STATEMENT OF

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BEFORE THE

SUBCOMMITTEES ON AVIATION AND
COAST GUARD AND MARITIME TRANSPORTATION
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
U.S. HOUSE OF REPRESENTATIVES

HEARING ON

GPS Reliability: A Review of Aviation Industry Performance, Safety Issues and Avoiding Potential New and Costly Government Burdens

June 23, 2011.

Chairman Petri, Chairman LoBiondo, Ranking Members Costello and Larsen, and Members of the Subcommittees:

The Global Positioning Satellite (GPS) system was originally developed by the U.S. military. Today it is still operated, and primarily paid for, by the Air Force.

In 1983 President Reagan announced that, as a matter of national policy, the United States would make GPS available to users world-wide. In 1994, a year before GPS became fully operational, President Clinton went a step further and decreed that GPS would be offered as a free service. Finally, in 2000, the accuracy of the civil signal was increased, and new industries based on precision navigation were born.

Today, the use of GPS is ubiquitous. Indeed, no one knows how many commercial uses are built around GPS; worldwide sales of GPS navigation devices exceed $20 billion, annually, and an estimated $3 trillion worth of commerce relies on GPS for tracking, timing and navigation. Whatever the actual number, the decision to provide GPS as a free service constitutes one of America's greatest economic gifts to the world since the Marshall Plan.

As with so many other technologies that we have pioneered, our leadership in GPS technology and application is opening new doors to American R &D and creating countless new jobs. Each new satellite that we launch, and each new ground augmentation we develop, not only makes our nation safer and more efficient, but increases our leadership potential exponentially.

Many GPS applications are vital to transportation safety and efficiency. Tens of millions of drivers across America use GPS to navigate; over 6 million cars are equipped with General Motors' On-Star system, alone. The Federal Aviation Administration (FAA) estimates that by 2013, some 60,000 aircraft will be equipped with GPS to navigate the skies over America. Positive Train Control, and improved safety for rail transportation, will increasingly rely on GPS.

The Department of Transportation has committed to deploying NextGen to modernize America's air traffic control system. NextGen relies on GPS. Precision GPS will improve safety, reduce fuel costs, and effectively increase the capacity of crowded airports without the need to add runways or other expensive infrastructure. So far, the FAA and industry has 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.

Since 2004 the Department of Transportation has been the lead federal agency for all federal civilian uses of spectrum, including GPS. The Deputy Secretary of Transportation, along with the Deputy Secretary of Defense, co-chairs the National Executive Committee for Space-Based Position, Navigation & Timing, which includes representatives from seven cabinet agencies, NASA, and the Joint Chiefs of Staff. GPS is essential for the operations of first responders, search and rescue, resource management, weather tracking, energy independence, critical infrastructure such as dams and power plants, financial transactions and banking, surveying and mapping, and industries such as precision agriculture, where the ability to water and fertilize plants with centimetric accuracy increases conservation, reduces waste run-off, and saves American farmers up to $5 billion, annually.

Transportation security, public safety and front line workers use GPS-enabled technologies and services every day to protect the U.S. transportation infrastructure, facilitate the flow of cargo, and to protect the traveling public across all modes of transportation.

In its recent correspondence to the Federal Communications Commission, the National Public Safety Telecommunications Council stated that "public safety relies on the reception of GPS for wireless 9-1-1 location, dispatch of 'closest responder' based on GPS location, mapping/response directions to responders based on GPS, synchronization of simulcast systems across the country based on GPS time signals and a myriad of other mission critical functions."

To provide the accuracy necessary for precision navigation, GPS receivers must be designed with a “wide front end” that picks up signals across a range of 20Megahertz or more. In order to pick up this wide range of signals, the limits of physics and practical engineering are such that the precision receivers also pick up signals from the adjacent band, reserved for Mobile Satellite Systems (MSS), such as satellite phones.

Until recently, these limitations did not create a conflict. The GPS and MSS band were both designed to be ‘quiet’, limited to weak satellite signals, a tiny fraction of a watt when they reached the earth. GPS receivers easily filtered out the MSS signals.

Since 2003, the Federal Communications Commission has taken several steps to increase the effective use of the MSS band. These steps include allowing “ancillary terrestrial components” (ATCs) to provide supplementary signals in urban canyons and other areas where satellite signals cannot reach. The ground-based signals from ATCs can be powerful, more than 1 billion times the strength of a satellite signal, and would overwhelm the filter of any GPS receiver that was picking up the signal. However, to protect the primacy of mobile satellite service, the FCC in 2003 and 2005 restricted the ATCs to a subordinate role; ATCs could supplement, but not interfere with, MSS transmissions. As long as MSS operations were protected from interference, so was GPS.

In March, 2010 President Obama announced an administration goal to free up 500 MHz of federally-owned spectrum and make it available for mobile broadband, in support of a goal to provide at least 98% of Americans with access to 4G high-speed wireless service, and to especially provide access to underserved rural communities.

Consistent with these goals, LightSquared proposed that the FCC allow the company to broadcast broadband signals in the MSS band. The concept is appealing; if feasible, LightSquared would develop the first wholesale-only wireless 4G-LTE broadband network, reaching over 260 million people by the end of 2015. The network would be “open,” allowing anyone to develop devices and applications to run on it, creating new business opportunities for retailers, device manufacturers, and others.

In January, 2011, the FCC approved the concept, contingent on LightSquared conducting tests with the GPS industry and affected federal agencies to identify and mitigate any interference with GPS. The LightSquared-led Technical Working Group (TWG) is due to report its findings to the FCC on July 1st.

FAA technical staff participated in the TWG testing. In addition, the FAA commissioned RTCA to study the impact of LightSquared's proposed operations on aviation. DOT also joined a joint federal study – the NPEF – to assess the impact on a broad range of common government and commercial GPS receivers.

By all accounts, LightSquared's technical cooperation in all three of these studies was exemplary. The company shared proprietary business plans, as well as technical data and equipment, to inform the federal tests and modeling. And the tests showed that LightSquared's design and filters effectively prevented "out-of-band" emissions; in other words, their powerful broadband signal was not 'leaking' into the adjacent GPS band.

The tests also examined "overload interference" – interference with the GPS receivers that 'listened in' to the adjacent MSS band. Unsurprisingly, the powerful broadband signal overwhelmed filters and effectively blocked GPS signals in most devices tested. In broad terms, the most modern and most accurate devices, picking up the widest range of signals, tended to be the worst affected. Less accurate "narrow band" GPS receivers, such as those commonly built into cell phones, were less affected.

The final stage of LightSquared's operating plan involves parallel broadband transmissions on two 10-MHz-wide blocks, with a 9 MHz buffer between them. Two powerful, parallel signals can create an echo effect, called 'intermodulation,' elsewhere. The tests showed that, depending on the transmitter and receiver designs, these parallel transmissions could create an echo in the GPS band, overlapping the GPS signal. Such interference would make the original LightSquared proposal incompatible with current GPS operations.

America's greatest inventor, Thomas Edison, famously tested and rejected thousands of potential filaments before finding one that made the light bulb work. In the same vein, we have now tested one proposal from LightSquared, and found that it did not work as originally hoped. But there are alternatives and potential mitigations that may be worth exploring.

On June 20th, LightSquared offered one alternative, proposing to initially broadcast only on the "lower ten" to avoid many of the interference issues. This alternative has promise, especially in limiting interference with aviation. However, this alternative was not part of the original operating plan that was analyzed. More testing would be

needed to fairly assess the impact on the full range of civil GPS equities, by both "lower ten" broadcasts, and by whatever end-state LightSquared proposes for full operations.

The Department of Transportation would like to work towards a "win-win" – if one exists -- that allows for increased broadband access, without disrupting existing and planned GPS-based services, such as NextGen. Any alternative must be robustly tested, as was the original plan. It is critical to define the operational, safety, and economic impacts to all known applications and user communities. Should the FCC and the NTIA deem LightSquared's June 20th proposal worthy of further consideration, DOT will participate in, and as necessary lead, any required testing.

The Department of Transportation is responsible to represent the interests of other civilian federal agencies as well as our own. There are many applications, including scientific and space, precision agriculture, mapping and surveying, which require access to both GPS and MSS signals. Billions of dollars of public and private funds have been invested in these sectors. Their challenges may be the most difficult to resolve. The Department of Transportation will look for solutions to their challenges, as well as our own, in interagency discussions.

The review of LightSquared's proposal, and other incidents, such as the truck with a GPS jammer affecting operations at Newark Airport last year, remind us of how vulnerable GPS can be to interference. Going forward, as the FAA and the aviation industry continue to invest billions of dollars in NextGen, Deputy Secretary Porcari has committed the Department of Transportation to work with other federal agencies to ensure that we have a plan in place to ensure that the GPS systems in development now will not be compromised by interference in the years to come.