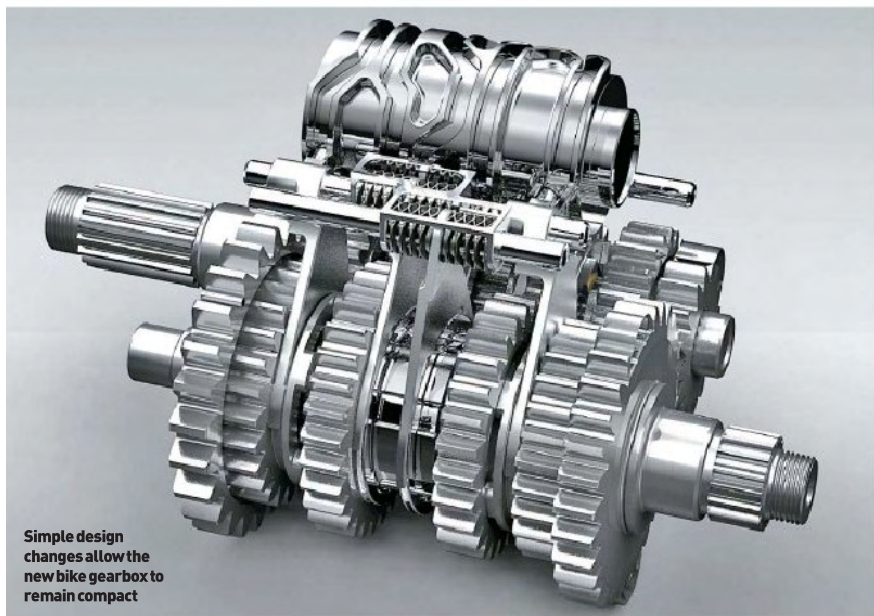


UK technology pioneers radical new bike gearbox

New system claims faster, smoother shifts and better economy but retains traditional 'feel'



Simple design changes allow the new bike gearbox to remain compact

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A BRITISH company is working to put one of the fastest-shifting and most efficient motorcycle gearboxes into production in the next few years.

Zeroshift, based in Milton Keynes, has developed the system for racing and HGV use, but have now adapted the split-second change system to fit into the compact dimensions of a motorcycle gearbox. The design's simplicity means there's no need for drastic alterations either, as the system uses mostly conventional parts.

Zeroshift's Engineering Manager Richard Thompson explained: "Because it switches from one gear to the next instantly it's better for acceleration, smoother and gives better fuel economy too. We have simulations that show a 1.4-litre car with our gearbox can accelerate as fast as a 1.6-litre car without it, because of the advantages."

The system is already grabbing the attention of the industry, too. "We've got an OEM manufacturer on

board now, and we're speaking to others. Some firms are looking at proving it in racing and sports bikes, whereas some want to fit it to tourers," Thompson explained.

The Zeroshift system is similar to a conventional gearbox – with an input shaft, output shaft, gearchange

'Some firms are looking at the system for race and sports bikes, others for tourers'

**RICHARD THOMPSON,
ZEROSHIFT**

barrel and selector forks. Some of the gears are splined to the shafts and some are free to run on bearings, and the gears have engagement dog teeth on the sides and the selector forks can move certain gears axially on the shafts to engage other gears.

A conventional clutch is used and the standard gearshift pattern is used (1-neutral-2-3-4-5-6).



Zeroshift's Thompson says major bike makers are interested in its new gearbox

The main difference in the design lies in a three-part mechanism called the ZS cluster. This comprises a hub assembly and concentric output shafts. The hub consists of two drive rings that can move axially on a star-shaped hub splined on to the output shaft, which are moved by two selector forks.

The odd gears (first, third and fifth) are on one side of

the transmission and the even gears (second, fourth and sixth) are on the other, with a single ZS hub fitted between the two halves of the box. The output shaft comprises of a concentric set of shafts which can be 'switched' between via the Zeroshift hub.

The gearchange barrel is moved, and it performs three tasks in quick succession –



pre-selecting the next gear, switching the drive from the last gear and de-selecting the gear you were in.

Although both rings engage in the 'odd' side of the transmission, only one is transmitting the drive torque down on to the output shaft. The other ring, which acts as

'The process of changing gears takes just 50 milliseconds, so to the rider the change feels instantaneous'

the 'overrun' ring, is unloaded and can be freely moved across to engage into the 'even' side of the box.

Due to the ratio difference, higher gears rotate faster than the gear before it – second is faster than first, third is faster than second and so on.

This means when the unloaded ring is moved across the hub into engagement it unloads the trailing

ring which was transmitting the torque from first gear. This 'trailing' ring is then moved across into second gear to finish the shift.

Because first gear stays driving until the drive ring is moved, there's no lag while one gear is disengaged then a new one selected.

A downshift uses the fact the gear you're going into is travelling slower, so on engagement the trailing ring is retained due to overrun torque and the free ring engages the new higher ratio, switching the torque and unloading the trailing ring.

The whole process takes 50 milliseconds (from pressing the gear lever to the next gear being engaged) so the change is felt instantaneously by the rider, and drive is constant throughout the procedure unlike a conventional clutchless change or using a quickshifter.

SHIFTING GEAR:

FOR many decades, bike gearboxes have retained the same foot-change sequential gearbox with a hand-operated clutch – the gear lever migrated from the left to the right side, but most post-war machinery has largely the same layout.

But in the last few years manufacturers have looked at the transmission as an area for improvement, as finding an advantage elsewhere is becoming increasingly difficult. Thompson explains: "It's now more beneficial to spend money on transmission than it is on the engine – you get more return for your money."

Constantly Variable Transmission has been around on scooters since the '80s, but Aprilia has put the system on the Mana 850 which has the design of a conventional bike, except it has no clutch lever. It has a foot selector, but instead of swapping cogs the lever operates a switch that commands the electronics to switch between one of

ONLINE

SEE HOW IT WORKS

Watch an animation of the Zeroshift gearbox at www.motorcyclenews.com



Using many conventional gearbox parts, Zeroshift's new design relies on a new hub design and concentric output shafts

THE GEARBOX REVOLUTIONS



Aprilia's Mana 850 uses scooter 'twist-and-go' technology

seven predetermined ratios to give a sportier feel out of town. But the Mana is selling slowly in the UK as riders are still unsure about twist-and-go bikes.

Yamaha has also achieved limited success with the FJR1300A, which uses an electronically-activated clutch attached to a fairly conventional gearbox. But its system is quite clunky and neutral is 'below' first instead of between first and second, which some riders don't like.

'Honda's new V4, due in 2010, has dual-clutch technology'

Honda is the next manufacturer to try a new gearbox technology in the market – a dual clutch system was recently announced by the firm and will be fitted to the tech-fest



Yamaha's FJR1300A uses an electronic clutch to shift gears

V4 model to be revealed in the early part of 2010.

The system has a clutch for both the odd and even gear sets, which are separated like Zeroshift, but the electronic control system predicts which gear you want next and engages it instead of waiting for gear lever input.

If you ask for the predicted gear it then instantly swaps from one clutch transmitting drive to the other, but if you decide to go the opposite way (up instead of down for

example) through the gearbox then the electronics have to catch up.

Honda also has the Human-Friendly Transmission, which uses adjustable hydraulics to vary gear ratio – either progressively or in steps to give a feel more like a conventional gearbox. The system debuted on the DN-01, and is more suited to tourers and cruisers due to the weight and slow shifting nature – it's expected to be fitted to the next Goldwing.



THE MOST OUTSPOKEN MAN IN MOTORCYCLING

KEVIN ASH

In his penultimate column of 2008, Ash tries to fathom why we don't give Moto Guzzis enough love

MOST questions in marketing surveys like to know why you bought whatever it was you purchased, but I'd like to pose one the other way around: in the last year, if you bought a new bike, why didn't you buy a Moto Guzzi?

OK, there are some obvious answers to that, especially if you were in the market for a 1098 or a ZX-10R or something specific. But there are plenty of not-so-obvious ones too, especially coming from people who ended up with a Triumph Bonneville maybe, or a BMW R1200RT, or Ducati Sport Classic, maybe a Japanese cruiser or even a big trail bike.

Moto Guzzi has something to offer in each of these sectors, and Guzzi dealers say they get a lot of queries and no great shortage of people asking for test rides. And yet that's all it amounts to interest, not hard sales.

It shouldn't be because of quality issues as Guzzis are built to perfectly acceptable modern standards, certainly as good as BMWs and at the moment, probably more reliable than many of the German bikes too. Guzzis are made in much the same way as Aprilias (both are Piaggio Group companies) and quality isn't an issue with those.

Is it the looks? This is more subjective of course, but as far as I'm concerned Guzzi makes some of the best-looking motorcycles available: the Griso is knockout and the V750 Classic is a tasty machine. OK, so the 1200 Sport is clumsily-styled, but the Stelvio's interesting, the Norge looks good and the cruisers are fine in their class.

'If you bought a bike this year, why didn't you buy a Guzzi?'

Guzzis are also some of the best-steering bikes you can buy, especially the smaller models, making them especially suitable for inexperienced riders. As for spares supply and other back-up, there are no real issues with Guzzi these days.

Of all the Guzzis the Stelvio suffers the most against its direct competition, BMW's GS, mostly for its lack of midrange power, but this is a huge market sector and you'd expect sales to be stronger nevertheless. After all, we keep hearing about the residual fondness for Guzzi in this country which dates back to the days of the Le Mans and

Spada touring bikes, and the dependable work-horse reputation the company had as well as its sporting heritage.

Guzzi, in fact, has had an unhealthy dependence on the home Italian market for many years, with some 50% of sales being made there, while abroad people have essentially stopped buying Moto Guzzis. Last year only around 4000 new Guzzis were sold throughout the world outside Italy, and less than 9000 bikes in total. Those are dismal figures, thoroughly undeserved by the bikes themselves. But why?

Is it simply because there aren't enough dealers? Is it because bike buyers still don't trust Moto Guzzi's reliability or build quality? Are we so influenced by advertising that Guzzi's low marketing budgets haven't been enough to catch our eye?

Most people like to claim they're not affected by advertising, but the statistics prove otherwise, leaving Guzzi in the Catch 22 situation of not selling enough bikes to support a big ad campaign, so it doesn't sell many bikes.

I'd love to know the real reasons as it genuinely puzzles me, so if you get a moment, do write in. And have a fine Christmas!



Guzzi's 1200 Sport is beautifully-finished, individual and – most importantly – has soul