Brainstorm: Automotive Electronics

Edited by Jason Lomberg

How can we increase the commercial viability of advanced technology vehicles?

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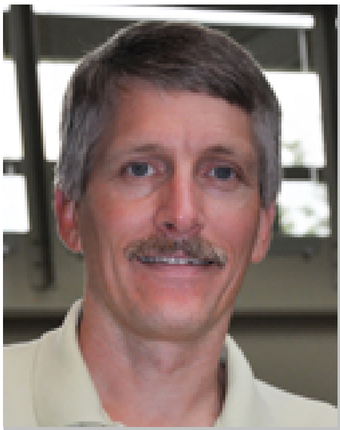
Automotive companies increasingly automate tasks, such as distance detection, crash avoidance, and anti-skid steering, that inch the high-end automotive toward avionics fly-by-wire capabilities. For the avionics community to achieve its comparatively gold-star safety record, avionics OEMs ensure their software systems meet stringent DO-178B standards. Developers must prove that each and every line of code can be bidirectionally traced from requirement through the pass/fail of specific tests. No line of code can remain that does not rise from a requirement, has not been tested, and is not proven to do what it was intended to do.

Despite this level of stringent control, a jet flying from Brazil to France in 2009 crashed into the Atlantic Ocean. Why? Based on initial investigations, it appears that exaggerated weather conditions caused the autopilot to overcorrect, resulting in the crash. As a result, the FAA has narrowed the weather conditions in which autopilot can be used.

The automotive community has always argued that they don’t have profit margins that allow for such stringent testing, while continuously moving more capabilities into uncertified software. Imagine a full-fledged, drive-by-wire scenario in which your vehicle instantly recognizes my vehicle is applying the brakes to turn left at the next intersection. Clearly, your vehicle will instantly respond, slowing your vehicle to ensure you don’t drive into me because it—unlike you—hasn’t had a fight with the wife, isn’t texting your first meeting to tell them you’re late, isn’t hung over, etc.

Now, imagine that same scenario a multitude of cities over in which a network problem occurs because GM, Ford, Toyota, Porsche, and all the others like them chose not to follow stringent programming and certification standards. The number of deaths from such a network glitch would far outweigh the catastrophes of a plane going down. It’s pretty obvious that if commercialization of advanced vehicular technology takes place, the necessary systemic checks must also be in place. It’s the only way to go.


Peter Riendeau, Melexis, www.melexis.com [2]

Increasing the viability of advanced technology vehicles will only occur by education and marketing directed at the average consumer. The hybrid vehicle has achieved a measure of success not due to fundamental economics, but rather the ‘hip’ factor. The air bag, anti-lock brakes and other safety technologies required public awareness well before reaching ubiquity. Consumers anticipate long service life from their vehicles and are conservative regarding new technology. Targeting highly visible early adopters, like celebrities and public figures and popular consumer events that reinforce new technology as both hip and reliable are key factors leading to widespread acceptance.

Advanced electric, fuel cell and alternative fuel vehicles need to reach the tipping point before consumers will commit their hard earned income and feel confident that after five years this technology will still efficiently transport them on their daily rounds. Other advanced technologies like night vision systems, traction control, integrated infotainment and navigation systems must appeal not only on initial purchase, but also be relevant and demonstrably beneficial at years 3,5 or even 10 of the vehicle’s lifecycle. These lofty hurdles doubtlessly explain the maddeningly difficult task of creating inflection point technology that expedites change in the automotive marketplace.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The commercial viability of advanced technology vehicles, such as hybrid and electric vehicles(HEV/EV) will come about when the cost, convenience and reliability aspects have been addressed.

The cost of advanced vehicles is driven by the relatively immature technology of the drive train power electronics alongside low production volumes, which are not yet sufficient for the cost reductions seen in mainstream automotive volumes. The costs will also drop as circuit designs and drive methodologies advance with further integration of power and control, the adoption of high temperature wide bad gap semiconductors such as Silicon Carbide (SiC)and innovative semiconductor packaging concepts.

The high temperature capabilities of SiC will enablea reduction in the size of the power electronics and an increase in power density and switching frequency, facilitating the removal of separate under bonnet cooling systems in the vehicle. Higher operating temperatures can accelerate component failure so there needs to be a drive towards more reliable systems focussing on the power electronics packaging and the elimination of failure mechanisms.

Further, without access to the necessary charging infrastructure, whether home, city or highway based, growth and commercial success of HEV/EVs will be held back.

Links:
[1] http://www.ldra.com
[2] http://www.melexis.com
[3] http://www.ttelectronics.com