Written Testimony of John M. Foley
Director, Aviation GNSS Technology
Garmin International, Inc.

Before the Committee on Transportation and Infrastructure
Subcommittee on Aviation
U.S. House of Representatives

"A Review of Issues Associated with Protecting and Improving Our Nation's Aviation Satellite-Based Global Positioning System Infrastructure"

February 8, 2012

My name is John M. Foley, and I am Director, Aviation GNSS Technology, for Garmin International, Inc. ("Garmin"). Garmin is extremely appreciative of the opportunity that you have given us to address the issue of protecting and improving our nation's Global Positioning System ("GPS"). Not only does GPS represent the very core of our business, it is a valuable national treasure, and we are heartened that the Subcommittee has scheduled today's session so we can explore and discuss how to protect it.

This hearing is very timely after the year we have just experienced. Over the last twelve months and continuing today, we have seen one part of our government come close to authorizing a new high powered terrestrial broadband service that would have posed an extreme threat to the existence of GPS. We think it is very prudent today to review what we learned from that experience as well as the extensive GPS benefits that we might have lost, so history does not repeat itself.

Before I begin, I would like to emphasize, as my colleague Phil Straub did when he appeared before this Subcommittee last June, that Garmin is not opposed to the rollout of improved broadband service. Improved broadband is essential for our economy to prosper and our businesses to remain globally competitive. We just believe that such advancement, and the implementation of other new services and technologies, should not be done in a way that would cripple GPS service.

I. Garmin Is a World Leader in the Design and Manufacture of Reliable GPS-Enabled Aviation Products

Garmin is the leading manufacturer of GPS products for the General Aviation ("GA") industry in the United States. It also is a leading supplier of general location/navigation GPS devices to consumers around the world. Garmin has been manufacturing GPS-enabled navigation devices since 1991.

Over the past two decades, Garmin's aviation business has grown, and today Garmin has a larger installed user base of GPS equipment than all other aviation manufacturers combined. Garmin provides a full suite of avionics for GA aircraft, helicopters, and Part 25 business aircraft. When Phil Straub testified before you, he provided a lengthy list of our aviation

products, and I attach that list to this testimony as Appendix A. Since Mr. Straub testified, we have introduced two new products for the GPS aviation market:

- *The GTX™ 23 ES remote transponder, a new remote-mounted Mode-S extended squitter transponder for experimental and light sport aircraft.* Using GPS's referenced positioning information, the extended squitter technology in this device positions it for ADS-B compliance and enables it to automatically transmit more accurate, and more reliable, traffic surveillance data – including aircraft flight identification, position, altitude, velocity, climb/descent, and heading information. Traditional Mode S and Mode C transponders can only broadcast altitude, and thus require ground-based radar to correlate and identify the aircraft position. The GTX 23 E offers much more.

- *The aera® 796 and aera 795, a new series of portable aviation navigation devices.* These products similarly improve the information available to pilots. The aera 796 features 3D Vision, a unique 3D view of database-generated terrain. 3D Vision uses GPS position and a terrain-alerting database to recreate a behind-the-aircraft perspective view of the topographic landscape. The resulting virtual reality display offers pilots a supplemental 3D depiction of land and water features, including terrain, obstacles, runways, and airport signposts, all shown in relative proximity to the aircraft. With the flick of a finger, the 3D view can be rotated around the aircraft to easily view the terrain surrounding the aircraft.

II. Our Customers As Well As Documented Studies Consistently Remind Us of the Life-Saving Improvements That GPS Makes to Aviation Safety

The introduction and use of GPS-enabled devices, like Garmin's, have brought significant advances in aviation safety, particularly for the GA market. GPS has become ubiquitous and indispensable in the years since Garmin introduced its first aviation GPS receiver. Virtually all types of aircraft utilize GPS for navigation and approaches. For the majority of these aircraft, GPS is the primary means of navigation.

When Phil Straub testified last summer, he did an excellent job articulating how GPS-dependent features on our devices assist pilots day-in and day-out and describing the features that improve aviation safety. Again, I would like to make sure his very clear explanations are a part of this record, so I attach them as Appendix B.

Perhaps the best way for interested parties who are not themselves pilots to experience how these systems work is to view them from a pilot's perspective. I commend to you the following two videos that Garmin has prepared that put the viewer in the cockpit of both fixed-wing aircraft and helicopters:

- "Garmin G1000 retrofit avionics impresses King Air owners and operators," *available at* http://youtube.com/watch?v=Y9_Wo7e0XOMZ; and

- "Garmin Helicopter Solutions," *available at* http://www.youtube.com/watch?v=GtLUIcNBhuU.

Both videos show what it is like to experience the operational features GPS provides, including improved traffic awareness and terrain awareness.

Almost from the launch of our first products in 1991, our customers quickly began to make us aware of how our products bring life-saving benefits to aviation. Over the years, we have received hundreds of reports from customers who have written to tell us how our products saved their lives or the lives of their colleagues, friends, and loved ones. These often harrowing, but ultimately positive, tales are replete in our records and on our customer blogs. Stories like the following show how various devices throughout our GPS avionics product line have saved lives in many different ways:

- A couple of years ago, one Florida pilot gained instant regional notoriety when he used his Garmin GPSMAP® 696 to help him land his small plane on a dark Tallahassee-area road after he had experienced engine roughness and could not make it to the nearest airport.

- A number of pilots involved in organ transplant flights have told us that their aviation GPS devices have ensured that they fly the most efficient route between two destinations when time is critical for preservation of their life-saving cargo. (For one pilot's story, *see* http://www.youtube.com/watch?v=ds0HoBn7GAQ.)

- For search and rescue missions, first responders have reported that GPS helps them deploy teams in search grids and then provides a standard for communicating the exact position once a search subject is found and emergency air evacuation is critical to the subject's survival.

- One military pilot in the Iraqi war wrote to tell us that, when a complete electrical failure caused his plane to lose use of all navigation and communications radios, his own portable GPS device allowed him to program in his return route back to Kuwait, saving both his multimillion dollar aircraft and his life.

- A helicopter pilot assigned to Iraq similarly reported that not only he, but every one of his pilots in his unit had "either a Garmin 196 or 296 that we fly with and they have saved our lives many times."

- Another pilot flying from Austin, Texas to Gulfport, Mississippi related that, when the alternator in his new plane unexpectedly began to fail, his GPS III Pilot helped guide him along a highway to a safe landing at a nearby airport despite hazy visibility, a lack of landmarks, a dead battery, and no radio.

- Finally, a new pilot with under 100 hours flying experience told us that his Garmin GPSMAP 295 saved his life and that of a friend when he lost visibility off the Florida coast because of a sudden freak storm and had to rely on his Garmin device to guide him to the nearest airport.

As use of GPS-enabled aviation devices has become more prevalent, studies have begun to emerge documenting and quantifying the life-saving benefits that our own customers have

anecdotally reported to us. Among the conclusions and statistics included in these studies are the following:

- Just last month, it was reported that, due to FAA implementation of a recommendation from the US Commercial Aviation Safety Team ("CAST") that airlines install terrain avoidance systems, terrain accidents have been greatly curtailed, if not eliminated. From 1982 to 1992, bad weather or dark conditions contributed to 12 airline crashes that killed 420 people. No such U.S. airline accidents have occurred since 2005, when the FAA mandated that airlines install such GPS-enabled warning devices on turbine aircraft. ("How U.S. Airlines Got a Whole Lot Safer, "*Bloomberg Businessweek,* Jan. 26, 2012, available at http://www.businessweek.com/magazine/how-us-airlines-got-a-whole-lot-safer-01262012.html.) This same article reported that, in the last five years, the odds of a U.S. airliner going down and killing someone have become 1 in 49 million, a 93 percent decline from 1994 to 1998, when they were 1 in 3.7 million. Accident rates are also down in Canada, Europe, Australia and Japan. (*Id.*)

- The availability of GPS has made a huge difference in preventing runway collisions. A recent analysis by the U.S. Department of Transportation's Volpe National Transportation Systems Center showed that use of a surface moving map with own-ship position, features only available through GPS, could prevent approximately one-third of all runway incursions based on FY2007 and FY2008 data. The benefit doubled with the addition of *all* surface traffic (air cargo and surface vehicles) to the moving map displays. (S. Chase, *et. al.,* "Mitigating Runway Incursions: A Safety Benefits Assessment of Airplane Surface Moving Map Displays," November 2010, *available at* http://www.volpe.dot.gov/coi/hfrsa/docs/chaseeonyeh2010.pdf.)

- According to the FAA, from 2006 to 2011, fatal controlled-flight-into-terrain ("CFIT") accidents in GA and non-scheduled air carrier operations decreased 44 percent from the preceding five years; fatal approach-and-landing accidents and all fatal accidents at night decreased by 30 percent. Glass cockpits became standard equipment in GA aircraft beginning about 2003, and the FAA reports that glass cockpits and GPS are a primary explanation for these improvements and that they will likely continue for several more years as GPS-based equipment continues to penetrate the GA market. ("LightSquared Impact to Aviation Operations Input Provided by Federal Aviation Administration," at A-3, Appendix A to Letter from Joel Szabat, Deputy Assistant Secretary for Transportation Policy to Mr. Karl B. Nebbia, Associate Administrator, National Telecommunications and Information Administration, July 21, 2011.)

- The FAA has quantified that the safety impact of a 10-year loss of GPS functionality would result in the loss of approximately 800 lives. The figure includes fatality estimates for both air carrier and GA operators. The FAA noted that the figures for each component were conservative and that its study did not even take into account assumptions concerning serious injury, minor injury, and property loss. (*Id.* at A-4.)

- The Capstone project in Alaska, a precursor to nationwide roll-out of the new NextGen system, produced even more evidence that GPS-enabled devices improve aviation safety:

-- The Bethel/Yukon Delta area of Alaska served as the initial test bed since it is served by approximately 25 percent of the commercial aircraft in Alaska and has a proportional number of accidents. A 2004 study by The MITRE Corporation and the University of Alaska at Anchorage found that, from 2000 to 2004, the rate of accidents for Capstone-equipped (ADS-B equipment) aircraft was reduced by 47 percent. (FAA, "Surveillance and Broadcast Services, Western Service Area (WSA)," *available at* http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/surveillance_broadcast/wsa/.)

-- According to the FAA Alaska Region's Administrator, in the early 1990s, Alaska was averaging 180 aviation accidents per year, and it averaged one aviation fatality every nine days. At the end of FY2010, the state recorded 93 accidents, a 50 percent decline. (S. Day, "Alaska aviation safety continues improvements," *Juneau Empire*, Oct. 13, 2011, *available at* http://juneauempire.com/local/2011-10-14/alaska-aviation-safety-continues-improvements.)

-- In 2003, there were 20 accidents per 100,000 flying hours in Alaska, while, in the Lower 48, the number was 6 accidents. As of October 2011, Alaska had half as many accidents as in 2003. (*Id.*)

-- The Capstone program also reduced the number of aviation midair collisions in cruise flight. Prior to Capstone's initiation, cruise flight accounted for the largest number of accidents. By 2011, about 15 percent of aviation accidents were in cruise flight, 44 percent were during landings, and 27 percent were in takeoff or initial climb. (*Id.*)

With any loss or impairment of GPS, these documented benefits and positive trends would be immediately reversed. The opportunity for longer-term benefits would also be sacrificed. For GA in particular, its losses, unlike those related to air carriers, would not be offset by Instrument Landing Systems ("ILS") and air traffic control because some of the GA fleet would not be equipped with ILS, not all GA airports have ILS equipment, and GA aircraft may not be under air traffic control. Without GPS or with compromised GPS, the safety impacts and costs to GA would be felt in full and would be severe.

III. Garmin's Experience Over the Last 12 Months Has Firmly Convinced It That There Needs To Be More and Better Coordination Over GPS Policy at the Federal Level

Garmin, like many parties in business and government, was surprised when the proponent of a new high-powered broadband terrestrial network filed a letter with the Federal Communications Commission ("FCC") on November 18, 2010, informing the agency that it had developed a new business plan that involved offering Ancillary Terrestrial Component service on a wholesale basis to retail wireless providers. The proposed network involved 40,000 terrestrial transmitters located nationwide. Most importantly, the proponent would no longer commit to satisfying the FCC's "Integrated Service Rule" by offering service only for use with "dual mode" handsets. Instead, it contended that it would be offering an "integrated service" merely because

it would continue to offer Mobile Satellite Service ("MSS") in the rural and sparsely populated areas where its ATC service would be unavailable.

Without the provision of "dual mode" handsets, the proponent would no longer need to avoid self-interference, a crucial requirement basic to the GPS industry's willingness on several prior occasions to work with MSS applicants to ensure their Ancillary Terrestrial Component service did not result in harmful interference and remained truly "ancillary." The November 2010 filing transformed the proposed service into an offering that would severely degrade GPS service for the millions of individuals, businesses, and government agencies that rely upon it.

Garmin recognized the serious implications, and its engineers, as quickly as possible, began to conduct their own tests of the proposal, which revealed extensive interference. Given its preliminary testing, Garmin was again surprised when NTIA, despite its awareness of concerns from the Departments of Defense, Transportation, and Homeland Security, did not seek to delay or oppose a decision on the proposal, but instead sent a letter to the FCC Chairman stating that, if the FCC intended to grant the proposal as modified in the November 2010 filing, the agency should establish a process for analyzing the scope of the potential interference and possible solutions before allowing the network to commence service. Garmin completed its testing and prepared a report on the potential interference, which was filed with the FCC on January 20, 2011. Less than a week later, on January 26, 2011, the FCC's International Bureau granted the proponent's application, subject to the condition that it engage in a process with interested parties to identify the scope of anticipated interference and propose solutions for mitigating it.[1]

For almost six months, Garmin and many other private and governmental parties devoted millions of dollars to testing the effect of varying proposals for operation of the network upon a wide range of GPS devices. The test results revealed extensive problems with interference to the GPS signal just as Garmin had demonstrated at the beginning of the year and as anyone cognizant of the tremendous disparity in signal strength between GPS signals and the proposal could have predicted.

Despite all this work, another round of extensive testing occurred in the fall -- this time limited to cellular and general location/navigation GPS devices -- but still involving millions of dollars, numerous devices, and private and public parties. Again, as the Co-Chairs of the Space-Based Positioning Navigation and Timing National Executive Committee ("EXCOM") concluded in a letter to NTIA on January 13, 2012, the proponent's original and modified plans for its network would cause harmful interference to many GPS receivers. It noted that a separate analysis by the FAA similarly concluded that the proposals are not compatible with several GPS-dependent aircraft safety-of-flight systems. Based on the testing and analysis, the EXCOM Co-Chairs wrote that there appeared to be no practical solutions or mitigations that would prevent significant interference to GPS. According to the letter, no further testing was required.

As an interested observer and participant in much of the testing and as a company that in the past was focused on developing, manufacturing, and selling products rather than on government interaction, Garmin has found a number of developments over the last year to be

---

1 *Order and Authorization*, 26 FCC Rcd 566, 586-87, ¶¶ 41-43 (IB Bur. 2011).

troubling. First was the rapidity with which the FCC reached a decision, seemingly without conducting any of its own tests, spending time to evaluate Garmin's test results, calling for the proponent to address the testing or other concerns, or placing on the proponent the burden of demonstrating that its technical proposals were market-ready. Second was what appeared to be the FCC's failure to evaluate fully the objections of Cabinet-level departments with expertise on the matter at issue. Third was what seemed the FCC's strong willingness to allow a major change in policy and exception to its rules to occur in an application context rather than through traditional, statutorily prescribed notice and comment proceedings. The "grant first and test later" standard seemed anomalous, to say the least.

In trying to devise a means for preventing a repetition of the past year's experience, Garmin is loathe to prescribe more federal regulation or "red tape" for fear it would disrupt the well-functioning market-driven development of GPS products. Congress and the President have already established a U.S. space-based PNT organizational structure that includes the relevant stakeholders and provides a liaison role for the FCC. On paper, the structure appears logical and likely to be effective.

Given the events of the past year, however, Garmin would urge that future coordination be improved through some type of mechanism that requires the FCC to obtain PNT EXCOM sign-off or approval when proceedings before the FCC include documented or substantiated claims of potential interference to GPS. Garmin believes that officials involved in the PNT are those best qualified to decide how this increased coordination and approval should be structured. Garmin also believes the EXCOM Co-Chairs are very capable of making any determination that GPS would be impaired by proposed new technologies or services. If the Co-Chairs, however, feel that creation of the post of something akin to a national "Chief GPS Officer," with the individual drawn alternately from the Departments of Transportation and Defense, would help ensure coordination and better protect GPS, Garmin could support that idea.

In their January 13, 2012 letter to NTIA, the EXCOM Co-Chairs stated that they proposed to draft "new GPS Spectrum interference standards." In response, Garmin would simply note that another area of its surprise over the last year's events involved the seeming lack of acknowledgment at the FCC and in some other parts of the government that, at least for certified GPS aviation devices, industry and government regulators are already guided by numerous existing standards. The FAA and the Department of Defense mandated these aviation GPS receiver standards developed via a government-industry voluntary consensus process. For instance, the interference mask used by these standards predated the FCC's January 2011 decision.

In short, Garmin and other manufacturers like it have had their businesses greatly disrupted by the failure of constituent parts of the government to coordinate effectively among themselves. Fortunately for businesses, consumers, and the nation, this year has in essence been a "trial run." No system was actually launched or significant threat unleashed that wiped out or began to shut down GPS. With the advent, however, of devices at the consumer level that have the potential to jam GPS and the pressing need that some perceive to free up more spectrum, Garmin encourages government decision makers to take the lessons of this "trial run" to heart, so that we put in place enforcement and coordination mechanisms to ensure that the unthinkable does not occur in the future.

Appendix A

Garmin Aviation Devices That Improve Aviation Safety

- Fully integrated "Flight Decks," like the popular G1000®, which provide pilots with instrumentation, navigation, weather, terrain, traffic, and engine data on large-format, high-resolution displays;
- GPS navigation/communication devices, like the GNS™ 400 and 500 product lines that have been the General Aviation standard since 1998 (over 115,000 sold) and their successors, the recently certified GTN™ 650 and 750. These aid pilots with high-resolution terrain mapping, graphical flight planning, geo-referenced charting, traffic display, and satellite weather;
- Mode S transponders which feature the extended squitter broadcast that enables the transponders to automatically transmit more accurate, and more useful, traffic surveillance data to support Automatic Dependent Surveillance-Broadcast, including aircraft flight identification, position, altitude, velocity, climb/descent, and heading information; and
- Many other GPS devices that assist pilots in monitoring every element of their flight conditions.

Appendix B

How GPS-Enabled Devices Assist Pilots and Help Ensure Aviation Safety

The position information computed by GPS receivers provides pilots with a reliable and accurate navigation source. When it is integrated with other systems in the cockpit, GPS enables a multitude of capabilities that enhance safety and improve operating efficiency. As the Aviation Subcommittee knows, GPS is the foundation for the Federal Aviation Administration's ("FAA's") new NextGen System. The existing uses of GPS that are described below have made critical differences in the ability of pilots to ensure safety of life in the skies; proposed improvements in future devices will only enhance these benefits.

GPS provides pilots with the ability to fly point-to-point instead of following ground-based radio navigation aids that require longer flight paths between airports. GPS also gives pilots the ability to immediately orient where an aircraft is located relative to terrain or obstacle features when the GPS position is paired with map details. This combination provides "instant" orientation without the mental gymnastics that were necessary before GPS was introduced into the cockpit. This is a significant safety enhancement because it frees the pilot to concentrate on flying the airplane instead of working to stay oriented. During in-flight emergencies, GPS systems can provide immediate navigation to the closest airport, even in areas where there are no ground-based navigation aids.

GPS-based instrument approach procedures, both standalone and those enhanced by the Wide Area Augmentation System ("WAAS") or Ground-Based Augmentation System ("GBAS"), allow aircraft to land safely at airports throughout the country. GPS approaches require substantially less ground infrastructure than those approaches utilizing ground-based navigation aids such as the Instrument Landing System ("ILS"). GPS/WAAS-based Lateral Navigation ("LNAV")/Vertical Navigation ("VNAV"), Localizer Performance with Vertical guidance ("LPV"), and GBAS approaches provide both horizontal and vertical guidance that improve aviation safety by allowing the pilot to fly a stabilized approach to a safe landing. There are, in fact, now more LPV approaches in the United States that require GPS/WAAS rather than ILS approaches. All told, the FAA has published over 10,000 approach procedures that use GPS,[1] at roughly 3,000 airports and heliports across the 50 states and U.S. territories. Over 900 of these airports and heliports have only GPS-based approaches; in other words, instrument approaches are not possible at these airports without GPS. GPS navigation also enables the use of repeatable curved approach and departure paths to and from airports which shortens flight paths, requires less fuel burn, results in lower costs to operate, and creates a smaller carbon footprint. In summary, GPS navigation improves airport capacity, access, and efficiency.

---

1 *See* http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm, update effective June 2, 2011.

Availability, integrity, and accuracy are all necessary for GPS to function as a primary means of navigation and to ensure aviation safety. When weather is poor and a pilot cannot see outside the aircraft beyond the tips of the wings, he or she must rely on the plane's navigation system to keep the aircraft in safe airspace. During an approach, the pilot works hard to follow the FAA-prescribed flight path to the runway and must be able to rely on the GPS and have confidence in the system. Improperly executed instrument approach accidents are consistently among the most common causes of lethal descent and approach accidents.[2] The loss of the GPS signal during this critical time is clearly a hazard to safety. Without it, pilots have to scramble to stay ahead of the airplane by tuning to the frequencies of alternate navigation equipment and shifting their mindset to alternate navigation methods instead of relying on GPS.

Automatic Dependent Surveillance-Broadcast ("ADS-B") equipment broadcasts GPS-derived position reports to other aircraft in the vicinity and to Air Traffic Control centers on the ground. ADS-B will enable increased safety, precision, capacity, and capability for Air Traffic Control with a reduced cost of operation since it is not dependent on ground-based radar systems.

GPS is also used as an input to many traffic awareness systems, particularly those derived from ADS-B. These systems can enhance safety by providing pilots with timely alerts of potential collisions with other aircraft so that they can be avoided. Additionally, GPS supplies position, altitude, and velocity information to many terrain awareness systems. Such systems greatly reduce the likelihood of controlled-flight-into-terrain incidents by providing the pilot with audible alerts of potential terrain and obstacle conflicts along the flight path and a picture of the aircraft's position relative to the surrounding terrain and obstacles. GPS also enables synthetic vision systems to display external topography from the perspective of the flight deck, enhancing situational awareness when pilots are flying in instrument conditions.

Many aircraft are equipped with electronic multi-function displays that depict the aircraft's location on a map. GPS is a primary source of position data for these displays, which reduce pilot workload by improving situational awareness through pictures that show an aircraft's position on a map that can be overlaid with weather radar and traffic information while airborne. Other GPS-enabled map displays, such as Garmin's SafeTaxi®, provide the flight crew with a detailed picture of the runway and taxiway environment while on the ground to prevent runway incursions. When visibility is poor, it is difficult to remain oriented when taxiing. SafeTaxi®'s moving map display makes it easy.

In General Aviation aircraft, GPS is also used in conjunction with low cost inertial sensors to provide reliable, inexpensive, and lightweight attitude and heading systems. These devices replace spinning-mass gyroscopic instruments that have notoriously poor reliability and that otherwise would provide a pilot's primary means for determining attitude and heading during instrument flight.

---

[2] Aircraft Owners and Pilots Association Air Safety Institute, *2010 Nall Report: The Joseph T. Nall Report of Accident Trends and Factors*, at 24, 26, http://www.aopa.org/asf/publications/nall.html.

Finally, GPS is a crucial technology for airborne search and rescue operators. GPS allows search and rescue aircraft to fly precise, predetermined search patterns at any location, day or night, under all weather conditions. Accurate GPS position reports allow rescue personnel to quickly reach the correct location once the victim is found.

John M. Foley

Director, Aviation GNSS Technology, Garmin International

[redacted]

Education

Bachelor of Science, Computer Science and Mathematics (Double Major), May 1993
Virginia Polytechnic Institute and State University, Blacksburg, VA. Graduated magna cum laude.

Professional Experience

2003 – Present, Garmin International
Director, Aviation GNSS Technology
Leads the ongoing development of Garmin's FAA-certified aviation GNSS receiver technology. Contributed to the design and certification of Garmin's aviation GPS/WAAS receivers, including the GNS 430W/530W and GTN 650/750 product lines. Serves as Garmin's representative to RTCA Special Committee 159 (Global Positioning System).

1998 – 2003, UPS Aviation Technologies
Senior Software Engineer
Contributed to the design and certification of the GPS and navigation software for the CNX 80, the first FAA-certified GPS/WAAS receiver capable of flying LPV approaches. Led the software effort for the Apollo SL 30 VHF navigation and communication radio. Developed display interface software for the Link and Display Processing Unit, an ADS-B data link transceiver used in United Parcel Service aircraft.

1993 – 1997, Raytheon E-Systems
Software Engineer
Designed and implemented situation assessment applications for the Office of Naval Research and the Naval Surface Warfare Center. Developed geolocation control software for the CAPITAL-ITS traffic monitoring system.

Achievements & Awards

Patent # 6437739, Methods and Systems for Monitoring Multiple Channels in a Very High Frequency Omni-Directional Range Receiver.

Certified Private Pilot since 1998.

Inducted into the Virginia Tech Chapter of the Phi Beta Kappa National Honor Society.

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

Truth in Testimony Disclosure

Pursuant to clause 2(g)(5) of House Rule XI, in the case of a witness appearing in a nongovernmental capacity, a written statement of proposed testimony shall include: (1) a curriculum vitae; and (2) a disclosure of the amount and source (by agency and program) of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) received during the current fiscal year or either of the two previous fiscal years by the witness or by an entity represented by the witness. Such statements, with appropriate redaction to protect the privacy of the witness, shall be made publicly available in electronic form not later than one day after the witness appears.

(1) Name:

John M. Foley

(2) Other than yourself, name of entity you are representing:

Garmin AT, Inc. and Garmin International, Inc.

(3) Are you testifying on behalf of an entity other than a Government (federal, state, local) entity?

YES X If yes, please provide the information requested below and attach your curriculum vitae.

NO

(4) Please list the amount and source (by agency and program) of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) received during the current fiscal year or either of the two previous fiscal years by you or by the entity you are representing:

On September 14, 2011, the Federal Aviation Administration (the "FAA") awarded Garmin International, Inc. ("Garmin") a contract (the "Agreement") to lead a program management team through its subsidiary Garmin AT, Inc. as subcontractor that that will gather data and otherwise aid the FAA in developing and establishing certification criteria for avionics equipment that employs Wide Area Augmentation System ("WAAS") technology to enable pilots to make safer approaches and landings at U.S. airports. The term of the Agreement runs from October 1, 2011 through September 30, 2014, and the FAA has agreed to pay Garmin a ~~total of $~~716,720 for its work on this contract.

Signature

2/5/2012
Date