House Committee on Oversight and Government Reform
Subcommittee on National Security and Foreign Affairs Hearing

"GPS: Can We Avoid a Gap in Service?"
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The Testimony of Mr. F. Michael Swiek, Executive Director, U.S. GPS Industry Council

Thank you Chairman Tierney, Ranking Member Flake, and distinguished members of this Subcommittee, for providing an opportunity today to discuss this important topic.

The Global Positioning System (GPS) is one of the great U.S. success stories involving a shared national asset. GPS is a national model of successfully balancing military advantage and civilian equities to serve a broad and diverse range of national interests, from national security and public safety, to enabling critical infrastructures, advancing scientific research, facilitating local government productivity, and enhancing the productivity and competitiveness of diverse industries that are important to our economy and serving millions of individual Americans every day.

GPS is a model of government-industry cooperation contributing to the national economy through the entrepreneurial creation of companies, industries and jobs deriving value for users from integrating GPS positioning, navigation, and timing information in application solutions. The initial military investment in GPS has not only met military requirements and demonstrated invaluable military utility for the warfighter; it also provided a signal for civilian use at little to no additional cost. The dedicated men and women at USAF Space Command have achieved superb operational management of the GPS constellation for all users under Air Force stewardship of GPS. This operational excellence, together with predictable U.S. policy over two decades, has given the global community a stable, reliable signal that has provided a solid foundation for tremendous private sector investments in receiver and applications innovation. The result of this enlightened U.S. approach has been the worldwide adoption of GPS as a global information utility, providing major productivity benefits to the Nation.

It is difficult to say with precision just how big the GPS industry is because it touches and contributes to so many different applications and areas in so many ways. Some recent estimates have impressive numbers such as $15-50 billion annually worldwide depending on how one counts direct and indirect effects. GPS is a core information technology for many industries that are key to the U.S. economy. Examples include agriculture, aviation, construction, vehicle navigation, fleet management, public safety, geographical information systems, land use, environmental monitoring, earthquake monitoring, wildlife monitoring, disaster management, telecommunications, E911 cell phones, mapping, mining, marine transportation, surveying, infotainment, and probably a couple of hundred additional areas or more.

More impressive than the aggregate value of U.S. or worldwide GPS industries is the effect that GPS can have on the productivity and competitiveness of key industries. GPS enhances

productivity at times as much as 30 percent through exploitation of precise positioning, navigation, and timing in value chains. It is not an exaggeration to say that GPS is everywhere, not only where we commonly and almost ubiquitously see it, such as in consumer car navigation devices. It is there, essential and critical, even where you don't realize it. Whenever you make a call on your cell phone, withdraw money from your ATM, or send an e-mail, you are using GPS. GPS precise time signals are essential tools for synchronizing the networks through which these services operate. Turn on a light, and you are probably using GPS as well, as electric power grids similarly use GPS precise time signals for synchronization and fault detection. The roads you drive on may have been built by construction equipment guided by GPS. Not only has the term "GPS" become a common term in the public lexicon, it has become an essential and critical utility on which public and private infrastructures depend.

U.S. industry has been a major factor and leader in the development of today's GPS industry through entrepreneurial vision, technological innovation, and private sector investment. But, we have not done this alone. The U.S. Government has promoted and encouraged this development by establishing, maintaining and reinforcing a stable policy framework that has consistently received farsighted and bipartisan support. It has been a true partnership of shared visions, discussions and debates, cooperation and coordination. This has been possible through the open dialogue that has taken place since the early days of GPS, some 25 plus years ago, between civilian and military, industry and government on technical and policy issues as the technology, system and applications have evolved.

As we move forward to new generations of GPS satellites and signals, the challenge is to maintain this impressive level of reliability and stability. Successful adoption of modernized civilian GPS signals will occur if the installed user base can continue to trust the consistent and stable policy framework that the U.S. Government has provided for GPS for two decades. The new signals will need to sustain the legacy of accuracy, availability, and reliability established over the past twenty years. The adoption of GPS is a testament to the trust of users in Air Force stewardship. Users rely on the ability of the Air Force to operate and maintain the satellite constellation and stable signal structures that serves the warfighter and diverse civilian users in a way that enhances both our national and economic security. We strongly encourage the continuation of the open and balanced dialogue between all stakeholders; users and providers, civilian and military, industry and government. Our industry association strives to be an objective information resource to support that dialog.

Thank you. I would be happy to answer any questions you might have.

COMMERCIAL GPS APPLICATION EXAMPLES

The following examples of GPS applications provide user testimony that describes their decision metrics (e.g., productivity gains, return on investment and timeframe) to invest in and use commercial and consumer GPS products:

Precision Survey:

- **California:** The Bay Bridge replacement project benefited from precision GPS and optical technologies. The new 6,500-ton, 350-foot section of the San Francisco-Oakland Bay Bridge, used precision GPS to "retrofit-by-replacement" an opening in the existing bridge. One of the busiest bridges in the U.S. was shut down on August 31, 2007 at 8:00 pm and seventy hours later—11 hours ahead of schedule—the bridge was reopened.

- **Chicago, Illinois**: Rebuilding the Dan Ryan:
  - One of the busiest expressways in the U.S., Chicago's 14.5-km Dan Ryan Expressway underwent complete reconstruction from 2005 to 2007. The largest expressway rebuild in Chicago history, the massive $975-million project stayed on its swift three-year timeline by utilizing the latest GPS-based surveying, 3D data modeling, and machine control technology.
  - Divided into five sections, the project was a model of efficiency, quality control and productivity. By the end of 2007, the rebuilt road included several new lanes, reconfigured ramps, a new interchange, and enhanced lighting and sewers. The reconstructed Dan Ryan is safer, wider, more durable and easier to access.
  - The project's sections were connected through a precise control network. Set by the engineering companies using GPS-based systems, the control network covered 12,950 km2 and facilitated project coordination. In addition, the local precision GPS network was used by project surveyors who wanted to connect to the network without any base station.
  - For earthwork and construction, the general contractor and subcontractor used GPS grade control equipment, real-time precision GPS surveying systems and optical total stations. With grading, slope and actual position information inside the cab, they could run machine crews around the clock, greatly increasing productivity, minimizing errors and streamlining costs. They estimated that by project end about a million cubic yards of dirt was moved.
  - The earthwork crews were connected to the larger project through a 3D road model calibrated to the precision GPS network. The road model was downloaded in real time into the GPS-based control equipment and calibrated to within 9 mm tolerance.
  - Using that same 3D road model, the survey subcontractor's four crews utilized GPS rovers and total stations to set over 91,440 linear m of construction survey layout, as well as perform other tasks. The road model allowed the crews to work quickly and accurately, keeping up with around-the-clock schedule.
  - The Dan Ryan's fast pace and high accuracy requirements highlight how GPS-based technology helps connect the jobsite for greater efficiency, accuracy, and productivity.

Precision Agriculture:

Small growers to agri-business throughout the U.S. and worldwide use high precision GPS products in every step throughout the growing process.

- **Nebraska:** precision GPS network expands to meet increasing demand for +/- one inch repeatable accuracy:
  - In 2004, a company operating this precision network added capacity to meet fast growing customer demand for +/- one inch repeatable accuracy of precision GPS autopilot systems for farm equipment use in precision applications
  - In 2006, this company expanded capacity to serve 35 customers throughout their trade area
  - Some of the precision network signals are reliable as far as 12 miles from the transmitter (serving about 129,000 to 163,000 acres).
    - "The customer may move the precision GPS receiver to different machines throughout the year" according to the company president.

- **Illinois** corn growers see big payback on precision GPS steering systems:
  - This corn grower raises about 3,000 tillable acres of corn and soy beans. "These precision GPS systems save us $17,000 per year in fuel, labor, and repairs. At the same time, they increase our income by $54,000 each year due to less compaction, precise placement of seed over strip-tilled fertilizer, plus increased productivity and timeliness of planting and harvest operations. And those savings are based on $2.50 per bushel of corn and $2.50 per gallon of diesel fuel."
  - "These reduced costs and extra income from precision GPS products are repeatable—they happen every year and provide a return on investment of 110 to 120 per cent per year." The longest payback for a customer is approximately 2.5 years and the fastest payback is 3 months.

- **Kansas** grower:
  - "KSU research shows a possible 10-15 percent yield increase with strip tillage. Last Fall, we decided to upgrade to automated steering with precision GPS. When we knifed in Fall anhydrous, our pass-to-pass accuracy was one inch or better—often ¼ to ½ inch. When I went back with the N applicator, our system dropped the knives right back into the same grooves. This spring we will plant with our GPS on a Cat 55, then put the system on our sprayer. In a year or two, I can see adding a second GPS system, so we can run it on different jobs at the same time."

Precision Construction:

- Big Island, **Hawaii:** development project is being built on a 450-acre site, mindful of the delicate ecosystem, shoreline offset requirements, and indigenous culture:
  - The construction company added GPS-based automatic grade control in 2005.
  - The fact that operators have instantaneous cut-and-fill feedback is something they like. When they are ripping, they can drop their blades and the display will say you need to drop the blade another two feet to be on plan.

o A significant advantage of the GPS-based automatic grade control system is that the work can be accomplished in one pass with little need for rework.
o "When this huge, complicated project is complete, I will be able to say that the finished grades match exactly what is on the plan with no deviations or exceptions—including the golf course, which understandably has to be dead on."
o "The feedback from the developer is that we're hitting grade consistently within three-tenths of an inch of the finished contour. They are amazed that we're grading that close to the plan specs."
o "Without automatic grade control, it would have been a nightmare to maintain accuracy on the slope. Because the dozers have the site plan right in the cab, we save a tremendous amount of time and increase our productivity."

• **Georgia:** Construction project: 2 million square foot footprint of a logistics warehouse:
o "We're glad our motor grader is equipped with the latest GPS-based grade control, according to the construction company building this project. We wouldn't have been nearly as precise, nor completed the pad as quickly.
o "We had our own survey crew check the building pad when it was completed. The finished pad was consistently within a half inch of the plan, throughout the whole plan throughout the whole expanse, fully one-third of the mandated tolerances… which was very, very, impressive."
o According to the construction company, the right tolerances of the graded pad made for much smoother placement of concrete. If you are even a quarter-inch on two million square feet, that is a lot of additional concrete. It is estimated that each additional quarter-inch of concrete would cost $1 million dollars."
o "When you're talking about the major advantages of equipping our motor graders and dozers with the GPS-based systems, the big on is time….it takes less time to do the work and to do it right. We're completing projects sooner, and we've literally cut our rework by 70 percent using the GPS system."
o As an example of the time saved, the construction company pointed to a four acre section of the parking lot that they had recently graded in 2 and ½ days. "If I had completed that section the conventional way with driving hubs every 25 feet, it would have taken six days."

• **Wisconsin:** a smaller excavating and utilities contractor:
o "You know we're still relatively new to the GPS-based grade control technology and the site positioning system rover. What sold my management were the productivity gains, combined with the desire to remain competitive in this market where bids can be separated by pennies per yard."

Fleet Management in Service to the Elderly and Handicapped:

Santa Clara County, **California**. As a non-profit, public benefit organization, OUTREACH is committed to the mission of supporting older adults, individuals with disabilities and low-income families with their efforts to lead independent and self-sufficient lives. From our origins as a War on Poverty program over 30 years ago, OUTREACH has grown to be one of the nation's premier Adult with Disability Acts (ADA) Paratransit and community transportation providers.

OUTREACH's service model is unique because it combines human service values with a transportation system that incorporates cutting-edge technologies, such as the Global Positioning System (GPS) and custom software solutions to increase program efficiency and cost effectiveness. The first year of operating the GPS-based paratransit vehicle tracking system, Outreach saved approximately $435,000.