HONDA INSIGHT drag car

Part 3: Finishing touches

BY AARON BONK
PHOTOGRAPHY BY E. JOHN THAWLEY III

With the chassis and engine complete, there's only detail work left before 'Bisi Ezerioha's normally aspirated Honda Insight drag car hits the track. Follow along this month as 'Bisi puts the finishing touches on the car before making shakedown runs.

PAINT AND BODY

Bodywork was completed at Car Craft in Riverside, Calif. The Insight was sprayed inside and out with a paint scheme rendered by Thom Taylor of *Hot Rod* magazine. Bob Godfrey at Car Craft widened the fiberglass front end to clear the 9-inch-wide M&H Racemaster slicks.

'Bisi compensated for the extra weight added from the fiberglass hood by gutting the Insight's doors. It now weighs just under the NHRA All-Motor Class 1,650-pound minimum, track ready.

INTAKE AND EXHAUST

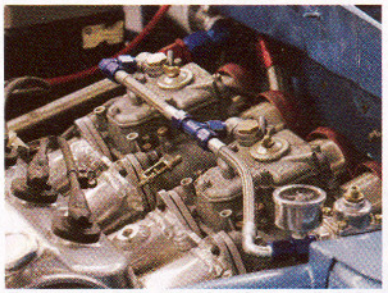
The Accord engine and Integra transaxle bolt to the chassis via custom fabricated solid mounts from Steen Chassis. With the engine in place, intake and exhaust components are attached.

The ability to distribute, vaporize and burn fuel was considered carefully when selecting the engine's fueling options. The more efficient the atomization, the better the combustion.

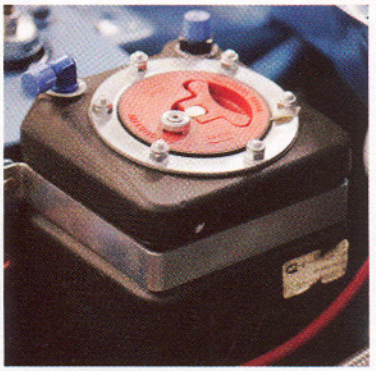
As an engineering student, Ezerioha studied the fluid dynamics of injection vs. carburetion. Using a 1.6-liter Civic Si intake manifold and a 44mm Mikuni carburetor, he constructed a test rig that allowed him to observe and record fuel atomization events at a simulated wide-open throttle. What he discovered is counterintuitive.

The tiny orifices and small spray pattern of most fuel injectors limits their ability to atomize fuel. These constraints require them to be placed more than two feet away from the intake manifold in order to achieve an atomization cloud comparable to the Weber carbs on his F-series race engine.

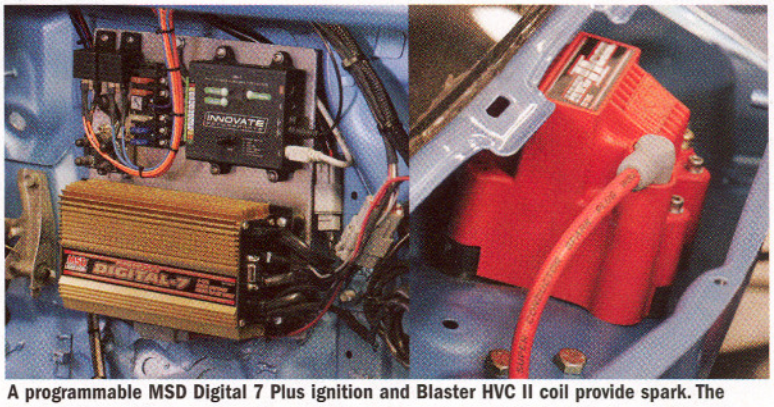
'Bisi explains that carbs atomize fuel better, but fuel injection controls air/fuel ratios better. When the carbs can maintain an ideal air/fuel ratio, like at wide-open throttle, he says they will outperform injection.



Ezerioha conducted testing that concluded the Weber carbs lowered inlet temperatures relative to fuel injection. The results are explained by the Joule-Thompson effect. This effect describes a method of cooling, based on expansion, in which a gas in a high-pressure area seeps into a low-pressure area, resulting in cooling. Ezerioha claims this is partially why carbs work better in this application.

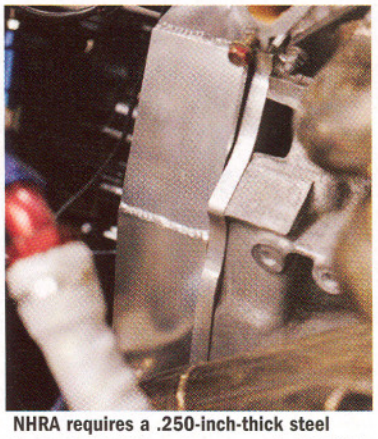


A Jaz Products one-gallon tank stores the Rockett Brand 118-octane fuel. With the 17:1 compression ratio, fuel is critically important to engine performance. Rockett Brand fuel is specially formulated for high-rpm and high-compression race engines and meets NHRA guidelines.



A programmable MSD Digital 7 Plus ignition and Blaster HVC II coil provide spark. The Digital 7 allows for individual timing curves that may be tailored for each gear depending on load and engine speed. Ignition curves will be optimized during dyno testing.

Innovate Motorsports' LM-1 Air/Fuel Ratio Meter can record up to 44 minutes of air/fuel data for laptop retrieval. Also included is the LMA-3 AuxBox which has the ability to record five additional engine parameters.



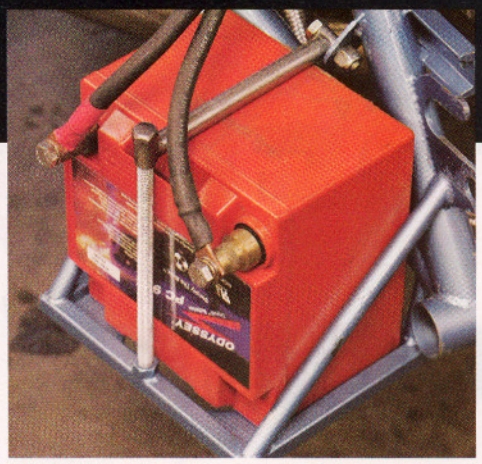
NHRA requires a .250-inch-thick steel flywheel shield for all cars running 11.99 and quicker. Steen fabricated this one from chrome-moly plate since none are available for the D-series gearbox. The shield completely surrounds the bellhousing.

HONDA INSIGHT dragcar

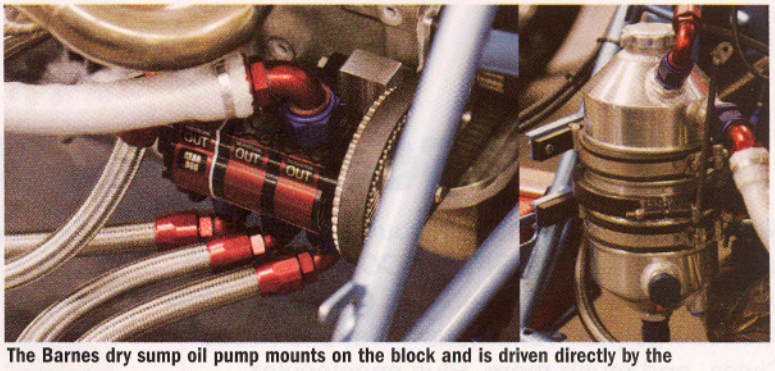
Ezerioha concedes that fuel injection has many advantages that aren't utilized in this kind of application. And while we hesitate to start a carb vs. injection debate, Ezerioha reminds us his competition is yet to produce an injected engine making similar power without resorting to alcohol.

Based on the results of the test rig, twin Weber DCO/SP, 55mm side-draft carburetors with 47mm venturis were selected to carry out intake duties. The "55mm" refers to the barrel size. The barrel then necks down to 47mm (the venturi) before enlarging again.

Selecting the proper barrel and venturi combination is the tricky part of carburetor sizing and directly affects air speed and airflow. While the "bigger is better" philosophy is tempting, it's not always right. Smaller venturis are often



In an effort to save weight and reduce parasitic drag, many of Ezerioha's competitors ditch their alternators and rely on 16-volt batteries. He's not willing to risk engine damage caused by insufficient fuel pump voltage, so a 12-volt Odyssey PC 925 battery is mounted up front. The heavy Accord alternator is replaced with a smaller unit from a Toyota Tercel.



The Barnes dry sump oil pump mounts on the block and is driven directly by the crankshaft. The external tank stores oil, allowing the crank to spin free of oil sludge.

HONDA INSIGHT dragcar

The Progress Group custom-built the Insight's coil-overs. The clevis brackets were specially placed to work with the Civic spindles. Progress-supplied camber adjustment bolts fasten the coil-over to the hub.

The Progress Competition Series One coil-overs can be disassembled and revalved for a wide range of damping characteristics to allow fine-tuning of weight transfer.

Ed Flores of The Progress Group measures the Insight's ride height and weight distribution using corner scales. The front to rear distribution is confidential, but the diagonal corner weights do equal one another. Weight is an NHRA-legal 1,650 pounds.

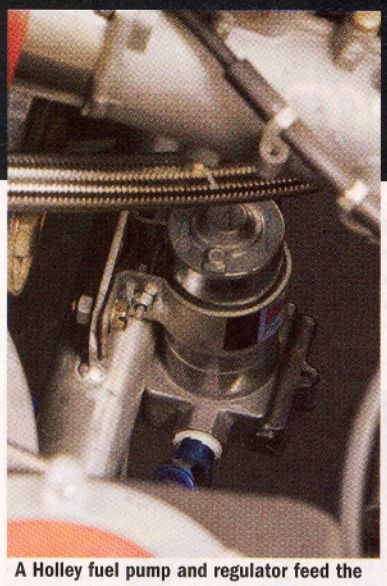
that's able to measure vacuum and positive pressure.

Luckily, space and packaging allowed the exhaust to exit at the point with the greatest pressure differential to further improve the scavenging effect and reduce drag: under the car near the gearbox.

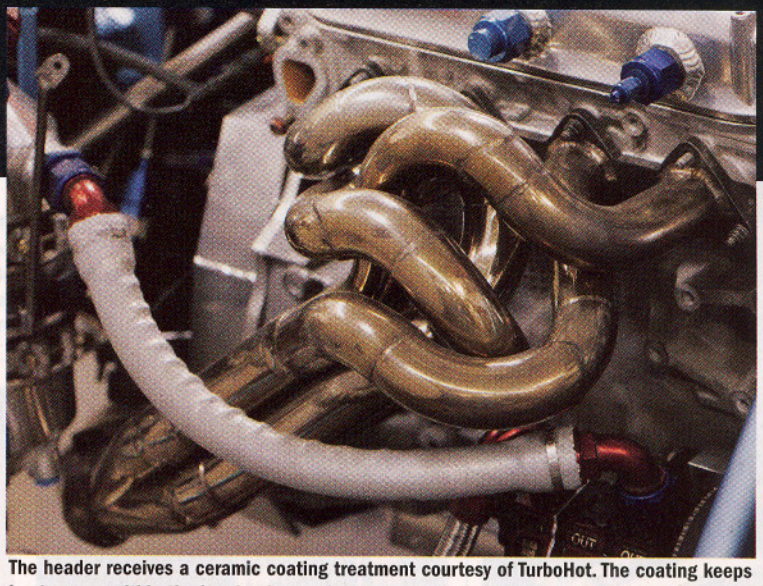
SUSPENSION

The goal for the suspension is straightforward: to achieve maximum traction by keeping the weight over the front wheels. Constructing the suspension is a joint effort between The Progress Group and Steen Chassis.

The Progress Group upgraded the Insight with 2001 Civic spindles, larger diameter TCI 500-hp axles and Animal House ceramic wheel bearings. The Insight's small stock splined shafts would snap like twigs when exposed to the torque of the F-series engine and 27-inch-tall slicks. The lightweight Animal House ceramic bearings produce a lower coefficient of friction at the ball/raceway interface, resulting in 33 percent less bearing



A Holley fuel pump and regulator feed the carbs and maintain steady pressure.



The header receives a ceramic coating treatment courtesy of TurboHot. The coating keeps heat energy within the header, increasing scavenging and reducing under hood temps. Ezerioha claims gains of up to 5 hp from the coating alone.

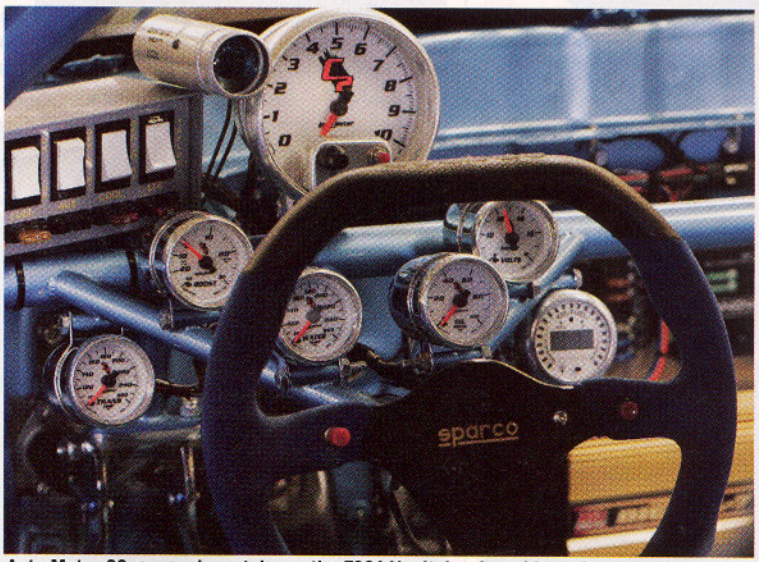
better. The purpose of the venturi is to increase the vacuum acting on the main jet, thus increasing atomization. Smaller venturis produce more vacuum, but less flow. The trick is finding the right combo.

On the exhaust side of the head, gases exit through a Bisimoto exhaust header. The goal of the header is to create a vacuum by means of exhaust pulsation. This is known as scavenging. Scavenging accelerates the air/fuel mixture entering the cylinders, thereby increasing efficiency and power.

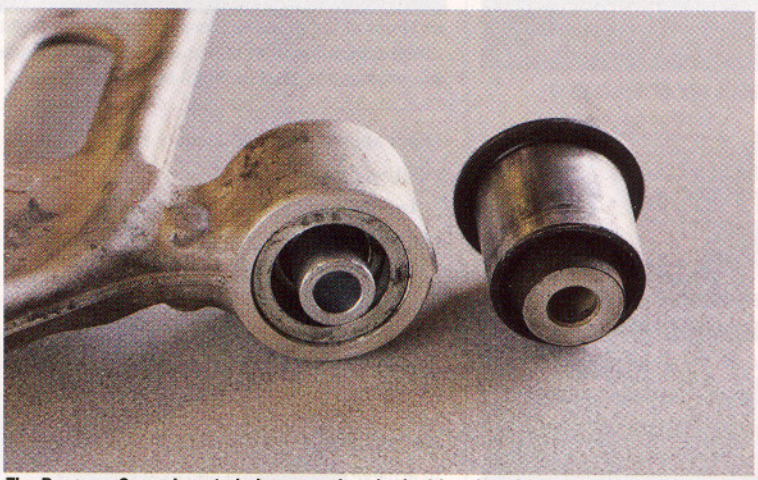
To optimize header design, Ezerioha constructed a chamber to study exhaust sound waves. Through observation of the exhaust pulses, he was able to derive a correlation between engine speed and engine displacement to maximize scavenging. Various diameters and bends were tested to determine optimal header construction relative to his target rpm range and engine displacement.

The header is a custom piece designed by Ezerioha and is constructed of stainless steel and uses a four-into-one merge collector. It achieves flow rates equivalent to a straight pipe.

Spent exhaust gases have mass, so terminating the header in the wrong place has the potential to create additional aerodynamic drag. To determine an optimal exhaust exit location, Ezerioha performed pressure tests using a manometer, a device



Auto Meter C2 gauges keep tabs on the F22A1's vitals, alongside an Innovate Motorsports XD-1 air/fuel gauge.



The Progress Group inserted chrome-moly spherical bearings into the lower control arms, replacing the factory rubber bushings, to help eliminate wheel hop.

The Progress Group shock dyno produces data used to dial in the Insight's dampers. The dyno cycles the shock and produces computer-generated damping curves based on the results. The curves represent the resistance vs. the velocity of the shock shaft in both compression and rebound. Once measured, damping characteristics may be adjusted and retested prior to installation.

friction. This allows more power to the wheels and less rolling resistance.

The steel Civic spindles are heavier than the Insight's aluminum spindles but allow a pair of Progress spherical bearings to complement the Insight's lower control arms. The chrome-moly bearings are set inside a steel shell and are pressed into the arms. The bearings are designed to eliminate longitudinal tire shaking during launch.

A custom set of coil-overs from The Progress Group replace the factory shocks at each corner. The one-off coil-overs are based on The Progress Group's Competition Series One coil-overs and allow for simple disassembly and valving changes. Up front, the coil-over's lower mount points were moved inward 1.5 inches to allow for additional tire clearance. The upper mounts remain in the stock location per NHRA rules.

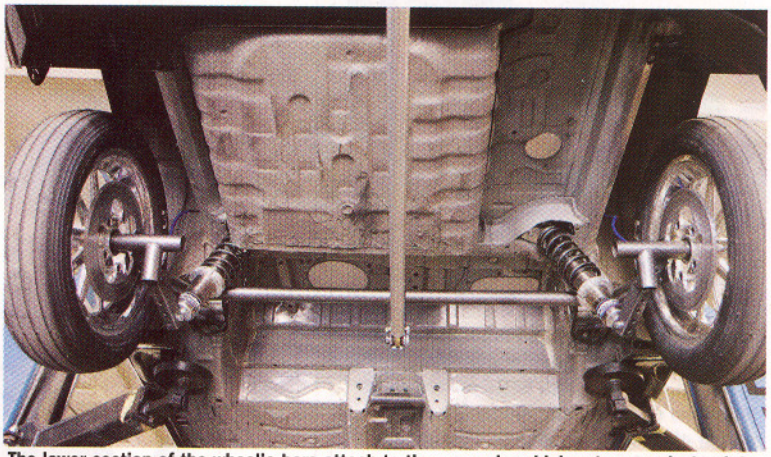
As the Insight is lowered, the steering arm angle is significantly increased, creating clearance problems and increasing bump steer. To solve the problem, the coil-overs' steering arm brackets were relocated lower on the strut body, making the steering arm parallel to the ground.

Out back, Steen fabricated a chrome-moly rear axle to replace the bulky stock setup. The one-piece axle eliminates the

reactive nature of the Insight's stock rear suspension, but affords major weight savings. It's also shorter than stock, allowing the rear wheels to tuck under the car—an aerodynamic and aesthetic advantage. The axle mounts to the rear coil-overs and features an adjustable wheelie bar mount.

The stock springs are mounted to the axle and rest vertically inside a perch. The shocks are set at a forward angle, spanning from the chassis to the axle separate from the springs.

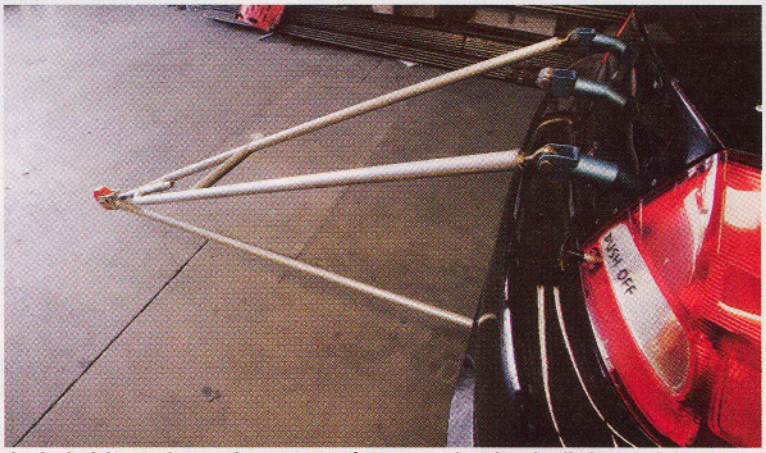
The Progress Group rear coil-overs attach to the factory shock mounts per NHRA rules. This placement eliminates the stock, vertically placed spring and increases the suspension's motion ratio from 1:1 to 2:1. The motion ratio is the relationship between damper travel and wheel travel and is used to calculate spring and damping rates. As a result, a much stiffer spring is required.



The lower section of the wheelie bars attach to the rear axle, which acts as a pivot point when load is transferred to the bars.

WHEELIE BARS

Regardless of drive wheel orientation, forward acceleration transfers weight rearward, which helps a rear-wheel-drive



As the Insight accelerates, its mass transfers rearward to the wheelie bars and then back to the rear axle.

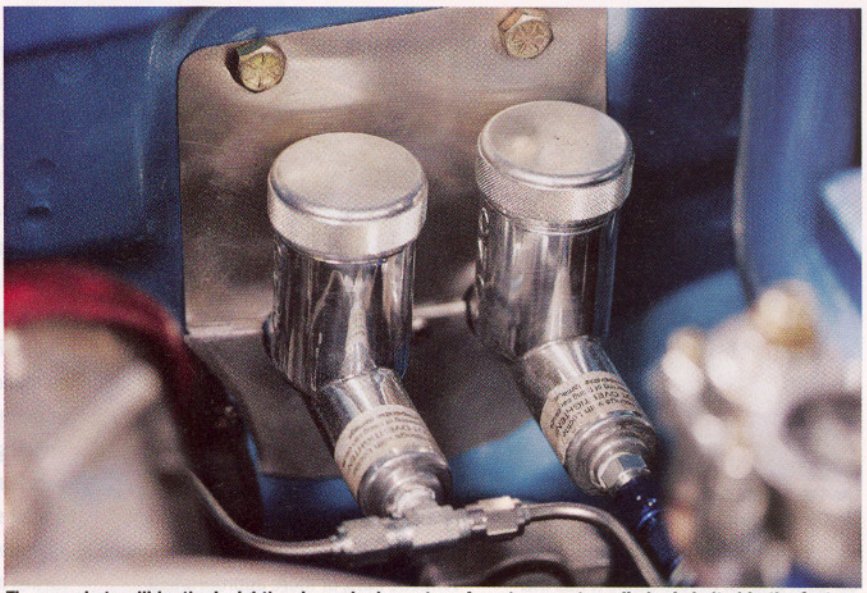
car gain grip for acceleration. It has the exact opposite effect on a front driver by transferring weight off the drive wheels when it's needed most. The solution?

Wheelie bars, or more appropriately, traction bars. The bars act as a wheelbase extension—the longer the wheelbase, the less effect mass transfer will have.

In conventional applications, wheelie bars keep the rear end from squatting. But on the Insight, the wheelie bars are designed to transfer rearward-shifting weight back to the front wheels.

'Bisi's wheelie bars are made of .065-inch 6061-T6 aluminum tubing, generally not the material of choice for a component that will experience this kind of load.

Ezerioha explains "wheelie bars can be made of paper, if they're designed properly." The most important factor is building them so they won't bind. The bars feature adjustable rod ends and brackets for fine-tuning. NHRA rules limit wheelie bar length to a maximum of 65 inches measured from the rearmost portion of the bumper. Preloading of the bars is prohibited. The wheels must spin freely at the starting line.



The parachute will be the Insight's primary brake system. A custom master cylinder is bolted in the factory location minus the brake booster. Power-assisted brakes are of little value when using a parachute.

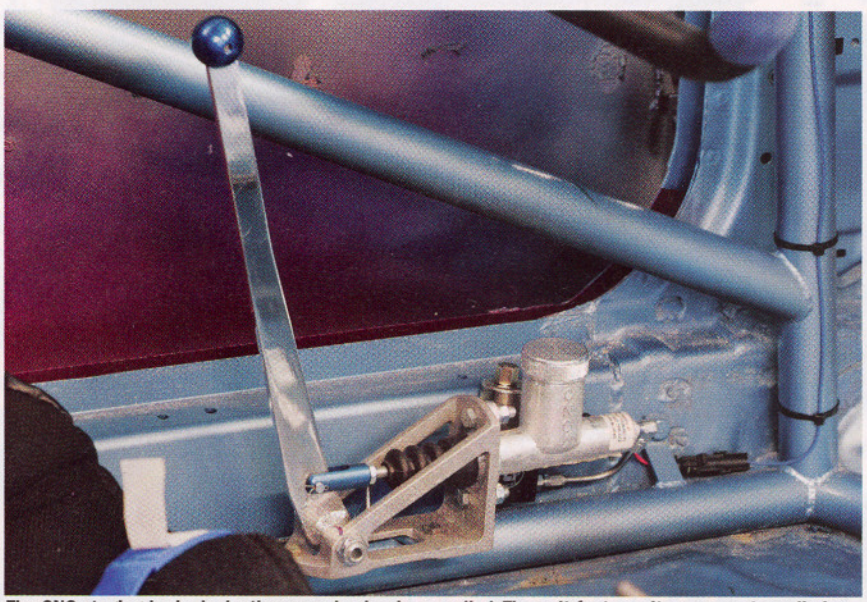
BRAKES AND WHEELS

The brake system is minimal, as the parachute will supply most of the stopping power. When mated to the '01 Civic spindles, the Insight's calipers are offset away from the rotors, reducing the pad/rotor contact area.

Larger diameter rotors were sourced from Fastbrakes of Phoenix, Ariz. The 10-inch cross-drilled rotors mate to Wilwood single-piston calipers and EBC Green pads.

The rear is comprised of Anglia spindle mounts featuring custom aluminum discs and calipers. A TCI line lock in conjunction with a CNC Inc. staging brake applies rear brake pressure for burnouts and launches.

Circle Racing Wheels of Cerritos, Calif., provided a set of Pro-Series Import drag racing wheels. The 15-inch rims up front feature a two-piece design and weigh 8.9



The CNC staging brake locks the rear wheels when applied. The unit features its own master cylinder and fluid reservoir, allowing it to work independent of the front brakes.

pounds each. M&H provided a set of 15x9x27-inch Racemaster slicks. NHRA allows up to a 28-inch tire for the All-Motor Class.

Out back, 17-inch skinnies are used. The forged one-piece wheels weigh 9 pounds each. All of Circle's Pro-Series import drag racing wheels are constructed of CNC spun, 6061-T6 aluminum.

Look for a test and tune update on the Insight detailing the final pre-race prep work, power figures and 60-foot times in the next few months. ■

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PREVIOUS INSTALLMENTS

June 2005
Part 1: The chassis

July 2005
Part 2: The engine and transaxle

SOURCES

Animal House Racing
(973) 953-4631
www.animalhouseracing.com

Auto Meter Products Inc.
(815) 895-6786
www.autometer.com

Barnes Systems
(310) 534-3844
www.barnessystems.com

Bisimoto Engineering
www.bisimoto.com

Bonaco Performance Line, Inc
(909) 985-3429
www.bonacoinc.com

Car Craft Inc.
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Circle Racing Wheels
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CNC Inc.
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www.progressauto.com

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www.steenchassis.com

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