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New Engine Design Sparks Interest

By NEAL E. BOUDETTE

WEST SPRINGFIELD, Mass.—On Easter Sunday in 2001, Carmelo Scuderi called his family together in his home here and announced, essentially, that he had outsmarted the world's auto makers and their billion-dollar research departments.

The retired engineer and inventor told his children and grandchildren he had developed a dramatically more fuel-efficient design for the internal combustion engine, something car companies have been chasing for decades.

Eight years later, the late Mr. Scuderi's revelation no longer seems as far-fetched. His design—which involves grouping an engine's cylinders in pairs, with each pair focusing on specific tasks—is gaining attention in an auto industry that is now more open to fuel-saving innovations.

A half dozen or so car makers, including France's PSA Peugeot Citroen SA and Honda Motor Co. of Japan, have signed nondisclosure agreements with the Scuderi Group, the company founded by Mr. Scuderi's family, to be able to study the technology closely, said consultants who are working with the firm. Daimler AG of Germany and Fiat SpA of Italy also are looking at the Scuderi design, executives at those companies confirmed.

"We have looked at their simulations and their [research] papers and it is worth looking into further," said a Daimler scientist familiar with the matter. "There is realistic potential here."

Honda declined to comment.

Robert Bosch GmbH, a giant German auto supplier with expertise in engine components, is developing parts for the Scuderi prototype, with the hope the engine will someday make it into production.

On Monday in Detroit, the Scuderi Group, owned by Mr. Scuderi's wife, five sons and three daughters, unveiled a prototype engine, the next step toward proving that the design works.

The Scuderi engine still needs to pass many tests. Auto companies are bombarded with designs for new engines, and almost all never pan out. In fact, the basic design of the gasoline engine has remained largely unchanged for a century.

But the race to improve fuel economy has heated up because of volatile gasoline prices, increased interest in reducing oil imports and the phasing in of tougher fuel-economy and emissions standards.

Car makers worry it will cost billions of dollars to perfect new technologies, like electric cars and hybrids, to cut fuel consumption. They could eliminate much of that expense if they could improve the tried-and-true internal combustion engine.

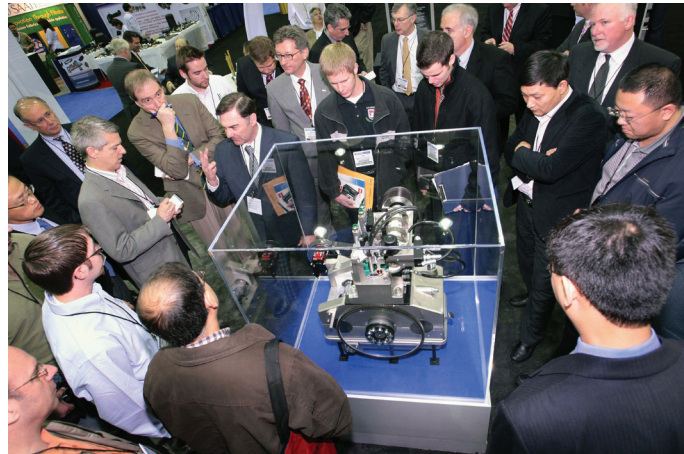
One answer could be a technology called HCCI, which yields a gasoline engine that operates much like a diesel, requiring no spark plugs. Honda, General Motors Corp. and others have invested in HCCI. The Scuderi engine is another possibility.

Today's gasoline engines leave much room for improvement. Only about a third of the chemical energy contained in a gallon of gasoline is converted into mechanical energy that turns the wheels of the vehicle. The rest becomes heat or exits the tailpipe as unburned fuel.

Mr. Scuderi was an expert in thermodynamics, which examines the relationship between mechanical motion, friction and heat.

In a normal engine, a piston moves up and down in a cylinder in a four-stroke cycle—down as a mixture of air and fuel enters the cylinder; up to compress the mixture; after a spark ignites the fuel, the piston is driven back down in the power stroke; and then up again, pushing out exhaust gases and starting the cycle over.

In the Scuderi design, pairs of cylinders work together. One cylinder does nothing but intake and compression. It is part-



Scuderi Group unveiled a prototype of its fuel-saving engine Monday in Detroit. Car makers including Honda and Daimler have shown interest.

nered with another that does only combustion and exhaust. A high-speed valve channels the pressurized fuel-air mix from the compression cylinder to the combustion cylinder.

Mr. Scuderi envisioned putting two sets of paired cylinders together to make a four-cylinder engine. According to his calculations, this setup should reduce resistance within the engine, result in greater compression of the fuel and air, and faster and more complete burning of the mixture.

Mr. Scuderi calculated that these and other changes could convert about 40% of the energy in gasoline into mechanical energy.

Mr. Scuderi suffered a heart attack and died in 2002. His children continued to refine the engine design, and now envision adding a tank to store highly compressed air that can be fed into the combustion cylinder to further improve efficiency.

The firm believes the Scuderi engine, equipped with the air tank and a turbocharger, could

increase a vehicle's fuel economy by perhaps 50%.

Sivam Sabesan, an engine expert at consulting firm Frost & Sullivan who has examined the Scuderi design, said there are no obvious flaws that would suggest the engine won't work. "You just have to throw [engineering] resources at it and you can work it out," he said.

And since the design is a rethinking of the standard engine, makers wouldn't need new plants to produce it, an advantage over other future technologies like electric cars or hydrogen fuel cells.

Still, Mr. Sabesan cautioned that the engine needs at least two more years of development before it could be ready.

Without a working engine, it's hard to know how the design will perform at different speeds, and whether it will be durable. Problems could arise because of the difference in temperatures between the paired cylinders, with the combustion cylinder heating up much more than the compression one.

