Directions 2006

Our Visionaries:

System Design
Raymond Swider is program analyst for positioning, navigation, and timing in the Office of the U.S. Assistant Secretary of Defense for Networks and Information Integration. His essay adapts a plenary session address he made at the Institute of Navigation's GNSS conference in September 2005.

System Design
Vidal Ashkenazi is CEO of Nottingham Scientific Ltd., a UK-based small company which has been involved in the Galileo Program since its earliest conceptual Definition Phase. He is also a charter member of *GPS World*'s Editorial Advisory Board since 1990.

Navigation & Guidance
Per Enge is a professor of aeronautics and astronautics at Stanford University, where he is the Kleiner-Perkins, Mayfield, Sequoia Capital Professor in the School of Engineering. He is the research director of the Stanford Center for Position, Navigation, and Time, and a member of the National Academy of Engineering.

Tracking & Wireless
Mario Proietti is CTO and co-founder of TechnoCom Corporation, a company enabling wireless location services and assuring their ongoing performance. He has been a member of *GPS World*'s Editorial Advisory Board since 2001.

Timing & Synchronization
Dennis Erickson is chief systems engineer with Ciber, Inc., designing advanced power system control systems and data acquisition, dissemination and analysis systems. He is an IEEE Fellow.

Military
Nicolas de Chezelles holds the rank of major general in the Délégation Générale pour l'Armement of the French Ministry of Defense. He has been active since the mid-1970's in French military navigation systems, use of space, electronic warfare, and other activities, and has been a member of *GPS World*'s Editorial Advisory Boardsince 1990.

Surveying & Mapping
Ken Alder is a professor of history, Milton H. Wilson Professor in the Humanities, and director of the Science in Human Culture Program at Northwestern University. His most recent book, *The Measure of All Things: The Seven-Year Odyssey and Hidden Error that Transformed the World*, was published by The Free Press of New York in October 2002 and by Little, Brown of London in September 2002. He gave a much longer version of the essay that appears here as a keynote address at the Trimble Users Conference, October 2005.

Each December as we close out the year, *GPS World* conducts an annual visioning exercise, attempting to peer into the mists of the future.

Along the lines of the classic business advice "Find a need and fill it," this year we asked seven leaders in diverse sectors of the GPS/GNSS community for their answers to the question "In 2006, what need should the global satellite navigation community seek to address?" Herewith what they foresee.

Our last essay comes from outside the satellite navigation community, and does not even mention GPS or GNSS, though it does recount the founding of geodesy. Read it as a parable, if you will, for this era of impending interoperability, when a tool used by scientists and engineers increasingly finds its way into the hands of consumers around the world.

Vehicle Integration Hits the Road

By Mario Proietti

GPS's role in safeguarding public safety by determining the location of wireless 911 calls is well known. Perhaps less known is another use of GPS technology we are helping to develop — the use of GPS with short-range communications to significantly improve vehicle safety.

Down the road, the use of precision GPS capabilities — within a few centimeters — will push new vehicular safety applications into a class of their own. The Vehicle Safety Communications Consortium found that the most important mid-range (deployed between years 2012 and 2016) applications will require GPS and vehicle-to-vehicle communication. Pre-crash sensing, cooperative forward-collision warning, and lane-change warning all depend on GPS's synergy with dedicated short-range communication (DSRC), and all scored at the highest level of their benefit scale. GPS will capture key data, such as position, velocity, acceleration, heading, and yaw, and DSRC will communicate data to nearby vehicles and the roadside to initiate actions and warnings when needed.

The implementation of DSRC, one of the U.S. Department of Transportation's (DoT's) initiatives for improving vehicular safety, has been in the planning stages for years. As part of the Vehicle Infrastructure Integration (VII) initiative, DSRC enables short-range, high-bandwidth communication between roadside transceivers and fast-moving vehicles and even supports vehicle-to-vehicle communication. You've likely heard about some applications of this technology, such as enhanced intersection control, safety messaging, electronic toll collection, and pre-emptive traffic control for emergency vehicles.

A marriage between GPS and DSRC creates a whole new class of applications that neither technology can offer on its own. "DSRC without GPS is pretty useless, particularly for safety applications," said Chris Wilson, VP, ITS Strategy and Programs for DaimlerChrysler Research and Technology North America Inc. Conversely, GPS needs DSRC to enable many of the new "wow" safety applications. "There is little issue with a vehicle's safety when it is on its own. It's when you add other vehicles and lamp posts to the mix that you have trouble." You need to communicate locations to make magic.

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The accuracy of conventional GPS technologies is sufficient to support new warning systems for traffic lights and stop signs. DSRC can communicate the phase of the traffic light (for example, green for 2 seconds longer) and speed and distance guidelines to approaching vehicles. A vehicle can compare the information with its position, velocity, and acceleration readings and warn its driver if appropriate. With 2,300 annual fatalities and 240,000 injuries in the United States caused by running traffic lights and stop signs, warnings could have a significant effect.

DSRC deployment faces barriers. Wilson explained the chicken and egg problem. "Vehicle manufacturers like DaimlerChrysler can put DSRC in vehicles, but it will be years before there is a significant critical mass of vehicles with which to exchange safety information." However, if the U.S. DoT deploys an infrastructure of roadside transceivers that provide an array of useful safety and traffic information, there will be immediate value to consumers who equip their cars with DSRC. DoT is working with vehicle manufacturers to develop a joint business model that gets DSRC deployed both in vehicles and along the roadside — hence the chicken and egg. The dilemma will be resolved in 2008, when the DoT and vehicle manufacturers are expected to make a decision about the viability of a deployment based on this joint commitment.

In the meantime, the U.S. Federal Communications Commission has already earmarked 75 MHz in the 5.9-GHz band for DSRC, expressly for enhancing the safety and productivity of the nation's transportation system. This allotment will lead to more immediate applications, perhaps including downloads of tunes and flicks straight from the home computer or Wi-Fi hot spots to the onboard audio/video system. These systems will encourage vehicle manufacturers to offer 802.11a/b/g, a close relative of DSRC (802.11p), in their vehicles, thus greatly defraying the costs of DSRC implementation. And with a multimedia revolution in vehicles already in full swing, the need for GPS and DSRC safety applications grows day by day.