

**LIGHTSQUARED: THE IMPACT TO
SMALL BUSINESS GPS USERS**

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BEFORE THE
COMMITTEE ON SMALL BUSINESS
UNITED STATES
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LIGHTSQUARED: THE IMPACT TO SMALL BUSINESS GPS USERS

WEDNESDAY, OCTOBER 12, 2011

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SMALL BUSINESS,
Washington, DC.

The Committee met, pursuant to call, at 1:02 p.m., in Room 2360, Rayburn House Office Building, Hon. Sam Graves [Chairman of the Committee] presiding.

Present: Representatives Graves, Bartlett, Chabot, King, Mulvaney, Tipton, Herrera Beutler, West, Hanna, Schilling, Schrader, Cicilline, Owens, and Hahn.

Chairman GRAVES. Good afternoon, everyone. We will bring this hearing to order. I want to thank all of our witnesses for being here today. This is a very important hearing. I know some of you traveled a ways, and I appreciate you being here.

Today we will hear about how LightSquared's proposal is going to impact the ability of small businesses to access the global positioning system, GPS. Thousands of small businesses rely on an accurate GPS signal for their day-to-day operations, and potential interference could severely handicap or impair those businesses.

LightSquared aims at providing wireless 4G broadband coverage to 260 million Americans in both rural and urban communities by 2015. I agree that we need to find innovative ways to provide high-speed Internet access to underserved areas. Access to high-speed Internet provides small businesses, especially those located in rural communities, with the opportunity and resources to compete in an electronic and global marketplace. However, such innovation should not jeopardize the currently established systems, including GPS, and add more unnecessary burdens to those who use them.

Since it was first launched, taxpayers have invested over \$35 billion in the GPS system. This national asset has become an integral part of our economy. We can see the value-added benefits in a variety of sectors. From a safer and more reliable energy grid to precise agriculture mapping, nearly every industry has benefited from this technology. Moreover, recent studies estimate that GPS supports over 3 million U.S. jobs and contributes over \$3 trillion in economic activity.

Federal test results from LightSquared's proposal showed significant interference on all types of GPS receivers. This alarmed many small businesses that could be required to replace or retrofit their current GPS system. This would be an enormous cost to small business. Even though LightSquared is committed to spend \$50 million to retrofit Federal GPS devices, this does nothing for the nearly 1

million small businesses that are left to pay the bill that will easily cost billions of dollars.

Moving forward, I am confident that we can find a solution to provide more broadband to rural areas while not jeopardizing any small business GPS users. Again, I want to thank all of our witnesses for their participation. And I now yield to Ranking Member Velázquez for her opening remarks.

Ms. VELÁZQUEZ. Thank you, Mr. Chairman. Good afternoon, and thank you to all the witnesses for being here today. Expanding access to broadband is not just about technology. It is about job creation and growth. Through its adoption, companies can reach new markets across the globe while reducing costs at home. In fact, the number of jobs depending on broadband and information technology is expected to grow by 25 percent over the next 10 years. This makes the expansion of broadband connectivity a critical priority and is the main reason the administration set a target of reaching 98 percent of the population through such technology.

Today we will examine a proposal that will advance this objective. This plan, which centers on constructing a hybrid ground-based satellite network, would have broad benefits. Beyond its immediate payoff, widespread broadband adoption will mean new economic opportunity for communities across the Nation, particularly rural America. For individuals looking to launch a new enterprise, broadband offers lower start-up costs. This is especially important now as many dislocated workers are looking to entrepreneurship as a way to replace lost income.

For the established small business, high-speed Internet can expand a firm's client base using a company Web site, social networking, or other forms of online advertising. Firms can utilize voice and video communication to connect with customers around the world and reach previously untapped markets. They can store data on line and access office productivity tools.

While the proposal we are considering today shows promise to accomplish these goals, we have to consider its interference potential. One example is GPS, which serves a critical role in aviation safety and efficiency. In fact, the Department of Transportation's NextGen program focuses on modernizing this platform, and it is expected to create 160,000 jobs in 4 years, the same number the aviation industry lost in a decade.

With 360,000 GPS-equipped aircraft and over three million jobs, we must ensure interference does not undermine this growing industry. Not only must we address the aviation industry's concerns, we also need to investigate the plan's small businesses impact. Business owners in a variety of trades, like precision agriculture and construction, rely on GPS technology for its cost-saving benefits. Small farmers use GPS to save \$5 billion annually on water and fertilizer costs. Inaccurate information or expensive equipment upgrades caused by interference could result in small business job losses.

Recognizing these concerns, it is imperative to test this plan's technology. Doing so will ensure small businesses are not left with costly burdens. Regardless if this new plan is ultimately adopted, we must continue to push forward with R&D and evaluation. At some point, either through the current effort or subsequent endeav-

ors, we will be able to mitigate GPS interference successfully and bring the benefits of broadband to nearly all small businesses and their customers. We should not let a complication that has multiple solutions hinder progress towards nationwide connectivity.

Time and again, advanced technologies have been a springboard for growth. From mobile phones to biotechnology to the Internet, new technologies have brought jobs and prosperity. With this in mind, I look forward to hearing how we can further foster innovation.

Thank you, Mr. Chairman.

Chairman GRAVES. If Committee members have an opening statement prepared, I would ask that they submit it for the record. And just to explain to you the timing system, each of you have 5 minutes, and the lights will indicate green for that time period. When you are down to a minute it goes yellow, and then red when you run out of time. If you run out of time, it is not that big a deal, just don't go too far over.

This hearing has obviously—or this subject matter has been heard in a lot of Committees on the Hill so far, Small Business Committee, because it has such an impact here. But the Armed Services Committee, Transportation Committee, the Science and Technology Committee, the Agriculture Committee will probably have a hearing on it. So it is of huge importance.

With that, we will go to our witnesses now so you each can give your statements, and I am going to turn to Representative West from Florida to introduce our first witness.

Mr. WEST. Thank you, Mr. Chairman and Ranking Member. Our first witness will be Mr. Dennis Boykin IV, the founder and manager of DB4 Consulting. Mr. Boykin is a small business owner, a veteran, licensed pilot, and a proud aircraft owner. He is an Army veteran, an artilleryman with whom I served together in 1991 in Desert Shield, Desert Storm, in the 5th Field Artillery, and Dennis, it is great to see you again, and hopefully all is well with your family. He has been flying for over 30 years. Mr. Boykin will be testifying on behalf of the Leesburg Executive Airport Commission. Mr. Boykin.

STATEMENTS OF DENNIS B. BOYKIN, MANAGING PRINCIPAL, DB4 CONSULTING, LLC, LEESBURG, VA, ON BEHALF OF THE LEESBURG EXECUTIVE AIRPORT COMMISSION; RICK GREENE, PRECISION AGRONOMY MANAGER, MFA INCORPORATED, COLUMBIA, MO, ON BEHALF OF THE AGRICULTURE RETAILERS ASSOCIATION; JEFF CARLISLE, EXECUTIVE VICE PRESIDENT, LIGHTSQUARED, RESTON, VA; AND TIM TAYLOR, PRESIDENT & CEO, FREEFLIGHT SYSTEMS, IRVING, TX, ON BEHALF OF THE AIRCRAFT ELECTRONICS ASSOCIATION

STATEMENT OF DENNIS B. BOYKIN

Mr. BOYKIN. Chairman Graves, Ranking Member Velázquez, members of the Committee, and old Army comrades, thank you for the introduction and thank you for the opportunity to address this critical issue today.

As Congressman West noted, critical to me not only as a small business owner who owns high-precision GPS in order to keep my

aircraft safe and, more importantly, keep the people underneath my aircraft safe, but in a leadership position as leader of the Leesburg Executive Airport, concerned about the welfare of our airport because we run a business.

I have three concerns regarding this potential interference with high-precision GPS receivers: my family's safety, the costs associated with the proposal, and the impact on our general aviation infrastructure. I have spent nearly \$40,000 on GPS equipment installations over the last 8 years in two airplanes. I am not unique in my community. Many of us have spent a lot of money to increase our margin of safety while running our businesses and flying our airplanes. And make no mistake about it, GPS is a matter of life and death. This is not hyperbole. I am a combat veteran, and I know something about life-or-death situations, and although I know you hear a lot of hyperbole sometimes about this issue, GPS is critical not just to business but to life.

First let's talk about my airport in Leesburg. We have a saying out there, as I serve the town and its residents in running that airport, that airports are not about airplanes, they are about commerce. Our airport provides an interstate commerce benefit, bringing over 200 jobs and \$80 million a year in economic impact to Leesburg and Loudoun County, Virginia. We have over 250 aircraft based at our field, and nearly all of them are GPS equipped.

Now, the FAA estimates, if LightSquared deploys the system as tested at Holloman Air Force Base a few months back, they are estimating a \$440 million a year negative economic impact to general aviation, 800 lives lost per year, and \$22 billion in opportunity costs if NextGen isn't deployed. That is their numbers, not mine. My estimate is a little more personal. I don't want to have to go explain to residents in Leesburg and to the town council why the airport is causing trouble.

In my second role managing a business, I am hearing LightSquared's claims that their system won't interfere with GPS. Then I read Mr. Russo's testimony to the House Armed Services Committee Subcommittee on Strategic Forces that says exactly the opposite. LightSquared claims they have a filter—in fact Mr. Carlisle I think has one here with him—that will magically solve the problem that they caused, in my opinion. Am I expected to bear the expense of the certification, installation, downtime, and test flights surrounding these filters? Mr. Carlisle will tell you not, that Garmin should provide that. Oh, by the way, the FAA hasn't certified these yet.

Speaking of businesses, let's talk about environmental impacts. Recently I took a business trip to Florida to an Army conference. Made that trip on a direct routing, thanks to GPS. Saved an enormous amount of fuel not following the airway routes. This is the next—this is the entire precept behind NextGen, direct routing. With any impact on GPS, we lose those environmental improvements in the reduced carbon footprint of each flight.

And, finally, I am concerned about the safety of every flight. GPS signals enhanced by wide-area augmentation service have created a precise flight environment today that is unrivaled in our history. Flight is so much safer today than when I learned to fly 30 years ago, I am no longer uncomfortable in getting up in bad weather.

Now, let me put you in an entirely likely scenario. Imagine yourself flying in my airplane at night, returning from a trip, we are in the clouds, I am on a GPS/WAAS approach to runway 17 at Leesburg, and the screen goes blank because there is a harmonic attenuation from the LightSquared cell tower I just flew over. Now, the engineers will tell you that cell phone towers only impact ground receivers. Every general aviation pilot on the East Coast will tell you otherwise. And don't ask me why I know this, but up to about 5,000 feet you can get a good cell phone signal. I just happen to know that. There is absolutely no reason to create this risk to life and property without proper testing and without proper coordination.

Now, we are going to hear a lot of testimony about how folks have fixed the problem already and there isn't an issue. Frankly, I will remind everybody here that we are in a Committee meeting chaired by someone from Missouri, and they have a great saying in Missouri, "Show Me." And I would like somebody to put together a test that puts multiple base stations, multiple handsets out on that test range at White Sands in Holloman, and make sure this thing really does work before we put lives at risk.

I have a little bit of experience. When I used to work for the Motorola Corporation I had to get trained in RF propagation. I am not an engineer, but I know that things can interfere with each other, and I hope this Committee would have something to say about how that works.

I thank you for your time and I thank you more importantly for your service to our great Nation.

[The statement of Mr. Boykin follows on page 28.]

Chairman GRAVES. Thank you, Mr. Boykin.

Our next witness is Mr. Rick Greene. Rick is a precision agronomy manager for MFA in Columbia, Missouri. In his role, Rick helps family farmers utilize precision agriculture technology to increase crop yields and efficiency. Rick is testifying on behalf of Agriculture Retailers Association. Thanks for being here.

STATEMENT OF RICK GREENE

Mr. GREENE. Thank you, Chairman Graves and Ranking Member Velázquez and members of the Committee. I appreciate the opportunity to appear before you today. My name is Rick Greene, I am here to testify on behalf of the Agriculture Retailers Association, a trade association which represents ag retailers and distributors of crop inputs, equipment, and services. ARA members are scattered throughout all 50 States and range in size from a fairly small family business to a large cooperative with multiple locations.

I am a precision agronomy manager for MFA Incorporated, a cooperative built by farmers for farmers. Our core business includes sales, service, and inputs of seed, fertilizer, precision agronomy, grain, feed, and livestock supplies.

I began my agricultural journey in 1995 when my father first purchased a yield monitor with GPS. During that time it was a struggle to operate this new type of technology and cope with the inaccuracies of GPS. While at Iowa State, as accuracy started to improve, I came to love what precision agriculture can do for farm-

ing, by preserving the environment, minimizing inputs, maximizing yield to give our farmers a greater return on their investment.

So what is precision agriculture? Precision agriculture is using the latest technology to provide sound agronomic recommendations in a timely fashion in order to maximize yield, manage inputs, preserve the environment to ensure farmers with a sustainable way of farming.

So, do some of your areas of your lawn grow better than others? Farm ground is the same way, only on a larger scale. Since then, GPS technology has evolved exponentially. Fleet vehicles use GPS for logistical tracking to minimize fuel consumption. Tractors drive themselves within one inch worth of accuracy to minimize overlap. Planters and sprayers turn off individual sections and automatically reduce overapplication of inputs. On-the-go sensors detect how much nitrogen a plant will require. River levees are surveyed in two-thirds of the time that it takes traditional surveyors. Aerial applicators vary nitrogen rates on the fly to reduce runoff and increase plant uptake. Irrigation systems vary water rates based on soil characteristics to reduce water waste. And the list goes on.

We would not be able to perform any of these functions without the high-accuracy GPS. Jess Lowenberg with Purdue University did a study back in 2004 using an 1800-acre model farm, and he found that a farmer that uses high-accuracy GPS will decrease his hour of operation by 17 percent. That 17 percent is not only operation but it is also a decrease in fuel, maintenance, and inputs like seed, pesticide, and fertilizer. Times are changing, and the producer needs to be more efficient in order to combat global competition.

Bruce Erickson, with the Purdue University, also did a study on economic adoption of precision farming technologies. From 2002 prices are up 350 percent in commodities, seed prices are up 266 percent, and fuel and fertilizer is up 270 percent. Efficiency and increased productivity is the key to surviving in this global market.

According to the United Nations Food and Agricultural Organization, the world population could rise to 8.2 billion people in 2030, which will require 50 percent increase in food production over the next 20 years in order to feed the global demand. The only way we are going to be able to achieve this goal is by using high-accuracy GPS, biotechnologies, and proper management.

Precision agriculture industry has over 400,000 high-accuracy receivers valued at \$13,000 and a replacement cycle of 10 to 15 years, and adds an approximately \$19.9 billion per year of value to the grower. MFA has over 700,000 acres in GPS nutrient management, \$9.5 million—or 9.5 million acres covered with high-accuracy RTK coverage, and has almost \$20 million of GPS equipment sold to the farmers that will be directly affected by the implementation of LightSquared's terrestrial component.

Since 2005, MFA has seen a 600 percent increase in sales and adoption rate of 40 percent of our customer base. It is like asking the American population to switch their analogue TVs to a \$13,000 digital TV when LightSquared throws a switch. LightSquared must not be allowed to broadcast their signal in the upper and lower bands of the GPS until a feasible and economic resolution is found.

To conclude, it is the accuracy of GPS that makes the technology important. Ideally, a solution will be found that allows GPS and wireless broadband to coexist, but LightSquared and GPS providers will have to work together. We believe farmers and ranchers and GPS companies should not have to bear the additional financial burden in resolving this issue. Thank you.

[The statement of Mr. Greene follows on page 34.]

Ms. VELÁZQUEZ. It is my pleasure to introduce to the Committee Mr. Jeffrey Carlisle. He is executive vice president for Regulatory Affairs and Public Policy for LightSquared. Prior to joining LightSquared, Mr. Carlisle served as deputy chief and, later, chief of the FCC's Wire Line Competition Bureau where he managed the development of the Commission's broadband policies. He has over a decade of experience in telecommunications law. Welcome.

STATEMENT OF JEFF CARLISLE

Mr. CARLISLE. Thank you very much. Mr. Chairman, Ranking Member, members of the Committee, thank you for having me here today to talk to you about LightSquared and GPS. And one thing that is very important to understand up front, and my colleagues on the panel here are going to very clearly make the case that GPS is important to them, and nobody in my company doubts that one bit. In fact, GPS is crucial to us. We have to have a functioning GPS system in order to coordinate the signals on our network, and the people who bring devices to our network are all going to have GPS devices, GPS receivers built into their devices. So no debate about that GPS is important, it is crucial to the American economy, we use it every day, and it is important to safety of life.

There is another important issue, though, that is particularly relevant to this Committee, and that is the fact that small businesses suffer today from a lack of choice in their ability to get wireless services. The Committee itself has recognized this numerous times. LightSquared is building a network that won't just bring one competitor to the market, but will bring dozens of competitors to the market. We already have over 17 business partners who are waiting for us to have our network ready to go so they can start selling broadband services to end users. The effectiveness is to enable them to lower prices to end users and small businesses, the people who need it most; better connectivity and extension of connectivity to rural areas which historically have been on the short end of the stick when it comes to wireless networks, and will definitely be so when it comes to broadband networks. And this is a problem that we have to deal with, make no mistake. The lack of effective broadband infrastructure makes America 15th in the world in terms of broadband adoption.

And why is this important overall? These consume 24 to 25 times more data than a regular cell phone. That was just 3 to 4 years ago before that started to be the effect. In less than 2 years we will have too many devices and too little spectrum. We are the only realistic new source of spectrum within that time frame. And let's be clear: There will always be issues with existing uses of spectrum when you have a new network being built. With 700 MHz, which was another band, it was wireless microphones. With here, it is GPS. With 800 MHz several years back, it was public safety.

These issues can be solved. If we can't solve them, we aren't going to be able to provide services to the people who need them, and the real loser on that will be small businesses. They are the ones whose bottom line get hit the worst. "Not in my backyard" does not work in spectrum. There is not one piece of spectrum in the whole range that you can pick that will not have some sort of incumbent issue.

So how do we solve the issue? I think, unfortunately, a lot of the commentary that you hear about this conflates our old proposal of starting in the spectrum closest to GPS with the proposals we have on the table now, where we will offer our service on the spectrum farthest away, and this will address the issue for over 99 percent of GPS devices, simply by physics. They don't look that far down into our spectrum, and that covers cellular devices, personal navigation devices, it covers aviation devices. And to show that effect, the government testing itself, which was separate from the industry testing on this, concluded that initial test results demonstrated that some applications, for example aviation, were able to operate with little to no degradation when we were operating on the spectrum farthest away from GPS. That has been established for months now.

So what are we left with? We are left with precision devices. So we are going from 400 million devices across the country to something less than 750,000, perhaps as few as a hundred thousand. These are the ones that are designed to get to centimeter-level accuracy and are used in agriculture, surveying, and construction, and I think there is room for skepticism in terms of the claims as to how hard this issue is to solve. For months now, we have heard about there is not enough room in the devices; it would take a backpack-size filter to fix it; it would cost too much; it is going to take too long; it is going to take years and billions of dollars.

Well, I have a precision device right here, actually. It is from an unnamed manufacturer; we bought it on e-Bay, it is right there. As you will see when you take the dome off, there is room in this device, and this is the antenna. This is where you place the filter for the antenna. It is right here. It is this little square here. The filter that we have developed in a matter of days at a cost of \$6 per unit is right here.

Now, our solution isn't going to be a solution for every receiver. Many receiver manufacturers will come up to—will have to come up with their own solutions. But what this is, is a proof of three concepts: It can be done; it can be done inexpensively; and it can be done quickly. I also think the issue of bearing the cost for this proposal is also something that is misunderstood.

Just last August in 2010, Garmin issued a voluntary recall of 1.2 million GPS receivers that had battery issues. Their stock price declined about a cent the day they announced that. So this is an issue that comes up in private industry all the time. Manufacturers who have put devices out there, that are subject to this kind of interference when they shouldn't be, should bear some of the responsibility. And we have already borne a significant amount of the cost of addressing the issue for hundreds of millions of devices, and I look forward to receiving your questions. Thank you.

[The statement of Mr. Carlisle follows on page 36.]

Chairman GRAVES. Thank you, Mr. Carlisle.

Our final witness is Mr. Tim Taylor, the president and CEO of FreeFlight Systems in Irving, Texas. His company manufactures aviation GPS navigation systems for commercial and military aircraft. He has over 35 years of experience in this industry. Tim is testifying on behalf of the Aircraft Electronics Association. Welcome and thanks for being here.

STATEMENT OF TIM TAYLOR

Mr. TAYLOR. Chairman Graves, Ranking Member Velázquez, and members of the Committee, thank you for the opportunity to appear before you today to discuss the impact of small business GPS users in industry of the proposal from LightSquared. My name is Tim Taylor, and I am president and chief executive officer—

Chairman GRAVES. Make sure your mike is on.

Mr. TAYLOR. Is that better?

Chairman GRAVES. There you go. That helps.

Mr. TAYLOR. I am sorry. My name is Tim Taylor, and I am president and chief executive officer of FreeFlight Systems. Today I have the privilege of also representing the Aircraft Electronics Association. The Association represents more than 1,300 aviation businesses worldwide, including avionics manufacturers, repair stations, distributors, and schools. Of these, more than 80 percent are small businesses.

My company, FreeFlight Systems, is a manufacturer of avionics systems for commercial and military aircraft and was the first company to certify an airborne WAAS receiver. FreeFlight Systems specializes in NextGen avionics, GPS navigation systems, GPS/WAAS sensors, dynalink radios, and radar altimeters. Our entire industry has been working toward the implementation of GPS-based navigation, air traffic management, and landing systems for over a decade. This ongoing transformation of the Nation's airspace system, NextGen, is predicated upon the availability of ultra high-integrity GPS position information, which has, in turn, been made possible by some 30 years of work in GPS technology that lives on the very fringes of human engineering capability.

All of this development has been accomplished with a consistent assumption of a certain level of protection of the GPS signal spectrum, one that long predates any of this recent debate.

LightSquared has proposed a nationwide wireless broadband network that pours high-energy radio waves into the previously protected spectrum. We, like all Americans, support a low-cost nationwide wireless broadband network, but not one that compromises the safety and efficiency of the national air transportation system. Quick studies are being undertaken and quick decisions are being made. This is entirely incompatible with the requirements of safe airspace critical system design.

I am reading of voluntary spectrum self-limitation, and I see reports of instant solutions to interference through the addition of a filter that was thrown together in the past few months. This is not how it works for us. The FAA estimates, and I would agree, no less than 10 to 15 years would be required to bring an amended product safely to the aviation marketplace, assuming no further changes to spectrum use.

So 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 extreme cost to small business that any change to the aviation-certified GPS navigation and surveillance systems would cause.

GPS satellites are low powered and a long way away. The signals we receive are less than the noise interference generated by the metal box we put the receiver in, but people's lives depend upon our ability to read that information and not get it wrong any more than once in every 10 to 1,000 million flight hours. 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 maintain performance requirements like these in a rapid response mode to a significant noise environment change is entirely unreasonable. For example, in a stable requirements environment, we have been developing a replacement GPS for one of our older products for some 6 years. We are still about a year away from a certified GPS engine, and 2 to 3 years away from a usable avionics system implementation. Approval of that system into real aircraft will take another 1 to 2 years.

I can categorically tell you I do not know if the new system will work in the most optimistic LightSquared plans that are on the table. I can tell you it will not work at all at LightSquared's FCC-approved transmission levels and spectrum. AEA member companies have been manufacturing, 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 airspace. Any efforts by LightSquared to generate a requirement resulting in costly re-certification and retrofits of the already installed systems will directly and negatively affect the industry and the Nation's airspace.

In closing, while we support the concept of a low-cost national wireless broadband system, no system, regardless of its anticipated benefit, can be allowed to compromise the safety and security of the national air transportation system. Changes that affect the national air transportation system require long-range planning, and we encourage LightSquared or any other company to participate in the aviation technical standards development process. 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 once the current generation of products reaches the end of its service life.

The idea that a new entrant into the marketplace can arbitrarily introduce a new product that immediately compromises aviation safety and security, while expecting the aviation industry to design,

manufacture, test and certify, and install an aviation-compliant filter, is simply not realistic.

Thank you for providing me this opportunity to address the Committee. I will be happy to answer any questions you may have.

[The statement of Mr. Taylor follows on page 62.]

Chairman GRAVES. Thank you, Mr. Taylor.

Mr. Carlisle, I have a quick question on your receiver there you have got, which I have never seen a receiver that big before, but my question to you is: The filter that you held up, which you talked about you could fit inside there easily, the GPS antennas that I have on the aircraft that I fly are the same size as that filter, maybe just a little bit larger, so how is that going to fit in that antenna? And that includes the streamlined casing on it for the slipstream. I am just curious how that is going to—

Mr. CARLISLE. I am glad you asked that question because it allows an opportunity to really clear this issue up. This is a precision receiver that gets you down to centimeters for use in agriculture, surveying, construction. The type of receivers you are talking about in your plane are not that kind of precision receiver, all right? Under our proposal, which puts us at the bottom end of our band, under the minimum performance standards which are adopted internationally, we should be fine under that. The FAA is reviewing that. But all the testing of aviation receivers that was done by both the Federal Government and by industry shows that the aviation receivers perform much better than the minimum performance standard. So we are not talking about, under our current level of proposals, requiring any changeout—and let me repeat that because it is important—any changeout of aviation receivers. If it was going to take us 8 to 10 years to go through the certification process in order to do that, that would not be a commercially feasible business plan. So what we have proposed is the use of our spectrum that does not require any changeout of aviation receivers.

Chairman GRAVES. Well, that brings us—and the problem I have is, and in your testimony you used the comment “little to no degradation.” The “little” is the part that bothers me. And you said just now in the question, you said “should be.” It is the “should be” that bothers me because in aviation we deal in zero tolerances.

Mr. CARLISLE. Uh-huh.

Chairman GRAVES. Zero tolerances. So if there is any concern out there, we are going to end up having to retrofit and filter because it is zero tolerance. And what that is going to cost, you know, and I am very curious as to what—in fact, I want to hear from all the panel, you know, what we think this is going to cost in terms of that retrofit, because at least when it comes to aviation it has to be certified. If it has to be certified, that is when it gets really expensive.

Mr. CARLISLE. I absolutely agree with you, and if I can directly respond to that, that is absolutely true. And the fact is that we should only move forward if this can be done while absolutely assuring safety of life and aviation, all right? And we are working with the aviation community in order to do that. That is something that we believe is nonnegotiable, all right? Nobody in our company is running out to irresponsibly deploy a network that is going to cause issues with people, with air safety in the United States. That

is not what we are about, and we are absolutely committed to making sure this will work and that the FAA is satisfied, that NTIA is satisfied, and FCC is satisfied on that front. And we have worked with FAA for years. We have worked with RT—we are members of RT—I am sorry, pardon me. We have worked with RTCA for years, we have been members for years on these issues, so we have put a lot of resources into making sure that happens.

In terms of cost, again, we believe our proposals will take us in a direction where there will be no cost to aviation in order to accommodate the network, and that is where we want to be.

Chairman GRAVES. How is that no cost, though?

Mr. CARLISLE. Because aviation receivers will not have to be replaced. We are taking all of the cost of solving the issue on our side, which is over \$100 million, by the way.

Chairman GRAVES. Mr. Taylor.

Mr. TAYLOR. So, first of all, I would echo your comments on “little to no.” We don’t live in the world of “little to no.” We live in the world of certainties, as I said, measured in thousands of millions of parts, very, very, very high integrity and availability of our systems.

I would also mention that many of the systems out there were developed back in the 1990s. I mean, there is a lot of aircraft systems. We as a company, have over 2,000, we know, systems flying that were developed in the 1990s. The requirements for noise interference testing on those was significantly less than the requirements levied on the modern receivers, so they certainly would have to be addressed, and I have no idea how they would work in this noise environment. No one has yet tested one.

For the newer receivers, as we said, there is a very strict FAA requirement for noise. As I understand it, the proposal for LightSquared to use the lowest spectrum comes very, very close to the edge of that or crosses slightly that current noise requirement, and the concept that we are going to be okay because there is some margin in there, again, does not work for me. This is something that needs to be tested and evaluated, and it is not one field test, it is a very serious comprehensive series of regressive testing that will take a long, long time to accomplish.

Chairman GRAVES. Mr. Boykin.

Mr. BOYKIN. I don’t know what the cost is. I will go back to testing, though, and it sounds—it all sounds good. But back to the “Show Me” concept, I will take you back to 1981 at a field in Arizona where a client of mine, when I worked for Motorola, was complaining about interference. I couldn’t figure out why he couldn’t talk to that repeater on the mountaintop 60 miles away. You could almost see the mountain, but he couldn’t talk to it with his 15-watt radio. Drove 2 miles back to Interstate 19 and found a crew from a large construction company that was operating in the 27 MHz band and asked them to key their radios every minute, drove back to my client’s site and said, okay, let’s try doing it now, and that is exactly what it was. My client was using a radio in the 450 MHz FM band for business. That is 400 MHz and 2 miles away, and that amount of electrical energy in the air interfered with a 60-mile transmission.

I note from the chart Mr. Carlisle brings in that we are talking about a spectrum spread of 30 MHz between ground-based transmitters that I have to fly over. So I will just go back to the point, Mr. Chairman, that I spent over \$2,000 a receiver to do my WAAS upgrade a few years ago. We are talking thousands of dollars for upgrades, if necessary. Let's get back to the testing. That is what really needs to get done.

Chairman GRAVES. Mr. Greene.

Mr. GREENE. Well, I will concur with the two gentlemen, Boykin on my left and Taylor on the end, with the fact that we need to have a lot more testing done on this just to make sure we don't go through and interfere. Being in the agriculture industry, I do go ahead, I do recognize that receiver, and that receiver is a lot of the same type of size that we have for our high-accuracy RTK.

Now, I went through and actually crunched some numbers. MFA has approximately 250 high-accuracy GPS units across the State, and we cover approximately 1 million acres with those high-accuracy RTK antennas. Assuming that LightSquared's filter is going to cost around \$800, to go and retrofit or basically to purchase those filters is going to cost roughly \$200,000, and \$200,000 for the filters and approximately \$200,000 for the resource. The resource is the personnel, the truck, the fuel expenses to go around and take care of that. Time frame in that period, will take at least 1 year's worth of time in order to go through and do that, and that is just for the 250 high-accuracy receivers that we have.

Now, if you go ahead and you take a look at it, Mr. Carlisle said that there could be anywhere between 100,000 and 750,000 high-accuracy RTK antennas. Our belief is that there is at least 750,000 to 1 million high-accuracy RTK receivers used in agriculture, used in construction, used in geography management. So you go and take those kind of numbers and you go and times it, basically it comes out to \$1,600 per unit that it will cost in order to go through and retrofit it with this filter, go and take it times that \$1 million—or, excuse me, 1 million high-accuracy RTK GPSs that are out there in the marketplace.

Mr. CARLISLE. May I respond on the accuracy? The numbers I actually used were that the universe of devices could be about 750,000 in the country. It is not entirely known exactly. It could be as high as a million. But in terms of the ones that actually have to be replaced or retrofitted, it is not going to be that entire universe. First of all, because a significant number of precision devices have already tested out in terms of being resilient, so that is 10 out of 38, or almost 25 percent.

Second, many of these receivers are going to be used in areas which are going to be far away from anywhere our network is going to be, and, third, our—this is not a flash cut. We are going to be deploying our network over a period of 5 years. There will be a certain amount of exchange of devices that would take place in the ordinary course of business anyway. So that is how you get down to the 100,000 to maybe 200,000 number that you have to focus on and actually change out. Just to correct the record.

Chairman GRAVES. I don't want to dominate the questions because we have got a lot of members here with questions, and I will save the rest of mine for the end of the hearing. But I do have one

quick one for you, Mr. Carlisle, because the test results have revealed some significant interference in that upper 10 MHz band, and so you have proposed launching in the lower 10 for your service. My question to you is: Will you guys never use that upper 10—

Mr. CARLISLE. Well, we will certainly use—

Chairman GRAVES [continuing]. Of GPS?

Mr. CARLISLE [continuing]. Continue to use it for satellite services. We have used it there for 15 years without any issue at all with GPS, and those satellite services provide services to public safety, oil and gas, all sorts of folks in the United States uses it. Our satellite services were used after Hurricane Katrina. After the tornadoes in Joplin, first responders had our units there. So we will continue to use the spectrum.

We would like a continued dialogue as to whether or not we could ever commercially deploy that spectrum because then you do start to get into the issues that Mr. Taylor and Mr. Boykin have raised about aviation functions and the susceptibility of a larger number of GPS receivers, simply because more of them look into that spectrum. So you would need a longer conversation about that, but we are open to having that discussion, open to talking about alternatives.

Chairman GRAVES. But right now, I mean, basically you are not using that upper bandwidth, you are just basically doing that, that is just the company has decided not to do it, there is no requirement for that, you could use it at any time?

Mr. CARLISLE. We would—let me be clear. The only issue that comes up down the road is if, you know, we deploy out in our network using the 10 MHz all the way down on the other end of the band. We can do our full deployment to 260 million people with that amount of spectrum. The issue is the number of devices, the amount of usage that ultimately goes on the network.

That won't be a problem we have for at least 5 to 6 years. And in the meantime, you can either—you can skin that cat a lot of different ways. You can modify the way you are using your current spectrum, you can use the new spectrum in ways that are very different, much lower powers that would not raise an issue on interference. You could also look at swapping for alternative spectrum or something like that. There are a whole bunch of things that should be looked at before we—while we move forward on the lower 10, but—and also keep in mind our customers are retailers. They will have options in the marketplace, too. By that time other spectrum may very well have been brought online, and if they need more spectrum for their customers, they can go out and buy it from somebody else. So I think there are a lot of different ways to skin that cat down the road, and we are willing to talk with the government agencies and the GPS manufacturers about how we do that.

Chairman GRAVES. I am worried about the future and this betting on the outcome that something is going to happen in the time frame between now and then. That worries me a great deal, that it isn't going to happen. I am going to yield to Ranking Member Velázquez.

Ms. VELÁZQUEZ. Thank you. Mr. Carlisle, if filtering technology is the solution to interference, are you aware of how much it will

cost small firms because, after all, this is the Small Business Committee, and we are here because we understand that it could have a negative impact on small businesses. And I would like to know if—it is important for all of us to recognize that it is not just the cost of retrofitting but also if you took into account indirect costs, such as time and lost resources or use of equipment, if those were included in your calculation.

Mr. CARLISLE. Okay. Well, that is a very good question, and thank you for asking it because I think it highlights an important point there, in that filtering is not the only solution. Filtering is the solution for high-precision receivers, okay? For the vast number of small businesses who day-to-day only use consumer-level devices that aren't precision, moving down to the spectrum and lowering our power is going to address the issue for them.

Now, for those small businesses who do use precision equipment, our very strongly held belief is it shouldn't cost them a cent. It shouldn't cost them a cent. We will be deploying our network in a way that they will have advanced notice of when—of where we will be and when we will be there. There will be time for them to work with their manufacturers to get alternatives, and the manufacturers really should be stepping forward on this. I don't think there is any question about that.

Mr. Taylor in his testimony, has, you know, made statements that this was all of a sudden came up and wasn't anticipated, that our power levels were all of a sudden jumped up. We are operating at transmission levels, power levels that were approved in 2005. There have been years to address this issue.

Ms. VELÁZQUEZ. Okay. Thank you. Mr. Taylor, the DOD's 2008 GPS standard encouraged filters for GPS devices. Can you please explain how exactly these filters minimize interference and whether you currently use these filters in your GPS devices?

Mr. TAYLOR. First of all, we do not make much in the way of military GPS. We do a small amount of military GPS, so I cannot specifically address that question. From a more general aviation receiver point of view, we would be happy to look at filtering as a possible means of mitigating the risk associated with the spectrum challenges we are talking about.

GPS is different from telecommunications. The way GPS works, the signal—I will not get technical, I promise. The signal is a broadband spread-out signal. We need, in order to reliably discriminate the information, we need to be able to see a broadband signal, so filtering limits that, and it will—filtering will impact the performance of our receivers. I can't tell you today to what extent.

Ms. VELÁZQUEZ. Okay. Mr. Carlisle, I understand the updated plan includes a design to eventually expand operations to the entire spectrum band, yet no details have been provided. Does the company have a timetable for this expansion and how will this affect GPS?

Mr. CARLISLE. We won't need additional capacity, as I said earlier, for at least 5 to 6 years, and so I think that is the outside timetable. And as I said, there are many alternatives that we would want to consider to see what was commercially reasonable and safe.

Ms. VELÁZQUEZ. Your company believes that its plan can increase coverage to at least 260 million people by the end of 2015. In light of our current economic conditions, what role do you see your company's expanded wireless broadband network playing in job creation?

Mr. CARLISLE. I think it will play a significant role in it. Our invest—to build that network, you have to plow \$9 billion into the American economy. We have already spent a billion dollars in American technology to put our satellites up. That was with Boeing in Washington State and Harris in Florida. In order to achieve a network build like this, you have to spend a tremendous amount of money all across the country. Wherever you put a tower up, that is folks from your vendors, that is contractors, that is small business people providing that service, and then it is contractors and small business people providing the maintenance going forward. So we have estimated very conservatively that the impact of our investment on the American economy is 15,000 jobs supported a year for each of the 5 years of the build-out. Following that, each one of our business partners, because they don't have to spend money on owning and maintaining their own network, can plow that money into their own retail operations and hire jobs there.

Ms. VELÁZQUEZ. Okay. My question to the other three witnesses, the FCC believes that LightSquared's proposed network is going to benefit and have a positive impact on broadband access for rural small businesses, but we also know that existing GPS technology will be harmed. So my question to the three witnesses is, how do you recommend that we proceed going forward? Should an innovative idea be outright rejected without any real attempts to find a technical solution? Mr. Boykin?

Mr. BOYKIN. Thank you, ma'am. And obviously we don't want to withhold any technology. Technology has led our economy. I will go back to—I am starting to sound like a broken record here. We need to do some testing. Things aren't always as they appear to be in the RF spectrum, and I will point back to the fact that the original test had one base station. I pointed out earlier, I used to work for Motorola. Motorola was not only the company that designed land mobile radio in the beginning, Motorola is the company that invented cellular technology with the 800 MHz system Mr. Carlisle referred to. Those experiences at Motorola taught me that when you get two or more radios in close proximity, things get different, and you will note that some of these tests were done with one radio in an anechoic chamber, a noise-free chamber. We need to put a couple of base stations out there, a couple of handsets, and I will offer up my airplane, if somebody wants to chip in for the gas. I would be happy to fly out to New Mexico, it is a beautiful State, and fly over and make sure that this thing actually works.

Ms. VELÁZQUEZ. Mr. Greene.

Mr. GREENE. Thank you. I concur with the rest of the group that the fact that we need to do some additional testing. And being a Cubs fan, and knowing that their spring training happens out in springtime out in Arizona, I would be happy to go out there and help out in any possible way that I can.

However, definitely some more testing needs to be made. We feel like broadband Internet will bring an exceptional increase to our

business perspective as well, but if we don't have—if we don't have the GPS to collect the data, there will be no data to transfer into in order to do more processing.

Mr. TAYLOR. Again, we all agree that we need more broadband services in the country, no doubt, but from the aviation community's point of view it has taken decades, decades of a complicated interaction between receivers, GPS constellation, ground infrastructure, to come with something that is robust enough to be safe, the safety of life for people to fly safely. And one or two flight tests will be fun, but it will not answer the question, and I cannot tell you there is a fast answer for this. I think it is going to take time and analysis and interaction. I cannot see any other answer, I am afraid.

Ms. VELÁZQUEZ. Mr. Carlisle, what is wrong with testing?

Mr. CARLISLE. There is nothing wrong with testing, and in fact we are fully supportive of the further testing that NTIA asked for, but I am not sure the background materials Mr. Taylor has read—but frankly, there has been a more comprehensive testing of this issue than any other interference issue ever presented to the GP—to the FCC. There were 130 devices tested in eight independent labs over a series of months by an industry group that had 37 of the Nation's top GPS engineers on it. That was just the industry testing. There were dozens of devices tested in New Mexico at Holloman Air Force Base by the U.S. Air Force. Furthermore, there were devices tested by the FAA and the Jet Propulsion Laboratory. Moreover, RTCA, their GPS group ran an analysis of the minimum performance standards against our signal, and that analysis is continuing to be done by FAA. So we have no issue with there being further testing to make sure we are absolutely safe on safety of life, but let's not ignore the fact, there has been an awful lot of testing already and analysis.

Ms. VELÁZQUEZ. Thank you, Mr. Chairman.

Chairman GRAVES. Mr. Schilling.

Mr. SCHILLING. Thank you, Mr. Chairman. Just quickly, a couple of things. I guess I will go to Mr. Carlisle. If the retrofit replacement of the GPS receivers in the market, if you have to do a retrofit, will you guys be paying for that or will that be the person that is having the retrofit done, say a farmer, for example?

Mr. CARLISLE. That is a very important question, because for 9 months what the GPS manufacturers have done is they have said there is only two parties in this debate. There is the LightSquared network and there are the users of GPS who are going to be affected by it. They have conveniently left themselves out of the equation.

Again, I don't think the users should have to pay a cent. We have already paid, and the total value of our commitments is over \$160 million at this point to solve the problem for the vast majority of consumer devices. For these precision devices, where there really is no solution that we can put on our transmissions except to abandon the band entirely, we think given we are talking about 100- to 200,000 devices, maybe a few more than that, but that is the order of magnitude we are talking about, and that our power levels have been set for 6 years, that that is the right outcome there.

Mr. SCHILLING. Okay, very good. Thank you. Now I want to go to Rick Greene. A couple—I come from a large agricultural area. One of the things, have you guys done any looks at maybe like if things do need to be switched around, how long a tractor will have to be down, you know, how that will affect like a single tractor versus a large family farm?

Mr. GREENE. I haven't put any numbers per se, but one of the things with agriculture, it is very time sensitive, and it is one of those things where if we can't get to everybody by springtime, then a producer could go and have the option—well, I have got—a producer could go and see a projected downtime of—well, let me just give you an example.

So in the State of Missouri we have 1 million acres underneath high-accuracy RTK coverage, okay? If you go and look at 180 bushels per acre times \$7 corn, say for instance those acres don't go through and get planted, that will be \$1.26 billion that the producers will have lost that year, just for our 1 million acres that we have in the State of Missouri.

Mr. SCHILLING. Okay, that is a lot of corn. Okay, very good. That is all the questions I have. I yield back my time, Chairman.

Chairman GRAVES. Mr. West.

Mr. WEST. Thank you, Mr. Chairman, and Ranking Member. My question, Mr. Carlisle, and I guess I will take it into a little bit different direction. You are talking about developing this out in rural communities, correct? I am very concerned, because when you start to look at a lot of military type of activity, military activity out around a lot of rural communities like NTC, National Training Center, Twentynine Palms, China Lake, impact areas and this type of thing, my question is: What type of testing, and what is your implementation plan? What have you done to work with the Department of Defense as far as aircraft, you know, helicopters, fixed wing, laser designating devices and, as well, as smart munitions, because I think it would be a bad day for small businesses and communities if that spectrum were to somehow interfere with a training exercise and all of a sudden a smart munition ends up somewhere where it is not supposed to be.

Mr. CARLISLE. Thank you for your question. We have actually been working with DOD since 2008 to coordinate the use of our spectrum, and with the OASD and NII group within the Pentagon, and in terms of the more recent identified issue with GPS receivers, which was really only brought up in September of 2010, we have had extensive exchanges with U.S. Space Command about the use of GPS within the U.S. military, also with Northern Command.

General Shelton's testimony before the House Armed Services Committee a few weeks ago quite accurately outlined the fact that, well, you know, you have got to train the way you are going to fight, and so we have to be using the same equipment here as we are using over there. The fact is that we know where the training facilities are. We know where the proving grounds are. Today we operate under a very significant requirement to limit our power near air fields and near navigable waterways. It limits our power significantly in order to avoid any interference with aircraft or maritime receivers in our band.

You can extend those operating limits to base stations we might put near military bases in order to avoid that interference, because you know where the activity is going on. That is one thing you can do. There are other options.

Mr. WEST. Well, then my question is: Have we actually put some of these towers out there and run some tests on this with—across the spectrum with different types of aircraft and munitions to make sure that we are certified?

Mr. CARLISLE. The U.S. Air Force ran a classified testing of military receivers in New Mexico in April of this last year. Those results are classified. Our cleared consultants have not seen them, but we would assume they have run that testing.

Now, they ran it under our old business plan which was to start closest to GPS, and that is part of the reason there was a reason for further testing now, was to make sure that the lower 10 option works for those.

Mr. WEST. And for the rest of the panel, I guess the question is when was the first time that you all really heard about this impact or potential interference on the GPS system? This kind of like surprised us, that we should just be restrained to birthdays?

Mr. BOYKIN. Well, I am not sure about birthdays Congressman West, but I can tell you that like a lot of issues that come up in public policy, we had a land development issue next to our airport that we learned about by reading about it in the Washington Business Journal. We learned about this by reading about it in the newspaper.

I understand that the most recent application to the FCC over the Thanksgiving weekend last year, literally was over the Thanksgiving weekend, and the public notice came out with a 10-day turnover, the Thanksgiving holiday, which having done a lot of business with the Federal Government I find pretty speedy. But our first indication of this was strictly out in the public area—arena.

Mr. GREENE. Same thing here. We basically first heard about it in the public arena probably in the March or April time frame. And then from there, it was quite simply kind of watching the news to see as this thing progresses.

Mr. TAYLOR. Same answer, I am afraid. It has been less than a year, and just been trying to keep up with it as reports appear in the press. We have more recently been contacted by the FAA and by the military to provide receivers for testing. So we became involved in that way, but quite recently.

Mr. CARLISLE. May I say when we first learned it? I will be very quick. We first learned of it in September of 2010 when the GPS manufacturers brought it to the attention of the FCC. We have actually have been working GPS interference issues with the GPS community since 2002 when we reached an agreement with them to limit our emissions into their band. So we have a cliff on our spectrum, there are filters in our transmitters that stop our signal from leaking into GPS.

The issue that was—and there was no problem with that agreement for 8 years. There is still no problem with that agreement. All the equipment tested out the way it should. The issue that was raised in September 2010, much to our surprise as well as everybody else's here, was that the GPS receivers look well into our

band. So it doesn't really matter if we are limiting our signal if we are operating within our band within our authorized frequencies. They are looking at it and can be overloaded. So that is when we learned of it and we have been dealing with it since then, too.

Mr. WEST. Thank you, Mr. Chairman. I yield back.

Chairman GRAVES. Ms. Herrera Beutler. Mr. Hanna.

Mr. HANNA. What will it cost to retrofit—not retrofit, but for new devices, devices not thought of or built yet to accommodate your bandwidth?

Mr. CARLISLE. It depends on the device. If you are talking about cellular phones where you have got millions of these devices and you can build at a very high level of volume, you are talking about filters that cost less than a nickel that exist today that can go into this.

I think there was some ambiguity, or nobody really knew how expensive it would be to develop a filter for precision devices, which are really the hardest ones to deal with. Well, we now know you can deal with precision receivers that are on the market today and also sold to government agencies and surveyors, and all sorts of people use them, for \$6. So going forward, this is a very small incremental cost to deal with it.

Mr. HANNA. And you estimate that you will be able to provide Internet service to another 50 billion people in rural communities?

Mr. CARLISLE. Is that on top of the 260 million that we are required to?

Mr. HANNA. Yes.

Mr. CARLISLE. Absolutely. We have already struck deals with several rural companies that we have the potential to go outside of our footprint. That is Cellular South, SI Wireless in southern Illinois. And just today we announced a deal with a company that plans to deploy in towns down to 10,000 people or less, that will reach out to areas that have been historically underserved. We may not have a regulatory requirement to serve above those 260 million people, but it is good business to do it and we should be doing it.

Mr. HANNA. And have you done studies on the potential growth from that, economic growth?

Mr. CARLISLE. I know there are studies out there that indicate broadband infrastructure investment is one of the majority determinants of economic growth. I grew up in a rural neighborhood that—where we had electromechanical switches until the 1980s in California. And I will tell you, the one thing that keeps people in rural communities is if they feel they have got economic opportunity there. They are not going to have that economic opportunity if you don't have the highway going out there. Same thing is they are not going to have that economic opportunity if you don't have the broadband infrastructure there today. It is just not going to happen. Leave aside issues like public safety, provision of medical services, and education.

Mr. HANNA. Thank you, I yield back.

Chairman GRAVES. Mr. Tipton.

Mr. TIPTON. Thank you, Mr. Chairman. Mr. Carlisle, I would like to go back to one of your comments. You talked about the filters stopping leaking as you described it.

Mr. CARLISLE. Uh-huh.

Mr. TIPTON. Is that 100 percent? With the filters there is not going to be a problem?

Mr. CARLISLE. Yes, sir. That was confirmed in both the industry tests and the government testing. Both confirmed that our filters are doing exactly what they are supposed to be doing. They actually filter our signal down to a level that is a thousand times stricter than what the FCC requires for us. And that was a level, by the way, that the GPS industry put in 2002 and asked us to agree to. So that is what we agreed to.

Mr. TIPTON. Okay. Great. I come from rural Colorado, and obviously support a lot of broadband being moved out into rural America. But we have a lot of problems right now, particularly for our small businesses that are struggling in terms of a lot of the costs. None more so, probably, than a lot of our farmers and other GPS users who are already struggling right now in our economy.

The U.S. Census Bureau estimates that about 50 million people live in these rural areas. How many of these 50 million citizens that are in rural America right now would receive new broadband service? And additionally, can you tell us how many would be covered by LightSquared if you move forward with your operations?

Mr. CARLISLE. In terms of wireless service, they will get it the day we turn on and get our next-generation units out there. Remember, we have a satellite that covers 100 percent of the United States to 200 nautical miles offshore. And it reaches these devices. That is why we spent a billion dollars on it. We spent \$250 million of that billion inventing technology that had never been built before. So the day we are out there—

Mr. TIPTON. Is that satellite, is that just a receiver that then transmits? Is the technology on the ground?

Mr. CARLISLE. Yes, it is a pipe. So you can put basically any kind of signal you need over it.

And so that will operate at speeds that are approximate to what you get on 3G today. So you can do phone calls, emails, texts on it today.

Now, when we roll out—now, the rollout of our 4G network, that is going to depend on the business deals we do and the opportunity out there. But I will say that we have had a significant amount of interest from rural wireless companies who don't see an alternative to being able to build out. On this issue, there was a 700 MHz for rural development that was put out there. And unfortunately, those carriers can't get enough of the volume to be able to attract the chip companies and the handset manufacturers to put those frequencies on their devices.

So it has been very difficult for them to actually have an independent way of moving forward. And that is why entities like the Rural Cellular Association support LightSquared.

Mr. TIPTON. And I think that is an important point because it does get down to some economics. In your statement you claimed that the revised implementation plan will solve interference for 99.5 percent of GPS receivers. And making the assumption—this is obviously a big assumption—that your figures are completely accurate, I understand that .5 percent of the receivers you admit are affected by high-precision receivers used in agriculture, construction, and surveying.

You stated today in your testimony that this .5 percent figure is actually 750,000 to, I believe, a million units. That is a lot of Americans that are going to potentially be negatively impacted by this implementation. How are we going to deal with that?

Mr. CARLISLE. To be clear about the number, I think 99.5 percent is probably a liberal estimate of it. Actually, if you take the worst-case scenario of only 400 million devices in the universe, which seems to be the minimum that we have seen as a estimate, and 1 million precision devices being out there, which is the largest number we have ever seen estimated, it is .25 of a percent. So really the number should be 99.75 percent.

But in terms of how we fix that, there are three factors which indicate that the full universe is not going to need to be replaced. First, a significant number of precision devices use different types of technology. Some use satellite technology to achieve high levels of precision. Some, like RTK, use terrestrial technology. So when you test these out you see different results. And about 10 out of 38 were fine. Now, the majority won't be. By fine, I mean they didn't suffer harmful interference under the strictest definition of "harmful interference" used by the GPS manufacturers.

So not all of them are going to be affected. Not all of them are going to be used in close proximity to where we will be operating. Even in rural communities where we are deploying, we may only have the ground network in the denser areas rather than in the far fields, far away.

And then third, it is not a flash cut. We will be deploying over 5 years and we will have an unprecedented level of transparency as to where we are going to be and when we are going to be there. So people will know well in advance. And a certain number of these devices are going to change out in the ordinary course of business anyway.

So in terms of the cost, I think you start getting that portion, if you assume it is 750,000 or a million, is it 300,000 devices, is it 200,000, is it 100,000? We have seen that estimate from some GPS manufacturers. I don't know, but it is not going to be the full universe. And we believe that cost is appropriately borne by the manufacturers.

Mr. TIPTON I yield back, Mr. Chairman. Thank you.

Chairman GRAVES. Mr. Mulvaney has no questions?

Mr. MULVANEY. No.

Chairman GRAVES. Let the record show that is a first time. Mr. King?

Mr. KING. Thank you, Mr. Chairman. I appreciate you holding this hearing. It is something that needed to be and still needs to be aired out. And I find myself in one of those conflicting pieces of real estate that is very much impacted by the GPS guidance of our farm equipment and also can use a little more broadband.

But I wanted to direct my first question to Mr. Greene, and that is the impact on precision farm equipment, GPS guidance. And as that was developed, I don't know how many years ago we are talking about, perhaps 10 years or so ago as it was put in place, do you have knowledge of any efforts that were made to look at the spectrum then? And do you have the basis by which the decisions

were made to build out the ag guidance technology on that spectrum?

Mr. GREENE. Yes, I would be happy to address that issue. The agricultural industry looked at that kind of spectrum back in the, oh, I believe it was around the late nineties, early 2000s area. And one of the things I have gotten from several manufacturers of GPS is that they were actually asked to have their spectrum in that area be movable, if you will. So if the company called Sky Terra at the time would like to go and change the OmniSTAR megahertz signal that it was operating it on, the company could go and move it from one side of the spectrum to the other side of the spectrum.

Mr. KING. And your perspective on this is that the spectrum that has been purchased by LightSquared, you disagree, I think, to where the overlap might be? Is that a fair characterization?

Mr. GREENE. Yes, that is correct.

Mr. KING. And if a decision were made then on where that bright line might be, rather than where that gray line might be, how would you respond to this? And that would be if a company or an entity purchases spectrum that they have a complete and full legal right to that spectrum aside from the definition of where that bright line versus gray line might be? Would you agree with that? Mr. Greene.

Mr. GREENE. Yes.

Mr. KING. Thank you. And then, so if there is to be mitigation of this problem that I sure hope does get resolved—and the testimony that has been here and the dialogue about the filter that at least presumably can resolve this, what is your position on which side of this spectrum should pay for that technology? Which side of this argument should pay for that technology?

Mr. GREENE. You know, there is an old interference phrase that goes across the regular wireless network: First come, first served. And basically when you go and put a new frequency up on a tower, if your frequency interferes with somebody else, then you have to go ahead and remove your equipment or find an alternative way in order to resolve the issue.

Mr. KING. Provided that you own that spectrum, as you said earlier?

Mr. GREENE. Yes, correct.

Mr. KING. And aside from that, even with that argument, let's just say that some entity has the authority to make this decision clearly and they draw a bright line, and that bright line is someplace along the line with some of this GPS equipment that I want to keep operating, I want to solve this problem in the worst way, if that finds itself on a spectrum that is clearly and legally determined to be LightSquared's then you would say from a legal perspective it is up to then the ag industry to take care of the cost of the filtration?

Mr. GREENE. Well, I would say there is no clear-cut line on this. Like the other couple of gentlemen were saying, that frequencies have a tendency to go and bleed together. And testing out that interference and checking to see what is available is what the real key it.

Mr. KING. You would say you would apply the first come, first served to that area?

Mr. GREENE. That is correct.

Mr. KING. I am running out of time and I don't want to spend it all focused on you, Mr. Greene, but I appreciate that.

I want to turn to Mr. Carlisle who has listened to all of this dialogue, and ask the 180-degree opposite of these questions. If the shoe is on the other foot and it is determined in a clear way that the GPS people are there with a spectrum that they have a claim to, whether it is a gray area or a bleedover or first-come, first-served, who then would you say should pay for the filtration? And I think you testified—I am going to guess this—that this problem can technologically be solved. Doesn't it sort down then to who writes the check to solve it?

Mr. CARLISLE. That is exactly right. And I would say if this were a case of our transmitter bleeding across to the GPS spectrum, into the spectrum that they are using that is Federal Government spectrum, by the way, that is used by the GPS manufacturers at no cost, if we are bleeding over there, then that would be our responsibility to solve. And we spent \$9 million developing the filters to solve that. There is a chart at the back of my testimony that shows this.

If the question, though, is then are their receivers looking into our band, there is no principle of first come, first served recognized in the law. Certainly not in FCC regulations. FCC allows you to build any kind of receiver you want, but you have to take the risk if you are looking outside your band and if you have the effect of blocking authorized services, then you have no claim to protection. And by the way, this is recognized in the user manuals of many GPS devices.

I have got an excerpt here from a Garmin G900X integrated cockpit GPS navigation device manual which says: This device complies with part 15 of the FCC rules—the rule I just mentioned. Operations subject to the following two conditions: Device may not cause harmful interference and this device must accept any interference received, including interference that may cause undesired operation.

Mr. KING. I appreciate that acknowledgement. I would just conclude with this question: Is either side of this argument looking to the taxpayers to pay the difference?

Mr. CARLISLE. Absolutely not.

Mr. GREENE. No.

Mr. KING. I appreciate that. Mr. Chairman, thank you. I yield back.

Chairman GRAVES. Mr. Carlisle, as far as the testing goes, you guys have tested your upper bandwidth but you are still in the process of testing the lower bandwidth; correct? Those results are not in yet?

Mr. CARLISLE. To be clear, the technical working group testing, which was the industry testing for all classes of devices, the lower 10 was tested. So we have a full set of data for all 130 devices. The further testing that needed to be done was for classified receivers that were not tested on the lower 10 in the independent government testing, and some additional validation testing as NTIA set out in its letter a couple of weeks ago.

Chairman GRAVES. My next question—Mr. Taylor and Carlisle, you can comment too—you talk a lot about over the course of the next 5 or 6 years there is going to be normal changeout of devices, but in the aviation community because they are so expensive, because of certification issues out there, there is still a lot of older devices out there that are working—working very well, and we hope work well into the future.

But Mr. Taylor, can you comment on those? You know the ones I am talking about. The ones that came out in the nineties—late nineties, early 2000s.

Mr. TAYLOR. Yes. Yes, sir. Normal service life for commercial aviation equipment, minimum is 15 years; we are required to support equipment for 15 years. Often it lasts much longer than that. As you said, it is incredibly expensive to make a change to an aircraft, to change a critical system like a GPS. The larger the aircraft, the more complex the change.

Those systems that predate this entire discussion are in the field in thousands. And I know thousands is not a big number compared to the numbers we are hearing in terms of equipments fielded here. But this is thousands that you care about. It is airplanes that you fly on every day. Many of them have equipment that was developed long before this debate started and to which no one knows the answers. I don't know the answer. I build it; I don't know the answer to its susceptibility. And that equipment will in normal course of business be in service for at least another 5 years, some of the older equipment. Some of it for much longer than that. It lasts for a long time and stays in service.

On the spectrum, I just wanted to clarify something on the spectrum. The RTCAs as you said, the RTCA preliminary report, which is a quick report, said that if LightSquared stays at the lower 50 MHz of the lower spectrum, lower half of the lower spectrum at very reduced power, you just impinge or don't impinge on the standards to which new equipment is developed. Brand new equipment. If you go to the next 5 MHz of the lower band, its acquisition is affected, tracking might be affected. You go to the upper band, then acquisition and tracking is affected.

RTCA said that of the full spectrum, there would be no GPS aviation service over the entire eastern United States and close to any major city where this system is operating. Today I heard for the first time again the lower 10 MHz is now the one that is contemplated. If the lower 10 MHz is used at even the reduced powers that we are discussing, RTCA says—I say—you will have problems with aviation GPS receivers, even the newest ones that are in service today. And who knows what the story is with the older ones?

Mr. CARLISLE. I would like to correct the record on a couple of things. First of all, on what RTCA found. What it found was that the lower 5 was cleared and that the next 5 MHz for tracking was likely fine, but there could be issues with acquisition, and further analysis was necessary. And the FAA is undertaking that further analysis.

The RTCA report did say if we were using our upper 10 megahertz then, that could impact aviation. But unfortunately, this issue continues to be conflated into our new proposals to move

down to the lower 10 at the power levels we were authorized to do in 2005.

The other point I would mention is on the aviation receivers and whether the older ones are better than the newer ones. One thing we found through the testing process is months and months and months ago, when we were at the very beginning of this, I think we like other people just assumed, well, this has got to be old GPS receivers. It is old technology. Certainly the newer technology is better.

Well, what we found out was that wasn't actually the case. Older technology actually is in some cases less susceptible to this kind of interference because it is not as wide open. The GPS industry has moved further and further into more and more precise equipment which requires you to pick up more GPS energy and requires them to look further and further into our band.

And I am happy to get further follow-up information on this to make sure I am recalling correctly, but my understanding is the older RTCA standards which predated the currently applicable ones are actually less open and will have less wide open receivers than the ones that are currently authorized under the current standard. And that is the one that is being analyzed today. But I will provide follow-up information on that to make sure that is correct.

Chairman GRAVES. Mr. Boykin, did you have a comment?

Mr. BOYKIN. Far be it for me to spoil a really good party, but in fact I am following along with the RTCA paper and Mr. Carlisle is exactly accurate in his comments about that. But what it points out there is that there is a small margin for error. That same paper points out that traditionally, GPS being an aviation safety service, the analysis includes a six-decibel safety margin as standard practice.

I am starting to see numbers here that are getting very small and very small safety margin. So my comment to that would be back to the same comment that we started with: A significant amount of testing that still needs to be done. And as my colleague from the GPS manufacturer said, that isn't going to be taken lightly and isn't going to be done tomorrow.

Chairman GRAVES. Mr. Greene, I will give you the last word.

Mr. GREENE. Well, we all know how much wireless Internet to rural areas as well as GPS is to the rest of the country, and how much of an economic impact. And like to go and follow everybody else and say that, you know what, more testing does need to be done, and I hope we don't jump into a situation that gets everybody in trouble in the end.

Chairman GRAVES. I thank you all for participating today. The Committee is going to very closely follow the action of the FCC in the LightSquared proposal and I plan to send a letter to the FCC reinforcing the need for comprehensive tests of all types of devices to ensure that there isn't going to be any interference for small business GPS users.

With that, I would ask unanimous consent that all members have 5 legislative days to submit statements and supporting materials for the record. Seeing no objection, it is so ordered.

[The information follows:]

Chairman GRAVES. And with that, the hearing is adjourned.
[Whereupon, at 2:30 p.m., the Committee was adjourned.]



October 13th, 2011

***Written Statement To The House Of Representatives Committee On
Small Business***

***Regarding The LightSquared Application And It's Impact On GPS
Navigation***

Dennis B. Boykin IV

Managing Principal & Founder, DB4 Consulting, LLC

Chairman Graves, Ranking Member Velazquez, members of the Committee, and old Army comrades, thank you for the opportunity to address this critical issue today - critical to me, a small business owner who depends on high-precision GPS to keep myself, my family, my passengers, and the people underneath my aircraft safe from harm.

I have many titles, including small business owner, licensed pilot, aircraft owner & operator who uses general aviation for business, and Chairman of the Leesburg Executive Airport Commission. My business, DB4 Consulting, LLC, is a veteran-owned small business in Leesburg focused on supporting small and mid-tier government contractors in program development and business processes. My background includes 24 years of military service, 12 years of commercial experience in this area, and specialized experience in small business operations. I am a frequent speaker and published author on small business contracting issues.

I have 3 concerns regarding this serious potential interference with high-precision GPS receivers: My family's safety, the costs associated with this proposal, and the impact on our general aviation infrastructure.

Over the 30+ years I've been flying, I've flown just about 40,000 miles in nearly 2,000 hours of flying experience, and I've figured out Rule # 1: "***Never scare yourself***". I'm not into aviation for the thrill - I'm in it for the utility. Sure, I enjoy the freedom of flight,



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viewing the world from a new perspective, and the professional challenge of controlling the aircraft, but for me, getting in the cockpit really means mitigating every risk possible, to the greatest extent possible, in order to make the flight as safe as possible. That over-riding concern for safety might explain why I do things like exceed FAA training standards, set my own personal safety standards that are higher than required, and over-spend on maintenance. It also might explain why I've spent nearly \$ 40,000 on GPS equipment and installations over the last 8 years in two airplanes.

For me, and more importantly my passengers, depending on GPS isn't something we take lightly - it's a matter of life and death. Now, I'm sure folks come up here all the time and use a lot of strong words like that - but in this case, it's not hyperbole, it's a subject with which I am more than a little familiar. I took an oath 38 years ago to *support and defend the Constitution of the United States against all enemies, foreign and domestic*, and after 3 tours of duty overseas and a fair amount of combat experience defending our nation, I know when something is a life or death issue, and when it isn't. I can assure you as certainly as I know the sun will rise tomorrow that the LightSquared proposal to mis-use allocated spectrum, and the interference associated with GPS that has been documented by many organizations, definitely falls into the category of something that can kill me. That makes it a big priority for me.

First, let me explain my volunteer work supporting the Town of Leesburg and our airport. I brief the Town Council every year on the health and well being of their airport, and every year I start the briefing with the phrase - "**Airports Are Not About Airplanes, They're About Commerce**". It's that interstate commerce benefit that drives the airport that brings over 200 jobs and \$80 M a year in economic impact to Leesburg & Loudoun County. Our fleet of 275 based aircraft is nearly completely GPS equipped, and



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requiring every one of those aircraft to add filters involves certified technicians, downtime, and out-of-pocket expense. Can we expect Mr. Sanjiv Ahuja to foot the bill for hundreds of thousands of general aviation aircraft across the nation?

Here's where the numbers really get scary – the FAA estimates \$ 440 Million a year in negative economic impact to General Aviation if this network is deployed, and the potential loss of 800 lives per year. These numbers don't include an FAA estimate of \$ 22 Billion in costs to the economy if Nextgen isn't deployed – a system I'll discuss in more detail later.

Clearly, as a steward of the public trust, and their funds, I'm more than a little concerned that this system will wreak economic havoc on our airport. I don't look forward to answering to the Town Council and the taxpayers of the Town when we lose tenants as they either give up their aircraft, or lose their aircraft, and their lives, in accidents caused by GPS outages. Explaining a budget awash in red ink, or worse, explaining why airplanes crash in backyards, is not a pleasant duty. I'd appreciate not being put in that position, thank you.

In my second role, managing a business, I'm glad to hear that LightSquared has proudly announced the development of a GPS filter to eliminate the spectrum interference issue that their ground-based system will cause in this part of the spectrum dedicated to satellite-based systems. Now, no one's seen this device but them, so we have to take their word for it that it exists, it works, and it's available. That's great – they've fixed the problem they're creating - but does it then become my problem?

First, let's be very, very clear – they're causing the problem – not GPS users or



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manufacturers. LightSquared is very public in their claims that it's 'their spectrum', even to the point of now threatening legal action, yet they fail to mention that their conditional approval to use ground-based transmitters was only to 'fill in the gaps', as the FCC said, and in all cases the waiver was based on restrictions against interfering against other spectrum users. Claiming that 'GPS manufacturers should have known' is just plain throwing out a red herring here.

But enough about the industry – what about users, like myself, who's businesses are impacted by this argument ? LightSquared claims that Javad GNSS has produced a filter that will magically solve the problem. OK, not only has this filter not been approved by the FAA yet, here's a thought: Javad has absolutely no experience in aviation, so don't count on them having a viable product ready to fit my Garmin high-precision, WAAS-enabled receivers anytime soon.

And then once it does go thru the certification process, who pays for them? I can assure you that based on my nearly thirty years of aircraft ownership, I am far more qualified to render an opinion as to the expense and impact of this proposal than LightSquared is – and I can assure you that the costs of retrofit are going to be very, very high. We're not talking about putting a plug into a cable – we're talking about removing sophisticated electronic components from hundreds of thousands of aircraft, and taking those components apart, and then re-installing them. Start adding up those costs, and the numbers are staggering – certified technicians, downtime, and the inevitable damages caused by errors in the work. Thousands of small businesses and hundreds of thousands of pilots should not have to pay to support LightSquared's business model.

And speaking of business concerns, let's talk about environmental impacts. The FAA's



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Nextgen system, which is completely dependent upon accurate and reliable GPS navigation, will save countless gallons of fuel and eliminate a significant amount of carbon emissions when implemented by moving aircraft through the skies in direct routes, rather than on the airway system that exists today. At the altitudes I fly, I'm already reaping the benefits of GPS navigation by 'going direct' – routinely receiving direct clearances (rather than flying airways) from the DC Metro area to points in South Carolina, Alabama and Florida. These reduced emissions, added up over multiple flights with hundreds of thousands of aircraft, are extremely important. The Lightsquared system puts those advantages at risk.

And finally, as a father and husband who flies for business, routinely flies his family on vacations, flies combat-wounded veterans to medical appointments, and flies animal rescue missions, I'm concerned for the safety of every flight.

I learned to fly over 30 years ago, when navigation was dependent on less-accurate VHF radios and AM beacons. I never really felt safe putting folks at risk in an airplane I was flying until we got to the point where GPS signals, enhanced by ground stations in the WAAS environment, created a precise flight environment that matched the accuracy of the weather information we now receive in the cockpit. Today, we enjoy a plethora of instrument approaches at my home airport in Leesburg, which was selected by the FAA to be one of the first five WAAS approaches in the nation. Any discussion of a potential interruption of these signals is a big deal when it impacts safety of flight. Remember, I said at the beginning that I never scare myself in a flight. Well, I've had a GPS outage once, and luckily it was in clear weather on a sunny day, and that was pretty scary. Now imagine yourself flying passengers on a night flight, in the clouds, on the GPS/WAAS approach to Runway 17 at Leesburg, and the screen goes blank due to a



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harmonic attenuation from the LightSquared cell tower you just flew over. The ramifications are obvious, as is the conclusion that any reasonable person would reach: *There is absolutely no reason to create this risk to life and property, just for their profits.*

The applicant received a waiver to put ground-based transmitters in a spectrum originally designated for satellite-based systems, and that waiver was only to fill in the gaps. Now, they're attempting to re-purpose the spectrum, and do so at great risk to others. How that happened is not my concern - what is my concern is that every single person who gets in an airplane is being put at risk for someone else's business model, and that's just plain wrong.

In closing, I appreciate anything this Committee can do to mitigate the risks created by this situation, and I thank you for your service to our great nation.



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Tuesday, October 04, 2011

Subject: House Small Business Committee Testimony – Impact of LightSquared’s proposal on GPS users

THANK YOU

Thank you, Chairman Graves, Ranking Member Velazques and Members of the Committee; I appreciate the opportunity to appear before you today. My name is Rick Greene, and I am here to testify on behalf of the Agricultural Retailers Association (ARA), a trade association which represents America’s agricultural retailers and distributors of crop inputs, equipment and services. ARA members are scattered throughout all 50 states and range in size from small family-held businesses or farmer cooperatives to large companies with multiple outlets.

BIOGRAPHY

I am the Precision Agronomy Manager for MFA Incorporated, a cooperative built by farmers for farmers. Our core business includes sales and service of inputs like seed, pesticides, fertilizer, precision agronomy, grain, feed and livestock supplies. I began my precision agriculture journey in 1995 when my father purchased one of the first yield monitoring systems with GPS. During that time it was a struggle to operate this new technology and cope with the inaccuracies of GPS. While at Iowa State University, as accuracy improved, I came to love what precision agriculture can do for farming by preserving the environment, minimizing inputs, and maximizing yield to give our farmers a greater return on their investment.

OVERVIEW OF PRECISION AGRICULTURE

So what is precision agriculture...? Some say “farming by the foot” or “Doing the right thing, at the right time, in the right place with the right amount”. Precision Agriculture is using the latest technology to provide sound agronomic recommendations in a timely fashion in order to maximize yield, manage inputs and preserve the environment to ensure farmers with a sustainable way of farming.

For example, take a look at your lawn. Some areas grow well and others not quite so well. Soil productivity is determined by soil characteristics, nutrient deficiency and lime recommendations. Farm ground is the same, only on a larger scale. Originally, we believed placing more plant food on less productive area would cause it to produce more. However, by using precision agriculture techniques and GPS, we can identify plants who are more efficient consumers of soil nutrients; thus reducing environmental waste.

As stated by Paul Schrimpf, Group Editor of CropLife Media, “From the earliest days of personal computing, retail agronomists and growers had been thinking about how to use computer technology and geographical information to improve the way land is farmed. But it wasn’t until GPS became available to the public in the mid-1990s that this notion would become a practical reality. Virtually everything done on farmland – planting, scouting, fertilization, crop protection application, and harvesting – can be turned into usable data; thanks to the geo-referencing power of GPS.”

ECONOMIC, ENVIRONMENTAL AND GLOBAL IMPACTS

Since then, GPS and technology have evolved exponentially. Fleet vehicles use GPS for logistical tracking to minimizing fuel consumption. Tractors drive themselves with 1-inch accuracy to minimize overlap. Planters and sprayers turn off individual sections automatically to reduce over-application of inputs. On-the-go sensors detect how much nitrogen a plant requires. River levees are surveyed and corrected in



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2/3's of the time it takes traditional surveyors. Aerial applicators vary nitrogen rates on the fly to reduce run-off and increase nutrient uptake. Irrigation systems vary water rates by soil characteristics to reduce water waste...and the list goes on. We would not be able to perform any of these efficient management practices without high-accuracy GPS.

Jess Lowenberg-DeBoer with Purdue University did a study back in 2004 on a 1,800-acre model farm and found that a farmer will decrease his hours of operation by 17% if he uses high accuracy GPS. This decrease includes fuel, maintenance, labor hours, and inputs like seed, pesticides and fertilizer. Times are changing and the producer needs to be more efficient in order to combat global competition. Bruce Erickson's, Director of Cropping Systems Management with Purdue University, study on Economics and Adoption of Precision Farming Technology. From 2002 commodity prices are up 350%, seed prices are up 266% and fuel and fertilizer prices are up 270%. Efficiency and increased productivity is the key to their survival in this global market.

The GPS industry has close to 1 million high accuracy GPS receivers used in Agriculture, Construction, Survey, Oil & Gas, Utilities and Government operations. It will take 10-15 years to complete a normal replacement cycle and affects up to \$10 billion in equipment. Even if the Javad filter (\$300 - \$800) works, implanting it to the 1 million receivers will cost \$300 to \$800 million which doesn't include the additional personnel, installation and down-time. It's like saying that because Chevy has an all-electric car on the market we can shut down every gas station in the US next year or all analog TV's need to be replaced the day the digital switch was turned on.

LightSquared must not be allowed to broadcast their signal in the upper or lower bands of GPS. Not today, tomorrow or ever until a feasible and economical resolution is found.

TO CONCLUDE

It is the accuracy of GPS that makes the technology important to agriculture, and farmers should not be expected to accept or live with a disruption in their service as a result of LightSquared's actions. Ideally, a solution will be found that allows GPS and wireless broadband to co-exist, but LightSquared and GPS providers will have to work together. We believe that farmers, ranchers and GPS companies should not have to bear any additional financial burden in resolving this issue.

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TESTIMONY

OF

JEFFREY J. CARLISLE

EXECUTIVE VICE PRESIDENT, REGULATORY AFFAIRS & PUBLIC POLICY
LIGHTSQUARED

HOUSE COMMITTEE ON SMALL BUSINESS

2360 RAYBURN HOUSE OFFICE BUILDING

OCTOBER 12, 2011

My testimony today will explain how LightSquared is helping small businesses across the country by investing \$14 billion in a wholesale nationwide wireless broadband network. My testimony will also address the steps LightSquared has proposed to deploy this network safely, in a way that protects the use of GPS by small business, government, and everyday consumers. As we have stated before, and as has been clearly shown in recent weeks, the interference issue is a question of engineering choice by GPS manufacturers, and can be addressed through proper design. My testimony will also address the issue of cost. LightSquared's proposals have the effect of assuming the cost of accommodating hundreds of millions of receivers, meaning GPS manufacturers do not need to replace receivers now in consumers' hands. Some portion of the relatively small number of remaining high precision receivers will need to be either replaced or retrofitted, but it is wrong for the GPS manufacturers to scare their users by arguing that this cost will fall on them. The manufacturers themselves should step up to cover this cost, as it was their technology choice that created the situation.

I. LIGHTSQUARED IS BUILDING CRITICAL INFRASTRUCTURE FOR SMALL BUSINESS

LightSquared shares the commitment of the members of this Committee to bring the sorely needed benefits of broadband investment to small business and rural America. As Chairman Graves said in May 2010,

There is a severe lack of appropriate infrastructure that limits many American communities, businesses, and families from gaining full access to these services. Rural areas in many states are particularly likely to lack the infrastructure needed to allow them to benefit from this vital technology. Without access to affordable broadband services, the economies and development of these communities can suffer.

Whatever policies this government adopts with regard to technology and broadband, we must first make a commitment to ensuring that small businesses and rural communities will benefit from this infrastructure investment. Regulatory policies that diminish the incentive for such private sector investment will benefit neither small businesses nor the economy that will rely on them for growth needed to create jobs.

Further, we applaud the Committee's bipartisan letter to the NTIA and the Rural Utilities Service on November 19, 2009 about broadband stimulus funding, acknowledging "the role of broadband in stimulating the economy and creating jobs" and asking for steps that would make it easier for small business to receive such funding.

LightSquared is making a private investment in broadband infrastructure, and by doing so it will support over 15,000 jobs a year for each of the five years that it will take to construct this network, many of which will be with the contractors and small businesses across the country that support wireless infrastructure.

When completed, our ground network will provide over 260 million people with access to wireless broadband service at expected speeds of 5 to 10 megabits per second. We will provide service on a wholesale basis, meaning that we will significantly reduce the costs of network access for wireless providers across the country, enabling them to lower bills by hundreds of dollars a year for the average consumer. We will reach people in rural and remote areas outside of our initial footprint through partnerships with rural providers such as Cellular South and Southern Illinois Wireless. Indeed, our network is particularly important for Americans in these areas because of our integrated satellite/ground network, which allows a customer to have a network connection for voice and data no matter where they are in the country. This is particularly crucial at a time when the United States ranks 15th in the world in broadband adoption, and 28% of rural Americans who have no access at all to broadband.

LightSquared's network will lower prices, increase competition in the marketplace, give consumers new choices, broaden access to broadband, and increase public safety and emergency response.

The LightSquared network will benefit U.S. small business in multiple ways:

- As mentioned above, small businesses will be involved in the building and operation of the network.
- Many of LightSquared's business partners are themselves small business, who will provide valuable broadband services to their customers and support new jobs. I have attached a list of our current partners to my testimony, and included statements from our partners about the opportunities provided by the LightSquared network. I have also attached an open letter from one of our partners, Power Net Global.
- As the Committee has recognized, small businesses have a desperate need for reliable and affordable broadband. Over 150 letters have been filed with the FCC from across the country emphasizing the benefits to small business of the LightSquared network. I have attached excerpts from these letters to my testimony.
- As you know, many small businesses are in rural parts of the country, and as I mentioned above, the LightSquared integrated service is particularly well suited for these customers. I have also attached a copy of a letter sent last month to the House and Senate Agriculture Committees from the American Farm Bureau Federation, the American Sugar Alliance, the National Association of Wheat Growers, the National Farmers Union, the National Potato Council and the Western Growers Association. This letter emphasizes the importance of broadband to rural economic developments, and urged the committees "to communicate to the [FCC] the benefit farmers and ranchers will receive from expanded broadband access and precision agriculture. The FCC must ensure that accurate GPS will continue to be available for precision agriculture and also ensure that broadband access be made available for all of rural America."

While my testimony emphasizes the importance of broadband to small businesses and rural America, I also want to make absolutely clear that we know how important GPS is to many small businesses and to farmers. Certainly, we understand the extent to which people across the country have placed their trust in GPS manufacturers and expect their devices to continue to work the way they were supposed to work. That's why we've made a comprehensive set of proposals to address the problem of GPS receivers looking into our spectrum.

II. LIGHTSQUARED HAS ABSORBED THE COST OF SOLUTIONS FOR HUNDREDS OF MILLIONS OF GPS DEVICES

Contrary to what the GPS manufacturers have told many of their users, at no time has LightSquared ever said GPS users should bear the cost of fixing their receivers. GPS manufacturers created this problem, GPS manufacturers should bear the cost of fixing it. The GPS manufacturers would like to confuse their users in order to avoid responsibility for fixing a problem they ignored.

In order to understand the proposals LightSquared has made, it is important for the Committee to understand how the current interference issue arose. In September 2010, the US GPS Industry Council (USGIC) raised the possibility that the LightSquared network could overload GPS receivers because many GPS receivers are designed to not only capture GPS signals, but also capture signals from our spectrum, which is directly adjacent to GPS spectrum.

The USGIC raised this issue years after LightSquared had been authorized to build a ground network. The FCC wrote rules allowing satellite companies to use their spectrum to build ground networks in 2003, and issued LightSquared's predecessor an authorization to do so in 2004. In 2005, the FCC removed any limits on the number of base stations (the transmitters in cell towers) that we could build, and established the power levels we plan to use today. I have attached a chronology, with citations to the public record, to my testimony.

The GPS manufacturers were not absent from these proceedings – far from it. GPS interests participated extensively in these original rulemaking proceeding, and the Departments of Defense and Transportation reviewed all the FCC’s orders through the NTIA’s interdepartmental review process. Indeed, USGIC asked LightSquared’s predecessor to limit our energy that could bleed over into the GPS band. If we did nothing, comparatively powerful base stations used in cell sites would drown out faint GPS signals. In 2002, we agreed to limits on emissions out of our band into GPS that were 1000 times stricter than what the FCC required, and designed our network around this agreement. I have attached a chart showing this effect.

Subsequent entries in the public record show that GPS manufacturers were fully aware that we could build an extensive ground network. In 2003, the USGIC stated in a filing with the FCC that its rules allowed us to deploy “tens of thousands” of base stations. In 2004, the USGPSIC supported our application for authorization to build a ground network. After the 2005 order that set our network’s power levels, public disclosures to the SEC by GPS companies acknowledged the possibility that use of spectrum could materially and adversely affect the utility and reliability of GPS receivers.

Yet, the GPS manufacturers said nothing about the susceptibility of their receivers to overload until September 2010. They did not appeal or ask for reconsideration of the FCC’s rules, nor did they ask for an amendment to our existing agreement.

The GPS community has tried to maintain that we caused the problem because we asked for a modification to the types of end user devices that could be brought to our network. This is easily demonstrated to be false. First, we asked for the modification in November 2010, *two months after* USGIC identified their receiver overload issue. Raising it in our modification process was nothing more than taking advantage of an available FCC proceeding. Second, end

user devices have nothing to do with the overload effect the GPS community identified – it is entirely a function of the number and power of our base stations, which as I stated above was established in 2005. Third, the USGIC did acknowledge, 8 years ago, that we would operate tens of thousands of base stations in our band. The possible scale and scope of our use of the network was well known by, or at least obvious to, any of the large companies that manufacture GPS receivers, all with presences in Washington, and they did nothing. This, despite the fact that the Department of Defense’s standards for use of the GPS constellation specify that manufacturers should use a receiver that filters out signals from adjacent bands if they expect to have full performance.

In the end, the GPS manufacturers either failed to understand the vulnerability of their own receivers or took the calculated risk that LightSquared would not be able to complete its network. Either way, they did nothing to prepare their receivers or their users for the planned changes in the spectrum environment.

Despite the history of this issue, the fact remains that many receivers were placed into the stream of commerce that were not going to be compatible with the uses established by the FCC in 2003 and 2005. If LightSquared were to be able to move forward with its network within any reasonable period of time, the responsible thing to do would be to test to determine the scope of the issue and possible mitigation. This is exactly what the FCC did when, in January of this year, it ordered us to work with the GPS community and federal agencies on joint testing.

As a result of that testing – which was perhaps the most extensive study of interference ever conducted – we now know how to mitigate the problem.

Key to understanding mitigation options understands that the vast majority of GPS receivers look only at LightSquared’s spectrum that is immediately adjacent to GPS.

LightSquared's original plan, before USGIC advised of the overload issue in September 2010, was to use this spectrum first, and then bring additional spectrum online later, when it needed further spectrum to serve capacity needs. This additional spectrum is on the other end of LightSquared's band, as far away as possible from the border with GPS. Indeed, the frequencies LightSquared planned to use far away from GPS are a full 23 MHz removed from the bottom of the GPS frequency,

Unsurprisingly, then, testing shows that LightSquared's *planned* deployment would cause interference with a broad range of different types of GPS receivers, because the planned deployment would have started close to GPS. Much of the alarming reports of loss of GPS functionality continue to focus on this original planned deployment. The tests also show, however, that use of the spectrum far away from GPS does not cause interference for the vast majority of GPS receivers.

These results were consistent with testing and analysis performed by other entities. Among the recommendations of the government engineer-led NPEF report was a recommendation to conduct further testing of the 10 MHz furthest away from GPS, as the testing conducted by the federal government agencies on receivers so far has shown minimal or no interference. Similarly, a report by RTCA, the aviation standards organization, stated that the 5 MHz furthest away from GPS does not cause a problem for aviation receivers under worst case analyses, and that further analysis is needed to confirm that the next 5 MHz is similarly clear. Notably, the RTCA also noted that aviation receivers tested performed significantly better than the minimum performance standards. LightSquared is optimistic that this further analysis will not change the report's conclusion.

LightSquared has developed its position in response to the actual testing data, and has made the following proposals to resolve GPS interference issues:

- First, LightSquared will operate at lower power than permitted by its existing FCC authorization, staying at the power level authorized in 2005.
- Second, LightSquared will agree to a standstill in the terrestrial use of its upper 10 MHz of its frequencies immediately adjacent to the GPS band.
- Third, LightSquared will commence terrestrial commercial operations only on those portions of its spectrum that pose no risk to the vast majority of GPS users.
- Fourth, LightSquared will work with Inmarsat to find a place in our band where precision manufacturers can be placed over the long term that is isolated from terrestrial operations.
- Fifth, LightSquared will limit the power reaching the ground to levels that would, based on actual testing data, definitely eliminate interference issues for the vast majority of receivers. This proposal was developed using the much stricter definitions of harmful interference proposed by the GPS community.
- Sixth, LightSquared will fund research and development for precision GPS receivers and make \$50 million available to replace or retrofit federal precision receivers.

The net result of these proposals is that LightSquared will eliminate any need to replace or retrofit cellular phones, personal navigation devices, timing devices or aviation devices, which together account for somewhere between 400 million and 500 million GPS-enabled devices in the United States. These proposals will cost LightSquared over \$150 million to implement – a significant cost given that it could have been prevented years ago through responsible GPS receiver design. Nevertheless, this is a cost LightSquared is willing to bear in order to move forwards with deployment of its network.

III. GPS MANUFACTURERS ARE RESPONSIBLE FOR THE COMMERCIAL PRECISION RECEIVERS THEY SOLD TO THEIR CUSTOMERS

As LightSquared has stated before, while its proposals will allow the vast majority of consumers to continue to use their receivers without having to replace them, there will be some segment of precision receivers that will need to be replaced or retrofitted. Precision receivers are accurate to within a few inches, and are primarily used in agriculture, surveying and construction. Although we have estimated the number of precision receivers in the United States as approximately 500,000, other estimates have placed the number as high as 750,000 to 1 million devices – at most a quarter of one percent of all devices in the United States, though used in important functions.

Not all of these devices will need to be replaced or retrofitted. Testing showed that 10 out of 38 tested receivers could coexist with our operations in the spectrum farthest from GPS. This proved that for precision receivers the interference issue is not a physics issue. It is a technology design issue and can be addressed through proper design. Moreover, not all precision devices will be used in close enough proximity to the LightSquared network to ever suffer interference. Finally, as it will take until 2015 to fully deploy LightSquared's network, some of these precision receivers would have been replaced in the ordinary course of business. Accordingly, the total number of devices that would have to be replaced or retrofitted is only a portion of the total embedded base.

LightSquared has proposed to bear the research and development costs for developing filters that would allow precision receivers to coexist with its network. Indeed, it partnered with Javad, a respected precision GPS manufacturer, and Javad has already developed a prototype and is rapidly moving to production models. Other GPS manufacturers are also stepping forward with precision GPS solutions, showing that where there's a technical fix, the market can and will

step forward to deploy it. LightSquared has also committed to coordinate the rollout of its network in order to allow the trade out of federal precision receivers, and so that users of precision receivers will know where we are building in advance.

It remains the case, however, that even with all of LightSquared's commitments, there will be some portion of commercial GPS receivers that will need to be replaced or retrofitted. Having solved the interference issue for the vast majority of users at considerable expense, and done everything it could to operate within its spectrum in a way that protects GPS receivers, it is the responsibility of the GPS manufacturers to fund the replacement or retrofit of the remaining portion of GPS receivers. This is the only fair resolution of the issue given the GPS industry's knowledge of the possible interference issue raised by the design of their receivers and their failure to address it when the rules were finalized in 2005.

In order to continue to avoid this responsibility, the GPS industry has wrongly tried to shift the focus from the precision receivers it sold to its customers to LightSquared – using intentionally inflammatory language to scare GPS users and make it appear that LightSquared wants them to bear the cost of equipment replacement. LightSquared does not believe that placing the burden of cost on GPS users is fair. Manufacturers regularly bear the cost of voluntary recalls and fixes to their devices, and this case should be no different, particularly in this case where (1) LightSquared has absorbed the cost of fixing the problem for over 99% of the other receivers, (2) the GPS industry's knowledge of the issue, and (3) the manifest ability of the GPS industry to bear the cost of fixing this last portion of devices. On this last point, not only do GPS manufacturers enjoy the use of government spectrum for free, but they are well funded, with John Deere alone carrying over \$3 billion in cash, Garmin over \$1.5 billion, and Trimble over \$250 million.

IV. CONCLUSION

LightSquared has never dismissed or made light of the sincere concerns expressed by the GPS community over the interference issues raised by the design of GPS receivers. Nor has LightSquared ever said that, because it is a receiver issue, GPS users have to bear the any part of the cost. LightSquared has committed to be a good neighbor. By taking the steps I've outlined in my testimony, LightSquared will address this issue for over 99% of the receivers currently used. These steps are not inexpensive to us, and they are not easy, but they can and must be done. We are stepping up to this commitment so that all Americans – and particularly individual consumers and small businesses -- can get the benefit of our significant investment in critical infrastructure, and continue to have all the benefits of a robust GPS system.

Jeff Carlisle is Executive Vice President for Regulatory Affairs and Public Policy for LightSquared, where he is responsible for all domestic and international regulatory and policy matters including those at the FCC, Congress, the Executive Branch, the ITU, and in foreign markets.

Before joining LightSquared, Jeff served as Vice President of Regulatory Affairs for SkyTerra Communications. Before joining SkyTerra, he served as Vice President, International Public Policy and Government Relations of Lenovo, the global computer manufacturer. Jeff headed Lenovo's Washington office from 2005 until 2008.

From 2001 to 2005, Jeff served as Deputy Chief and then Chief of the FCC's Wireline Competition Bureau. At the FCC, he managed the development of the Commission's policies on broadband and competitive entry into the local exchange market, and he was the architect of the Commission's policies on Voice over Internet Protocol (VoIP) and bankruptcy of common carriers. From 1995 to 2001, he practiced law at O'Melveny & Myers and independently, starting as a transactional attorney and then specializing in broadcast and telecommunications law.

Jeff recently taught about regulation of the Internet at the Columbus School of Law at the Catholic University of America, and has spoken at numerous events on telecommunications, trade and security policy issues. He received a B.A. in History, magna cum laude and with honors, from UCLA; a J.D. from Boalt Hall at the University of California, Berkeley; and an M.A. in Law and Diplomacy from The Fletcher School.

LIGHTSQUARED CUSTOMERS

Customer Profile	
ATC Wholesale Customers	
	InterGlobe Communications is an experienced Competitive Local Exchange Carrier founded in 1992 and headquartered in New York City that provides integrated services for businesses primarily located in New York, New Jersey and Pennsylvania.
	Best Buy is a multinational retailer of technology and entertainment products and services with operations in the United States, Canada, Europe, China and Mexico. The Best Buy family of brands and partnerships collectively generates more than \$30 billion in annual revenue and includes brands such as Best Buy, Audiovisions, Best Buy Mobile, The Carphone Warehouse, Five Star, Future Shop, Geek Squad, Magnolia Audio Video, Napster, Pacific Sales, and The Phone House. Best Buy supports these brands through retail locations, multiple call centers and Web sites, in-home solutions, and product delivery activities.
	Sprint Nextel offers a comprehensive range of wireless and wireline communications services to consumers, businesses and government users. Sprint Nextel served more than 52 million customers at the end of 2Q 2011.
	netTALK, Inc. is a publicly traded company engaged in the distribution and sale of products supported by its digital voice service. The netTALK DUO, now sold by many retailers including Dell and Walmart, is a communications device that has the ability to connect directly to a router or modem (no computer needed) or the computer's USB port, offering consumers free local and long distance calls to any landline or mobile phone in the U.S. and Canada from anywhere in the world.
	Flat Wireless was organized in November of 2007 to offer products and services under the ClearTalk Brand. The company offers unlimited wireless service with no credit check, no deposit, no annual contract and unlimited anytime minute flat-rate pricing plans. Flat Wireless has approximately 2 million licensed pops and approximately 1.9 million covered pops in all its market areas.
	PowerNet Global (PNG) a company with CLEC authorizations in 42 states and a 20 year history of operations, provides high quality voice, data, SIP and managed communications services to business and residential customers nationwide.
	Leap is a communications provider headquartered in San Diego that offers unlimited access to wireless voice and data services for a flat rate without requiring a fixed-term contract. The Company and its joint ventures operate in 35 states

LIGHTSQUARED CUSTOMERS

	<p>and the District of Columbia and hold licenses in 35 of the top 50 U.S. markets.</p>
	<p>CareConnect™ by ESCO Technologies, is the leading communications solution for Senior Living Communities across America. At no capital cost to a community, CareConnect™ will install and maintain its state-of-the-art communications equipment and network to support Nurse/Emergency Call, Telephone, Internet, and TV services. CareConnect saves Senior Housing Community clients the enormous expense of updating their communications infrastructure while simultaneously, providing their staff and residents with better services at a lower monthly rate than they are currently paying.</p>
	<p>C Spire Wireless, headquartered in Ridgeland, Mississippi, is the nation's largest privately held wireless provider with approximately 1,100 employees residing in the Southeastern United States. C Spire Wireless provides wireless services and support through 85 retail locations, corporate sales teams, a Telesales group, customer contact call centers and online at cspire.com.</p>
<p>SI Wireless</p>	<p>SI Wireless provides the latest voice and data services to underserved areas of rural America. As a member of the Sprint® Rural Alliance, SI Wireless offers customers 3G services throughout the U.S. SI Wireless also extends the use of its network to other wireless carriers whose customers may further benefit from a 3G network in areas not covered by their carrier's network footprint.</p>
	<p>Earthcomm Solutions is a privately held telecom and internet service provider located in Corpus Christi, Texas. The company serves consumers and small business enterprises primarily in Texas, and has distribution channel arrangements with a number of independent computer stores.</p>
<p>SIMPLEXITY.</p>	<p>Simplexity is the internet's leading authorized seller of cell phones and wireless services. Based in Reston, Virginia, the company operates proprietary e-commerce platforms, providing affiliates and marketing partners with integrated solutions for cell phone and wireless product merchandising, activation, logistics and fulfillment. Simplexity's business and technology solutions include comprehensive inventory and rate plan management, order processing, automated activation, online merchandising, high-level customer care and customer relationship marketing.</p>
	<p>Advantia is a private company that delivers dial tone and other telecom services to over 3000 business customers (most of whom are based in Texas) including Prudential, Gulf States Toyota and KKR. The company plans to include wireless enterprise routers in its product mix and is working with the likes of Ruckus and CradlePoint to deliver fixed and mobile broadband wireless solutions into the SME market.</p>
	<p>VoX Communications is a provider of wholesale and retail Voice over Internet Protocol (VoIP) services located in Orlando, Florida. Using their own nationwide VoIP network, VoX offers wholesale broadband voice origination and termination services to cable operators, carriers, ISPs, CLECs, resellers and other wireless and wireline operators, as well as enhanced VoIP telephone service to the small business and residential marketplaces. VoX provides a feature-rich, low-cost and high-quality alternative to traditional wireline phone service.</p>

LIGHTSQUARED CUSTOMERS

	<p>YourTel America is a privately owned CLEC founded in Missouri in 1995 that serves wireline and wireless customers through 14 branded retail outlets, online centers and network operations in Kansas, Missouri, Illinois and Oklahoma. They are approved as an Eligible Telecommunications Carrier (ETC) with wireline and wireless certificates granted by each state commission where they operate and authorized under the FCC's Universal Service (US) Program for Low-Income Consumers.</p>
	<p>AirTouch Communications, Inc. is engaged in the development and marketing of patented telecommunications devices capable of converging multiple services and applications such as voice, data, WiFi, bridging, video, security and entertainment into one hardware platform. AirTouch holds several patents that enable its products to enhance cellular signals within the home and office.</p>
	<p>Headquartered in Redmond, WA, Aircado is a privately held wireless broadband service provider. The company's goal is to expand its offering of affordable, reliable, secure community-based wireless internet services for smaller towns and communities.</p>



What LightSquared's Partners Are Saying

Businesses large and small around the United States are partnering with LightSquared to offer affordable wireless services to their customers. These partnerships will help them stay competitive, enter into new markets and offer more choices to their customers. Visit our partners' page to learn more.

Advanta Technologies: LightSquared to Enable Our Nationwide Wireless Broadband Offering

"We now have the opportunity to provide nationwide wireless services to our customers," said Sjon Stevens, vice president of operations of Advanta. "Only LightSquared's unique business model combined with advanced 4G-LTE technology will enable Advanta to offer our customers an innovative, yet affordable, portfolio of products and services that deliver a real business advantage." (9/6/2011)

Simplexity MVNO Services: LightSquared Allows Us to Offer Customized Service at Fraction of Cost and Time

"Our operational scale and experience will give our partner companies the ability to provide customized wireless offerings to their customers at a fraction of the time and cost normally required to launch a full scale MVNO," said Terry Hsu, president of Simplexity MVNO Services. "We look forward to utilizing LightSquared's nationwide network and wholesale business model to enable businesses and organizations of all shapes and sizes to offer wireless solutions tailored to their customers' needs." (8/30/2011)

Inmarsat: LightSquared and Inmarsat Collaborate to Support Hurricane Irene Emergency Responders

"During emergencies such as Hurricane Irene, reliable satellite communications is essential for emergency responders and government agencies," said Andrew Sukawaty, chairman and chief executive officer of Inmarsat. "Together with LightSquared we have moved rapidly to ensure that we have sufficient capacity to support emergency management agencies and first responders." (8/29/2011)

InterGlobe Communications: LightSquared Allows Us to Offer Customized Mobile Data Services

"The partnership with LightSquared helps fulfill our commitment to provide customized solutions that are tailored to the very demanding needs of our clients," said Al Mayerhoff, president of InterGlobe Communications. "With access to LightSquared's 4G-LTE and satellite services, we have an opportunity to offer competitive mobile data service options that meet our clients' need for speed, mobility and network resiliency." (8/23/2011)

EarthComm Solutions: LightSquared Partnership Supports Mission of Affordable and Advanced Communications

"At EarthComm Solutions, our mission is to provide the most affordable and advanced communications services available in the market to our customers," said Russell McNorton, chief executive officer of EarthComm Solutions. "With LightSquared, we have found a superb wholesale 4G-LTE network provider and we are very excited to enter this partnership." (8/15/2011)

ClearTalk Wireless: Our Customers Deserve Great Broadband Service

"ClearTalk is committed to providing our customers with the latest in high-speed broadband services," said ClearTalk chief executive officer Kevin Beierschmitt. "This agreement extends a national, reliable, state-of-the-art 4G-LTE network throughout the ClearTalk service area. Our customers deserve great broadband services, and we are delivering these services to them." (8/8/2011)

PowerNet Global: LightSquared's Wholesale Model Enables Delivery of Advanced Services to New Markets



"The partnership with LightSquared helps fulfill our goal of delivering an expanding array of advanced communications services to our customers across the country," said Bernie Stevens, president and chief executive officer of PowerNet Global. "LightSquared's nationwide network and wholesale business model give us the opportunity to deepen our existing customer relationships and expand into new markets." (8/4/2011)

Sprint Nextel: LightSquared Allows Flexibility in Meeting Consumer Needs and More Efficient Use of Network

"This spectrum hosting agreement with LightSquared allows Sprint to more efficiently use its Network Vision platform," said Steve Elfman, president of Network Operations and Wholesale for Sprint. "In addition to improving our cash flow, it provides additional options and flexibility in how we meet our customers' future capacity needs." (7/28/2011)

netTALK: LightSquared Helps Fulfill Vision of Delivering New Services Throughout America

"Our partnership with LightSquared helps fulfill our vision of delivering the most advanced communications services to customers throughout America," said Anastasios 'Takis' Kyriakides, president of netTALK. "With LightSquared's wholesale business model, we also now have an opportunity to serve new customer segments with very competitive services." (6/28/2011)

SI Wireless: Rural Carriers Can Now Compete with Larger Competitors

"This agreement is key to our vision of delivering the most advanced communications services to our customers," said SI Wireless Chief Executive Officer, Terry Addington. "We understand that subscribers of Tier 2 and 3 carriers expect access to the most advanced technology nationwide and LightSquared's business model is completely aligned with the coverage and capacity needs of rural operators, allowing them to compete with their larger competitors." (4/21/2011)

Cellular South: LightSquared Gives Rural Customers Access to Most Advanced Technology and Reliable Coverage

"LightSquared's wholesale-only, integrated 4G-LTE wireless broadband and satellite network, makes them a valuable partner because it enables us to provide our customers, including those in rural locations, with nationwide access to the most advanced technology and reliable coverage available," said Hu Meena, president and CEO of Cellular South. (4/20/2011)

Cricket (Leap Wireless): LightSquared's Network Allows Us to Expand Coverage and Add Capacity

"This new roaming arrangement will allow us to offer customers an even-greater 4G service area as LightSquared expands its own network," said Doug Hutcheson, Leap's President and CEO. "We believe that the broad coverage resulting from this business agreement will enhance our ability to offer compelling products and services and allow us to strengthen our retail relationships and distribution capabilities. It will also give us flexibility to access additional 4G capacity where needed as data-centric devices become more popular and require more and more bandwidth." (3/22/2011)

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PowerNet Global's Open Letter to FCC

September 26, 2011

PowerNet Global, a leader in the telecommunications industry for nearly two decades and multi-award winning company, is a premier provider of voice, data, SIP, and managed services. Headquartered in Cincinnati, Ohio, PowerNet Global has achieved consistent growth by developing and marketing an expanding array of competitive products and maintaining a clear focus on delivering unrivaled service to its partners and customers.

In order to stay competitive in our target markets and better serve our customers, we offer wireless services to complement our other communications services. However, we have found this to be a very challenging task, given the extraordinarily dominant position held by a few national carriers.

That's why we are very excited about our new partnership with LightSquared. Their wholesale model of 4G-LTE network presents our company with the opportunity to enter the wireless marketplace and have a fair chance at winning business.

Our partnership with LightSquared will also allow us to offer lower prices, innovative product offerings, and expanded capacity to not only our current markets, but also to rural and underserved markets that are in dire need of these types of services.

For the matter of GPS interference, PowerNet Global urges the Federal Communications Commission to find a technical solution that will allow LightSquared to move forward with its 4G-LTE network as soon as possible, as their network presents a real solution to the need for affordable advanced wireless broadband service in the U.S.

As decisions about this matter are being made in Washington, PowerNet Global will continue to work hard to serve its customers and be a good employer. However, we urge regulators in Washington to be mindful of the interests of GPS, LightSquared, and service providers like PowerNet Global, so that we can all bring better communications service to the public.

Thank you for your time and attention to this letter.

Sincerely,

Bernie Stevens, CEO

Excerpts from Letters to the FCC Regarding Small Businesses

The FCC received over 150 letters from small business owners, mayors, state legislators and others who state that LightSquared's network will significantly boost small businesses and economies in towns and cities across the country.

Selected quotes:

Oregon State Representative Mike Schaufler

"As Co-Chair of the House Committee on Business and Labor and the Representative for Oregon House District 48, I am writing to express support for LightSquared's plans to bring a much-needed 4G-LTE wireless network to Oregon.

At a time when demand for mobile broadband is driving prices and congestion through the roof, expanding next-generation wireless capacity should be a top priority of Congress. The U.S. is lagging when it comes to broadband speed, relegating some communities to second-class status in the Information Age and holding back economic recovery. Improving wireless broadband speed and reliability is especially important in rural Oregon, where it can help revitalize the economy and create jobs."

West Virginia: Jack Roop (Beckley)

"Southern West Virginia desperately needs more high-speed broadband wireless capacity. The lack of reliable service in our area threatens public safety, discourages business development and inconveniences the many tourists to our area. If Raleigh County and Beckley are to experience continued growth, it is vitally important to improve our wireless networks infrastructure."

Virginia: William J. Panele (Richmond)

"There have been long-standing efforts to promote telecommuting and small businesses development built around ubiquitous broadband to provide economic growth and a better quality of life outside of the dense urban or suburban markets. Because LightSquared will make its technology and network available on a wholesale basis, the rural and underserved localities where these services will be sold will benefit by more jobs, more local and state revenue, more small business opportunities and more access to information and education."

California: Mayor Eduardo Garcia (Coachella)

"Rural businesses are fast falling behind in today's rapidly changing global economy. Coachella business owners must gain more access to dependable telecommunications technology, and we need the Federal Communications Commission to fight on our behalf. Increased broadband coverage will serve as an economic stimulant for growing businesses in rural communities, and will be integral to Coachella's and the nation's economic recovery.

LightSquared's model will specifically help rural business owners in Coachella because it will allow more competitors to enter the broadband market, making broadband not only more

accessible for business owners, but also more affordable. This new network will allow for greater innovation, and will ultimately help shrink the "digital divide". Competition means better service and lower prices."

Minnesota State Representative Rod Hamilton, Majority Whip and Chairman of the Agriculture and Rural Development Policy and Finance Committee

"LightSquared's low-cost 4G network will allow more telecomm companies to provide services in rural communities like those in our districts. This is good for rural organic farmers seeking to market on-line. This is good for rural EMS and law enforcement personnel needing to contact hospitals or families during a crisis. This is good for entrepreneurs that may want to start an Internet-based business in rural Minnesota."

September 26, 2011

The Honorable Debbie Stabenow, Chairwoman
Senate Committee on Agriculture
328-A Russell Senate Office Building
Washington, DC 20510

The Honorable Frank Lucas, Chairman
House Committee on Agriculture
1301 Longworth House Office Building
Washington, DC 20515

The Honorable Pat Roberts, Ranking Member
Senate Committee on Agriculture
328-A Russell Senate Office Building
Washington, DC 20510

The Honorable Collin Peterson, Ranking Member
House Committee on Agriculture
1301 Longworth House Office Building
Washington, DC 20515

Dear Chairwoman Stabenow, Chairman Lucas, Ranking Member Roberts and Ranking Member Peterson:

As agricultural organizations that represent farmers and ranchers, we seek to improve the economic viability of rural America. A conflict over the use of spectrum has arisen between LightSquared, a company that can provide wireless broadband access throughout rural America, and the providers and users of Global Positioning System (GPS) technology, which is a key component of advances in precision agriculture. We believe that both of these technologies have great potential to drive economic development in rural America and a reasonable agreement should be reached to allow for their future success.

We support the expanded use of precision agriculture, which allows farmers and ranchers to run more efficient, economical and environmentally conscious operations. Disruption to GPS has the potential to reduce farm and ranch profitability by raising production costs. We also support robust and competitively priced broadband deployment in rural America to better serve farmers and ranchers. The full deployment of broadband access will drive economic development, better education and improved health services in rural America.

We urge your committees to communicate to the Federal Communications Commission (FCC) the benefit farmers and ranchers will receive from expanded broadband access and precision agriculture. The FCC must ensure that accurate GPS will continue to be available for precision agriculture and also ensure that broadband access be made available for all of rural America.

Thank you for your efforts to allow for the continued development of both technologies.

Sincerely,

*American Farm Bureau Federation
American Sugar Alliance
National Association of Wheat Growers
National Farmers Union
National Potato Council
Western Growers Association*

cc:
*Members of the House Committee on Agriculture
Members of the Senate Committee on Agriculture*

LIGHTSQUARED AND GPS – THE FACTS

For the last decade, LightSquared has planned to deploy a terrestrial network, and worked with the GPS community to make sure its network would not interfere with GPS.

LIGHTSQUARED’S SERVICE HAS BEEN EXPECTED FOR ALMOST TEN YEARS

- In 2001, LightSquared proposed using satellite spectrum for a fully-capable ground network. In 2002, after discussions with the GPS industry representatives, LightSquared agreed (<http://fjallfoss.fcc.gov/ecfs/document/view?id=6513283601>) to curtail any portion of its signal that crossed into GPS frequencies. This agreement imposed restrictions that were 1000 times stricter than what the FCC rules eventually required. http://edocket.access.gpo.gov/cfr_2010/octqtr/pdf/47cfr25.253.pdf.
- In 2003, the FCC adopted initial rules allowing LightSquared’s ground network to operate near GPS. http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-15A1.pdf. These rules were adopted after a full review by DoD, FAA and all other interested government agencies. As the FCC said recently, “extensive terrestrial operations have been anticipated in [LightSquared’s spectrum band] for at least 8 years.” *FCC MSS Flexibility Order*, ¶ 27 (Apr. 6, 2011). http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-57A1.pdf.

THE GPS INDUSTRY UNDERSTOOD THE SCOPE OF LIGHTSQUARED’S NETWORK

- When the rules were first written in 2003, the FCC had an explicit limit in the technical characteristics as to the number of base stations LightSquared could build – 1,750 per 200 KHz channel, which, when applied to the company’s network, would equal a little over 10,000 base stations. ATC Report and Order, FCC 03-15, at ¶¶ 144-47 (February 10, 2003). http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-15A1.pdf.
- In 2003, the U.S. GPS Industry Council (“USGIC”) stated that the restrictions of the 2002 agreement were necessary to protect GPS against “[t]he increased user density from potentially millions of MSS mobile terminals operating in ATC mode . . . [and] *potentially tens of thousands of ATC wireless base stations.*” Reply Comments of USGIC, IB Docket No. 01-185, at 2 (Sept. 4, 2003) (emphasis added). <http://fjallfoss.fcc.gov/ecfs/document/view?id=6515082621>.
- In 2004, the USGIC supported the LightSquared application for authority to operate a ground network under the 2003 rules, stating that the 2002 agreement was “intended to protect GPS receivers and at the same time allow [LightSquared] to maximize the utility of its ATC [ground network] service to its users.” Letter from USGIC to FCC (Mar. 24, 2004). http://licensing.fcc.gov/myibfs/download.do?attachment_key=366878.
- In 2005, the FCC removed all limits on the number of base stations LightSquared could build and increased their permissible power to 1.6 kw, the level at which LightSquared now plans to operate. *ATC Order on Reconsideration*, FCC 05-30, at ¶¶ 48-50, 53 (February 25,

2005). http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-30A1.pdf. Again, this decision was reviewed by all interested government agencies and was not challenged by USGIC.

- Beginning in 2006 and continuing to 2010, LightSquared disclosed its intent to build a wireless network using tens of thousands of base stations in its annual filings with the SEC <http://www.sec.gov/Archives/edgar/data/756502/000119312506067030/d10k.htm> and <http://www.sec.gov/Archives/edgar/data/756502/000119312510041110/d10k.htm>.

THE GPS INDUSTRY KNEW ABOUT LIGHTSQUARED'S PLANNED POWER LEVELS AND DID NOT OBJECT

- In 2009, LightSquared asked the FCC to increase the power levels of its base stations by approximately 10 times to 15 kw, to match the power levels at which other wireless networks are permitted to operate. http://licensing.fcc.gov/myibfs/download.do?attachment_key=-164606.
- USGIC did not object to even those higher power levels. It objected only to the possibility of interference into the GPS band from low-power indoor femtocells, an objection it withdrew (http://licensing.fcc.gov/myibfs/download.do?attachment_key=738501) in August 2009 after reaching agreement with LightSquared. http://licensing.fcc.gov/myibfs/download.do?attachment_key=731265.
- In March 2010, the FCC approved LightSquared's increased power levels. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-10-534A1.pdf. As with all previous FCC proceedings, the order was issued after a public proceeding and was fully coordinated with all interested federal government agencies. Neither GPSIC, nor any other party, filed for reconsideration or review of this order.
- Also in March 2010, the FCC required LightSquared to build a ground network reaching 260 million people by the end of 2015. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-10-535A1.pdf. Neither GPSIC, nor any other party, filed for reconsideration or review of this requirement.

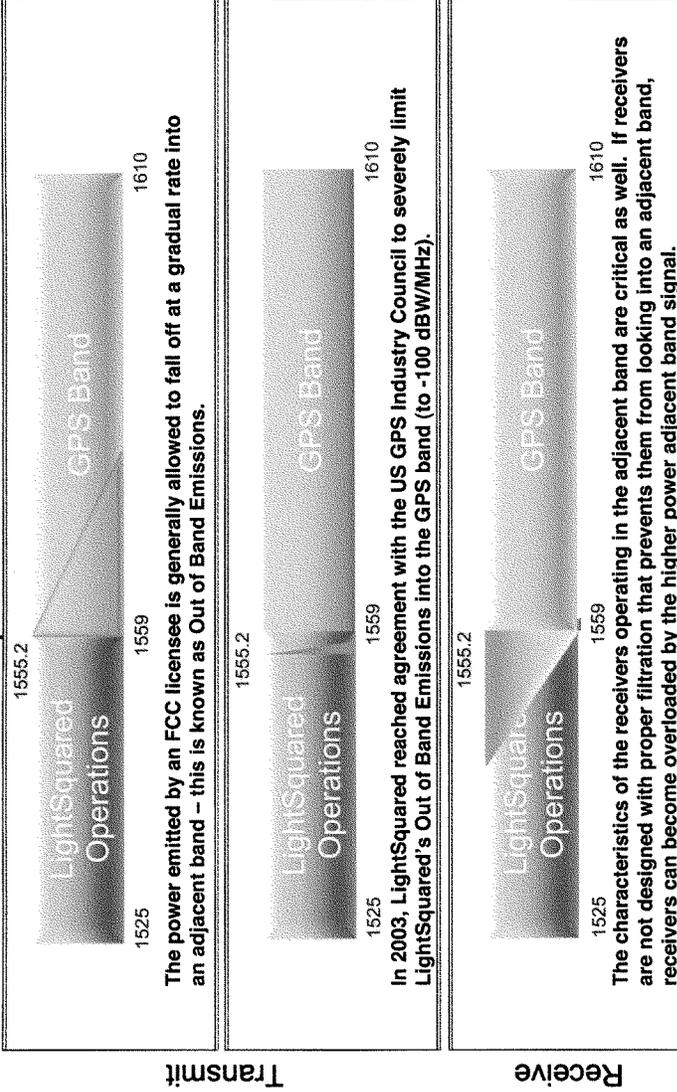
LIGHTSQUARED IS DOING EVERYTHING IT CAN TO WORK WITH GPS TO ADDRESS ISSUES RAISED ONLY A FEW MONTHS AGO

- In September 2010, USGIC raised for the first time (<http://fjallfoss.fcc.gov/ecfs/document/view?id=7020912452>) -- in a general mobile satellite proceeding -- the possibility that some GPS receivers may be subject to interference because they can be overpowered by signals transmitted by LightSquared inside the spectrum the FCC licensed to LightSquared.
- In November 2010, LightSquared applied (http://licensing.fcc.gov/myibfs/download.do?attachment_key=852869) to allow devices onto its ground network that do not also communicate with its satellite. This application did not change the power, number, deployment or any other technical characteristic of

LightSquared's base stations. USGIC raised the same objection it raised in September.
http://licensing.fcc.gov/myibfs/download.do?attachment_key=854795.

- Although the interference issue was irrelevant to this application, LightSquared, in January 2011, proposed a rigorous program of testing to determine the extent of the susceptibility of GPS receivers to LightSquared's transmissions, which the FCC made a condition of granting LightSquared's application on Jan. 26, 2011.
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-133A1.pdf.
- The FCC validated the GPS testing process in April, 2011 by unanimous Commission vote, noting USGIC's September 2010 comments and the cooperative testing program, and stating that "responsibility for protecting services rests not only on new entrants but also on incumbent users themselves, who must use receivers that reasonably discriminate against reception of signals outside their allocated spectrum." *FCC MSS Flexibility Order*, ¶ 27 (Apr. 6, 2011). http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-57A1.pdf.

The Two Sides of the Equation: Transmitters and Receivers



Images are for illustration and are not drawn to scale





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
October 12, 2011

2361 Rayburn House Office Building
Washington, DC

Appearing for Aircraft Electronics Association:
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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.

Congressman Mick Mulvaney

Questions for the Record

Mr. Jeff Carlisle, Executive Vice President, LightSquared

Committee on Small Business Committee Hearing entitled

"LightSquared: The Impact to Small Business GPS Users"

October 12, 2011

To the extent permitted by law, please provide the answers to the following questions.

Q: Please identify any investor who owns an interest of 5% or more in your company.

Q: How much money has your company, or its predecessor SkyTerra, contributed to political campaigns and organizations in total since its inception? In the last 5 years?

Q: To whom have such contributions been made, and in what amounts?

Q: I understand that on April 28, 2011, there was a meeting between representatives of your company and representatives of the White House, which was referred to by the White House as the "LightSource Interference Meeting." Please identify who was in attendance at that meeting.

Q: Have you or other representatives from your company, including any executive, major investor or owner of your company, met with the President of the United States, or members of his immediate family? With his staff or aides on occasions other than April 28, 2011? If so, please identify who was in attendance at such meetings and when such meetings took place?

Q: What issues have you or representatives of your company discussed with the President, members of his immediate family, White House staff or aides? Have any of your discussions included your business, your FCC license, or potential issues with interference in your spectrum? Please describe.

Q: Did any of your company's communications with the President, members of his immediate family, his aides or his staff ever refer to your company's fundraising efforts or campaign contributions to the President and/or his political party? Please describe.

Q: Now or at any time in the past, has President Obama or any member of his immediate family held any interest in LightSquared, its predecessor SkyTerra, or any of its affiliates or subsidiaries? If so, please identify the dates and percent interest owned.

Q: Now or at any time in the past, has FCC Chair Julius Genachowski or any member of his immediate family held any interest in LightSquared, its predecessor SkyTerra, or any of its affiliates or subsidiaries? If so, please identify the dates and percent interest owned.

Q: Now or at any time in the past, has any other FCC official, or member of his or her immediate family, held any interest in LightSquared, its predecessor SkyTerra or any of its affiliates or subsidiaries? If so, please identify the individual, dates and percent interest owned.

Schilling Questions for the Record

1. Mr. Carlisle, can you explain in more detail what the Javad GNSS solution is and how it would work in conjunction with the various GPS products and manufacturers? In addition, could you tell me what kind of testing has been done on devices partnered with the Javad solution?
2. Mr. Carlisle, many businesses in my district have expressed some concern that changing the antennas or filters on a GPS can change its performance, such as increasing power usage, which shortens battery life, or that the filters can actually reduce the accuracy of the device. Can you assure those businesses and consumers in my district that the Javad device will not do this?
3. Mr. Carlisle, LightSquared has said it will not use the upper 10 MHz of spectrum but you testified in this hearing that LightSquared would like "continued dialogue" on using this part of spectrum. Can you clarify what you mean by this and what LightSquared's plan for this spectrum would be moving forward? For example, does LightSquared have any plans of acquiring more spectrum either through the proposed incentive auctions for spectrum currently obtained by broadcasters, if this is approved, or by purchasing other spectrum?

**RESPONSES OF
JEFF CARLISLE, EXECUTIVE VICE PRESIDENT
LIGHTSQUARED
TO QUESTIONS FOR THE RECORD FROM
CONGRESSMAN MICK MULVANEY**

**Committee on Small Business Committee Hearing entitled "LightSquared: The
Impact to Small Business GPS Users"
October 12, 2011**

Q1: Please identify any investor who owns an interest of 5% or more in your company.

A: As a private company, LightSquared does not comment on its ownership. However, LightSquared can confirm that the only investor that owns 5% or more of LightSquared's common shares is Harbinger Capital Funds.

Q2: How much money has your company, or its predecessor SkyTerra, contributed to political campaigns and organizations in total since its inception? In the last 5 years?

A: LightSquared's Political Action Committee (PAC) was established in 2005 and began to make donations in 2006. I have had involvement with the PAC only since joining SkyTerra in May, 2009. The total amount donated since the inception of the PAC is \$26,350. The total amount donated since November 2, 2006 is \$23,850.

Q3: To whom have such contributions been made, and in what amounts?

A: Please see the attached table that lists all contributions made.

Q4: I understand that on April 28, 2011, there was a meeting between representatives of your company and representatives of the White House, which was referred to by the White House as the "LightSource Interference Meeting." Please identify who was in attendance at that meeting.

A: No employee or representative of the company met with anyone at the White House or any part of the Executive Office of the President on April 28, 2011.

Q5: Have you or other representatives from your company, including any executive, major investor or owner of your company, met with the President of the United States, or members of his immediate family? With his staff or aides on occasions other than April 28, 2011? If so, please identify who was in attendance at such meetings and when such meetings took place?

A. No representative of the company, including executives, major investors or owners, has had a formal meeting with the President or any member of his immediate family. On September 30, 2010, the company's CEO, Sanjiv Ahuja, attended a fundraising dinner

hosted by the Democratic National Committee and Organizing for America, which the President also attended. Aside from the President and Mr. Ahuja, there were approximately 100 others donors attending. At that dinner, Mr. Ahuja had only a brief exchange with the President where he mentioned LightSquared's plans to deploy a nationwide integrated network, and the infrastructure investment these plans represented.

Reading "staff and aides" to include offices within the Executive Office of the President, representatives of LightSquared including executives, major investors or owners have had the following meetings with staff or aides. We believe the following staff or aides were present at these meetings based on our records.

September 22, 2009: Phil Falcone, Sanjiv Ahuja and Henry Goldberg – all representing Harbinger Capital Funds, a major investor of SkyTerra -- met with Jim Kohlenberger of the Office of Science & Technology Policy and Susan Crawford, the President's Special Assistant for Science, Technology, and Innovation Policy. The subject matter of the meeting was a general briefing on Harbinger's planned acquisition of SkyTerra and plans for funding the company's buildout of its ground network.

January 21, 2010: Phil Falcone was scheduled to meet with Jim Kohlenberger of the Office of Science & Technology Policy. This meeting, however, never occurred: it was cancelled and not rescheduled. (Note, in some public accounts this meeting was incorrectly identified as being scheduled with John Holdren, Director of the Office of Science & Technology Policy.)

January 5, 2011: Sanjiv Ahuja, Jeff Carlisle, Doug Smith and Henry Goldberg – all representing LightSquared -- met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director at the White House, Aneesh Chopra, Chief Technology Officer, Damon Wells, Assistant Director, White House Office of Science and Technology Policy, and Scott Deutchman, Deputy Chief Technology Officer. The subject matter of the meeting was LightSquared's wholesale business plan.

May 2, 2011: Sanjiv Ahuja, Jeff Carlisle, Henry Goldberg and Timothy Hannegan – all representing LightSquared -- met with Ronnie Chatterji and Ben Jones, staff members of the Council of Economic Advisors. The subject matter of the meeting was LightSquared's wholesale business plan and its Innovation Sandbox in Silicon Valley. The Innovation Sandbox is a facility where anyone can test their application or device on LightSquared's network for free, significantly reducing costs for wireless innovators.

July 19, 2011: Sanjiv Ahuja met with Vivek Kundra, the Federal Chief Information Officer. The subject matter of the meeting was Mr. Kundra's planned departure for Harvard, which had been announced a month before.¹ They also briefly discussed LightSquared's wholesale business model.

Q6: What issues have you or representatives of your company discussed with the

¹ <http://www.whitehouse.gov/blog/2011/06/16/our-nation-s-first-federal-cio>

President, members of his immediate family, White House staff or aides? Have any of your discussions included your business, your FCC license, or potential issues with interference in your spectrum? Please describe.

The issues discussed at the meetings listed in response to Q5 were Harbinger's investment in SkyTerra, planned deployment of a nationwide integrated network, LightSquared's wholesale business model and LightSquared's Innovation Sandbox. The only reference in these meetings to LightSquared's FCC license was at the September 22, 2009 meeting, where Harbinger's pending acquisition of SkyTerra was mentioned. Spectrum interference was not discussed at any of these meetings.

Q7: Did any of your company's communications with the President, members of his immediate family, his aides or his staff ever refer to your company's fundraising efforts or campaign contributions to the President and/or his political party? Please describe.

At no time did any representative of the company mention fundraising efforts or campaign contributions of any kind in any of the meetings listed in response to Q5. As far as LightSquared is aware, the only mention of fundraising in any communication with the White House were two emails on September 23, 2010 sent by LightSquared's outside counsel. These emails were provided to the Center for Public Integrity pursuant to a FOIA request and publicly reported.²

Q8: Now or at any time in the past, has President Obama or any member of his immediate family held any interest in LightSquared, its predecessor SkyTerra, or any of its affiliates or subsidiaries? If so, please identify the dates and percent interest owned.

Neither President Obama nor any member of his immediate family has held any interest in LightSquared or its affiliates or subsidiaries since Harbinger's acquisition of SkyTerra (as LightSquared was then known) was consummated on March 29, 2010.

Before March 29, 2010, SkyTerra's shares were publicly traded. SkyTerra's transfer agent reports that at no time prior to March 29, 2010, was President Obama or any member of his immediate family a registered holder of shares in the company. We understand from media reports, however, that, in February 2005, President Obama purchased shares of SkyTerra worth \$90,000 and that, eight months later, he sold all of those shares for approximately \$75,000.³ As he was not listed as a registered holder of shares by our transfer agent, we assume any shares held were registered through a

² <http://www.iwatchnews.org/2011/09/15/6530/gop-demands-investigation-lightsquared-contacts-white-house>

³ <http://www.nytimes.com/2007/03/08/us/politics/08obama.html?scp=3&sq=obama%20skytterra&st=cse>

brokerage account (which is the case for most shareholders of public companies).⁴

Q9: Now or at any time in the past, has FCC Chair Julius Genachowski or any member of his immediate family held any interest in LightSquared, its predecessor SkyTerra, or any of its affiliates or subsidiaries? If so, please identify the dates and percent interest owned.

Neither Chairman Genachowski nor any member of his immediate family has held any interest in LightSquared or its affiliates or subsidiaries since Harbinger's acquisition of SkyTerra was consummated on March 29, 2010. In addition, at no time prior to March 29, 2010, (a) according to the company's transfer agent, was Chairman Genachowski or any member of his immediate family a registered holder of shares in the company or (b) to our knowledge, was Chairman Genachowski or any member of his immediate family a beneficial owner of shares of SkyTerra through a brokerage or other account.

Q10: Now or at any time in the past, has any other FCC official, or member of his or her immediate family, held any interest in LightSquared, its predecessor SkyTerra or any of its affiliates or subsidiaries? If so, please identify the individual, dates and percent interest owned.

None of the FCC officials set forth below (representing all current Commissioners, Bureau Chiefs and Office Chiefs), nor any member of his or her immediate family, has held any interest in LightSquared or its affiliates or subsidiaries since Harbinger's acquisition of SkyTerra was consummated on March 29, 2010.

In addition, at no time prior to March 29, 2010, (a) according to the company's transfer agent, was any such FCC official a registered holder of shares in the company, or (b) to our knowledge, was any such FCC official a beneficial owner of shares of SkyTerra through a brokerage or other account. For the latter part of this question relevant to ownership of publicly traded shares of SkyTerra, we searched the following publicly available names of FCC officials but do not know the names of their immediate families.

Michael Copps; Robert McDowell; Mignon Clyburn; Joel Gurin; P. Michele Ellison; Mindel De La Torre; William Lake; James Barnett, Jr.; Rick Kaplan; Ruth Milkman; Sharon Gillett; Julius Knapp; Austin Schlick; David Hunt; David Robbins; Greg Guice; Marlene Dortch; Paul de Sa; Thomas Wyatt

⁴ Relevant to this question, and questions 9 and 10, LightSquared has requested a report of owners of SkyTerra shares that were owned through brokerage accounts and therefore not registered directly with SkyTerra's stock transfer firm. As a result of SkyTerra no longer being a public company, the stock transfer firm requires several weeks to compile such a report. Accordingly, ownership information related to shares reported through brokerage accounts could not be compiled in time for this response, though we expect to receive it shortly. If this report requires any changes to any of the answers provided herein, we will immediately amend this response and provide additional information.

Table A

Response to Congressman Mulvaney Question 3

LightSquared PAC Contributions Since Inception

To	Amount	Candidate
15-Jun-06 Congressman Joe Barton	\$500	Congressman Joe Barton
16-Aug-06 Friends of George Allen	\$1,500	Senator George Allen
21-Sep-06 Dan Lungren for Congress	\$500	Congressman Dan Lungren
21-Nov-06 McCaskill for Missouri	\$1,000	Senator Claire McCaskill
30-Jan-07 Senator Inouye	\$2,000	Senator Daniel Inouye
28-Feb-07 Friends of Jay Rockefeller	\$500	Senator Jay Rockefeller
3-Apr-07 Mark Pryor for U.S. Senate Committee	\$500	Senator Mark Pryor
7-Jun-07 DANPAC - Senator Daniel Inouye	\$2,000	Senator Daniel Inouye
22-Jun-07 Friends of Byron Dorgan	\$500	Senator Byron Dorgan
27-Jun-07 Senator Ted Stevens	\$2,500	Senator Ted Stevens
30-Nov-07 Friends of Mark Warner	\$1,000	Governor Mark Warner
4-Dec-07 Johanns for U.S. Senate	\$500	Senator Mike Johanns
17-Mar-08 Udall for Colorado	\$250	Congressman Mark Udall
16-May-08 Friends of Jay Rockefeller	\$500	Senator Jay Rockefeller
5-Aug-08 McCain Victory 2008	\$1,000	John McCain
21-Aug-08 The Markey Committee	\$1,000	Congressman Ed Markey
22-Sep-08 Lampson for Congress	\$500	Congressman Nick Lampson
23-Oct-08 Texans for Henry Cuellar	\$100	Congressman Henry Cuellar
5-Dec-08 Alaskans for Begich	\$500	Senator-Elect Mark Begich
13-Jan-09 DAN 10 - Senator Inouye	\$500	Senator Daniel Inouye
6-Feb-09 Friends of Byron Dorgan	\$1,000	Senator Byron Dorgan
27-Oct-10 Friends of Cliff Stearns	\$1,000	Congressman Cliff Stearns
10-Nov-10 Forward Together Warner Committee	\$1,500	Senator Mark Warner
3-Mar-11 Mountaineer PAC (Rockefeller)	\$1,500	Senator Jay Rockefeller
12-Aug-11 Trust PAC	\$2,500	Rep. Fred Upton
12-Aug-11 Walden for Congress	\$1,500	Rep. Greg Walden
TOTAL	\$26,350	

**RESPONSES OF
JEFF CARLISLE, EXECUTIVE VICE PRESIDENT
LIGHTSQUARED
TO QUESTIONS FOR THE RECORD FROM
CONGRESSMAN BOBBY SCHILLING**

**Committee on Small Business Committee Hearing entitled “LightSquared: The
Impact to Small Business GPS Users”
October 12, 2011**

Q1: Mr. Carlisle, can you explain in more detail what the Javad GNSS solution is and how it would work in conjunction with the various GPS products and manufacturers? In addition, could you tell me what kind of testing has been done on devices partnered with the Javad solution?

The Javad GNSS solution focuses on components within the antenna of high precision GPS devices which allow such devices to reject LightSquared’s signal being lawfully broadcast in the adjacent spectrum band. This can be accomplished while maintaining the performance specifications of the high precision GPS equipment.

Javad’s newly developed external active antenna creates a multi-stage front end using commercially available ceramic and surface acoustic wave filters as well as appropriate linear noise amplifiers to provide a flat GNSS pass band that meets the stringent requirements necessary for high precision GPS devices. These antennas are suitable for use with existing devices manufactured by Javad as well as equipment sold by other manufacturers that have the ability to utilize external antennas.

As part of the development process, Javad has tested its solution in its own laboratory to ensure it meets the objectives set out in the initial design. LightSquared is preparing to take possession of several Javad pre-production units which will undergo testing shortly by an independent lab. Once these tests are complete, LightSquared will provide these devices for testing through the process established by NTIA and Precision, Navigation & Timing Executive Committee (PNT EXCOM).

It is important to note, however, as I stated in my testimony, that the Javad solution is a proof of three concepts: that a technical fix is possible, that it can be done quickly, and it can be done inexpensively. Accordingly, if the Javad solution is not a “one size fits all” solution for all GPS receivers, it shows that solutions do exist, and solutions could have been easily implemented at any time since LightSquared was authorized to build a ground network as a result of FCC decisions from 2003-2005.

Q2: Mr. Carlisle, many businesses in my district have expressed some concern that changing the antennas or filters on a GPS can change its performance, such as increasing power usage, which shortens battery life, or that the filters can actually reduce the accuracy of the device. Can you assure those businesses and consumers in my district that the Javad device will not do this?

LightSquared is committed to working with PNT EXCOM to ensure that the test plan for high precision devices properly accounts for two essential elements: the ability of devices to reject LightSquared's adjacent band Lower 10 MHz signal, while allowing the device to maintain its existing performance characteristics. The test plans that were developed with the GPS industry as part of the Technical Working Group will be a useful guide in the development of these new test plans.

Q3: Mr. Carlisle, LightSquared has said it will not use the upper 10 MHz of spectrum but you testified in this hearing that LightSquared would like "continued dialogue" on using this part of spectrum. Can you clarify what you mean by this and what LightSquared's plan for this spectrum would be moving forward? For example, does LightSquared have any plans of acquiring more spectrum either through the proposed incentive auctions for spectrum currently obtained by broadcasters, if this is approved, or by purchasing other spectrum?

Eventually, LightSquared will need to add additional capacity to its network, assuming retailers using the network bring enough subscribers to require such capacity. We do not expect to need such capacity for 5 to 6 years at least. LightSquared wants to have a full discussion of what options for additional capacity could be accomplished within a commercially reasonable period of time. It should also be borne in mind that our customers are retailers who can reasonably be expected to have alternatives in the marketplace by the time we would need to add more capacity.

With regard to purchasing other spectrum, this is a suggestion GPS manufacturers have made repeatedly. In making this suggestion, they have not acknowledged that LightSquared has already invested almost \$4 billion in our currently licensed spectrum, or explained why it is incumbent on LightSquared to now purchase entirely new spectrum when the current interference problem is caused by the incorrect design of their receivers.

We would note that regardless of whether ground operations use the upper 10 MHz, satellite operations can use this spectrum without causing interference to GPS receivers – LightSquared's mobile satellite services and GPS have coexisted for 15 years without interference. Accordingly, whether or not the upper 10 MHz is used for ground operations, LightSquared would still plan to use spectrum in this area for satellite operations.

**SUPPLEMENTAL RESPONSES OF
JEFF CARLISLE, EXECUTIVE VICE PRESIDENT, LIGHTSQUARED
TO QUESTIONS FOR THE RECORD FROM CONGRESSMAN MICK MULVANEY**

**Committee on Small Business Committee Hearing entitled "LightSquared: The
Impact to Small Business GPS Users"
October 12, 2011**

Supplement Provided: November 21, 2011

Based on a recent review of records, LightSquared would like to supplement its October 12, 2011 responses to the questions for the record. LightSquared is continuing to review records and may provide additional information to Committee.

Supplemental Response to Q5

A. No representative of the company, including executives, major investors or owners, has had a formal meeting with the President or any member of his immediate family. On September 30, 2010, the company's CEO, Sanjiv Ahuja, attended a fundraising dinner hosted by the Democratic National Committee and Organizing for America, which the President also attended. Aside from the President and Mr. Ahuja, there were approximately 100 other donors attending. At that dinner, Mr. Ahuja had only a brief exchange with the President where he mentioned LightSquared's plans to deploy a nationwide integrated network, and the infrastructure investment these plans represented.

Reading "staff and aides" to include offices within the Executive Office of the President, representatives of LightSquared including executives, major investors or owners have had the following meetings with staff or aides. We believe the following staff or aides were present at these meetings based on our records.

September 22, 2009: Phil Falcone, Sanjiv Ahuja and Henry Goldberg -- all representing Harbinger Capital Funds, a major investor in SkyTerra -- met with Jim Kohlenberger of the Office of Science & Technology Policy and Susan Crawford, the President's Special Assistant for Science, Technology, and Innovation Policy. The subject matter of the meeting was a general briefing on Harbinger's planned acquisition of SkyTerra and plans for funding the company's buildout of its ground network.

January 21, 2010: Phil Falcone was scheduled to meet with Jim Kohlenberger of the Office of Science & Technology Policy. This meeting, however, never occurred: it was cancelled and not rescheduled. (Note, in some public accounts this meeting was incorrectly identified as being scheduled with John Holdren, Director of the Office of Science and Technology Policy.)

November 12, 2010: Henry Goldberg, representing LightSquared, met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director. The subject matter of the meeting was a general briefing on LightSquared's plans to deploy a nationwide integrated network.

January 5, 2011: Sanjiv Ahuja, Jeff Carlisle, Doug Smith, and Henry Goldberg -- all representing LightSquared -- met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director at the White House, Aneesh Chopra, Chief Technology Officer, Damon Wells, Assistant Director, White House Office of Science and Technology Policy, and Scott Deutchman, Deputy Chief Technology Officer. The subject matter of the meeting was LightSquared's wholesale business plan.

March 2, 2011: Henry Goldberg, representing LightSquared, met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director. The subject matter of the meeting was related to representation of a different client; Mr. Goldberg recalls that they briefly discussed LightSquared developments.

March 9, 2011: Henry Goldberg, representing LightSquared, met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director. The subject matter of the meeting was primarily unrelated to LightSquared; however, the conversation also included reference to current LightSquared developments.

March 28, 2011: Henry Goldberg, representing LightSquared, met with Phil Weiser, Senior Advisor for Technology and Innovation to the National Economic Council Director. The subject matter of the meeting was availability of federal spectrum.

May 2, 2011: Sanjiv Ahuja, Jeff Carlisle, Henry Goldberg and Timothy Hannegan -- all representing LightSquared -- met with Ronnie Chatterji and Ben Jones, staff members of the Council of Economic Advisors. The subject matter of the meeting was LightSquared's wholesale business plan and its Innovation Sandbox in Silicon Valley. The Innovation Sandbox is a facility where anyone can test their application or device on LightSquared's network for free, significantly reducing costs for wireless innovators.

July 19, 2011: Sanjiv Ahuja met with Vivek Kundra, the Federal Chief Information Officer. The subject matter of the meeting was Mr. Kundra's planned departure for Harvard, which had been announced a month before.¹ They also briefly discussed LightSquared's wholesale business model.

Supplemental Response to Q6

A. The issues discussed at the meetings listed in response to Q5 were Harbinger's investments in SkyTerra, planned deployment of a nationwide integrated network, LightSquared's wholesale business model, and LightSquared's Innovation Sandbox. The only reference in these meetings to LightSquared's FCC license was at the September 22, 2009 meeting, where Harbinger's pending acquisition of SkyTerra was mentioned. The only reference in these meetings to spectrum interference was at the March 28, 2011 meeting between Henry Goldberg and Phil Weiser, where the availability of federal spectrum was discussed.

¹ <http://www.whitehouse.gov/blog/2011/06/16/our-nation-s-first-federal-cio>.



**Statement of the
American Farm Bureau Federation**

**TO THE HOUSE COMMITTEE ON SMALL BUSINESS
REGARDING THE HEARING ON
LIGHTSQUARED: THE IMPACT TO SMALL BUSINESS GPS USERS**

OCTOBER 12, 2011

The American Farm Bureau Federation thanks Chairman Sam Graves (R-Mo.), Ranking Member Nydia Velázquez (D-N.Y.) and all members of the committee for holding this hearing. A conflict over the use of spectrum has arisen between LightSquared, a company that can provide wireless broadband access throughout rural America, and the providers and users of Global Positioning System (GPS) technology, which is a key component of advances in precision agriculture. It is important that farmers and ranchers who utilize and benefit from precision GPS through the use of precision agriculture and would also benefit from the expansion of broadband services to rural communities have an opportunity to discuss this conflict.

The American Farm Bureau Federation believes that high-speed broadband services have great potential to bring opportunities to rural Americans, but those opportunities must not jeopardize GPS. Farm Bureau represents more than 6 million families, many of whom rely on precision GPS as an integral part of their farming business through the use of precision agriculture. Precision agriculture allows farmers and ranchers to run efficient, economical and environmentally conscious operations. Farmers use GPS for accurate mapping of field boundaries, roads and irrigation systems; for precision planting; and for targeting the application of fertilizer and chemicals that combat weeds and crop diseases. GPS also allows farmers to work despite low-visibility field conditions such as rain, dust, fog and darkness.

Farm Bureau also believes that action is needed so farmers and ranchers have the same access to educational, medical, business and government services as Americans living in more populated areas. Rural Americans are more likely than their urban counterparts to use dial-up service. Current and future generations of rural Americans will be left behind their fellow citizens if they are without affordable high-speed broadband service to tap into health care and educational services, government agencies and new business opportunities. Farm Bureau believes access to modern, affordable broadband services has the potential to correct this inequity.

In our July 21, 2011 comments to the Federal Communications Commission (FCC), Farm Bureau urges the FCC to ensure there is no interference with GPS receivers prior to granting LightSquared permission to operate its high-powered base stations. The comments also stress that it is important that the cost of resolving this issue not be passed along to farmers and ranchers through higher GPS or equipment costs. Farm Bureau believes that LightSquared should cover the cost of all technical fixes to the interference issue. We urge that the FCC take the necessary time to ensure that this is the case before proceeding further on the LightSquared application.

Any filter that is developed must demonstrate that precision agriculture GPS devices have the same accuracy as the current instruments. It is the accuracy of GPS that makes it useful to farm and ranch operations. Any disruption to the accuracy of GPS has the potential to reduce farm profitability by raising production costs and affecting farm and ranch operations. Comprehensive testing must be completed to ensure farmers and ranchers do not lose the accuracy of their GPS devices.

Farm Bureau supports comprehensive and rigorous testing by the FCC and an independent technical company to ensure there is no interference between the broadband and GPS signals. While the deployment of broadband services is important to economic development, better education and improved health services in rural America, the use of precision agriculture is vital to America's farmers and ranchers as they continue to feed, fuel and clothe the world.

Friday, July 29, 2011

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

RE: In the Matter of LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component; SAT-MOD-2010118-00239

Dear Secretary Dortch,

High precision GPS has become an essential technology in several critical aspects of production agriculture in the United States. It is the position of the undersigned organizations that there should be no actions taken by the Federal Communications Commission that would jeopardize the availability or performance of GPS. Together the American Society of Agricultural and Biological Engineers (ASABE) and the American Society of Agronomy (ASA) represent over 17,000 engineers, scientists, researchers, and practicing professionals. Therefore, we appreciate the opportunity to comment on the conditional waiver granted to LightSquared for the creation of its 4G wireless broadband network. While expanding access to broadband internet is an admirable goal, we fear that interference by the LightSquared network on GPS will reduce the performance of the high-precision GPS systems now essential to agriculture.

High-precision GPS integrated with other innovative technologies has advanced the productivity and environmental sustainability of agricultural production systems, and it is crucial to the evolution of agricultural production systems required to meet the food, feed, fiber and fuel needs of a growing world population. The following examples are only a few of the ways high precision GPS optimizes the economic and environmental viability of agriculture.

- A farmer whose tractor is equipped with a high-precision GPS system can apply different rates of fertilizer across his or her field. This ensures that crops receive an optimal dosage, leading to higher yields and profit. Just as importantly though, precision fertilizer optimization can reduce over-fertilization, which is expensive and can lead to nutrient runoff or leaching into streams, rivers, and groundwater.
- Similarly, applicators of crop protection chemicals have been able to more precisely target their applications, reducing their environmental impact while increasing their efficacy. High-precision GPS systems have allowed the development of machine control systems that eliminate double application of products when an applicator crosses an area where application has already occurred.
- Auto-steer for agricultural equipment, which relies on high-precision GPS, allows for increased farmer safety and fewer passes through a field. This results in significant savings in fuel and reduces soil compaction, a serious impediment to

plant growth and another promoter of excessive runoff that can pollute waterways.

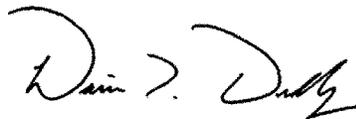
- Yield monitoring and mapping offers a glimpse into the year-to-year performance of each portion of a field. This information is being used to address persistent poor performance and to compare alternative agronomic practices.

Developing and operating precision agricultural systems requires contributions from a variety of professional disciplines. Researchers at universities and in extension services run experiments to scientifically validate newly developed techniques and to broaden the scope of current applications. Engineers, geographers, computer programmers and other IT specialists, work together to develop the equipment and software used in the field. Agronomists and crop advisers conduct the grid sampling and data interpretation necessary for farmers to make informed decisions about land and input use. The diversity of high-skilled jobs created in the sector contributes to sustainable economic growth. Any degradation of the GPS signal reduces the utility of all these systems, leading to a decrease in innovation and investment in the field. Loss of high-precision GPS will not be just an inconvenience, it will be a serious setback to the industry and to our environment that will require years for recovery.

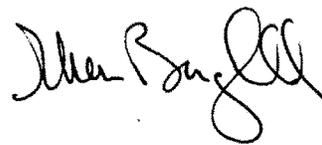
The world's population is projected to reach 9 billion people by 2050, requiring a 70% increase in food production. This immense task must be done using less water and little more land than is currently in cultivation. Widespread efficiency gains, like those that precision agriculture make possible, will be crucial to meeting the increased demand for food, feed, fuel, and fiber in the twenty-first century.

We implore on you not to grant this request by LightSquared Subsidiary LLC for modification of its authority, which will jeopardize high-precision GPS technology that is so crucial to the agricultural and many other industries. We appreciate your consideration of our concerns.

Sincerely,



Darrin Drollinger, Executive Director
American Society of Agricultural
and Biological Engineers (ASABE)



Ellen Bergfeld, CEO
American Society of Agronomy (ASA)



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Additional Supporting Documentation on LightSquared's impact on GPS

Key Points

- Satellite Wireless Broadband will not interfere with GPS. LightSquared terrestrial (ground based) high powered signal in the MSS band will.
- We need to have the Upper MSS band off the table for all of GPS's sake.
- We need solid evidence the Javad filters will work with all types of high accuracy receivers.
- It will be LightSquared responsibility to pay for the filters and replacement costs.
- We are going to need high accuracy GPS if we are going to feed a global economy and preserve the environment.

LightSquared

- Claim to fame: Deliver wireless broadband internet access to rural America.
- The MSS Band progression: MSV to SkyTerra to LightSquared on March 2010.
- In 2003 and 2005, the FCC authorized the terrestrial operation in the MSS band to fill very limited gaps of satellite coverage and prevent jamming their own satellite signal
- Chang of Plan: LightSquared is looking at having 40,000 towers to broadcast the high-powered terrestrial signal in the upper and low MSS band.
- In June 2011 LightSquared stated they would commence operations in the lower band and introduce the upper band later.
- Now LightSquared admits there is interference in the lower band but have found a filter to minimize interference for Javad receivers and possibly other high accuracy receivers.

GPS Benefits

- Direct economic benefit of GPS Technology to Commercial GPS users are estimated to be over \$67.6 billion per year in the United States.
- There are more than 3.3 million jobs that rely on GPS technology of which 130,000 are in manufacturing and 3.2 million in commercial use.
- Direct economic cost of full GPS disruption to commercial GPS users and manufacturers are estimated to be \$96 billion per year.
- Of that \$96 billion, \$67.6 billion will be GPS users cost in foregone benefits. Of that \$67.6 billion, **\$19.9 billion will be lost in Precision Agriculture.**

There are over 1 million high accuracy receivers in the market place used for...

- Military operation, emergency response, mining operations, utilities and government, surveying and construction, monitoring earthquakes, volcano and floods, and agriculture management.

Commercial GPS Growth

- From 2005 to 2010, the GPS Commercial segment grew by 305 percent from 1.9 to 7.7 million units.
- MFA's precision agriculture sales grew 600 percent with a 40% adoption rate.



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- There are approximately 400,000 High Accuracy Receivers in Ag which cost ~\$13,000 with a normal replacement cycle of 10 – 15 years.

Farmers will need GPS to overcome the challenges facing agriculture today

- Weather alterations, environmental regulations, bio-technology, transportation, government regulation, identity preserve for public acceptance, and sustainability.

Agriculture Economical Return from High Accuracy GPS in Missouri

- Corn Yield increase of 30 bu/ac x \$7.00 bu x 1 million ac = \$210 million dollars
 - o 15 bu in Strip-till, 10 bu in Variety Placement, and 5 bu in fungicide.
- Corn input savings
 - o Approx \$362 /ac in input costs * 17% savings = \$61.54/ac loss
 - o Total for MO = \$61.54 million dollars
- **Total cost of not having High Accuracy GPS in MO= \$271.54 million dollars per year**

Who is Javad?

- Company who, according to commonly used US business databases has 8 employees in the US office and according to their own website has over 100 employees in Russia and 12 dealers US wide, claims their filters only address the lower block.
- Minor player in survey industry.
 - o Will Javad filters work with the rest of the GPS industries receivers?
 - o The volume it will require to produce the filters?
 - o Do we want a Russian based company handling our GPS?
- Cost associated:
 - Filters - \$300 to \$800 per unit for their own receivers,
 - Resources - \$600 per unit (i.e. Personnel, truck, gas, time ect.)
 - Down-time – 1 year for 250 units
 - o MFA has 250 units = \$400,000 w/o down time
 - Filters - \$200,000, Resources - \$200,000,
 - Approximately \$1600 per unit
 - Down time costs: 1 million acres x 180 bu/ac x \$7.00 corn = \$1.26 billion
 - o All 1 million High Accuracy GPS receivers = \$1.6 trillion w/o downtime
- Taking off the top of the GPS receiver will void the warranty from all Agriculture GPS manufactures.

Questions to be answered by LightSquared

- Has LightSquared taken the upper band off the table?
- When will they be going on the record with the FCC to give up the upper block permanently?
- Is Wide Area Augmentation Satellites (WAAS) affected in the lower band?
- Isn't it true if LightSquared proposed a network like this one in 2003, 2005 or anytime since, they would have still needed the waiver and they would have got exactly the same reaction as they have now.



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- Who is Javad?
- What is Javad's GPS market share in high accuracy receivers and what function do they perform?
- Will you be able to retrofitting or will you have to replace other high accuracy receivers? What kind of cost will be associated with that?
- Even if this filter works, who exactly are you suggesting pays the hundreds of millions, or potentially billions of dollars of costs to replace or modify the nation's high precision GPS systems already purchased and in daily use?
- Will the Department of Defense want a filter in their high accuracy receivers that is made from a Russian based company?
- Do you have a solution for MSS band Ag GPS receivers which numbers in the hundreds of thousands?
- What data transfer rates will terrestrial and satellite offer? And isn't that comparable to other systems in the marketplace today?

Ways to solving Broadband internet across America:

- Could you operate the satellite component of LightSquared's network in the MSS satellite band and the terrestrial component in other spectrum which won't interfere?
- Could you adjust power and spectrum on the terrestrial system to eliminate GPS interference and following the proper channels and procedures to do the appropriate testing?
- Are there other satellite alternatives that could provide the same level of service?

