Congressional Hearing Report

The House Transportation and Infrastructure Subcommittee on Aviation held a hearing entitled "A Review of issues associated with protecting and improving our Nation's aviation satellite-based Global Positioning System Infrastructure."

Members in attendance:

- Rep. Thomas Petri (R-WI), Chair, Subcommittee
- Rep. Howard Coble (R-NC)
- Rep. John Duncan (R-TN)
- Rep. Frank LoBiondo (R-NJ)
- Rep. Chip Cravaack (R-MN), Vice Chair, Subcommittee
- Rep. Blake Farenthold (R-TX)
- Rep. Chuck Fleischmann (R-TN)
- Rep. Reid Ribble (R-WI)
- Rep. Jerry Costello (D-IL), Ranking Member, Subcommittee

Witnesses:

Panel 1

- The Honorable John Porcari, Deputy Secretary, U.S. Department of Transportation
- Mr. Vincent Galotti, Deputy Director, Air Navigation Bureau, International Civil Aviation Organization (ICAO) of the United Nations

Panel 2

- Mr. Thomas Hendricks, Senior Vice President of Safety, Security and Operations, Air Transport Association
- Captain Sean Cassidy, First Vice President, Air Line Pilots Association
- Mr. Craig Fuller, President and CEO, Aircraft Owners and Pilots Association
- Mr. John Foley, Director, Aviation GNSS Technology, Garmin AT, Inc.
- Dr. Scott Pace, Director, Space Policy Institute, Elliot School of International Affairs, The George Washington University

Rep. Petri's opening statement:

- For this Subcommittee, aviation safety is the top priority. According to the Department of Transportation (DOT), GPS has served as a critical component of aviation safety improvements that the aviation community has embraced.
- Moreover, GPS is critical to the safety and efficiency improvements planned as a part of NextGen.

- Our aviation infrastructure and efforts to update with NextGen are a platform for growth in the U.S. economy. NextGen is also a catalyst for job creation within the aviation industry.
- It's important for government to avoid constraining that growth by eliminating the efficiency gains and job creation achieved by NextGen, which is reliant on GPS.
- As important as GPS is to transportation safety and efficiency, its signal strength is very weak. Therefore, GPS is susceptible to interference by other transmissions.
- Over the past year, the Subcommittee has watched with interest the developments of the issues related to radio spectrum within the L band. As the FCC deliberates the issues before it, we recognize the potential impacts on the transportation community, hence the hearing today.

Rep. Costello's opening statement:

- Submitted statement for the record.

Rep. Cravaack's opening statement:

- GPS is the cornerstone of the aviation system in the U.S., and any threat to GPS needs to be handled with the utmost care and ensure that our skies are safe.
- One of my key concerns has been the LightSquared project, and how it affects GPS devices. I'm very concerned that the reliability of GPS might be put at risk.

The Honorable Porcari's opening statement:

- Global Positioning System (GPS) applications are vital to transportation safety and efficiency.
    - Tens of millions of drivers across America use GPS to navigate.
    - The Department's Federal Aviation Administration (FAA) estimates that by 2013, 60,000 aircraft will be equipped with GPS to navigate the skies over America.
    - Positive Train Control, which is an improved safety application for rail transportation, will increasingly rely on GPS.
    - The Intelligent Transportation System (ITS) program will depend on GPS as a key technology for vehicle collision-warning and crash-avoidance systems.
- The Department of Transportation has committed to deploying the Next Generation Air Transportation System (NextGen) to modernize America's air traffic control system. NextGen will transform America's air traffic control system from the aging ground-based system of today to a satellite-based system of the future. NextGen employs GPS technology to shorten routes, save time and fuel, reduce traffic delays, increase capacity, and permit controllers to monitor and manage aircraft with greater safety margins.
- The FAA and industry have invested as much as $8 billion into NextGen. The FAA conservatively estimates that the benefits of NextGen will total $23 billion by 2018, and over $120 billion by 2030.
- In addition to the transportation applications I mentioned, GPS is essential for the operations of first responders, search and rescue, resource management, weather tracking and prediction, earthquake monitoring, national security, and critical infrastructure such as dams and power plants, financial transactions, surveying and mapping, and industries such as precision agriculture, where the ability to fertilize plants with centimeter-level accuracy increases conservation, reduces waste run-off, and saves American farmers up to $14-30 billion, annually.
- In sum, LightSquared's proposal would require constant, individual monitoring and adjustment to over 40,000 broadcasting sites nationwide, to ensure that they could be, and would remain, consistent with air safety requirements. This is simply not practical. Therefore, based upon all of the testing and analysis that has been performed, there appears to be no practical solutions or

mitigations that would permit the LightSquared broadband service, as proposed, to operate in the next few months or years without significantly interfering with GPS.

- It is the unanimous conclusion of the test findings by the Position, Navigation, and Timing Executive Committee (PNT EXCOM) agencies that both LightSquared's original and modified plans for its proposed mobile network would cause harmful interference to many GPS receivers. As a result, we believe no additional testing or analysis is warranted at this time.
- Substantial federal resources, including over $2 million from the FAA, have been expended and diverted from other programs in testing and analyzing LightSquared's proposal.
- This level of investment in assisting a commercial applicant to achieve the successful approval of its government application is quite unusual. However, due to the Administration's commitment to increased access to broadband, the investment was merited, but given the results we reviewed, further investment cannot be justified at this time.
- The PNT EXCOM agencies continue to strongly support the President's June 28, 2010 Memorandum to make available a total of 500 MHz of spectrum over the next 10 years, suitable for broadband use.
- We propose to work with National Telecommunications and Information Administration (NTIA) to draft new GPS spectrum interference standards that will help inform future proposals for non-space, commercial uses in the bands adjacent to the GPS signals, to strengthen existing national policy protection of adjacent band spectrum.
- We will ensure that any such proposals are clearly communicated with stakeholders and are implemented without affecting existing and evolving uses of space-based PNT services vital to economic, public safety, scientific, and national security needs.

Mr. Galotti's opening statement:

- Russia has its GLONASS which has had some reliability and maintenance problems over the years although that government has now committed to a next generation system.
- Europe has its Galileo which is not yet operational and China is in the process of launching its Compass system.
- Because of the reliability and continued upgrading of the GPS and the commitment of the United States government, GPS is the most fundamental and important piece of supporting infrastructure of the Global Navigation Satellite System (GNSS).
- International Civil Aviation Organization's (ICAO) close involvement with satellite navigation systems goes back to the work of the ICAO Committee on Future Air Navigation Systems (FANS Committee). The United States was a major contributor and participant to that committee. In adopting the outcomes of the FANS Committee at the Tenth Air Navigation Conference in 1991, a conclusion was reached that "the exploitation of satellite technology appears to be the only viable solution to overcome the shortcomings of the present system and also fulfill the global needs and requirements of the foreseeable future... and that satellite based systems will be the key to worldwide improvements."
- In recognition of this turning point and acknowledgement by the world community of the important of global satellite navigation systems, which was highly dependent on the U.S. GPS, President Clinton formally offered the GPS standard positioning service or SPS, to the global aviation community, through ICAO, to support the needs of international civil aviation. The U.S. commitment was formally reaffirmed in 2007 under President Bush as follows: "The U.S. Government maintains its commitment to provide GPS SPS signals on a continuous worldwide basis, free of direct user fees, enabling worldwide civil space-based navigation services and to

provide open, free access to information necessary to develop and build equipment to use these services."

  - For the record, I should point out that even before the work of the FANS Committee and the efforts of both Presidents Clinton and Bush, the availability of GPS to civil aviation first came about, when President Reagan authorized its use for international civil aviation after Korean Air 007 was shot down in 1983 for straying into Soviet airspace because of a navigation error. So it is safe to say that every sitting President since Ronald Reagan has either formally affirmed or re-affirmed the use of the U.S. GPS system in support of a global satellite navigation system.

- Following the initial U.S. offer, ICAO developed International Standards on a more generic approach to satellite navigation systems, under the GNSS program. With the availability of ICAO Standards, the GPS system became globally recognized by the international civil aviation community as the central element of GNSS. ICAO and the entire international civil aviation community are now completely reliant on the long-standing U.S. government policy and its international commitment to GNSS, as a key enabler of ICAO's strategic objectives. GNSS, and specifically GPS, has become the backbone of the global aviation infrastructure.
- Today, the importance of GNSS to international civil aviation cannot be overstated as it has grown into the most critical piece of the global infrastructure in support of a seamless and interoperable global system. I will give a few practical examples:
  - In areas of the world where the conventional terrestrial navigation aid infrastructure is inadequate, GNSS may well be the only reliable source of navigation information for international air transport. In other words, GNSS may be even more critical to safety of U.S. citizens when flying outside the U.S. than within;
  - Before GNSS, navigation in high seas airspace was crude and inaccurate. Separation distances between aircraft used by air traffic control were as much as 100 miles laterally and 15 to 20 minutes in trail. The superior accuracy of GNSS, especially when integrated with sophisticated flight management systems, has enabled a number of substantial navigation improvements, which are the foundation of the ICAO concept of performance based navigation or PBN. In PBN airspace, separation between aircraft is significantly reduced thereby increasing capacity while bringing safety, efficiency and environmental benefits. The United States provides air traffic control services over vast expanses of high seas airspace. In the North Atlantic alone, there are over 2000 crossings a day. The trans-Pacific passenger traffic is expected to grow by 4.2 percent between 2009 and 2030. The intra Asia/Pacific traffic during that period is expected to grow by 5.1 percent and at and at present, approximately 8,000 flights per year operate on trans- or cross-polar routes as they allow shorter, more direct long-haul routes, which save fuel and minimize environmental impact and are more convenient for passengers.
  - Until very recently, all final approaches to land at major airports were accomplished by means of instrument landing systems. Such systems, while proven and reliable, are expensive to implement and maintain. In the U.S. and in other high density traffic countries, this may not be a critical issue. However, in many parts of the world, maintaining such systems is prohibitive because of cost and expertise. Using GNSS as the basis for PBN approach procedures, more and more approaches to land are accomplished by means of the equipment in the aircraft only, with little or no reliance on ground equipment, bringing enormous safety benefits at many airports. And airports that previously had no instrument approaches now have PBN approaches. Today, when

U.S. airlines fly approaches into Lagos (Nigeria), Almaty (Kazakhstan), Ulan Bator (Mongolia), Dakar (Senegal), Quito (Ecuador) and Georgetown (Guyana) to name but a few out of hundreds, they are more assured of safe operations because of GNSS-based PBN;
    - In more developed areas of the world, gradual decommissioning of conventional navigational aids is underway in favor of a GNSS-based navigation system. This will enable significant cost savings while enhancing safety;
    - Globally, GNSS is the enabling technology for a host of performance and safety enhancements;
    - GNSS is important for next generation aircraft surveillance and here I am referring to automatic dependent surveillance—broadcast or ADS-B. ADS-B is being introduced in many countries as a replacement of or in lieu of traditional and expensive radar systems. ADS systems use GNSS positioning information, which is relayed to the ground for air traffic control purposes. And ADS – Contract or ADS-C, also based on GNSS, is being used in high seas airspace for surveillance, where prior to this, surveillance was not possible;
    - And finally, two of the most significant near term air traffic management improvements that have recently become available, and that GNSS supports, are continuous descent operations and continuous climb operations. Each of these have the benefit of allowing aircraft to continuously descend or continuously climb when operating in and out of airports, avoiding the inefficient practice of air traffic control of leveling aircraft off several times during arrival and departure.
- Finally, after highlighting the importance of GNSS, and in this case GPS, internationally, I would like to touch on a major issue that has as much, if not more, of an impact globally than domestically. I am referring to the protection of aviation frequency spectrum. Available radio frequency spectrum is the lifeblood of aviation and the protection of spectrum used by aviation radio systems is absolutely essential for flight safety. In the case of GNSS systems where power of the received signal is extremely weak, spectrum protection is particularly important.
- I would urge you to consider that any decision by the United States that affects frequency spectrum which impacts on GNSS, will have a critical impact on:
    - The excellent aviation safety record;
    - The GNSS investment by the entire international fleet of every airline;
    - The international standards set up;
    - New-equipment and/or re-certification of existing equipment which is a lengthy and expensive process.
- I cannot overstate the serious concerns of ICAO with respect to any decisions that may negatively impact on the availability and protection of GNSS, and the U.S. GPS on the Global Navigation Satellite System upon which the international civil aviation community has placed such importance. This has a lot to do with the full faith of the U.S. government that the global aviation community has come to expect.

Panel 1 Sample Q&A

Rep. Petri:

- Mr. Porcari, you mentioned that the DOT should work with the NTIA to draft new GPS spectrum interference standards to strengthen existing national policy protection of the adjacent band spectrum. Could you elaborate on what that all means?

Mr. Porcari:

- One thing that recent events have shown us is that GPS is not only a national infrastructure asset, but to protect that asset we are going to have to be much more sophisticated in the future. In laymen's terms, on both sides of the existing GPS frequency there were Mobile Satellite Services (MSS) applications that were always quiet—that did not interfere with GPS's ability to hear its very weak signal from space.
- We would take a whole of government approach to this, working through the PNT EXCOM. The idea would be to identify—before anyone invests capital—what are compatible uses with GPS.
- In general terms, the more precise the GPS receiver the more the device will need to listen beyond the GPS frequency. Acknowledging that fact and building a policy around that would be a very good use of staff time. From a policy standpoint it would be critical to protecting GPS as an asset.

Rep. Petri:

- How is the proposal to set inference standards different from setting receiver standards?

Mr. Porcari:

- There are currently no receiver standards.
- The idea of spectrum interference standards would be to give everyone involved confidence in the long term as they build more and more precise devices. I know our focus is on aviation, where GPS is absolutely critical to operations today, but will be more so in the future.
- Spectrum inference standards would be clear guidelines for all users, both within the GPS spectrum and adjacent spectrum.
- We think if we can build the consistency and predictability for both the GPS users and adjacent spectrum users then that will serve everyone's interest well.

Rep. Petri:

- I understand there is an issue over who's interfering on whose turf? Please explain.

Mr. Porcari:

- GPS by its nature is a very weak space-based signal. It's very faint when it is received by GPS receivers in terrestrial applications.
- I think of it in zoning terms, because that's probably the best way to think of compatibility of uses. GPS spectrum was originally put in a quiet neighborhood, because it needed a quiet neighborhood with quiet neighbors to be able to have accurate receivers. The adjacent pieces of spectrum were for Mobile Satellite Services (MSS), which was another quiet use. What has happened with this specific proposal is essentially you went from an MSS proposal—with limited ground augmentation—to a ground-based service with limited satellite augmentation. And that really changed the fundamental nature of signals and how they would be received. Also, it's really important to point out that GPS was put in a quiet piece of the spectrum on purpose, because it has to have quiet neighbors.

Rep. Petri:

- So this was well known at the technical level at the time this strategy was put in place?

Mr. Porcari:

- Yes, the physics and the technical part of this have been well known all along. And, from an international point of view, harmonizing that use was important as well.

Rep. Costello:

- Mr. Porcari, please clarify a point. I understand that DOT is proposing to work with other agencies to develop a policy. Does that mean for radio transmission standards in the spectrum? Are we talking about transmission standards?

Mr. Porcari:

- What we are talking about is more generic and broadly spectrum interference standards. We could establish—with consensus and input from stakeholders—the kind of standards that protect the GPS spectrum both today and in the future. If you look at the evolution of GPS in the last 10-15 years, for example, the GPS uses (especially in aviation) have gotten more and more precise.

Rep. Costello:

- We're talking primarily about transmission standards?

Mr. Porcari:

- We're talking primarily about the requirement for precise navigation devices that use GPS to be able to utilize as broad a band as possible, which they have been to date, and was acknowledged by MSS service approval on adjacent ends of the L-band spectrum. I say this because to all fairness to potential users outside of the GPS band, establishing those standards would give them a good sense of what kind of uses would be compatible and which would not.

Rep. Costello:

- Mr. Porcari, you also mention in your testimony that the Obama Administration is to free spectrum and make it available to mobile broadband to provide access to underserved rural communities. I certainly support that goal. If the MSS band is not compatible with the high speed wireless transmissions, what can the Administration do to provide greater access to high speed service?

Mr. Porcari:

- Again, every part of the Administration is committed to identifying those 500 MHz of additional spectrum over the next ten years. We strongly support the need for rural broadband and broadband competition. But we think working across the government with our PNT EXCOM and NTIA will ultimately be helpful. We do not presume to what action the FCC—an independent commission—would take.

Rep. Coble:

- Mr. Porcari, are there immunity GPS standards for military that protect them from transmissions outside the GPS band?

Mr. Porcari:

- My understanding is that there are not. And in some cases the DoD is using commercial-off-the-shelf aircraft avionics that are FAA certified for commercial use for military use.

Rep. Coble:

- What standards are currently in place to make sure that the receivers purchased pick up signals only using the GPS frequency band?

Mr. Porcari:

- There are no current standards in place and that is part of the reason for this discussion. We think going forward with having consistency and predictability of spectrum interference standards it will help all parties involved.

Rep. Coble:

- Mr. Galotti, what impact might protections for GPS have on the marketplace for radio spectrum? And, how does this bare on whether GPS warrants protections?

Mr. Galotti:

- The number on global aviation that is out there is $3 trillion to the global economy annually. So probably a good case could be made economically that aviation is critical, but there will be more and more pressure from the telecommunication providers.

Mr. Porcari:

- I don't know the values of the spectrum in itself, but I would point out the national investment we have made in GPS has been enormous. It is one of the more precious pieces of national infrastructure, even if you can't see it. It's also a U.S. national leadership issue. I would point out in the aviation context that one of the single best safety advances we have made in the 20 past years is the terrain avoidance warning system, which is enabled by GPS.

Rep. Duncan:

- This is my first real involvement with this issue. Mr. Porcari, I've read the PNT EXCOM's statement, and it's a very strong statement. There I'm talking about the reference to years before there might be a solution. It's fascinating that you're saying there is nothing LightSquared can do for years to find a solution. LightSquared says they dispute PNT EXCOM findings. How are they disputing them?

Mr. Porcari:

- First, I think LightSquared should better explain how they dispute the findings. I would point out that the PNT EXCOM statement is strong, but warranted given the circumstances. When we talk about the next few months or years, you have to remember there is a very large installed base of GPS receivers. Just focusing on aviation there are about 60,000 GPS receivers out there that are used for safety of flight applications. Each of those is about $40,000. If you look at the life cycle of aircraft and avionics, they serve for decades. The reason for that part of the statement is there is no easy retrofit or filter that would make LightSquared's current proposal compatible with aviation.

Rep. Duncan:

- I wasn't saying it wasn't warranted. I just thought it was fascinating that nothing could be done with how fast technology advances these days.

Rep. Cravaack:

- I can truly tell you, as a pilot, in the cockpit there is a palpable difference with terrain avoidance warning systems using GPS. When you're flying that approach to Salt Lake City, Utah from the east and you're skirting the top of those mountains it is really a comfortable feeling having GPS in the cockpit.
- LightSquared has agreed to a standstill on the upper portion of the spectrum closest to the GPS signal, and LightSquared has stated they would like to work with the GPS community to come up with mitigating strategies in order to initiate commercial operations in the next two or three years. In your opinion, do you think two or three years will be enough time to find a mitigating strategy? And, what would be the cost to aviation to implement that strategy?

Mr. Porcari:

- I'm not sure what a standstill means on the upper 10 MHz. There are no time limits or technical triggers that I'm aware of on that.
- There is a fundamental incompatibility between the LightSquared proposal and the continued use of GPS as a precision air navigation provider.

- Again, I would point out this has been built over decades, where more and more we are reliant on GPS for a much higher standard of safety than we were able to achieve with the old instrument landing systems.
- I can't speculate on the cost of retrofits—even if they existed—to current avionic uses.

Rep. Cravaack:

- Just to be clear, there are no plans at this time to retrofit or reconfigure any systems to work LightSquared into this bracket? Is that correct?

Mr. Porcari:

- That is correct.

Rep. Farenthold:

- I'm troubled that a terrestrial based system, like LightSquared, has the potential to interfere with GPS. I'm afraid that points out the delicate nature of the GPS system and the potential vulnerability to attack. Suppose someone not friendly to the U.S. put up some high power jammers, we would be in trouble. It seems we're creating a vulnerable system with no backups. Can you comment on that?

Mr. Porcari:

- You've brought up a very good point. GPS by its very nature has vulnerabilities. One of the things we've done is after we completed the National PNT architecture study, the FAA as a follow on to that has committed to a PNT research program. As we move to NextGen it is more and more important to have GPS backup systems. However, the backup systems will only be short duration systems. By short duration I mean minutes as opposed to days.

Panel 2

Mr. Hendricks's opening statement:

- The continued integrity of the GPS system is critically important to the millions of customers who we fly every day, as well as the tens of millions of other people in our country who rely on it. GPS will be the backbone of air navigation both domestically and internationally in the coming years. Interference with its accessibility or reliability would be catastrophic for civil aviation and the communities that depend on air transportation.
- With respect to the LightSquared proposal, the incontestable fact is that it will create widespread GPS interference, which will have ruinous effects on aviation. Experts have repeatedly reached that conclusion. LightSquared's proposal therefore should be withdrawn. This matter needs to be put to rest once and for all.
- To be clear, we do not oppose the expansion of wireless broadband services but any expansion cannot be permitted to interfere with existing or anticipated aviation GPS use, many of which will significantly enhance safety. We are dependent on that technology; there is no substitute for it.
- One obvious lesson of the convoluted experience with the LightSquared application is the need for a government wide policy that protects the aviation GPS spectrum. Without such an authoritative policy, spectrum encroachment will remain a threat.

Captain Cassidy's opening statement:

- GPS has been beneficial to communities in remote areas like Alaska. At over 4 times the land area of California, not only is Alaska massively big, but its desolate terrain and hostile weather have meant that aircraft operations there are subject to significantly more hazards than those in

the rest of the United States. At most airports, ground-based navigational aids have either been limited or unavailable due to terrain, and they are often extremely expensive to maintain. This meant that many of the air carrier flights often had to be cancelled for weather or due to ground equipment being out of service. In that region, air carrier flights are not simply a convenient form of transportation; due to the fact that they are often the only means of connecting a population center with critical services, cancellations of flights have a major impact on public safety.

- One of the first airports in Alaska, and in fact the world, with a GPS-based instrument approach was the capital of Alaska, Juneau. Before the advent of GPS, the limited accuracy of conventional navigational aids available combined with very closely situated mountainous terrain dictated that the arrival procedures needed to have high weather minima, meaning that even with instrument flight systems in place, relatively high ceilings and visibility were still necessary to fly there safely. This operating environment, compounded by notoriously dramatic weather swings, limited the number of days the airport could operate. Consequently, a large percentage of flights were cancelled into the state capital—a city where the longest road only spans 40 miles.
- In 1996, ALPA pilots flying for Alaska Airlines pioneered GPS-based procedures, using concept called Required Navigation Performance or RNP approaches, into Juneau. RNP technology provides computer-generated landing paths with pinpoint accuracy by using a combination of onboard navigation technology and the GPS satellite network. The RNP arrival route for runway 26 descends below the level of surrounding mountains as it takes the airplane down the narrow Gastineau Channel. The precision nature of the RNP approach allows the aircraft to remain over the center of the channel and away from the high terrain nearby. Due to GPS-based RNP technology, the pilot is able to gradually descend and place the aircraft in a position to be safely aligned with the runway. In the case of a missed approach or go-around, the flight crew is still able to safely maneuver the aircraft clear of the terrain- again using RNP guidance. The net result is that it allows aircraft to fly safer, more reliable approaches, and reduces reliance on ground-based navigation aids.
- Since the initial RNP operations at Juneau, Alaska Airlines has expanded the use of RNP for operations into other airports in Alaska, Hawaii and the Continental U.S. They have developed and received operational approval from the FAA for over 80 different RNP procedures. In terms of measurable results, in 2011 alone, out of the over 6,300 flights Alaska Airlines operated, more than 1,500 of those flights would have likely resulted in a cancellation or divert but for the benefits of RNP technology. The resulting savings for the company was over $19 million in revenue and 210,000 fewer gallons of fuel burned.
- These are significant savings for just one airline for just one year, but that is only one part of the story. Due to GPS technology, many communities now have services that simply would not been possible without those capabilities. ALPA has had a front row seat on the development of these procedures and a unique appreciation for the potential of this technology since our pilots flying for Alaska Airlines fly into those communities daily using this technology, and have witnessed the benefits firsthand.

Mr. Fuller's opening statement:

- We are in absolute full agreement with the Obama Administration on the question before you today. The statements by the Deputy Secretary of Transportation were to the point and we agree with every point that was made there. Indeed, the other agencies of the Administration are of the same view. There is only one, somewhat reluctant, regulator that hasn't gotten the message.

- I'd like to give a few comments from a different perspective.
- In a way GPS is pretty simple. As I took off in a small plane yesterday, a black box on the plane received GPS transmitters from space. All that box did initially was identify those signals and determine precisely where it was. The genius of GPS is what it enables. The fact that GPS has been around a long time as a technology that can precisely determine where something is in space doesn't mean this is old and not exciting.
- The fact that the black box continued to determine where that airplane was in space allowed the box to calculate the plane's airspeed, heading, towers nearby, and if I had an emergency the box would tell me where the nearest airport was and how to get there. Simply because it could receive this small signal from space.
- We've just begun to tap the genius of GPS and what it can enable. And it is absolutely at the center of NextGen technology. We have 5,200 public use airports in the U.S., and we couldn't possibly afford to put instrument landing infrastructure in all those airports. Yet, every one of those airports can have a precision approach to every runway using GPS capabilities. That's what GPS enables.
- From where we sit, from my 400,000 members, we see GPS as absolutely essential.

Mr. Foley's opening statement:

- The GPS industry in the U.S. counts for 130,000 direct jobs. What was once a government only technology is fully woven into the fabric of our infrastructure. That did not happen overnight. It has taken two decades of hard work to mature it from a fledgling technology into a reliable force for safety and efficiency. Yet, unbelievably what we have built together is now threatened.
- Loss of just a fraction of GPS capability would pose a significant danger to aviation safety.
- Several areas are particularly worrisome are:
    - Loss of GPS while on approach would unsafely increase pilot workload during a critical phase of flight.
    - Loss of GPS would deny coverage at hundreds of airports and heliports lacking ground-based navigation aids.
    - Without GPS the terrain awareness warning system would not work.
    - Loss of GPS means loss of situational awareness for cockpit displays of weather and information, including on the ground to prevent runway incursions.
    - Reliable GPS is essential for the FAA's proposed NextGen system.
- We can sum up the last year in four words: grant first, test later.
- Grant first, test later seems to stand the process of public decision making on its head. This approach placed a severe burden on everyone's time, attention and resources. A burden that should have been placed on those seeking something from the FCC.
- Everyone worried about GPS reliability had to devote 6 months last spring and spending millions of dollars to test the effects of constantly changing proposals. The test revealed extensive interference. Anyone aware of the tremendous difference in signal strength between GPS and a high powered terrestrial network could have predicted this result. Yet, despite all of this another round of extensive testing resulted last fall. The PNT EXCOM, again, concluded the modified proposal would cause harmful interference to many GPS receivers. No practical solutions exist to prevent significant interference with GPS.
- Garmin has found many developments over the last year to be troubling:
    - Why did the FCC make a far reaching decision without conducting its own test? Or spend time evaluating Garmin's test results?
    - Shouldn't an applicant have the burden of demonstrating market readiness?

    - Why were the objections for the Department of Transportation and Defense ignored?
- Where do we go now?
    - Future coordination must be improved. The FCC should acquire PNT EXCOM signoff when proposals before it potentially interfere with GPS reliability.

Dr. Pace's opening statement:

- The most serious threats are not to GPS itself but to the spectrum environment on which it depends.
- Every type of threat from band sharing, segmentation, out of band emissions, noise floor increases, reallocation of adjacent bands have been attempted over the past 15 years. To date all such threats have been removed or mitigated through government and industry cooperation and through bipartisan support in multiple Congresses and Administrations who sought to protect the spectrum GPS operates in.
- I would say the U.S. has sufficient law and policy on the books to protect GPS. What has been missing at times is a willingness to enforce those laws and procedures, and follow the basics of good government.
- Given the high stakes involved in preventing risk to GPS it is tempting to look for a special policy fence that would automatically prevent problems from arising. Given that the FCC is an independent regulatory commission, however, that does not report to the President, any special policy fence for GPS will require Congressional action in a very complex area.
- Receiver standards have been mentioned as a possible area for allowing high power emissions in bands adjacent to GPS spectrum, or at least creating a more predictable regulatory environment for new entrants. I do not believe this will be a useful approach and would suggest, instead, defining GPS spectrum protection criteria. There is a subtle difference, but an important one. The creation of government driven design standards, outside those necessary for national security and public safety, can stifle innovation. Receiver standards can also be a subtle regulatory means for sacrificing some categories of GPS users and their applications in rapidly evolving markets. On the other hand, transparent protection for the GPS spectrum environment can provide better predictability for new entrants while not constraining GPS applications.
- Finally, I'd like to mention two areas of risk not related to spectrum:
    - In today's fiscal environment, it may be tempting to slow or cancel the acquisition of GPS III satellites, or hope to rely on foreign systems to fill the gaps. This is a very dangerous idea given our nation's reliance on GPS and the lack of demonstrated reliability on foreign systems.
    - A second risk area would be disruption to current GPS users as an unintended result of modernization. There is a need to explicitly confirm that changes to GPS are backwards compatible with the installed base. If not, there needs to be transition plan developed with the relevant stakeholders in government, industry and non-government organizations.

Panel 2 Sample Q&A

Rep. Petri:

- You've heard the testimony of the previous panel, Mr. Foley and Dr. Pace, could you comment on it?
- Is this a staff failure? Do we need clearer fences? How can we avoid this waste of resources in the future?

Mr. Foley:

- The main thing is we need to protect the spectrum that we have. Looking backwards, from my perspective, there are some standards for interference that have been in place for quite some time. So it was a bit of surprise for us that when this new proposed system came up it was putting out signals far in excess of those interference protection limits.
- Any future plans, we'd like to build on those existing limits. And that's what the PNT and DOT has said. The extent that we do that is the best way to move forward. And more generally, improve coordination between the FCC, PNT, and all government agency and stakeholders get engaged when new policy is made.

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Dr. Pace:

- Looking back at it, the fundamental error was not applying the intent of past practices to the Administrators Procedures Act, giving notices of proposed rulemaking that look to reallocate spectrum. The argument was made that this was not a reallocation from MSS to a high powered broadband terrestrial mobile services, and that this was just a relaxation of some outdated constraints, and that some waivers could be applied and maybe some new efficiencies could be found. I think in retrospect that was to cleaver by half. It was a reallocation. That a notice of proposed rulemaking should have been done. The notice of proposed rulemaking would have generated the technical data necessary to understand what was involved, and one would have quickly seen this was a non-starter.

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