

AMTs. "I think we have done it so convincingly that we have shift quality that is actually superior to the best planetary automatic transmissions. For example, the ZF six-speed gearbox in the Jaguar XJ is considered to have one of the smoothest shifts in the industry, but it is possible to still feel the shifts. Our tests have shown that ZeroShift is smoother than the ZF six-speed."

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 percent, emissions reduction of around seven percent and enhanced performance.

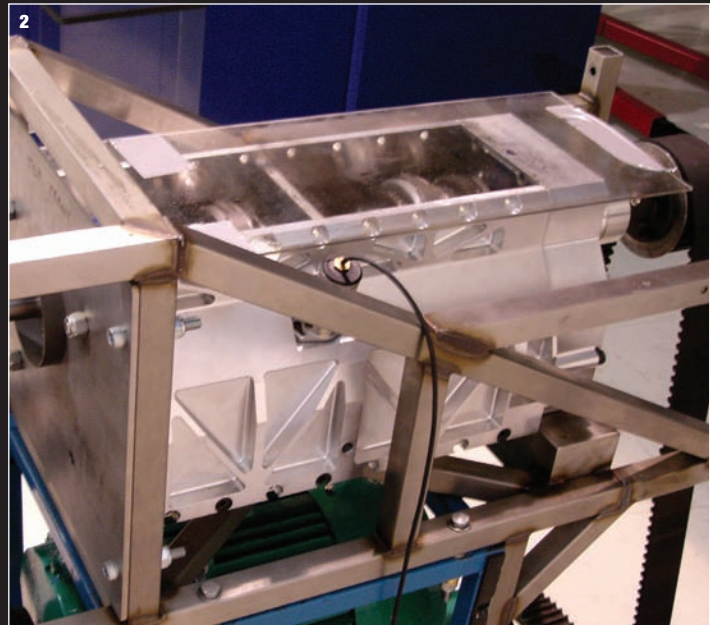
So how does it all work? With a torque limit of 5,000Nm, ZeroShift works on a dog box system, not too dissimilar to the system found in typical racing application transmissions employed throughout the last two decades.

But instead of the typical dog ring, the ZeroShift technology uses of 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 down-sizing powertrain trend.

Martin continues: "Even if a company has dual-clutch transmissions in production today, I can't imagine why that company would continue to produce dual-clutch technology in the next five years because of the Zero-Shift transmission."

First developed in 2002, the ZeroShift transmission can be applied to petrol, diesel and hybrid electric vehicles. Martin says he's talking to a number of OEMs regarding production projects, with the overall aim to install ZeroShift transmissions in a mass production passenger car by the end of the decade.



1. Prototype ZeroShift in a Ford Mustang
2. ZeroShift transmission being tested
3. ZeroShift directors, l to r: Bob Dover, Charles Matthews, Bill Martin, Roy King



further AMT applications. I think 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



STEVE GIFFORD, BORGWARNER

"We produce a very large number of dual-clutch units for VW, and we'll expand that number in the future for other customers"

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 development projects for the start of production. The company's busy DCT schedule starts next year, when it brings to market three DCT 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 transmission 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 CVT for several years, ZF is now working hard to develop its own dual-clutch technology. "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 Europe." At last year's