



» TECH

SEAMLESS SHIFTING IS AN ADVANCED GEARBOX GIVING HONDA'S MOTO GP RACERS AN EDGE?

WORDS: Ben Purvis PHOTOS: Zeroshift

Honda's RC212V has fairly dominated the 2011 MotoGP season, with paddock insiders pointing at a mysterious "seamless-shift" transmission as the source of this newfound pace. HRC Vice President Shuhei Nakamoto has only this to say: "Obviously HRC is not using anything illegal, but it's true we have something new in the transmission that allows for faster gear changes." Leaked patent documents (see *Drawing the Line*, page 42) have given some insight into how the new transmission might operate, and many experts point to British gearbox specialists Zeroshift as the source of this technology. Confidentiality agreements prevent Zeroshift from confirming or denying any HRC affiliation, but they were happy to share their seamless-shift technology—which they say will appear on production machines soon.

"It's taken five years to develop an operating system, and in the last year we've had at least two customers willing to go further," design engineer Darren Mescall says. "They're in the late-prototype stages, and certainly by the end of the year we should have a large announcement."

What advantage does a Zeroshift



Because it uses a conventional gear linkage and fits into a regular transmission case, the Zeroshift seamless-shifting technology could be easily and inexpensively adapted to existing engine designs.

gearbox offer? Changing gears in a conventional transmission creates a gap in power delivery as one gear is disengaged for another. Zeroshift's transmission switches between ratios without interrupting torque, smoothing acceleration and deceleration and saving precious fractions of a second on the racetrack. Whatever Honda is using operates like a conventional transmission, adding fuel to speculation that there's Zeroshift technology inside. With Zeroshift planning announcements within a year, Honda's secret won't remain secret for long.



HOW ZEROSHIFT WORKS

In a normal gearbox, a "dog ring" between two gears slides one way or the other to lock the chosen gear to the output shaft. Between each gear is a neutral space where that dog ring spins freely. The Zeroshift transmission eliminates that neutral space by using "bullet rings" to engage the gears. A gear is selected when one ring is moved until its bullets hook onto drive teeth on the side of that gear. A second bullet ring moves in the same direction with its bullets filling the gap between the teeth, eliminating any slack between the gears. Eliminating this slack is what creates seamless upshifts and downshifts, even allowing mid-corner shifts without upsetting the chassis. Go to www.zeroshift.com to see a useful animation of this transmission in action.



ZEROSHIFT VERSUS DCT

Honda's Dual Clutch Transmission already offers seamless, semi-automatic shifting—why not use a variation of that in MotoGP? DCT allows two gears to be engaged simultaneously by disengaging one clutch and engaging the other. This system is very complex, requiring sophisticated hydraulics and electronic software. Zeroshift delivers similar seamless shifting action to the DCT but in a much simpler package—and it's legal under MotoGP rules banning dual-clutch transmissions. Low actuation forces and high mechanical efficiency would make the Zeroshift gearbox easy to automate too, without requiring the complex hydraulics of the DCT. And because it operates like a conventional manual gearbox, with a foot lever and hand clutch, riders feel more comfortable with it. In the relatively conservative world of motorcycling, familiarity is good.