Statement of the

Aircraft Electronics Association

before the

Committee on Small Business

U.S. House of Representatives

Hearing on

LightSquared, The Impact to Small Business GPS User
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Chairman Graves, Ranking Member Velázquez, and Members of the Committee:

Thank you for the opportunity to appear before you today to discuss The Impact to Small Business GPS User of the proposal from LightSquared.

My name is Tim Taylor, and I am president and chief executive officer of FreeFlight Systems of Irving, Texas. I have the privilege of representing the Aircraft Electronics Association (AEA).

The Association represents more than 1,300 aviation businesses worldwide, including repair stations that specialize in maintenance, repair and installation of avionics and electronic systems in general aviation aircraft. AEA membership also includes instrument facilities, manufacturers of avionics equipment, instrument manufacturers, airframe manufacturers, test equipment manufacturers, major distributors, and educational institutions. Of the 1,300 companies, more than 80 percent are small businesses.

My company, FreeFlight Systems, is a manufacturer of professional-grade avionics system solutions for commercial and military aircraft and was the first company to certify an airborne WAAS receiver. FreeFlight Systems specializes in the design, development, and production of GPS navigation management systems, GPS/WAAS sensors, and radar altimeters. Operating from our FAA certified design, manufacturing, and repair center in Waco, Texas, we serve our avionics customers with retrofit and Original Equipment Manufacturer (OEM) applications.

Summary

The introduction of a nationwide broadband wireless network utilizing a non-compatible ancillary terrestrial component that compromises, or brings into question, the safety and security of airborne navigation equipment using Global Positioning System (GPS) is simply not acceptable. A resolution which requires the modification of the GPS system must also include compatibility to associated navigation systems , surveillance and emergency locator systems. There is not a simple or non-complex fix.

The testing and certification of aviation products must meet rigid safety standards which are time consuming as well as extremely expensive. And finally, any changes to the GPS position source on the aircraft must be tested against all other systems within the aircraft and the associated Air Traffic Management infrastructure, so there is not one FAA standard that must be amended but rather dozens of FAA functions and standards will have to be re harmonized and validated

Background

LightSquared has proposed a nationwide wireless broadband network that uses, as LightSquared claims "a unique integration of satellite and terrestrial technology." In January 2011, the International Bureau of the FCC granted a conditional waiver to LightSquared Subsidiary Inc. While we, as all Americans, support a low cost, nationwide wireless broadband network, a system that compromises the safety and efficiency of the national air transportation system is simply not acceptable.

For more than 20 years, Global Positioning System (GPS) technology has been integrated into aircraft navigation systems. The development and reliability of this technology has allowed for the FAA to develop and propose their NextGen initiative for the Air Transportation System. NextGen is a comprehensive overhaul of our National Airspace System (NAS) to make air travel more convenient and dependable, while ensuring your flight is as safe, secure and hassle-free as possible.

The primary goals of NextGen are to enhance the safety and reliability of air transportation, to improve efficiency in the NAS and to reduce aviation's impact on our environment. The White House and the U.S. Department of Transportation have declared NextGen a top national transportation and infrastructure priority.

There is good reason for that. Aviation is crucial to our nation's economy. As recently as 2009, civil aviation contributed $1.3 trillion annually to the national economy, and constituted 5.2 percent of the gross domestic product. It generated more than 10 million jobs, with earnings of $397 billion. The general aviation sector alone adds at least $150 billion to the U.S. economy annually, supports over 1.2 million jobs, and provides crucial air services to every community in the United States.

General aviation's services are particularly important to small and medium sized communities unserved by major airports. The benefits of general aviation to Americans, particularly rural Americans, will only continue to grow with the introduction by the FAA of its "NextGen" air traffic management system, which promises to expand general aviation's ability to provide service to numerous communities not currently served by air.

NextGen relies on the accuracy, integrity and availability of GPS technology for aircraft navigation and surveillance systems which the FAA uses for the management of aircraft in flight including the sequencing for landing and airport ground operations.

All expert reports submitted to date indicate that LightSquared's proposed use of the Ancillary Terrestrial Component ("ATC") is simply not compatible with the current safety critical uses of Global Positioning System ("GPS") technology.

The record also shows that no technology exists to mitigate the interference LightSquared will cause. Most discussion related to mitigation has centered around filters that simply do not exist. Even if such filters someday come into existence, retrofitting the entire base of installed and in-use aviation GPS devices would be logistically impossible in the timeframe LightSquared appears to have in mind. It would take years to obtain the required changes to FAA standards and then to accomplish the necessary equipment installations. The FAA estimates that 10 to 15 years would be required to bring an amended product to the aviation marketplace.

My testimony today is not intended to support or deny the reports that have been submitted regarding the compatibility of the two systems; the record has more than enough evidence to draw a conclusion. My intent is to explain the aviation certification process and the extreme cost to small businesses any change to the aviation certified GPS navigation and surveillance systems would cause.

Global Positioning System Use and NextGen

Aviation navigation systems have advanced from the early 1920s, with simple direction-finding radio beacons to the modern use of Global Positioning Systems. Without going back to the early systems, the previous system to GPS for long-range navigation utilized a ground-based navigation system called LORAN. LORAN (Long Range Navigation) is a terrestrial radio navigation system using low frequency radio transmitters in multiple deployment (multilateration) previously operated by the U.S. Coast Guard to determine the location and speed of the receiver.

Global Positioning System (GPS) has replaced LORAN as a primary navigation system for both aviation and marine navigation uses, and the LORAN system has now been decommissioned.

For short-range navigation, the aviation industry relied on VOR (VHF omni-directional radio range). A VOR ground station broadcasts a VHF radio composite signal including the station's identifier, voice (if equipped) and navigation signal. A VOR signal is accurate to a few hundred miles. So, for an aircraft on an extended cross country flight, the aircraft would fly point to point adjusting its routing every few hundred miles – a very inefficient system for long range flights.

Because of the integrity and availability of the Global Positioning System, GPS navigation technology has become the standard for both long range and short range airborne navigation systems. The FAA has introduced nearly 3,000 GPS based approaches to airports throughout the country. In addition, GPS technology is the standard for nearly all trans-oceanic flights.

The integrity and availability of GPS technology has allowed the FAA to modernize the National Airspace System and how it manages air traffic.

In addition to navigation, the FAA relies on GPS technology for the surveillance of aircraft both airborne and on the ground. The legacy surveillance technology utilizes radar as the tool for identifying airborne aircraft. The accuracy of the radar system is inversely proportional to the distance the aircraft is from the ground-based radar facility, that is, the farther the aircraft is located from the radar site, the less accurate the signal position would be.

Because of the integrity and availability of GPS technology, the FAA's newest surveillance tool is ADS-B (Automatic Dependent Surveillance – Broadcast). This system captures the aircraft position from the aircraft's on-board GPS equipment and automatically broadcasts the aircraft's position s in all regimes of flight.

GPS technology is critical for the safety of the traveling public as well as the core technology for the FAA's NextGen initiative: a national transportation and infrastructure priority.

In the event of an aircraft accident, the latest generation of Emergency Locator Transmitters (ELTs) also interfaces with the aircraft's GPS navigator or uses an internal GPS to provide

accurate GPS position to notify emergency rescue services on the exact location of the accident and hopefully, the survivors.

Replacement

It has been recommended that a simple filter might mitigate the incompatibility of these two technologies. I will let the experts with the FAA and RTCA discuss the viability of these solutions, but let me assure you, in aviation, there is no such thing as "simple."

All aviation navigation, communication, surveillance and ELT products are manufactured to an FAA Technical Standard Order (TSO). The standards for GPS navigation systems are defined by multiple Technical Standard Orders (TSO) that are managed by the FAA. These TSO's in turn refer to multiple highly specific Minimum Operational Performance Standards (MOPS) which are jointly developed by the FAA and Industry.

In addition, the interface between GPS position sources and the surveillance and emergency locator systems are also defined by FAA technical standards. Before any functional changes can be made to a GPS system, the underlying MOPS have to be revised and then implemented. The FAA then must change their technical standards for GPS systems as well as every other technical standard that relies on a GPS position source.

The manufacturing process for aviation products can easily take as long as six years to bring a product to market, and years beyond before any return on investment can be realized. Unlike commercial electronic products, aviation products must be designed, manufactured, tested and certified to not only operate without error, but also to prohibit the new product from negatively impacting the operation of any of the other aircraft systems.

In flight, rebooting is simply not an option.

GPS satellites are low powered and a long way away. The signal levels are lower than the thermal noise interference generated by the metal box that we put the receiver in - but people's lives are dependent upon our ability to read that information and not get it wrong any more than once in every 10 million flight hours.

An aviation GPS systems does not just need to know where it is - it also needs to know if it knows where it is. In other words, the aviation GPS systems must not only be accurate but also must be able to perform testing of itself and the satellite data it is receiving to determine the system's ability to be accurate.

An example - for a passenger aircraft to be approved to use one of the 3,000 approaches mentioned above in low visibility, the FAA requires that the chances of the aircraft's position being miscalculated during the final 20 seconds of approach are less than 1 in 10 million. When you look at the rest of the aircraft systems contributions to errors, the GPS requirement is that the chances of it giving wrong information is around 1 in one thousand million per hour. In this example, we are also in the worst possible conditions for GPS reception - close to the ground

with likely blockage of satellite signals from buildings and terrain and closest to possible interference sources.

If you have ever been on an aircraft landing in low visibility conditions you will appreciate this level of integrity - as do those who live close to airports. To expect the industry to meet performance requirements like these in a rapid response mode to a significant noise environment change is entirely unreasonable.

For reference, in a stable requirements environment we have been working on a GPS for this application for some six years - and we are still about a year away from a certified compliant GPS engine - and 2-3 years away from a systems implementation of that GPS engine into a usable avionics system. Add another two years for implementation and approval of that system into a real aircraft application.

Despite all the hip shots and rhetoric, I can categorically tell you that I do not know if that new system will work in the multiple LightSquared spectrum and power plans that are on the table. Even if it works fine, it will take years of work to prove that it will meet the required integrity levels.

Many of the GPS systems flying in aircraft today were developed in the 1990s We still produce and support a significant number of such systems as do all of the small group of companies that have earned a position as aviation GPS suppliers. For general aviation the picture is a little better with the majority of the technology being from the 2000 / 2003 timeframe. This of course predates the concept of giving up protection of the GPS spectrum.

Avionics systems are typically hard to develop and harder yet to get approved. Once we have such approvals it is very time consuming and costly to make changes. If we make meaningful changes that affect performance, these costs are higher and our customers are affected since their installation and operational approvals will have to be evaluated and probably amended.

Some of the older systems in service, including GPS systems, have reached an age where significant modification is not possible without a complete redesign due to parts issues and the difficulty of proving that there are no unintended consequences of the modification. These systems are permitted to operate in the airspace system because they have proven themselves over decades of safe operation in today's environment.

These older systems (and there are some 150,000 in operation today in the U.S.) are going to be very difficult to adapt to a new noise environment and will most likely have to be replaced. If we assume a very fast development of replacement systems that can live with the LightSquared FCC approvals (and this will probably be in the yet -to-be-certified for safety of life L5 band) of 5-7 years, with 2-3 years added for requirement development and installation approval, we could be looking forward to another decade of a World War II vintage airspace system in the U.S.

Current Aviation GPS Market

The fleet in the U.S. is some 250,000 aircraft - many of which need or want two GPS per aircraft - so we are looking at a total market of more than 400,000 systems. About half have GPS today and more than 90 percent will have to have it by Dec. 31, 2019, for ADS-B compliance.

The product costs of GPS systems for aircraft are not inexpensive. A simple GPS sensor for a light GA aircraft used for NextGen surveillance only is approximately $3,000. A simple GPS Navigator for these aircraft range from ten to fifteen thousand dollars per system (many of these aircraft have dual systems installed). The more advanced WAAS GPS Navigators necessary for NextGen are as much as $35,000 for a light aircraft and up to $500,000 some Airline GPS/Flight Management Systems. A GPS sensor alone for airline use is in the $7,000 to $50,000 range, (airline size aircraft usually require two sensors per aircraft). The installation and approval cost of these systems can range between a few thousand dollars for a simple system to tens of thousands of dollars for more complex system.

This is not just a domestic issue. All foreign aircraft that want to fly in the U.S. airspace must also meet the U.S. standards. There is significant effort spent by the FAA and the State Department to ensure that the U.S. rules are harmonized with International rules through the International Civil Aviation Organization (ICAO). This is a complex and extremely lengthy process.

AEA Member Prospective

As early as 1992, the FAA has mandated that airborne supplemental area navigation equipment using GPS must meet the minimum performance standard of RTCA, Inc. Document No. RTCA/DO-208, "Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS)," dated July 1991.
On July 10, 2003, the Federal Aviation Administration (FAA) commissioned the next generation of GPS airborne navigation systems with the introduction of their Wide Area Augmentation System (WAAS). WAAS improves the availability, accuracy, and integrity of the NavSTAR Global Positioning System (GPS) standard positioning service, enabling WAAS avionics to be used for all phases of flight, including approaches with vertical guidance (APVs). Appropriately certified and installed WAAS avionics may be used for all phases of flight – departure, en route, including area navigation (RNAV) and airways navigation; arrival, and for instrument approaches.

The majority of the fleet that has GPS installed today has a GPS system which was designed prior to 2003 and in many cases as early as the 1990s. The majority of aviation GPS receivers on the market today were also designed prior to 2003, and even the very new ones that we are planning to introduce next year were designed to the basic 2003 requirements with some increases in noise requirements - but these amendments still assumed protection of the GPS band.

AEA member companies have been selling and installing GPS navigators, surveillance and emergency locator systems to the aircraft owners and operators for nearly 20 years. These systems have been designed, manufactured and certified to the government's technical standards to provide the aviation consumer with an assurance of usability and acceptability within the

National Air Space. The new generations of these products have all been certified to meet the FAA's NextGen standards. Any efforts by LightSquared to generate a requirement resulting in costly recertification and retrofits of the already installed systems will directly and negatively affect the consumer's confidence in their systems and their willingness to upgrade to the modern systems required of NextGen.

The most recent "upgrade" of GPS systems, advancing the early 1990s basic GPS system to the 2003 WAAS system cost the aircraft owners at a minimum $2,000 per installed system. And this was a "simple" plug-and-play installation.

Closing

While we support the concept of a low cost national wireless broadband system, no system, regardless of anticipated benefit, can be allowed to compromise the safety and security of the national air transportation system.

Any proposed changes that affect the national air transportation system requires long range planning, and we encourage LightSquared, or any other company, to participate in the aviation technical standards development process through RTCA. RTCA and the FAA have been working towards NextGen for nearly 20 years. If neighboring technologies need changes in the aviation systems in order to be compatible, these companies need to work with the FAA and RTCA so that the next generation of aviation products might be designed and certified to be compatible with their future business plans.

The idea that a new entrant into the marketplace can arbitrarily introduce a product that immediately compromises aviation safety and security, while expecting the aviation industry to design, manufacture, test, certify and install an aviation compliant filter, is simply not realistic.