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Who's On Top?
THE ULTIMATE 2009 GUIDE TO THE LEADERSHIP AT GENERAL MOTORS, FORD, AND CHRYSLER
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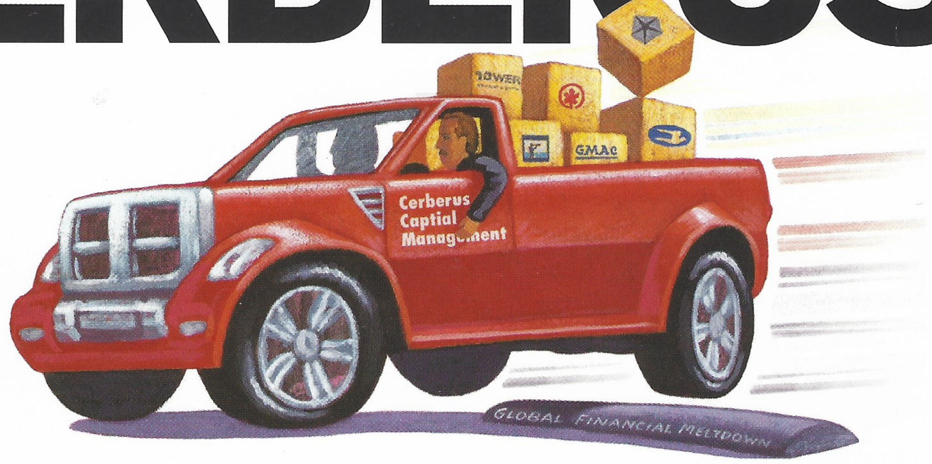
WHAT DRIVES CERBERUS?



Chrysler is the best-known company within Stephen Feinberg's global empire, which spans from banking to real estate, and aviation to financial services. Plus, an exclusive Cerberus revenue chart totaling more than $100B.

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OFF ROAD The Chevy Tahoe was the second autonomous vehicle to cross the finish line in a recent race, but it won the overall competition, thanks to its record time.

COURTESY OF GM

The Great Race

AUTOMAKERS, RESEARCHERS, AND UNIVERSITIES ARE RACING FULL STEAM AHEAD TO PERFECT AUTONOMOUS VEHICLES

BY GARY WITZENBURG

The green flag flew at sunrise, and the race was on. Eleven assorted vehicles started, one by one, onto a complex urban course set up on a former U.S. Air Force base in Victorville, Calif. Thirty more cars took the course to increase traffic density as thousands watched from the sidelines and on the Internet.

The 11 vehicles negotiated 60 miles of simulated urban driving, complete with intersections, but without drivers. They merged, passed, parked, and dodged heavy traffic, including each other, as quickly as they safely could. One lost control and stopped just short of an old commissary building. Another pulled into a carport and quit. Two traded paint trying to occupy the same lane at the same time.

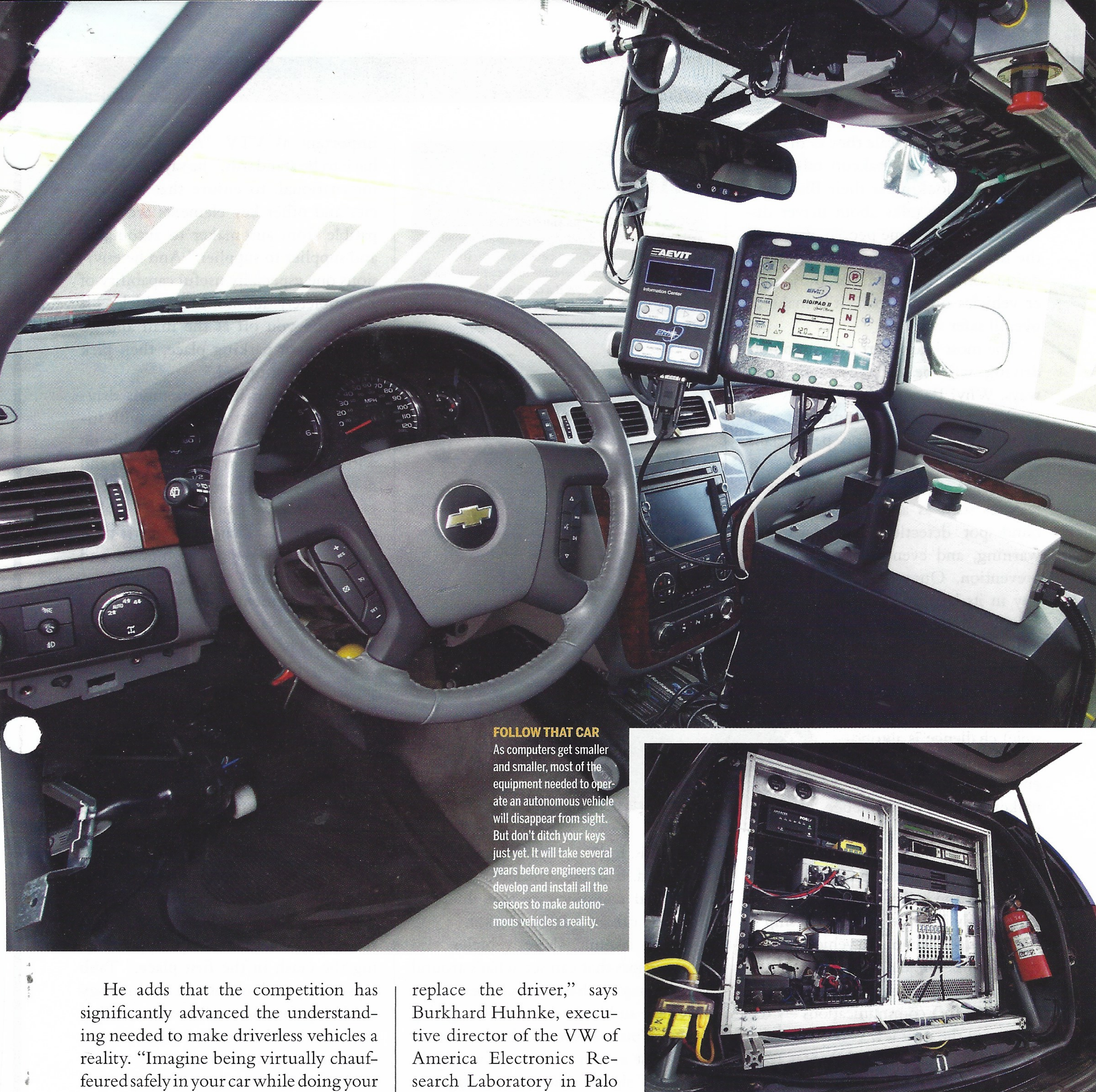
"Junior," Stanford University's Volkswagen wagon, crossed the finish line first after just over four hours. Tartan Racing's GM/Carnegie Mellon-sponsored "Boss," a dark Chevy Tahoe, finished a minute later, followed eventually by just four of the 11 starters. But since the Boss had started 20 minutes after Junior, it was declared the $2 million first-prize winner. Second-place VW/Stanford took home a cool $1 million, and the third-place prize of $500,000 went to Virginia Tech's Cadillac SRX.

Each entry was a computer-controlled robot bristling with radars, lasers, cameras, and electro-mechanical actuators, all of which required a large team to develop and operate. The winning Tartan team was supported by Continental AG, Intel, Google, Applanix, TeleAtlas, Vector, Ibeo, Mobileye, CarSim, Clean-Power Resources, M/A-COM, NetApp, Vector, CANtech, and Hewlett Packard (in addition to General Motors and Carnegie Mellon University).

The Defense Advanced Research Projects Agency (DARPA), the research-and-development arm of the U.S. Defense Department, sanctioned this "Grand Challenge," the third in a series. Of the 15 entries that attempted a 142-mile desert course in the 2004 initial competition, exactly zero finished. In 2005, four completed a 132-mile desert route under the required 10-hour limit, and Stanford's VW Touareg won the $2 million.

Why autonomous? As part of its 2001 National Defense Authorization Act, Congress decreed that "it shall be a goal of the Armed Forces to achieve the fielding of unmanned, remotely controlled technology such that … by 2015, one-third of the operational ground-combat vehicles are unmanned." DARPA's goal in support of that mandate is to develop technology that can execute military supply missions, for example, without human drivers.

But autonomous driving, and the technologies that may someday make it possible, also hold enormous possibilities for automakers and the driving public. "Imagine a world where there are no car crashes and very little traffic congestion," suggests Larry Burns, GM's vice president of research and development and strategic planning. "We're actively developing cars that can drive themselves, and the DARPA Urban Challenge provides an excellent opportunity to demonstrate our progress."



FOLLOW THAT CAR
As computers get smaller and smaller, most of the equipment needed to operate an autonomous vehicle will disappear from sight. But don't ditch your keys just yet. It will take several years before engineers can develop and install all the sensors to make autonomous vehicles a reality.

He adds that the competition has significantly advanced the understanding needed to make driverless vehicles a reality. "Imagine being virtually chauffeured safely in your car while doing your e-mail, eating breakfast, and watching the news," Burns says. "The technology in the Boss (named after GM Research founder Charles F. "Boss" Kettering) is a steppingstone toward delivering this type of convenience."

The research effort is not meant to deny people who enjoy the act of driving or who don't trust a vehicle computer to get them from Point A to Point B. "While fully autonomous driving may be a possibility for the future, it's not Volkswagen's intent to replace the driver," says Burkhard Huhnke, executive director of the VW of America Electronics Research Laboratory in Palo Alto, Calif. "By pursuing a stretch goal, such as an autonomously driven vehicle," he adds, "we're able to advance certain aspects that will be of use in more conventional and current driver-assistance and safety systems." To further that end, VW of America recently announced a $5.75-million contribution to create a Volkswagen Automotive Innovation Lab (VAIL) on Stanford's campus.

Not to be upstaged, GM announced the establishment last June of an Autonomous Driving Collaborative Research Lab at Carnegie Mellon's Pittsburgh campus under a new five-year, $5-million agreement. "We have a shared vision of developing technologies that have the potential to resolve transportation challenges," says Alan Taub, GM's executive director for research and development.

Taub says that too many drivers aren't paying attention, anyway. "Look around when you drive at what some people are doing while they're driving. They're putting on makeup, talking on the phone, looking at their BlackBerries. Everyone talks about driver distraction, but to some people, driving *is* the distraction. They would rather be doing something else. For those other vehicles on the road, it'll make an overall safer world."

The most likely start of autonomous driving will be limited-access highways. Why? Because the necessary lane markings are clear and consistent, and, presumably, there are no pedestrians. Some drivers already have access to early stages of autonomous driving with features such as active cruise control, blind-spot detection, lane-departure warning, and even lane-departure prevention. Once a vehicle can stay in its lane and maintain its spacing from the vehicle ahead on the freeway, it can almost drive itself.

But the most difficult (some might say impossible) challenge is autonomous driving in an urban environment, which is what makes DARPA's challenge so intriguing. "That is a real stretch play," Taub says.

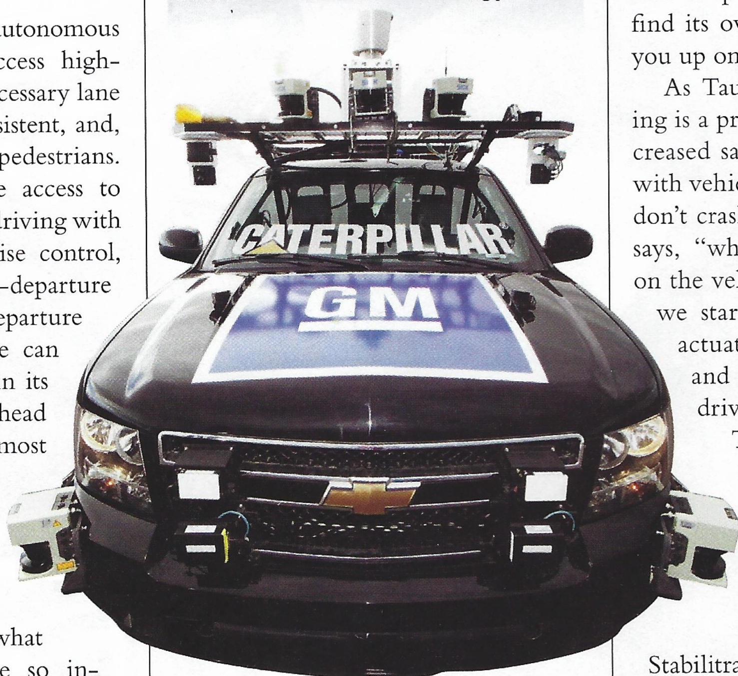
Still, GM is quite serious about autonomous and believes it's in the driver's seat, largely because of its leadership in telematics connections to vehicles, which it markets as OnStar. Taub says the next critically important step — vehicle-to-vehicle (VTV) communications — will roll out in the next few years. "We're on our eighth generation of OnStar technology," he says, "and VTV communications capability is built right into that same board with OnStar."

But what good is VTV communication if only a small number of the newest vehicles have it? "The fleet turns over in 10 years," Taub notes, "and we could speed it up with aftermarket transponders. We've recently demonstrated that we can do a VTV aftermarket kit."

He does paint an appealing safety scenario: "Imagine you have a fleet of vehicles rolling down the road. Each one has a GPS and a map, so it knows precisely where it is. Each one knows its trajectory and speed. If all the vehicles talk to each other and communicate that information, you can get relative motion.

Blind Spots

Getting autonomous cars and trucks out of the lab and on the open road will require a sophisticated vehicle-to-vehicle communication system. The equipment would allow vehicles to essentially talk to one another. For example, if a car five vehicles ahead suddenly brakes, a common set of sensors will alert the other vehicles to slow down accordingly.



ESY OF GM

"Let's assume these vehicles also have sensors that can see what's around them. Imagine that, five vehicles ahead, a vehicle suddenly does an emergency brake. Your sensors can't see that in time, just as you as a driver wouldn't. But if a signal that says 'emergency braking ahead' is instantly sent back to all the trailing vehicles, they're all able to stop in time instead of maybe having a big pile-up. We've demonstrated this, it's robust, and it gets there in time. We see a future where we augment on-board sensors with VTV communication. Then, long-term, once it's on virtually all vehicles, it starts to eliminate the sensors."

Auto consultant Jim Hall, managing director of 2953 Analytics in Birmingham, points out that vehicle-to-base communication may ultimately be as important as VTV. "And there will have to be standards," he says, "perhaps international, to ensure that frequencies and other key elements are compatible from automaker to automaker and supplier to supplier." And he envisions one especially useful capability of a completely autonomous vehicle: "It will drop you off at the mall and go find its own parking place, then pick you up on command."

As Taub sees it, autonomous driving is a progression that starts with increased safety and eventually ends up with vehicles that drive themselves and don't crash. "The journey started," he says, "when we put anti-lock brakes on the vehicle. That was the first time we started having a computer and actuators and sensors taking over and augmenting what the human driver was doing."

Then it progressed from ABS to stability control — not only managing the braking, but also using the engine and transmission to achieve greater stability. GM is now launching its third-generation Stabilitrac III system, which begins to use steering, as well, to aid stability.

"We're moving from a world where you assume the vehicle is going to crash and do everything you can in passive safety to make it safer, to one where we're also focusing on preventing the crash in the first place," Taub says. "If you look at the technology road map for moving toward avoiding crashes, the elements of that intersect very nicely with autonomous."

As each element gets developed, he adds, "We'll do things to make it easier on the driver. You already see some vehicles that will park themselves, but the key is that the same technologies that enable self-parking allow us eventually to have vehicles that can avoid collisions. So we have two road maps running in parallel — active safety and autonomous driving — enabled by the same technologies. We're marching [toward] a world where the driver eventually can do other things and, at the same time, [toward] vehicles that won't crash." **db**