service, while providing added safety during operations.

The portfolio of solutions related to onboard multimedia technologies and connectivity offered by MTA takes a decisive step forward in this field with the implementation of a complete in-vehicle system called SIC. SIC can be developed for agricultural vehicle applications and features an intelligent central unit that can handle a multidisplay system.

Thanks to its specialization in electromechanical and electronics components for OEMs, MTA has developed a unit based on a flexible and powerful architecture that makes use of a latest generation multicore microprocessor with a very high computing power.

The unit can handle up to four full HD displays inside the vehicle, as well as collect and convey the information coming from the vehicle, and the images from cameras through BroadR-reach technology and data from wireless connectivity. The presence of this 'electronic heart' makes the display and the central dashboard become separate devices on the system, enabling OEMs to replace them easily in the transition from one vehicle application to another.

Furthermore the unit is ready to be adapted for additional functions based on specific customer requirements, such as the 360° Surround View function. This is enabled using four digital cameras with image processing libraries to give 360° on the cab display. This system eliminates blind spots for increased safety.



ABOVE: **MTA's SIC is a complete in-vehicle system**

LEFT: **The central unit can drive up to four displays within the cab**

Two platform options

MTA is able to supply the customer with two different solutions – a Linux-based and an Android-based software architecture.

The Linux platform is very flexible and allows the products to be developed according to the specific needs of the customer's application. However, such flexibility does not come at the expense of compliance with stringent software development standards, as the company is working on its infotainment systems according to the Automotive Spice process required by leading OEMs.

The second solution, based on the Android automotive operating system for graphical applications handling, largely allows the integration of customers' functionalities, thus increasing the full potential of the system.

This original solution is made possible thanks to the agreement MTA signed with Elektrobit, a global supplier of embedded and connected software products and services for the automotive industry.

The Android solution has also led to the development of an innovative architecture that uses an additional core of the microprocessor for increased safety and security.

The system brings together the latest infotainment functionality and digital instrument clusters, allowing maximum performance. It can simultaneously run an Android premium class infotainment system and a 3D instrument cluster.

To show customers its offer related to onboard multimedia technologies and connectivity, MTA has also developed a show-cab, equipped with this central unit and four displays, showing the live performance of this evolved electronic system. **iVT**

This article is a summary of a presentation made at iVT Expo 2019 by MTA technical director for electronics R&D, Stefano Casari

NILS HABICHT

A console for control

bauma 2019
APRIL 8-14 • MUNICH
Topcon Electronics
Hall A2, Stand 249

CONSOLES FOR OPERATORS USING MOBILE MACHINERY MUST BE VERSATILE AND EASY TO USE, AND DISPLAY WITH CLARITY

Versatility and ease of use make the OPUS A6 2nd Generation an ideal console for the mobile machinery market. It is compatible with any vehicle with a CAN interface and it can be configured in just a few clicks. High quality standards and customer-centric product development are just two reasons why Topcon is a market leader.

How can the increasing functionality of mobile machinery be handled without overloading the user? By creating the perfect interface between man and machine, Topcon believes.

This philosophy translates onto the OPUS A6 2nd Generation operator panels, distinguished by a high level of operating convenience and ease of programming.

Topcon's rugged, field-tested products are designed to be used in harsh working environments. Each device is subjected to four rigorous tests for functionality, durability and extreme temperatures in order to ensure the best quality for every customer.

ABOVE: **The A6s can be installed as part of a dashboard or as a standalone system**
BELOW: **The A6e can be positioned horizontally or vertically for use in cabs**

High connectivity

The OPUS A6 2nd Generation is ideal for complex human-machine interfaces that rely on processing of a wide range of information.

The OPUS A6 features a bright, high-resolution display with a clear picture offering complete ease of use under all operating conditions. With an optimized size of 7in (18cm) and an 800x480 pixel resolution, everything the operator needs is perfectly readable.

The large 512MB of RAM memory, combined with the 32bit, i.MX 6 processor with 800MHz, as well as optional 2GB or 4GB of flash memory, is ideally suited to demanding applications. An aluminum housing provides maximum stability and optimal heat dissipation.

The device can be oriented either horizontally or vertically, and it can be integrated in either standalone or dashboard mounting. Up to three built-in camera inputs enable the user to easily connect analog cameras.

Additionally, a digital Ethernet camera can be connected. With two CANbus ports and four input that can be configured between analog, the OPUS A6 2nd Generation is suitable for a wide range of mobile machines. It can read and display any enclosed CAN message. It's no surprise that Topcon has sold more than 88,000 units to date.

On the standard version, the full-speed USB 2.0 input on the front is best suited to high-speed data exchange and is positioned in the casing of the unit for maximum protection against the elements. The unit offers 12 soft keys and four hard keys.

The OPUS A6 2nd Generation eco and standard versions feature a multicolor LED that provides an immediate visual indication if any faults are detected. An onboard speaker enables the playback of WAV and MP3 files for auditory alerts. Additionally, HD video files can be played on the display to instruct the user visually.

The device can be programmed with C++, CODESYS, ISO-VT or Topcon's OPUS Projektor software. The Projektor tool enables the user to easily display any CAN message. The user can also integrate images and objects easily by dragging and dropping, and thus does not require programming skills to customize the display interface.

Upon the acquisition of Wachendorff Elektronik in 2015, Topcon became the world's only manufacturer that specializes in display units that are developed and assembled entirely in Germany. The displays – manufactured in Geisenheim, Germany – complement the full portfolio of Topcon Positioning Group, a leader in precision solutions for mobile work machines. **iVT**

Nils Habicht is a marketing specialist at Topcon Electronics

CHRISTOPH HORN

Improving machine learning

bauma 2019
APRIL 8-14 • MUNICH
Vemcon
Hall A2, Stand 408

OEMs ARE INCREASINGLY USING TECHNOLOGY PLATFORMS TO STREAMLINE THE WORK OF OPERATORS AND IMPROVE THE FUNCTIONALITY OF MACHINES, SO THAT THEY INTERACT MORE PRODUCTIVELY WITH THE MATERIALS AT HAND

OEMs need to differentiate themselves from the competition. One way to do so is to offer intelligent machines with productivity-increasing applications. Furthermore, OEMs are looking for new revenue streams and are particularly interested in investigating Internet of Things (IoT) applications. How can OEMs make machines more intelligent in order to drive sales?

It is not the machine alone that builds our homes. Therefore, OEMs focus on optimizing the collaboration between man, machine and materials with intelligent, partially autonomously working machines. In doing this, they help contractors to increase productivity. This is where Vemcon CoPilot comes in. It automates and optimizes recurring machine movements, through controlling the hydraulic system in the machine. CoPilot supports the driver with driver assistance. As a result, the operator can also work with less experienced drivers, thereby saving time and costs, as well as getting valuable insights into the performance of connected machines.

ABOVE: **The Vemcon CoPilot automates and optimizes recurring machine movements**

How does machine learning work?

With the upcoming version of CoPilot, machines will be equipped with machine learning to work partially autonomously. Algorithms will independently learn about hydraulic system behavior of the machine within minutes and automate machine movements. The important hydraulic question at any time during the excavator movement and at any joint of the excavator is: How much control valve stroke is required for each movement? Vemcon has developed a Local Model Network – a neural network – to answer this question. It uses sensors on the excavator to initially measure the velocity and position during machine or joint movements, and it can also collect and evaluate other values, such as temperature and load.

In order to integrate, for example, automatic grading into CoPilot of the OEM's excavator, Vemcon only has to carry out the grading process for a few minutes. With the first grading, about 3,000 measuring points are collected for velocity and position. After a few minutes, the algorithm collects some 100,000 measuring points. These are sufficient to provide a proposal for the machine movement. On the basis of this proposal, driver and excavator work precisely. The continuous grading process, which is already supported by machine learning, optimizes the algorithm as the amount of data increases. The algorithm learns from and supports the operator simultaneously, and both work better from minute to minute.

How is CoPilot integrated into machines?

With Vemcon, it takes OEMs around 18 months – from analysis to serial production – to bring machines with CoPilot into the market. This includes the automation concept and a virtual prototype, two steps that considerably decrease time, costs and risk that OEMs normally experience during the concept vehicle development phase.

Aside from Vemcon's process expertise, it is the underlying technology platform that enables the fast time-to-market. All required hardware components are part of this platform. They are compatible with all usual interfaces and come with automation software and apps. The hardware package covers a powerful terminal with a touch display, functionally safe buttons, a connectivity module, a powerful and functionally safe control unit, an electrohydraulic CoPilot block, highly dynamic IMU sensors, and pressure and temperature sensors. OEMs who want to keep certain hardware components in their machines, such as a display, profit from Vemcon's ability to adapt the hardware platform accordingly.

Once CoPilot is built in, OEMs offer intelligent, partially autonomous machines, and can generate revenue streams through IoT applications. For this, they offer constructors quickly integrated, productivity-enhancing functionalities in the form of apps. Furthermore, OEMs can collect machine data in the actual work processes to find further areas of improvement. **iVT**

Christoph Horn is OEM application engineer at Vemcon

GERRIT DE WAARD

IoT on wheels

bauma 2019
APRIL 8-14 • MUNICH
IFM
Hall A2, Stand 203

CHANGING CUSTOMER DEMANDS ARE PUSHING VEHICLE MANUFACTURERS TO INCORPORATE TECHNOLOGIES THAT CAN COLLECT VAST AMOUNTS OF DATA FOR ANALYSIS. FORTUNATELY THERE ARE FIRMS READILY ABLE TO ASSIST THEM

Connected mobile machines have been around for decades, but it is only during the last few years that the rapid evolution of digital technology has boosted expectations of their capabilities. The way OEMs are building their business models around their seemingly classic machines is outdated and industry is ready for the next era of mobile machines.

The main driver for the changing business models is the internet of things (IoT). It not only affects the consumer market, but also the off-highway sector.

Keeping up with the next generation

Nowadays the mobile machine market, normally quite conservative, also faces challenges to meet these requirements. First, the right business model has to be found, otherwise it is a waste of money.

The different requirements and approaches to IoT in different companies are marked. The main business case for using IoT is an increase in sales as well as a change in the company's machine sales model. Having OEE (overall equipment effectiveness) figures and KPIs requires careful consideration.

The development and service departments therefore pursue other goals. For them, IoT means easy access to the machine in case of problems and the opportunity to collect a huge amount of data for analysis and improve the understanding of the machine based on the information gained.

ABOVE: **The ecomat platform is embedded in the machine**

BELOW: **IFM's system offers end-to-end connectivity**

These requirements led IFM down the IoT road – providing the company with useful insights. One such insight is that simplicity and deep integration are the two most important customer needs.

Simplicity is the key to being successful in the future mobile machine market. Even though today's software design engineers for mobile machines are highly skilled, customer expectations are different. They require that the connection should just work, all the way through the machine, preferably with an app on a smartphone. This clearly describes a real plug-and-play expectation in the market.

Simplifying things for customers enables a shorter time-to-market. This is because the solution is quickly integrated into the machine and development processes are sped up as valuable machine information can be addressed very easily.

Customers want as much information as possible from the systems in their machine and, if required, to be able to do an over-the-air update of the machine. Wherever the machine is, access, diagnosis and servicing should be as simple as if they're next to it.

The only way to achieve this is to have the solid connectivity with the machine and have a highly secured access to its IFM control system. This allows OEMs to access the most valuable information from their machines.

The future of cloud connectivity

The next generation of cloud connectivity solutions is the ecomatmobile IoT platform. It offers simplicity and it is deeply embedded in the machine.

Getting a connection between the machine and the cloud has never been easier. In just a matter of minutes the machine is connected and starts collecting information.

The ecomatmobile IoT platform offers a full end-to-end connectivity solution but, being modularly built, is tailored to specific customer needs. There's no fussing with SIM cards, cloud contracts and having to setup complex IP infrastructures. With the ecomatmobile IoT platform, the customer has one solution and one partner to make a machine ready for the future. **iVT**

Gerrit de Waard is a product manager for mobile IoT at IFM electronic

elobau

creating ***sustainable*** *solutions*

Visit us to discover our solutions for a noise-free cabin

bauma
April 08.–14. 2019 Munich
Hall A2, Booth 314

Lightweight but Heavy Duty

New from elobau is the single axis joystick JS. Designed for the extreme environments of off-highway vehicles, and made from a glass fibre reinforced polymer, it has all the functionality and robustness you would expect from elobau, but is a lightweight 500 grammes. With a width of 49 mm, the compact base is ideal for installation in cabs with limited space. The slim design allows very close mounting of multiple joysticks next to each other for fast and easy operation of several functions. The joystick is customisable from various mechanical actuation options and outputs to suit each application. Designed for operator comfort, the handle can be equipped with up to 3 push buttons. With a mechanical life of 4 million cycles, and the ability to withstand forces of up to 1000N, it's a knockout solution.

For more information, please visit www.elobau.com

HEIKKI HAKALA

bauma 2019
APRIL 8-14 • MUNICH
Hevtec at Epec stand
Hall A2, Stand 426

Drivetrain optimization

TO MANAGE CONTROLS AND ENERGY FLOW IN SYSTEMS MADE UP OF MULTIPLE SOURCES OF ENERGY, A COMPLEX CONTROL STRATEGY IS REQUIRED TO REALIZE THE FULL BENEFITS OF THE HYBRID POWERTRAIN

Many industrial sectors have gained an interest in reducing emissions and operating in a greener manner. Fossil fuels have been the primary source of energy in the off-highway vehicle industry over the past century. When correctly used, electric and/or hybrid electric powertrains can provide not only the possibility of more environmentally friendly operation, but can also help to reduce operational costs.

An electric powertrain can help to improve efficiency by reducing or eliminating local emissions. An electric driveline can also provide a more dynamic feel, with a response up to 10 times faster than that of a traditional powertrain. All in all, the overall productivity of a machine can be vastly improved with an electric powertrain.

Choices of drive power

A fully electric powertrain, typically powered by battery, is not viable in all industrial applications. This might be due to limitations of the high battery capacity leads to high cost of battery and raises the cost of the machine and operating temperature, a lack of charging infrastructure on-site, or safety aspects. To tackle at least some of these obstacles, a hybrid electric powertrain can be considered. It could help to improve efficiency by either reducing the need for, and eliminating, inefficient powertrain components, or by running those components in a more efficient manner.

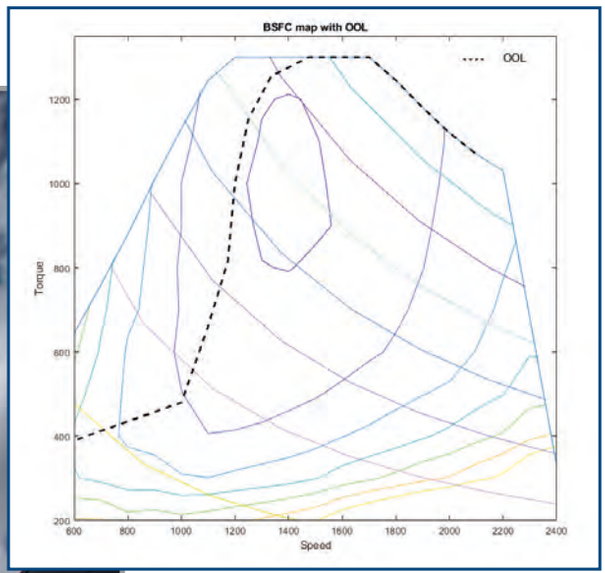
An hybrid electric powertrain can greatly decrease the required onboard battery capacity by having an additional energy storage, such as a supercapacitor.

By choosing a serial hybrid powertrain, the internal combustion engine (ICE) can be decoupled from the wheels. This means that the ICE can operate more freely since ICE speed no longer needs to be relative to machine speed. This improves efficiency by reducing fuel consumption and thereby cutting exhaust gases.

Usually the main targets of a hybrid powertrain are to improve fuel economy, reduce emissions and lower the total cost of ownership.

Key ways to optimize an ICE hybrid powertrain include: controlling the ICE operating points; minimizing engine dynamics and idle time; optimizing ICE on/off times; shaving the power

BELOW: **Hevtec created the multiple energy source hybrid driveline to the Pon CAT 323F Z-LINE machine**



ABOVE: **Adhering to the optimal operating line on a BSFC map maximizes fuel efficiency**

peaks, for example, with electric energy storage; maximizing energy recuperation; and optimizing energy storage control.

As an example, one possible criterion for ICE operating point selection is to maximize fuel efficiency. This can be achieved with a brake specific fuel consumption (BSFC) map. The optimal operating line (OOL) can be found on the BSFC map for each power level. Following it will result in minimizing fuel consumption. Similar graphs based on exhaust gas emissions are also available. If exhaust gas emissions are considered vital criteria for control of the ICE, it is possible to choose the operating point based on these graphs instead.

The operating point can also be chosen using combined graphs. Each variable can be weighed differently to emphasize a specific criterion dictated by the customer's use case. To control these individual items, driver demand needs to be followed as closely as possible while considering all the constraints in the system. Therefore, knowing and understanding all the components in the system is the starting point for creating an energy control strategy.

Control strategies

There is a wide array of approaches that can be used in the hybrid powertrain control strategy. The easiest solution is to use a rule-based strategy known as 'heuristic', which relies mainly on human expertise and knowledge of the system. However, this is not as effective as the optimization-based method (OBM). The downside of the OBM is that it usually requires heavy calculation capability from the controller, hence it is not viable for each case. In addition, optimization-based strategies often require prior information about the drive cycle, which may vary greatly even within single OEM applications.

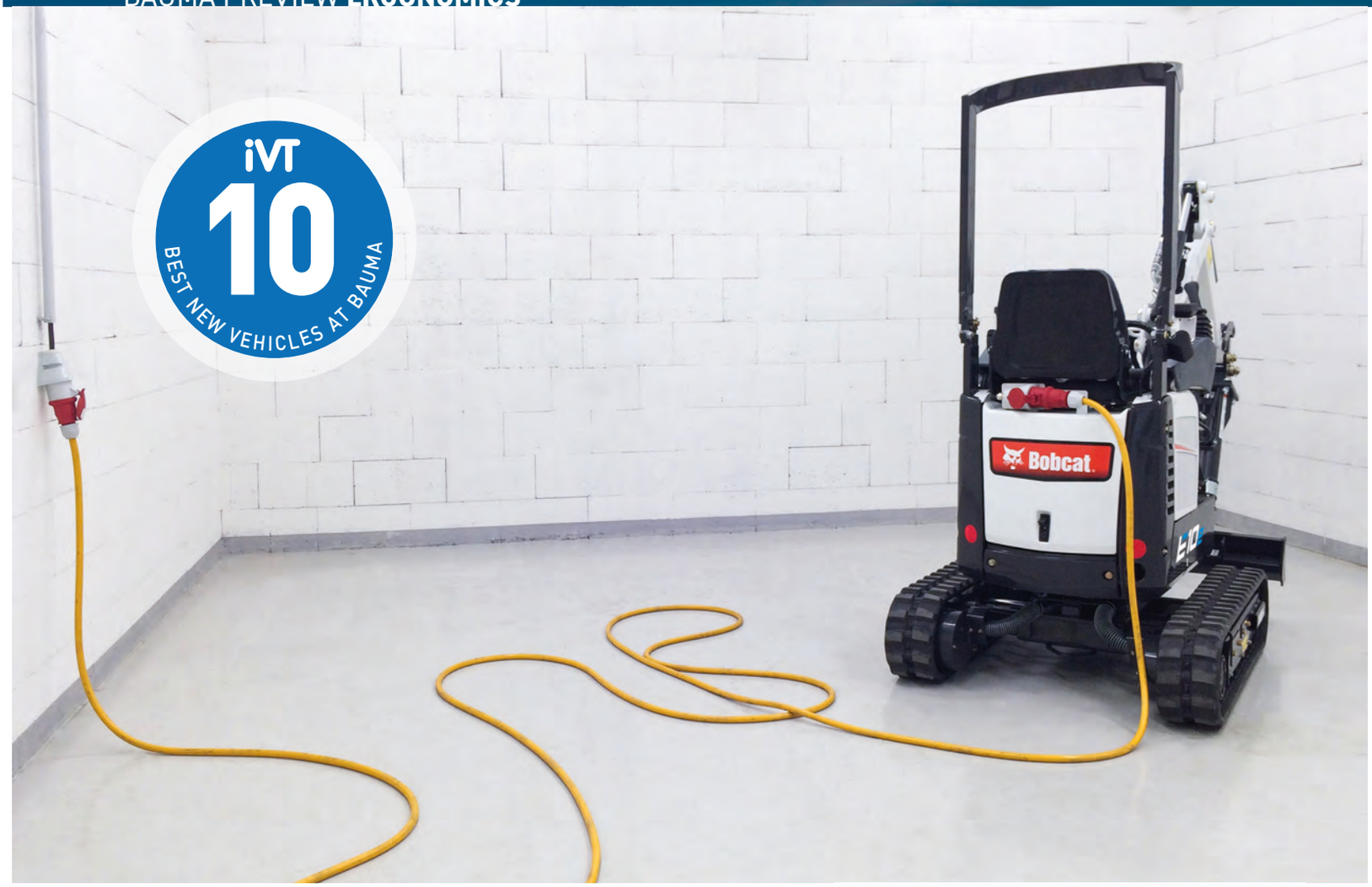
A lighter version of the OBM is optimization-oriented approach, which adapts to changes in the drive cycle. It does not need prior information about future driving conditions, and does not need time-consuming tuning for each application.

Simulation provides a cost effective way for studying system behavior in more depth without the need for a prototype. With a simulation model, energy consumption in predefined drive cycles can be explored and the most effective solution for the specific application can be determined. Fine-tuning the control strategy through model simulation can also help goals to be reached more quickly in real-world applications. Moreover, model simulation can help to prevent unwanted delays in the machine commissioning phase, as well as in the further development of the control strategy if the customer's requirements change.

Freely scalable solution

The Hevtec Oy's control system consists of distributed control units and an optional human-machine interface. The system is freely scalable depending on the needs of the application, from single to tens of units. The system controls torque to the wheels and at the same time handles energy flow between the components in a sophisticated manner, depending on the energy source type, power demand and the dynamics of the system. The machine can consist of one or several energy sources – for example, an electrical grid, ICE, battery and supercapacitor. The control system supports multiple interactions with existing engine control units and machine interfaces. **iVT**

Heikki Hakala is CTO of Hevtec Oy



Electric-powered mini excavator

At Bauma in 2016, **Bobcat** attracted a lot of interest from visitors with its prototype of the E10e electric mini-excavator. At this year's Bauma, Bobcat will present the resulting E10e. The vehicle is the industry's first commercially available, fully electric powered, zero tail swing mini-excavator in the 1 ton class.

The E10e combines the successful features and high performance of the E10z diesel machine for working in confined spaces, with its safe, quiet, zero-emission design. Due to its low noise output of just 64dBA, the E10e is ideal for use in indoor demolition, basement projects, and areas where low noise and/or night-time work are mandatory.

The E10e can easily be maneuvered to working sites, thanks to its compact width of just 72cm (28in). Once it is positioned and ready for work, its undercarriage can be expanded to 110cm (43in), for maximum stability while working.

All the systems and components on the E10e have been optimized for work in harsh environments. The patented electrohydraulic powertrain system uses the electric motor's capabilities and all the electric powertrain components are sealed to meet the IP67 rating.

Bobcat has optimized the battery pack so that it provides sufficient capacity to match typical work patterns. Using an external Bobcat supercharger, the E10e, when charged during operators' breaks, can operate throughout a full working day (eight hours) and can be fully recharged within 2.4 hours.

bauma 2019
APRIL 8-14 • MUNICH
Bobcat
Hall FN, Stand 820

05
ERGONOMICS

ULTRA-THIN TOGGLE

Otto's new T71 toggle is 35% narrower than its T7 toggle, making it a great alternative for use in rugged, demanding applications where space is limited.

Sealed to both IP68S and IP69K, the thin T71 series is available in single pole, single throw (SPST) and single pole, double throw (SPDT) configurations. The high contact pressure and superior contact wiping action of the design makes the T71 an excellent choice for use in switching loads from logic level up to 16A. These toggles feature positive detent action for safe switching operation. In conjunction with the unique Otto snap-action switch mechanism, the T71 offers non-teasible contact transfer.

Designed for use in tight spaces and to control panels and grips, the T71 can be used underneath heavy equipment, in industrial controls, and in marine and appliance applications.

Other features of the ultra-thin T71 toggle include: a choice of terminal styles; shock and vibration resistance; RoHS (restriction of hazardous substances) compliance; and an optional black matte finish.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **554**

bauma 2019
APRIL 8-14 • MUNICH
Otto
Hall EWE, Stand 023

1954
The year that the first ever Bauma Munich took place

INNOVATION FOR **FULL VEHICLE CONTROL**

AMA Instruments, a division of the AMA Group, is launching a product dedicated to off-highway applications for remote control of displays.

DashControl is an innovative device thanks to its flexibility, functionality and highly ergonomic design. It allows the operator to manage the dashboard display direct from the arm rest or the command console. Using the encoder with a high-grip rubber wheel, the operator can set predefined parameters, set the positions of the actuators, navigate through remote display menus and configure the work mode.

The high brightness and high-definition color display, in a scratch resistant anti-reflective PMMA casing, can be used to add extra features and assign dynamic functions to the seven backlit keys.

DashControl also features a CANbus port and eight power outputs of 3A each, with protection against short circuiting.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **555**

bauma 2019
APRIL 8-14 • MUNICH
AMA Instruments
Hall B5, Stand 443

Compact duty crawler crane

Liebherr will present its newest duty-cycle crawler crane at Bauma: the HS 8040 HD. With a width of just 3m (10ft) and a swinging radius of 3.5m (11.5ft), the standard version is the most compact in Lieberr's HS series – yet has an impressive lift capacity of 40 metric tons.

The HS 8040 HD is powered by a 230kW Liebherr diesel engine that complies with the NRMM exhaust certification Tier 4/Stage V. The machine is also fitted with two free-fall winches with a 120kN line pull each. The crane's boom has a maximum reach height of 40m (130ft).

With a weight of less than 40 tons, the HS 8040 HD duty-cycle crawler crane can also be transported easily. The rails and walkways on the upper carriage of the vehicle do not have to be dismounted when it is transported. It is ideal for use with slurry wall grabs, dragline buckets and casing oscillators. It can also be used as a service crane for lifting jobs.

bauma 2019
APRIL 8-14 • MUNICH
Liebherr
Hall ICM, Stand 308

The HS 8040 HD has a transport weight of less than 40 metric tons

The crawler crane has a 3.5m (11.4ft) swinging radius

iVT 10 BEST NEW VEHICLES AT BAUMA

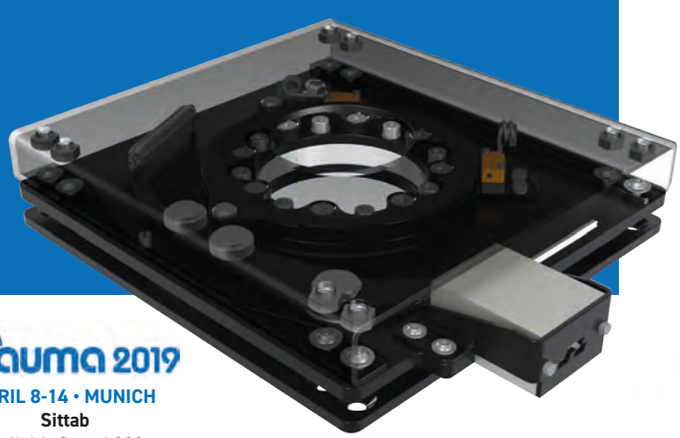
BUILT-IN QUALITY
AND PROVEN COMFORT

Wherever there is a requirement for a modern, well-equipped operator station, seat accessories specialist **Sittab** has a suitable product. The HD Turntable for seating is designed for extreme loads in rough forestry terrain, but still maintains the comfort of infinite locking. One of Sittab's latest developments is the 2020 cab option selection.

Sittab is a small company with many customers. All its designers work together at its headquarters in Sweden. Sittab picks up on trends and market needs, and incorporates customers' requests into the development of the features found in each project. Everything is processed through Sittab in-house.

Sittab's products are comfortable and based on ergonomic data. Whether new or based on traditional concepts, the company's developments are always a safe choice. Quality is designed into the product, not merely verified afterwards – and Sittab applies this mindset automatically. The company also supplies a small aftermarket locally in Sweden, which acts as a reference group for new products. Operators test the comfort and durability of products and Sittab implements their feedback, so there are never any surprises for OEMs.

READER INQUIRY SERVICE
To learn more about this advertiser, visit www.ukimediaevents.com/info/ivm
Quote Ref: **556**



bauma 2019
APRIL 8-14 • MUNICH
Sittab
Hall A6, Stand 320

BERTRAND GAUTHIER

A next-generation joystick

bauma 2019
APRIL 8-14 • MUNICH
Apem
Hall A2, Stand 229

IN THE OFF-HIGHWAY VEHICLE MARKET, OEMS AND SUPPLIERS ARE STRIVING TO IMPROVE ERGONOMICS AND COMFORT, AND REDUCE MUSCULAR FATIGUE FOR OPERATORS IN ORDER TO IMPROVE PRODUCTIVITY

In the pursuit of improved ergonomics, vehicle manufacturers are adopting electrical joysticks, looking for outstanding aesthetics and increasing the number of vehicle functions controlled by the operator. With more accurate control and the ability to perform additional functions simultaneously, the expected result is to have improved efficiency and more quickly performed tasks. Since the European Machinery Directive 2006/42/EC came into effect, vehicle manufacturers now must also comply with IEC 62061 and ISO 13849 standards to increase functional safety.

Vehicle cabins are becoming joystick-centric, with more and more functions integrated directly onto the control handles. Joystick designers like Apem are facing a new challenge: how to offer a perfect ergonomic joystick for each type of off-highway vehicle without re-inventing the wheel at each development. With its wide range of human-machine interface (HMI) components, Apem offers a huge number of joystick configurations by combining pushbutton switches, thumbwheels, rocker switches, miniature joysticks, and NV series navigator switch-on customizable rear and front faceplates. Apem customers can benefit from qualified and field-proven HMI components on standard or custom grips that match their needs exactly. Some of these components have been used on hydraulic joysticks for years and are designed into a large number of construction vehicles and tractors.

ABOVE: **Apem offers catalogue and custom configured joysticks with best-in-class HMI components**

Integrating functionality

To integrate additional switches on joysticks, Apem has developed the IX series, a new SIL2/PId-capable pushbutton featuring a compact diameter bushing and an elastomer membrane actuator. The IX series offers the same advantage as the IA series and is well known in the construction industry as a reliable, dust-proof switch that is ideally suited for use in harsh environments. The new IX series switch also includes features such as marking and illumination.

Forward-neutral-reverse (FNR) rocker switches are becoming the norm in new vehicle cabins. This safety-critical function enables the operator to forward or reverse movements of the vehicle.

At Bauma 2019, Apem will launch its new safety-critical FNR series. The FNR series is SIL2/PId-capable with a circular switch body shape to guarantee an IP67 sealing. In addition, the tactile feedback and the shape of the actuator have been optimized to avoid unintentional activation and reduce operator fatigue.

With Apem's small form-factor NV series, customers can even have a navigation display controller at their fingertips. With its push-to-validate function, the operator can easily navigate in the display menu. By moving this function on the joystick, the vehicle manufacturer will improve ergonomics while reducing the global cost of ownership.

Miniature joystick integration on complicated joysticks enables the control of complex movements. It is a new trend associated with the younger gaming generation.

Apem offers its field-proven TS series, a wide range of SIL2/PId-capable miniature joysticks with many options including an embedded illumination ring on the actuator for appealing aesthetics. The illumination can also be activated to alert the operator.

Apem's broad range of HMI components can now be easily integrated onto the new XD series joystick, either on a standard or a custom handle, depending on the customer's application. The XD series joystick base is SIL2/PId-capable and has been specifically developed for off-highway vehicles with its shallow, below-panel mounting for easy integration and extremely robust construction able to withstand up to 1,780N horizontal load. **iVT**

Bertrand Gauthier is group strategic marketing manager at Apem

MAURO MEDICI

Inside the comfort zone

bauma 2019
APRIL 8-14 • MUNICH
Siac
Hall A6, Stand 226

A GROUP OF EUROPEAN CAB MAKERS HAVE COMBINED THEIR EXPERTISE AND JOINED FORCES TO FACE THE MARKET WITH A BRAND-NEW APPROACH

Three years after Bauma 2016, Siac's position on the cab market is stronger than ever. As well as its presence in Europe, it has plants in India and its newest in Russia. Siac has formed a new partnership with Lochmann Kabinen, which has also acquired KML.

"Siac has always put a big effort into widening and covering its market share in the cabin industry," says Mauro Medici, general manager of Siac. "Thanks to Siac's partnership with Lochmann and KML, it can now rely on a new multifunctional intercompany team to offer a formidable know-how."

Innovation and attention to customers' and the market's requirements are, and have always been, at the core of Siac's vision. "Thanks to the expertise of our inter-company team, we are now capable of meeting the most demanding requirements coming from our customers, by focusing on the most important aspect of the cabin: functionality," says Medici.

Testing the cab

"Safety, ergonomics and comfort go hand in hand with the functionality of the cab. For this reason, the cabins designed and manufactured by Siac are a perfect combination of such three key points," continues Medici.

The safety of the operator is paramount. It is ensured through finite element method testing of the cab's metallic frame and through other physical tests carried out at certified laboratories in countries including Italy.

Projects are developed with a Safety at 360° approach in mind. For example, safety is considered not just for the operators who use the machine, but also to those who will carry out maintenance on the field. As well as a computer-aided design simulation, one of the most efficient assembly/disassembly sequences for all components, simulations are also carried out on the first prototypes.

Key cabin features

Cabins must be functional and, above all, ergonomic. For an ideal level of comfort to be reached, it is crucial for a selection of the components to be fitted virtually in the cab. In some cases, this is done with the aid of augmented reality.

ABOVE: **Augmented reality enhances comfort levels within the cab**

Moreover, in order to provide the best level of comfort for the operator, Siac carries out studies on thermal and sound insulation. The correct insulation ensures a more comfortable cab. The final result of the studies are verified in an anechoic chamber through testing carried out at certified laboratories.

Cabin comfort is also impacted by temperature control. The air-conditioning system and the air-distribution system are some of the most complex aspects of the cab to be designed and tested. Siac develops complete systems that are capable of sustaining even the most severe conditions for air-conditioning, air heating and air filtering, in compliance with Category 4 requirements. Such developments include proving a proper air-distribution system by exploiting the characteristics of computational fluid dynamics.

"I am very much satisfied with the way Siac is managing the most demanding requests coming from its customers," says Medici. "Cab comfort is one of the hardest challenges that cab makers face. Thanks to our approach and our knowledge of the best technical solutions available on the market, cabin operators can be assured with the result that they are going to get from their Siac cab." **iVT**

Mauro Medici is general manager at Siac

WAYNE WARD

The science behind comfort

bauma 2019
APRIL 8-14 • MUNICH
Sears Seating
Hall A6, Stand 518

OPERATOR HEALTH AND COMFORT IS BECOMING INCREASINGLY IMPORTANT FOR RETAINING TALENTED VEHICLE OPERATORS, REDUCING STAFF TURNOVER AND PROVIDING A SAFE AND PRODUCTIVE WORK ENVIRONMENT

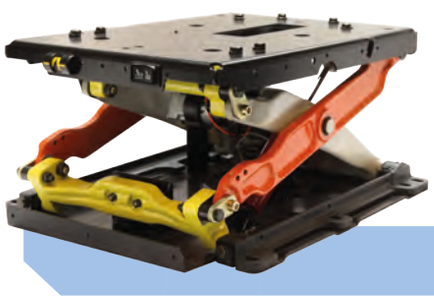
Reducing harmful whole body vibration (WBV) is an important aspect of optimizing operators' health. By using a 6DOF ride simulator, Sears Seating is able to recreate and test its products in the lab based on vehicle ride files taken from real working environments. WBV is measured using several accelerometers placed throughout the seat. This information not only allows for accurate comparison testing, but also fine-tunes suspensions for the greatest WBV reduction.

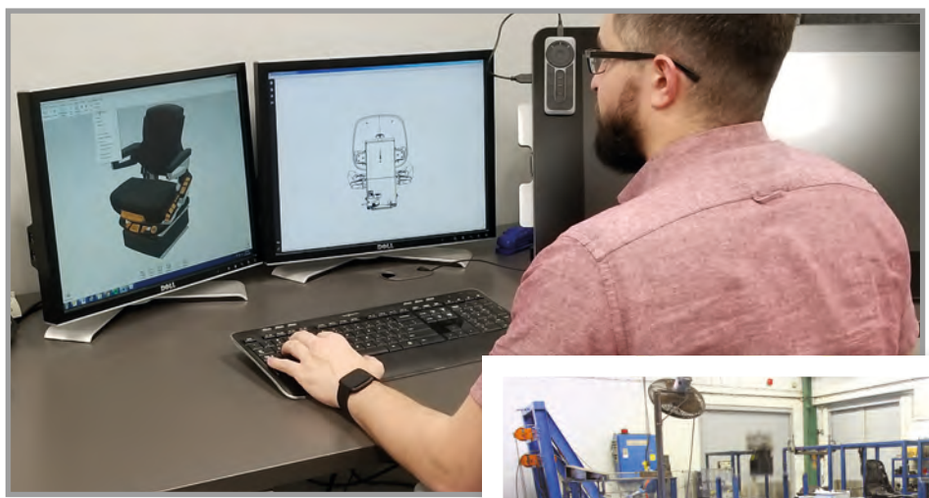
Measuring comfort

While the reduction of WBV can be quantified, increasing comfort is a more complex goal because it is derived from a multitude of subjective perceptions, physical attributes and external factors. Sears Seating's investment in its new Comfort Lab aims to drive the empirical data behind comfort.

Complete with the latest testing equipment, Sears' Comfort Lab employs the latest technologies to find the optimal foams, test climate control systems and create ergonomic, correctly contoured seats for a wide range of applications. To design and build seats of the future for the off-road industry, substantial time is invested into replicating fieldwork to enhance operator performance and pinpoint high-pressure points on the body using dynamic pressure-mapping systems.

It's the physical science behind comfort and extensive research into the human form that has guided Sears Seating to the next level of physical object research and empirical data in order to optimize comfort. By using information from studies and the human seating guides, Sears Seating is able to design ideal seat shapes for operators around the world. The goal is to support machine operators from the smallest and lightest to the heaviest and largest. Understanding the human form and how it interacts with the seat and machine has enabled Sears Seating to develop comfortable seats for all applications.





ABOVE: **3D CAD software refines seating design**
RIGHT: **Seats and suspension are tested in the lab**
BELOW: **Suspension is integral for comfort**

Creating elements of the seat

Cushion design is a special competence. The initial design, or pre-modeling, begins with hand-drawn concepts and can be further refined using design software before it is rendered in a 3D CAD environment. Sears Seating uses 3D data and an array of tools to conceptualize cushions, from hand-carved to machine-created foam. Sears Seating is capable of making prototype cushions from slab foam, or foam poured into temporary molds. In some cases these molds have inserts to allow variations of the cushion to be made.

Cushion cover development is key to achieving a high level of fit and finish for Sears Seating's products. Experienced pattern makers use traditional methods combined with advanced material cutters to create seats with a variety of colors and designs. High-quality, rigorously tested vinyl, Ultraleather, cloth and leather are used to achieve the customer's desired look and feel, while unique thread colors and stitching can be intermixed throughout the seat cushions to add extra visual elements and to reinforce the customer's brand. Sears Seating's Comfort Lab houses the personnel whose experience enables collaborative relationships with the customer's designers to develop these unique seat styles.

Testing, human form research, cushion design and cover development all come together in the Comfort Lab. It is the collaboration of these proficiencies that translates to a continuous effort toward high-level comfort, fit and finish for seating products. Sears Seating works hard to create products that not only provide unmatched comfort, but also help drivers and operators deliver maximum productivity and uptime. **iVT**

Wayne Ward is vice president of product engineering at Sears Seating

CYNDIE RABATEL

Custom-made HVAC units

bauma 2019
APRIL 8-14 • MUNICH
Siroco
Hall A6, Stand 336

A VARIETY OF ELEMENTS, INCLUDING STAFF AND CUSTOMER IDEAS, TEST FACILITIES AND CALCULATING TOOLS, ARE USED IN THE DESIGN AND DEVELOPMENT OF CUSTOMER-SPECIFIC HVAC SOLUTIONS

HVAC (heating, ventilation and air-conditioning) systems from Siroco make mobile machine operators' environments comfortable.

"Customer-specific development represents 50% of our overall engineering activity," says Sylvain Reydellet, managing director of Siroco.

The company, which has been an international supplier of HVAC solutions for thermal and electrical vehicles for over 40 years, adapts its service offering for each of its customers by providing computational and test tools.

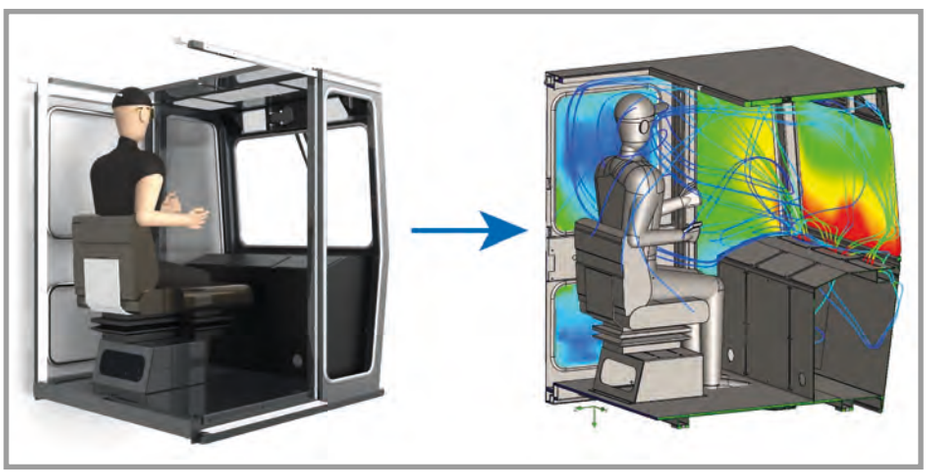
Demand for comfort

The demand for thermal comfort in construction vehicles has increased considerably in recent years.

"As construction specifications get tighter, we have noticed that product development times have got shorter," says Reydellet.

HVAC units have to be more efficient and integrate more functions, including air distribution, filtration, pressurization, ingress protection of components, thermal comfort, and electronic management and multiplexing via CANbus.

To speed up integration of these technologies into its products, Siroco's engineering department, composed of nine employees including an electronics engineer as well as a research and development engineer, has recently extended its expertise to areas of thermal and aeraulic simulation.



ABOVE: **Computational fluid dynamics is used to optimize thermal effciency**

BELOW: **Siroco's simulation cab is equipped with thermal sensors**

"Siroco already has significant experience in the analysis of numerical modeling via the simulation of plastic injection through daily practice with ModFlow software," says Sébastien Perraud, research and development engineer at Siroco. "We needed a reliable tool like SolidWorks Flow Simulation, a complementary module of our computer-aided design, for the computational fluid dynamics. It enables users to study and optimize the geometries, and efficiency of HVAC units, as well as of air ducts and air diffusers. By simulating an HVAC unit, we evaluate the advantages and disadvantages of the various technical solutions, reduce the system air-pressure losses and visualize the airflow lines.

"Dialog with engineers has evolved. Thanks to the finite element mesh of the environment operator, we are able to indicate to our customers where they should place air diffusers in the cab to guarantee the best ventilation distribution."

Simulation and testing

Simulation is helpful for the conception of HVAC ideas, but isn't enough to validate an HVAC solution. Indeed, when creating a prototype, the components of choice need to be proved and precisely made according to the digital template.

"We are quickly able to make models with standard components, thanks to the 3D printing available on-site," says Christopher Ray, a test engineer at Siroco. "Our test tools – the climatic chamber and airflow measuring bench – are then used to assess the HVAC's performance in a standard cabin specially dedicated to the simulation."

"This cabin is equipped with temperature sensors and other sensors connected to a compressor condenser bench with a cooling unit and a water heater. It enables us to measure the evolution of the thermal loop [heating and cooling] according to ISO 10263. Thanks to this investment, prototyping delay is reduced and feedback can be given to the customer quickly."

Development in India

Siroco develops and sells its solutions around the world. Being well established in the northern hemisphere – in Europe, Japan, Korea and North America – the company is now enhancing its international profile by extending its operation to India. Siroco's Indian subsidiary opened in January 2019 in Pithampur. **iVT**

Cyndie Rabatel is marketing manager at Siroco

ERIC GÖPEL

bauma 2019
APRIL 8-14 • MUNICH
Eberspächer
Hall A4, Stand 249

One-stop HVAC shop

OPTIMAL THERMAL MANAGEMENT IN CONSTRUCTION – FOR THE MACHINERY ITSELF, AS WELL AS THE OPERATOR CAB – IS CRUCIAL FOR WORK TO BE CARRIED OUT DURING ALL WEATHER CONDITIONS

Excavators and construction machines must be able to work in any season and weather condition, which is where ideal thermal management can help. Heating and cooling specialist Eberspächer has been a reliable partner in this field for many years and is now expanding with the acquisition of French climate control organization Kalori.

"With Kalori's technical expertise, we will be able to comprehensively extend our range of climate control systems for special vehicles in a targeted way," says Dr Jörg Schernikau, COO of Eberspächer Climate Control Systems and Automotive Controls.

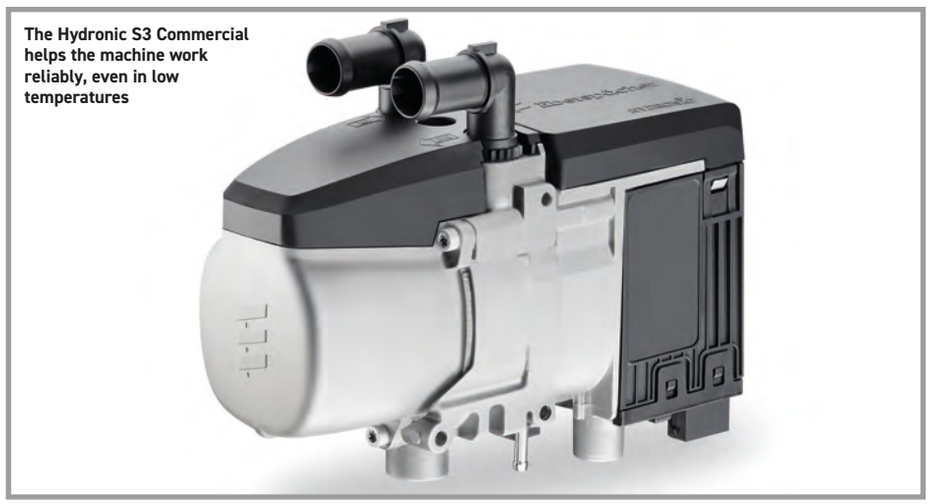
Heating and cooling systems from Kalori enhance comfort and safety. Its products are suitable for use in off-highway applications such as construction, agricultural and forestry machinery.

Reaching the right temperature

Work must continue efficiently on construction sites, even when temperatures are below freezing. Keeping machines running at all times can be expensive, but the cost is often unavoidable because a cold engine cannot be started and operated in winter weather conditions without suffering damage. An engine-independent water heating system like the Hydronic S3 Commercial is an economical alternative.

It is started using an app, timer or remote control before a shift begins, and it preheats the engine's cooling circuit. The Hydronic S3 Commercial can help reduce wear and keep the construction machine working reliably even at low temperatures.

ABOVE: **Kalori has been acquired by Eberspächer**



The Hydronic S3 Commercial helps the machine work reliably, even in low temperatures

The water heater can also heat the driver's cab to an ideal temperature using the vehicle's heating, ventilation and air-conditioning (HVAC) system. A pleasant working environment improves vehicle operators' concentration and efficiency, during summer and winter weather.

If engine preheating is not needed, then the Airtronic 2 is another technology for preheating the driver's cab. This compact air heater can be installed in the tightest of spaces.

Electric preheaters such as the Plugtronic enhance the heater portfolio. Powered by a 230V socket outlet, it preheats the engine via the vehicle's water circuit and can also heat the vehicle interior.

Convenient operation

Control units from the EasyStart family are available for convenient operation of Eberspächer preheaters. The new, permanently installed EasyStart Pro control unit permits intuitive operation. The required start time and heating period are preset using the timer function, and the integrated temperature sensor ensures optimal temperature control. Eberspächer preheaters can also be controlled from any distance using the EasyStart Web. Additionally, fleet operators profit from the advantage of operating up to five heaters per user account.

As a heating and cooling system supplier, Eberspächer offers optimal thermal management for construction machinery that is being used during any season – from preheaters and integrated climate control systems to compact roof-mounted air-conditioning systems. Kalori's experience in HVAC development, application and production complements Eberspächer's expertise in thermal management.

Active worldwide

Heating and climate control solutions from Eberspächer equip any construction machine to cope with a wide range of weather conditions. The thermal specialist's global service and distribution network provides additional assistance.

"Our objective in making this acquisition is to open up new markets and strengthen our volume customer business," says Dr Schernikau. "We aim to become a global leader in thermal management solutions for special vehicles."

Both Eberspächer and Eberspächer Kalori SAS will be exhibiting at the 2019 Bauma trade fair in Munich, Germany – in Hall A4, Stand 249, and Hall A5, Stand 351, respectively. **iVT**

Eric Göpel is a sales manager at Eberspächer

REINVENTING STRENGTH

Introducing the complete family of rugged glass-front PowerView® displays from Murphy by Enovation Controls.

With glove-friendly touchscreens and high-bright screens for full sunlight visibility, they bring durable power and performance to every application.

Let the application experts at Enovation Controls help you seamlessly integrate powerful HMI machine control into your next project.

bauma

VISIT US AT BAUMA, BOOTH #A4.509

MURPHY®

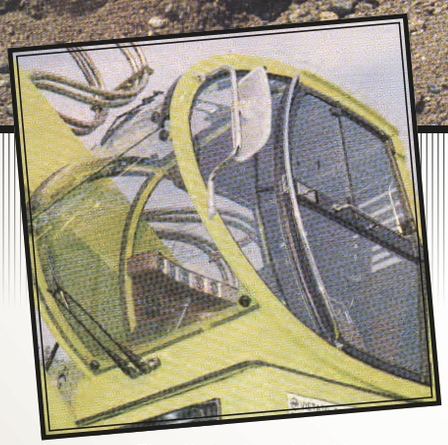
by ENOVATION CONTROLS

www.enovationcontrols.com

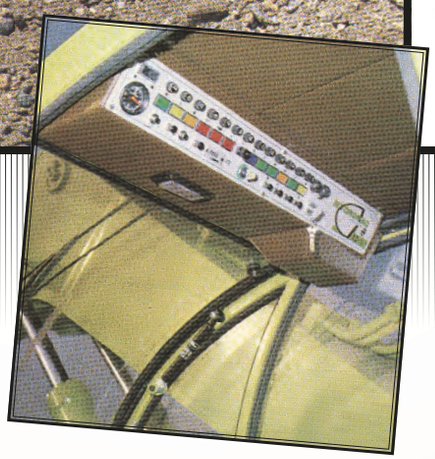
SEEING IS BELIEVING

In 1979, an excavator was launched with styling that was years ahead of its time, and it's still providing inspiration for industrial designers today

The design of the H180, released in 1979, influenced the style of future hydraulic excavators



The elliptical windshield gave H180 a futuristic feel



Automotive designers Pininfarina were responsible for styling

The H180 pioneers the vertical hood design

Hydromac was an Italian brand founded in Turin in 1965 by Carlo Bruneri, who, together with his brother Mario, pioneered the development of the hydraulic excavator. Early Hydromac vehicles were relatively simple and based on ones the brothers had developed previously as Bruneri Yumbo excavators. But in 1979 Hydromac launched something quite different. Its H180 model, with distinctive elliptical windshield, looks futuristic, even by today's standards. And while the switches and dials in the cab certainly aren't quite the touchscreens of today, a quick glance at the interior photos is all that's required to establish that this was a machine of some sophistication for its era. Even the hood was distinctive due to its vertical design, which was later shared by the H150 model.

But all this slick, Italian flair came at a price. Automotive designers at Pininfarina were responsible for the vehicle styling, and Hydromac signed a deal whereby it had to pay Pininfarina royalties for every single excavator it sold.

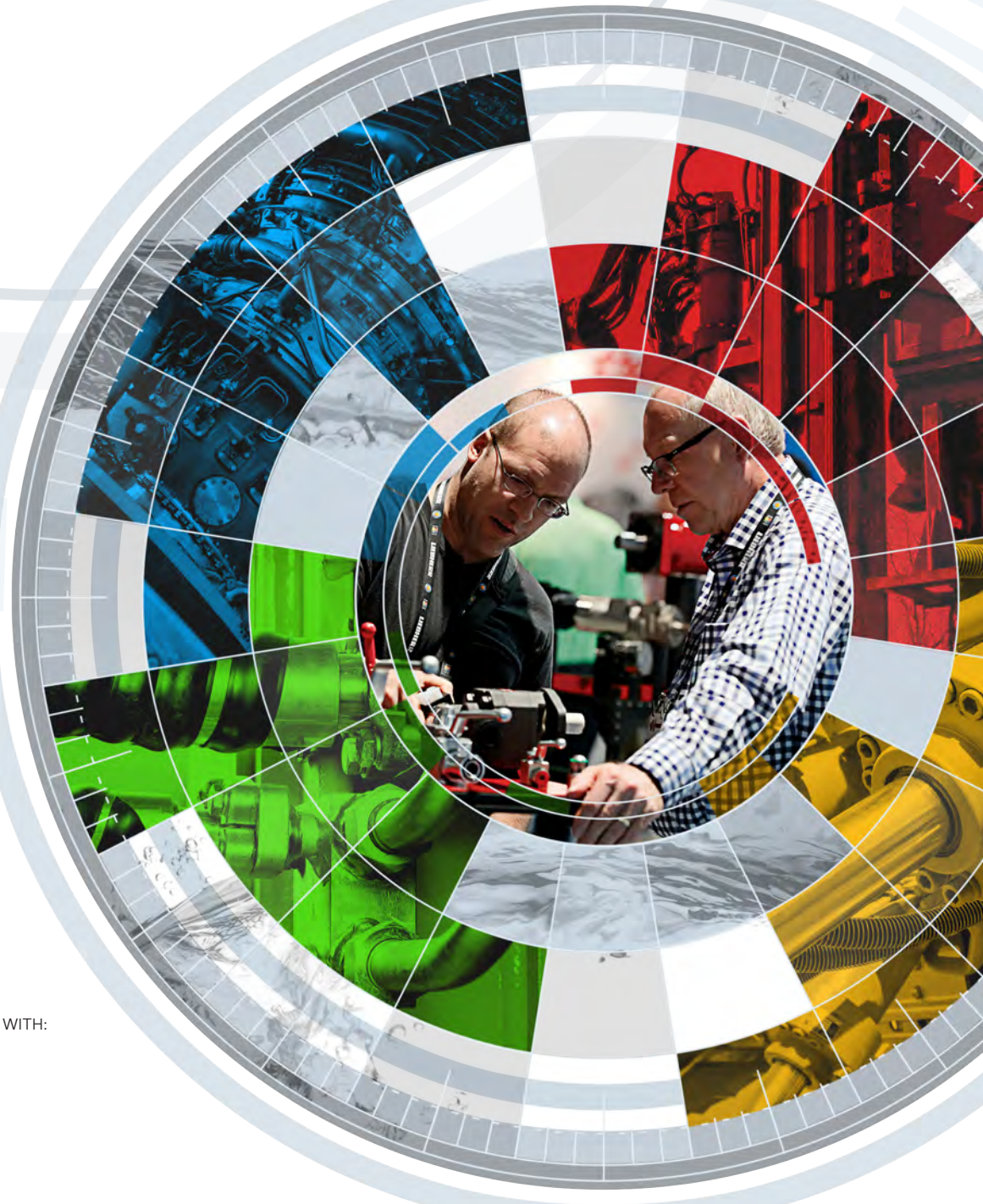
Such arduous terms didn't help with balancing the books and the company closed at the end of 1983, when the rights to manufacturing Hydromac's range were bought by investors. The range then went on to be produced in various locations across Italy with different owners until the mid-1990s, when the brand exited the European market. However, it lives on under new ownership in Buenos Aires, Argentina, where the Hydromac excavators are still produced to this day. **iVT**

The distinctive cab on the Hydromac H180 provided inspiration to industrial designer Alberto Seco, when he developed his Othar demolition excavator concept, which you can read about in full on page 58

WHERE SMART ENGINEERS GO FOR SMART SOLUTIONS

Thousands of engineers in fluid power, power transmission and motion control will come together at IFPE 2020 to exchange knowledge, solve technical problems and discover new solutions. Join them in Las Vegas in March 2020.

SEE WHO'S EXHIBITING AT IFPE.COM



IFPE 2020

INTERNATIONAL FLUID POWER EXPO
MARCH 10-14, 2020
LAS VEGAS, NV, USA

SHOW OWNERS:

AEM Association of Equipment Manufacturers

NFPA National Fluid Power Association

CO-LOCATED WITH:

CONEXPO-CON/AGG 2020

A LEGACY OF HYDRAULIC INNOVATION

JOHN S. BARNES › HESSELMAN › HALDEX › CONCENTRIC

bauma

APRIL 8-14, 2019 MUNICH

Visit us at Hall A4, Stand 518

POWER ON DEMAND COMES THROUGH IN THE CLUTCH

CONSTRUCTION • MATERIAL HANDLING • AGRICULTURAL • MOBILE/OFF-HIGHWAY

Unique Dual-Cone Clutch technology provides power on-demand performance

Concentric's patented DCC (dual-cone clutch) technology is designed for robust, high-performance duty in material handling, construction, agricultural equipment and other mobile/off-highway applications. The DCC can be paired with various models of Concentric's popular Ferra gear pump products to deliver power-on-demand capability. The proven coupling design eliminates noise radiation and delivers reduced fuel consumption through a reduction in parasitic losses via failsafe activation that defaults to "engaged". The DCC pump can be easily integrated due to its compact, power-dense design and control. The combined clutch pump features improved starting conditions where unused power can be re-directed to other functions.

CONCENTRIC
Technology + Innovation = Sustainability

Celebrating 90 years of Hydraulic Innovation in 2019

www.concentricAB.com/dcc

Concentric Rockford Inc. +1-800-572-7867
Concentric Hof GmbH +49-9281-8950
Concentric Pumps (Suzhou) Co. Ltd. +86-512-8717-5100