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## More Speed? Power? Now Drivers Can Have It Their Way

By DAVID J. WALLACE

One winter several years ago, Jim Conforti of Bonneville, Utah, had trouble getting his BMW 325i to start. At an altitude of 4,000 feet, the pre-programmed fuel mixture flooded the car's spark plugs when temperatures hovered near 32 degrees.

Mr. Conforti, a software engineer, was puzzled and

set out to chart the fuel mixture programmed for the car. He adjusted it to a leaner setting, and the car started up promptly thereafter. Eventually, Mr. Conforti decided to open a sideline business, Bonneville Motor Werks (the German spelling is deliberate), to create and sell high-performance parts for BMW's that are "reverse engineered" from factory specifications.

Bonneville is one of dozens of companies, along with uncounted individual motoring enthusiasts, that are fine-tuning engines to meet personal needs -- that is, redoing or undoing the work of car manufacturers.

Such tinkering is growing, thanks to the On-Board Diagnostic II system, known as O.B.D.-II, a computer the size of a paperback book that has been installed in every car sold in the United States since 1996.

As happens so often with new technologies, O.B.D. has spawned an industry of its own. Reprogramming cars by tweaking the computer's chips has evolved from a hobby to a multimillion-dollar business. Companies like Dinan Motorsports in Mountain View, Calif., tout



Tim Kelly for The New York Times

Jim Conforti, owner of Bonneville Motor Werks in Bonneville, Utah, fine-tunes a BMW for high performance.

high-performance chips. Web sites provide detailed instructions on how, for a few hundred dollars, car owners can swap the chip boxes themselves and turn their sedan into a speed demon.

Where shade-tree mechanics once adjusted carburetor fuel mixtures and timing by working under the hood with hand tools, now any computer equipped with the proper programs can read, reprogram and change a car's performance.

By remapping some data points, torque settings can be reprogrammed, horsepower can be increased, and top speeds, limited electronically at the factory, can be extended. On the other hand, a parent might want to control speed, not increase it to prevent, say, a teenager from exceeding 55 miles per hour. One man in Michigan, who bought a Ford Mustang police car programmed for high-performance highway driving, recently asked an online chat group how to reset the car for a calmer ride.

"In some cases, people will have a drivability issue they want to solve, not just more power," said Mr. Conforti, who has a patent application pending on a small device that can change BMW settings from normal to high performance and back again. "One car has a tendency to slowly decelerate when you hit the clutch and it hangs -- the idle control valve seems to open or electronic throttle takes over -- which makes for smooth shifting. But for people who have to *hold* the clutch, it can be annoying waiting for the revs to match up. For those drivers, maybe the problem can be tuned out."

Factory settings are designed to be forgiving, accommodating a wide range of drivers and behaviors. For example, some drivers do not use the proper high-octane gasoline when prices rise; others don't change the oil on time. Factory presets allow the car to compensate for such variables. But reprogrammed cars can lack that flexibility, causing the engine to be damaged by seemingly innocent corner cutting.

Michael Vaughn, a spokesman for the Ford Motor Company, warns that changing settings could void a car's warranty and affect engine durability. Reprogramming a car can also strain its brakes, tires, suspension and other parts.

Nonetheless, there is nothing illegal about changing a car's performance, as long as the vehicle passes state inspection and emissions tests, and reprogramming is not likely to render a car unsafe.

In fact, car company engineers are watching the so-called aftermarket carefully for solutions to problems they might not have considered, or improvements for ambitious drivers. All this makes for an uneasy truce between car manufacturers and those who want to change their hard work.

At heart, O.B.D.-II is the car's brain: it monitors various systems to

ensure peak performance, and has become a crucial diagnostic aid for mechanics.

The system was originally intended to control emissions. In the mid-1980's, carmakers began using electronics to manage engine functions that affect emissions, like idle settings and fuel mixture. California was the first state to mandate use of the O.B.D. system, recognizing the benefit of controlling pollution through computerized controls. National standardization of O.B.D. by the federal Environmental Protection Agency followed in 1993.

Oxygen sensors, knock sensors and other tiny tools let the car "learn" how well its pollution-control system is working. The engine then adjusts to different temperatures, altitudes and other conditions to ensure optimal emission control, fuel economy and overall performance.

To most dashboard watchers, the O.B.D. system is apparent only when the red or orange "Check Engine" light glows. After a few miles, it might go out, just as unexpectedly as it came on.

Problem solved: the car's sensors reported a change in operation and corrected it by adjusting a setting. Sometimes, however, when a part is wearing out or already broken, the "Check Engine" light is stubborn.

The computer tucks away a few kilobytes of data about the problem that caused the light to go on. It will then divulge details about the vehicle's operation to a mechanic with a scanning tool. Depending on the car manufacturer, the diagnostic tools and the system itself, up to 300 facts can be stored about a car, including the maximum speed it was driven, the engine's peak r.p.m. level, emission levels and the condition of sensors throughout the vehicle.

Mechanics can plug a sensor into a small jack near the driver's seat, download a file that taps the O.B.D.-II chip's memory and use the data to locate, identify and repair what is wrong.

The increasingly intricate electronic connections throughout cars are making replacement parts more expensive, and the sophisticated O.B.D. system has complicated the mission of more than a few manufacturers -- from NAPA Auto Parts, which makes basic replacement-part items, to makers of high-performance exhaust, fuel injection and air filter systems.

"Now that we're monitoring performance of parts or systems through the emissions system, they're concerned their part may not be compatible and cause the 'Check Engine' light to come on," said John Trajnowski, principal engineer with vehicle and environmental engineering at Ford.

Original-equipment manufacturers are cautiously sharing engineering details, without drawing the curtain too wide. They are

keen to know where chip tuners are able to improve performance and eager to capitalize on the market.

"We've set up a system where aftermarket part manufacturers work through a third party, enabling them to make parts that comply without giving up proprietary information," Mr. Trajnowski said. "They can market their part, and our trade secrets won't get out to G.M. or Toyota -- things like how we run the engine, how we do the monitoring, control timing, fuel, etc. We wouldn't want that leaked to our competitors."

Security has also been an issue for car owners. Paul Olsen, an electrical engineer with B&B Electronics Manufacturing Corporation in Ottawa, Ill., which builds the diagnostic tools that read the chips, recalls the conspiracy theories that bubbled up when the O.B.D. system first came out.

Motorists feared that mechanics would invade their privacy by sharing information about driving habits with manufacturers, who might void their warranties, or with law-enforcement officials, who might note the driver's need to speed. The fear has apparently not been realized.

"People were concerned about privacy and Big Brother, but now look at it more favorably," said Mr. Olsen, who has created a Web site devoted to O.B.D. ([www.obdii.com](http://www.obdii.com)) for mechanics and curious car owners.


But Bob Redding, a lobbyist for the Automotive Service Association, which represents auto repair businesses, wrote an article recently for its Web site about one Orwellian possibility. He pointed out that the technology exists to monitor the onboard computers of eight lanes of traffic traveling, theoretically, bumper to bumper at 100 m.p.h. By remote, computers could scan each car for the code indicating excess emissions.

Drivers with cellular phones, he posited, might then receive a call telling them the bad news: they had just flunked an emissions test.

*David J. Wallace is a Boston writer who covers business and technology.*

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