The Alternative Line

by Joe Holzer for Publication in CNY-PCA Redline Report

Travel Power II

Last time we considered AC voltages as used for stationary electricity. If you have been on a cruise ship, or have an RV, you may have noticed the ability to have a wall outlet and use your appliances even while moving. Yet most of these do not have a very long extension cord to the NiMo grid. There are two ways to achieve this Mobile Power capability: a generator which makes a similar sine wave voltage as that found in your house wall sockets, or an "inverter". These create what is referred to as a "modified sine wave", what is really a fast On-Off function to build "blocks" of power which approximate a sine wave. This is the most frequent "quiet" device found. For almost all AC devices this is perfectly usable, but will create a very high frequency buzz in magnetic devices (motors, transformers, etc) which will only be perceptible to the most finely tuned ear. Probably not for any of those of us who've heard motorcycles lately.

That inverter works by taking the DC from the car (typically) battery, and by electronic switching and a transformer, boosts the small (typically 12 VDC) battery voltage to a higher (typically 120 VDC) by rapidly reversing the voltage polarity, then re-assembling to make the modified wave form. That 10x ratio is important, especially to explain what is currently being planned in the automotive electric world. Ohm's law says that V=IR. I is current, expressed in Amps, and R is resistance, also called impedance, expressed in Ohms. Simply put, for the same relative load, or POWER usage, as V increases, I decreases. But the limiting factor for a given cross section of wire is current, pretty much no matter the voltage, until it gets high enough to jump across the air or insulation barrier. You have seen this if your ignition wires get wet, or if you have ever looked at the spark jump in a sparkplug. That is why utilities step the voltage up to multiple thousands of volts to carry for their long distance transmission, say from their powerplant to your neighborhood, where they then step it back down for your usage. The advantage is the greatly reduced costs for the wire to carry the power, but that requires the large wire spacing and ringed insulators you see on big power towers. And what makes them dangerous.

Bio testing has shown that voltages applied to your body below 60 V are unlikely to kill you, even if they can cause severe burns. So, in the interests of reducing weight and costs (including legal), the auto industry has fixed on 42 VDC to become the new standard to replace the current 12 VDC, which will reduce current load by the same 3.5x factor. So, for example, where a 10 ga. wire was needed to run the blower in your car, and it would get hot, an 18 ga. wire will do the job with plenty of safety. For those of us "old geezers" who recall cars as originally using 6 VDC, there will be a similar "transition" period during which "point-of-use" step-down adapters will be needed for use of aftermarket devices, like radios, cellphones, etc., which are currently all spec'd for 12 VDC. But you can rest assured those devices will ultimately be sold in the 42 VDC spec, just as car radios eventually changed to 12 VDC.

However, there WILL be a downside, which we here in CNY and the "saltbelt" will recognize well. As wire sizes are reduced, their susceptibility to corrosion goes up. There will be offsetting technologies to help some, such as optical cable bus. That is "message carrier", which will use electronics at each point of use to switch on and off by instruction instead of the current independent wiring, and use a single "power" bus going to all devices equally. So, for example, one copper wire will go to the back of the vehicle, as will one glass-fiber communications bus. There, an encoded bit set will be recognized by a taillight as telling it to turn on, say for example when you apply the brake, and another instruction will tell it to turn off later when you stop braking. This also offers some unique capabilities, as for example that same bus pair could be used for return signals, say from a rear radar, which would tell how far the following vehicle was and its approach rate. Your travel speed and decel rate would also be on the bus aimed at another device like your speedometer. But it could be usable by a host of others. So a computer might instruct the bus to rapidly flash your lights to warn the following driver. And (Orwellian though it might sound), even reduce your decel rate to avoid the collision if it senses you have more room in front of you, by letting up on your brakes via the ABS system.

Another advantage of the increase to 42 VDC is that the car's alternator and battery can be made smaller. The battery will simply have a lot more cells than the current six; twenty one if lead-acid continues, but NiMH is also a real possibility, or even Lithium Ion like most notebook computer applications. You could also expect to see things like power steering use only electrics as a cost and weight reduction. Those changes might actually add reliability for most users, but again corrosion will be a problem for us. Oh well.