An exhaust probe can save you time and improve your diagnostic accuracy. However, practice, common sense, experience and logical follow-up testing are required.

In my last column (April 2006 issue, available at www.motor.com), I discussed the operation of the FirstLook exhaust probe. From the e-mails I received it seems I was not completely clear about the “pulse wave mass accelerometer” functioning of the sensor. So in the interest of clarity, let’s review (see Fig. 1 below).

The yellow trace is a Mitsubishi MAP sensor and the red trace is the FirstLook exhaust probe. Both sensors are connected to a vacuum hose, which is also connected to a hand vacuum pump.

The MAP sensor output is 3.7 volts at atmospheric pressure and the exhaust probe output is 0.0 volts. You can see that as I applied vacuum (lower pressure) to the system (seven pumps), the MAP sensor voltage dropped in incremental steps. The exhaust probe responds to changes in the vacuum/pressure, dropping each time and then returning to 0.0 volts.

At 20 in. of vacuum on the hand pump gauge, the MAP sensor voltage is 1.0 volt. Notice that the exhaust probe output is 0.0 volts. When the vacuum is partially released, the MAP voltage rises to 2.5 volts and the exhaust probe voltage spikes up to 28 volts.

The Mitsubishi MAP sensor is used by many technicians for vacuum waveform diagnostics. Notice the superior sensitivity of the exhaust probe to the changes in vacuum/pressure. Once again, it’s important to remember that the FirstLook exhaust probe responds only to changes in vacuum/pressure and does not reflect the actual static pressure like the MAP sensor does.

Last time I covered misfire diagnostics with the exhaust probe, but there are a few points I didn’t address. First, with an apparent misfire and no code, or a P0300 random misfire, the PCM is no help in locating the misfiring cylinder or cylinders. With a fast hookup, the exhaust probe and a scope should locate the offending cylinders. This is huge considering the time it takes and how hard it is to get an ignition scope connection on late-model vehicles.

Secondly, when diagnosing a rough idle, the exhaust probe should assist in determining if cylinders are misfiring or if there’s an uneven cylinder contribution caused by, say, dirty injectors. If no engine issue is found, the customer’s “rough idle” complaint may be defective motor mounts transferring normal engine vibration into the passenger compartment.

Thirdly, last month I did the misfire testing on my 2000 Honda Odyssey. Due to design variations, not all systems respond exactly the same. Create a misfire to see the exact waveform response on the system on which you’re working.

Lastly, in the first image last month I compared the exhaust pulse to the MAP sensor (intake pulses). When I created the misfire I did not include the MAP sensor trace. Keep in mind that the MAP/vacuum pulses are likely to remain normal during a misfire event related to fuel or ignition. An engine with a misfire is still going to...
pump the air the same as an engine in good shape. The only effect on intake vacuum from this type of misfire would be from the slight change in crankshaft speed. The MAP/vacuum pulses would be significantly affected by an engine mechanical problem.

Okay, let's discuss engine mechanical diagnostics with the exhaust probe. In Fig. 2 at right, the yellow trace is the exhaust probe and the red trace is from a Vetronix current probe hooked up to the battery positive cable. Both hookups took seconds.

The capture shows relative compression (no combustion) while the engine was cranked. I have removed one spark plug to simulate a major single-cylinder compression problem. Counting the exhaust and current humps, it almost looks like this is a five-cylinder engine. The missing compression stroke makes the effect run over and influence the reading for the next cylinder in the firing order. Note the red arrow pointing to the abnormal current hump and corresponding exhaust pulse. Anything less than humps of equal amplitude and spacing is grounds for conducting a compression test.

Generally, you can execute this test by flooring the accelerator and entering clear flood mode. However, clear flood mode does not always work; some cars may not support it, or leaking injectors could provide enough fuel to cause an engine start. If clear flood mode is not an option, you'll need to disable the ignition, the injectors or the fuel pump.

Using an exhaust probe with a scope takes practice, common sense, experience and logical follow-up testing. This tool will save you diagnostic time and improve your diagnostic accuracy.