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Turbo Preview Honda CX500

HONDA GL1100 INTERSTATE

Suzuki's 16-Valve GS750EX Versatility Made A Virtue

Rear Suspension Techno Single-Shock Systems

Yamaha IT465H Enduro Off-Road Skywalker

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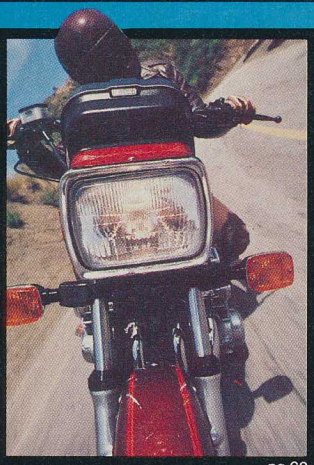
September 1981 Volume XXXII No. 9



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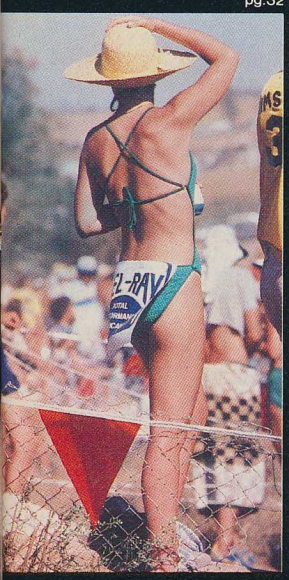

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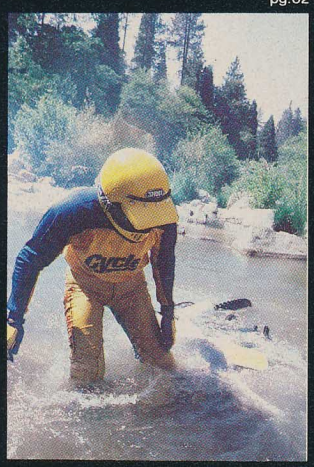

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This Month's Cover: Although he's hidden behind the GL-crest, DDC, America's answer to Mighty Mouse, played a starring role in Robin Riggs' captivating photo of Honda's GL1100 Interstate. In order to position the giant Gold Wing emblem, Riggs nailed Daniel's shoes to the wall at the appropriate level, inserted DDC into the shoes, and epoxied the shield to his helmet top. Then, threatening DDC with a bare 220-volt line, Riggs told Daniel to stand up *very* straight. Presto. And click. The test begins on page 20.

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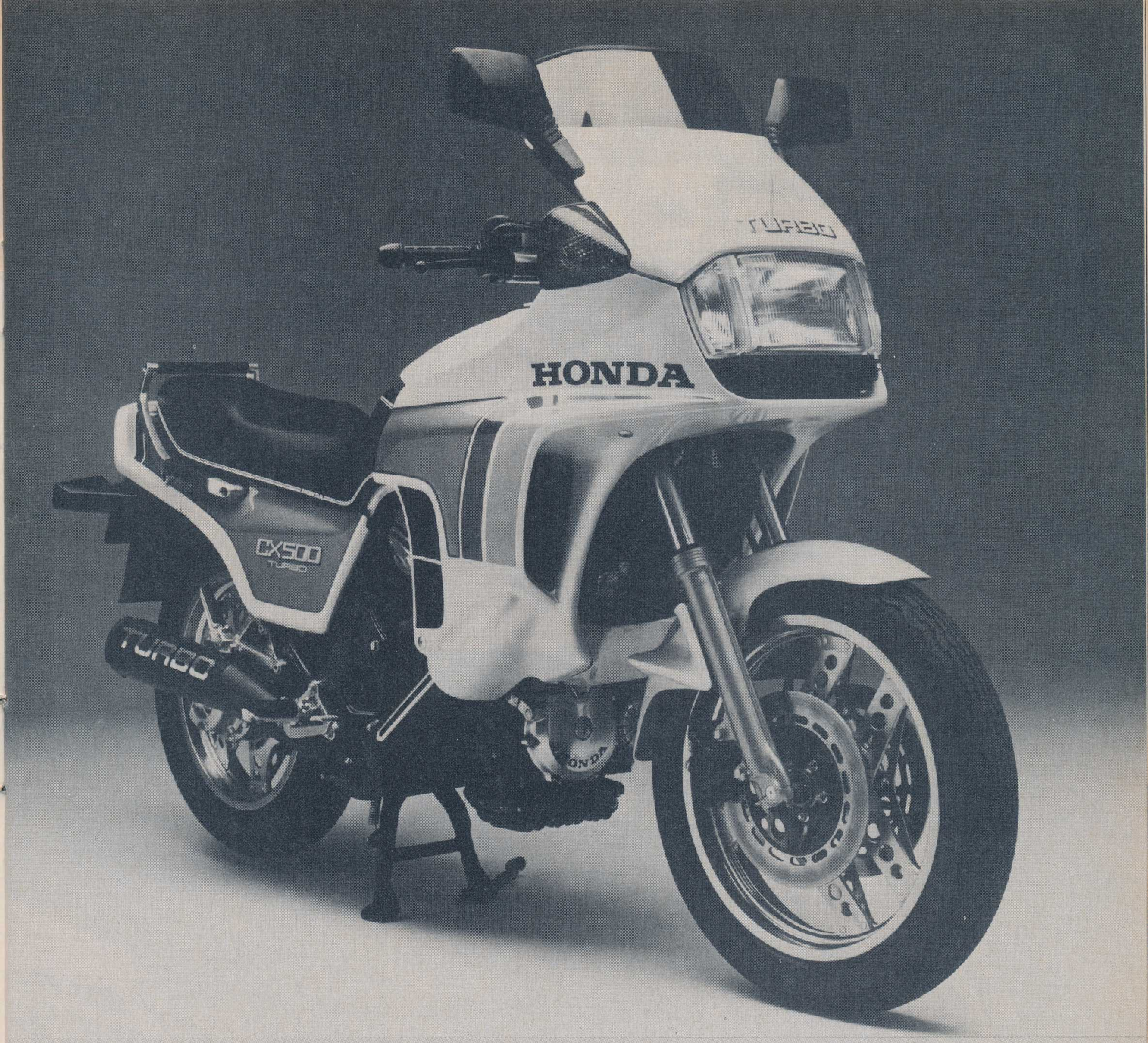


Preview

Honda CX500 Turbo

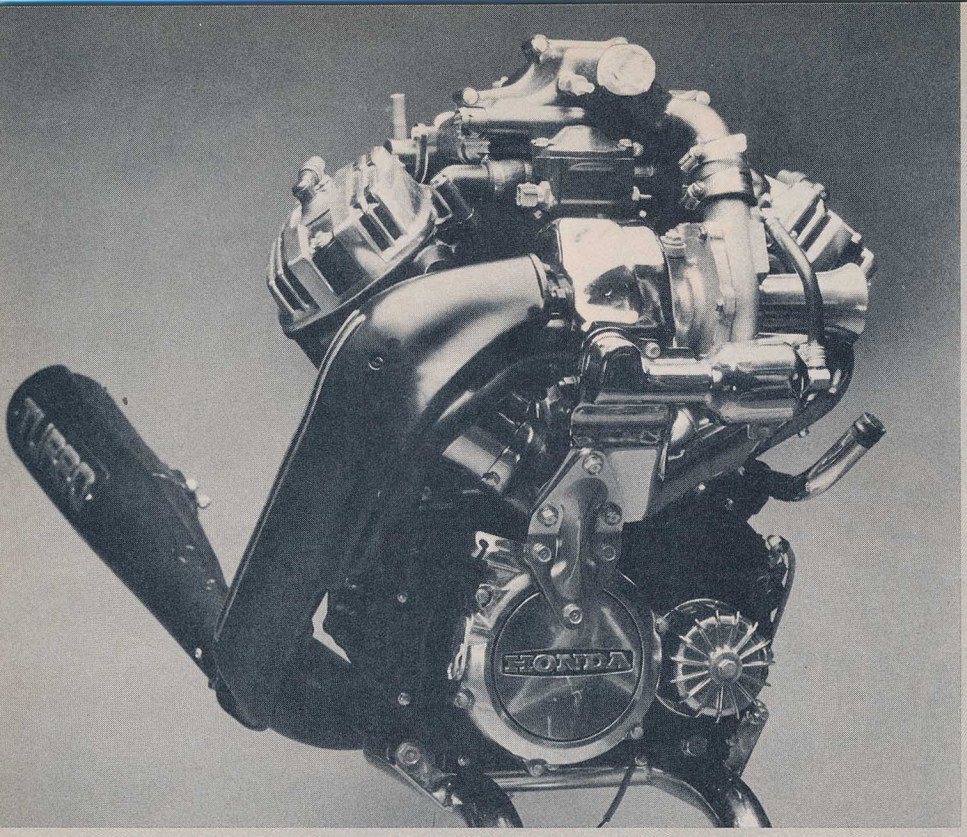
Prototypes, Honda said. We asked: Which parts aren't production? Reply: Ask which *are*—that list is shorter.

● HONDA RAN A FUTURISTIC CX500 TURBO UP the flagpole last year and *everybody* saluted. There was widespread sighing and salivating, and a captivated motorcycle press informed the world that small-bike agility and big-bike performance had at last been combined in a single, wonderful package. One of *Cycle's* contemporaries, moved to absolutely orgiastic enthusiasm, declared that the Honda Turbo's appearance on earth marked the dawning of a new age in motorcycling.

All of this excitement was stimulated by a motorcycle which, insofar as anyone outside of Honda knew for sure, might have had a wooden engine. It didn't, but that was beside the point. Honda's real purpose in building that first CX500 Turbo was to gauge public acceptance of the concept. They wanted to know if zoomy styling and buzz words, like "turbocharging" and "fuel injection," would make motorcyclists' hearts beat a little faster. What they got was mass tachycardia, a clear signal that the CX500 Turbo should be readied for production.

Present scheduling is for the CX500 Turbo to go into production in November, this year, and for examples to arrive at dealerships in January 1982. You won't be seeing a production version of Honda's Turbo (and we won't be testing one)

PHOTOGRAPHY: DAVE HAWKINS

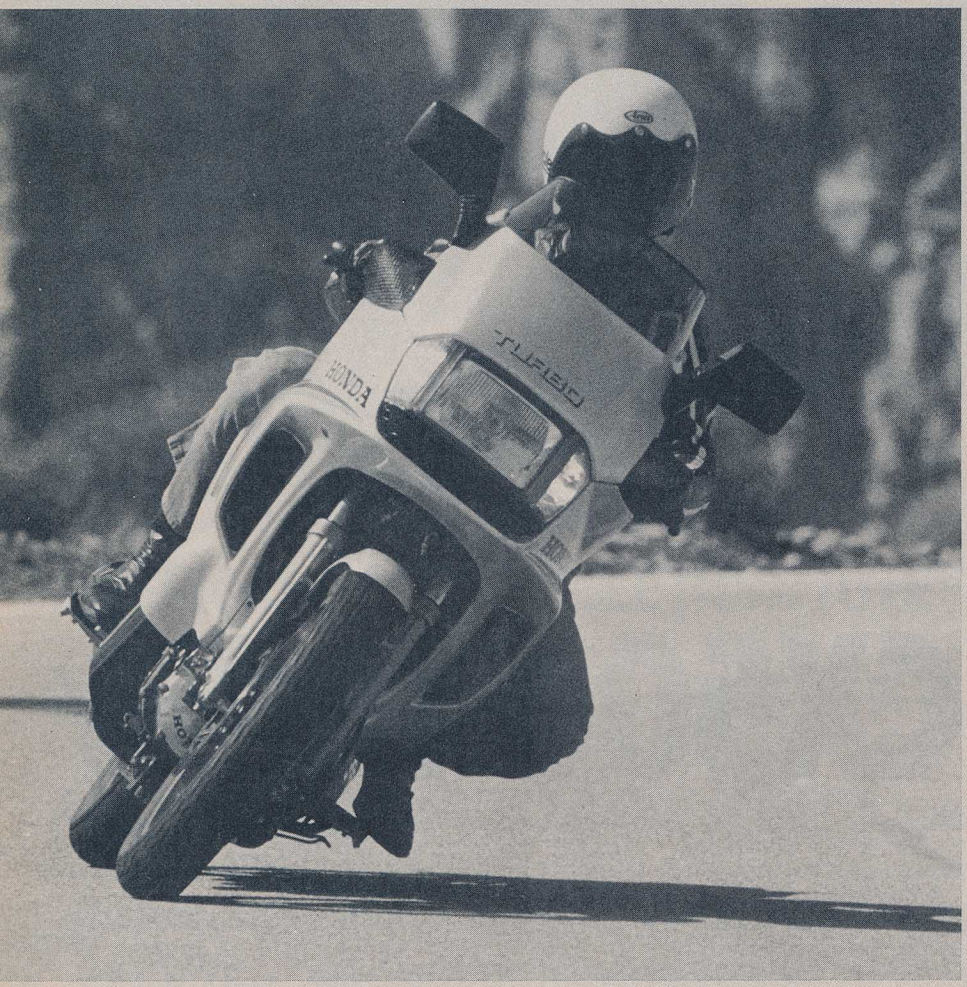


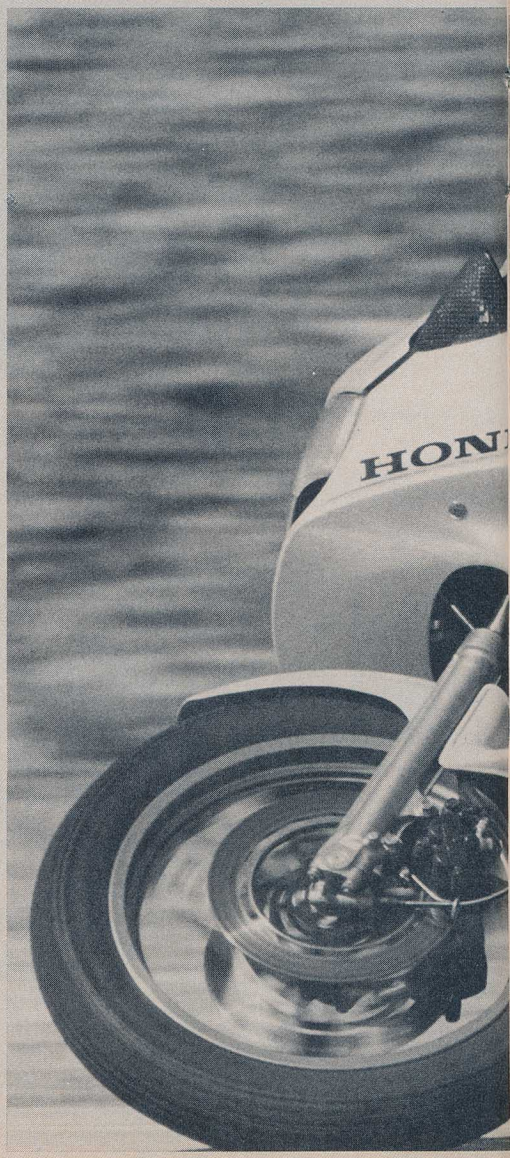
Honda CX500 Turbo

until then. But we can tell you roughly what to expect from the Turbo, as Honda recently invited members of the motorcycle press to examine and ride pre-production prototypes of the new bike.

We are told Honda's engineers decided early in their planning that water-cooling would be essential, which is why they used the CX500 for the Turbo project instead of the air-cooled CB650 four. This suggests that they also had fixed upon high boost pressures and a *big* power increase from the beginning. That certainly is what they did. Current specifications call for the CX500 Turbo to run at boost pressures up to 19 pounds per square inch, and to make nearly twice the stock horsepower. These do place a large load on the CX500's cooling system, and for more than the obvious reasons. Along with the heating effects of doubling the cylinders' air/fuel charge there also is the warming action of the turbocharger itself to be considered.

Turbochargers compress air, and air's





temperature rises with its pressure. And if we assume that the Honda turbocharger has a compressor efficiency of 80 percent (of adiabatic), air entering the compressor at 70 degrees Fahrenheit will leave it at temperatures up to 262 degrees F. Further, on a hot summer's afternoon, with ambient temperatures above 90 degrees F and the turbocharger pumping full boost, the air being fed to the engine will be at a scorching 300-plus before it reaches the cylinders.

Honda increased the CX500's bulk heat removal capacity in making the Turbo: the radiator was made larger, and so was the water pump impeller. The radiator had to be relocated to make room for the turbocharger, and the standard CX500 camshaft-driven fan was eliminated. A thermostatically switched electric fan, like that on the GL1100, keeps air moving through the radiator when the CX500 Turbo is caught in traffic.

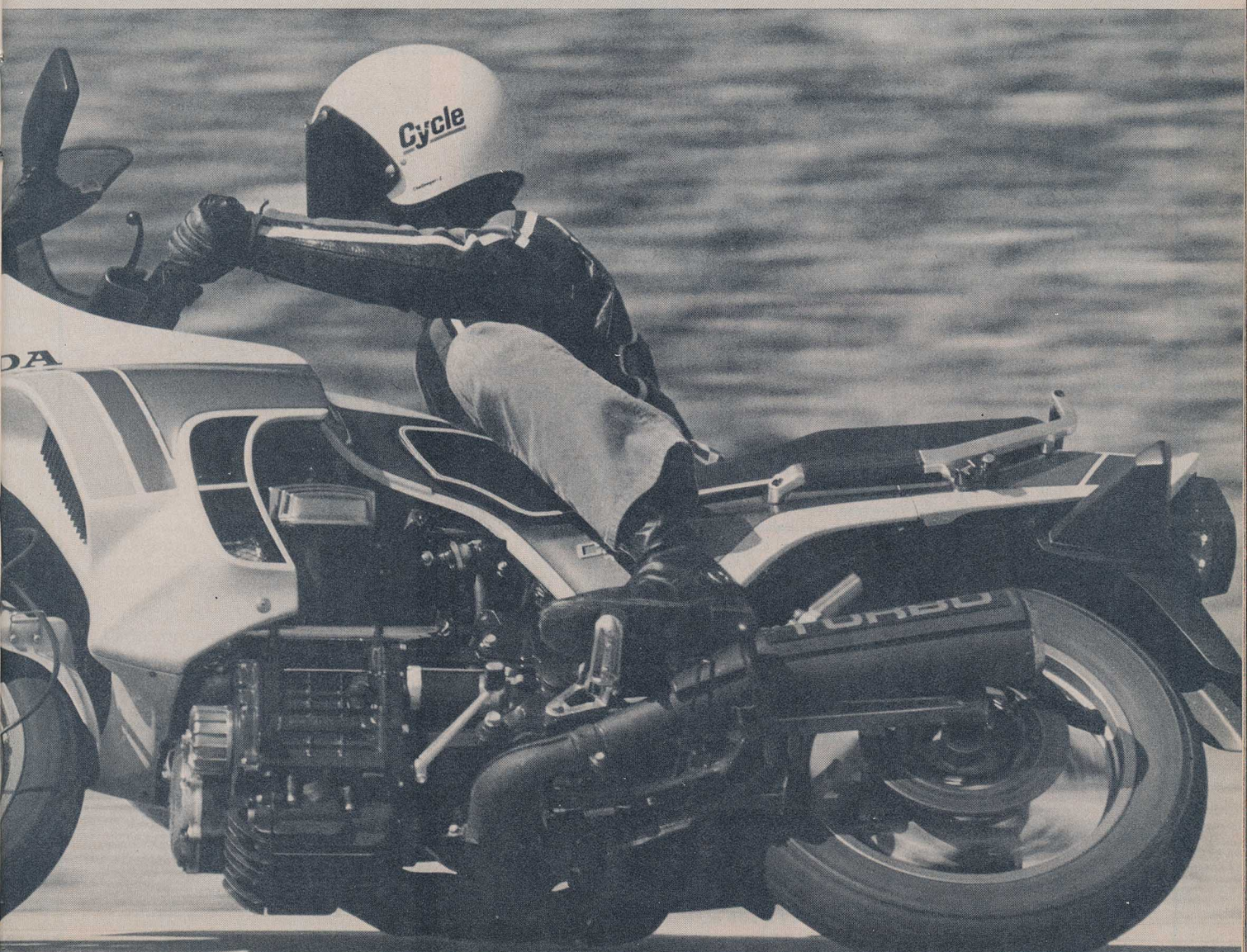
The turbocharger Honda uses on the CX500 is a miniature of those intended for automotive applications. Its exhaust-driven turbine wheel has a diameter of only 50 millimeters, or 1.97 inches; its compressor, at 48mm (1.89 in.), is even smaller. The turbocharger can take exhaust gas temperatures of up to 1650 degrees F without weakening at shaft speeds as high as 240,000 revolutions per minute; the compressor must be spinning more than 180,000 rpm to crank up useful pressure.

Because the turbocharger is exhaust-gas-driven, it cannot deliver full boost unless the engine is being operated at or near full throttle. But it does not require that the engine be running at full speed. There's enough exhaust flow to raise full boost over a wide range of speeds well below the 8000-rpm power peak. Over-boosting in the upper engine speed range is prevented by a manifold pressure-controlled waste gate built into the turbocharger, which opens to allow exhaust gases to bypass the turbine when the boost rises to 19 psi.

Over-boosting cannot occur even if the waste gate should happen to stick shut. A second line of protection is incorporated in the CX500 Turbo's computer-controlled fuel injection system, which has sensors feeding it information about air temperature and pressure at the compressor inlet and exit, and downstream from the throttles, as well as about throttle position and what the intake valves are doing. If the boost pressure goes above 19 psi, the fuel injection computer simply shuts off the fuel and will not resume injecting until the boost is back under the safe limit.

The CX500 Turbo's fuel injection system has two unusual features. One is that air flow is sensed only through implication. The computer assumes that the volume of air passing into the engine is a function of manifold pressures and the orientation of the two 32mm (1.26-in.) throttle butterflies. The other is that the injection of fuel is timed. A pair of pulsers at the aft end of the camshaft signals for injection at particular points relative to the engine's intake periods. Everyone else has said that injection timing is immaterial; Honda put the Turbo's injector nozzles in the usual place, just upstream from the intake ports, but Honda takes the unusual view that injection timing is highly important.

Manifold pressure signals are also sent

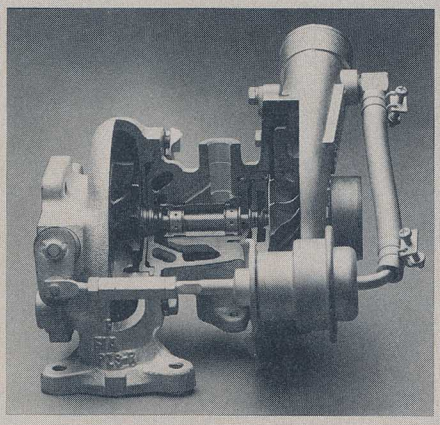


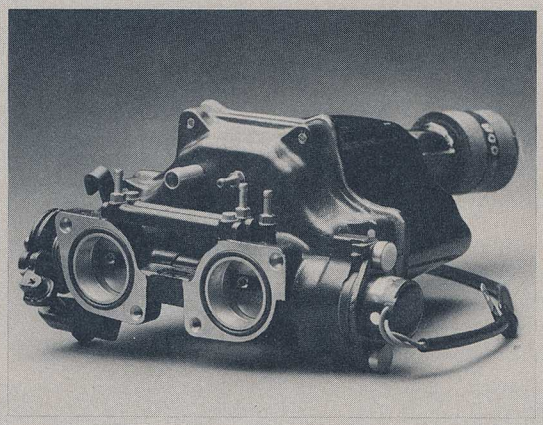
Honda CX500 Turbo

to the control unit of the CX500 Turbo's ignition system. This transistorized system is triggered by pulsers placed next to a flywheel, is of the inductive type, and delivers a stronger spark than the standard CX's capacitor-discharge ignition. But its really interesting feature is that it advances and retards the spark timing to suit crank speed and boost pressure. Honda could not use so much boost without this ignition system.

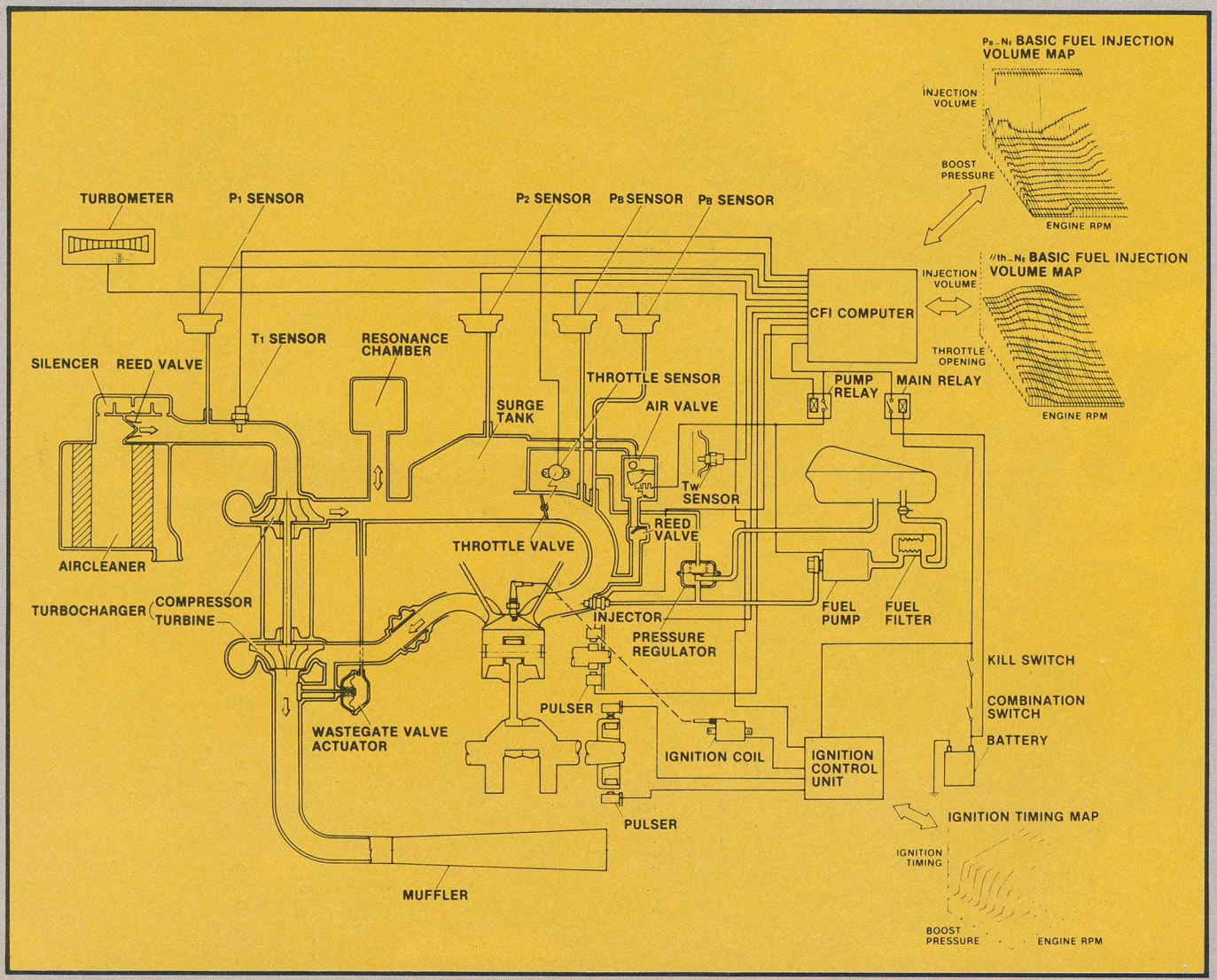
The CX500 engine, like all V-twins, is inherently ill suited to turbocharging. Its exhaust pulses are too widely spaced for best results, and the uneven firing intervals tend to cause one cylinder to be more pressurized than its mate. Honda overcame the latter difficulty by placing a largish (about one quart) plenum chamber in the manifolding between the turbocharger and the engine. Also, to prevent engine-induced flow surging in the turbocharger's compressor, they put a resonance-damping "Helmholtz" chamber right at the compressor's outlet.

Extensive engine modifications accompanied the fitting of the turbocharger. The CX500 Turbo's pistons are forged instead of cast, and have a dome configuration that lowers the compression ratio to only 7.2:1. More rigid wrist pins are supplied, and stronger connecting rods, and both rod and main bearings were changed to sets having a higher load capacity. The engine's exhaust valve faces have been specially treated for improved heat resistance, and similar attention has been given the valve seats and guides. Even the cam followers and





Honda's turbocharger, far left, uses an exhaust waste gate controlled by a rod and pressure diaphragm to limit boost. Air from the turbo's compressor goes to a surge tank, then to the throttle body, which also holds a throttle position sensor and hose connections for the full injection system's air pressure sensors. This system, diagrammed below, has two solenoid-type injection nozzles opened by electrical pulses from the computer. The CFI computer's basic fuel volume computations are made by using engine speed, calculated from ignition pulse rate, and throttle position. Then it considers air pressure and temperature at the turbocharger inlet, pressures in the surge tank and the manifold, and even radiator water temperature, before it decides how long the timed injection periods must be for a correct mixture.



valve rockers are stronger, and there is an automatic tensioner for the camshaft's drive chain.

A Honda representative has told us that the CX500 Turbo has 77 brake horsepower, compared with 48 bhp in the standard model. The difference in power is at least that great; we'd guess that the prototypes we rode had something nearer 95 bhp. Honda has not tried to pass the power down a standard drivetrain. The transmission has stronger gears and entirely new ratios; there's a new, GL1100-sized clutch; and the Turbo gets a stronger ring-and-pinion casing.

Many new and/or upgraded parts have been incorporated in the Turbo's chassis. Like the fork, which now has 37mm (instead of the Interstate GL's 35mm) tubes, and an all-aluminum swing arm that's almost two pounds lighter than its steel counterpart. The excellent Honda twin-piston brake calipers are used at both the front and rear wheels, and the dual front brake has 270mm discs—30mm larger than standard. Word is that neither the Turbo's steering geometry nor its Pro-Link rear suspension is the same as a normally aspirated CX500's. Finally, the Turbo has wider-than-normal wheel rims: a 2.50-18 up front and a 2.75-17 for its rear wheel. Both wheels are fitted with high-speed "V-rated" tires.

Honda's CX500 Turbo has the same wheelbase as the GL500 Interstate, and both bikes have fairings. So much for similarities. You could hang saddlebags on a CX500 Turbo, but if the production version is anything like the prototypes we rode you'd never succeed in converting it to anything even remotely like a touring bike. The Turbo, as we presently know it, is a purely—and let's say peculiarly—sporting motorcycle. It's out of its element boxed in by speed laws and trucks on turnpike-type highways. Ridden straight and slow it feels, and *is,* distinctly clumsy and sluggish.

In traffic the CX500 Turbo is outclassed by nearly everything, including a stock CX500 and even some cars. Slogging along with its revs down below 4000 and its turbine loafing, the Turbo is just a heavy, tall-geared CX500 with a low-compression engine. We tossed one of the prototype Turbos on a scale and it weighed 550 pounds with hardly more than fumes in its fuel tank; topped up, it would have gone about 575 lbs, and you need more than 500 cubic centimeters and a 7.2:1 compression ratio to get that much mass moving smartly.

Honda's people told us that the CX500 Turbo will work up full boost down at only 4000 rpm, offering as proof official charts bearing boost, torque and power curves. Alas, the charts may have referred to some CX500 Turbo engine somewhere, but we don't think the charts related to the bikes we rode. None of the CX500 Turbos we rode showed much life below

(Continued on page 78)

CX500 TURBO *Continued from page 51*

5000 rpm, and none was truly vigorous below 6500 rpm. And even at higher engine speeds the turbine seemed to quit abruptly when throttle was rolled off, leaving the engine boostless for a couple of instants after resuming open-throttle operation.

But when Honda's CX500 Turbo had 7000 rpm and full boost to work with, it was a rocket. Given the difficulty of making a clean launch from the starting line, the Turbo's quarter-mile times may never look too impressive. Don't let that fool you, because once the bike hits its stride it is absolutely breathtaking. Our much-abused Suzuki GS1100 would leave the Turbo gasping and floundering in its wake in a fifth-gear, roll-on from 4000 rpm, but once the Honda came on the impeller the Suzuki was quickly reeled in again. Beginning a roll-on at 5000 rpm, the GS and Turbo pulled together briefly, then the Honda galloped away. Beginning a roll-on at any engine rpm above 5000 rpm, the CX simply charged away from the 1100 at an incredible rate. And anything that can reel in a GS1100, even one that's below par, is *fast!*

The route we were directed to take on our CX500 Turbo ride was the locally famous Angeles Crest Highway, a swoopy asphalt scrawl connecting La Canada with Wrightwood, the Big Pines Recreation Area and points beyond. It was a ride on which we learned almost nothing about the CX500 in the real world, except during its town/freeway beginning and end, but we came to know much with respect to turbo lag and the Honda Turbo's handling. The latter we liked very well; the former we learned to cope with.

In an odd way, the CX500 Turbo's handling is like that of the new CBX. Both feel strangely soft, without the crispness usually associated with good handling. Yet both the CBX and the Turbo do steer precisely, if not especially lightly, and both can be ridden along a twisty road very rapidly. The CX500 Turbo feels a great deal lighter than the scales suggest however. Where the CBX feels ponderous at times, the CX500 feels much lighter than its actual weight.

Fortunately for the person trying to ride the CX500 Turbo fast, it is free of serious handling vices. Two of the prototypes had higher-than-recommended air pressure in their coil/air-spring rear shocks. The bike with the factory-suggested air pressure was prone to weave and bob about a bit in fast turns, but the others were nice and steady. Not perfect, but very steady, and that steadiness was appreciated as we began learning about dealing with turbo lag. One of us actually applied a 125 MX technique, fanning the clutch to exit corners smartly. The clutch survived, but the same rider also used throttle-on/rear brake-on tactics and incinerated a set of brake pads.

Others among us dealt with the turbo

lag by means of curses or prayers, according to our several natures, and most found themselves cranking in more throttle while braking for corners—then rolling off throttle while accelerating away. Why? Because the amount of power arriving at the CX500 Turbo's rear wheel was only secondarily related to throttle position. We used lots of throttle to create the condition under which power could be made, and then eased the throttle to modulate the exceptional power boost-pressure had created.

There wasn't one among us who didn't like the CX500 Turbo, though we all disliked the more intrusive manifestations of turbo lag. Despite some grumping about the seat being slightly wrong and the handlebar being too straight, everyone liked the seating position. We also liked the way hot air was ducted out the fairing's sides instead of wafting back to scorch our knees, and all of us thought the access panel above the halogen headlight was a nice feature. Honda has also eased future CX500 Turbo owners' service problems by making the bike's computer diagnose and reveal its own illnesses; and by setting up an exchange arrangement that should mean you never have to buy a computer outright.

Styling is a subjective thing, to be freely liked or despised. We can offer in this regard the fact that people who spotted the CX500 Turbos while we had them did react strongly and favorably. If you buy one of the Turbos, be prepared for strangers to do double-takes and then come over to tell you how much they admire your motorcycle. It's a high, almost enough to make you forget about turbo lag. If they're nice, you can show them the Turbo's "dotted smile" pressure indicator—which widens as the boost rises.

It was too bad that the pressure gauge was part of an instrument panel set too deeply to be easily read in daylight, if you have anything else to watch. Too bad, too, that the CX500 Turbo is so afflicted with in-town tired blood. Maybe a bit less boost and a touch more compression are called for here. We'd like to see these things fixed.

Honda isn't finished with the CX500 Turbo quite yet. Exactly what will be changed, or could be, and what may be regarded as final as stone engraving, no one could say with absolute certainty. All the bikes we rode were prototypes with large numbers of hand-built parts, and many things can happen between prototype and final production stages. We've seen fabulous motorcycles in prototype stage before which gave way to less inspiring production examples. And we've seen lackluster prototypes which were forerunners to impressive production machines. As things stand now with the Honda Turbo, the prototypes we rode were very good motorcycles, and with some nudging, the production version of the CX500 Turbo could be a great one. ◉