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TRUCKS OF THE FUTURE

Connectivity, automation remain key design criteria

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System-Based Approach Maximizes Downspeeding Benefits | PAGE 18

Improved Detection Capabilities Create Safer Vehicles | PAGE 32

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Volume 35, No. 1, January/February 2017

The Year of INVISIBLE ADVANCEMENTS

There is a lot to look forward to in a new year, especially one that is set to be potentially monumental in new policy implementation and domestic infrastructure investments. President Trump's website highlights policies for infrastructure investments reaching from pipelines to roads to next generation equipment to coal and shale energy production. Investment coupled with trade policy reform could ultimately redefine the global landscape for international OEMs, so it will be interesting to watch the coming year unfold.

On AEM's I Make America website, *imakeamerica.com*, it states:

It's a new era for U.S. trade policy in 2017, with the new Trump administration and a new Congress taking its place in Washington.

AEM is well-positioned to work with President-elect Trump's team to identify barriers to increased U.S. exports and unfair trade practices that undermine the U.S. manufacturing base. Real opportunities exist to work with the Trump administration on increasing access to foreign markets for equipment manufacturers through trade agreements, export financing and U.S. trade enforcement.

But equipment manufacturers should also be careful to study provisions related to taxes and domestic production that could have broad ramifications next year.

All politics aside, the heavy-duty vehicle industry is primed for advanced technology development and implementation.

My prediction is that 2017 will be the year that we see a new set of advanced technologies emerge now that onboard systems like telematics and GPS systems have become an accepted and expected baseline of machine performance and metrics. Things that are already in their infancy, such as the Internet of Things and Smart Data are taking the vehicle industry to the next level.

Much of the enhancements we will discover throughout the course of the next year will probably be data-driven, software-driven and sensor-based system development that will continue the progress in vehicle tracking, automation and electrification. Perhaps we will refer to 2017 as *The Year of Invisible Advancements* for mobile equipment.

Also, to note, you may notice a slight change to our regular monthly column on page 8. Formerly known as the *Economic Outlook*, we have renamed the section *Equipment Market Outlook* to better reflect the specific equipment market information being put forth by ITR Economics. It's a new name, but the same great information you have come to rely on for your market analysis and future projections.

How do you use the economic and market data ITR Economics provides each month? Tell us at *editor@oemoffhighway.com*!

IN THE NEXT ISSUE

THE MARCH ISSUE

- CONEXPO-CON/AGG & IFPE Show Coverage
- New Sensor Technology Trends
- Stage V Aftertreatment System Optimization
- Fluid Power Technology Focus
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TRANSITION to Recovery

U.S. Mining and Construction Machinery Production have transitioned to a recovery stage as headwinds from low commodity prices relent. Recovery is expected for U.S. Agricultural Machinery Production, as well, at least through the early part of 2017.

Europe and China will be the markets for growth opportunities as the U.S. trucking industry continues contraction into 2017. Rising commodity prices also indicate an improvement for the Europe Construction Machinery and Mining Production Index.

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QUESTIONS?

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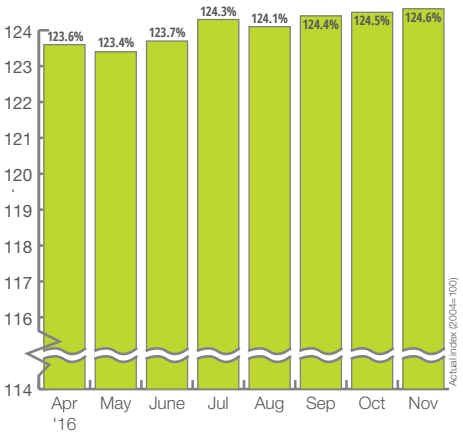
U.S. Leading Indicator:

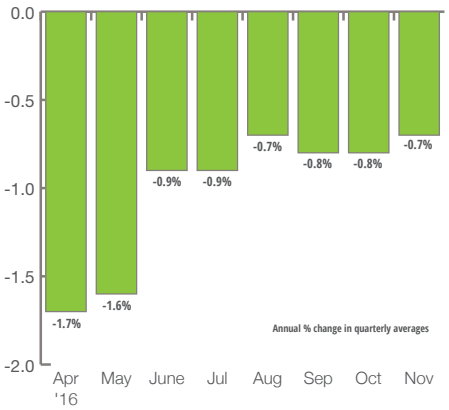
- The U.S. Leading Indicator flattened in November.
- One month of data is not enough to confirm an end to the current rising trend, and the general rise in the Indicator suggests economic tailwinds for the U.S. economy in 2017.



Editor's Note: Please note that this chart has been modified on the Y-axis to show the trend more easily.

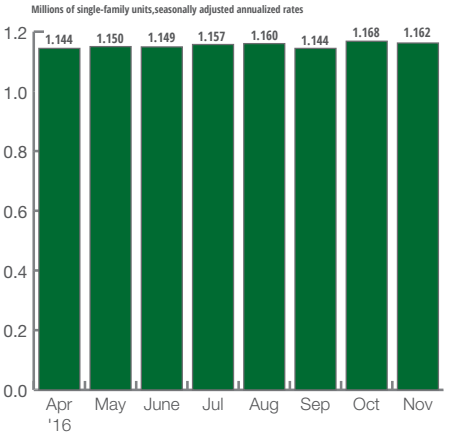
U.S. Total Industrial Production:

- U.S. Industrial Production for the 3 months through November is down 0.7% compared to the previous year.
- Leading indicators suggest that a recovery trend is taking shape. Look for the year-over-year comparison to turn positive for 2017.



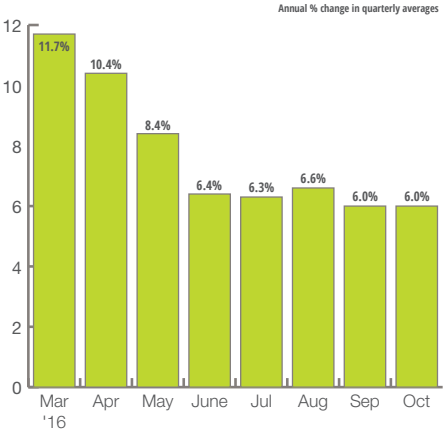
Housing Starts:

- Annual Total U.S. Housing Starts ticked down to 1.162 million units in November, as Multi Family units dragged down the total for the month. Single Family Starts are rising.
- ITR expects the overall trend will be positive for 2017 despite the ominous look of the November downturn.



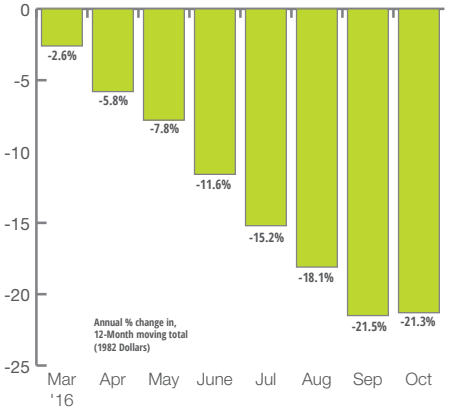
Private Nonresidential New Construction:

- U.S. Private Nonresidential New Construction was subject to a minor upward data revision since the last report.
- Construction during the 3 months through October is up 6.0% compared to the previous year and more rise is probable.



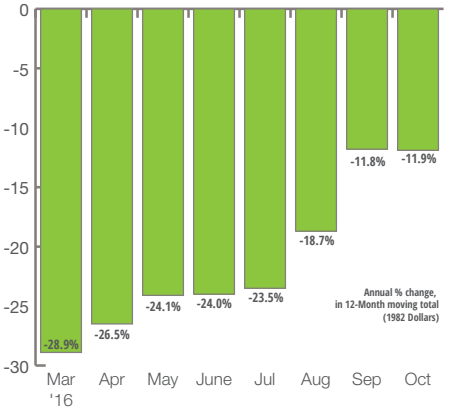
Construction Machinery, New Orders:

- U.S. Construction Machinery New Orders during the 12 months through October are down 21.3% compared to the previous year.
- New Orders tentatively transitioned to a recovery trend, although further decline is likely in the first half of 2017.



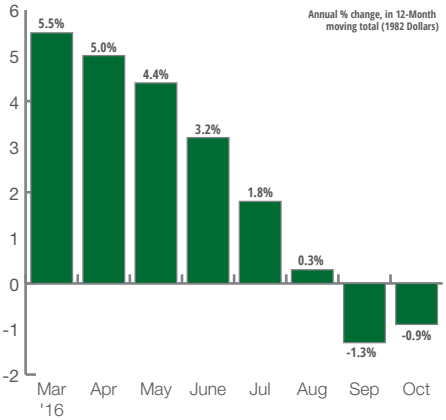
Farm Machinery & Equipment Shipments:

- The U.S. Farm Machinery & Equipment Supplies Production annual growth rate fell to -11.9% in October.
- Negative rate-of-change forewarns of further decline in the annual growth rate in the near term.



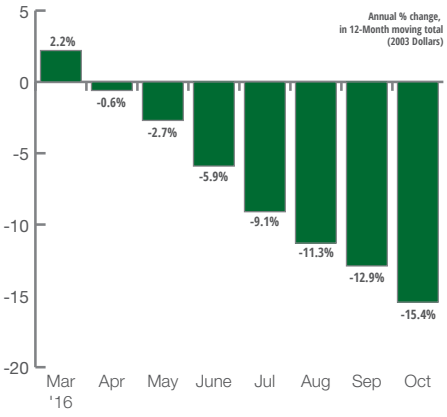
Total Public New Construction:

- Construction during the 3 months through October fell 4.4% compared to the previous year.
- Recessionary pressures will give way to recovery as we progress through 2017.



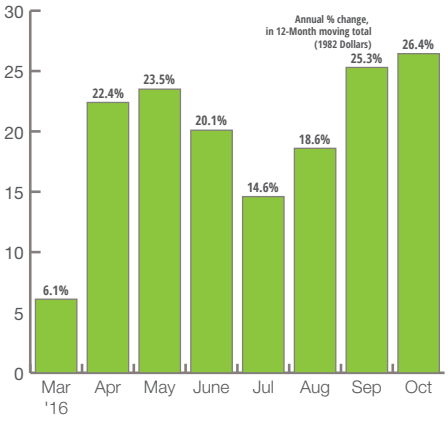
Heavy-Duty Truck Shipments:

- U.S. Heavy-Duty Truck Shipments during the 12 months through October are down 15.4% compared to the previous year.
- The rate-of-change signals suggest that declining Shipments are likely through at least early 2017.



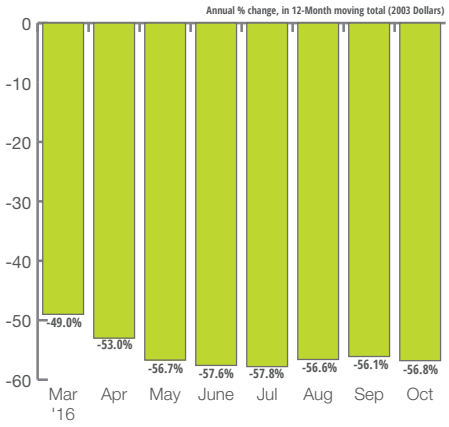
Defense Industry, New Orders:

- U.S. Defense Capital Goods New Orders during the 12 months through October are up 26.4% compared to the previous year.
- Expect persistent expansion in this segment throughout 2017.



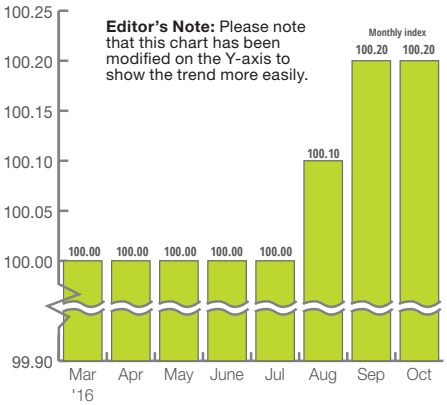
Mining, Oil & Gas Field Machinery New Orders:

- U.S. Mining, Oil, & Gas Field Machinery New Orders for the 12 months ending October came in 56.8% below the previous year.
- There are signs that the recessionary trend in New Orders is slowly abating, concurrent with the rise in energy prices and the modest rise in the Rig Count. ITR projects a recovery will develop in the second half of 2017.



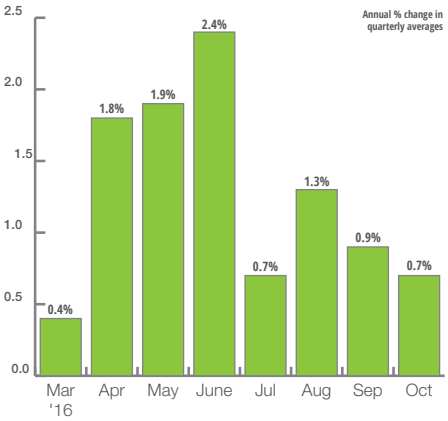
Euro Area Leading Indicator

- The Europe Leading indicator ticked up in October.
- Mild rise in the Indicator since May signals general growth in Europe in the second half of 2017.



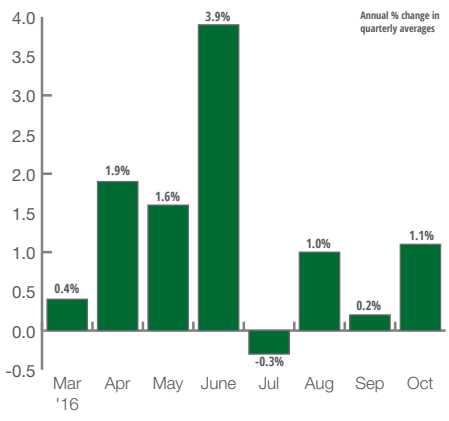
Industrial Production, United Kingdom:

- The U.K. Industrial Production quarterly growth rate fell to 0.7% in October.
- The U.K. will avoid recession in this business cycle, in line with ITR's expectations for Europe in 2017.



Industrial Production, Germany:

- Germany Industrial Production during the 3 months through October came in 1.1% higher than the previous year.
- Total exports in Germany are expanding, which will help Industrial Production rise as the general business climate in Europe also improves in 2017.



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TRUCKS OF THE FUTURE

The IVECO Z TRUCK concept features a more aerodynamic shape for improved fuel efficiency and automated driving capabilities.

by Sara Jensen

Creating a safer, easier work environment through increased connectivity and vehicle automation are the key design criteria for truck manufacturers over the next decade.

Every 2 years, the IAA Commercial Vehicle show *(event information, 10754832)* highlights the latest technologies and vehicle concepts for heavy-duty on-highway applications. At the 2016 edition, many companies chose to demonstrate their predictions for what the future of trucking will look like by displaying concept vehicles.

Connectivity, automated systems, and improvements in fuel efficiency and emissions output were among the key traits these "trucks of the future" possessed. For instance, the IVECO Z TRUCK concept vehicle featured a more aerodynamic design, the ability to run on bio-LNG and a waste heat recovery system to reduce emissions to nearly zero *(learn more, 12261136)*. Automated driving systems on the Z TRUCK are used to demonstrate technologies capable of improving safety and the transition towards more autonomous driving.

Bosch's VisionX concept vehicle included the vast amount of driver assistance systems the company foresees being integrated into future truck models. These systems will combine with automation and Internet of Things (IoT) capabilities to make the driving experience safer and easier *(learn more, 12259689)*.


BOSCH
Fewer buttons, switches and displays in the operator cab will help make it easier for truck drivers to focus on their job tasks.

The vehicle came about as a demonstration of the technologies the company laid out in its VisionX study which overviews how it sees the trucking industry progressing over the next 10 years *(learn more, 12257254)*. It looks at how connectivity, modern display and control instruments, as well as sensor technology and electrically supported steering systems will provide a more intelligent means of cargo transport, route management and eventually automated driving.

According to Johannes-Joerg Rueger, head of Bosch's Commercial Vehicle and Off-Road Unit (CVO), Bosch is extremely strong in automation for the passenger vehicle market with products such as radar, video and ultrasonic technologies that will be needed to continue advancing driver assistance systems. "We believe now for connectivity, driver assistance, as well as powertrain electrification for commercial vehicle and off-road applications, it's exactly the right point in time [to enter the market]," he says. "Business volume, in terms of driver assistance systems, as well as connectivity products and services

IVECO

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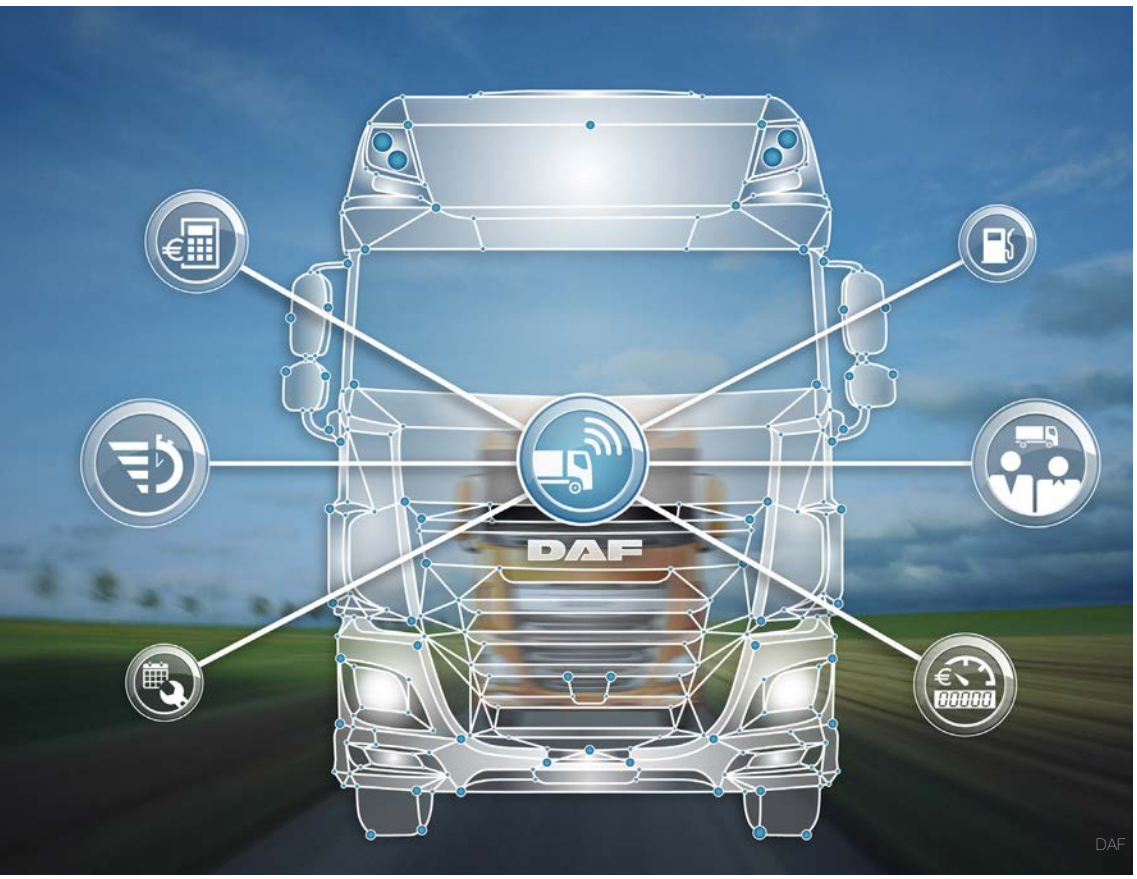

Like many other manufacturers, DAF envisions trucks will continue becoming more connected workspaces.

will increase dramatically in the next couple of years."

Because of this, in early 2016 Bosch established a new business unit to bring more of its technology expertise to the commercial vehicle market *(learn more, 12229346)*. Finding the right time to enter a market is a delicate balance, Rueger notes. "If you enter too early then you put a lot of money into pre-development studies with no real volume. If you enter too late then competition has captured all the market and business."

Demonstrating the future

The Bosch VisionX concept truck included various connectivity and automated systems Bosch currently offers or believes are on the horizon. While the VisionX truck is not meant to be an operational vehicle that will be tested in real-world scenarios, many of the technologies are either already in use or being tested on actual vehicles. "It was a demonstration object to put our vision and a combination of different technologies on display, and show to our customers and the public," says Rueger. In essence, it's a simulation of what future truck models could look like.

Among those future innovations is an enhanced operator experience through the reorganization and simplification of human machine interface (HMI) components. In its VisionX study, Bosch notes the large number of switches, levers and displays within the operator cab which can increase the risk of distraction and mistakes. The goal for future truck cabs is to make HMI as easy to use as today's smartphones.

One of the ways Bosch will go about this is to have clear, hierarchical control structures and displays adapted for specific driving conditions, such as convoying. In addition, Bosch foresees enhanced displays and camera systems which can monitor traffic around the truck, replacing rear-view mirrors and minimizing a driver's blind spots. *Visit oemoffhighway.com/12246040 to read the article "Mirrorless Vehicles are Closer Than They Appear" to learn more about Bosch and other companies' current camera systems which aim to replace truck mirrors.*

Rueger says much of the technologies demonstrated in the concept vehicle revolve around changes coming to the driver workplace. "It's all about different systems around driver assistance, connectivity and services which make the life of the trucker easier and the whole process more efficient," he says.

Increased connectivity and the implementation of concepts such as platooning will change the truck driver's workplace dramatically. Truckers will no longer be just a driver, but will be capable of doing many of the things that are now currently done at a fleet office such as having the ability to send and receive documents and track cargo. Better predictive maintenance will help reduce downtime further by alerting drivers of the need to replace parts sooner or even while en route to a delivery or pickup.

Platooning—two or more trucks wirelessly connected in a convoy—will take advantage of automated driving capabilities and provide another means of easing the driving experience. All trucks in the convoy accelerate, brake and steer at the same time, lead by the first vehicle. Increased fuel economoy is possible with platooning, as well, due to the vehicles following one another at a closer distance and thus getting the benefits of slipstreaming. Currently, it's estimated fuel consumption can be reduced by up to 10%. *Visit oemoffhighway.com/12233087 to*

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Bosch's VisionX concept vehicle was used to demonstrate the various technologies it sees on the horizon for the trucking industry.

learn more about truck platooning in the article "Follow the Leader."

Efficiency and reduced emissions output will continue to play an important part in the way trucks will be designed in the future. The VisionX vehicle featured a diesel engine combined with an electric motor that reduces fuel consumption in specific driving conditions. Additionally, inclusion of the electric motor electrifies auxiliary systems to improve fuel economy even further.

In the future, more cities are anticipated to have stricter emissions regulations, requiring the use of electric drive capabilities to minimize emissions output. Enabling vehicle operation by either an efficient diesel engine or an electric motor would allow a truck to do both highway and inner-city driving.

Rueger says that at some point in time, smaller inner-city delivery trucks will most likely go the pure electric route. While there are some on the roadways today, the cost of an electric drive system compared to diesel engines are still high. However, if in the next few years there is a significant cost reduction, particularly for batteries, then electric drive trucks, especially for inner-city driving, could become more prevalent, providing fleets with a better total cost of ownership incentive. "We believe there will be a co-existence of both," says Rueger, "For long-haul trucks, diesel engines will still be first choice for the foreseeable future."

The future is closer than ever

Bosch's goal when developing the VisionX concept was to demonstrate what will be capable within the next 10 years. While there is no set timeframe for when the technologies will become industry standards, early iterations of many are already being used in today's trucks. Driver assistance systems which warn of a lane departure or perform emergency braking, for instance, are currently in use, and in Europe are required by legislation to be integrated on all new truck models.

As the benefits of these systems becomes more apparent, their development will continue and there will be a greater likelihood of more advanced iterations being available in the not-too-distant future.

Much of the technology and componentry needed to bring these future technologies into existence are currently available. "It's not that we're talking about something which is totally undeveloped, and not yet clear whether it can be achieved," says Rueger. Instead, it has to do with cost, testing and validation, and in some instances regulations. Platooning, for example, involves the trucks following one another at a distance of 10-15 m (32.8-49.2 ft.) which is not currently allowed at maximum speed.

Because it takes time to develop and validate the technologies of the future—and get the industry and regulators on board with some of them—a step-wise approach will be taken to rolling out many of them. Lane departure warning systems as they exist today send an alert to the driver so corrective action can be taken. Rueger says the next step in the system's development process, though, would be the implementation of automated steering capabilities which keep the vehicle in its lane.

"The big truck companies and OEMs are preparing for the various technologies in the timeframe of 10 years from now because the technologies will need to be validated step-by-step," Rueger concludes. "That takes some time."

Head to the Web

Read about more future concept and test vehicles.

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Peloton DOE Project to Reduce Vehicle Energy Through Smart Powertrains, Platooning
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MAN Truck & Bus Participating in Cooperative Driving Research Project
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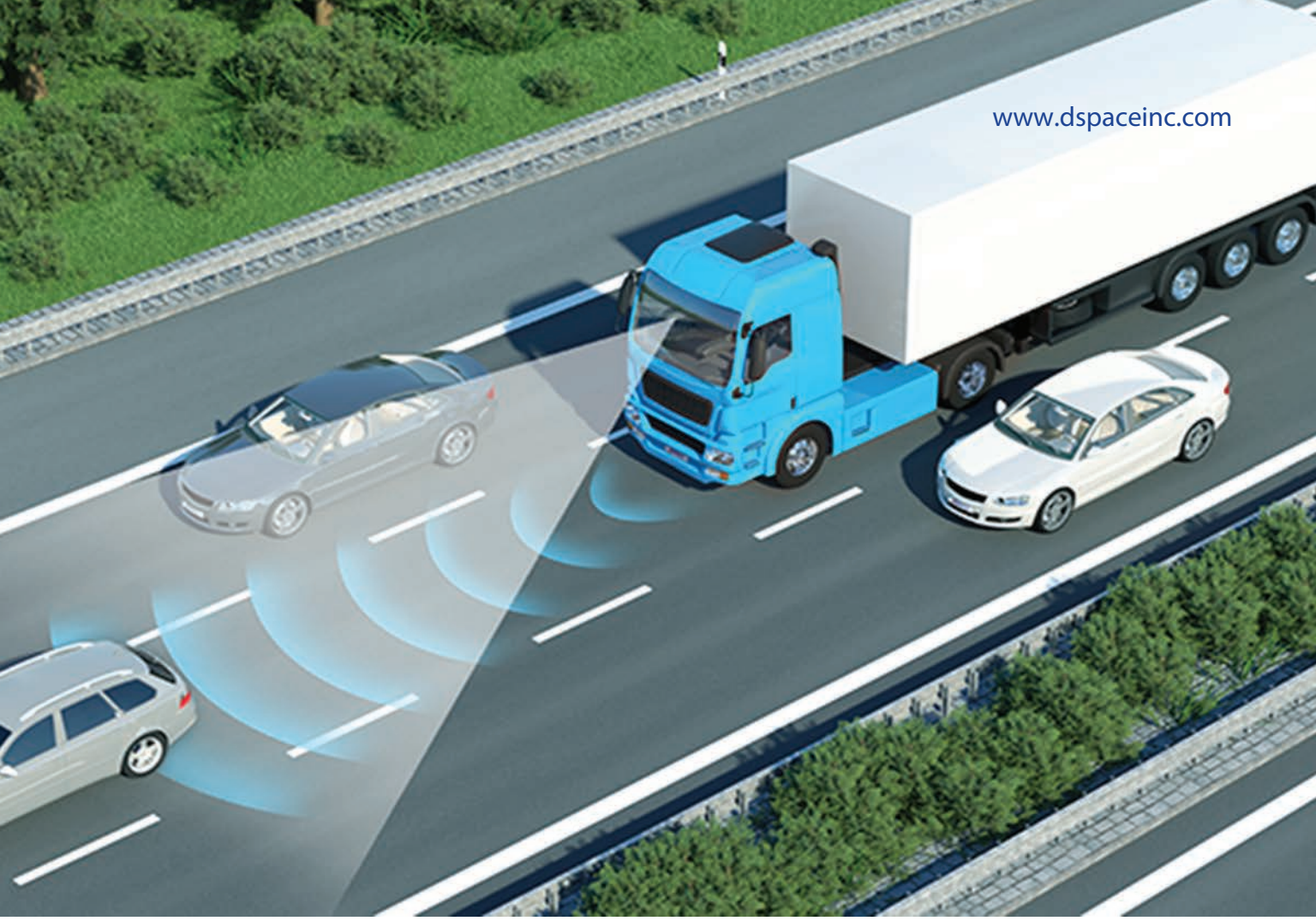

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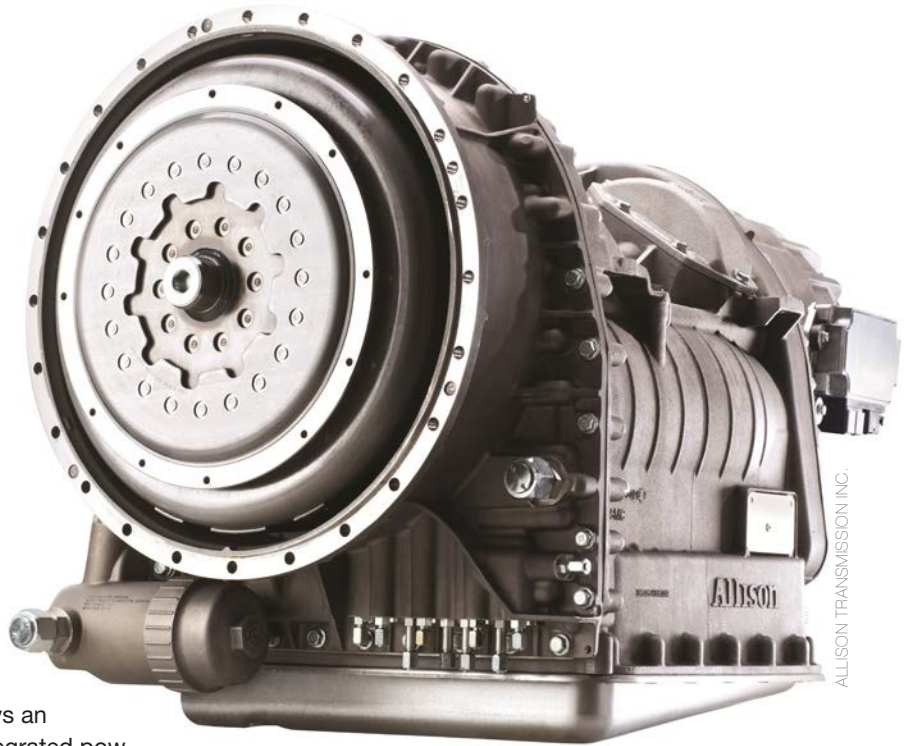
SYSTEM-BASED Approach Maximizes Downspeeding Benefits

To ensure fuel efficiency gains from engine downspeeding, two component manufacturers partnered to develop an optimized system solution.

by Sara Jensen



ALLISON TRANSMISSION INC.

The TC10 transmission combines Allison's torque converter technology with a unique twin countershaft gear scheme to provide full power shifts and cruising fuel economy for greater productivity and efficiency.

In October, Allison Transmission and VanDyne SuperTurbo announced their collaboration to develop a demonstration Class 8 truck combining Allison's TC10 transmission with VanDyne's mechanically driven turbocharger to maximize the benefits of engine downspeeding *(learn more, 12269409)*.

"Downspeeding the engine can provide fuel economy improvements, but often at the risk of reduced powertrain performance," says Dan Ellabarger, Director of Business Development at Allison Transmission Inc.

To help mitigate these performance issues, the companies determined it necessary to take a system-based approach instead of looking at each technology individually.

Thomas Waldron, Executive Vice President, VanDyne SuperTurbo Inc., says an integrated powertrain system is required to achieve the desired effects of downspeeding, and that to enforce it, the transmission needs to be in play.

In general, the transmission is what controls the speed at which an engine operates, setting the shift schedules for the vehicle. As such, much of the development efforts for the project revolve around the control systems for the transmission and turbocharger; the aim is to modify the shift schedules of the transmission while simultaneously adjusting the way the engine's boosting system (the driven turbocharger) works to match engine performance to those shift schedules in order to achieve efficient engine downspeeding.

Technologies working together

Ellabarger says the Allison TC10 is an inherently efficient device as it combines the company's torque converter technology with a unique twin countershaft gear scheme to provide full power shifts and cruising fuel economy for greater productiv-

VANDYNE SUPERTURBO INC.

The VanDyne and Allison demonstration truck will be put through various tests to validate the efficiency benefits of their system.

ity and efficiency. To enhance these benefits even further for the project, Allison will apply a new control strategy which will incorporate predictive shifting.

With the addition of the VanDyne SuperTurbo (aka the turbocharger) to the system, the engine will be more responsive, as well. This is due to the SuperTurbo's ability to act as a supercharger through transients by using a combination of turbine and engine power to allow faster rises in engine torque while minimizing the need to run higher engine rpm. "The ability of the TC10 to power shift in conjunction with the ability of the VanDyne SuperTurbo to quickly increase engine torque maintains the performance capabilities expected by drivers," he says.

Waldron notes that the SuperTurbo being able to provide a boost in engine power is beneficial to overcoming the performance issues

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often associated with downspeeding. "When you're trying to maintain and run at downspeed, there are always some issues," he says. "There are performance problems that [occur] if you're limiting the rpm the engine is allowed to run, and in order to compensate for that you need to run fast, efficient transients which the SuperTurbo specializes in."

VanDyne's turbocharger features a high speed planetary which Waldron says significantly reduces the speed of the turbocharger. Doing so enables a variable device, such as a CVT (continuously variable transmission), to be applied to control the overall ratio in speed between the engine and the turbocharger. "It allows you to effectively control the amount of air flow and boost pressure to the engine precisely, and it allows you to adjust it as an extra lever inside of the entire system tuning," he explains.

If a sudden increase in power output is required from the engine, such as for vehicle acceleration when approaching an incline, the SuperTurbo provides the quick transient response necessary by acting as a supercharger, using both turbine and engine power to increase engine torque without increasing rpm.

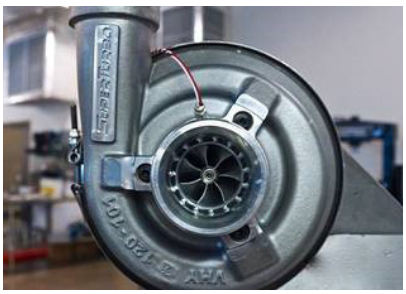
The turbocharger knows when to do this because of the communication between it and the transmission. In a traditional powertrain, when approaching an incline the transmission will automatically downshift and engine rpm will increase to make the climb. But with the Allison and VanDyne system, the transmission can inform the SuperTurbo when it's time to provide the extra torque necessary to make the climb while maintaining the engine downspeed condition.

Waldron says the SuperTurbo can also act as a turbocompounder. The device's turbine is capable of collecting excess power, such as when in a highway cruise condition. Once the SuperTurbo's turbine begins collecting more energy than its compressor needs, a torque reversal occurs within the device turning it into a turbocompounder which can now provide power back to the engine.

Putting the system to the test

While the first 9 months of the project was spent on system modeling, Waldron says the vehicle in which the Allison and VanDyne system is being tested is now fully operational. VanDyne supplied the truck itself and turbocharger, while Allison supplied the transmission and did the full vehicle retrofit, including changing final drive axle ratios to meet the downspeeding requirements of the project.

The goal is to achieve a downspeed to around 1,000-1,200 rpm which is generally a heavy-duty diesel engine's most efficient operating point. In addition to the transmission and turbocharger working together



VANDYNE SUPERTURBO INC.

The SuperTurbo is able to provide a boost of extra torque when necessary to keep the engine in a downspeed condition.

to maintain these speed parameters, VanDyne says the closer spaced gear ratios of Allison's TC10 is also beneficial to maintaining the lower rpm range.

"The real key is getting efficiency from the downspeed and having no performance penalty," says Waldron. "In fact, the goal is observed increased performance with the efficiency gain all at once."

The demonstration truck is currently in its testing environment; it will first go through transient acceleration runs followed by steady state highway cruise testing.

Jared Brown, Engineer at VanDyne SuperTurbo Inc., says some full acceleration tests have been done with the new system and shown faster acceleration than a traditional truck configuration while maintaining a lower engine speed. "That's what we want to see, and initial tests show we're going in the right direction," he says.

Waldron notes that vehicle testing is not always easy as there are a lot of factors involved such as fluctuations in temperature, varying road and traffic patterns, and wind conditions. To compensate for these, he says it's important to build a large data set to test against, which the companies are in the process of compiling. At the time of printing, the companies were moving into drive cycle testing, as well.

Ellabarger says that as vehicle testing of the system begins to produce results which meet or exceed initial simulation models, future testing may involve other Allison fully automatic transmission models paired with the SuperTurbo. Additionally, as testing progresses, he says Allison will provide updated transmission calibrations such as its FuelSense 2.0 technology to further optimize the engine and overall system.

By working together on the project, each company brings its individual expertise to the table in order to create the best system possible. "The benefit of both companies working together is to extend and enhance the separate component benefits by providing an optimized total vehicle system solution," says Ellabarger.

"A lot of it is an exercise in controls and logic," Waldron says. "The SuperTurbo is a variable device we can set to run different air/fuel ratios and perform with shifts in the transmission. It requires both companies to really optimize the system."

Once the companies have completed more testing and have proof of the efficiency and performance benefits their system can offer, the next step will be to work directly with truck OEMs to integrate the technology. "We want to make sure our system is proven and optimized, and then we can approach the OEMs toward their uptake of it," says Waldron.

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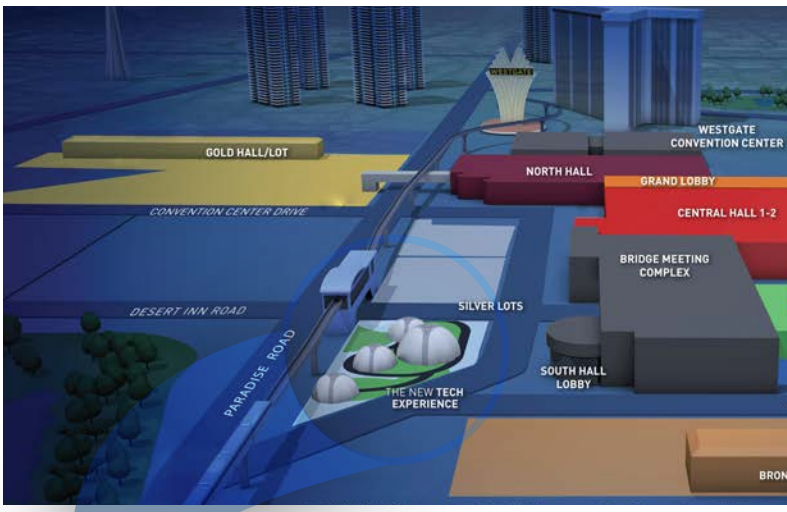
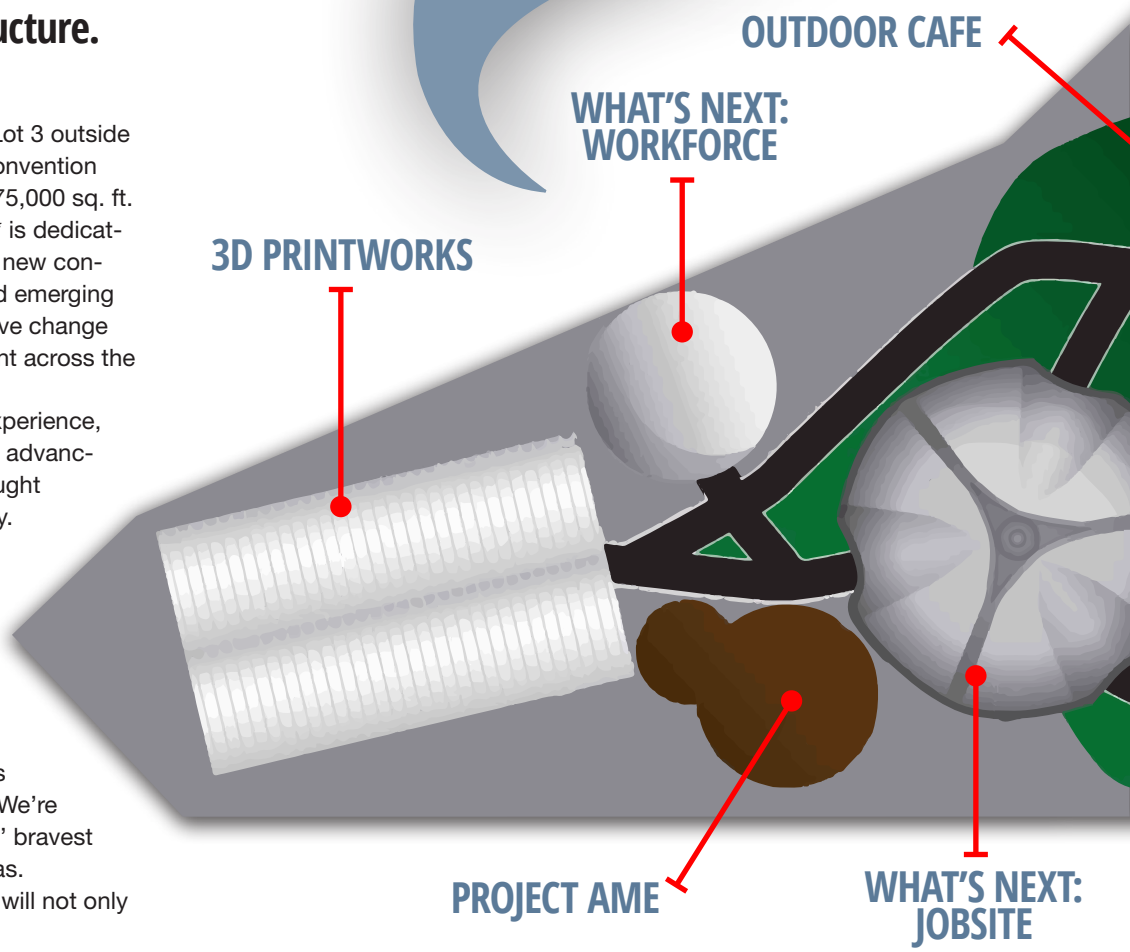
A New Tech Experience at CONEXPO-CON/AGG

Attendees will be able to step into the future of the construction industry at the new immersive Tech Experience pavilion and see emerging technologies for the jobsite of the future; innovative wearables to enhance health, safety and productivity; cutting-edge skills for careers of the future; and new materials to enhance our nation's infrastructure.





Located in Silver Lot 3 outside the Las Vegas Convention Center, the new 75,000 sq. ft. Tech Experience* is dedicated entirely to presenting new construction innovations and emerging technologies that will drive change and process improvement across the industry.

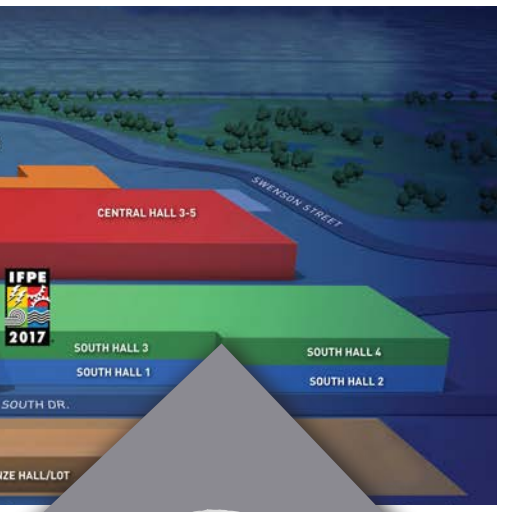
"With the new Tech Experience, CONEXPO-CON/AGG is advancing to a new level of thought leadership in our industry. We're calling on AEM members to submit a proposal to be a part of it," says Sara Truesdale Mooney, Show Director and Vice President Exhibitions and Business Development for AEM. "We're looking for our members' bravest and most innovative ideas.

"The Tech Experience will not only

"Technology and innovation will drive change for the future of the construction industry, and we're excited that students are playing a vital role in bringing the newly designed machine to life."

—Eric Lanke, Chief Executive Officer of NFPA

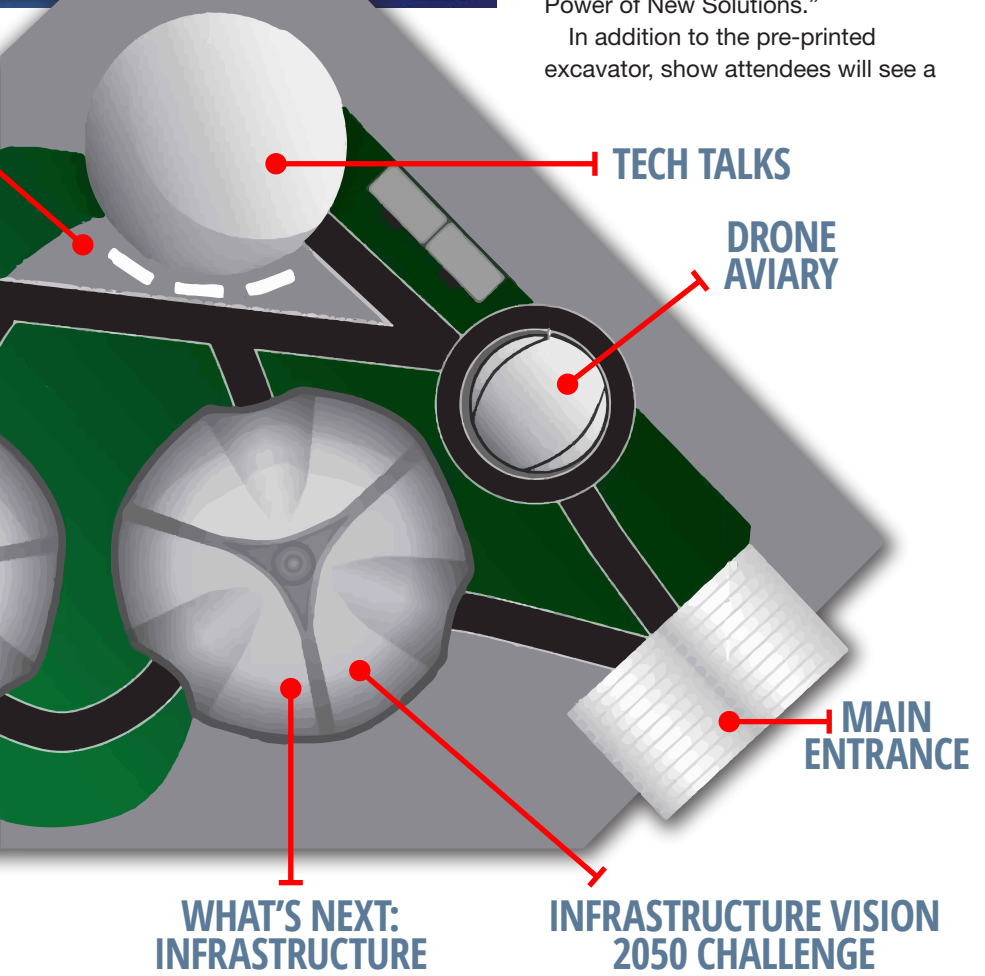
present a vision for the future of our industry, but it will also raise awareness of technologies that enhance safety, productivity and profitability. Attendees will explore three key zones," says Truesdale Mooney. "The worksite of the future, the jobs of the future and the infrastructure of the future. We'll also feature additional engagement zones including a Maker Beta Lab that will feature a collaborative future factory environment and the world's first fully functional 3D printed excavator."



World's first 3D printed excavator

Both CONEXPO-CON/AGG and IFPE are teaming up to unveil the world's first fully-functional 3D printed construction excavator and the first large-scale use of steel in additive manufacturing. The excavator will bring to life how technology is transforming the construction industry in line with the shows' 2017 themes, "Imagine What's Next" and "The Power of New Solutions."

In addition to the pre-printed excavator, show attendees will see a



SHOW PREVIEW: TECH EXPERIENCE PAVILION

www.oemoffhighway.com/ifpe-conexpo

second excavator printing live on the show floor.

"We know our members look forward to seeing the industry's most innovative technologies at CONEXPO-CON/AGG and IFPE each show year and 2017 will not disappoint. We're thrilled to bring such a significant technological and first-of-its-kind achievement like the 3D printed excavator to the show; it will be a platform to demonstrate how the latest innovations and applied technologies are changing the future of [the] construction industry," says John Rozum, IFPE Show Director.

The excavator is a joint collaboration between the Association of Equipment Manufacturers (AEM), National Fluid Power Association (NFPA), Center for Compact and Efficient Fluid Power (CCEFP), Oak Ridge National Laboratory (ORNL) and the National Science Foundation (NSF).

Research teams from Georgia Tech and The University of Minnesota converted the excavator design to one that is conducive to and takes full advantage of 3D manufacturing. Graduate engineering students at Georgia Tech created a boom and bucket featuring integrated hydraulics with the goal of decreasing the weight, materials cost and maintenance, while students at the University of Minnesota designed a hydraulic oil reservoir/heat exchanger and cooling system that reduces the size and weight, and increases the efficiency of the machine.

"Technology and innovation will drive change for the future of the construction industry, and we're excited that students are playing a vital role in bringing the newly designed machine to life," says Eric Lanke, Chief Executive Officer of NFPA.

Quick Facts on CONEXPO 2017:

WHEN: March 7-11, 2017

WHERE: Las Vegas Convention Center, Las Vegas, NV

SHOW HOURS:
Tuesday, March 7 - Friday, March 10
Exhibits 9 a.m. to 5 p.m.

Saturday, March 11
Exhibits 9 a.m. to 3 p.m.

NUMBER OF EXHIBITORS: +2,500

TOTAL FOOTPRINT: +2,500,00 sq. ft.

* The new Tech Experience pavilion totals over 75,000 sq. ft.

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IFPE 2017 Includes EEHPC

IFPE will host the fluid power industry's prestigious Energy Efficient Hydraulics and Pneumatics Conference.

The Energy Efficient Hydraulics and Pneumatics Conference (EEHPC) will be held in conjunction with IFPE to bring an added dimension of fluid power education to the show. "Industry professionals will benefit from the additional knowledge-sharing and networking," says Bob Mortensen, IFPE 2017 Chair and President, Off-Highway Division of HUSCO International.

The EEHPC focuses on concepts and techniques to keep fluid power (hydraulics and pneumatics) systems operating at peak efficiency to reap significant energy savings.

The conference traditionally includes a "future of fluid power" program, which at IFPE 2017 will explore robotics challenges and opportunities.

The EEHPC is sponsored by the NFPA, the FPDA Motion & Control Network, and the International Fluid Power Society.

Four half-day IFPE "college-level courses" will emphasize hands-on technical knowledge on the effective use of hydraulics in mobile equipment: (1) fundamentals of hydraulic systems; (2) hydraulic fluid properties, efficiency and contamination control; (3) hydraulic system design strategies for mobile applications; and (4) electro-hydraulic, systems design and control.

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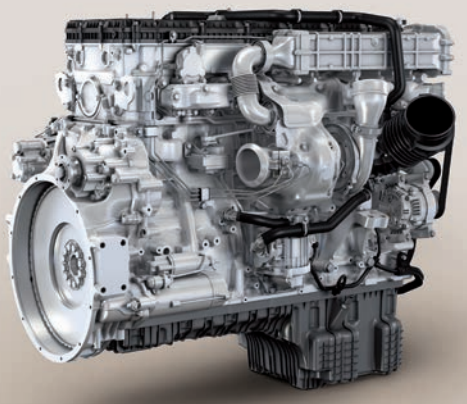

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NFPA Hosting World Fluid Power Summit at IFPE 2017

The NFPA's World Fluid Power Summit will feature industry and association leaders from around the globe who will provide an overview of fluid power market trends.

The world of fluid power is already making its plans to gather at IFPE 2017, the leading international exposition and technical conference dedicated to the integration of fluid power with other technologies for power transmission and motion control applications. But one event currently being organized and hosted by the NFPA will truly bring the world of fluid power together for information sharing and education.

The World Fluid Power Summit will be held on Thursday, March 9, 2017, beginning at 12:00 noon, at the Las Vegas Convention Center, and will include lunch for all attendees.

Industry and association leaders from more than a dozen countries—including Australia, Canada, China, Germany, India, Italy, Japan, Mexico, Taiwan, Turkey, the United Kingdom, and the United States—are expected to attend, with a representative from each country making a presentation on fluid power market trends in their home markets.

Additional presenters have also been invited, seeking engagement with the world fluid power community on important standardization initiatives and the growth of worldwide fluid power certification programs.

The summit is open to all interested participants, but seating will be limited, and advance registration is required.

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Education Sessions Focus on Technology of the Future

A record 143 education sessions, including the new Technology track, will focus on the latest trends and technologies such as drones, autonomous vehicles, Big Data and the Internet of Things.

CONEXPO-CON/AGG 2017 will offer a record 143 education sessions across 10 tracks, including a new Technology track, to provide attendees with the latest industry knowledge and best practices to improve their professional skills and company productivity.

"Education is a critical component of CONEXPO-CON/AGG, and we encourage attendees to take advantage of the convenience of so many learning opportunities available; they'll be able to work smarter because of the knowledge they gain here," says Rich Goldsbury, CONEXPO-CON/AGG 2017 Chair and President of Bobcat Co. and Doosan.

The new CONEXPO-CON/AGG 2017 Technology track focuses on industry innovations and future growth opportunities in the technology field, including drones, autonomous machines, 3D imaging, smart apps, gamification, Big Data and the Internet of Things (IoT).

The technology track complements the new 75,000-plus sq. ft. Tech Experience showcasing the ideas and technologies that will transform construction in the future.

The CONEXPO-CON/AGG 2017 education tracks will also offer the latest trends and best practices focused on: asphalt; concrete; cranes, rigging & aerial lifts; equipment management & maintenance; and more.

IFPE 2017's education program provides crucial information on new fluid power, power transmission and motion control technologies to engineers and others involved in the design and manufacturing process.

A full schedule of the available Education Sessions at both 2017 shows is available online at www.conexpoconagg.com/education or www.ifpe.com/education.

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IMPROVED DETECTION CAPABILITIES Create Safer Vehicles

Object detection systems with improved range and visibility near the face of the system help ensure safety on the job site.

by Sara Jensen

Safety on the job site continues to be an area of concern for the heavy-duty equipment industry as operator visibility is often restricted due to the large size of the equipment. Because of this, object detection and other safety systems have become more prevalent on heavy equipment within recent years.

At MINExpo INTERNATIONAL 2016, both Caterpillar Inc. and Hitachi Construction Machinery announced the availability of object detection systems on their equipment. Caterpillar is expanding the number of machines on which its Cat MineStar Detect Object Detection systems will now be available. In addition to being available on more Caterpillar machine models, the systems can also now be used on surface mining equipment from other OEMs to help mixed fleets standardize the safety technologies they utililze *(learn more, 12264136)*.

During the show, Hitachi introduced its new Aerial Angle vision display system with object detection technology *(learn more, 12264665)*. The system features a Stationary Mode which uses camera image processing technology to warn operators of nearby objects when the vehicle is stopped or starting to move. When the vehicle is in

Hitachi's Aerial Angle vision display system with object detection uses millimeter wave radar technology to detect oncoming vehicles.

motion, Forward Mode warns the driver of an approaching vehicle on the road head. Forward Mode uses millimeter wave radar technology developed by Hitachi Ltd. to detect oncoming vehicles.

PRECO Electronics also introduced its new PreView Sentry Object Detection System at MINExpo 2016 *(learn more, 12261125)*. One of the key features of the system is its ability to accurately detect objects up to the "face" of the radar. Doug Whitfield, Director of Marketing at PRECO Electronics Inc., says this capability, which is standard across the company's entire suite of offerings, is critical to ensuring operators receive active and accurate alerts when people or objects are in close proximity to a piece of equipment.

Competitive systems, he says, have had difficulty accurately and consistently detecting objects within the first 4 ft. (1.2 m) of the radar sensor, creating a potentially dangerous situation. For the PreView Sentry, PRECO developed proprietary digital signal processing algorithms to reliably detect people and objects from the face of the radar all the way out to almost 100 ft. (30.5 m).

ZF FRIEDRICHSHAFEN AG

Evasive Maneuver Assist uses multiple system integration to detect and avoid objects within a vehicle's path.

How the system works

Depending on the desired detection zone, the radar sensor is mounted on the back, sides or front of a piece of equipment and provides up to 360-degree object detection. The sensor is connected by heavy-duty cabling and sends messages to an in-cab display to provide operators with audible and visual alerts when objects are detected. Up to 16 objects can be detected and tracked at one time; the radar is capable of determining both the location and velocity of the objects it detects.

Providing audible alerts in addition to visual ones prevents operators from having to constantly monitor a

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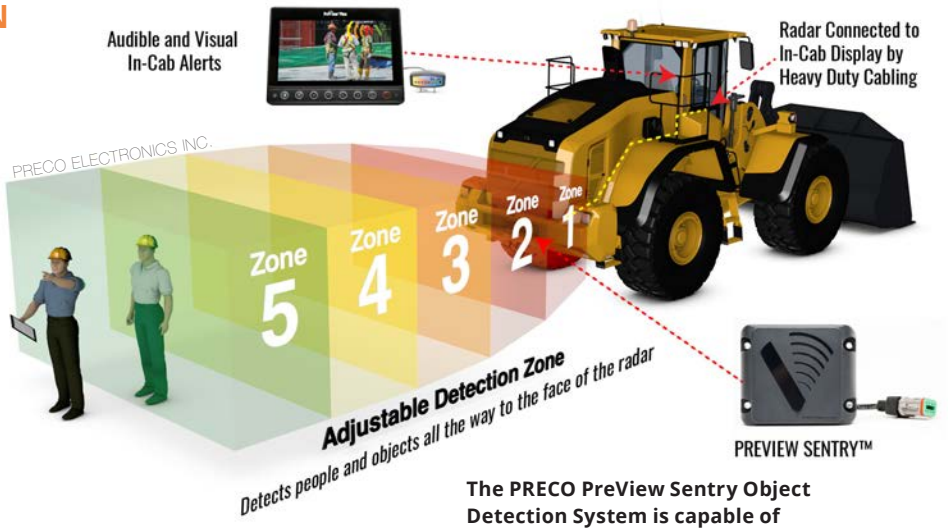
screen to determine whether or not there is an object in their path; instead, they can stay focused on their work and look at the system's camera display once the alerts are sent.

The PreView Sentry system can be used on nearly any size machine—from a small skid steer to a 400-T mining haul truck—and features an IP69K rating to ensure durability in harsh operating environments. Built-in safety alerts notify an operator if there is something blocking the radar or if there are communication issues within the system, further assuring the reliability of the system.

Whitfield notes that PRECO spent 2 years researching and developing the system, and over a year testing it with OEMs before determining it was ready to bring to market. The system operates over a 24 GHz bandwidth; of the three main frequency bandwidths typically used for object detection systems, the company chose to use 24 GHz to maximize the flexibility, accuracy and power it could provide.

The company says its system is one of the most flexible on the market as it allows the range and width of detection to reach up to 30 m (98.4 ft.) and be adjusted as needed. It can also be programmed by an OEM to fit a specific vehicle design which Whitfield says is usually the preferred method. However, PRECO can also program the system for a manufacturer if requested.



The PRECO PreView Sentry Object Detection System is capable of detecting objects from the face of the radar up to almost 100 ft. (30.5 m) from the vehicle.

Beyond object detection

If an OEM wants to further enhance the safety capabilities of its equipment, Whitfield says the PreView Sentry system can be connected to a vehicle's electronic control unit via CANbus to create a full safety system that goes beyond just object detection. For example, a manufacturer could have CAN messages sent which trigger the machine's brakes once an object is detect by the PreView Sentry system. In this manner, the OEM could ensure corrective actions are taken when an object is detected in case the vehicle operator is not able to react in time.

ZF and WABCO's recently introduced Evasive Maneuver Assist (EMA) system is an example of how this type of multi-system integration is being employed in on-highway applications. EMA utilizes sensors to detect an object in the vehicle's path and then intelligent control units and physical maneuvering performed by actuators steer the vehicle away from the object if the operator does not react within a certain amount of time *(learn more, 12226523)*.

Telematics systems can also be connected with the PreView Sentry, says Whitfield, to provide reports

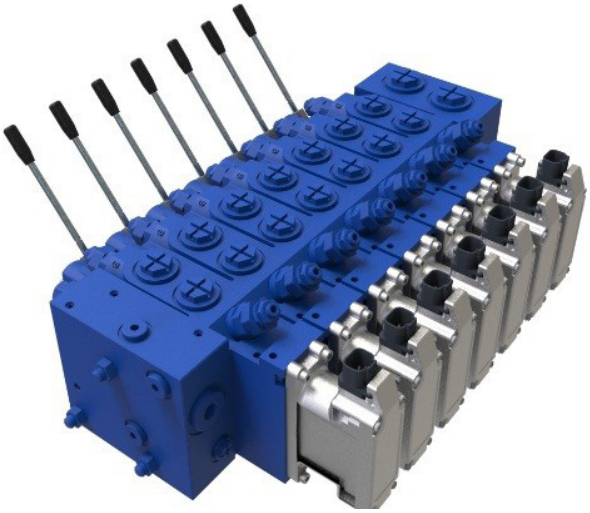
The Cat MineStar Detect Object Detection system provides specific camera views to show the operator where potential hazards are detected.

CATERPILLAR INC.

on near misses, distance and angle of objects within the system's field of view, driving habits, whether an operator breaks in time, and more.

Whitfield says safety systems will continue to evolve in order to provide more comprehensive information about the environment in which machines are operating and work together with other vehicle systems to provide a safer working environment. The market is rapidly moving toward active operator assist features. One key feature is the market adoption of a vehicle braking and slowing as it detects an obstacle in its course.

Sensor fusion—linking data from several sensors (such as radar, image recognition system and LIDAR sensors) to compute something that could not be determined by a single sensor—is one of the evolutions Whitfield foresees. When applied to safety, he says the applications are limitless. Sensor fusion allows the linking of disparate systems, including collision mitigation technology with an Advanced Driver Assistance System (ADAS). Based on the ultimate goal, the combination of the systems can actively alert the operator or directly engage the vehicle's braking, suspension and steering controls to mitigate potential collisions. These capabilities are currently being used within various autonomous vehicles, and, Whitfield concludes, are helping lead the way toward greater acceptance of unmanned equipment.



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- Individual load independent flow control via section pressure compensators
- Low hysteresis
- Manual override
- Flow: inlet maximum 150 L/min (39.6 gpm) (with valve compensators)

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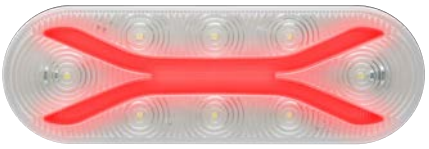

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Optronics International has unveiled several unique new 4-in. (10.16 cm) round and 6-in. (15.24 cm) oval LED stop, tail, turn lamps.

- Employs newly engineered Light Guide technology which allows LED light to be transmitted from one location in the lamp to another and enables illumination of complex shapes and patterns
- Light Guide uses clear, shaped, polymer cylinders that guide and project LED light in very specific ways
- Achieves smooth lighting contours
- Offers brighter and more attention-grabbing appearance
- Patterns stand in contrast to hot spots associated with most LED vehicle lighting
- Available in flange-mount and grommet-mount versions, and with standard PL-3 and Weather Tight termination options
- Meets all FMVSS 108 photometric requirements for visibility and safety
- Lenses and housings are made of tough polycarbonate material that is sonically welded
- Features solid-state, surface-mount device (SMD) design that protects electronics against moisture, shock and vibration

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Lincoln Industries offers its ThermoLinc Genesis thermal insulating coating.

- Features protective properties for service temperatures from -40-200 C (-40-392 F)
- Lightweight, pliable and able to expand and contract with changes in the substrate
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- Chemically resistant, highly durable, easily repairable
- Offers impact and abrasion resistance
- Can be applied over complex geometries for use in wide variety of applications

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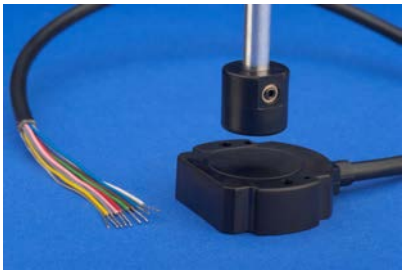

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Novotechnik U.S. introduces the RFC4800 Series of touchless angle sensors measuring angular position up to 360 degrees, revolution counter and speed—without wear.

- Features include programmable zero point offset, measurement averaging and sign of rotational direction
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- Includes IO-Link as digital interface, offering serial communication protocol which makes wiring easier
- Other output interfaces include analog voltage and current, as well as digital outputs options—SSI, SPI, incremental and CANopen
- Single and multi-channel versions are available
- Sealed up to IP69K
- Operating temperature range is -40-125 C (-40-257 F)

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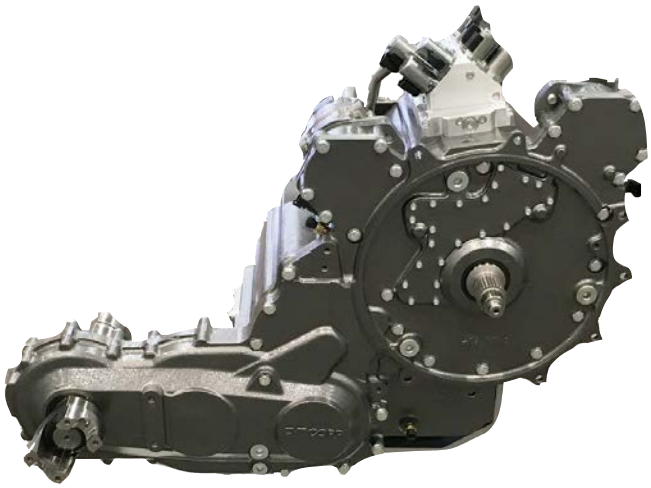
LED Combination Light

ABL Lights announces the release of the 3800 LED Combination light.

- Offers direct drop-in replacement for halogen design
- Prevents snow and ice buildup via lens heat sync
- Multi-voltage of 12-24V
- Vibration resistance is 15 Grms from 24-2,000 Hz and shock resistance is 60 G
- Meets various industry standards including ISO 13766, ISO 14982, ISO 12985 and CISPR25
- Protected against reverse voltage
- Includes electronic thermal management to protect against overheating
- Water tightness to IP68/IP69K
- Operating temperature range is -40-85 C (-40-185 F)
- Features salt spray protection to ISO 9227
- Lens is hardened glass with free-form reflectors and aspherical lens modules

oemoffhighway.com/20848383



Continuously Variable Transmission

The ECOMEC 150 continuously variable transmissions (CVTs) from CVT Corp. offer increased efficiency, productivity and fuel savings.

- Fully mechanical CVT
- Automatic shifting and infinite number of ratios resulting in improved vehicle performance and engine optimization, increasing work efficiency and saving time
- Maximum tractive effort at low engine rpm (no torque converter)
- Use with mechanical or electronic engine
- Drop in replacement for a PowerShift
- Open platform controls and software to adjust the vehicle sophistication level
- Simple and precise controls
- Smooth and efficient forward/reverse shuttling for a comfortable ride
- Replicates torque converter behavior

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Joystick

The C15 joystick from Caldaro can be used across an application spectrum from the toughest working environments to high precision equipment.

- Circuit board and electronics are potted with compound to protect from salt, water, lubricants and chemicals
- Operating angle is 9, 12 or 20 degrees
- Sealed panel mounting

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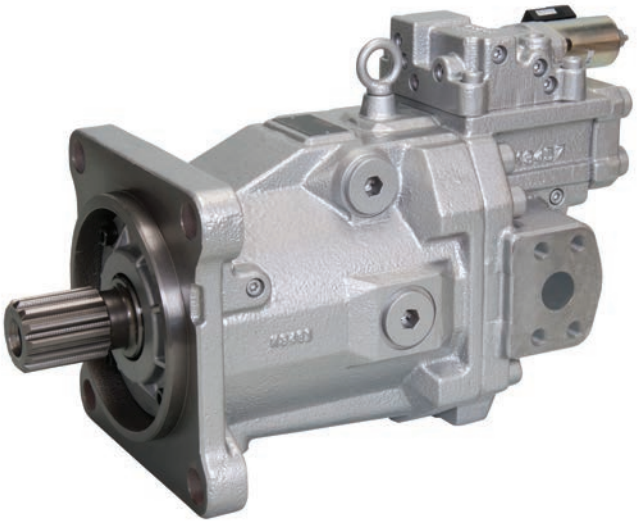


Axial Piston Motor

The M7V Series from Kawasaki Precision Machinery is a high speed variable displacement swash plate type axial piston motor. It is suitable for use in hydrostatic transmissions, drill rigs and crane winch systems.

- 85, 112 and 160 cc displacements
- 400 bar continuous pressure rating
- Electronic and hydraulic displacement control
- Fixed displacement version available

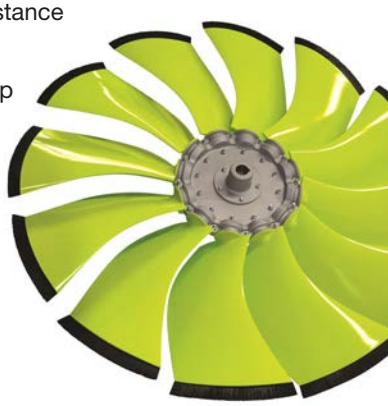
oemoffhighway.com/20846525

Fan Blade Extensions

Multi-Wing introduces its EPS Fan Blade Extensions.

- Features bristles on the end of each blade, closing the gap between the shroud and fan tip
- Minimizes turbulence in the blade, improves fan performance and reduces noise
- Increases efficiency by up to eight percentage points and pressure by up to 25%
- Strength tested for durability in tough off-road applications and use in HVAC systems
- Third-party tested for chemical resistance
- Compatible with all Multi-Wing fans
- Suited for operating temperatures up to 280 F (120 C)
- Withstands loads of more than 1,016 N/in. (40 N/mm)
- Performs at maximum operating speed for PAG fans
- Performance and noise remain unchanged even after 400,000 impacts

oemoffhighway.com/20846632



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armoredvehiclesus.iqpc.com

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April 4-6, 2017 | Stuttgart, Germany
www.thebatteryshow.eu

ELECTRIC & HYBRID VEHICLE TECHNOLOGY EXPO EUROPE
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How to Control a Bulldozer

Variations of dozer attachment control over the decades have included everything from hand-operation to cables to the earliest forms of hydraulic control.

by Thomas Berry, Archivist, Historical Construction Assn.

As tractor-mounted attachments, particularly bulldozers, came into use in the early 1920s, a related challenge emerged: How to control the attachment?

The dozer blade, left to its own devices, will follow gravity downward — which is why safety demands that a dozer or other attachment be fully lowered when the machine carrying it is idle. A means of raising the dozer clear of the ground and control its depth when working was needed.

Given the technology at the time, a hand-operated chain windlass was the first answer. Turned from the operator's station, the windlass controlled the blade's height. One operator could handle the operation of the tractor and the windlass, but often a second man would turn the windlass so the operator could concentrate on the tractor.

The earliest hydraulic controls for dozers also appeared in the early- to mid-1920s. LaPlant-Choate Mfg. Co. developed a unique counter-balanced hydraulic dozer that was operated by a large cylinder on the back of the tractor. It enabled one operator to handle both the tractor and the dozer and was well balanced. However, it could only lift the dozer; all downward pressure for work was supplied by gravity and the physics of the blade's interaction with its load.

R. G. LeTourneau perfected cable control for tractor attachments. He had been developing scrapers and other tractor-drawn and mounted machinery for years, and had been using electric motors with rack and pinion mechanisms to control them. But two problems emerged: This system was slow for dozer use; and, in the language of the time, it simply couldn't stand the gaff of dozer operation. The loads applied to the dozer brutalized the rack and pinion.

In 1928, LeTourneau introduced a modified cable winch on the back of the tractor and a tube to the front through which the cable passed to reach the dozer.

HCEA ARCHIVES

LaPlant-Choate's hand-cranked dozer, on a Holt T-35 tractor owned by Chris Austin at the 2004 HCEA National Convention, Saegertown, PA.

HCEA ARCHIVES

A restored Cat Sixty with a counterbalanced LaPlant-Choate hydraulic dozer.

While, like LaPlant-Choate's hydraulics, down pressure could not be applied, it was quick, easily controlled by one operator, and had the added advantage of being able to operate towed equipment. Cable control became standard for most mid-sized and all larger tractors, while hydraulics were limited to smaller machines.

It wasn't until the mid- to late-1950s that hydraulics were perfected for dozer control on the larger tractors, and today's hydraulics provide not only lift and down pressure, but also tilt and angling.

The Historical Construction Equipment Assn. (HCEA) is a 501(c)3 non-profit organization dedicated to preserving the history of the construction, dredging and surface mining equipment industries. With over 4,000 members in 25 countries, its activities include publication of a quarterly educational magazine, Equipment Echoes*; operation of National Construction Equipment Museum and archives in Bowling Green, OH; and hosting an annual working exhibition of restored construction equipment. The 2016 show is September 16-18 at the museum. Individual memberships are $35.00 within the USA and Canada, and $45.00 U.S. elsewhere. HCEA seeks to develop relationships in the equipment manufacturing industry, and offers a college scholarship for engineering and construction management students. Information is available at www.hcea.net, by calling 419-352-5616 or e-mailing info@hcea.net.*

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