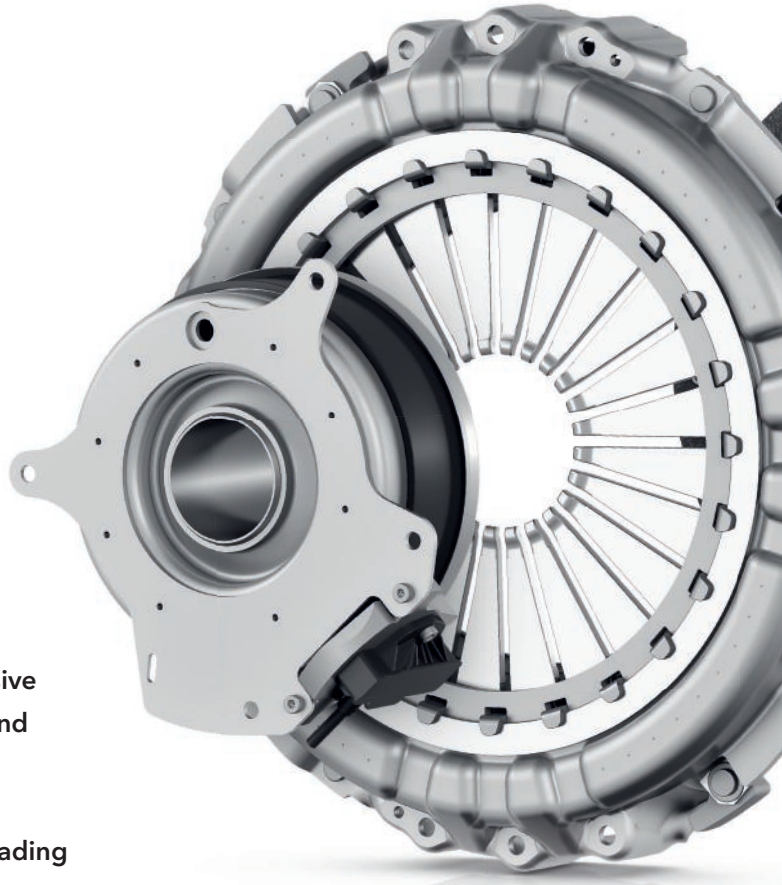

Speed of change

While engines have been under the cosh of the progressive rules of Euro levels over the last two decades, clutches and transmissions' development has only been directed by engineering innovation and competitive advantage. Ian Norwell looks at their journey and where they are heading

The manual transmission is not dead yet; Phil Moon, DAF's marketing manager in the UK, reports that around 15% of its heavy trucks still take them. They find a home with heavy haulage, where operators feel they have better fine control. But for the long distance, mile-munching fraternity, an AMT (automated manual transmission) is now essential for fuel economy. And not only that market: with bespoke software changes, all AMTs can change 'personality' for various applications.

TEAM EFFORT

Now, all of the OEMs have their own versions of the gold bricks that make up a fully competent transmission: cruise control (CC); adaptive cruise control (ACC), which automatically regulates the distance to the car in front; predictive cruise control (PCC), which uses global positioning system (GPS) mapping to survey the landscape several kilometres ahead to assesses the correct shifting strategy; and Eco-Roll (ER), which puts the transmission into neutral where the gradient and momentum allow to save fuel. The product names vary (see table), but the principles are common.

A look across the heavy truck makers, however, shows two different approaches in transmission supply. In the red corner are the brands that use in-house drivelines: Volvo with I-Shift; Mercedes-Benz with PowerShift3; Scania with Opticruise; and Renault with Optidrive. Volvo in particular has pushed it as an operational and marketing advantage for decades. In the blue corner sit the remaining contenders – DAF, Iveco and MAN – that don't make their own transmissions, but do very well with ZF-based equipment. They don't suffer in the technology race either, because ZF's latest TraXon transmission family is as advanced as any. Its ConAct pneumatic release cylinder for a Sachs clutch (pictured above; ***https://is.gd/ubesah***) has been specifically designed for AMTs. Traxon is equipped also with technically revised single-disc clutches adapted to modern engines.

COMPONENT HARMONY

Being able to call on a transmissions specialist that can tailor its product – or more likely its software – for a specific drivetrain seems to work just as well as producing it in-house. Relying on ZF hasn't stopped DAF holding UK market leadership.

But getting the engine and gearbox to talk to each other in a civil fashion doesn't necessarily come easily, even inside production families. In this respect, the US market is gradually having its fingers prised away from the beloved 'component' truck, in which operators assemble their own vehicle from diverse drivetrain component makers. There was an interesting meeting of different cultures in May 2015 in Las Vegas, when a Freightliner Cascadia tractor fitted with Mercedes-Benz PowerShift3 AMT was demonstrated in a fully-autonomous driving trial. It was a very unhappy mid-Atlantic marriage; there were a lot of impact sounds and shuddering from beneath as the shifts went through.

To be fair to Daimler, transmissions weren't the point of that groundbreaking

	VOLVO
Transmission brand name	I-Shift
Manual transmission option?	No
GPS-enabled cruise control brand name	I-See
Coasting mode brand name	I-Roll

trial; but it did show how you can no longer just drop a gearbox in willy-nilly. It's the electronic architecture that has developed, and now plays a role as important as all of the rotating metal parts. Even a modest Volvo FL rigid truck (which features the I-Sync automated transmission) has 21 different ECUs controlling its behaviour.

SPEED

The speed of shifting in AMTs continues to increase, with DAF's ZF-based application giving a 'fast-shift' performance in the top two ratios. They also allow an extra 100Nm of torque to be deployed there, making the need to shift to lower gears even less frequent. In 2014, MAN also promoted its TipMatic's 'SpeedShifting' capability for the top three gears.

Of course, the fastest shifting possible is with Volvo's I-Shift AMT with a dual clutch (DC). It operates in much the same way as VW's DSG system fitted to passenger cars and the Transporter T5 van, in which each clutch takes care of half the ratios, and the next gear is always ready so that drive is simply and seamlessly transferred between one clutch and the other. Although the system's benefits might be difficult to detect in a head-to-head test, engineering common sense tells us that incremental gains in journey time and driver comfort must be hiding here. More than 150 UK buyers over the last two years agree.

Whether single- or double-clutched, transmissions are ever more tightly integrated with the rest of the driveline. John Comer, head of product management, Volvo Trucks UK and Ireland, says: "The architecture linking the I-Shift transmission to the rest of the truck has needed to become more sophisticated as additional devices have come on stream. CC, ACC and PCC have all added more capability."

Comer adds that the use of transmission braking systems is also part of the equation. These include retarders (hydraulic-based non-friction brakes) and intarders (similar systems integrated in the gearbox). A third system is brake blending; it combines non-friction brakes such as the above, as well as engine and exhaust brakes, with the footbrake pedal. The auxiliary systems are deployed first, although the pads and discs are deliberately brought lightly into contact once every dozen normal brake applications to keep the brake calipers and other components working to prevent seizure from lack of use.

"The architecture linking the I-Shift transmission to the rest of the truck has needed to become more sophisticated as additional devices have come on stream. CC, ACC and PCC have all added more capability"

John Comer

Even Volvo's heavy haulage customers have been won over by its I-Shift AMT. Probably the last bastion to relax their grip on a manual gearshift, they've finally caved in, Volvo said when it launched its ultra-low (32:1) crawler gear. The Swedish manufacturer is finally removing the manual gearbox from its European heavy truck range, with the last specimens now in production.

The skill that was once deployed in executing smooth gear shifts has now moved to a different one: that of understanding how all these transmission devices work, and how to get the best out of them. An AMT is superficially very easy to operate, but the driver now needs to be making educated decisions about which system to employ for best fuel efficiency. For example, approaching distant roundabouts, an AMT could adopt Eco-Roll without traditional engine braking. These sorts of changes to driving style are subtle, but essential when there are no big wins on fuel economy left.

Transmission performance refinements now come from electronics hidden away in a black box. How far away autonomous trucks are is a tough call, but they wouldn't even be an option if we weren't already enjoying their benefits in modern transmissions. TE

FURTHER INFORMATION

ZF TraXon overview - https://is.gd/eboyoy
'Paradigm shift' - https://is.gd/vuline
'Productivity push' - https://is.gd/gequgu
'Efficiency revolution' – https://is.gd/baface

MERCEDES-BENZ	SCANIA	RENAULT	DAF	IVECO	MAN	(ZF)
PowerShift3	Opticruise	Optidriver +	TraXon from ZF	Hi-Tronix*	TipMatic**	TraXon
Special order	Special order	No	Yes	Yes: ZF EcoSplit with ServoShift assistance	Yes	No
Predictive Powertrain Control	Active Prediction	Optivision	Predictive Cruise Control	Hi-Cruise	EfficientCruise	Prevision GPS
EcoRoll	Eco-roll	Optiroll	Eco roll	Eco-Roll	EfficientRoll	ZF rolling function

** Rebadged TraXon from ZF; ** Rebadged AS-Tronic from ZF*