WIND

Lessons from Driving on Mars

How Autonomous Vehicles Are Disrupting Automotive Manufacturing

WHEN IT MATTERS, IT RUNS ON WIND RIVER

EXECUTIVE SUMMARY

Parallels between the aerospace and automotive industries illustrate the importance of relying on new kinds of experts to meet the challenges in developing autonomous driving systems.

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GOOGLE, NASA, AND AUTONOMOUS VEHICLES

If the conversation around your office coffee machine turned to talk of self-driving vehicles, most likely the first company you'd think of is Google. Whether you are for or against the basic concept of a self-driving car, Google has been keen to point out that its primary goal is to dramatically reduce the number of traffic accident deaths and injuries. In the U.S., 94% of vehicle accidents are caused by human error, so removing the human aspect of driving certainly seems a logical step.

But away from planet Earth, one of the most famous self-driving vehicles is NASA's Mars Science Laboratory rover Curiosity, which landed on the red planet's surface in 2012. Most readers may understand the simple principles behind how an autonomous vehicle works, but making it actually happen is a different matter—especially when the vehicle in question will be used 225 million kilometers away. VxWorks®, the Wind River® real-time operating system (RTOS), powers the Curiosity rover and was responsible for the completely automated landing on Mars.

Building the Curiosity rover was not only a major engineering feat; it also demanded huge changes in the way such a vehicle is designed and in the combination of the many engineering disciplines involved. These organizational and structural changes are now having a profound effect on the way that key automotive manufacturers and original equipment manufacturers (OEMs) are moving forward with their own autonomous driving platforms. Given the need for complex and intelligent software to support mission-critical systems (whether it be the Mars rover or a connected car), there are definite parallels between the aerospace and automotive realms, and automotive companies can learn much from the A&D industry.

A DIFFERENT APPROACH

Google, like NASA, had no previous experience designing an autonomous vehicle, so the company approached its autonomous vehicle completely differently from the way a major automotive brand, with its own legacy engineering management disciplines, would. Both Google and NASA recognized the importance of building engineering teams possessing broad expertise, and involved technology experts from academia, specialists from Silicon Valley, disruptive thinkers, and a wide cross section from their industry partners and supply chain.

Why? One salient reason is that autonomy requires intelligence, and the basics of a learning machine are grounded in complex algorithms. People who specialize in these subjects and who are responsible for such innovative thinking are more abundant in academia and innovation-led OEMs than in the discipline-based hierarchical structures inside an automobile manufacturer. Such traditional, stove-piped engineering teams have typically needed to operate within a black-box approach to designing electronics systems, rather than taking a completely different, system-wide view. As Conway's law states, organizations that design systems become constrained to produce designs that typify the communication structures of these organizations.

EVOLVING COMPUTE IN THE VEHICLE

Advanced driver assistance systems (ADAS) are already credited with bringing a new level of high-performance computing into the vehicle. Many advances in computer science and pattern recognition have brought a level of compute power never before seen in a vehicle and, in turn, have enabled limited levels of autonomy. New services such as V2X and C2X will continue to stretch the industry's skill base, resulting in a shake-up of the whole business model.

NEW PARTNERS FOR NEW CHALLENGES

It is no surprise, therefore, that many of the leading automotive manufacturers are now taking bold steps to reshape their design engineering supply chains as well as establish commercial agreements with IT system integrators, academia, and cloud service providers. For example, BMW recently signed a three-year research contract with Loughborough University in the UK to report on how humans interface with their cars.[1] The university has a long track record of collaboration with automotive companies such as Jaguar, Land Rover, Rolls Royce, and Ford. And a report from management consulting firm McKinsey forecast that the major automakers need to face up to decisions about autonomous vehicles within the next two to three years or face becoming a late adopter.[2]

As automotive manufacturers and their partners advance in their thinking, so will the depth of autonomous systems. Tackling challenges such as the differences between day and night time navigation, more natural voice recognition, and creating a fail-safe infrastructure will gradually start eliminating some of the barriers to consumer adoption and volume production. The cost of putting such supercomputer power into a space-constrained and harsh environment will also need to be addressed, not to mention the need for engine control unit (ECU) consolidation, fast networking topologies, and less dependence on reliable wireless communication.

CONCLUSION

The automotive industry is undergoing an unprecedented amount of change. Viewed by many as the last of the "old guard" of traditional manufacturing, the industry must rapidly adapt. But the changes it makes will also have a profound effect across many other associated services, such as those of motor insurance, vehicle service, and after-market equipment suppliers. Given the increasing demands and complexities around automotive software, auto companies will need to continue to lean on the right experts to take them to the next level.

1 "New research with BMW Group to look at the future of human-car interfaces," Loughborough University.

www.lboro.ac.uk/departments/sbe/news/articles/2015/new-research-with-bmw-group-to-look-at-the-future-of-human-car-interface.html

2 Michele Bertoncello and Dominik Wee, "Ten ways autonomous driving could redefine the automotive world," Insights & Publications, McKinsey & Company.

www.mckinsey.com/insights/automotive_and_assembly/ten_ways_autonomous_driving_could_redefine_the_automotive_world