

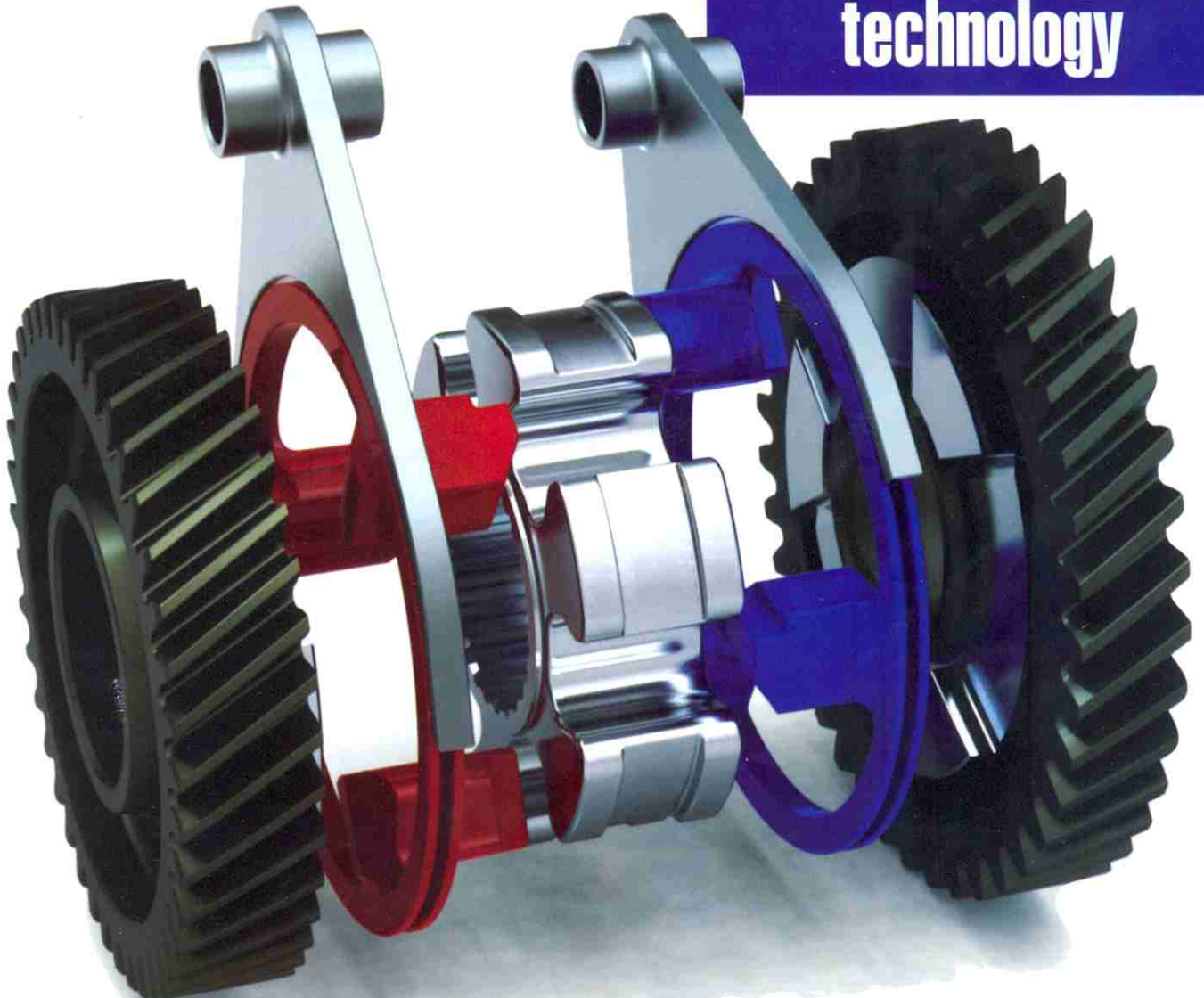


European

TRUCK + BUS technology

Stability: the mechanical solution • Bolt-on hybrids save fuel • Matching articulated tractor-trailer aerodynamics

Spring 2008



Making a smooth shift between ATM and automatics

Automatic coupling > Hybris concept > Engine materials

Transmission smoothes shift between AMT and full autos



It's not often that developments in racecar engineering filter up the weight scale to bus and truck applications, but that is the situation with specialist innovation company Zeroshift. The firm, based in Milton Keynes, England, has launched a gearbox technology that is said to bridge the gap between automated manual transmissions (AMTs) and full automatics.

Commercial confidentiality prevents Zeroshift from saying which top car racing teams it works with,

but anyone with an ear for an exhaust note cannot help but notice the speed with which certain cars are able to push gearshifts through.

Now the company says it is in a position to work with the heavy vehicle industry to produce a transmission which is cheaper than a full auto, but will provide a smooth gearchange with zero torque interruption. Consequent advantages include lower noise and reduced fuel consumption.

Synchromesh has long since disappeared from the AMTs offered by the likes of ZF for the truck market, and vehicles fitted with these transmissions now use their sophisticated electronics to exactly match engine, transmission and road speed when putting a change through. However, although this makes for a cheaper, lighter and more compact transmission, it has also heralded the return of the fuel-wasting throttle blip accompanying each downward change.

Zeroshift takes a different approach. Conventional synchromesh is replaced by pairs of interlocking rings, each of which incorporates three drive elements in a single forged component. The shift forks which make the gearchange can be operated by electrical, hydraulic or pneumatic actuators depending upon preference. The process is managed by an electronic control system which Zeroshift has developed to co-ordinate gearshift,



Secondary steam saves fuel

Recovering waste heat can improve the fuel efficiency of a heavy truck engine by up to 40%, according to Clean Power Technologies Inc.

The company's CESAR (Clean Energy Storage and Recovery) system reuses waste heat from the exhaust of a conventional internal combustion engine.

A heat exchanger captures waste energy, which is then stored in the form of steam in an accumulator for 'on demand' use either in the same primary engine, or in a secondary vapour engine. Power can be produced solely by the secondary vapour engine even after the primary combustion engine has shut

down – for instance to power auxiliary truck systems, such as trailer refrigeration and cab cooling or heating, in regulatory 'no idle' and 'quiet' zones.

In addition to initial truck applications, Clean Power also has a well developed passenger car programme and believes there to be longer-term potential in the locomotive and marine sectors.

Abdul Mitha, president and chief executive of Clean Power, said: "These results are a major achievement. We set high expectations, described by some observers as 'ambitious', by predicting fuel efficiency gains of up to 40%. For our tests to have reached the top of this range firmly validates the



shifts, the technology has obvious applications in mixed and urban duty cycles. Zeroshift claims potential fuel savings of at least 5% in mixed duties, and a further benefit is either enhanced acceleration or the opportunity to downsize the engine and benefit from weight and fuel savings.

The system allows 'power-on' shifting – even from forward to reverse – making it ideal for certain off-highway applications, while the smoothness of the shift will eliminate the 'nod' associated with conventional transmissions, which should appeal to the PCV sector.

Compared with conventional full automatics, the Zeroshift transmission is far simpler, and the technology can easily be adapted into a conventional manual gearbox.

Zeroshift managing director Bill Martin said: "For an established manufacturer of manual gearboxes, it is an extremely affordable way to offer a high-quality fully automatic transmission."

He sees particular appeal in the 7.5 tonne sector: "Automatics can bring significant benefits here, particularly in multi-drop applications, but the cost of planetary automatic gearboxes has been too high and the controllability of AMTs has been too poor."

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Zeroshift

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throttle and clutch operations to maintain full control over the driveline as the shift goes through.

Starting off from neutral, the first ring is engaged to take up drive, while ring two engages within a few degrees of rotation to take up the backlash. Upshifts are made by ring two taking up the drive and ring one the backlash. As ring two is unloaded during the gearchange the axial force required is as low as 40N, compared with up to 1,000N on a conventional AMT. These components can therefore be made from proven materials and do not require sophisticated surface treatments.

Because there is no torque interruption between

theoretical calculations and analyses of the technology's inventor, Fred Bayley, professor emeritus at the University of Sussex.

"Furthermore, this data adds additional weight to our discussions with commercialisation partners for hybrid power systems in both the truck and passenger vehicle markets."

The test programme, conducted at Clean Power's Newhaven R&D facility in East Sussex, England, has analysed data from almost five million readings of fluid flows, temperatures and pressures taken from a system that combines an advanced steam accumulator, supplied by Clean Power's collaborative partner Doosan Babcock (previously Mitsui Babcock), with a Caterpillar C18 diesel engine, a parallel secondary engine and a dynamometer rig.

It is while running under this 'joint mode' that

Clean Power's CESAR system has successfully achieved a 40% reduction in fuel consumption. The company is already applying the results from this phase of testing, which commenced in mid-October 2007, to design a second-generation steam accumulator which will be lighter and even more efficient.

Mr Mitha added: "Combustion engine and steam hybrid technology offers huge potential for green transport. Not only is our system highly cost-effective, avoiding the need for government subsidy support, but it is also suitable for adoption by vehicle manufacturers and energy companies without new delivery systems or transportation infrastructure."

More information
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