

# The Alternative Line

by Joe Holzer for Publication in CNY-PCA Redline Report Copyright 2010 <http://www.holzerent.com>

## Technology – What’s Right, What’s Wrong, and What’s Weird

How many of you dear readers know anything about “fly by wire” technology? First applied to the aircraft industry, it has been adapted to cars since the mid 90’s, beginning with the upscale models. Today it is hard to find a car which does not utilize the method. The term was coined as a descriptor for replacing direct human control over flight surface mechanisms with those controlled by computers. Are you aware, for example, that the B1 Stealth Bomber would fall from the sky from instability if a human had to operate the controls, and that it is only airworthy because a computer is constantly adjusting the surfaces, like rudder (the B1 doesn’t even have one), ailerons (yes, spelled that way, instead of the more logical “airolons”), and elevators (a funny name for a horizontal plane, not to confuse you with the B1, which is usually also a horizontal plane ;-). But, as usual, I digress. You can imagine also the advantages for such technology as “fly by wire” (FBW) when you consider the aircraft of WWII vintage. It took a strong crew indeed to recover a B-17 from a dive, as the airflow against the elevators countered the forces the pilot could assert with his muscles. It was a constant problem for dive bomber pilots, and is part of why you often see a staggered tab forward of the pivot axis for the control surface – it lent counter forces to the main plane, even while exerting the desired leverage to move the aircraft trajectory.

In cars, prior to FBW, the gas pedal, steering and brake actuation were all direct linked to the drivers’ actions. Even in the case of power steering, which receives its boost pressure from a valve on the steering column which opens proportionately to the input to the steering wheel, and is well recognized by most of you I am sure when you lost that pressure and had to steer the car anyway. Keep that thought – we’ll use it later on. The gas pedal usually had a cable or mechanical linkage which directly operated the “butterfly valve” in the throat of the carburetor, or throttle body in the case of fuel injected engines. That butterfly valve acted exactly as a rudder works, except instead of trying to move the car, it restricts the flow of air into the engine, thereby reducing the work it can do, as the throttle pedal is depressed less. Power brakes and steering are more complicated, but the comparison is the same – if you lose the power, you can still stop and steer the car. So how many lawsuits do you think there were for “unintended acceleration” before we had “fly by wire”? Not many, because most drivers had experience driving when there were no power assists.

FBW in cars is actually designed to make things simpler for manufacture, provide for better fuel economy and lower emissions, and actually improve reliability. How many of you track junkies know that a fundamental test during your inspection should include checking for throttle return, a task usually done wrong by most inspectors? The proper procedure, instead of the typical pushing the throttle at the engine, or fast down-up on the pedal, is to push the pedal to the floor, then SLOWLY let it up and watch for any evidence of binding at the engine end, rejecting if any is found. Think about it – how often even on the track do you apply ONLY on-off pressure to the throttle? Almost all driving involves an analog (sliding scale) rather than a binary (on-off) application of all controls, and it is in that small motion area where sticking usually occurs. So you can see the problem. FBW, called “Drive By Wire” (DBW) in cars puts all that mechanism at the point it is needed, using electrical motor inputs called “servos”, thereby making only one mechanical point of sticking possible, while adding only the likelihood of electrical failure – a net reduction in failure exposure. And in the case of electric power steering, reduces energy consumption and adds reliability. Or so Toyota thought.

Those of us who are shade-tree mechanics are frustrated at these things. How, for example, do I test a throttle return which doesn’t move in any way unless the car is running, and must therefore race to redline and slowly drop down as the pedal is released. Add to that the concept of a Hybrid with kinetic energy recovery braking and you can see the complexity. Your typical Porsche has a pretty straight-forward braking system – you push the pedal which presses a master cylinder piston to push fluid to the brake calipers, which presses the brake pads against the rotors (sorry you drum brake people ;-). The kinetic energy of car motion is converted to heat in the friction between the rotor and the brake pads, thereby decelerating you. A Hybrid, on the other hand, can actually use the energy to convert it back to usable electricity, by converting the drive motor to a generator, by effectively reversing the polarity when the brake is applied. There are limits, though. The energy which can be recovered is less than that which moved the car in the first place, and the recovery rate is limited by the size of the motor/generator and the battery charge rate limits. So engineers have to design systems which work in parallel – under light braking try to recover the max possible before applying frictional braking which is energy lost as heat. That itself is conceivably not difficult – have the master cylinder piston travel further before actually applying hydraulic pressure (it is done by moving the fluid makeup hole slightly forward from its normal position, which simply causes more free travel of the brake pedal than in normal cars), but in order to regulate the braking by the motor/generator, there must be a variable field current in the motor/generator which regulates the rate of kinetic energy absorption/conversion to electricity. That adds a level of complexity, as well as increasing the possible failure modes.

So what has this to do with Porsche? Well, in case you have not noticed, even Porsche has felt compelled to jump on the hybrid bandwagon. Their first example is actually an add-on to the transmission in the Cayenne, which also involved moving some functions normally found on the front of the engine (like power steering and brake boost, as well as AC) so they could run on the electric system when the engine de-coupled. All of which adds further to the complexity and likelihood of failure mode. But, as anyone who owns a 997 can attest, you don't need it to be a hybrid to be incomprehensible by the shade tree mechanic.

The Toyota problems have been manipulated by a frenzied media and the world of ambulance chasing misery exploiters. They have been exacerbated by people who think nothing of getting behind the wheel of a two ton lethal weapon and firing up the text messaging without ever bothering to read the owner's manual. Nor to get even the most rudimentary understanding of what to do when everything doesn't go exactly as it always did from their reliable Toyota. In fact, Toyota did such a remarkable job on so many fronts that it has become the stick by which EVERYTHING has come to be measured. That Mr. Toyoda would cry as he apologized for the problems is more indicative of his integrity, which is sorely lacking in the bankers who caused the financial crisis I note, that anything else I can imagine. Ask Skip, your dear editor, how many apologies he ever received from his various Alfa or Brit car makers over the years for the absolutely atrocious quality control those "classics" exhibited. Yet he somehow came to love those cars, and misses them now. How easily memories of the bad manage to self-erase. It's like surviving a divorce or loss of a job.

But far from running away from Toyota as seems to be some cases, I would be trying to buy whatever car I needed today with the double ovoid emblem on the hood. Because, seemingly unlike so many other buyers of Toyotas (or any other car), I know that the brakes will stop any car at more than ten times the possible acceleration rate from their engine, even if the power boost breaks as well. And the best fix for unintended acceleration (if any such thing actually exists – see 1980's Audi) is to shut it off, which with the push-button ignition doesn't even lock up the steering. However, you need to read the manual to discover that you have to hold the button for three to five seconds to prevent unintended shutdowns, which is why so few people actually knew THAT.

I have my own example of technology awry; my main server (mini tower desktop computer) had its \$20 power supply lose its fan voltage, but not its CPU voltage. Which fried the motherboard/CPU. Rather than try to fix that, I assumed (break that word up and you will see MY problem immediately ;-)) I could buy a new motherboard just as I had in the past, and swap that out to get faster speed. Just a second, boy. Between then and now HDD devices migrated from IDE/ATA100 to SATA. Meanwhile, though, DVD writers are still mostly IDE. Since I wanted to avoid the need for a lot of added hardware, I wanted a motherboard which had all the normal I/O like USB, Ethernet, parallel (for my older printers) and serial ports, plus onboard video and audio. I found one, it arrived, and I immediately realized that it had only ONE IDE channel. But since all my HDD and DVD are IDE, I needed to adapt them. One more variable and delay. Then I discovered that my existing memory would not work and I needed DDR TWO. So more wait. Finally I got it all together, and it crashed. A call to the seller was met with "call the manufacturer". So much for customer service. The manufacturer's techs were also less than all aware of issues, because it took me to the third person to discover the real problem and fix.

My OEM recovery disk had XP Home. Unknown to me was that Bill Gates decided that all his customers were probably criminals, so he made it check that the motherboard was always the same, because he knows that things are fixed once they are used the first time, right? Right... But I could get around that by using my XP Pro setup. Unfortunately as I learned MUCH later, my XP Pro preceded SP 2 (Service Pak 2) only slightly, for which the OEM maker had supplied a separate CD with the SP2 to install, which also unfortunately needed to be on the setup disk to prevent the crashes I continued to experience no matter what I did. Thankfully, I was finally able to get a tech at the motherboard maker who knew what he was about, and he explained the PCI.SYS problem to me which was fixed with SP2, but was required for the new motherboards. Thankfully he had a workaround, called 'slipstreaming", and thanks to him I now have an XP Pro with SP3 on the same CD, which worked like a charm. Except that it was still locked on my drives, meaning they had to have the XP Pro overwrite the XP Home, which wiped the prior registry, effectively making unrecoverable about half my earlier apps. Thanks Mockro\$oft, you protected me from... what? If someone steals the computer, they can reformat the drives to use anywhere else. And the data is not locked either, as they can be put in a \$19 USB enclosure and read as though they were purchased for the purpose! So much for the concept of value to the customer instead of Mockro\$oft.

It is sometimes hard to believe I actually KNOW anything! Technology. Who can keep up??

