

CW EXCLUSIVE: Kawasaki Ninja H2 Streetbike! – AKA “THE DISRUPTOR” An in-depth look at the most extreme production motorcycles ever made: Supercharged H2 streetbike joins the R-model “track bike” that makes more than 300 hp.

November 4, 2014 By [Kevin Cameron](#) [22 Comments](#)
Photographer : Jeff Allen



In its black-chrome mirrored finish, the manned missile that is the supercharged 998cc Ninja H2R track bike debuted at this fall's [Intermot show](#). A month later, its road-going “A-spec” H2 brother appeared at Milan's EICMA show. This is an earthquake-fault break with the past, just as was its inspiration—the original competition-eating 750 H2 of 1972. Kawasaki's goal? To produce “the most exciting and fastest motorcycle ever, to revolutionize how people think of motorcycles, to create a motorcycle of the future that is still ‘new’ 10 years from now.”

Kawasaki's internal code for this project was “8200.” At *Cycle World*, we called it “Mega Awesome.”

Why release a track-only motorcycle first? Because it could be built, unleashed, with no limitations: No laws, no DOT, no EPA, and no gentleman's agreements to limit horsepower or top speed. The H2R could be everything Kawasaki Heavy Industries and its high-technology aerospace divisions had to offer, from turbine tech to the wind tunnel to composites to the motorcycle division's formidable engineering capacity. Top-speed potential? A few calculations

suggest the H2R could exceed 250 mph. The idea here is for [Kawasaki](#) to shock the sleeping market, remake its company image, and leap upmarket with this hyper-performance motorcycle.

This will not be a slow-steering, long-wheelbase power station on wheels but a sportbike-size, sportbike-agile package that can flick into corners and carve with the best. The supercharger and its drive system are packaged almost invisibly behind the cylinder block.



H2R's distinctive style comes from function, as revealed in Kawasaki's test wind tunnel at Gifu in central Japan. The company's poets of marketing call this "Intense Force Design." The fairing is so abbreviated that it is not much more than a radiator duct. Those organic-looking end-plated downforce winglets keep the front tire planted at high speed. Look into the carbon-FRP fairing material on the H2R and see the weave of stronger-than-steel fibers. The A-spec road-legal model's fairing is polypropylene to help reduce cost and features turn signals where those dramatic winglets are mounted, while also deleting the fairing-side wings.

The 998cc inline-four-cylinder engine is all new—not a repurposed ZX-10R, even though the bikes share the same displacement. It was designed around its heavy-duty oiling system—essential to carry the heavy bearing loads of a supercharged engine. Our Kawasaki informants spoke of seeing 14,000 rpm while riding prototypes. I was impressed because making ZX-10R-based racing Superbikes live at high revs hasn't been easy. This new engine is designed to make it easy.

When Kohei Yamada, designer of Kawasaki's original Ninja 900 of 1984, planned this supercharged ogre-bike that started as a skunkworks project, he asked the aftermarket for a blower that could do everything he wanted it to do and work well without a bulky intercooler (no room!).

"No way," came the reply. Compressing air makes it hot, and if that heat is not removed, it pushes combustion toward knock or detonation. So Yamada went to Kawasaki's own Gas Turbine & Machinery Co., which designs and manufactures jet engines. They designed a fast-spinning centrifugal compressor whose high efficiency would heat the airflow least.



That compressor's 2.7-inch impeller is the heart of this motorcycle and has the beauty of natural law. Manufactured from a forging, it spins at up to 140,000 rpm. Air is flung outward from its six vanes at up to 1,500 feet per second, and then this velocity energy becomes pressure peaking at 38.4 psi in the blower's scroll housing. This pressure is ducted upward into the "highly rigid" aluminum airbox, containing the engine's four steeply downdraft 50mm Mikuni intake throttle bodies. The airbox has to be rigid for the same reason 747 fuselages are: They are pressurized.

Have you heard Kawasaki's H2 teaser audio track? You hear the engine winding way up, chirping with each upshift and downshift. The chirps are the sound of the airbox pressure relief valve (a high-tech whoopee cushion) venting unneeded boost. It's a new world.

What? No throttle by wire? It only looks that way, with two conventional throttle cables emerging from the throttle grip housing. They go to a pulley on the throttle position sensor mounted near the intakes. Its data goes to the engine ECU, which decides how best to carry out the rider's torque demand. If required, traction control, engine-braking control, or launch control may intervene to maintain tire grip; with a claimed 300 hp on tap, things happen fast. A stepper motor then rotates the throttle shaft to the desired angle.

A jackshaft behind the cylinders is driven from a gear cut into the crank's #6 flywheel. A chain takes power up to a second shaft whose right-hand end drives a planetary step-up drive to the impeller. The impeller spins on ceramic ball bearings, damped by squeeze-film technology, at 9.18 times crank speed. Patent drawings show a two-speed drive—a high ratio to make boost at lower revs and a lower one to keep boost from becoming excessive at high revs. There was even talk of a three-speed, so there may be surprises when the machine actually appears or on subsequent iterations. Patents are written to cover many possibilities.



Supercharged engine exhaust is super hot. To survive it, exhaust valves are friction-welded from an Inconel head and stainless stem. “Inconel” identifies a family of nickel-based gas turbine superalloys. Exhaust ports are short to minimize exhaust gas heating of the head. Because so much compression takes place in the supercharger, engine compression ratio must be reduced to 8.5:1. The cast pistons (as in two-strokes and in gas turbines, materials with highest hot strength cannot be forged, only cast) have flat, featureless tops and no squish: In supercharged engines there is intense charge motion from their higher intake velocity, and the open combustion chamber preserves flame-accelerating turbulence all the way to TDC. Each piston's heavy thermal load is handled from below by two oil jets. For reduced friction, there are two

compression rings and an oil scraper. The special connecting rods have larger big-end bearings and larger (than ZX-10R) rod cap bolts.

If this engine can make 300 hp, who needs MotoGP? Kawasaki engineers are clearly proud of creating reliability at this power level—something which requires a cylinder head knock sensor and software to detect detonation and instantly retard ignition timing to stop it (making possible operation on pump fuels). Detonation occurs when part of the unburned charge has been heated so much that oxygen molecules join hydrogen atoms battered off of hydrocarbon fuel elements to form the reactive fragment OH-. If heat creates enough of this touchy stuff, the unburned charge auto-ignites, burning as a sonic shock front. Shock waves make the audible clatter of combustion knock, overheating metal and blasting it loose. This engine has layers of antiknock countermeasures.



Power goes to a high-mounted hydraulically operated clutch on the right side with 5.5-inch-diameter plates—10 in the B-spec closed-circuit engine and nine in the A-spec. To keep plates free, the basket is treated with “Kashima coating,” which combines the hardness of aluminum oxide ceramic with the low friction of the solid lubricant molybdenum disulfide. This is a slipper clutch, and, combined with KEBC engine-braking control, sliding or hop of the rear wheel during braking is prevented.

The transmission is “very similar” to one Kawasaki used in MotoGP. In this “dog-ring” design, instead of the gears themselves being slid back or forth along splined shafts by the shift forks, all engagement is accomplished by moving narrow, light dog-rings instead. All the gears on the input shaft are fixed. All the gears on the output shaft spin on needle bearings. Between each of the three pairs of output shaft gears are dog-rings, splined to the shaft and carrying engaging dogs on both faces to match dogs on the gears they face. Each of the six gear meshes has its own oil jet, and each of three shift forks has two such jets. That’s a lot of oil jets (these 12, plus eight in the crankcase, and more lubing the supercharger drive), so this engine has a much higher oil flow rate than other bikes. Oil cooling is via an oil-to-water heat exchanger. A submerged pump takes oil from a deep, aeration-preventing superbike-style dagger sump on the left underside of the crankcase.

The shift linkage carries a potentiometer-type shifter switch that unloads the gears by briefly cutting the power before the shift puts pressure on a shifter fork.



As you see, the H2/H2R has a steel-tube trellis chassis. The task was to achieve stability and control with “an accommodating quality.” In other words, enough chassis flexibility to allow tires at full lean to follow small-amplitude pavement roughness without loss of grip. Why a trellis? The official answer is that it competes least for space and has the openness to enhance engine (and probably rider!) cooling. But we saw pictures of Ducatis in some internal documents. Clearly, Kawasaki is trying to send a new message with this bike. The frame’s tube ends are laser cut to provide a close fit for the strongest welds. A single-sided swingarm was chosen “to provide cornering clearance by creating room for the exhaust on the right side.” (Another “official” answer.) It is welded from aluminum forgings and pressings.

Suspension is KYB, with a black DLC-coated 43mm AOS-II (Air-Oil Separate) fork and single suspension unit at the rear, adjustable for preload and rebound and compression damping. A transverse-mounted Öhlins steering damper is fitted. Fork rake at the time of our early look on prototypes was 25.2 degrees and trail not stated. Fuel capacity is listed as 4.5 gallons.

Brakes are Brembo, with center-grooved twin 330mm steel discs at the front and a pair of radial-mounted calipers with four 30mm pistons each. The H2R’s single rear disc is of 250mm diameter.



New five-spoke star-design wheels are finished in black and polished aluminum. As you’d expect on such a machine, the inner faces of the rim flanges on the H2R are knurled to prevent tire slip. The closed-circuit, non-DOT bike is delivered with 120/600R-17 and 190/650R-17 Bridgestone slicks. For the A-spec road-legal bike, tires are Bridgestone Battlax RS10SG.

A compact dash combines a round analog tachometer with attached rectangular LCD screen presenting usual instruments plus indicators for traction control, ABS, engine-braking, boost, and launch control. All lights are LED—save for the number plate lamp! The ABS is the latest generation, more compact than that of the ZX-10R. Only on the closed-circuit H2R can the antilock be switched off.

In the words of one who has ridden the bikes, “Engine response is instant. Just crack the throttle in a corner and you are in traction control. The closed-circuit bike is incredibly loud; there’s no muffler. The H2 makes an unreal whistling sound on full throttle, coming from the supercharger. But in a corner, you hear random pinging sounds. They are little sonic booms from the supercharger impeller. The Brembo brakes have zero wasted lever motion.”

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Kawasaki’s pride in this “free-form engineering masterpiece” is symbolized by use of the historic “River Mark” logo on the H2 and H2R. This is the first modern application to any motorcycle of this logo that was used on the company’s first manufacturing facility in the 1870s, and it appears on the top fork crown and at the front center of the fairing. This is reserved for premium products. A total of 72 patents protect the new features of this machine.

Product planners know that spending is moving upmarket. As the old mass market weakens, Japan’s usual commodity motorcycles become invisible to the upscale buyer, who needs a standout product with unique identity to trigger his/her spending. Rather than snooze on with the others, Kawasaki has decided to treat this change as an opportunity. As with the original H2 and Ninja 900 of 1984, the new H2 and H2R will define Kawasaki for the coming decades.

Right now, we know very little about the price or marketing plan for the H2 and H2R, but when we said, “bring money,” our Kawasaki contacts nodded and said these bikes will be built to orders received. Basically, buyers will make an initial deposit at a Kawasaki dealer then await production, test, shipment, and delivery. Each bike will then be assembled by one experienced person, to Kawasaki’s highest standards of fit, finish, and function.

Consider the motorcycle market disrupted.