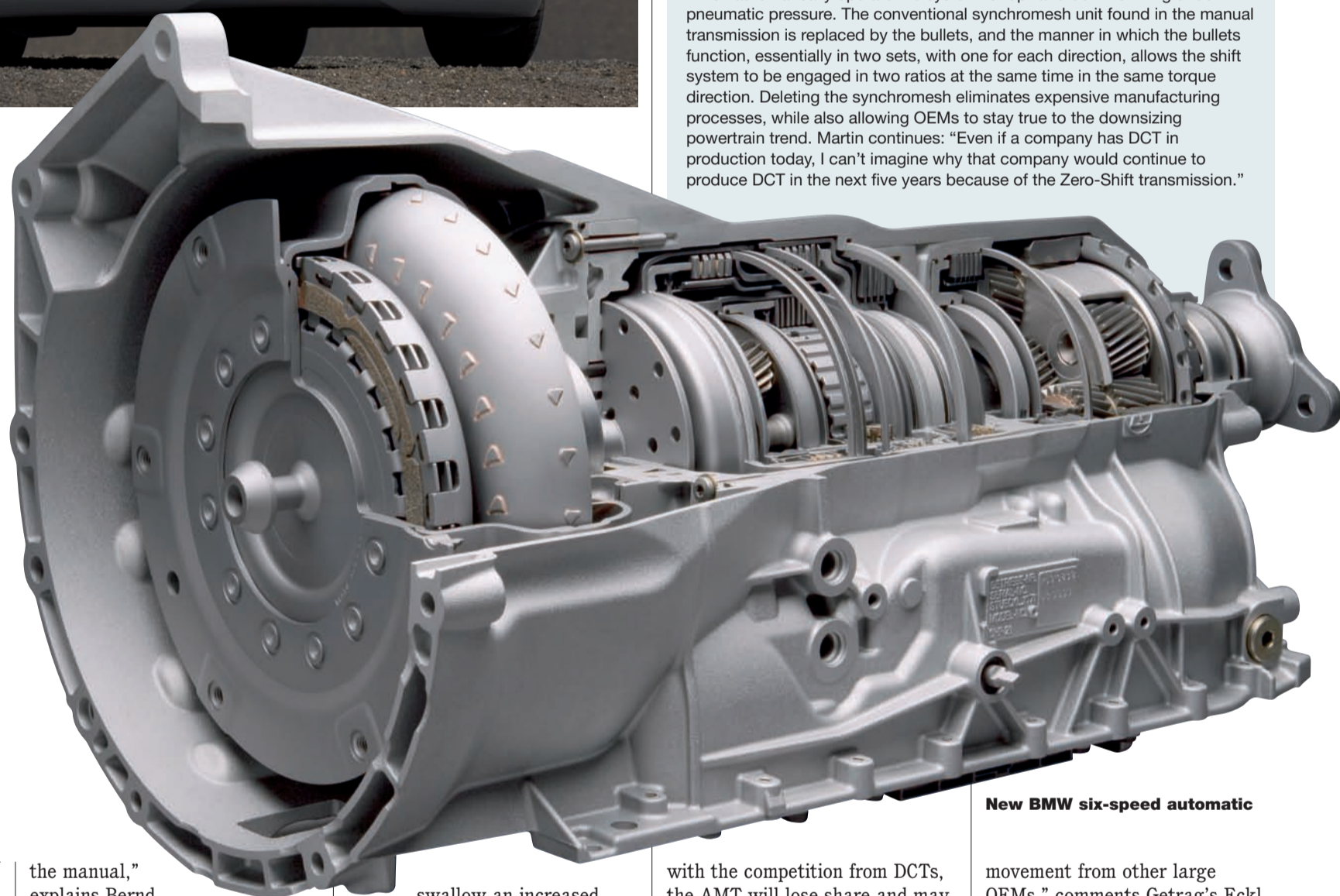


Gear change



The new BMW 3 Series Coupe gets a state-of-the-art gearbox

Never before has the gearbox been so complex. Four key industry figures have strong views on how the next decade will shape the technology



New BMW six-speed automatic

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EAC News

The last few years have seen the transmissions world almost turn upside down. There's been more change, technological breakthrough and innovation than ever before. The traditional manual and automatic gearbox technology is now competing with a raft of new initiatives, including DCTs, AMTs and CVTs. Such change and intense competition has led to different transmission suppliers and OEMs to back different technology. As a result, it's now become accepted that over the next 15 years some transmissions will succeed, while others will fade out.

Getrag, largest independent maker of manual gearboxes, is backing DCTs to have the biggest impact. "Dual-clutch transmission combines the comfort advantages one gets in automatic gearboxes with the efficiency benefits from

the manual," explains Bernd Eckl, R&D VP at Getrag. "It is clear from both physics and mechanics that the manual is the most efficient transmission in the world. Combining a manual and auto has to be the optimum solution: Efficiency with comfort, and fuel economy advantages of up to 15 per cent."

The development of the DCT has led some to think that the days of the conventional manual and automatic are over. Eckl disagrees, despite his support for DCT's: "It is not the end of the automatic or manual, but there will be dramatic changes in what types of transmissions drive different markets."

Getrag estimates that at present the global market is roughly split 60:40 for automatic over manual. By 2015, that map will have changed. Eckl forecasts that in the next ten years, manual gearboxes will

swallow an increased 56 per cent global share because "heavy growing markets such as India and China will embrace the manual". Getrag's favoured DCT will have taken 15 per cent of the market by 2015, while CVT – limited to only Japan – will remain marginal with a one per cent stake. The big loser is the automatic, which could have its 60 per cent share of the global market today cut to just over a quarter by 2015.

Getrag's VP of R&D qualifies the forecast: "Automatics will lose the most market share due to the fact that most of the manual's growth will come from new markets in Asia. In developed markets – especially in North America – DCTs will replace a lot of auto gearboxes."

A second casualty to the rise of DCTs will be AMTs, as Eckl confirms: "I think in the car industry, there will not be any further AMT applications. I think

Zero hero

Not all believe that AMTs will be wiped out by DCTs in passenger car applications by the end of the next decade. Introducing the ZeroShift transmission, an automatic-manual box that Bill Martin, ZeroShift's founder and MD, promises will be the "next big thing".

He continues: "The in-gear efficiency of a manual is higher than any other gearbox type, and that high efficiency level translates into performance, economy and reduced emissions. The problem with conventional manual gearboxes, and the automated version, is not the in-gear but the shift. In the ideal world, an AMT with the shift quality problem resolved – and without causing any compromise to the technology – is the Holy Grail for transmission makers. ZeroShift is exactly that transmission system."

From the start of the project, Martin and his team of engineers set about solving the shift quality problem that feature on today's AMTs. "I think we have done it so convincingly that we have shift quality that is actually superior to the best planetary automatic transmissions."

Confidence indeed, and according to Martin, the benefits of the ZeroShift transmission are huge: Cheaper to manufacture than DCTs, fuel economy savings of up to five per cent, emissions reduction of around seven per cent and enhanced performance. So how does it all work? With a torque limit of 5,000Nm, ZeroShift works on a dog box system, not too dissimilar to the system found in typical racing application transmissions employed during the last two decades. But instead of the typical dog ring, the ZeroShift technology uses six unidirectional dogs, or bullets as Martin calls them, which automatically operate the system for up- and down-shifting under pneumatic pressure. The conventional synchromesh unit found in the manual transmission is replaced by the bullets, and the manner in which the bullets function, essentially in two sets, with one for each direction, allows the shift system to be engaged in two ratios at the same time in the same torque direction. Deleting the synchromesh eliminates expensive manufacturing processes, while also allowing OEMs to stay true to the downsizing powertrain trend. Martin continues: "Even if a company has DCT in production today, I can't imagine why that company would continue to produce DCT in the next five years because of the Zero-Shift transmission."

with the competition from DCTs, the AMT will lose share and may not even exist by 2015 to 2020."

Eckl is not alone in doubting AMTs. Despite his company having a contract to supply BMW with automatic-manuals, ZF's transmission chief, Gerhard Wagner, also believes AMTs will be a loser in the transmissions battle: "Ultimately, the customer will not accept the very bad shift quality of AMTs. Of course, there will be customers that want very sporty drives, and for them the automatic-manual will be the right transmission, but on a broader range the number of AMTs will decrease."

So it seems the DCT takeover is already underway. VW has confirmed that all its east-west configuration cars will be handed over to DCTs in the next five years. That means all front-wheel-driven cars will transfer from automatic transmissions to dual-clutch. And that's just the start: "We see the same

movement from other large OEMs," comments Getrag's Eckl.

Between 2008 and 2010 Getrag will have 11 different dual-clutch projects. The busy DCT schedule starts next year, when it brings to market three innovations: "The 2007 DCT is a front-wheel-driven application for one of the big OEMs in Europe," teases Eckl. "It's a wet type, dual-clutch with up to 400Nm of torque. Within three months of launching this technology, we will also have an in-line, wet dual-clutch as well as a transaxle wet DCT." The first dry dual-clutch from Getrag is due in 2009.

Having focused on CVTs for several years, ZF is working hard to develop its own DCT. "The DCT has a really good future in Europe," enthuses Wagner. "European customers prefer manuals and the DCT is similar to a manual – more similar than an automatic with a torque converter. I think dual-clutch transmissions will be a winner in