

Case study: The Defense Advanced Research Projects Agency (DARPA)

The Defense Advanced Research Projects Agency (DARPA) held its third Grand Challenge competition on November 3, 2007. The DARPA Urban Challenge features autonomous ground vehicles executing simulated military supply missions safely and effectively in a mock urban area. Safe operation in traffic is essential to U.S. military plans to use autonomous ground vehicles to conduct important missions. DARPA awarded prizes for the top three autonomous ground vehicles.

The Challenge

The challenge was to build an autonomous vehicle that could not only move through a mock urban environment - negotiating busy intersections and merging into traffic - but also interpret and obey traffic signals and avoid moving obstacles. DARPA 2007 originated from the Pentagon's mandate that one-third of the military's ground combat vehicles be unmanned by 2015 and was the most realistic operational challenge to date for autonomous vehicles.

The Solution

With a challenging environment containing numerous dynamic obstacles and a host of other impediments, success at DARPA relied heavily on the reliability and accuracy of pose (positioning and orientation estimation). The Applanix POS LV system is the established industry leader in generating precise, robust positioning and orientation information for mobile data acquisition systems. The POS LV delivers top results because it not only guides vehicles physically but also helps them perceive their environment and respond to it. Designed to operate under the most difficult GPS conditions found in urban and suburban environments, POS LV enables accurate positioning for road geometry, road surveying, vehicle dynamics, as well as GIS database and asset management.

The Results: Top Finishers Chose Applanix

The Applanix POS LV system was an integral component of the top finishing teams including the top two finishers: Carnegie Mellon and Stanford University. In all, Applanix POS LV was chosen by:

- 10 of the 36 cars that reached the qualifying round
- 5 of the 11 teams in the Urban Challenge Race
- 3 of the six vehicles to finish the course
- the top 2 finishers

"We consider Applanix to be the market leader in this field. Their technology is just very, very precise. It gives us a fantastic estimation of where our vehicle is," said Sebastian Thrun, Professor, Stanford University.

Accurate and reliable position and orientation data was a fundamental ingredient of the winning autonomous vehicle guidance and control systems. The Urban Grand Challenge demonstrated that even small errors in pose estimation can lead to erroneous terrain characterization and significantly reduce vehicle performance. Applanix POS LV data accuracy proved to be essential in winning the race.

Image 1: Carnegie Mellon's Chevy Tahoe with POS LV on-board - Winner of the 2007 DARPA Urban Challenge



Image 2: Stanford University's Passat Wagon came in second, thanks to POS LV and an array of Sensor equipment



Image 3: Both Carnegie Mellon and Stanford at the starting line



Image 4: Carnegie Mellon crosses the finish line - remember no drivers are inside the vehicle



Image 5: Stanford finishes a close second

