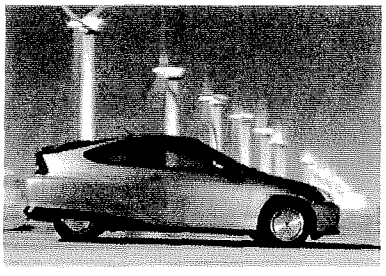
Shot Peening in the News

We are always searching for shot peening in the news and we recently found press releases on two very different cars. As evidenced by our recent workshop in Dearborn, Michigan, we are big believers in shot peening in the automotive industry.

These vehicles couldn't be more dissimilar—the petrol-electric hybrid Honda Insight and the 2005 Ford GT 500 hp supercar.



Honda Insight

Cited as "...a petrol-electric hybrid two-seater coupe that blends a mass of new technologies to achieve the world's lowest fuel consumption for a mass-produced petrol engined car".[1] How the Insight achieves its low fuel consumption is at least a partial validation of the research of Sidney Terry (Chrysler) and Roger Simpson (Advanced Material Process Corp.) Mr. Terry, retired V.P. from Chrysler, was the keynote speaker for the 2004 Workshop in Dearborn and he recapped the paper he and Mr. Simpson wrote in the late 1980s: An Essay on Cost as a Function of Weight in Automobiles and the Use of Shot Peening to Reduce Both. According to Mr. Terry and Mr. Simpson, reducing weight in the automobile is the key factor for the car designer that needs to increase fuel economy. (The paper was reprinted in *The Shot Peener* Spring, 2004.)

The Insight press release reads: "The engine design process included a review of the whole structure in order to create the lightest one-litre engine in the world. Connecting rods, for example, are not only forged steel, but also case-hardened (or carburized) for significantly increased strength. In the Honda S2000 this method was chosen mainly to realise high engine speed; in the Insight's engine, the strength enhancing technology was applied to create a thoroughly slim design, achieving a reduction in weight of 30 per cent compared with a conventional connecting rod.

A new Honda-developed magnesium alloy, with a high degree of resistance to thermal induced expansion, has been used for the engine sump in place of aluminum alloy, giving a 35 per cent weight reduction. The casting also incorporates the oil-filter bracket, AC-compressor bracket and an engine block stiffener.

Other weight saving technology includes: a thinner-sleeved cylinder block, which also allows for a more compact engine block, bracketless ancillary equipment, a magnesium PCU case, and an increase in plastic parts (intake manifold, cylinder head cover, water pump pulley), and of course the compact VTEC cylinder head. The plastic resin intake manifold weighs only 1 kg, roughly half the weight of a comparable aluminum manifold. The individual pieces that make up the manifold, such as the intake runners, plenum chamber and throttle-body mounting, are permanently connected with a vibration-welding technique. Clutch and brake pedals are fabricated from aluminum."

Terry and Simpson saw the role shot peening could take in reducing weight and costs in automobile production but they didn't envision its role in friction reduction. According to the article, "The less energy lost through friction, the more that can be recovered in the regenerative mode, and any means of reducing friction is thus of vital importance in the quest for low fuel consumption. Honda's engine designers looked not only at the valvetrain arrangement, but also at the material and surface treatment of each new part. The effect of all the new technologies employed is a 38 per cent reduction in overall friction in comparison with a conventional 1.5 litre engine.

Among the measures adopted are roller type rocker arms, first seen in the Honda S2000 and adapted to the single cam VTEC mechanism, providing a 70 per cent reduction in friction losses. The sliding pin used to operate the cam profile switchover in the VTEC mechanism is now integrated within the roller's inner shaft for a lighter and more compact rocker arm design, thus helping to reduce inertial weight. It has also allowed the valve spring load to be reduced by 30 per cent.

[1]For more information, go to www.plugitin.co.uk/insight.htm

The lightweight aluminum alloy pistons have a minimal skirt area and the surface of the skirt has been shot-peened. Shot-peening produces a special 'micro dimple' surface which improves the retention of the oil film between the piston and the cylinder reducing friction by approximately 30 per cent. An unusual feature of the engine's design is a crankshaft axis shifted, or offset, 14 mm, relative to the cylinder bore axis. In other words, the crankshaft does not sit directly under the cylinder. This was done in the interest of minimizing friction caused by the side thrust of the pistons against the cylinder walls, just after top-dead- centre, as each piston begins its descent on the firing stroke.

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In a conventional engine, piston-side thrust and the friction it generates are the result of the crankshaft's resistance to turning at this point. This resistance is the result of the small angle formed by the crank throw relative to the centreline of the piston and cylinder. The IMA engine's cylinder bores are offset to be over the crank throw at this point, so the piston and connecting rod push straight down, thereby minimizing side force on the piston. Cylinder bore offset accounts for as much as a three per cent reduction in internal friction."

Watch for more information in *The Shot Peener* on the use of micro bead shot peening to reduce friction. Osamu Kata, Executive Director, and Yoshio Miyasaka, President, from the Japanese company, Fuji Kihan Co., Ltd., made a presentation at the 2004 Shot Peening and Blast Cleaning workshop on this very subject.

The Ford GT

The Ford GT is an American Supercar reborn. "It was in France, in the mid-1960s, that the great American supercar came to life. A low-slung, muscular racing car built to win on the legendary Le Mans race circuit, the Ford GT project was spearheaded by no less a powerhouse than company Chairman and CEO Henry Ford II. His goal was to change performance car history. And he did. The Ford GT race car beat the world's best in endurance racing, placing 1-2-3 at the 24 Hours of Le Mans in 1966 and winning the next three consecutive years.

Today, the all-new 2005 Ford GT supercar comes to life in the form of three production road cars that honor the classic race cars in design and engineering ingenuity. The Ford GT production car, like the concept, casts the familiar, sleek look of its namesake, yet every dimension, every curve and every line on the car is a unique reinterpretation of the original. The car features a long front overhang reminiscent of 1960s-era race cars. But its sweeping cowl, subtle accent lines and high-intensity-discharge (HID) headlamps strike a distinctly contemporary pose.

Powering the Ford GT, is the all-aluminum 5.4L powerplant. This 'Powered by Ford,' Detroit displacement is fed by an Eaton screw-type supercharger, as well as dual fuel injectors per cylinder. Additional features include four-valve cylinder heads, and forged components, including the crankshaft, H-beam connecting rods and aluminum pistons. The resulting power output is 500 horsepower and 500 foot-pounds of torque. To bear the stresses necessary to produce 500 horsepower, a forged-steel crankshaft, shot-peened H-beam connecting rods and forged aluminum pistons are used. "In total, 85 percent of the reciprocating parts are unique to the Ford GT," says Curt Hill, Ford GT powertrain engineering supervisor."[2]

The average guy can own a street-legal Ford GT. An average guy with $150,000.[3] If you prefer green over muscle, the Honda Insight pricing starts at $19,180.

[2]Portions of this article were reprinted with permission from the Supercharger. The Supercharger is a publication of the Society of Engineers (S.A.E.) Detroit Section.

[3]For more information on the GT, go to: http://www.fordvehicles.com/fordgt/faq.asp