

[H.A.S.C. No. 112-65]

**SUSTAINING GPS FOR NATIONAL  
SECURITY**

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HEARING

BEFORE THE

SUBCOMMITTEE ON STRATEGIC FORCES

OF THE

COMMITTEE ON ARMED SERVICES  
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

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HEARING HELD  
SEPTEMBER 15, 2011



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U.S. GOVERNMENT PRINTING OFFICE

68-466

WASHINGTON : 2012

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## SUSTAINING GPS FOR NATIONAL SECURITY

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HOUSE OF REPRESENTATIVES,  
COMMITTEE ON ARMED SERVICES,  
SUBCOMMITTEE ON STRATEGIC FORCES,  
*Washington, DC, Thursday, September 15, 2011.*

The subcommittee met, pursuant to call, at 11:42 a.m. in room 2212, Rayburn House Office Building, Hon. Michael Turner (chairman of the subcommittee) presiding.

### **OPENING STATEMENT OF HON. MICHAEL TURNER, A REPRESENTATIVE FROM OHIO, CHAIRMAN, SUBCOMMITTEE ON STRATEGIC FORCES**

Mr. TURNER. Good morning. I want to welcome everyone to the Strategic Forces Subcommittee hearing on sustaining GPS [Global Positioning System] for national security.

I was planning to make the usual statement of appreciation to the witnesses for their appearance here today. And to those witnesses who took this issue seriously enough to be here—General Shelton, Ms. Takai, Mr. Nebbia, Mr. Russo and Mr. Knapp—I do want to thank you for taking the time to be here and your testimony.

That said, I have the unfortunate responsibility to inform the subcommittee that the Federal Communications Chairman Genachowski refused to appear today. I must also make clear that I consider the chairman's failure to show up today to be an affront to the House Armed Services Committee.

Further, it appears to be symptomatic of a disregard by the chairman to the consequences of the FCC's [Federal Communications Commission] January 26th waiver to LightSquared.

Now, we have heard that perhaps even the chairman was even in this very building today. We would like to know that from the chairman, whether or not he even came so close to this hearing as to be in this building and still not appear.

At no time did the chairman offer an alternative time to appear. We are unaware of any issue of this being merely a scheduling conflict. And the chairman did say that he was concerned about it prejudicing the process about what he might say during the hearing.

Personally, I believe this is an absolute effort by the chairman to avoid the oversight questions by Congress, to avoid the responsibility of the issue of how this will affect GPS and what the FCC's processes appear to be irregular as to how this manner is moving forward.

So I am very concerned that the chairman has not appeared and has not given us, really, a very good understanding or a very good reasoning as to why he is not answering these questions.

Now, I do appreciate the chairman is apparently willing to provide personal responses to written questions for the record submitted by the subcommittee, according to staff. But the chairman's priority should be the same as the subcommittee's: Sustaining GPS for national security.

Now, we all understand the difference between written questions and in-person testimony. You don't have an ability to ask a follow-on question. No one else gets to hear the aspect of his question to have them follow a different take. This, I think, makes the ability of this subcommittee to get to the bottom of these issues and to, more importantly, advance the issue of sustaining GPS for national security more difficult.

With that out of the way, I wish to introduce and express my appreciation to the witnesses who are here: General William Shelton, Commander of the Air Force Space Command. I note this is General Shelton's second appearance before this subcommittee in as many weeks. Either the General really likes us or he is working to accommodate us on a very strong basis. Ms. Takai, Chief Information Officer for the Department of Defense; Mr. Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration; and Mr. Anthony Russo, National Coordination Office, Space-Based Positioning, Navigation and Training, National Oceanic and Atmospheric Administration; Mr. Julius Knapp, Chief of the Federal Communications Commission Office of Engineering and Technology.

Mr. Knapp, I want to thank you for being here today. And I want it to be clear that neither I nor my colleagues have anything other than gratitude for your service. Our concerns are with the chairman's lack of appearance. And we certainly appreciate the information that you are going to provide us today, but we do believe that the chairman has additional questions that he needs to be answering.

I want to thank all of you for being here.

Now, why are we here this morning?

General Shelton, you might remember this question. It was asked by a member of the subcommittee during the classified briefing you provided all of us last week on LightSquared GPS test results.

And that question is, why are we here? I mean, to some extent this issue seems relatively clear, and yet we are still facing a process that is moving forward. And so that is why we are having this hearing today, which is to try to get some light on the issue of LightSquared and GPS.

A brief recap of how we got here to the point of this hearing: On January 26th of this year, the FCC granted a conditional waiver of its own rules allowing LightSquared to establish a terrestrial broadband network and be freed of certain gating requirements, which were designed to keep any potential terrestrial service from overwhelming the satellite spectrum that LightSquared held.

As we now know, this network would operate with over 40,000 base stations operating at a frequency adjacent to that long used by Global Positioning System, known as GPS, at almost 5 billion times the power of the GPS system. The chairman of the FCC knew that there were concerns about the proposed waiver for LightSquared as he received a letter from Deputy Secretary of Defense Bill Lynn on January 12, 2 weeks before the waiver was issued.

The Deputy Secretary wrote to Mr. Genachowski that “there is strong potential for interference to these critical national security space systems,” referring to GPS. This letter also asked that the chairman pay “personal attention on this matter.”

Without objection, this letter will be made part of the record of this hearing.

[The information referred to can be found in the Appendix on page 97.]

Mr. TURNER. We also know that National Telecommunications Information Administration Assistant Secretary Lawrence Strickling wrote to Chairman Genachowski recommending that the FCC not go forward with the LightSquared waiver request.

Many have observed that the FCC followed an irregular process on the LightSquared waiver. First, the National Legal and Policy Center stated in a February 2, 2011, letter to the chairman and ranking member of the House Oversight and Government Reform Committee that “over the course of the past year, a series of odd decisions, questionable meetings and procedural anomalies at the Federal Communications Commission and White House highlight Mr. Falcone’s growing influence in the hallways of government.” Mr. Falcone is the CEO of the hedge fund Harbinger Capital Partners, which owns LightSquared.

Without objection, this letter will be made a part of the record.

[The information referred to can be found in the Appendix on page 98.]

Mr. TURNER. Additionally, in a March letter to Chairman Genachowski, the Deputy Secretary of Defense, joined by the Deputy Secretary of Transportation noted that, “the DOD [Department of Defense] and DOT [Department of Transportation] were not sufficiently included in the development of the LightSquared initial work plan and its key milestones.” This letter again sought the FCC chairman’s personal attention.

Without objection, this letter will also be made a part of our record.

[The information referred to can be found in the Appendix on page 105.]

Mr. TURNER. And just yesterday, the Center for Policy Integrity released a report detailing, “emails show wireless firm’s communications with the White House as campaign donations were made.”

In my capacity as a member of the House Committee on Government Reform and Oversight, I will be asking Chairman Issa and Ranking Member Towns to promptly investigate this matter. We cannot afford to have Federal telecommunications policy, especially where it affects national security, to be made in the same way that the White House has parceled out a half billion dollars in loan

guarantees to the failed Solyndra Corporation, a large political campaign contributor of the President.

While there is clearly concern about how the FCC has conducted this process, those concerns are within the purview of the House Committee on Energy and Commerce and the House Committee on Oversight and Government Reform. Also, aside from the scope of today's hearing, but of significance and concern nonetheless, is the impact to GPS receiver manufacturers, like Trimble Navigation in my home town of Dayton, Ohio, which manufactures GPS receivers for the agricultural sector and heavy machinery producers, like Caterpillar.

But this subcommittee's main purview is national security. And the national security consequences of the LightSquared network are significant. As I mentioned, the concern in this case is that LightSquared's proposed network of 40,000 base stations around the U.S. which broadcast at an adjacent signal frequency to that used by the GPS system, but at 5 billion times the signal strength, will render or may render useless the DOD's GPS receivers.

I think General Shelton will be telling us today that it does. General Shelton, Commander of the Air Force Space Command, informed the House Strategic Forces Subcommittee members in last week's briefing that "tests show LightSquared's signal causes significant interference to military GPS." Simply put, if the FCC gives LightSquared the final go-ahead to build out this network, I fear that the DOD's training activities in the United States may come to an end. This cannot be allowed to happen. As the members of the House Armed Services Committee know, before U.S. troops are deployed, they conduct extensive real world training, which includes the use of GPS for orientating U.S. Forces, locating friendly forces and locating enemy forces, conducting search and rescue activities, targeting of precision-guided ordnance and calling in close air support. None of these activities are possible without DOD's high-precision GPS receivers, which would be most affected by the LightSquared network.

As a Member of Congress I can think of no higher responsibility than making sure our U.S. military forces are fully trained and equipped before they are deployed overseas to Afghanistan, Iraq, or any place in harm's way.

Likewise—and this is something in all of our minds close to the 10th anniversary of the 9/11 attacks on the United States—significant harmful interference to the GPS system would be a tremendous liability to our defense of our homeland.

General Shelton, I recall you making this point, and I look forward to your comments on that today.

The Armed Services Committee's position, as articulated by the Turner-Sanchez amendment to the National Defense Authorization Act of fiscal year 2012, is that the Federal Communications Commission should not grant LightSquared final approval of the conditional waiver granted to the company on January 26, 2011, until the Commission has dealt with potential harmful interference to DOD's GPS receivers.

LightSquared itself has no apparent objection to this provision. LightSquared has been making a vigorous case for its \$4 billion investment in its proposed network build-out of a new nationwide



broadband service. That it is a bipartisan policy objective to encourage more nationwide broadband service and more competition as a policy is not in dispute, at least not before this committee.

The question for the subcommittee today is how to evaluate the harm identified by the Department of Defense to its \$34 billion investment in GPS, GPS ground stations and DOD high-precision military GPS receivers.

Again, it is more important than how much this cost, the issue of what is the effect upon the warfighters who rely on this technology for safety and their technological edge against adversity. And let me state that harm to GPS, once again very clearly, “tests show LightSquared’s signal causes significant interference to military GPS.”

As my colleagues know by now, on Tuesday of this week, the FCC apparently came to the same conclusion and issued a *Public Notice* that “potential for harmful interference” meant that “additional targeted testing is needed.” I consider this to be the understatement of the decade. But we need to know what this *Public Notice* actually means for DOD GPS users. This may very well be an effort to push matters off merely a few months under the assumption that Congress will be distracted.

I look forward to the testimony of the witnesses to get to the bottom of this matter.

And with that, let me turn to my ranking member, Ms. Sanchez, who has done some excellent work on this topic and has been a great defender of our GPS system for the Department of Defense.

[The prepared statement of Mr. Turner can be found in the Appendix on page 29.]

**STATEMENT OF HON. LORETTA SANCHEZ, A REPRESENTATIVE FROM CALIFORNIA, RANKING MEMBER, SUBCOMMITTEE ON STRATEGIC FORCES**

Ms. SANCHEZ. Thank you, Mr. Chairman.

And thank you to the witnesses for being here before us.

You know, I am not really concerned, Mr. Chairman, about Chairman Genachowski not being before our committee today. I think that you and I had a very good meeting with him last week. And he stated some of the reasons why he really didn’t want to be before our committee today, if you will.

And he also sent a letter, I know, to you, which I would like to put into the record so that everybody can see what the chairman of the FCC has said with respect to this issue at this point.

[The information referred to can be found in the Appendix on page 106.]

Ms. SANCHEZ. I would like to say that it seems to me that this is really a fight brewing, a fight brewing out there between commerce, if you will, and the civilian issues that we face every day with respect to communicating, between people in particular and information sharing, et cetera, and our military security. And if that is the case, if this is going to be sort of a battle between commerce and our national security, I think that you and I would agree, Mr. Chairman, that I think national security is going to be on the top layer for, not only us and not only the Congress, but for Americans if they are faced with that “one or the other” solution.

So what I think this process is about is to see if there is an accommodation that allows our commercial aspects to move forward in order to make our country as competitive as it can be and yet, at the same time, continue to allow us the type of national security that we all have worked so hard toward. And, you know, those types of pushes and those types of fights, if you will, are really what this Congress is about, and it is really about policy issues and really it is about Americans and what they decide that they want. And that is why it is important that we have these types of hearings and that we have things pretty out in the open as much as we can so that Americans can also see not only the type of work that the Congress does, but what is really at stake.

So I do—and I want to take note that in the Congress in particular, there are always these judicial types of issues. Energy and Commerce as a committee, of course, is pushing to see more jobs come forward, to see new technologies come forward, to have communication happen. We on the military committee, it is our job to ensure that our national security is at its best.

So I look forward to this hearing for that reason, because we have heard from a lot of sides. There are a lot of people walking the halls of Congress trying to speak to these issues.

GPS assets, I want to say, are critical to our national security and to our way of life. And so I actually support the increase and the improvement of broadband service, but not at the expense of national security. So I just want people to know that.

Again, I don't know that it is one or the other. There might be accommodations.

But here is the issue: The issue is that we are in a time of limited budgets, and that we have a deep investment by our military and by our taxpayers with respect to the programs that we already have, to the devices that we have, and so anybody trying to do something from a commercial aspect will have to show us that it doesn't affect our national security and that if there is mitigation to be done, that that should not necessarily fall on the taxpayer.

But then again, that is what public policy is about. That is what votes are about. That is what elections are about as we move forward.

I would like to say, Mr. Turner, you and I have worked very well on this committee, and I don't think that we need to point fingers or politicize or really call into question people's intents or what their motives are. I hope that is not the case in some of the harsher language that I heard right now in your opening statement.

You know, I want to do the right things, and Members of Congress want to do the right things. I hope that this hearing will give us a better understanding for several key issues.

I also want to say another thing before I get into the specifics of this. A lot of questions are being placed on whose intent, whose motivation, et cetera, including to our military men and women. And I think it is right to question, but I do not want to see anybody smeared in this about what their motives or intents are, especially not our military people. So I just want to say that, too, to our general sitting there. I think it is important to have this discussion.

This hearing, I hope, will provide us the opportunity to better understand key issues that we need to understand in making deci-

sions: First of all, the risk and the impacts of LightSquared's proposed terrestrial 4G network plan and how that interference will affect our weapons systems; the level to which our military depends on GPS assets; whether the interference can be mitigated, and whether the fixes would require recertification of our weapons programs; what the impact is to the mission, and what those costs would be.

It bears noting, and I think the chairman put that forward, that our investment from the taxpayer standpoint is almost \$35 billion. And if there is to be further testing, what that would look like and what the timelines would be for something like this.

What the FCC's process is for deciding whether to allow implementation of LightSquared's proposal, and what consultations are ongoing with other agencies, and whether those agencies in their consultation, if that is being taken seriously by the FCC. I think that is an important point because, you know, some would think that they are not listening.

How the interagency process will ensure that our national security issues are considered and resolved satisfactorily.

I think those are the important issues, and I look forward to this. And again, I am glad that it is out in the open so that we can do away with whose intent, and who is a winner and loser, and really focus on our national security and our communication for the future for America.

Thank you, Mr. Chairman. And I will submit my written testimony.

[The prepared statement of Ms. Sanchez can be found in the Appendix on page 33.]

Mr. TURNER. Thank you, Ms. Sanchez.

Without objection, the letter you referenced will be made part of the record, though I note I do believe that it is nonresponsive and ambiguous in many key respects of the questions that we had asked.

I will be submitting additional questions to Chairman Genachowski that he has indicated that he will accept personally.

As we are turning to our witnesses, I just want to reiterate the central purpose for this hearing: We currently are in a situation where DOD says that LightSquared, their system affects GPS and our national security. We are looking at this information in light of the fact that the FCC has already, in part, proceeded with LightSquared in a manner which would affect our national security, and we still understand that there is a process going forward with the FCC that, ultimately, this could go forward. So we are in the context of understanding its effects on national security, and I think the understanding—and I am looking forward to General Shelton's testimony—of the clarity that this is not ambiguous, that this affects national security and affects our GPS.

With that, General Shelton.

**STATEMENT OF GEN WILLIAM L. SHELTON, USAF,  
COMMANDER, U.S. AIR FORCE SPACE COMMAND**

General SHELTON. Mr. Chairman, Representative Sanchez and distinguished members of the subcommittee, it is an honor to ap-

appear before you today alongside these other witnesses as the Commander of Air Force Space Command.

Our command is the DOD lead for the Global Positioning System constellation of satellites responsible for developing, building, launching, and operating GPS to deliver precision, positioning, navigation and timing services to billions of military, civil and commercial users.

Although GPS is a military-procured and operated satellite constellation, it is recognized as a global utility, serving users around the globe. In fact, its use is so ubiquitous here at home, I would put GPS in the category of critical infrastructure for the United States.

And for our military, GPS has become an essential capability for a host of applications in joint operations.

Today I appear at the subcommittee's request to discuss the testing conducted thus far for the proposed LightSquared terrestrial broadband network. The test we conducted in concert with the FAA [Federal Aviation Administration] was robust, with over 100 receivers from 24 different organizations, and it spanned the military, Government, aviation, precision, agriculture, automotive, and general-use communities. It is important to note that the testing was conducted using an actual LightSquared transmitter, broadcast filters, and antennas which would be used in their network.

In addition to providing their equipment and setting it up to ensure an accurate test, LightSquared personnel reviewed our test plan to ensure it was consistent with their originally planned network deployment.

The test results showed LightSquared signals, operating according to their originally filed deployment plan, interfere with every type of receiver in the test. These results were compiled in a report submitted through the National Telecommunications and Information Administration to the FCC on July 6th of this year.

LightSquared has since proposed an alternative deployment plan, which involves lower power broadcasts and the use of only the lower 10 megahertz of their assigned frequencies. We conducted only limited testing on broadcasts in the lower 10 alone, but precision receivers, and even some cell phones, were still affected. Further testing would be required to fully characterize the potential interference with this lower 10 plan.

As we move forward under NTIA's [National Telecommunications and Information Administration] direction in evaluating the latest LightSquared proposal, Air Force Space Command remains open to ideas on mitigation strategies, but we must ensure we continue to lead the world in PNT [positioning, navigation and timing] services and reliably support our users worldwide.

In summary, based on the test results and analysis to date, the LightSquared network would effectively jam vital GPS receivers, and to our knowledge thus far, there are no mitigation options that would be effective in eliminating interference to essential GPS services in the United States.

I thank the committee for your continued support of Air Force Space Command and the capabilities we provide this Nation, and I look forward to your questions. Thank you, sir.

[The prepared statement of General Shelton can be found in the Appendix on page 34.]

Mr. TURNER. Ms. Takai.

**STATEMENT OF TERESA M. TAKAI, CHIEF INFORMATION  
OFFICER, U.S. DEPARTMENT OF DEFENSE**

Ms. TAKAI. Good morning, Chairman Turner, Ranking Member Sanchez, and distinguished subcommittee members, and thank you for the opportunity to testify regarding the importance of GPS to our national defense capabilities.

My testimony today will focus on the importance of GPS reliability to the Department of Defense in ensuring that our warfighters and allies have the critical positioning, navigation and timing, or PNT, capabilities that they require.

As General Shelton said, we believe the GPS stands as a cornerstone of the DOD PNT capability and is integrated into almost every aspect of our U.S. military operations. To give you but a few examples, GPS signals are used to ensure the accuracy of precision-guided munitions, to guide troop movements, to synchronize communication networks, and to enable battlespace situational awareness, and to conduct search and rescue missions.

DOD is committed to sustaining and modernizing GPS to maintain and improve our military PNT capabilities. Several GPS innovations are scheduled during the next 10-plus years, including three new civil signals, enhanced encrypted military signals, and a new constellation operational control segment, which are scheduled to come on line by 2018 and then be implemented systemwide into the GPS receiver populations over the successive 5 or more years.

As DOD's chief information officer, I have the collateral duty as the co-chair of the executive steering group of the National Executive Committee for Space-Based PNT, along with my counterpart from the Department of Transportation. The role of that EXCOM [executive committee] is to advise departments, agencies and the Executive Office of the President regarding strategic policies, requirements, and security of all PNT infrastructures, including GPS.

In response to the January 2011 Federal Communications order that conditionally allowed LightSquared to unbundle their ancillary terrestrial component restriction in the mobile satellite services band adjacent to GPS, the PNT EXCOM tasked the National Space-Based PNT Engineering Forum, or the NPEF, to perform testing to ascertain the potential interference. As General Shelton mentioned, that testing was performed at White Sands Missile Range in Holloman Air Force Base in New Mexico.

That report was completed on June 15th of 2011 and then submitted to NTIA for their review and transmitted to FCC. The test data indicated that proposed LightSquared terrestrial operations would cause harmful interference to GPS operations. GPS receivers of various types of manufacturer, operated not just by DOD but by the U.S. Coast Guard, the Federal Aviation Administration, the State of New Mexico Public Safety, commercial aviation, and precision farming systems showed varying degrees of degradation of GPS accuracy, interruptions to GPS signal acquisition, or total loss of GPS tracking and position.

None of the parties cognizant of the NPEF testing dispute that the LightSquared terrestrial network plan that was tested by NPEF caused unacceptable levels of harmful interference to GPS. The testing also showed a source of interference that was due to the combined effect of the LightSquared dual-channel signal. This inter-modulation product was generated on top of the GPS L1 signal in its GPS band, interfering with GPS receivers. This IMP [inter-modulation product] was caused by the LightSquared dual-channel choice and its design, and not by the designs or filtering limitations of the GPS receivers.

Subsequently, LightSquared and the GPS industry filed their Technical Working Group report. That report also does not contest the NPEF results, nor does it offer a mitigation solution of the IMP interference. Instead, as has been mentioned, LightSquared proposed to the FCC the recommendation of an alternative terrestrial network that was not in the test plans of either the NPEF or TWG [Technical Working Group] tests and was not tested to any extent comparable to the dual-channel tests.

LightSquared's modified proposal recommends launching commercial services initially in only their lower 10 megahertz. DOD at this time has not received a sufficiently clear and complete description of a LightSquared lower 10 megahertz deployment plan to professionally analyze its new aggregate interference environment.

In addition, we are evaluating the effects of LightSquared's terrestrial transmissions on the military's use of the Inmarsat satellite systems for data and voice communication. The LightSquared terrestrial system will interfere with DOD usage if Inmarsat if appropriate mitigation actions are not taken.

We are diligently working with Inmarsat to identify mitigating techniques for reducing the potential interference for military, land, maritime, and aeronautical missions and communication requirements.

The Department will continue to work with its administration partners and NTIA, as well as with Congress, to address long-term solutions regarding the balance between Federal spectrum requirements and the expanding demand for mobile broadband services. We look forward to working with the FCC, NTIA, and LightSquared to ensure that all further proposed mitigations or alternatives for the LightSquared terrestrial network are thoroughly tested to ensure no harmful interference to GPS receivers or other military spectrum requirements. The ability of GPS to operate without harmful interference remains of paramount importance to the Department. Thank you for your interest in the Department's efforts in this area, and I would be glad to answer any questions that you have.

[The prepared statement of Ms. Takai can be found in the Appendix on page 49.]

Mr. TURNER. Mr. Nebbia.

**STATEMENT OF KARL NEBBIA, ASSOCIATE ADMINISTRATOR,  
OFFICE OF SPECTRUM MANAGEMENT, NATIONAL TELE-  
COMMUNICATIONS AND INFORMATION ADMINISTRATION,  
U.S. DEPARTMENT OF COMMERCE**

Mr. NEBBIA, Chairman Turner, Ranking Member Sanchez, and members of the subcommittee, thank you for the opportunity to testify on behalf of the National Telecommunications and Information Administration, the President's principal advisor on telecommunications and information policy, and manager of Federal use of the radio spectrum.

As Associate Administrator for the Office of Spectrum Management, I oversee this critical spectrum function. I am pleased to discuss NTIA's efforts to ensure that critical uses of GPS continue without interference.

In November of last year, LightSquared proposed to modify its authorization for a mobile satellite service auxiliary terrestrial component previously understood to be a satellite service gap filler. This proposal requested authorization to deploy, on a wholesale basis, a nationwide terrestrial network with handsets that do not connect to the satellite system. These operations would occur in two spectrum bands on either side of the GPS range, with two signals within each of these two bands.

This proposal represented the potential for increased mobile broadband capacity and choice for all Americans. However, LightSquared's proposal generated concern from the GPS community that the network would cause interference to GPS receivers. These concerns did not arise from LightSquared's emissions spilling into the GPS band, but from the fact that some GPS receivers would not adequately filter LightSquared signals outside of the GPS band. Also, some other GPS receivers, including precision receivers, improved their accuracy by extending into the MSS [Mobile Satellite Services] band.

On January 12th, NTIA advised the FCC that the Federal agency concerns warranted a full evaluation. On the 26th of January, the Commission granted LightSquared a waiver conditioned on consultation with NTIA and the resolution of GPS interference concerns. Between January and June, a Technical Working Group co-chaired by LightSquared and the GPS Industry Council; NASA [National Aeronautics and Space Administration], via the Jet Propulsion Lab; RTCA [Radio Technical Commission for Aeronautics], on behalf of aviation interests; and the Executive Committee for Space-Based Positioning, Navigation and Timing, the EXCOM, all conducted tests of GPS devices in the presence of LightSquared signals. These tests were based on LightSquared's original plan to transmit two separate 10 megahertz base station signals within the band just below GPS.

On July 6th, NTIA submitted the results of the EXCOM test showing that LightSquared's proposed operations would cause interference to both Government and commercial GPS uses. NTIA recommended that the FCC continue to withhold authorization to commence commercial operations. The report of the Technical Working Group reached similar conclusions.

As a result, LightSquared proposed to modify its plan and use only the lower 10 megahertz channel. This change came too late for

full testing and evaluation by Federal agencies and raised concern about applying critical resources to an evolving proposal.

NTIA and the Federal agencies have been reviewing the test data to determine whether the use of the lower 10 megahertz would eliminate interference to general navigation and cellular GPS receivers, and whether additional testing and analyses are needed.

Everyone agrees that some timing and precision devices will receive interference even if LightSquared uses only the lower 10 megahertz. Therefore, for those applications, some other mitigation technique will have to be developed and tested.

Last week NTIA requested that the EXCOM work with LightSquared to develop a test plan to study, by November 30th, remaining concerns for general navigation and cellular receivers, and we have provided that document as an exhibit within our testimony.

Meanwhile, LightSquared is pursuing the design and manufacture of a filter to mitigate impacts to precision receivers. With respect to timing receivers, LightSquared has identified an antenna with filter characteristics that may provide a possible solution.

LightSquared has agreed that it will not commence commercial operations until the Federal agencies test these techniques and conclude that they prevent interference without degrading the performance of the receivers.

The Administration intends to protect critical and national security-relevant GPS services. Due to the need for additional spectrum for mobile broadband, we will try to resolve these interference issues to maximize use of the band.

We will, in coordination with the FCC, work to complete the required testing or analysis and determine what strategies can provide workable solutions. We await LightSquared's delivery of a filter for the high-precision receivers and will seek prompt agency testing and analysis of that solution when it arrives.

LightSquared has submitted a new proposal to the Commission seeking to protect GPS operations based on an agreed signal level on the ground. We will also review this approach as we move forward.

In coordination with the Federal agencies, we will provide thorough and expert input to this dialogue so that the American public can extract the greatest possible benefit from the radio spectrum.

Thank you again for the opportunity to testify, and I am pleased to take your questions.

[The prepared statement of Mr. Nebbia can be found in the Appendix on page 56.]

Mr. TURNER. Mr. Russo.

**STATEMENT OF ANTHONY J. RUSSO, DIRECTOR, NATIONAL COORDINATION OFFICE, SPACE-BASED POSITIONING, NAVIGATION AND TRAINING, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**

Mr. RUSSO. Chairman Turner, Ranking Member Sanchez, and distinguished members of the subcommittee, thank you for this opportunity to appear before you.



The Global Positioning System has grown into a worldwide utility whose multi-use services are integral to our national and homeland security. Services dependent on GPS information are now an engine for economic growth and improve both the safety and the quality of life. The system is essential to first responders and a key component to multiple critical infrastructure sectors.

Since 1983, the United States has had a multi-use policy in place for GPS. This policy has had strong bipartisan support, and each successive administration has strengthened the interagency participation in the program. In 2004, President Bush issued a policy establishing a deputy secretary-level executive committee, or EXCOM, to advise and coordinate on GPS issues. Last year, President Obama signed a comprehensive National Space Policy which left this EXCOM structure in place but added emphasis and additional guidance in four key areas related to GPS, and specifically addressed the issue of GPS interference. This policy also directs the identification of impacts to Government space systems prior to any reallocation of spectrum for commercial, Federal, or shared use.

To execute the staff functions of the EXCOM and to assist them in ensuring implementation of the President's policy objectives, a National Coordination Office was established with representatives from every department or agency with major equities in GPS. I am the director of this interagency office.

On the 26th of January of this year, the FCC approved a conditional waiver for LightSquared's high-powered broadband network that the executive committee had warned might cause significant interference to GPS applications. And with the permission of the executive committee, I tasked interagency working group called the NPEF to conduct modeling, simulation, analysis, bench testing, chamber testing, and live sky testing to evaluate the effects of LightSquared's transmissions on GPS receivers.

The group was co-chaired by leaders in FAA and the Air Force, but with supporting technical representatives from across the interagency. And despite the numerous limitations and constraints that I have listed for you in my written testimony, the NPEF was able to complete the job they were asked to do. They evaluated a wide range of representative receivers against all three phases of LightSquared's proposed deployment.

The answer is definitive: LightSquared's proposed system will create harmful interference. The NPEF could not identify any feasible option that would mitigate harmful interference for all, or even most, GPS users and still allow LightSquared to meet their system requirements.

Now, when the FCC granted the conditional waiver, they directed the creation of a LightSquared-led working group to conduct tests and resolve the interference concerns that the EXCOM had raised. The FCC highly encouraged participation from the Government, so 10 of our best technical experts from across the interagency participated in this Technical Working Group, or TWG, along with strong representation from across the diverse GPS industry. The test results collected and analyzed by this TWG were consistent with the results of the Government NPEF test.

On June 29th, LightSquared submitted their TWG report acknowledging the harmful interference their system would create.

And simultaneously, LightSquared submitted a separate recommendations report outlining a proposed three-part solution. The LightSquared recommendation report was not reviewed or evaluated by the TWG, and all 10 of the Government participants disagree with the assertion it makes about TWG results.

LightSquared's three-part proposal is very constructive and involves both lower authorized power and a rephrasing of their deployment so that the channel further from the border of GPS comes first. This would decrease, but not eliminate, the number and extent of initial impacts to GPS devices and allow more time for the development of mitigation methods.

This new initial phase was not tested by the Government, since it wasn't proposed until after we had submitted our results. But yesterday, I did receive permission from the executive committee to begin a new round of testing focused on this new signal configuration.

In LightSquared's new proposal, they offered a standstill for operating their second higher frequency channel, which does impact all classes of GPS receivers. Now, just when they would need to use the second channel was undefined. However, LightSquared testified to Congress they were seeking a glide path to using it within 2 to 3 years. Therefore, any necessary mitigation measures would have to be in place by that timeframe.

Further study is needed, and in progress, on the most recent LightSquared proposals, and my office will support these studies. I thank you for this opportunity to speak on this issue of great strategic importance to the Nation and to over a billion worldwide users of GPS. I look forward to your questions.

[The prepared statement of Mr. Russo can be found in the Appendix on page 71.]

Mr. TURNER. Mr. Knapp.

**STATEMENT OF JULIUS KNAPP, CHIEF, OFFICE OF ENGINEERING AND TECHNOLOGY, FEDERAL COMMUNICATIONS COMMISSION**

Mr. KNAPP. Good afternoon, Chairman Turner, Ranking Member Sanchez, and members of the subcommittee.

My name is Julius Knapp, and I am chief of the Federal Communications Commission Office of Engineering and Technology, where I have been an engineer for 37 years.

OET [Office of Engineering and Technology] is the Commission's primary resource for engineering expertise and provides technical support to the chairman, commissioners, and the FCC's bureaus and offices.

I appreciate the opportunity to testify on behalf of the Commission concerning the process for working with other agencies to resolve spectrum interference issues and on LightSquared. The FCC has managed America's commercial spectrum since 1934, although our predecessor agencies were operating since 1912. We have nearly 100 years of accumulated experience in governing airways and ensuring that the services using our Nation's valuable spectrum do not cause harmful interference to one another. This work is a central part of our core mission.

As you are aware, the FCC and the NTIA share responsibility for managing the radio spectrum. While the FCC is responsible for use of the spectrum by the commercial sector, as well as State and local governments, the NTIA is responsible for use by the Federal Government, including the Department of Defense. The FCC and NTIA have coordinated use of the spectrum by various services, and prevented and resolved harmful interference under a memorandum of understanding that has worked effectively for more than 70 years.

My written testimony provides historical background on the development of rules for the ancillary terrestrial component service of the Mobile Satellite Service. There are two brief points I would like to make. First, the provisions for terrestrial service were first adopted in 2003 and affirmed in 2005 in an open rulemaking, in which GPS interference issues were considered.

Second, an authorization was granted to LightSquared's predecessors in 2004 to offer ancillary terrestrial service in the L-Band spectrum adjacent to GPS. The Commission, in January 2011, granted LightSquared a conditional waiver of the rule requiring an integrated satellite and terrestrial service. Under this conditional waiver, customers of LightSquared's wholesale mobile satellite and terrestrial service could themselves offer standalone terrestrial service at retail, provided LightSquared itself offers only a fully integrated terrestrial and satellite service.

The waiver did not alter any of the provisions governing LightSquared's terrestrial network and continued to require LightSquared to provide a robust satellite service consistent with the launch of its new satellite last November.

After LightSquared submitted its request, the GPS industry, the NTIA, and other Federal agencies raised strong concerns that LightSquared's base stations operating adjacent to the GPS band would cause overload interference to GPS receivers. This was a new issue that had not come up previously.

Accordingly, the conditional waiver stipulated that LightSquared could not provide commercial service until the Commission, in consultation with NTIA and working with the agencies, is satisfied that the concerns about potential or harmful interference to GPS have been resolved. The conditional waiver also directed LightSquared to organize and participate in a GPS interference Technical Working Group, in which interested parties could work directly with LightSquared to resolve potential GPS harmful interference concerns. LightSquared filed the final report of the Technical Working Group on June 30th, and the public comment period on that closed on August 15th, although we have continued to meet with all of the parties.

Based on the results of the working group's testing, LightSquared submitted its recommendations to address the interference problems. LightSquared, recognizing that the upper portion of its band significantly interfered with GPS receivers, proposed to operate only in the lower portion of its band furthest away from GPS. Earlier this week, the Commission's international bureau and the Office of Engineering and Technology released a *Public Notice* which reflects the Commission's determination, in consultation with the NTIA, that additional targeted testing is needed to ensure

that any potential interference from commercial services offered by LightSquared do not cause harmful interference of GPS.

In closing, I want to make absolutely clear that, as Chairman Genachowski has said, and I believe it is in his letter as well, the Commission will not authorize LightSquared to begin commercial service if its operation would cause harmful interference to GPS. The Commission and its staff would never take, and have never taken, an action that would threaten the safety or security of American citizens.

We will continue to work closely with the NTIA, the Department of Defense, and the Federal agencies to assess LightSquared's latest proposal and determine the viability of technical solutions that would enable both services to coexist. We would be certainly happy to keep the committee informed of our progress, and I look forward to answering any of your questions. Thank you.

[The prepared statement of Mr. Knapp can be found in the Appendix on page 85.]

Mr. TURNER. Thank you so much, Mr. Knapp.

I appreciate your statement of that commitment. That is why, of course, we are having this hearing. And we have four witnesses before you who said that this system absolutely affects our national security and our GPS, upon which we are reliant, and so as we said before, we are certainly looking forward to this being resolved so we can all have that confidence that the FCC will recognize the clear and unambiguous statements of the four people that spoke before you.

General Shelton, you have been just incredible in helping this committee to try to understand this and to come up to speed on it. As we look to GPS, the operations of our military, we look to you, the technical experts, to come and tell us, in balancing these issues of technical capabilities, is there an impact to our national security, and is there an impact to the GPS on which we rely?

We appreciate your very clear statements and your dedication in looking at testing and engineering requirements so that when you have provided us your conclusion, that we can all be confident in it.

In your prepared testimony you state, "testing showed unacceptable interference to all 33 high-performance receivers, as well as certain military receivers, tested in the vicinity of the LightSquared low band transmitter."

In our classified briefing, you provided us with some slides that are unclassified, and I have those here, and I appreciate this representation of showing the interference that is coming from the terrestrial system upon the GPS's frequency. And I ask that this slide be included in the record of today that shows that this encouragement or interference is really the area where we start to see the problems in the operations for GPS.

And then also, on slide 11, which comments on the proposal of the lower 10 channel, your statement on this slide is, "not acceptable, based upon initial test results from both the Engineering Forum and Industry Council reports," and then you say more tests needed. I note, in your written testimony you state, similarly, clearly this affects GPS even at their proposal of the lower 10. So, with that, knowing that, both in your testimony and the slide, there is

a statement of “additional testing needed,” could you please tell us, going forward, what would be the path for evaluating this option of the lower 10 that is proposed by LightSquared?

And from what you have seen so far, what is your opinion as to whether or not this is at all even a realistic option as you continue to test it?

General.

General SHELTON. Mr. Chairman, as we looked at that under the previous testing we saw, certainly, interference even with the lower 10. The TWG saw the same thing. They saw interference in certain types of receivers—not all—but certain types of receivers. The latest direction from the NTIA—and Mr. Nebbia may want to talk more about this—but the latest direction is to not test the high-precision receivers and the timing receivers just yet because there are some mitigation options that have been proposed, but aren’t quite yet ready for prime time; that is, filters on the high-precision receivers and a special antenna on the timing receivers. We—

Mr. TURNER. Now, before you go forward, I want you to finish, so don’t lose your thought process there, but to clarify the issue of the filters, the filters are something that you would have to do, not that they would have to do, right? I mean, it doesn’t go on LightSquared’s system? It goes on your system?

General SHELTON. It does. LightSquared has proposed that they could develop these filters.

Mr. TURNER. And then you would have to put this in everything?

General SHELTON. Absolutely. Every precision receiver would have to be retrofitted. How that might affect the overall platform that it is on is an unknown.

Mr. TURNER. And the concepts of any time that you are modifying these systems, you add the issue of vulnerability to the systems and all type of unintended consequences that we can’t be certain of, including the enormous cost that you would be facing.

General SHELTON. Enormous cost, time, integration testing to thoroughly wring out these filters, if they are technically feasible. And even with that, because there is a difference of opinion, technical difference of opinion here, we believe that the precision of those receivers would be impacted even in the presence of that filter. There is, without getting too technical here, there is a center frequency, and then there are harmonics off that center frequency. It is those harmonics that go out among other frequencies that are important for the precision of those wideband receivers, if you will. Clipping off those harmonics decreases the accuracy of the receiver. If there is something else magic out there, we don’t know about it.

Mr. TURNER. And that is an interesting point, because certainly you are very aware of the existing engineering, that the technology that is there—so to summarize for a moment, what we have here is your unambiguous statement that LightSquared system interferes. The two options that have been proposed, the lower 10 is one that does not ameliorate the interference, and the filters, both of which at this point seem to be unacceptable options from your testimony.

And then I have to ask you a question that is, I think, a little bit amusing, and I would like your thoughts or reactions. We are going to go a little bit from the technical. As you know, while we

were sitting in the classified briefing, one of the Members brought with them this giant ad in *Politico* by LightSquared. And this ad says, "Excuse me, you are in my space." And in this picture, they have got these two guys on a train and the one guy is leaning over in the other guy's space. I think the guy who is infringing on the space is supposed to be DOD and commercial users.

I think they are trying to indicate, General, that this may be you on the train going into LightSquared's space. And this—it was odd in the tone of the ad, because again it is not that it is an issue of technical clarity; it was an ad of blame. And so I have some questions for you. LightSquared argues that in this ad they say, "They're causing the problem. They've ignored government standards for eight years. They're taking advantage of an \$18 billion subsidy."

General, can I have your thoughts on these allegations? I know you have seen the ad, too, and I think it is just very curious, and I would just love your response.

General SHELTON. Mr. Chairman, the frequency band that we are talking about here has, by FCC rulings in the past, has always been intended to be a "quiet neighborhood," that GPS could coexist with other signals of the same magnitude. GPS is a very weak signal coming from space. It is a spread spectrum signal. It takes very special processing by receivers to pull that signal out of the background noise. If you have signals of a similar strength to GPS, that is not a problem for the receiver. However, if you put a rock band in the middle of that very quiet neighborhood, it is a very different sort of circumstance.

Does that reach into the spectrum that LightSquared was assigned? Absolutely, it does, but that was intentional in the design of the GPS receivers to, again, take those harmonics that stretch out. So to say that the manufacturers aren't adhering to a standard, if you look at what we think they are considering to be the standard, that standard is about broadcasts from the satellite, not about receiver design.

Mr. TURNER. Well, I just want to point out also, then, my interpretation of this graphic picture here, because I think what is happening is not just that it is actually DOD and GPS users that are being pushed away; with the LightSquared system, according to current testing, no one else would be allowed on the bus. So we are not even trying to share space. We are having one completely block out the other.

I have additional questions. I know other members do. But I will turn at this time to the ranking member.

Ms. SANCHEZ. Thank you, Mr. Chairman.

Thank you again to the witnesses.

General, could you elaborate on the impact of redesigning, manufacturing, testing, integrating, modifying cost and time on everything that would be affected if you—if there was a technical solution to this and there was a prototype that actually worked and you were convinced it worked, what would be the timing and the cost, in your opinion, to DOD to fix just our stuff that needs to work, continue to work?

General SHELTON. We have not estimated costs. However, I think it would be very safe to say that the cost would be in the B's, bil-

lions of dollars. We believe that the timing would probably be a decade or more to accomplish all this.

And the reason for that is, there are probably a million GPS receivers out there in the military. Maybe even more than that. But again, its use is so ubiquitous in weapons, in high-performance platforms, in timing of computer networks and all those sorts of applications that we take advantage of the GPS signal. We would have to install this filter—again, if it is technically feasible—we would have to thoroughly test it. We might even have to do software modifications to accommodate it. I mean, there is just a whole bevy of questions that are unanswered at this point.

Ms. SANCHEZ. Thank you. Thank you.

Mr. Knapp, would the FCC be the one who addresses the question of who would pay for all this fix?

Mr. KNAPP. The first focus is on, do you have a fix that works, and how could it be implemented, and is it viable? And, certainly, the judgments relative to the military systems would have to be by Department of Defense.

Whether there is a way to pay for that and the timing of it, we would have to be working with the parties to see if there is a viable solution.

Ms. SANCHEZ. Mr. Nebbia, given the technical complexities and, as you probably can tell, the political sensitivities that are arising, can you assure this committee that you and your colleagues have the right ability and the right process to effectively analyze and resolve this issue? What is your comfort level? Because this is going to come to a head here some time.

Mr. NEBBIA. Thank you, Ranking Member Sanchez.

We certainly have an ability within NTIA to work with the Federal agencies, including the General's team, who are experts in dealing with GPS issues. There are quite a number of agencies, including experts within the Department of Transportation, NASA, and others. And certainly, under the coordinated effort of the EXCOM, we have a significant resource there to delve into these issues.

It is critical for us—I really can't speak to the political issues in that sense—but that we work through the factual and technical issues. That is what our team can do. We can look at the technical problems that have arisen from this proposal, and we can work through that through real testing, through analysis, through modeling, to come up with answers. So I think in that process we have, certainly, adequate involvement of various Federal agencies. We have done a lot of consultation back and forth with the Commission. We have the Interdepartment Radio Advisory Committee, a committee of Federal agencies, that supports us, in addition to the EXCOM that has provided able input. So I think the ability there is to work through it and to look for what solutions are, in fact, available in the end.

Ms. SANCHEZ. Thank you.

General Shelton, according to the FCC and LightSquared, neither DOD nor GPS raised any concerns during the multiyear process. Would you take this opportunity to fully explain why it took so long for the Department and GPS to respond to the significant terrestrial network?

General SHELTON. Yes, ma'am. I don't know that it is totally accurate to say that there were no concerns. I think this was a very different business plan that was put forward, and I do believe we were caught a bit off guard. The network proposed originally was a space-based network, and then it was space augmented by ground and then it became principally ground. A very significant shift: 40,000 transmitters out there is a very different business plan than just a few augmentation transmitters.

Ms. SANCHEZ. And when did you really kind of start sticking your foot in and say, "Wait a minute, something is wrong here, we need to be involved here"? At what point in this 8-year—

General SHELTON. About January 2011, the January-February timeframe this year is when we really started to get concerned.

Ms. SANCHEZ. And the last question—I know there are plenty of members here who have questions. It is very well attended here. The last question I have for all of you very quickly, do you all each individually feel that your agencies have the ability to work through this and that the interagency communication and listening to each other is happening or do you think there are breakdowns?

General SHELTON. I think we have got good representation.

Ms. TAKAI. I would agree with General Shelton.

I think it is important to note that the PNT EXCOM has really been the focal point for all of our discussion. And we have done that very deliberately because it does include representation from all of the parties. And I think being able to work through that committee enables us to look at all of the interests. And I think one of the interests that we haven't talked about a lot here is our partnership with DOT and making sure that we have the FAA concerns adequately registered as well, because we are very dependent upon the commercial, and it is very important that we have them included. So I think using the PNT EXCOM and then having the close cooperation with NTIA and FCC gives us the ability to have the open dialogue that we need.

Ms. SANCHEZ. Thank you.

Mr. NEBBIA. I agree. I think I already gave an answer along this line. So I will just pass on to Tony and put him in the hot seat.

Mr. RUSSO. Well, I concur with the other speakers.

We do have very strong participation from all of the departments and agencies that are affected, and at very high levels. We have had assistant secretaries, under secretaries, deputy secretaries, personally working on this issue.

One area of caution I would have is that the technical expertise on this mostly resides with General Shelton's folks. We have a lot of people that are users of GPS but don't necessarily understand how the black box works. So they can tell you how important it is to their operation, but when it gets down to the very detailed technical discussions with LightSquared, we need help from the Air Force.

Mr. KNAPP. I feel very confident in the process that we have in place. What we have tried to do is engage all of the experts in this.

We have had many tough problems before, I know in my career, and at times, they have seemed unsolvable. You work through it. You have a debate, and wherever the chips fall based on the engineering is where it will come out.



Ms. SANCHEZ. Thank you, Mr. Knapp.  
And thank you, Mr. Chairman. I will yield back.

Mr. TURNER. Mr. Scott.

Mr. SCOTT. Thank you, Mr. Chairman.  
General, Madam, Mr. Russo.

Mr. Knapp, thank you for your statement that you would not allow anything that would interfere with national security come through with the FCC.

I want to go back to this letter. Mr. Nebbia, is that correct? Is that how I say it? I am somewhat—I have read this letter and just briefly.

But I want to read one of the sentences. “Without waiting for the interference issues to be resolved relating to high-precision and timing receivers, we would like to move forward to reach resolution of any remaining federal agency concerns with respect to the cellular and personal/general-navigation receivers.” This is from—and it says to contact you if there are any questions.

And it is signed by Lawrence Strickling, who I don’t know.

But I have been in politics for 14 years. I have never seen an agency advocate so strongly for something like this, unless there was pressure from above or a relationship that was not being disclosed. And I guess I would like for you to explain to me why your agency is advocating with the strength, and going to the lengths that you are, in advocating for this private company when you have got a general sitting there—and you are a graduate of the Naval Academy, as I understand. You have got a general sitting there saying that what these people are doing will affect national security, and yet we have got a Federal agency that is advocating on behalf of a private business. Why should the taxpayers be paying to prove these things? Why shouldn’t that private company be bearing the burden of the expenses?

Mr. NEBBIA. Thank you. Certainly, in this case, there is an effort on both sides to come to a resolution.

I would not characterize NTIA’s efforts on this part in any way as advocacy, as one side or another but, in fact, to move the proper people into place to work on the issue. We have had to bring together agencies on our side, get together with the Commission, talk to the GPS Industry Council, work with LightSquared, and so on.

In this particular case, the situation we have is that we know that there has been a proposed fix for a certain number of the categories of GPS uses that will not be available for some time. Our purpose here was to try to move the ball forward on the other parts that we felt could be worked on at this point, as opposed to waiting until some later date and getting back into it. So we still have that difficulty ahead of us. The precision uses, the timing uses will still have to be dealt with in the time to come. But it seemed like an opportunity, before then, for us to work specifically on these issues. The agency—

Mr. SCOTT. Sir, I am down to about 2 minutes. Can you give me another example of where your agency, the agency that you work for, has advocated on behalf of a company, that the Department of Defense has said that this particular issue affects national security? Can you give me another example of where your agency has written a letter with similar language, without waiting for these

issues to be resolved, that you want the other agencies to move ahead with licensing this? Can you give me an example of another company that you all have advocated for to that level and strength?

Mr. NEBBIA. Actually, the letter does not ask for us to move ahead with licensing. It is moving ahead in this process of testing. The NTIA regularly deals with difficult situations in looking at new commercial interests and demands for radio spectrum and the fact that, in some cases, we have to be looking at spectrum currently occupied by the military. We are engaged in that at this time. We have been engaged in it in the past.

In this particular case, the fact that it involves one company in this band, I can't say whether that is usual or unusual. We generally are dealing with issues of broad issue and broad policy.

Mr. SCOTT. Sir, the letter reads "move forward to reach resolution of any remaining Federal agency concerns." I have never seen an agency, a State agency or a Federal agency, advocate that strongly on behalf of any private sector company, unless somebody's wheel was getting greased.

I mean, the fact that we are even here having this discussion, I think, is absolutely ridiculous.

And, Mr. Knapp, I want to thank you for the commitment that the FCC will not allow the licensing of anything that will affect our national security.

General, I want to thank you for the work that you have done on this to protect America.

I yield back.

Mr. TURNER. Thank you.

Mr. Garamendi and Dr. Fleming also would like to go before the votes.

And if that is the case, then what we will do is, if these two gentlemen can complete in the time in which we need to go, we will conclude the hearing, and we will submit the remainder of our questions for the record.

Mr. Garamendi.

Mr. GARAMENDI. Perhaps the best way for me to proceed is not to ask a question but, rather, to state what I believe to be the situation. We have a very, very important system in place, the GPS system. It involves all types of activities, all of which have been mentioned here. It is, therefore, extremely important, in my view, that that system, in all of its various ways, be protected.

This goes to you, Mr. Knapp. It is not just the national security through the military. It is the economic security and the personal security of Americans and others around the world that are at risk here.

So I would suggest in every way I can that you look way beyond just the national security. My questions would go to that area.

Secondly, this is going to be a very expensive process of testing. We have a new company entering space occupied by others. It seems to me that that new company ought to bear the full cost of proving that it is not harming others.

It appears to me that is not the case. I have not heard anything from any of you that the company is paying for the testing that, it seems to me, is going to be both extensive and expensive.

And I would like all of you to comment in writing about what your costs of testing will be and where in your budgets you have that money, or whether it is best that the new company that wants to occupy this space should pay for the testing.

The subsequent question is, if the testing proves that certain things can be done—antennas or filters—who, then, pays for putting those into effect?

And I would like to have a written response from all of you. Thank you.

[The information referred to can be found in the Appendix on page 115.]

Mr. TURNER. Mr. Garamendi, thank you so much for your brief statement.

Dr. Fleming.

Dr. FLEMING. Thank you, Mr. Chairman.

I will try to be brief also. I came in a little bit late because I had another HASC [House Armed Services Committee] meeting that overlapped with this one.

What I basically would like to know in a nutshell, just frame, how did we get here on this? I know General Shelton made reference to the fact that the company originally was going to be primarily space-based and not terrestrially based, but it reversed over time. Perhaps engineering, science led us to go in that direction.

So can you give me a better explanation to encapsulate, how did we get here? And we have got engineers; we have got representatives from both sides. So I am open to anybody who might want to—

Mr. RUSSO. I think I can add a little to that.

Since 1971, the band below GPS has been allocated for Mobile Satellite Services. We have no problem coexisting with that neighbor.

And in the orders you heard about earlier—and you may, sir, have missed it, the oral testimony earlier—they talked about adding an ancillary terrestrial component. That was done for a very specific reason, to give the Mobile Satellite Services operators additional flexibility. And specifically it talked about a fill-in capability for gaps in coverage inside buildings and in dense urban terrain. That is actually written into the FCC orders on this, and that is what the company at the time applied for, to give them some extra capability to cover places where it might have a problem with coverage.

They also talked about, in answering complaints about this new authority, they talked about the fact that they would be limited in what they could do by a self-interference. In other words, they were required to have handsets that talked to space and terrestrial systems, and therefore, the company itself argued that that would then limit what power they could put out, and how many stations because, they would be interfering with their own service.

So what we are talking about now is, through a series of orders and amendments and mods [modifications] and reconsiderations and waivers, over time, that foundation, the assumptions that were made have changed, and we find ourselves now in a situation that is different than—

Dr. FLEMING. Could we have not contemplated this? Was it just something that morphed gradually without anybody really being able to contemplate that down the road, all these changes and amendments would eventually get us in trouble?

Mr. RUSSO. Sir, I think there are pieces of this that there could have been more discussion of along the way. But the big piece was this last piece. This last piece changes it from a space-based system with an ancillary fill-in capability to a primary terrestrial system. And that is this last waiver, and that is what that does.

Dr. FLEMING. I see. Well, was it not possible to stay with the original plan in a space-based system? Or did the company just find out that that wasn't going to work as planned?

Mr. KNAPP. I would largely agree with Mr. Russo, but I would also say that things evolved on both sides with the evolution of GPS and the expanded capabilities over time. This is something that—I think your description was fair. It slowly came about. The important thing is when we all understood that there was a problem there, we put the brakes on the deployment until we get it fixed.

Even, I think, with what we have learned here, the number of base stations, if each one were to have caused interference at 22 miles, I think everybody would agree that wouldn't have been acceptable anyway.

Dr. FLEMING. Right. Sure. Okay. Thank you very much.

I yield back.

Mr. TURNER. Mr. Lamborn.

Mr. LAMBORN. Thank you. And I will only ask one question for the sake of time and with votes pending.

And this will to be you, General Shelton. Thanks for being here. You may have addressed this earlier. Please accept my apology if you have because I was chairing another subcommittee, so I was not able to get here until a little bit later. And this is a little more general of a question. What are your concerns from a command and control perspective should GPS signals be somehow impaired?

General SHELTON. Congressman, if you are talking about the broadest sense of command and control, clearly we count on GPS precision as one of our key tenets of command and control, knowing where our forces are, knowing where the adversary's forces are at very precise locations, that is just fundamental to everything we do in command and control and modern warfare. So, without GPS, I think we back up quite a bit.

Mr. LAMBORN. And even in the U.S., not a global, but just a U.S. focus on this?

General SHELTON. Yes, sir. We train the way we prepare to fight. And if you take us back in training, you take us back in the way we fight. So we have to be as realistic as we can in training. And if you change the training environment to that degree, I think it is a fundamental step backwards.

Mr. LAMBORN. Okay. Thank you, Mr. Chairman. I yield back.

Mr. TURNER. I want to thank all of our witnesses today. We appreciate your participation. And we look forward to the Chairman of the FCC providing us with additional answers to our questions. Thank you.

[Whereupon, at 1:00 p.m., the subcommittee was adjourned.]

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**A P P E N D I X**

SEPTEMBER 15, 2011

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**PREPARED STATEMENTS SUBMITTED FOR THE RECORD**

SEPTEMBER 15, 2011

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**Statement of Hon. Michael Turner**  
**Chairman, House Subcommittee on Strategic Forces**  
**Hearing on**  
**Sustaining GPS for National Security**  
**September 15, 2011**

Good morning. I want to welcome everyone to the Strategic Forces Subcommittee's hearing on Sustaining GPS for National Security.

I was planning to make the usual statement of appreciation to the witnesses for their appearance here today, and to those witnesses who took this issue seriously enough to be here—General Shelton, Ms. Takai, Mr. Nebbia, Mr. Russo and Mr. Knapp—I do thank you for your time and testimony.

That said, I have the unfortunate responsibility to inform the subcommittee that Federal Communications Commission (FCC) Chairman Genachowski refused to appear today. I must also make clear that I consider the Chairman's failure to show up today to be an affront to the House Armed Services Committee. Further, it appears to be symptomatic of a disregard by the Chairman to the consequences of the FCC's January 26 waiver to LightSquared. I trust Chairman Genachowski is doing something very important this morning if he couldn't be here to discuss the significant harm to national security that may result from the FCC's action on January 26th of this year.

I appreciate that the Chairman is apparently willing to provide personal responses to written Questions for the Record submitted by this subcommittee, according to staff. But the Chairman's priority should be the same as the subcommittee's: "Sustaining GPS for National Security."

With that unpleasantness out of the way, I wish to introduce and express appreciation to the witnesses *who are here today*:

- General William Shelton, Commander of Air Force Space Command—I note this is General Shelton's second appearance before this subcommittee in as many weeks ... either the General really likes us or he's working to accumulate his frequent flier miles;
- Ms. Teresa Takai, Chief Information Officer, Department of Defense;
- Mr. Karl Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration;

- Mr. Anthony Russo, National Coordination Office, Space-Based Positioning, Navigation and Training, National Oceanic and Atmospheric Administration; and
- Mr. Julius Knapp, chief of the Federal Communications Commission's Office of Engineering Technology.

Mr. Knapp, I want to thank you for being here and I want to be clear that neither I nor my colleagues have anything other than gratitude for your service at the FCC; our concerns are with Chairman Genachowski. Thank you all for appearing before this subcommittee this morning.

Why are we here this morning? General Shelton, you might remember this question. It was asked by a member of the subcommittee during the classified briefing you provided all of us last week on LightSquared-GPS test results.

A brief recap of how we got here. On January 26th of this year, the FCC granted a conditional waiver of its own rules allowing LightSquared to establish a terrestrial broadband network and be freed of certain gating requirements which were designed to keep any potential terrestrial service from overwhelming the satellite spectrum LightSquared held.

As we now know, this network would operate with over 40,000 base stations operating at a frequency adjacent to that long used by the Global Position System (GPS), at almost 5 billion times the power of the GPS system.

The Chairman of the FCC knew there were concerns about the proposed waiver for LightSquared, as he received a letter from Deputy Secretary of Defense Bill Lynn on January 12, 2 weeks before the waiver was issued. The Deputy Secretary wrote to Mr. Genachowski that "there is strong potential for interference to these critical National Security Space Systems" referencing GPS, Inmarsat terminals, and Aeronautical Mobile Telemetry operations. This letter also asked for Chairman Genachowski's "personal attention on this matter." Without objection, this letter will be made a part of the record.

We also know National Telecommunications and Information Administration (NTIA) Assistant Secretary Lawrence Strickling wrote to Chairman Genachowski recommending that the FCC not go forward with the LightSquared waiver request. Many have observed that the FCC followed an irregular process on the LightSquared waiver.

First, the National Legal and Policy Center stated in a February 2, 2011, letter to the Chairman and Ranking Member of the House Committee on Oversight and Government Reform that, "over the course of the past year, a series of odd decisions, questionable meetings and procedural anomalies at the Federal Communications Commission and White House highlight Mr. Falcone's growing influence in the hallways of government." Mr. Falcone is the CEO of the hedge fund, Harbinger Capital Partners, which owns LightSquared. Without objection, this letter will be made a part of the record.

Additionally, in a March letter to Chairman Genachowski, the Deputy Secretary of Defense, joined by the Deputy Secretary of Transportation noted that "the DOD and DOT were not sufficiently included in the development of the LightSquared initial work plan

and its key milestones.” This letter again sought the FCC Chairman’s personal attention. Without objection, this letter will be made a part of the record.

And just yesterday, the Center for Public Integrity released a report detailing, “Emails show wireless firm’s communications with White House as campaign donations were made.” In my capacity as a member of the House Committee on Government Reform and Oversight, I will be asking Chairman Issa and Ranking Member Towns to promptly investigate this matter.

We cannot afford to have Federal telecommunications policy, especially where it affects national security, to be made in the same way that the White House parceled out a half billion dollars in loan guarantees to the failed Solyndra Corporation, a large political campaign contributor of the President.

While there is clearly a concern about how the FCC has conducted this process, those concerns are within the purview of the House Committee on Energy and Commerce and the House Committee on Oversight and Government Reform.

Also outside the scope of today’s hearing, but of significant concern nonetheless, is the impact to GPS receiver manufacturers like Trimble Navigation in my home town of Dayton, Ohio, which manufactures GPS receivers for the agriculture sector and heavy machinery producers like Caterpillar.

But this subcommittee’s main purview is national security, and the national security consequences of the LightSquared network are significant. As I mentioned, the concern in this case is that LightSquared’s proposed network of 40,000 base stations around the U.S., which broadcast at an adjacent signal frequency to the signal used by the GPS system, but at 5 billion times the signal strength, will render useless the DOD’s GPS receivers.

General Shelton, Commander of Air Force Space Command, informed the HASC–Strategic Forces Subcommittee members in last week’s classified briefing that “tests show LightSquared signal causes significant interference to military GPS.”

Simply put, if the FCC gives LightSquared the final go-ahead to build out its network, I fear the DOD’s training activities in the United States would come to an end. This cannot be allowed to happen. As the members of the House Armed Services Committee know, before U.S. troops are deployed, they conduct extensive real-world training, which includes use of GPS for orienteering of U.S. forces, locating friendly forces, locating enemy forces, conducting search-and-rescue activities, targeting of precision-guided ordnance, and calling in close air support. None of these activities are possible without DOD’s high-precision GPS receivers, which would be most affected by the LightSquared network.

As a Member of Congress, I can think of no higher responsibility than to make sure U.S. military forces are fully trained and equipped before they are deployed overseas to Afghanistan, Iraq, or any place in harm’s way. Likewise, and this is something in all of our minds this close to the tenth anniversary of the 9/11 attacks on the United States, significant harmful interference to the GPS system would be a tremendous liability to our defense of the homeland. General Shelton, I recall you making this point last week.

The Armed Services Committee's position as articulated by the Turner-Sanchez amendment to the National Defense Authorization Act for FY2012 is that the Federal Communications Commission (FCC) should not grant LightSquared final approval on the conditional waiver granted to the company on January 26, 2011, until the Commission has dealt with potential harmful interference to the DOD's GPS receivers. LightSquared itself has no apparent objection to this provision.

LightSquared has been making a vigorous case for its \$4 billion investment in its proposed network build-out of a new nationwide broadband service. That it is a bipartisan policy objective to encourage more nationwide broadband service and more competition is not in dispute ... at least not before the Armed Services Committee.

The question for this subcommittee today is how to evaluate the harm identified by the Department of Defense to its \$34 billion investment in GPS, GPS ground stations, and DOD high-precision military GPS receivers. Again, it is more important than money ... this is about our warfighters who rely on this technology for safety and their technological edge against adversaries.

And let me state that harm to GPS once again very clearly: "tests show LightSquared signal causes significant interference to military GPS."

As my colleagues know by now, on Tuesday of this week, the FCC apparently came to the same conclusion, and issued a Public Notice that the "potential for harmful interference" meant that "additional targeted testing is needed." I consider that the understatement of this decade. But, we need to know what this Public Notice actually means for DOD GPS users; this may very well be an effort to push matters off by a few months under the assumption Congress will be distracted by then. I look forward to the testimony of the witnesses to get to the bottom of this matter.

**Statement of Hon. Loretta Sanchez**  
**Ranking Member, House Subcommittee on Strategic Forces**  
**Hearing on**  
**Sustaining GPS for National Security**  
**September 15, 2011**

I would like to welcome General Shelton, Mr. Knapp, Ms. Takai, Mr. Nebbia, and Mr. Russo to this hearing on sustaining GPS capabilities for national security. Thank you for being with us today.

I would also like to note FCC Chairman Genachowski's meeting with Chairman Turner and me on this important issue, along with his letter to our subcommittee and the FCC announcement this week that the Commission "has determined that additional targeted testing is needed to ensure that any potential commercial terrestrial services offered by LightSquared will not cause harmful interference to GPS operations."

I believe this provides initial reassurance that a deliberate and careful process for assessing the question of whether concerns about significant interference with GPS capabilities can be satisfactorily resolved. GPS assets are critical to national security and to our way of life.

While I support efforts to increase and improve broadband service, we must ensure that plans for expanding this service do not adversely impact crucial navigation, timing and precision systems on which many of our nation's defense, as well as commercial, capabilities depend.

Last week, at our request in preparation for this hearing, General Shelton provided a closed briefing to our subcommittee detailing the classified test results and concerns about the consequences of GPS interference.

This hearing will provide the opportunity to better understand several key issues, including:

- The risks and impacts from LightSquared's proposed terrestrial 4G network plan, and how interference will affect weapons systems
- The level to which our military depends on GPS assets
- Whether this interference can be mitigated, whether "fixes" would require recertification of weapon systems, what the impact to the mission might be and what the costs would be. It bears noting that DOD investment in GPS stands at about approximately \$35 billion taxpayers dollars
- What further testing remains necessary
- What the FCC's process is for deciding whether to allow implementation of LightSquared's proposal and what consultations are on-going with other agencies
- How the interagency process will ensure that national security issues are considered and resolved satisfactorily

These are important questions to assess in order to understand what is at stake and consider a way forward that will safeguard national security. Again, welcome. I look forward to your testimony.

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COMMITTEE ON ARMED SERVICES  
UNITED STATES HOUSE OF REPRESENTATIVES**

**DEPARTMENT OF THE AIR FORCE  
PRESENTATION TO THE SUBCOMMITTEE ON STRATEGIC FORCES  
COMMITTEE ON ARMED SERVICES  
UNITED STATES HOUSE OF REPRESENTATIVES**

**SUBJECT: SUSTAINING GPS FOR NATIONAL SECURITY  
STATEMENT OF: GENERAL WILLIAM L. SHELTON  
COMMANDER, AIR FORCE SPACE COMMAND**

**September 15, 2011**

**NOT FOR PUBLICATION UNTIL RELEASED  
BY THE SUBCOMMITTEE ON STRATEGIC FORCES  
COMMITTEE ON ARMED SERVICES  
UNITED STATES HOUSE OF REPRESENTATIVES**

**Introduction**

Mister Chairman, Representative Sanchez and distinguished members of the Subcommittee, it is my honor to appear before you as the Commander of Air Force Space Command (AFSPC).

As the Air Force lead for organizing, training and equipping space and cyber capabilities, an important part of my command's responsibilities is to develop, build, launch, operate and maintain the Global Positioning System (GPS) constellation of satellites. These actions culminate in our delivering extremely accurate positioning, navigation and timing (PNT) services for billions of users worldwide. Today, my testimony will center on the results of testing conducted thus far on the planned LightSquared terrestrial network in relation to GPS signals and services. I will also briefly comment on LightSquared-proposed modifications to their original deployment plan which was the basis for the initial testing. Thank you for the opportunity to testify on this important issue.

PNT services are crucial in defense, civil, and commercial activities. Although the GPS satellite constellation is procured and operated by the US Air Force, its utility is leveraged extensively by a broad user community, including civil, commercial, and military sectors. For our military, GPS has become an integrated part of US and coalition training and operations. GPS is used by all our Services, from boots-on-the-ground patrols, to precision-guided munitions, to synchronization and security of communications networks, to search and rescue operations, to humanitarian relief operations. As I stated to this Subcommittee in my March 2011 testimony, I believe AFSPC has an obligation to provide the best support possible to our brothers and sisters in harm's way. GPS helps fulfill that obligation by providing an essential capability that is a tremendous enabler and enhancer of joint, combined, and allied operations.

The innovative uses of GPS are also interwoven into a wide array of civil and commercial sector applications. Examples include the aviation community, where GPS is used by the Federal Aviation Administration (FAA) to help control our national airspace. GPS is used by the Department of Homeland Security for National border and maritime security. First responders, such as law enforcement, medical emergency and firefighting crews, depend on GPS for easy and accurate ground navigation allowing quick responses to time-urgent events. Activities such as mining, surveying, shipping, banking, and telecommunications rely on GPS's PNT services as well. As a Nation, we have invested roughly \$34 billion to field and operate the GPS constellation. Clearly, it has become a global utility serving a worldwide user population.

As the Department of Defense's experts on GPS, AFSPC participated in recent testing to determine the effects, if any, of the originally planned LightSquared broadband service on the continued availability and reliability of GPS. These tests were conducted in the most realistic way possible with equipment and personnel provided by LightSquared. In summary, the test data collected by DoD, civil agencies, GPS industry partners, GPS receiver manufacturers, and GPS service providers all indicate the LightSquared terrestrial network operating in the originally proposed manner poses significant challenges for almost all GPS users. Below, I will briefly summarize the test activities that led to this conclusion.

#### **GPS Considerations Regarding Proposed LightSquared Broadband Service**

In January of this year, LightSquared (LSQ) was granted a conditional waiver. The waiver would permit LSQ to provide terrestrial-only service in two 10 MHz wide radio frequency bands adjacent to the GPS L1 signal once all interference concerns are resolved. This decision would fundamentally alter the use of the Mobile Satellite Service frequency band immediately adjacent



to GPS L1 by allowing a ground-based 4G broadband network to become the primary user—previously only transmissions of a similar strength to the GPS signal were allowed. The waiver included direction to LSQ to establish a working group with the GPS community to study potential interference to GPS, with a final report due no later than June 15, 2011. The report was to include the working group's analyses of the potential for overload interference to GPS devices from LSQ's terrestrial network, technical and operational steps to avoid such interference, and specific recommendations to mitigate potential interference to GPS. The LightSquared Working Group study report was filed on June 30, 2011. AFSPC had two representatives on that working group.

Parallel to, and independent of, the LightSquared Working Group study, the Executive Steering Group of the interagency National Executive Committee for Space-Based Positioning, Navigation, and Timing tasked the National Positioning, Navigation & Timing Engineering Forum (NPEF) to conduct an independent assessment of the LSQ planned deployment. The NPEF is co-chaired by the FAA's Ground Segment Lead for Global Navigation Satellite Systems and Space Based Augmentation Systems and the Chief Engineer, Air Force Space Command's Space and Missile Systems Center GPS Directorate. The NPEF testing was an interagency effort, with test participants including the US Naval Observatory, National Geospatial-Intelligence Agency, US Coast Guard, National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration (NASA), the Department of Justice, and FAA.

Additionally, the NPEF test was open to state and commercial partners, which included the State of New Mexico Emergency Services, General Motors/On-Star, Chrysler, Ford, Trimble Navigation, Novatel, U-blox and John Deere. Each of these organizations' representatives was

responsible for their own equipment and the data they obtained. Of particular note, the NPEF test is the only test thus far involving military receivers.

### NPEF Test and Results

#### Preliminary Interference Analysis

To provide a baseline for the NPEF Tests, in February 2011, one of our Federally Funded Research and Development Centers conducted interference analyses using signal characteristics and other data provided by LSQ. Based on the LSQ-provided deployment plan in urban areas, the typical user likely will be no more than 400 meters from a LSQ tower. The analysis showed that some GPS receivers could encounter signal reception interference at distances of several kilometers from a LSQ tower; therefore, the analysis concluded interference would be particularly acute in urban environments.

#### General Overview

The NPEF test was conducted in two phases during April 2011. It was facilitated throughout by the Air Force's professional GPS test squadron, the 746th Test Squadron at Holloman Air Force Base, New Mexico, and we owe them our thanks. As previously stated, LightSquared participated in the tests, providing and operating their own transmitters and antennas to simulate as closely as possible the LightSquared network signals that would be present under their originally proposed plan. The test was robust and comprehensive, involving over 100 receivers

from 24 different organizations, spanning the military, government, aviation, precision agriculture, automotive, and general use communities.

The first test phase involved anechoic chamber tests in a closed, controlled environment at White Sands Missile Range, New Mexico. The second phase, called “live sky” tests, used the same equipment and receivers, and was conducted in the open air environment at Holloman AFB, New Mexico. The test included 29 different types of military receivers, such as handheld models used by ground forces, aircraft units installed in F-15s and F-16s, weapons receivers used in GPS-guided munitions, and receivers used in our Remotely Piloted Aircraft.

The Coast Guard, NASA, FAA, and GPS industry organizations, such as Trimble, Novatel and John Deere, conducted their own independent testing during the DoD test event with 50 different types of receivers using the same test configuration.

The test results demonstrated empirically that the LightSquared signals interfere with all of the types of receivers in the test. The military results were compiled in a report that was submitted through the National Telecommunications and Information Administration (NTIA) to the FCC on July 6, 2011. The NPEF test results also are consistent with results obtained by commercial GPS industry organizations such as Trimble, Garmin and John Deere through their own independently conducted tests. I defer to these companies regarding their specific results.

#### Specific NPEF Test Results

For both the chamber and live sky phases, the NPEF test simulated all three phases of the originally announced LSQ deployment plan. Limited additional testing was accomplished on the 10 MHz single band in the portion of the spectrum farthest from the GPS L1 signal, the lower 10 MHz channel of the allocated bands.

Actual test results indicated significant degradation to every receiver-type tested. Most of the units tested completely lost their GPS service at some point. The specific military receiver test results are classified, but the results were consistent with the other receiver test results.

A. Aviation receivers operating as far as 7.5 miles from LightSquared transmitters completely lost GPS and were degraded out to distances of more than 16.5 miles. For two representative receivers tested by the FAA, results also showed GPS would be completely unusable for an aircraft 500 feet above the ground in an area spanning Stafford, Virginia through Washington and Baltimore, and out to Frederick, Maryland.

B. High precision GPS receivers such as those used for surveying and geological study requiring precise measurements were adversely affected out to 213 miles and totally lost GPS out to 4.8 miles.

C. Based on testing performed at the Jet Propulsion Laboratory, a class of receivers used in space to conduct certain types of atmospheric measurements would be unusable up to 12% of the time while in their typical orbits.

D. The State of New Mexico E-911 Program Director, who sent several GPS-equipped emergency and police vehicles to the test, stated in a letter to AFSPC that their equipment showed “the LightSquared network will cause interference to GPS signals and jeopardize 911 and public safety.”

The NPEF testing also demonstrated a phenomenon known as “intermodulation products,” essentially described as an echo effect resulting from the originally planned two channel operation of LSQ transmitters. This “echo” multiplies the impact of interference in GPS receivers and, to the best of our knowledge, cannot be suppressed by postulated LSQ transmit filters.

#### NPEF Test Limitations

In the interest of full disclosure, the NPEF test had several limitations due to time and resource constraints. These limitations included the following:

Not all GPS receivers/applications were tested. Examples include receivers dependent upon GPS for timing and cell phones with GPS applications. Some of these were tested by the LSQ Working Group.

As stated earlier, LSQ provided us with transmit equipment to conduct our testing. However, we were limited to a single LSQ transmit antenna. The aggregate effects of the nearly 40,000 antennas in LSQ's proposed network had to be modeled based on single transmitter test results. That modeling showed that the complete network of high-powered base stations envisioned by LightSquared would result in degradation or loss of GPS at distances out to dozens of miles and even extending out to operations in space.

LSQ network handsets (i.e., cell phones) are also radio transmitters and will operate in the frequency band just above the GPS L1 band. Although the handsets will transmit at lower powers than the tower transmitters, GPS users in close proximity (1 meter or less) to LSQ handsets theoretically could encounter interference in addition to the interference from tower transmitters. We are not aware if LSQ has built a prototype handset transmitter, so there are no test results to prove or disprove this concern.

#### LightSquared Working Group Test and Results

As stated earlier, the LightSquared Working Group also conducted tests. In general, those test results are consistent with the results obtained by the civil and commercial participants in the NPEF test.

As an adjunct to the report, LSQ submitted additional independent analysis and recommendations. One key point of divergence between the GPS community and LightSquared affecting the interpretation of test results is the definition of “harmful interference.” The commonly accepted level of interference in applications such as this is, formally documented by the International Telecommunication Union (ITU), is defined as 1 decibel (dB). LightSquared proposes harmful interference be defined as 6 dB, and because decibels are a logarithmic function, this definitional change would represent a 300% increase in the allowable noise received by GPS users. Our analysis indicates that to overcome this level of interference would require GPS satellites to broadcast signals four times more powerful than current power levels to compensate for this difference. We believe such a change would more than double the cost of GPS satellites and take 15 years or more to fully implement.

#### **Proposed Mitigations**

In accordance with the NPEF test plan, possible mitigation measures were evaluated, but all were deemed impractical as they would require significant modification, redesign and/or replacement of existing GPS equipment, of which there are literally billions worldwide. For the military alone, there are significant costs involved in re-designing, manufacturing, testing, fielding and integrating new or modified GPS receivers in our military equipment and weapons systems. The same is likely true for other GPS-dependent entities worldwide.

Additionally, impacts to certain user groups might not be mitigated under any circumstances because the LSQ signal would create interference that would reduce the level of GPS service below minimum requirements. An example of this is John Deere's StarFire service, which provides augmented GPS signals for the high precision agriculture and construction industries, as well as Department of Defense use.

Since the testing, which was based on the originally submitted deployment plan, LightSquared proposed a temporary, modified deployment plan. Key features of that revised plan include:

- A. Operate at lower power than their current FCC license allows.
- B. Broadcasting in just the lower 10 MHz channel of the allocated frequencies.

We believe the signal strength proposed as "lower power" is actually the same as in the originally published LightSquared plan—and was the power level upon which the NPEF tests were based. Additionally, limited NPEF testing was conducted on operations using only the lower 10 MHz channel. Our limited testing showed unacceptable interference to all 33 high-performance receivers, as well as certain military receivers, tested in the vicinity of the LightSquared low band transmitter. However, the limited lower 10 MHz channel testing conducted to date does not constitute a sufficient evaluation of LightSquared's revised deployment plan.

A conclusion in the LSQ recommendations paper is that interference "is because legacy GPS receivers do not adequately reject transmissions from base stations operating in the adjacent frequency band because the GPS receivers have been deliberately or, sometimes, inadvertently, designed or manufactured with the assumption that there would be no adjacent-band terrestrial transmissions." In fact, GPS receivers were quite purposefully designed to operate in a portion

of the radio frequency spectrum deliberately maintained as a “quiet neighborhood,” with neighboring frequencies primarily occupied by signals of comparable power levels, all based on the widely accepted understanding of previous FCC rules and intent. The proposed LightSquared transmitters will produce received signal strengths five billion times stronger than the GPS received signal.

Some have suggested GPS equipment can be redesigned for greater filtering to mitigate the interference, but even if this is possible, we believe it would involve substantial financial cost and likely degrade the accuracy of high performance receivers, which is critical to many key GPS users. A recent study by the Washington, D.C.-based NDP Consulting Group estimates the costs to GPS commercial users and manufacturers alone at \$48.3 billion in research & development and replacement costs if just 50 percent of users required redesign and/or replacement of their equipment. We do not yet have figures for civil or military modifications, but they will be significant, considering the volume of systems to be modified.

#### **Other Considerations**

The effects on GPS likely will be shared by our close partners in the Global Navigation Satellite Service community, which include the European Union, Russia, Japan, and China. As these partners build their own space-based navigation systems, we are striving to ensure our systems are as interoperable as possible. If the LightSquared network proceeds, we will need to work with these partners to determine feasible mitigation options. The European Union recently expressed its concerns with the LightSquared plan in a July 19, 2011 letter to the FCC.

#### **Summary**



Empirical test results indicate the originally planned LightSquared network does not preserve existing GPS service in representative environments for most users. However, AFSPC remains open to ideas on mitigation strategies that will ensure our continued service to the billions of worldwide users of GPS. We stand ready to work with the NTIA and LightSquared to pursue additional testing on newly proposed deployment plans and receiver filter designs. I thank you again for the opportunity to appear before the Subcommittee and I look forward to your questions.



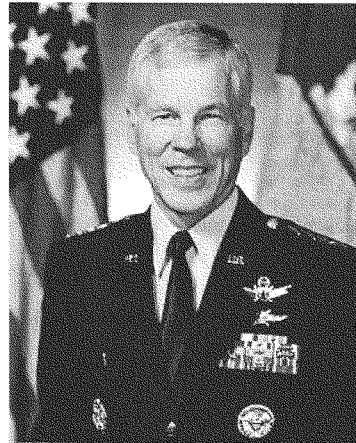
## BIOGRAPHY

**UNITED STATES AIR FORCE**

### GENERAL WILLIAM L. SHELTON

Gen. William L. Shelton is Commander, Air Force Space Command, Peterson Air Force Base, Colo. He is responsible for organizing, equipping, training and maintaining mission-ready space and cyberspace forces and capabilities for North American Aerospace Defense Command, U.S. Strategic Command and other combatant commands around the world. General Shelton oversees Air Force network operations; manages a global network of satellite command and control, communications, missile warning and space launch facilities; and is responsible for space system development and acquisition. He leads more than 46,000 professionals, assigned to 88 locations worldwide and deployed to an additional 35 global locations.

General Shelton entered the Air Force in 1976 as a graduate of the U.S. Air Force Academy. He has served in various assignments, including research and development testing, space operations and staff work. The general has commanded at the squadron, group, wing and numbered air force levels, and served on the staffs at major command headquarters, Air Force headquarters and the Office of the Secretary of Defense. Prior to assuming his current position, General Shelton was the Assistant Vice Chief of Staff and Director, Air Staff, U.S. Air Force, Pentagon, Washington, D.C.



#### EDUCATION

1976 Bachelor of Science degree in aeronautical engineering, U.S. Air Force Academy, Colorado Springs, Colo.  
 1980 Master of Science degree in aeronautical engineering, U.S. Air Force Institute of Technology, Wright-Patterson AFB, Ohio  
 1986 Armed Forces Staff College, Norfolk, Va.  
 1995 Master of Science degree in national security strategy, National War College, Fort Lesley J. McNair, Washington, D.C.  
 1996 Program for Senior Officials in National Security, Syracuse University and Johns Hopkins University  
 1997 Fellow, Seminar XXI, Massachusetts Institute of Technology, Cambridge

#### ASSIGNMENTS

1. August 1976 - May 1979, launch facilities manager, launch director and technical assistant to the commander, Space and Missile Test Center, Vandenberg AFB, Calif.
2. May 1979 - December 1980, graduate student, U.S. Air Force Institute of Technology, Wright-Patterson

AFB, Ohio

3. January 1981 - July 1985, space shuttle flight controller, Johnson Space Center, Houston, Texas
4. July 1985 - January 1986, student, Armed Forces Staff College, Norfolk, Va.
5. January 1986 - July 1988, staff officer, Deputy Chief of Staff for Operations, Air Force Space Command, Peterson AFB, Colo.
6. August 1988 - August 1990, staff officer, Office of Space Plans and Policy, Office of the Secretary of the Air Force, Washington, D.C.
7. August 1990 - June 1992, Commander, 2nd Space Operations Squadron, Falcon AFB, Colo.
8. June 1992 - June 1993, executive officer to the Vice Commander, Air Force Space Command, Peterson AFB, Colo.
9. June 1993 - July 1994, Commander, 50th Operations Group, Falcon AFB, Colo.
10. August 1994 - June 1995, student, National War College, Fort Lesley J. McNair, Washington, D.C.
11. June 1995 - September 1997, Deputy Program Manager and Executive Assistant, Cooperative Threat Reduction Program Office, Office of the Assistant to the Secretary of Defense for Nuclear, Chemical and Biological Defense Programs, Washington, D.C.
12. September 1997 - August 1999, Commander, 90th Space Wing, Francis E. Warren AFB, Wyo.
13. September 1999 - July 2000, Chief, Space Superiority Division, Office of the Deputy Chief of Staff for Plans and Programs, Headquarters U.S. Air Force, Washington, D.C.
14. July 2000 - November 2000, Director of Manpower and Organization, Office of the Deputy Chief of Staff for Plans and Programs, Headquarters U.S. Air Force, Washington, D.C.
15. November 2000 - May 2002, Director of Requirements, Headquarters Air Force Space Command, Peterson AFB, Colo.
16. June 2002 - January 2003, Director of Plans and Programs, Headquarters AFSPC, Peterson AFB, Colo.
17. January 2003 - May 2003, Director, Air and Space Operations, Headquarters AFSPC, Peterson AFB, Colo.
18. June 2003 - January 2005, Director of Capability and Resource Integration (J8), USSTRATCOM, Offutt AFB, Neb.
19. January 2005 - May 2005, Director of Plans and Policy (J5), USSTRATCOM, Offutt AFB, Neb.
20. May 2005 - December 2008, Commander, 14th Air Force (Air Forces Strategic), AFSPC, and Commander, Joint Functional Component Command for Space, USSTRATCOM, Vandenberg AFB, Calif.
21. December 2008 - July 2009, Chief of Warfighting Integration and Chief Information Officer, Office of the Secretary of the Air Force, the Pentagon, Washington, D.C.
22. July 2009 - January 2011, Assistant Vice Chief of Staff and Director, Air Staff, U.S. Air Force, Pentagon, Washington, D.C.
23. January 2011 - present, Commander, Air Force Space Command, Peterson AFB, Colo.

#### **SUMMARY OF JOINT ASSIGNMENTS**

1. June 1995 - September 1997, Deputy Program Manager and Executive Assistant, Cooperative Threat Reduction Program Office, Office of the Assistant to the Secretary of Defense for Nuclear, Chemical and Biological Defense Programs, Washington, D.C., as a colonel
2. June 2003 - January 2005, Director of Capability and Resource Integration (J8), USSTRATCOM, Offutt AFB, Neb., as a brigadier general and major general
3. January 2005 - May 2005, Director of Plans and Policy (J5), USSTRATCOM, Offutt AFB, Neb., as a major general
4. May 2005 - July 2006, Commander, Joint Space Operations, USSTRATCOM, Vandenberg AFB, Calif., as a major general
5. July 2006 - December 2008, Commander, Joint Functional Component Command for Space, USSTRATCOM, Vandenberg AFB, Calif., as a major general and lieutenant general

#### **BADGES**

Master Space Operations Badge  
 Basic Cyberspace Badge  
 Parachutist Badge

#### **MAJOR AWARDS AND DECORATIONS**

Distinguished Service Medal with oak leaf cluster  
Defense Superior Service Medal with oak leaf cluster  
Legion of Merit with oak leaf cluster  
Defense Meritorious Service Medal with oak leaf cluster  
Meritorious Service Medal with four oak leaf clusters  
Air Force Commendation Medal  
Joint Meritorious Unit Award with two oak leaf clusters  
Air Force Outstanding Unit Award with silver and two bronze oak leaf clusters  
Air Force Organizational Excellence Award with oak leaf cluster

**EFFECTIVE DATES OF PROMOTION**

Second Lieutenant June 2, 1976  
First Lieutenant June 2, 1978  
Captain June 2, 1980  
Major May 1, 1985  
Lieutenant Colonel March 1, 1990  
Colonel Feb. 1, 1994  
Brigadier General Jan. 1, 2001  
Major General July 1, 2004  
Lieutenant General Dec. 20, 2007  
General Jan. 5, 2011

(Current as of January 2011)

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**STATEMENT OF**

**TERESA M. TAKAI  
DEPARTMENT OF DEFENSE CHIEF INFORMATION  
OFFICER**

**BEFORE THE  
U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON ARMED SERVICES  
SUBCOMMITTEE ON STRATEGIC FORCES**

**ON**

**SUSTAINING GPS FOR NATIONAL SECURITY**

**SEPTEMBER 15, 2011**

**NOT FOR PUBLICATION  
UNTIL RELEASED BY THE  
SUBCOMMITTEE ON STRATEGIC FORCES  
HOUSE ARMED SERVICES COMMITTEE**

Good morning Chairmen Turner, Ranking Member Sanchez and distinguished Subcommittee Members. Thank you for the opportunity to testify before you as the Department of Defense (DoD) Chief Information Officer (CIO) regarding the importance of the Global Positioning System, or GPS, to our national defense capabilities.

My testimony today will focus on the importance of GPS reliability to the DoD in ensuring that our warfighters and allies have the critical Positioning, Navigation and Timing, or PNT, capabilities they need.

GPS stands as the cornerstone of the DoD PNT capability. GPS is vital to national security and is relied upon by our service men and women for a wide array of capabilities. Simply put, GPS is integrated into almost every aspect of U.S. military operations. GPS is designed to deliver extremely accurate information of 3-dimensional positioning and precise timing to DoD aircraft, ships, land vehicles, and personnel on the ground. Used throughout all the Services and Combatant Commands, GPS supports training and contingency operations, ranging from the tactical through strategic levels. To provide but a few examples, GPS signals are used to ensure the accuracy of precision-guided munitions, to guide troop movements, to synchronize communications networks, to enable battle-space situational awareness, and to conduct search and rescue operations.

Sustaining the reliability of GPS signals is a particular example of the Department's overall reliance upon access to the limited natural resource of the radio-frequency spectrum. The radio-frequency spectrum is crucial to DoD not only for GPS operations, but for literally all U.S. military operations. DoD uses federally allocated and regulated spectrum assignments for command and control operations, communications, intelligence, surveillance and target acquisition, and other military activities on land, at sea, undersea, airborne and in space. Military spectrum requirements are diverse and complex given the variety of different missions that the Department must support around the world. In the continental United States, our systems utilize spectrum and are critical to military readiness, allowing our forces to properly train as they must fight to support contingency operations overseas. DoD spectrum access requirements must also be interoperable with those of our military allies. Each of these factors grows DoD spectrum requirements much the same way as commercial demand for spectrum has been increasing.

The Department fully supports the national economic and security goals of the President's 500 MHz initiative and is committed to the implementation of more

effective and efficient use of the finite radio-frequency spectrum and the development of solutions that ensure no loss of critical National Security capabilities, to include GPS.

To deliver GPS service to all DoD, civilian, and commercial users who rely upon it, DoD maintains and continuously upgrades a constant constellation of 24 satellites, comprised of a minimum of four satellites each in six planetary orbits.

Congress mandated in Fiscal Year 1994 that all major DoD platforms and weapons systems must utilize GPS after September 2000. The Department has worked hard to meet this mandate and GPS continues to be critical for DoD missions, and is planned to remain at the center of military PNT solutions. In meeting this mandate, the Department also understands that the dependence upon GPS for major systems and operations makes them susceptible to unintentional or hostile interference.

On that basis, DoD is committed to sustaining and modernizing GPS to maintain and improve our Military PNT capabilities. Several GPS modernizations are scheduled during the next 10 plus years, including three new civil signals, enhanced encrypted military signals, and a new constellation Operational Control Segment, which are scheduled to come on line by 2018 and then be implemented system wide into the GPS receiver populations by upgrades or replacements over the succeeding five or more years. These GPS modernizations fulfill requirements that have been vetted by rigorous acquisition oversight to ensure they support the widest user bases while meeting sound budgetary constraints.

As the DoD's Chief Information Officer, I have a collateral duty as the co-chair of the Executive Steering Group (ESG) of the National Executive Committee for Spaced-Based Positioning, Navigation and Timing, along with my counterpart from the Department of Transportation. The PNT National Executive Committee (EXCOM) is co-chaired by the Deputy Secretaries of Defense and Transportation, and includes Agency members from the Departments of State, Interior, Agriculture, Commerce, Homeland Security, the Joint Chiefs of Staff, and the National Aeronautics and Space Administration and includes representation from the Director of National Intelligence to round out our national security team. Our role in the PNT ESG and EXCOM is to advise Departments, Agencies, and the Executive Office of the President regarding strategic policies, requirements and security of all U.S. positioning, navigation, and timing infrastructures, including of course GPS.

With those GPS and PNT contexts explained for the Subcommittee, I now move on to address the recent matters pertaining to LightSquared.

In response to the January 2011 Federal Communications Commission (FCC) Order that conditionally allowed LightSquared Subsidiary LLC to unbundle their Ancillary, or auxiliary Terrestrial Component, restriction in the Mobile Satellite Services band adjacent to GPS, the PNT EXCOM in February tasked the National Space-Based PNT Engineering Forum, or NPEF, to perform testing to ascertain the potential interference to GPS. DoD tasked the Air Force and Space and Naval Warfare Systems Center to conduct testing of the affects of LightSquared's proposed network deployment upon a cross section of DoD, civil aviation, public safety and commercial GPS receivers. That testing was performed at White Sands Missile Range and Holloman Air Force Base in New Mexico, in cooperation with the PNT's other Federal Agency members and its civil and commercial industry advisory members.

The NPEF test report was completed on June 15, 2011 and subsequently submitted to the spectrum regulator for Federal Agencies, the National Telecommunications and Information Administration (NTIA), for their review and transmittal to the FCC. The test data indicated that the proposed LightSquared terrestrial operations would cause harmful interference to GPS operations. For example, GPS receivers of various types and manufacture operated by DoD, National Geospatial-Intelligence Agency, U.S. Coast Guard, Federal Aviation Administration, the State of New Mexico public safety, commercial aviation, and precision farming systems showed varying degrees of degradation of GPS accuracy, interruptions of GPS signal acquisition, or total loss of GPS tracking and position, depending upon the GPS receivers' proximity to the tested LightSquared signal transmitter.

None of the parties cognizant of the NPEF testing, including LightSquared, whose personnel observed the NPEF testing on-site, or FCC staff, dispute that the LightSquared terrestrial network plan that was tested by NPEF caused unacceptable levels of harmful interference to GPS. The testing also showed a source of interference that was due to the combined effect of the LightSquared dual-channel signal. The LightSquared dual-channel, its so-called 'Lower 5 or 10 MHz' combined together with the 'Upper 5 or 10 MHz', caused an inter-modulation product, or IMP, that was generated on top of the GPS L1 signal in its GPS band, interfering with GPS receivers. This IMP was caused by the LightSquared dual-channel choice and its design, and not by the designs or filtering limitations of GPS receivers.



Subsequent to the NPEF test report completion, LightSquared and the GPS Industry filed their Technical Working Group, or TWG, report. That report does not contest the NPEF results, nor does it offer a mitigation solution of the IMP interference caused by LightSquared dual-channel signal. Instead, LightSquared proposed to FCC their recommendation of an alternative terrestrial network that was not in the test plans of either the NPEF or TWG tests and was not tested to any extent comparable to the dual-channel tests.

LightSquared's modified proposal recommends launching commercial services initially using only the lower 10 MHz. DoD at this time has not received a sufficiently clear and complete description of a LightSquared Lower 10 MHz deployment plan to professionally analyze its new aggregate interference environment.

In addition, DoD is evaluating the effects of LightSquared terrestrial transmissions to the military's use of the Inmarsat satellite systems for its data and voice needs. Inmarsat satellite terminals are used by the military units, commanders, and other senior government officials for global communications. The LightSquared terrestrial system will likely interfere with DoD usage of Inmarsat if appropriate actions are not taken to mitigate interference.

As a result, DoD is diligently working with Inmarsat to identify mitigating techniques for reducing the potential interference for the military land, maritime, and aeronautical missions and communication requirements.

However, interference to the land-based Inmarsat usage remains a challenge and cannot be handled in the same manner as the maritime and aeronautical usages. The military land-mobile users are in closer proximity to LightSquared's terrestrial operations and as a result will likely be affected more severely.

The Department will continue to work with its interagency partners and NTIA, as well as with Congress to address long-term solutions regarding a balance between Federal spectrum requirements and the expanding demand for mobile broadband services. DoD has a wealth of institutional and personnel expertise in radio-frequency engineering and looks forward to working with the FCC, NTIA, and LightSquared to ensure that all further proposed mitigations or alternatives for the LightSquared terrestrial network are thoroughly tested to ensure no harmful interference to GPS receivers, or other military spectrum requirements. The ability of GPS to operate without harmful interference remains of paramount importance to the Department.

I want to thank you for your interest in the Department's efforts in this area and I would be pleased to answer any questions you may have.



**TERESA M. TAKAI**

**Acting Assistant Secretary of Defense for Networks  
and Information Integration / DoD Chief  
Information Officer**



Teri Takai is the Acting Assistant Secretary of Defense for Networks and Information Integration and the Department of Defense Chief Information Officer (ASD (NII) / DoD CIO). She serves as the principal advisor to the Secretary of Defense for Information Management/Information Technology and Information Assurance as well as non-intelligence Space systems, critical satellite communications, navigation, and timing programs, spectrum and telecommunications. She provides strategy, leadership, and guidance to create a unified information management and technology vision for the Department and to ensure the delivery of information technology based capabilities required to support the broad set of Department missions.



Ms. Takai previously served as Chief Information Officer for the State of California. As a member of the Governor's cabinet, she advised the governor on the strategic management and direction of information technology resources as the state worked to modernize and transform the way California does business with its citizens.

As California's CIO, Ms. Takai led more than 130 CIOs and 10,000 IT employees spread across the state's different agencies, departments, boards, commissions and offices. During her tenure as State CIO, Teri pursued an agenda that supports viewing California's IT operations from an enterprise perspective, including: Forming a Project Management and Policy Office, release of the California Information Technology Strategic Plan, passage of the Governor's IT Reorganization Proposal, establishing a Capital Planning Process and directing agency consolidation activities.

Prior to her appointment in California, Ms. Takai served as Director of the Michigan Department of Information Technology (MDIT) since 2003, where she also served as the state's Chief Information Officer. In this position, she restructured and consolidated Michigan's resources by merging the state's information technology into one centralized department to service 19 agencies. Additionally, during her tenure at the MDIT, Ms. Takai led the state to being ranked number one four years in a row in digital government by the Center for Digital Government. Additionally, in 2005, Ms. Takai was named "Public Official of the Year" by *Governing* magazine. She is also Past-President of the National Association of State Chief Information Officers and currently serves on the Harvard Policy Group on Network-Enabled Services and Government.

Before serving in state government, Ms. Takai worked for the Ford Motor Company for 30 years, where she led the development of the company's information technology strategic plan. She also held positions in technology at EDS and Federal-Mogul Corporation. Ms. Takai earned a Master of Arts degree in management and a Bachelor of Arts degree in mathematics from the University of Michigan.

**Testimony of  
Mr. Karl Nebbia  
Associate Administrator, Office of Spectrum Management  
National Telecommunications and Information Administration  
U.S. Department of Commerce**

**Before the**

**Subcommittee on Strategic Forces  
Committee on Armed Services  
U.S. House of Representatives**

**Hearing on  
“Sustaining GPS for National Security”**

**September 15, 2011**

**I. Introduction.**

Chairman Turner, Ranking Member Sanchez, and members of the subcommittee, thank you for the opportunity to testify today on behalf of the National Telecommunications and Information Administration (NTIA). NTIA, an agency within the Department of Commerce, is the President’s principal advisor on telecommunications and information policy matters and manages federal agencies’ use of radio spectrum. As Associate Administrator for NTIA’s Office of Spectrum Management, I oversee NTIA’s federal spectrum management operations, including all engineering, frequency assignment, IT and spectrum policy, emergency planning, and strategic planning functions. I am pleased to appear today to discuss NTIA’s efforts to ensure that federal agencies’ mission-critical operations, including Global Positioning System (GPS) services, continue without disruption or harmful interference.

**II. NTIA's Role in Maximizing Efficient and Effective Use of Spectrum by Federal Agencies and Expanding Broadband Availability.**

In implementing its spectrum management objectives, NTIA is intently focused on enabling federal agencies to perform their missions while ensuring, to the greatest extent possible, that those agencies use and share spectrum efficiently and effectively. To do so, NTIA concurrently:

- manages frequency assignment and coordination, with a strong focus on mitigating and preventing interference;
- leads and manages the Interdepartment Radio Advisory Committee (IRAC), which is comprised of representatives from 19 federal agencies that provide advice to NTIA on spectrum policy matters;
- reviews and certifies spectrum support for new federal systems;
- coordinates satellite operations;
- conducts border coordination and international negotiations; and
- performs spectrum engineering and analysis.

In managing spectrum use by federal agencies, NTIA works very closely with the Federal Communications Commission (FCC), which has the authority to regulate non-federal uses of spectrum, as well as interstate and foreign telecommunications under the Communications Act of 1934.

Last summer, President Obama directed NTIA to collaborate with the FCC to identify and make available over the next decade an additional 500 megahertz of spectrum for fixed and mobile wireless broadband by either reallocating or creating opportunities to share spectrum

currently used by commercial or federal users.<sup>1</sup> The goal is to nearly double over the next decade the amount of spectrum that is currently available for commercial wireless broadband. By doing so, the NTIA and FCC will help spur innovation, expand economic growth and job creation, and preserve America's global technology leadership. To date, NTIA has identified 115 megahertz of federal spectrum for reallocation and is currently evaluating another 95 megahertz of spectrum with the goal of making a recommendation on that band by next month.

### III. NTIA's Role in Addressing Concerns Related to LightSquared's Proposed Network.

The current situation that has led to today's hearing involves the use of frequencies in two adjacent spectrum bands. GPS satellites operate in the 1559-1610 MHz band, where they transmit signals used by government, business and consumers to obtain location and timing information for myriad purposes. On either side of the GPS spectrum sits two frequency bands used by providers of Mobile Satellite Services (MSS). As originally envisioned by the FCC, MSS providers would utilize satellites to provide users with mobile communications services around the world and especially in areas where fixed line services did not exist or were extremely expensive to provide.

In 2003, the FCC granted MSS providers flexibility in how they could deliver their communications offerings by enabling them to integrate an Ancillary Terrestrial Component (ATC) into their MSS networks.<sup>2</sup> As envisioned, the ATC would augment MSS services by

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<sup>1</sup> See National Telecommunications and Information Administration, *Plan and Timetable to Make Available 500 MHz of Spectrum for Wireless Broadband* (Nov. 15, 2010), available at [http://www.ntia.doc.gov/files/ntia/publications/tenyearplan\\_11152010.pdf](http://www.ntia.doc.gov/files/ntia/publications/tenyearplan_11152010.pdf); see also Memorandum for the Heads of Executive Departments and Agencies, *Unleashing the Wireless Broadband Revolution*, (Presidential Memorandum), released June 28, 2010, 75 Fed. Reg. 38387 (July 1, 2010), available at <http://www.whitehouse.gov/the-press-office/2010/06/28/unleashing-wireless-broadband-revolution>.

<sup>2</sup> See Federal Communications Commission, *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, IB Docket Nos. 01-185, 02-364, 18 F.C.C. Rcd. 1962, 1964-65 (2003).

utilizing ground stations and mobile terminals that re-use frequencies assigned for satellite communications in order to enhance MSS coverage. By granting providers flexibility to integrate MSS and ATC, the FCC sought to maximize spectrum efficiency and expand communications capabilities in the United States by filling in the “gaps” in satellite coverage. However, the FCC stated that in order to meet its “integrated service rule,” the added terrestrial component had to remain ancillary to the principal MSS offering. This ancillary requirement was particularly important to users of the GPS since emissions from terrestrial base stations represent a significantly different interference threat to GPS than the far weaker signals emitted from satellites to the ground.

In November 2004, the FCC’s International Bureau granted a predecessor company to LightSquared Subsidiary LLC (LightSquared)<sup>3</sup> the authority to operate ATC facilities providing voice and data communication for users equipped with dual-mode MSS/ATC devices (*i.e.*, handsets that could communicate both with orbiting satellites and terrestrial base stations). Additionally, in subsequent *Orders* in 2005 and 2010, the FCC afforded LightSquared additional flexibility for the technical design of its ATC network.<sup>4</sup>

On November 18, 2010, LightSquared submitted to the FCC an application for modification of its existing ATC authorization to enable it to deploy, on a wholesale basis,

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<sup>3</sup> For the purposes of this testimony, “LightSquared” refers to various entities that have held the license for this mobile satellite service (MSS) spectrum since 1989, including SkyTerra Subsidiary LLC, Mobile Satellite Ventures Subsidiary LLC, Motient Services Inc. and American Mobile Satellite Company.

<sup>4</sup> See Federal Communications Commission, Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands, IB Docket No. 01-185, 20 F.C.C. Red. 4616 (2005); see also, Federal Communications Commission, SkyTerra Communications, Inc., Transferor and Harbinger Capital Partners Funds, Transferee Applications for Consent to Transfer Control of SkyTerra Subsidiary, LLC, IB Docket No. 08-184, Memorandum Opinion and Order and Declaratory Ruling, 25 F.C.C. Red. 3059 (March 25, 2010); Federal Communications Commission, SkyTerra Subsidiary LLC Application for Modification Authority for an Ancillary Terrestrial Component, File No. SAT-MOD-20090429-00047, Call Sign: AMSC-1, File No. SAT-MOD-20090429-00046, Call Sign: S2358, File No. SES-MOD-20090429-00536, Call Sign: E980179, Order and Authorization, 25 F.C.C. Red. 3043 (March 26, 2010).

nationwide 4<sup>th</sup> generation (4G) terrestrial wireless broadband network with handsets that do *not* include the satellite service.<sup>5</sup> LightSquared's proposal presented the very appealing possibility of significantly increasing terrestrial wireless broadband capacity and choice for Americans all across the country, offering greater consumer benefits and convenience, as well as seeking to promote innovation and job creation at a time of critical need. At the same time, however, LightSquared's 2010 proposal generated a significant number of concerns from the GPS industry and from GPS users; namely, that the terrestrial ATC network would present a threat of intolerable interference to GPS receivers, which both commercial and government interests use to provide services and to perform missions of great utility and benefit to millions of Americans.

Consistent with NTIA's mission to ensure efficient and effective use of spectrum while protecting critical federal government operations, NTIA consulted with affected federal agencies through the IRAC to determine if radio frequency emissions from proposed LightSquared base stations could cause harmful interference to GPS receivers, adversely impact GPS-dependent operations of federal agencies, and/or harm other federal uses of this MSS band. The IRAC, a standing committee of 19 spectrum-using agencies, provides advice on an ongoing basis to NTIA regarding policies, programs, procedures, and technical criteria pertaining to the allocation, assignment, management, and use of the spectrum.

NTIA's review indicated that LightSquared's system, as originally proposed, raised significant interference concerns for federal agencies. For the most part, these concerns arose from the fact that either: (a) GPS receivers do not contain filters adequate to avoid harmful impact from emissions from the proposed LightSquared network; or (b) certain high-precision

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<sup>5</sup> See Federal Communications Commission, LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD-20101118-00239 (Nov. 18, 2010).



GPS receivers – including but not limited to those that improve their accuracy by taking advantage of satellite signals transmitted from other MSS systems that share LightSquared’s spectrum – could be degraded.

It is worth noting that some of the federal agencies also expressed concern that emissions from the proposed high-power LightSquared base stations also would interfere with the primary communications function of these other MSS systems, particularly Inmarsat, which is a system used by a number of federal agencies for national security and homeland security communications.<sup>6</sup>

Accordingly, on January 12, 2011, NTIA advised the FCC that the LightSquared proposal raised significant interference concerns that warranted a full evaluation to ensure that LightSquared’s proposed terrestrial network would not adversely impact GPS and other critical federal systems, including Global Navigation Satellite System (GNSS) receivers, maritime and aeronautical emergency communications systems, and Inmarsat receivers used by federal agencies.<sup>7</sup> Specifically, NTIA raised concerns that LightSquared’s proposal:

- Could lead to an increase in interference to GPS receivers, such as Enhanced-911 (E-911) capable cellular handsets and consumer navigation and location devices;
- Could degrade or limit spectrum used by aeronautical emergency communications during oceanic flights, and maritime emergency communications used by the U.S. Coast Guard;

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<sup>6</sup> The federal agencies are working with Inmarsat to address potential interference to MSS communication systems from ATC operations.

<sup>7</sup> Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information and NTIA Administrator, U.S. Department of Commerce, to Julius Genachowski, Chairman, Federal Communications Commission (Jan. 12, 2011), available at <http://www.ntia.doc.gov/fcc-filing/2011/letter-regarding-lightsquareds-application-provide-mssate-service>.

- Risked interfering with certain Department of Defense and other federal agencies' MSS earth stations using Inmarsat commercial services; and
- By allowing wholesale customers to offer terrestrial-only plans, could result in such a large increase in terrestrial RF emissions that it could create new and more challenging interference issues.

In light of the concerns raised by multiple federal agencies, NTIA urged that if the Commission did grant LightSquared's application, it do so only on condition that the interference issues would be resolved before LightSquared would be permitted to commence commercial operations. NTIA also urged the FCC to motivate all parties to move expeditiously and in good faith to resolve those issues.

On January 26, 2011, the Commission granted LightSquared a conditional waiver of the ATC integrated service rule, but conditioned the waiver by ruling that LightSquared could not commence offering commercial service on its MSS L-Band<sup>8</sup> frequencies until the resolution of interference concerns relating to GPS.<sup>9</sup> Specifically, the Commission required LightSquared to organize and participate in a GPS interference technical working group (Technical Working Group) that included the GPS community and appropriate federal agencies. The mission of the TWG was to study the potential for interference to GPS devices and to identify measures necessary to prevent harmful interference to GPS receivers. The *Waiver Order* stated that the process will be complete "only once the Commission, after consultation with NTIA, concludes

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<sup>8</sup> The frequency range for the MSS L-Band is from 1525 MHz to 1559 MHz.

<sup>9</sup> LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD-2010118-00239; Call Sign: S2358, Order and Authorization (Order), 26 F.C.C. Rcd. 566 (2011).

that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete.”<sup>10</sup>

#### **IV. Commercial and Federal Testing for Potential Interference with GPS.**

Between January and June 2011, a number of groups undertook testing to determine the extent of interference of the proposed LightSquared network base stations with GPS receivers. These groups included the TWG co-chaired by LightSquared and the United States GPS Industry Council (USGIC), which is comprised principally of commercial entities. Separately, the National Space-Based Positioning, Navigation, and Timing Systems Engineering Forum (NPEF), on behalf of the National Executive Committee for Space-Based Positioning, Navigation, and Timing (ExCom), and RTCA Incorporated, in support of the Federal Aviation Administration, conducted independent tests. The NPEF includes federal users such as the Department of Defense and the Department of Transportation. It is important to note that these tests were based on LightSquared’s original operational plan under which its 4G base stations would use both the upper and the lower 10 megahertz signals of the MSS band.

On July 6, 2011, NTIA submitted to the FCC the report describing the NPEF testing, which demonstrated that LightSquared’s original proposed plan for terrestrial operations would introduce harmful interference to both government and commercial GPS applications.<sup>11</sup> Among its findings, the report indicated that the transmissions from the LightSquared network base stations would “result in degradation or loss of GPS function (ranging, position) at standoff distances of a few kilometers extending to space operations.” In its transmittal letter, NTIA

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<sup>10</sup> *Id.* at ¶ 43.

<sup>11</sup> Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information and NTIA Administrator, U.S. Department of Commerce, to Julius Genachowski, Chairman, Federal Communications Commission (July 6, 2011), available at <http://www.ntia.doc.gov/fcc-filing/2011/ntia-letter-transmitting-lightsquared-assessment-report>.

stated that additional tests should be performed and recommended that the FCC continue to withhold authorization for LightSquared to commence commercial operations until all valid concerns had been resolved.

At the same time, LightSquared filed the report of the TWG co-chaired by LightSquared and the GPS Industry Council, which reached similar conclusions as to the impact on GPS receivers of LightSquared transmissions throughout the MSS band.<sup>12</sup> Several federal agencies participated in the TWG, including the Federal Aviation Administration, the National Aeronautics and Space Administration (NASA), and the U.S. Air Force. The report identified significant technical issues with the proposed LightSquared operations in the upper portion of the MSS Band, which is closest to the spectrum used by GPS. The tests also identified some interference issues in the lower 10 megahertz portion of the band. As a result, LightSquared proposed on June 30, 2011 to modify its deployment to use only the lower 10 megahertz signal of the MSS spectrum in its initial deployment and operate its base stations at lower power. In addition, LightSquared agreed to a temporary “standstill” in the terrestrial use of the upper 10 megahertz signal immediately adjacent to the GPS band, and committed to coordinate and share the cost of underwriting a workable solution to mitigate interference to the precision measurement devices that experienced unacceptable overload even from the modified operating proposal. LightSquared has not yet clearly explained its definition of “temporary standstill” and if or when the standstill would cease.

This modification came too late to be fully evaluated in the NPEF tests. Accordingly, NTIA and the federal agencies have been evaluating test data to determine whether use of the

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<sup>12</sup> See LightSquared Subsidiary LLC (LightSquared) Final Report of the Working Group co-chaired by LightSquared and the United States Global Positioning System (GPS) Industry Council (USGIC), to the Federal Communications Commission (June 30, 2011).

lower 10 megahertz signal of the band, combined with other operating restrictions, would eliminate harmful interference to GPS receivers and whether additional testing and analysis needs to be performed before reaching any conclusions.

On September 9, 2011, NTIA requested the ExCom to work with LightSquared to develop a test plan to resolve all remaining concerns with respect to cellular and personal/general navigation receivers by November 30, 2011 (see Exhibit 1, attached hereto). In addition, NTIA's letter noted that LightSquared has acknowledged that its modified operating proposal to use only the lower 10 megahertz signal would cause unacceptable interference to high-precision receivers. Accordingly, LightSquared is proceeding to procure the design and manufacture of a filter to mitigate these impacts. LightSquared has agreed that it will not commence commercial operations unless and until the federal agencies test the filter and conclude that it is effective at eliminating unacceptable overload without degrading the precision performance of the receivers. With respect to timing receivers, LightSquared has identified the PCTEL antenna as a possible solution to mitigate interference. LightSquared has acknowledged that the federal agencies need to perform a more rigorous review of the effectiveness of this antenna in mitigating interference without degrading the performance of timing receivers.

The FCC established a formal pleading cycle to solicit comments on both the TWG report and LightSquared's new recommendations, as well as any alternative proposals that would enable GPS and L-Band mobile broadband to co-exist. Initial comments were due on July 30, 2011, and reply comments were due on August 15, 2011. At the appropriate time, the FCC, guided by the record it has established in this proceeding and upon consultation with NTIA, has the responsibility to make a final determination as to whether the harmful interference concerns relative to GPS receivers have been resolved, such that it can authorize to commence commercial

operations. However, given the need, recognized by LightSquared, to solve the issue of the precision receivers through the development of new filtering technology, the FCC cannot authorize the commencement of commercial operations by LightSquared until it brings forward a solution that is accepted by the federal agencies after testing and analysis.

**V. Conclusion.**

The Administration intends to protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the need for additional spectrum to support innovative new mobile broadband services, it is vital that we try to resolve the interference issues between GPS and terrestrial broadband use of MSS frequencies as quickly as we can. Therefore, in the short run, we will, in coordination with the FCC, work to complete the requested further testing or analysis required to establish whether there are any mitigation strategies that can resolve the GPS interference issues. We await LightSquared's delivery of a filter solution for the high-precision receivers and will endeavor to have the federal agencies test and analyze that solution promptly.

NTIA appreciates that the FCC has taken very seriously the concerns raised by NTIA on behalf of federal agencies in this matter, as well as its commitment to ensure that these concerns are resolved before permitting LightSquared to begin commercial operations. We look forward to providing thorough, expert input to the Commission as it moves toward a final decision in this matter. As always, we hope to reach a solution that ultimately allows the American public to extract the greatest possible benefit out of the radio spectrum.

Thank you again for the opportunity to testify. I am pleased to take your questions.

###

Attachment



**UNITED STATES DEPARTMENT OF COMMERCE**  
**The Assistant Secretary for Communications**  
**and Information**  
 Washington, D.C. 20230

SEP 9 2011

The Honorable William Lynn  
 Deputy Secretary  
 U.S. Department of Defense  
 1010 Defense Pentagon  
 Room 3E944  
 Washington, D.C. 20301-6000

The Honorable John Porcari  
 Deputy Secretary  
 U.S. Department of Transportation  
 1200 New Jersey Ave., SE  
 Washington, D.C. 20590

Dear Secretaries Lynn and Porcari:

On behalf of the National Telecommunications and Information Administration (NTIA), I would like to request that the Executive Steering Group of the interagency National Executive Committee for Space-Based Positioning, Navigation and Timing (ExCom) work with LightSquared to develop as expeditiously as possible a joint testing plan to validate data on the performance of cellular and personal/general navigation Global Positioning System (GPS) receivers in light of LightSquared's modified proposal to confine its operations to the lower 10 MHz signal (1526-1536 MHz) of the Mobile-Satellite Services (MSS) frequency band.

For reasons discussed below, NTIA requests that the program be limited largely to cellular and personal/general-navigation receivers and that the program be designed to allow for completion of testing and analysis by November 30. Based on the data collected to date, NTIA expects that limited further testing (i) will confirm the validity of the prior measurements collected in testing by the Technical Working Group (TWG) evaluating LightSquared's modified operating proposal and (ii) will provide NTIA and the federal agencies with the necessary data to determine what, if any, additional operating restriction is necessary in order to mitigate remaining interference issues related to cellular and personal/general-navigation receivers. As described below, there will later need to be a second phase of testing to evaluate proposed mitigation plans for high-precision and timing receivers which would commence once LightSquared develops a filtering solution to avoid interference with those classes of devices.

Before setting out the parameters of this testing program, I first want to update you on our recent activities to evaluate the potential impacts of LightSquared operations on GPS receivers. NTIA has held several meetings with representatives from the federal agencies and LightSquared to discuss these impacts, focusing on the potential impacts to high precision, timing, aviation, space, cellular, and personal/general navigation GPS receiver applications. Taking each of these categories in turn, here is the current status of our review of the potential impacts.

All parties, including LightSquared, have agreed that LightSquared's operations in the lower 10 MHz signal will cause unacceptable interference to the **high-precision receivers** tested by the TWG. Accordingly, LightSquared is undertaking to procure the design and manufacture of a filter to mitigate these unacceptable impacts. LightSquared has acknowledged in meetings with NTIA that it will not commence commercial operations unless and until the federal agencies test the filter and conclude that it is effective at eliminating unacceptable overload without degrading the precision performance of the receivers. Given this commitment, we see no reason for any further testing of high-precision receivers until LightSquared presents its filtering solution to the Federal agencies for testing and evaluation. At that time, the federal agencies will need to develop and execute a plan to test and analyze LightSquared's proposed mitigation.

The TWG performed measurements assessing the potential impact of the lower 10 MHz signal on **timing receivers**. As part of this work, LightSquared identified the PCTEL antenna as a possible solution to mitigate interference to timing receivers. Although the PCTEL antenna showed promise in mitigating interference, the TWG did not examine the impact it would have on timing receiver performance. Also, the PCTEL antenna which employs a narrowband filter may not mitigate interference to wideband precision timing receivers used by the federal agencies without severely impacting their performance. LightSquared acknowledges that the federal agencies need to perform a more rigorous review of the effectiveness of the PCTEL antenna in mitigating interference to timing receivers without degrading their performance.

LightSquared and the U.S. Department of Transportation have informed us that LightSquared has continued to discuss and analyze data regarding impacts to **aviation receivers** with the Federal Aviation Administration (FAA). We see no reason to request additional testing of these devices by ExCom at this time and recommend that the FAA continue to work this issue directly with LightSquared. Of course, once FAA concludes its work, we would expect that it would share its analysis and conclusions with the ExCom.

National Aeronautics and Space Administration (NASA) has performed testing on its current and future **space-based receivers**. These tests indicate that current receivers are not impacted by the lower 10 MHz signal but that newer receivers may be affected. NASA is doing additional work to determine whether it can make modifications in the design of these not-yet-deployed receivers to mitigate this potential interference without impacting their mission. As with the aviation devices, we see no reason for ExCom to undertake any testing of these devices given the work already underway at NASA subject to later review by ExCom.

Without waiting for the interference issues to be resolved relating to high-precision and timing receivers, we would like to move forward to reach resolution of any remaining federal agency concerns with respect to the **cellular and personal/general-navigation receivers**. The TWG performed measurements to determine the power level at which interference occurred from the lower 10 MHz signal to around 70 of these receivers. We understand that some of the federal agencies believe those measurements were limited in time and scope. Accordingly, we request that the test plan include a retest of the minimum number of devices from the original test necessary to prove statistically that the earlier test results are valid.



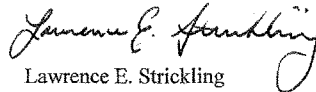
In addition, the TWG tests demonstrated that some receivers were more resistant than others to the lower 10 MHz signal. We request that the test plan include a retest of the 10 devices that were shown by the TWG testing to be more susceptible to the lower 10 MHz scenario. That data, combined with information the FCC is collecting on receiver design and specifications, will allow us to understand more completely the interference interaction and causation and provide the necessary information to determine whether we need to propose any additional operating condition on LightSquared to mitigate overload from LightSquared base stations to these types of devices.

Beyond these requests, we understand that the federal agencies may wish to include other cellular or personal/general-navigation devices for testing. For example, if there is a receiver available that utilizes the L1C signal, testing of which would yield results the federal agencies would find authoritative, we would urge that it be included in the test plan. The same is true if there are receivers available that are designed to use multiple radionavigation-satellite service signals, e.g., Galileo. As a practical matter, the ExCom can include other receivers in the test plan provided the testing and analysis can be completed by November 30. We want to do what is necessary so that our recommendations to the FCC regarding cellular and personal/general navigation GPS receivers can be conclusive and final. To that end, I want to make it clear that our recommendations will be based on NTIA standard definitions and methodologies for assessing interference. We will not accept conclusions or analysis based on propagation models and other tools that depart from our standard methodologies. Our technical experts are available to explain our tools to the extent our methodologies are not already clearly understood.

In addition, as previously indicated, the federal agencies will want to perform an analysis of the effectiveness of the PCTEL antenna in mitigating interference to timing receivers used by the agencies. We suggest that the ExCom consider moving forward now with that analysis but, given the open issues that remain with respect to precision and timing receivers, this work need not be completed by November 30.

Please submit all final test reports to NTIA. If you have any questions regarding this request, please do not hesitate to contact me or Karl Nebbia, NTIA Associate Administrator of the Office of Spectrum Management.

Sincerely,



Lawrence E. Strickling

cc: Teri Takai, DOD  
Joel Szabat, DOT

**Karl Nebbia**

Karl Nebbia is the Associate Administrator of the Office of Spectrum Management within the Department of Commerce's National Telecommunications and Information Administration (NTIA). In this capacity, he leads spectrum management for the executive branch agencies and manages engineering, frequency assignment, IT, policy, emergency planning and, strategic planning functions. Recent efforts have focused on President Obama's call to identify within 10 years 500 megahertz for wireless broadband.

Previously, he served as the Deputy Associate Administrator for Domestic Spectrum Management, acting as the focal point for development of domestic policy and coordination of spectrum issues with the FCC. In this capacity, he also chaired the Interdepartment Radio Advisory Committee (IRAC), an advisory committee with radio spectrum managers from 19 executive branch agencies. The longest standing federal advisory committee in the United States, the IRAC serves as the primary mechanism for frequency coordination with U.S. government users.

Mr. Nebbia has also extensive international experience as the program manager coordinating the participation of NTIA staff and the U.S. federal agencies in international spectrum management fora, particularly International Telecommunication Union (ITU) activities such as the ITU Plenipotentiary and Council, the ITU-R study groups, the Radio Advisory Group, the Radiocommunication Assembly, World Radiocommunication Conference (WRC), and ITU Development Sector regarding spectrum management.

Mr. Nebbia, a 1974 graduate of the U.S. Naval Academy, joined NTIA in 1983.

**Testimony of Mr. Anthony J. Russo  
Director  
National Coordination Office  
Space-Based Positioning, Navigation and Timing  
Hearing on "Sustaining GPS for National Security"  
Subcommittee on Strategic Forces  
U.S. House of Representatives**

Chairman Turner, Ranking Member Sanchez and distinguished members of the Subcommittee, thank you for this opportunity to speak to you today. The Global Positioning System has grown into a global utility whose multi-use services are integral to U.S. national and homeland security, economic growth, and transportation safety. It is an essential element of the worldwide economic infrastructure. Services dependent on GPS information are now an engine for economic growth, enhancing economic development, and improving both the safety and the quality of life. The system is critical to first responders and a key component to multiple sectors of U.S. critical infrastructure.

The Role of the Space-Based Positioning, Navigation and Timing Executive Committee

Since 1983, the United States has had a multi-use policy in place for GPS. This policy has had strong bipartisan support and each successive administration has strengthened the interagency participation in the program. In 2004, President Bush issued a National Space-Based Positioning, Navigation and Timing (PNT) Policy establishing a Deputy Secretary level Executive Committee to advise and coordinate on policies, programs, requirements, schedules, architectures and budgets to sustain and

modernize GPS, systems that augment or enhance GPS, and any backup capabilities. Last year, President Obama signed a comprehensive National Space Policy which left the PNT policy in place, but added emphasis and additional guidance in four key areas related to GPS. The policy outlines six primary goals, all of which are threatened by the proposed LightSquared deployment. These are:

- 1) Provide uninterrupted availability of PNT services;
- 2) Meet growing national, homeland, economic security, and civil requirements as well as scientific and commercial demands;
- 3) Remain the pre-eminent military space-based PNT service;
- 4) Provide civil services that exceed or are competitive with foreign space-based PNT services and their augmentation systems;
- 5) Remain essential components of internationally accepted positioning, navigation and timing services; and
- 6) Promote U.S. technological leadership in applications involving space-based PNT services.

To implement the President's PNT policy goals, the Executive Committee has specific tasks including: "*Review proposals and provide recommendations to the Departments and Agencies for international cooperation, as well as spectrum management and protection issues,*" and its member Departments and Agencies are further tasked to "*...seek to protect the radio frequency spectrum used by the Global Positioning System and related space-based augmentations.*" The Executive Committee is also responsible in this policy to identify impacts to government space systems prior to any reallocation of spectrum for commercial, federal, or shared use.

Because the Air Force develops, builds, launches, operates, maintains and modernizes the GPS constellation, the Deputy Secretary of Defense serves as Co-chair of all Executive Committee meetings and his personnel are integral to all activities performed in support of this Policy. To execute the staff functions of the Executive Committee, and to assist them in ensuring implementation of the President's policy objectives, a National Coordination Office (NCO) was established. The NCO is staffed with representatives from every department or agency with major equities in GPS and includes two Air Force officers with extensive GPS backgrounds.

The National Space-Based Positioning, Navigation and Timing Systems Engineering Forum (NPEF)

The NPEF is an interagency working group that supports the NCO on major technical issues that cross agency boundaries and their reports help form the basis for recommendations made to the Executive Committee. The NPEF is co-chaired by the Air Force's Chief Engineer from the GPS Program Office and the FAA's Ground Segment Lead for Global Navigation Satellite Systems and Space-Based Augmentation Systems. They are assisted by technical representatives and other staff from across the interagency.

On the 26<sup>th</sup> of January this year, the Federal Communications Commission (FCC) approved a conditional waiver for LightSquared's high power broadband network that the Executive Committee had warned might cause significant interference to government-wide GPS applications. On January 28, 2011, I briefed the Executive Committee's Steering Group, co-chaired by Ms. Takai as DoD's representative, on a

plan to evaluate LightSquared's proposal and determine some of the specific impacts. The tasking statement was approved by the interagency and released on February 9, 2011. A copy of this statement is included as an attachment to this testimony. There were several reasons why the Executive Committee chose to do this testing even though they knew the FCC was having LightSquared conduct similar testing:

- 1) We needed to include national security assets in the testing. Since all of LightSquared's work needed to be in the public domain, we did not want to expose vulnerabilities of military or intelligence systems. A separate classified annex of the NPEF report was transmitted to FCC via the National Telecommunications and Information Administration (NTIA) and is currently being assessed by their engineers.
- 2) We needed to assess certain assets that may be unclassified, but where the results are still very sensitive. Examples of these would be things in law enforcement systems and systems that are in homeland security applications.
- 3) We needed to consider system details that may involve proprietary contractor data, including the specific locations of future broadband towers. This information is included in a "For Official Use Only" document that was transmitted to the NTIA, but redacted from the publicly releasable versions.
- 4) We needed to consider the entire scope of interference effects. The FCC Conditional Order limited LightSquared's testing scope to only one type of interference effect called overload interference. There are other types of Radio Frequency (RF) interference effects which I will discuss later in this testimony.

The NPEF's test methodology involved modeling, simulation, analysis, bench testing, radiated testing inside an anechoic chamber, and what is called "live sky" testing where LightSquared set up a tower for us outdoors and broadcast a signal as close as they could to what they expect the actual configuration to be. Each of these methods has advantages and limitations and using multiple methods enhances our confidence in the results. I should point out that LightSquared actively supported our efforts. They provided their prototype hardware, including a custom filter for their transmitters, technical specifications, answered numerous engineering questions, and sent personnel to our test sites to review and comment on our test set-up. I would like to take this opportunity to publicly thank LightSquared for their cooperation. It greatly enhanced the fidelity of our results.

I do want to identify some limitations of our testing effort. The most significant is that we had only one LightSquared base station. Since interference effects in these scenarios are normally additive, this is a serious limitation in a planned environment where the LightSquared base stations are so densely enough packed that a given user will likely see effects from multiple towers simultaneously. This also greatly complicates some of the potential mitigation options. A second limiting factor was LightSquared did not have any LightSquared handsets available for us to test. The handsets operate at a different frequency than their base stations, but also close to GPS, but much less powerful. However, we anticipate they will be much more numerous and since they are mobile they could be anywhere and may even be frequently co-located with GPS receivers. Several technical experts on our team consider this to be a very significant problem, but we were not able to explicitly address this issue. A third limiting factor is

the inability to fully represent the diversity of the GPS user community. There are more GPS applications than we can count and at the NCO we learn of new applications at the rate of about three per week. Each application is different. Some require extreme position in location; others do not use position at all, but need very precise timing. Some applications require less precision, but need extremely high integrity—in other words they need high confidence the signal they receive is accurate. Still others do not even read the signal's message content; they only care about the phase relationship between the military and civil GPS signals. It was therefore difficult to construct tests that covered all of our diverse users in the time we had available. And a final limiting factor was the extremely compressed time frame.

But despite these limitations, the NPEF completed the job they were asked to do. They were able to look at a wide range of representative receivers against all three phases of LightSquared's proposed deployment plan. In all, 24 different organizations participated in testing more than 75 different receivers in over 50 separate test events. The answer is definitive: LightSquared's proposed system would create harmful interference throughout all three phases of its planned deployment. I have attached an Executive Summary of the publicly releasable results with this testimony. Our tests showed no evidence of out-of-band emissions. In other words, we were able to confirm LightSquared's claim they correctly filter their transmission so that it is not leaking into the GPS band. However, the tests also confirm the presence of other harmful interference effects. These are:

- 1) Co-channel Interference: Two systems that augment GPS are authorized users in the same frequency band where LightSquared has its license. These



are not government systems, but there are government users of these systems, including the Department of Defense. GPS receivers that obtain this augmentation signal are denied at great distances from any LightSquared base station. Filtering out co-channel interference is not feasible since the augmentation signal can be anywhere in that frequency band.

- 2) Overload Interference: Contrary to LightSquared's claims that only older or poorly designed receivers would experience desensitization, also known as overload interference, the NPEF testing showed the effect is pervasive and applies to our newest and best-designed military and civil receivers as well as to those in all sectors of the commercial markets. In fact, the high-end receivers are particularly susceptible to this overload interference. These receivers do contain filters to screen out energy from the adjacent band, but these filters were designed for an environment where the neighboring band was assumed quiet, to have relatively low power satellite signals and not the high power terrestrial transmissions now being proposed for the first time. Some GPS receivers can filter out several hundred thousand times the power of an adjacent signal, but the problem is that LightSquared's transmissions are about 5 billion times more powerful than the GPS signal if the tower is about one-half mile away. The scale of the difference between a LightSquared signal and the power of a GPS signal as it reaches the ground is difficult for us to comprehend. Dr. Brad Parkinson from Stanford University uses the analogy it is like looking for a teaspoon of water in Niagara Falls—that is a relative five billion times difference.

3) Intermodulation Interference: During preliminary tests conducted at Jet Propulsion Laboratories, NASA engineers discovered that when the two high-power LightSquared transmissions are received by a GPS receiver with sufficient power that the device's electronics start saturating, it creates a third signal inside the device. This third signal is weaker than the original LightSquared transmissions, but still many times more powerful than the GPS signal and washes out the GPS signal. In addition, the frequency of this third signal is almost dead center in the middle of the GPS frequency the GPS receiver is trying to detect and process. This is not unique to the LightSquared deployment and has been seen in other radio frequency transmissions where two high power transmissions are close together in spectrum. NTIA warned as far back as 2002 this might occur in this particular frequency band with reception of terrestrial transmissions. However, actual hardware had not been available until just this year and it was not further characterized. Not all GPS receivers experience this intermodulation effect, but many do and we were able to consistently recreate it in the anechoic chamber at the White Sands Missile Range and in live-sky testing at Holloman Air Force Base. The discovery of this effect surprised LightSquared and they still have offered no solution to the problem other than to say we will not experience it during the first phase of their deployment which involves only one of their two channels.

In the NPEF task statement the engineering team was asked to consider possible mitigations to any problems they discovered. They were asked them to investigate not

only things that we might reasonably request from LightSquared, but also to look at changes the GPS community could do that would mitigate harmful interference and still allow LightSquared to execute their business plan. The NPEF spent many hours considering the full range of options such as: reducing power on LightSquared's transmission, increasing GPS's transmitted power, building better GPS receiver filters or asking for exclusion zones around certain sensitive installations that use GPS. Unfortunately, we could not identify any feasible option that would mitigate harmful interference for all, or even most, GPS users, and still allow LightSquared to meet their system requirements. The only suggested option that might work would be moving LightSquared to a different part of the spectrum, and that involves a host of other issues outside the PNT community.

#### LightSquared's Technical Working Group (TWG)

When the FCC granted the Conditional Waiver, one of the conditions was for the company to fund testing efforts to resolve the interference concerns the Executive Committee and GPS Industry had raised. The FCC Order further directed the creation of a LightSquared-led working group and highly encouraged participation from the U.S. Government. NTIA, in their role as the President's principal advisor on spectrum issues, asked for help in coordinating the government participation in this TWG. We were able to get 10 of our best technical experts from across the interagency community included in the LightSquared Working Group. Due to legal restrictions, these people could not help write the findings/results, but could and did provide technical information about GPS and government operations at every stage of

LightSquared's effort. The TWG also included strong representation from across the diverse GPS industry. Altogether, the TWG contained 39 full-time members and 61 part-time technical advisors, split between GPS Industry, LightSquared, and the Government. Like the NPEF, the TWG used an assortment of different techniques culminating in two weeks of "Live-Sky" testing in Las Vegas. There was healthy cross flow of expertise and data sharing between the NPEF and TWG.

The TWG was divided into seven separate sub-groups based on GPS application type. The results were completely consistent with the NPEF results. All seven sub-groups reported significant harmful interference with respect to all three phases of LightSquared's planned deployment. There was no consensus on feasible mitigation options although most of the GPS Industry participants in the subgroups did advocate for moving LightSquared's service to a different part of the spectrum.

#### LightSquared's New Plan

On June 30, 2011, LightSquared submitted their TWG report acknowledging the harmful interference their system would create. Simultaneously LightSquared submitted a totally independent "Recommendations" report outlining a proposed 3-part solution. The LightSquared recommended solution was not reviewed or evaluated by the TWG and all ten of the government participants in the TWG disagree with assertions it makes about the TWG results. However, the Recommendations paper is a serious and constructive proposal and will be fully considered by the FCC.

- 1) First they agreed to re-order the phasing of their system deployment.

LightSquared now proposes initially deploying with the lower frequency of

their two channels—the channel that would be furthest away from the border of GPS. The new proposal for deployment phasing would decrease—but not eliminate the number and extent of initial impacts to GPS devices impacted and provide more time to implement any necessary mitigation methods.

- a. At this time we, do not know what the impacts of this initial channel transmission (referred to as the “10 MHz Low” phase) are. This configuration was not one of the ones tested by the NPEF because it was not proposed until after the NPEF completed testing. The NPEF informally collected a few data points in what they called an “initial exploratory evaluation,” but this is insufficient for a conclusion and an additional six months of study was recommended.
- b. The TWG itself did not evaluate LightSquared’s 3-part proposal and the “10 MHz Low” phase was not part of the original test plan. At the very end of their testing period, the TWG sub-groups were able to collect some data on a 10 MHz low transmission. However, there is no consensus in the TWG report regarding harmful interference, except in the High Precision area, where 31 of 33 High Precision receivers failed in this configuration. All seven TWG subgroups recommend further study on this issue.

2) LightSquared also agreed to reduce their power to a maximum of roughly 1500 watts per tower for initial deployment. This is significantly less than authorized by the FCC. However, it is exactly what LightSquared told the Departments and Agencies their planned operating power was at the beginning

of the TWG and NPEF efforts and it is this level the NPEF based much of its analysis on. LightSquared was unable to reach this power level during much of the live sky testing at Holloman and in Las Vegas, so many of the NPEF test data points were taken at reduced power levels.

3) LightSquared proposed a "standstill" for operating their second, higher frequency channel. The exact time they would need to use this second channel was undefined. However, LightSquared testified to Congress they were seeking a glide path to using it within 2-3 years and their CEO recently announced LightSquared would reach their full capacity by 2014. Additionally, the LightSquared recommendations document clarifies that:

"LightSquared intends ultimately to deploy a network using a full complement of terrestrial frequencies operating at appropriate power levels, in order to provide LTE capacity and service levels to its customers, it will delay incorporating into its terrestrial network the upper 10 MHz of its frequencies in which transmissions may jeopardize legacy GPS usage." <sup>1</sup> [Emphasis Added]

Any necessary mitigation measures would therefore need to be in place by that date. The TWG Report states that many High Precision GPS receiver applications may need as much as 10 or 15 years to design, test, and field receiver changes.

#### Summary

The extensive and comprehensive testing done by LightSquared, the NPEF and the GPS Industry conclusively demonstrates harmful interference from LightSquared's intended deployment of their high-power terrestrial broadband system and should not be allowed to commence commercial operations until the

<sup>1</sup> LightSquared Recommendation Paper filed with FCC 29 June 2011

identified problems are resolved to the satisfaction of the FCC.

The Administration believes that we must protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the President's instruction to identify 500 MHz of new spectrum for innovative new mobile broadband services, we will continue our efforts at more efficient use of spectrum. Therefore, in the short run, we will participate in the further testing required to establish whether there are any mitigation strategies that can enable LSQ operation in the lower 10MHz of the band. We also encourage commercial entities with interests to work with Lightsquared toward a possible resolution, though any proposed mitigation must be subjected to full testing. The challenge of meeting the President's goal also depends on long-term actions by Federal agencies in the area of research and development, procurement practices that encourage spectrally-efficient applications, and new policy development.

Further study is needed on alternative concepts, including the most recent LightSquared proposal. The National Coordination Office will assist as directed by the Space-Based PNT Executive Committee in any follow-on efforts. I thank you for this opportunity to speak on this issue of such strategic importance to this Nation and to over a billion world-wide users. I look forward to your questions.



**Mr. Anthony Russo**  
**Director**  
**National Coordination Office for Space-Based Positioning,  
Navigation and Timing**

Mr. Anthony Russo has served as the Director of the National Coordination Office for Space-Based Positioning, Navigation and Timing since January, 2010. Prior to 2010, he served as the NCO's Deputy Director between 2007 and 2009 on detail from the Air Force. Mr. Russo retired from the Air Force as a Colonel in 2009.

Mr. Russo's 27-year military career included a variety of assignments dealing with test and evaluation of space systems, national space policy, space warfare, and identification of threats and vulnerabilities to space systems. Mr. Russo has numerous hours of "hands-on" experience with adversary space warfare systems and has participated in over three dozen "live-fire" tests and exercises involving foreign GPS jamming devices interfering with U.S. military systems. Mr. Russo has been instrumental in characterizing the effects of GPS denial on U.S. operations and in the development of tactics, techniques, and procedures to counter the existing and future threats. He has helped developed systems to detect, locate, and identify potential threats to GPS and other space services.

Mr. Russo's positions included several assignments at both the Space Warfare Center and HQ Air Force Space Command as well as multiple leadership positions at HQ Strategic Command, 4950<sup>th</sup> Test Wing, and the Pentagon. He helped create, and then served as Commander of the 527<sup>th</sup> Space Aggressor Squadron where he employed numerous foreign weapon systems, including a variety of GPS jammers, to help train U.S. forces in realistic exercises. Mr. Russo has a Bachelor of Science in Engineering Space Physics from Lehigh University, and M.S. degrees in Systems Engineering Management from the Air Force Institute of Technology, Military Art and Science from Fort Leavenworth, and National Security from the Air War College.

Mr. Russo was a Distinguished Graduate at the Air Force Institute of Technology, won the MacArthur Award at the Army's Command and General Staff College, received the James Forrestal award at Air War College, and has earned numerous military decorations including the Defense Meritorious Service Medal and the Legion of Merit.



**Statement of  
Julius P. Knapp  
Chief, Office of Engineering and Technology  
Federal Communications Commission**

**Before the Armed Services Subcommittee on Strategic Forces  
U.S. House of Representatives**

**“Sustaining GPS for National Security”**

**September 15, 2011**

Good morning Chairman Turner, Ranking Member Sanchez, and Members of the Strategic Forces Subcommittee. My name is Julius Knapp and I am Chief of the Federal Communications Commission’s Office of Engineering and Technology (OET), where I have served as an engineer for 37 years. OET is the Commission’s primary resource for engineering expertise and provides technical support to the Chairman, Commissioners, and the FCC’s Bureaus and Offices. I appreciate this opportunity to testify on behalf of the Commission concerning the process for working with other agencies to resolve spectrum interference issues.

Members of this Subcommittee have expressed concern regarding the potential effect that LightSquared’s planned satellite and terrestrial wireless broadband network could have on GPS operations, particularly those operated by the Department of Defense. I want to make absolutely clear that the Commission will not authorize LightSquared to begin commercial service if its operation would cause harmful interference to GPS. The Commission and its staff would never take – and have never taken – an action that would threaten the safety or security of America’s citizens. Chairman Genachowski has

repeatedly stated that the Commission will enforce the January 26, 2011 *Order's* conditions requiring the resolution of harmful interference issues.

Also, earlier this week, the Commission's International Bureau and Office of Engineering and Technology released a *Public Notice*, which reflects the Commission's determination, in consultation with the National Telecommunications and Information Administration (NTIA), that additional targeted testing is needed to ensure that any potential commercial terrestrial services offered by LightSquared do not cause harmful interference to GPS operations. The *Public Notice* specifically correlates to guidance from the NTIA under our interagency Memorandum of Understanding (MOU) on spectrum coordination activities. The *Public Notice* strongly encourages all parties to work in good faith towards a solution that serves our dual goals of facilitating introduction of wireless broadband services while protecting GPS against harmful interference. The limitations of the Commission's January 26, 2011 *Order* modifying LightSquared's authorization also remain in effect: LightSquared will not be permitted to commence commercial operation if it would result in harmful interference to GPS systems, including Department of Defense systems. I have attached this *Public Notice* and the underlying correspondence from NTIA Administrator Larry Strickling to this testimony, and I formally request that you accept it for the record in this hearing.

#### **Spectrum Management Responsibilities**

The FCC has managed America's commercial spectrum since 1934, although our predecessor agencies have operated since 1912. We have nearly 100 years of

accumulated experience in governing the airwaves and ensuring that the cacophony of voices using our nation's valuable spectrum do not cause harmful interference to one another. This work is a central, core mission of the FCC.

As you are aware, the FCC and the NTIA share responsibility for managing the radio spectrum. While the FCC is responsible for use of the spectrum by the commercial sector, as well as state and local governments, the NTIA is responsible for use by the federal government, including DOD. These shared responsibilities require that the FCC and the NTIA coordinate on matters such as the allocation of the radio spectrum for use by various services and preventing and resolving harmful interference. The FCC and the NTIA coordinate activities on spectrum matters of mutual interest under a long-standing MOU.

This coordination occurs in multiple ways and at multiple levels of management. For example, the Chairman of the FCC and the Assistant Secretary for Communications and Information at the Department of Commerce coordinate high-level objectives and conduct spectrum planning. My staff works closely with Karl Nebbia, Chief of the NTIA's Office of Spectrum Management, and his staff, to work through challenging issues concerning the interaction between federal and commercial spectrum. The FCC also participates with NTIA's Interdepartmental Radio Advisory Committee, or IRAC, which includes representatives from the various federal agencies and departments, including DOD. FCC decisions that have implications for federal users of the spectrum are coordinated with the NTIA and the IRAC before the Commission adopts a final order.

The Commission's delegated authority rules permit its staff to handle a wide range of complex spectrum issues. My office in particular must review numerous engineering and interference issues on a routine basis, and we provide essential information to other bureaus as well as the Commissioners concerning potential interference issues. It is standard operating procedure for the Commission's bureaus to review matters under delegated authority and release orders after a 48 hour review period by the Commissioners. The LightSquared matter was decided in the same way as numerous other conditional waivers.

#### **LightSquared Conditional Waiver**

Some historical background is important to understanding the current procedural situation involving the LightSquared matter. Spectrum is allocated to Mobile Satellite Services (MSS) in nationwide geographies across three sets of frequency bands. They are designed to provide ubiquitous coverage throughout the United States. As a result, they offer the potential to provide service in rural areas and remote parts of the country that are not served, and may never be served, by terrestrial wireless systems. In 2001, MSS licensees Mobile Satellite Ventures LLC and Ico Global Communications (Holdings) Ltd petitioned the Commission to permit an ancillary terrestrial component that would be integrated with their satellite service to provide broadband coverage by terrestrial base stations in locations where reliable satellite service was challenging, particularly in urban areas. In 2003, the Commission adopted rules permitting MSS licensees to offer ancillary terrestrial service. The rules required licensees to offer an

integrated satellite and terrestrial service. The rules were subsequently modified and reaffirmed in 2005.

In 2009 Skyterra, the successor to MSV, filed a petition to transfer control to Harbinger Capital Partners. As part of that petition, Skyterra sought to modify certain technical conditions of its license. The U.S. GPS Industry Council (GPSIC) raised concerns about the potential for undesired signals from LightSquared's system falling into the GPS frequency band. Skyterra and the GPSIC ultimately resolved these concerns and filed a joint letter stating that the issue had been resolved. In March 2010, the Commission issued an *Order* approving the transfer of control from Skyterra to Harbinger (now LightSquared). The *Order* explained that Harbinger planned to construct a hybrid satellite terrestrial network and noted that the terrestrial component of the network would cover 90 percent of the United States. A second March 2010 *Order* modified the technical standards, including granting Harbinger's request to increase the power level of the planned terrestrial base stations consistent with the Skyterra-GPSIC filing.

In November 2010, LightSquared filed a petition, and the Commission on January 26, 2011 granted a conditional waiver of the integrated service rule. Under this conditional waiver, customers of LightSquared's wholesale MSS/ATC service could themselves offer stand-alone terrestrial service at retail provided that LightSquared itself offers only a fully integrated terrestrial/satellite service. The January 26, 2011 conditional waiver did absolutely nothing to change LightSquared's authority to operate

within its authorized L-Band spectrum, the configuration of its network – such as the number of base stations it operates – or its power levels. In particular, the conditional waiver did not convert this spectrum from a satellite service to a terrestrial service.

LightSquared continues to have a strict obligation to provide robust satellite service that is integrated with any terrestrial service offering, consistent with the launch of its new satellite in November 2010.

After LightSquared submitted its request, for the first time, the GPS industry, the NTIA and other federal agencies raised strong concerns that LightSquared's base stations operating adjacent to the GPS band would cause overload interference to GPS receivers. Accordingly, the conditional waiver stipulated that LightSquared could not provide commercial service until the Commission is satisfied that the potential GPS harmful interference concerns have been resolved. The conditional waiver also directed LightSquared to organize and participate in a GPS interference technical working group in which interested parties could work directly with LightSquared to resolve potential GPS harmful interference concerns. .

As a result of the FCC's conditions protecting against harmful interference to GPS, on June 30, 2011, LightSquared filed the final report of the Technical Working Group – which it jointly chaired along with the GPSIC. Based on the results of the working group's testing, LightSquared submitted its recommendations to address the interference problems. LightSquared, recognizing that the upper 10 MHz band significantly interfered with GPS receivers, proposed to operate only on the lower 10

MHz of its spectrum and to coordinate and share the cost of underwriting a workable solution for legacy precision measurement devices that may be at risk. Following the Commission's standard, transparent process, the report – like prior interim reports – was available to the public and the Commission sought comment on LightSquared's modified proposal and the test results, or any alternative proposals to enable these two important services – GPS devices and L-band mobile broadband – to co-exist. The comment period closed on August 15, 2011 and the FCC received over 3,000 comments. The September 13<sup>th</sup> *Public Notice* requires additional testing to assess the potential for interference to GPS under LightSquared's current technical proposals.

### **Conclusion**

It's important to consider the LightSquared matter in the context of the need to develop additional spectrum resources. The telecommunications and IT sectors represent 9.8 percent of the American economy. In 2010, the U.S. tech sector grew at a pace that was about twice as fast as the U.S. economy overall. The Internet ecosystem alone employs more than three million U.S. workers and sustains more than 20,000 American businesses. As a result of the rapid evolution of technology, we are entering a spectrum crunch. Spectrum is the invisible infrastructure that sustains the wireless ecosystem, and this essential, but finite, national resource is becoming scarcer and more valuable to both commercial and governmental entities. Wherever possible, consistent with other national priorities, we cannot allow spectrum to lie fallow or be put to anything other than its best possible use.

Multiple experts predict that demand for wireless spectrum will increase more than 35 times in the next few years. There are 300 million mobile subscribers in the United States and 90 percent of us keep our mobile device within arms length 24 hours a day. Just this year, Smartphones eclipsed PC sales. A typical smartphone places 24 times as much demand on spectrum as an old feature phone. Tablets, which were introduced about 18 months ago, demand 120 times as much capacity. President Obama's June 2010 Executive Memo directed the Secretary of Commerce, working through the National Telecommunications and Information Administration (NTIA) to collaborate with the FCC to develop a plan to make available 500 megahertz of spectrum over the next 10 years for wireless broadband use.

We remain focused on ensuring that the Commission enables businesses and users to take full advantage of the incredible economic opportunities that underutilized spectrum present. This includes the opportunity presented by LightSquared, which if successfully realized, would result in billions of dollars of new private investment, increased competition, and the creation of thousands of jobs.

At the same time, the Commission will ensure that entities such as LightSquared do not cause harmful interference to GPS systems. We will continue to work closely with the NTIA, DOD and other federal agencies to assess LightSquared's proposal and determine the viability of technical solutions that would enable both services to co-exist. We will certainly keep this committee informed of our progress.



I look forward to answering your questions.



### **Julius Knapp**

Chief of the Office of Engineering Technology , FCC

Julius Knapp is Chief of the FCC's Office of Engineering and Technology (OET). Mr. Knapp has been with the FCC for 37 years. Mr. Knapp became Chief of OET in 2006, having previously served as the Deputy Chief since 2002. Prior to that he was the Chief of the Policy & Rules Division where he was responsible for FCC frequency allocation proceedings and for proceedings amending the FCC rules for radio frequency devices. Mr. Knapp was Chief of the FCC Laboratory from 1994 – 1997 where he was responsible for the FCC's equipment authorization program and technical analyses. In his career at the FCC Mr. Knapp has been involved in matters affecting virtually every radio service, as well as a diverse array of technical issues such as hearing aid compatibility for wireless devices, closed captioning, CALEA and the Internet. Mr. Knapp received a Bachelor's degree in electrical engineering from the City College of New York in 1974. He is a member of the IEEE EMC and Communications Societies and is a Fellow of the Radio Club of America. He was the 2001 recipient of the Eugene C. Bowler award for exceptional professionalism and dedication to public service. He was the 2010 recipient of the Federal Communications Bar Association Excellence in Government Service Award and the WCAI 2010 Government Leadership Award. He has also received the FCC's Silver and Gold medal awards for distinguished service at the Commission.

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**DOCUMENTS SUBMITTED FOR THE RECORD**

SEPTEMBER 15, 2011

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DEPUTY SECRETARY OF DEFENSE  
1010 DEFENSE PENTAGON  
WASHINGTON, DC 20301-1010

JAN 12 2011

Mr. Julius Genachowski  
Chairman  
Federal Communications Commission  
445 12th Street SW  
Washington, DC 20554

Dear Chairman Genachowski:

The Department of Defense (DoD) has reviewed the Federal Communications Commission's (FCC) pending Order and Authorization (O&A) regarding the request by LightSquared Subsidiary LLC (LightSquared) to modify the Ancillary Terrestrial Component (ATC) service rules. DoD's initial review of this O&A revealed a potential for the LightSquared ATC network to interfere with the Department's Global Positioning System, Inmarsat terminals, and Aeronautical Mobile Telemetry operations.

The previously agreed to interference criteria, analyzed in 2002, are now dated especially when considering LightSquared's revised business model. Therefore, there is strong potential for interference to these critical National Security Systems. The Department strongly recommends deferral of final action on this ruling until the proper interference analysis and mitigation studies can be conducted based on this new business model.

Your personal attention on this matter is greatly appreciated and the DoD will continue to work with the National Telecommunications & Information Administration and FCC to resolve this issue as soon as possible.

cc:  
The Honorable Lawrence E. Strickling  
Assistant Secretary for National  
Telecommunications & Information  
Administration, Department of Commerce



# National Legal and Policy Center

*"promoting ethics in public life"*



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**Founded 1991**

February 2, 2011

The Honorable Darrell Issa  
The Honorable Edolphus Towns  
House Committee on Oversight and Government Reform  
U.S. House of Representatives  
Washington, D.C. 20515

Dear Chairman Issa and Congressman Towns:

As chairman and ranking member of the Committee on Oversight and Government Reform, your committee has a special responsibility to oversee ethics matters with federal policy implications. There are few issues more important today than reinforcing Americans' faith in government at all levels and particularly the high ethics standards the Obama Administration set forth two years ago.

Unfortunately, those ethics standards may have been called into question recently regarding federal wireless communications policy. This letter brings to your attention a series of odd procedural decisions at an independent regulatory agency – the Federal Communications Commission (FCC) – that appear to have been undertaken solely for the financial benefit of one individual. As outlined in further detail below, these process decisions, series of contacts, apparent appearances of impropriety, and potential conflicts of interest seem to reveal improper influence peddling before the Executive Branch, Office of Science and Technology Policy (OSTP), and the Federal Communications Commission.

### ***Background***

As you may know, the National Legal and Policy Center was among the first to disclose revelations that Andrew McLaughlin, the former White House Policy Advisor at OSTP, was secretly communicating by email with his former employees at Google about public policy issues affecting the company.

In the course of our research, we conducted a thorough review of visits to OSTP by industry leaders. As a consequence of our analysis of White House visitor records and meetings with OSTP officials, we have found another potentially troubling ethics issue concerning Phil Falcone, Harbinger Capital Partners, and Mr. Falcone's wireless venture, LightSquared.

Phil Falcone, the founder of a hedge fund known as Harbinger Capital Partners is currently under criminal and civil investigations by the Securities and Exchange Commission and U.S.

Attorney's Office in Manhattan for allegedly failing to disclose \$113 million in personal loans he took from his hedge fund to pay personal taxes. *The Wall Street Journal* has also reported that investigators are looking into allegations that Mr. Falcone allowed some clients to redeem funds from his hedge fund during the financial crisis of 2008, while preventing others from doing so.<sup>1</sup>

According to the *Wall Street Journal*, Mr. Falcone and Harbinger scored big gains for investors in 2007, but his fund has since shrunk from \$26.5 billion to about \$9 billion from losses and client withdrawals. Harbinger's fund was off 15% for the year as of last November, and investors like Goldman Sachs and Blackstone Group had put in requests to withdraw funds.

As importantly, investors have expressed increased anxiety over Mr. Falcone's plans to launch a global wireless satellite network known as *LightSquared*. The majority of Harbinger's declining assets have been pledged to the venture, but many believe the initiative is risky and underfunded. Experts believe that building a wireless network can require as much as \$40 billion in investment. Interestingly, a May 31, 2010 story from *The Register* reported that "Harbinger reckons with a suitably flexible FCC... it can get the network operable for something in the region of \$6 billion."<sup>2</sup>

#### ***Mr. Falcone's Wireless Plans***

Mr. Falcone's wireless plans appear to focus on taking advantage of an FCC wireless loophole that would allow the circumvention of the billions of dollars in investment required to purchase wireless spectrum by taking over a distressed satellite company (SkyTerra, now LightSquared) and entering the wireless phone and Internet market at a fraction of the cost of competitors.

Mr. Falcone then plans to lease or sell a part of that spectrum for wireless phone or Internet service to a consumer wireless company (or companies) that could share in the costs of building and operating the network -- all without the need to operate the satellite network, or sell satellite service.<sup>3</sup>

The plan centered around first securing FCC approval for Harbinger's acquisition of SkyTerra, then getting the FCC to "fast-track" approval for Harbinger to take advantage of a little-known spectrum loophole for satellite licenses.

#### ***The Loophole***

FCC policy regarding satellite license holders allows the holders to "supplement" satellite spectrum with *free* terrestrial (land-based) spectrum. The policy was implemented because satellites have limited transmission power, and the opaque nature of rooftops and buildings limits effective coverage. Satellite operators are thus permitted to run base stations on the ground, at the same frequency and use *free* terrestrial spectrum to "fill in the gaps." The land-based

<sup>1</sup> Authorities Probe a Top Hedge Fund," *Wall Street Journal*, 11/13/10.

<sup>2</sup> "Satellite firm offers 4G network on back of 2G business model", *The Register*, 5/31/10.

<sup>3</sup> See SkyTerra Proxy Statement, 2/26/10, p. F-5.

spectrum is known as Ancillary Terrestrial Component (ATC), and is free to use for companies possessing a satellite license.<sup>4</sup>

Thus, the loophole Harbinger was seeking allowed LightSquared to essentially build out its national 4G state-of-the-art wireless and broadband network using the *free terrestrial spectrum* it is permitted to use as part of its satellite license, avoiding the requirements to immediately invest upfront capital to launch expensive satellites. The terrestrial spectrum can then be leased to wireless providers.

It is important to note that other companies that want to compete in the U.S. wireless phone and Internet market have to pay billions of dollars at auction to use the public airwaves (spectrum), and those billions accrue to the benefit of taxpayers. By contrast, Falcone's bold plan would build out a national wireless network taking advantage of *free* spectrum – i.e., at taxpayer expense. Clearwire, for instance, already has invested substantial sums to secure spectrum and build out its wireless network.

***Falcone's Plans Required Unprecedented FCC Intervention on his behalf***

None of Mr. Falcone's plans would be successful, however, unless he was successful in persuading the Administration and the FCC to intervene on his behalf. And over the course of the past year, a series of odd decisions, questionable meetings and procedural anomalies at the Federal Communications Commission and White House highlight Mr. Falcone's growing influence in the hallways of government.

Mr. Falcone's plans required the investment of the majority of Harbinger's assets into a little-known satellite company (SkyTerra) despite substantial investor opposition. The merger between Harbinger and SkyTerra was conditioned on FCC approval, and accordingly, in October of 2009, the parties sought such approval for majority control of SkyTerra and a transfer of their satellite license in a proposed merger transaction.<sup>5</sup>

The transaction moved through the FCC at an accelerated pace and was approved within five months of filing its restructured takeover request in October 2009. For comparison sake, given the slow speed in which the agency acts, the FCC typically decides merger transactions in 180 days. Since many merger transactions go well beyond that period, the FCC has an informal 180-day "shot clock" as a method of keeping transactions moving inside of the agency. Falcone's approval arrived a month before the FCC's shot clock period.

On February 26, 2010 during the FCC's public comment period on the proposed transaction, Harbinger filed a confidential business plan document that included certain conditions the company agreed to in order to obtain FCC approval of the license transfer. These conditions included an unprecedented agreement that without prior approval from the FCC, Harbinger

<sup>4</sup> See 47 CFR § 25.119(b)(4)(i).

<sup>5</sup> "Authorities Probe a Top Hedge Fund," *Wall Street Journal*, 11/13/10).  
 SkyTerra Proxy Statement, 2/26/10, p. 76.  
 SkyTerra Proxy Statement, 2/26/10, p. 8.



would not be allowed to provide spectrum to the two largest wireless carriers, and similarly would not be allowed to carry more than a limited amount of traffic for either.<sup>6</sup>

During FCC merger proceedings, parties typically file confidential materials that are protected from the public. Under FCC rules, however, the public must be notified within 24 hours that a filing of confidential material was submitted into the record. In this case, the FCC withheld Harbinger's letter and the merger conditions from public disclosure for more than a month. The letter was made public only on March 31, 2010, five days after the FCC approved the license transfer, and nine days after the Harbinger/SkyTerra merger was approved by SkyTerra shareholders.<sup>7</sup>

The FCC also violated its own precedent by failing to place in the record and publicly disclose the merger conditions (non-confidential data) before the deal was finalized so that interested parties would have an opportunity to comment on the proposed conditions.

The FCC's electronic filing system also reveals additional anomalies with respect to Falcone's transaction – a confidential document filed on February 12 also appeared on the electronic docket on March 12—the document has yet to be made final. In fact, no public notice of the filing appeared in the electronic docket for any of the confidential filings made in late 2009 and early 2010 until weeks or months later.

On April 21, 2010 Senators Hutchinson, DeMint, Vitter and Brownback sent FCC Chairman Genachowski a joint letter with numerous inquiries regarding the Falcone transaction.<sup>8</sup> On May 10, Genachowski replied with a non-responsive letter. These correspondences were not posted electronically for weeks after they were filed. In addition to violating FCC procedure and precedent, the FCC's actions in withholding these documents from public view directly contradicts Chairman Genachowski's promise to maintain an open and transparent process at the FCC.

On November 19, 2010, Mr. Falcone implemented the final stage of his plan, applying for a waiver of FCC's rules to allow SkyTerra (now re-named LightSquared) to begin selling wireless phone and Internet services utilizing *free* terrestrial spectrum (ATC) to wholesale customers without having to operate its satellite system. In an unprecedented move for the agency, the FCC placed Mr. Falcone's waiver request on a "fast track" approval schedule with a truncated 10-day comment period over the Thanksgiving holiday. On the Friday after Thanksgiving, the FCC granted a three-day extension of the comment period, still well short of the standard 30-day period for public comment.<sup>9</sup>

#### ***How Phil Falcone ensured a "suitably flexible FCC"***

<sup>6</sup> Letter from Harbinger to Federal Communications Commission, 2/26/10.

<sup>7</sup> SkyTerra Press Release, "SkyTerra Communications, Inc. Stockholders Approve Merger with Harbinger," 3/22/10.

<sup>8</sup> Letter from Senators Hutchinson, DeMint, Vitter, and Brownback to Chairman Genachowski, 4/21/10.

<sup>9</sup> FCC Public Notice of LightSquared Application for ATC Waiver, 11/19/10; FCC Notice of Extension, 11/26/10.

Sensing an opportunity to exploit FCC satellite license “loopholes” while playing into the Administration’s agenda to find another facilities-based wireless and broadband provider, it now appears that Mr. Falcone worked throughout 2009 to secure special consideration and tilt the playing field to get his wireless venture off the ground.

According to White House visitor access logs, on September 22, 2009, Mr. Falcone and LightSquared CEO Sanjiv Ahuja personally visited the White House and met with the Chief of Staff at the Office of Science and Technology Policy (OSTP).<sup>10</sup> One day later, the Harbinger/SkyTerra merger agreement was signed.<sup>11</sup>

On September 30, 2009, one week after his September 2009 White House visit, Mr. Falcone contributed \$30,400 to the DSCC -- the maximum legal individual contribution limit to a party committee. His wife, Lisa Falcone, contributed an additional \$30,400 to the DSCC on the same day. (LightSquared’s new CEO Sanjiv Ahuja also contributed \$30,400 to the DNC in September of 2010).<sup>12</sup>

Mr. Falcone’s contributions to the DSCC were anomalous he long has been a much larger donor to the Republican Party. In fact, just prior to the \$60,800 in contributions to the Democrats, the most Mr. Falcone and his spouse previously contributed during that political cycle was \$2,400. As for Sanjiv Ahuja, his \$30,400 contribution to the DNC was his first political contribution in eight years, and prior to that he contributed only to Republicans between 1998-2002.

On January 21, 2010, Mr. Falcone visited the White House again, this time for an appointment with John Holdren, the Director of the Office of Science and Technology Policy.

***Falcone Hired Husband of Senior FCC Staffer to Lobby the FCC on Mobile Satellite Services***

In addition to well-timed political contributions to the DSCC at the height of merger review discussions, Mr. Falcone’s Harbinger also secured the assistance of a lobbying firm, the Palmetto Group, via Harbinger’s legal counsel Goldberg, Godles, Wiener and Wright to lobby Congress and the FCC on mobile satellite services.<sup>13</sup> Mr. Steve Glaze, a lobbyist with the Palmetto Group, was registered to lobby the FCC directly on mobile satellite services and is married to Terri Glaze, a senior staffer at the FCC.<sup>14</sup>

***Governmental and Private GPS Authorities Object to ATC License Due to Interference***

On January 12, 2011, the National Telecommunications and Information Authority (an authority housed within the Department of Commerce responsible for working with other Executive Branch agencies to develop and present the Administration’s position on telecom issues) sent a letter to Chairman Genachowski objecting to the ATC waiver for SkyTerra and stating that the “[g]rant of the LightSquared waiver would create a new interference environment and it is

<sup>10</sup> White House Visitor Access Logs.

<sup>11</sup> SkyTerra Proxy Statement, 2/26/10, p. 32.

<sup>12</sup> See www.opensecrets.org

<sup>13</sup> Palmetto Group Lobbying Disclosure Forms for 2008 & 2009.

<sup>14</sup> “Terri Glaze Named Director of FCC’s Legislative Affairs Office,” Broadcasting and Cable, 7/22/09

incumbent on the FCC to deal with the resulting interference issues before any interference occurs.” (emphasis in original)<sup>15</sup>

Attached to Assistant Secretary Strickling’s letter was a letter from Danny Price, Director of Spectrum and Communication Policy at the Department of Defense to Strickling, stating that “DoD is concerned with the [order and authorization] being conducted without the proper analysis required to make a well informed decision. Given the potential negative impacts to GPS, Inmarsat, and AMT operations, request NTIA advocate to the FCC to defer action on the waiver request and place this application under a Notice of Proposed Rule-Making . . . .”<sup>16</sup>

The United States GPS Industry Council (USGPSIC) has also raised concerns in a letter to the NTIA: “the potential for interference to existing terrestrial and adjacent mobile space services from the introduction of a primary terrestrial voice and data broadband service . . . is orders of magnitude more significant than under the original MSS ATC mode of operation.”

The USGPSIC letter continues, “none of these changes can be fully and fairly vetted without an open rulemaking proceeding, as the current application process initiated by the FCC is insufficient for the proposed changes. Indeed, the FCC governing statute and its rules and regulations require an Administrative Procedure Act (APA)-sanctioned rulemaking in order to implement this transformation . . . .”<sup>17</sup>

Notably, the letter raises serious concerns about interference with E911 and law enforcement GPS applications.

### ***Summary***

Last Tuesday, the FCC, on delegated authority, officially granted the request by LightSquared to drop the FCC’s long-standing requirement that its new 4G service be a satellite service. In granting the waiver, the FCC chose to issue a license modification for LightSquared because of what they term “unique” circumstances, instead of modifying its rules to apply to all providers--essentially guaranteeing that Mr. Falcone, and only Mr. Falcone, receives this special treatment.

One can speculate whether or not those “unique” circumstances are related to Mr. Falcone’s September 30, 2009 meeting with the White House, and subsequent political contributions to the DSCC (in fact, the maximum contributions allowed by law), but the outcome of the FCC’s decision means other similarly situated satellite companies will not be able to take advantage of the same loophole, as the license modification is only valid for LightSquared.

<sup>15</sup> Letter from Lawrence Strickling, Assistant Secretary of Commerce for Communications and Information, to FCC Chairman Julius Genachowski, 1/12/11).

<sup>16</sup> Letter from Danny Price, Director of Spectrum and Communication Policy at the Department of Defense to Assistant Secretary Strickling, 12/28/10).

<sup>17</sup> Letter from USGPSIC to NTIA, 12/13/10.

The ramifications of the FCC's favoritism are enormous. Consider for instance other competitive nationwide mobile providers like Clearwire, which have purchased terrestrial spectrum at auction for substantial sums and have invested millions more -- in Clearwire's case -- to build out its 4G network. For them, the message couldn't be more clear: Companies who play by the rules, create jobs, and invest in building out competing networks, are now at great risk of seeing their plans entirely upended by the FCC's arbitrary "unique" circumstances that give a Clearwire competitor the same terrestrial spectrum *for free*, and essentially exempt them from requirements to invest and build out a competing network by using a wholesale model where free satellite spectrum can be leased and "laundered" to other terrestrial mobile providers.


Based on this evidence and the record outlined above, it would appear that Mr. Falcone, a hedge fund trader currently under federal civil and criminal investigation, purchased a distressed satellite company to obtain a federal government bailout worth billions of dollars by shrewdly taking advantage of existing loopholes and preferential treatment by the FCC.

Mr. Falcone, who previously was almost exclusively a supporter of GOP causes and candidates gained access and influence to the Obama Administration and Democrats through well-timed White House visits and contributions to the DSCC -- weeks before filing his merger application at the FCC. Since then, at virtually every step of the way, Mr. Falcone has received favorable treatment and expedited consideration of his plans to offer wireless satellite services utilizing *free* terrestrial spectrum that would cost billions in the marketplace.

The FCC for its part, has fast tracked the merger, granting approval with lightning speed in March of 2010. During the entire process, the FCC has cut procedural corners, failed to publicly disclose ex parte contacts between Mr. Falcone, his representatives and the FCC, failed to consider the legitimate concerns of governmental authorities and GPS stakeholders about the ATC license waiver, and as announced last week, ultimately granted the crucial final waiver necessary for LightSquared (and only LightSquared) to begin offering wireless services using *free* terrestrial spectrum.

Given the above, and given the special responsibility of federal agencies to not only avoid conflicts of interest, but to avoid even the appearance of conflicts, the above record is troubling. No fair-minded person could look at the record so far and not believe that further investigation is warranted. These actions call out for your committee to conduct a thorough investigation so that citizens will have the benefit of the full record.

Sincerely,



Ken Boehm  
Chairman, National Legal and Policy Center

MAR 25 2011

Mr. Julius Genachowski  
Chairman  
Federal Communications Commission (FCC)  
445 12<sup>th</sup> Street SW  
Washington, DC 20554

Dear Mr. Chairman:

The Department of Defense (DoD) and the Department of Transportation (DOT) recognize the importance of implementing a thorough and equitable operational process for the LightSquared Working Group (WG). In that regard, DoD and DOT have reviewed the Commission's expectations for the LightSquared WG process as stated in the February 25, 2011, letter (DA 11-367) to LightSquared, and have several concerns with its stipulations, which we believe require your personal attention.

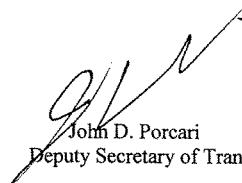
First, DoD and DOT were not sufficiently included in the development of the LightSquared initial work plan and its key milestones. We are concerned with this lack of inclusiveness regarding input from federal stakeholders. In particular, active engagement with DoD and DOT, the national stewards and global providers of the Global Positioning Satellite (GPS) service, is essential to protect this ubiquitous defense, transportation and economic utility as the WG process proceeds.

Second, the Commission's determination that consensus on the WG recommendations is not required does not provide guidance regarding how differing technical viewpoints from federal and private sector manufacturers and users will be reconciled. DoD and DOT need to understand how differing conclusions and recommendations developed during the WG process that could affect national security and transportation safety will be addressed.


Finally, DoD and DOT strongly advise that a comprehensive study of all the potential interference to GPS is needed. The new LightSquared business plan and the new FCC rules significantly expand the terrestrial transmission environment, increasing the potential for interference to GPS receivers. An exchange of all pertinent technical and operational information is also crucial to ensure the effectiveness of interference mitigation solutions.

In light of these concerns, and the importance of GPS for civil, military, and commercial users, we request clarification on these matters at your earliest opportunity.

Sincerely,



John D. Porcari  
Deputy Secretary of Transportation



William J. Lynn III  
Deputy Secretary of Defense

cc:  
The Honorable Lawrence E. Strickling  
Assistant Secretary for National Telecommunications & Information  
Telecommunications & Information  
Administration, Department of Commerce



## FEDERAL COMMUNICATIONS COMMISSION

September 15, 2011

JULIUS GENACHOWSKI  
CHAIRMAN

The Honorable Michael Turner  
Chairman  
Subcommittee on Strategic Forces  
Committee on Armed Services  
United States House of Representatives  
2354 Rayburn House Office Building  
Washington, D.C. 20515

Dear Chairman Turner:

Thank you for the opportunity to meet with you and Representative Sanchez to discuss the Commission's process related to LightSquared's planned operations in the MSS L-Band. Initially, I wish to inform you that on September 13th, 2011, the Commission's International Bureau released a Public Notice (PN), which reflects the Commission's decision, in consultation with NTIA, that additional targeted testing is needed to ensure that any potential commercial terrestrial services offered by LightSquared do not cause harmful interference to GPS operations, including Department of Defense systems and other systems related to national security and public safety. I have attached this PN for your review. The Bureau's PN specifically correlates to guidance from the NTIA under our interagency Memorandum of Understanding (MOU) on spectrum coordination activities. The PN strongly encourages all parties to work in good faith and expeditiously towards a solution that serves our dual goals of facilitating introduction of wireless broadband services to promote private investment and job creation while protecting GPS against harmful interference. The restrictions of the January 26, 2011 *Order* also remain in effect: LightSquared will not be permitted to commence commercial operation in the L-Band if it would result in harmful interference to GPS systems such as those operated by our federal partners.

The L-Band situation highlights a central reason for the creation of the Federal Communications Commission – spectrum is an essential, limited, and highly valuable resource necessary for both the economy and national security. Spectrum fuels mobile telephone, mobile broadband and other parts of the telecommunications industry, which is one of the largest growth sectors of our economy and vital to spurring job creation and consumer benefits, as well as strengthening our national defense and public safety. Licensed terrestrial commercial operation in the L-Band represents the potential for billions of dollars of private investment and thousands of jobs nationwide.

Since 1934, the Commission has worked with other agencies to resolve the often conflicting needs of commercial and government spectrum users. During this 77-year period,

numerous important spectrum issues related to public safety and defense have been handled efficiently and appropriately using this process. The existing MOU between the FCC and NTIA (which coordinates federal spectrum users) that led to yesterday's PN permits technical experts to review engineering issues and resolve spectrum interference problems in a collaborative, inclusive and fact-based manner. I should also note that neither the MOU nor the Communications Act of 1934<sup>1</sup> provide authority for placing financial requirements on other agencies with regard to spectrum usage and mitigation techniques.

To understand how the interference resolution process has worked and continues to work with respect to LightSquared's proposed use of the spectrum, some historical context is essential. First, the January 26, 2011 *Order* on which so much focus has been placed did not trigger LightSquared's access to the spectrum band adjacent to GPS. The Commission licensed this spectrum to LightSquared's predecessor in interest (SkyTerra) in 1995. In an effort to increase spectrum efficiencies and competition, the Commission in 2003 permitted MSS licensees to integrate ancillary terrestrial components into their networks. The Commission noted that this change in policy would encourage innovative techniques and better service. SkyTerra received terrestrial service authorization in 2004. The authorization provided SkyTerra authority for expansive ancillary terrestrial service, including the deployment of thousands of terrestrial base stations.

SkyTerra was acquired by LightSquared in March 2010, after an extensive comment and consideration period.<sup>2</sup> In approving this transfer of control, the Commission observed that if LightSquared successfully deploys its integrated satellite/terrestrial 4G network, it will be able to provide mobile broadband communications in areas where it is difficult or impossible to provide coverage by terrestrial base stations such as in remote or rural areas. No one, including the GPS industry, raised any issue during the multi-year proceeding or immediately following it regarding GPS receiver overload problems (the problem that is being raised now), even though, throughout this period, it was clear that LightSquared planned to deploy a significant terrestrial network in the spectrum adjacent to GPS.

The March 2010 *Order* transferring control from SkyTerra to LightSquared explained that LightSquared planned to construct a hybrid satellite-terrestrial network and noted that the terrestrial component of the network would cover 90 percent of the United States.<sup>3</sup> To achieve such a significant scale would necessarily require tens of thousands of towers. A second March 2010 *Order* addressed all of the technical standards, including granting LightSquared's request to increase the power level of the base stations. All interested parties had ample time to

<sup>1</sup> *The Communications Act of 1934, as Amended*, 47 U.S.C. § 1, *et. seq.*

<sup>2</sup> Harbinger Capital Partners Funds (which became LightSquared) and SkyTerra Communications filed transfer-of-license applications with the Commission in April, 2009. The comment period commenced on June 5, 2009, which featured 30 days for petitions to deny, 10 days for the applicants' responses and 5 days for reply.

<sup>3</sup> SkyTerra Communications, Inc., Transferor and Harbinger Capital Partners Funds, Transferee Applications for Consent to Transfer Control of SkyTerra Subsidiary, LLC, IB Docket No. 08-184, Memorandum Opinion and Order and Declaratory Ruling, 25 FCC Rcd 3059 at ¶ 56 (IB, OET, WTB, rel. March 25, 2010) ("Harbinger's network will cover 100 percent of the U.S. population via the satellite component and ultimately over 90 percent of the population via its terrestrial component.")

comment in advance of these *Orders* and could have filed for Commission reconsideration in the 30 days following their release.

It is important to note that the GPS industry actively participated in the 2010 transfer proceedings. Under current law, the Commission does not possess the legal authority to regulate receivers. The Commission determines engineering issues related to power output but relies upon licensees to provide initial technical information related to their receivers, especially if there is an issue with those receivers picking up signals outside of the licensee's band. Those who manufacture such receivers are best positioned to know of their limitations and specifications and have a responsibility to notify the Commission of any known problems.

Although the GPS industry raised concerns about potential out-of-band emissions from LightSquared's operations as early as July 2009, one month later the GPS industry specifically told the Commission that this issue had been fully resolved.<sup>4</sup> The FCC also coordinated its draft March order modifying LightSquared's authorization with the NTIA, which in turn coordinated with other federal agencies, including the Department of Defense under the MOU process. The Commission did not receive any formal objections relating to GPS interference. In fact, after the GPS Industry Council withdrew its initial concerns, no one raised any objections to the proceedings relative to GPS interference until almost nine months after the March orders were adopted and released.

On November 18, 2010, LightSquared filed its request to modify its Ancillary Terrestrial Component authority so it could continue to implement its business plan. Commission staff placed LightSquared's proposal on public notice. This matter was handled under the Commission's rules on delegated authority,<sup>5</sup> with the International Bureau as the primary bureau of record, but with the active participation of the Office of Engineering and Technology, the Office of Strategic Planning and Policy Analysis, and the Wireless Telecommunications Bureau. Shortly after LightSquared filed its request, the Commission's Spectrum Working Group convened a team of engineers to study the matter. The Group included participants from the bureaus listed above, as well as the Public Safety and Homeland Security Bureau and the Media Bureau.

The decision to review this matter at the bureau level under the Commission's delegated authority followed the FCC's standard operating procedure in these cases.<sup>6</sup> The Commission's

<sup>4</sup> SkyTerra Subsidiary LLC Application for Modification Authority for an Ancillary Terrestrial Component, File No. SAT-MOD-20090429-00047, Call Sign: AMSC-1, File No. SAT-MOD-20090429-00046, Call Sign: S2358, File No. SES-MOD-20090429-00536, Call Sign: E980179, Order and Authorization, 25 FCC Rcd 3043 (IB., rel. March 26, 2010) at ¶4 and n. 15 ("SkyTerra and USGPS subsequently submitted a joint letter resolving the concerns raised in the USGPS comments.")

<sup>5</sup> 47 C.F.R. § 0.201

<sup>6</sup> Each space station is built with a unique technical design that reflects each applicant's business plan and the space station's location in orbit. Consequently, half of all space station applications granted by the International Bureau from August 1, 2010 through August 1, 2011 contained requests for waivers of one or more Commission rules (32 out of 64 space station grants). See, e.g., Hughes Network Systems, LLC, *Declaratory Ruling*, 26 FCC Rcd 8521 (Int'l Bur. 2011) (waived certain technical and operational rules in allowing U.K.-licensed space station to serve U.S. market); Intelsat LLC, *Order and Authorization*, 26 FCC Rcd 3459 (Int'l Bur. 2011) (waived rule



staff frequently handles significant spectrum-related decisions. The Commission depends upon its highly trained professional staff of engineers, technologists, economists, statisticians, and lawyers to review the core issues related to each pending matter. The Commission's rules permit decisions to be made on delegated authority to ensure the timely consideration of pending requests to support a robust and active telecommunications industry and to ensure that the agency is not placing unnecessary barriers in front of commercial activity, private investment, and job creation. Bureaus also are permitted to grant waivers of the Commission's rules instead of initiating a rulemaking where a waiver will serve the public interest and good cause has been shown.<sup>7</sup> The rules provide for various avenues of Commission oversight, such as Applications for Review and Petitions for Reconsideration by the full Commission.<sup>8</sup>

As with most orders on delegated authority, the Commissioners and their staffs had a 48 hour period to review the International Bureau's *Order* prior to its January 26, 2011 release. Given the lengthy, documented history of decisions related to the L-Band and the *Order*'s conditions protecting against harmful interference and robust requirements for LightSquared to continue to provide satellite service, the *Order* raised no new or novel issues requiring Commission review. None of the other four commissioners' offices raised any issues concerning the *Order*.

During the Bureau's consideration of the waiver request, the agency received a January 12, 2011 letter from Deputy Secretary of Defense William Lynn expressing concerns about potential interference with GPS systems. NTIA Associate Administrator Larry Strickling also submitted a letter on January 12, 2011 conveying the preference of the federal agencies not to grant the waiver order but recommended that if the FCC did so it should establish a process to ensure the interference issues were resolved prior to LightSquared's offering service and develop a process that motivated all parties to move expeditiously and in good faith to resolve the issues. This is what the agency did.

I believed then, as now, that the highly conditional nature of the *Order* addressed NTIA's initial concerns and answered directly the individual points made by the various agencies. Indeed, the *Order* followed the alternative suggestion advanced in NTIA's comments, stating unequivocally that there would be no commercial operations until harmful interference was resolved. The *Order* also set up a specific timeline and inclusive fact-based process for dealing

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limiting co-primary status for fixed-satellite earth stations to certain "grandfathered" earth stations); GUSA Licensee, LLC, *Order and Authorization*, 25 FCC Rcd 14411 (Int'l Bur. 2010) (waived U.S. Table of Frequency Allocations to allow fixed satellite operations in a band allocated for the mobile satellite service). See also TerreStar Networks Inc., *Order and Authorization*, 25 FCC Rcd 228 (Int'l Bur. 2010) (waived technical rules for ATC base station operations); Panasonic Avionics Corp., *Order and Authorization*, DA 11-1480 (Int'l Bur. and OET, Aug. 31, 2011) and Row 44, Inc., *Order and Authorization*, 24 FCC Rcd 10223 (Int'l Bur. and OET 2009) (both decisions waived U.S. Table of Frequency Allocations to permit aeronautical mobile satellite service operations on a non-conforming basis).

<sup>7</sup> 47 C.F.R. §1.3; see also *WAT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), cert. denied, 409 U.S. 1027 (1972); *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990); *NetworkIP, LLC v. FCC*, 548 F.3d 116, 125-28 (D.C. Cir. 2008); *Northeast Cellular*, 897 F.2d at 1166.

<sup>8</sup> 47 C.F.R. ¶ 1.115 and 47 C.F.R. ¶ 1.108.

with those claims. To provide further reassurance, I met with the Co-Chairs of ExComm, Deputy Defense Secretary Lynn and Deputy Transportation Secretary John Porcari, and also spoke with FAA Administrator Randy Babbitt to discuss their concerns, explain the very limited scope of the *Order*, and encourage participation in the testing process.

Pursuant to the *Order*'s requirements, an inclusive technical working group was formed to test the parameters of deployment for interference, and develop mitigation techniques. Many of the interested federal agencies participated in this process, including the Defense and Transportation Departments. The *Order*'s conditions worked exactly as intended to help determine the scope of the interference issues involved and what if any remediation can be done to solve these problems.

Specifically, as a result of the testing, LightSquared has decided to forgo as stated the use of any of the spectrum in the upper portion of the L-Band and limit proposed activities to the lower band. As of August 15, 2011, the Commission had received over 3,000 comments on the technical working group's findings. The Commission's staff continues to examine each comment in accordance with the Administrative Procedure Act.<sup>9</sup> And the Commission continues its coordination with the NTIA under the MOU, as reflected in yesterday's PN requiring additional testing. As part of this process, we will continue to conduct outreach to the relevant federal partners to assure them that LightSquared will not move forward until harmful interference concerns are resolved.

This is not the first instance where a wide range of parties, including government entities, are debating appropriate interference protections for new radio services, nor will it be the last. We expect that as we attempt to identify sources of spectrum to deal with the looming spectrum crunch, we will have other instances of strong debates about the potential for harmful interference from new services operating in neighboring bands. What makes this situation particularly unusual is the extent to which certain legacy GPS receivers pick up signals far into the neighboring frequency bands. Our licensees are expected to operate within their own bands and to manufacture equipment that filters reception of services operating outside their own bands. If any one spectrum user could demand that neighboring bands remain vacant to improve the performance of their systems, then the spectrum would be used inefficiently and the revenue-raising auction process necessary to offset the national debt could be undermined, as well as meaningful private investment and job creation. There would be no incentive to manufacture devices that create opportunity costs for other potential users of the spectrum.

While we must search for long-term solutions to this problem, there is no question that we cannot afford to allow an otherwise lawful service to cause interference to essential GPS operations. At the FCC, where our mission includes national security and public safety as well as economic growth and job creation, we understand the vital nature of the services the GPS industry offers to the federal government, and specifically to the Department of Defense and other agencies involved in national security and public safety. Consistent with our mission, we will continue to work hard to find a solution to these challenges, in order to ensure that we are


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<sup>9</sup> 5 U.S.C. §§ 551, *et seq.*

making the most of our nation's wireless telecommunications infrastructure while ensuring the safety and security of our nation's citizens.

I look forward to continuing to work with the Strategic Forces Subcommittee. I will keep you apprised of any changes in the status of this matter.<sup>10</sup>

Sincerely,

A handwritten signature in black ink, appearing to read 'J. Genachowski', with a long horizontal stroke extending to the right.

Julius Genachowski

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<sup>10</sup> Your staff requested additional information about my role as the "Defense Commissioner." Under Section 0.181 of the Commission's rules, the "Defense Commissioner" represents the Commission on homeland security and defense issues to other agencies and actively participates in coordination activities.



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**WITNESS RESPONSES TO QUESTIONS ASKED DURING  
THE HEARING**

SEPTEMBER 15, 2011

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#### **RESPONSES TO QUESTION SUBMITTED BY MR. GARAMENDI**

General SHELTON. Testing on the initial LightSquared deployment plan cost the Air Force approximately \$500K. The first round of follow-on testing is expected to cost the Air Force approximately \$400K. These figures include test asset costs, but do not account for travel or personnel time. The costs for further rounds of testing have not been estimated. None of this testing was budgeted for by AFSPC; this reduces the resources available to support other testing and activities required to provide space and cyber capabilities to our warfighters.

Determination of who will be obligated to pay for adding the filters has not yet been made. This decision would likely be made by the FCC. [See page 23.]

Mr. NEBBIA. NTIA does not perform interference testing, so the additional costs of testing on NTIA is *de minimis* and consists principally of staff time to analyze test results, coordinate with the agencies of the Interdepartment Radio Advisory Committee (IRAC), and communicate views to the FCC. While LightSquared has indicated that it is willing to share the cost of any proposed interference mitigation approach for Federal users of precision and timing receivers, the precise extent of the cost and the responsibility for paying such costs has not been determined. [See page 23.]





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**QUESTIONS SUBMITTED BY MEMBERS POST HEARING**

SEPTEMBER 15, 2011

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## QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. 1. I have learned that during the testimony coordination process, you were asked to include the following in your prepared remarks:

“The Administration believes that we must protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the President’s instruction to identify 500 MHz of new spectrum for innovative new mobile broadband services, we will continue our efforts at more efficient use of spectrum. Therefore, in the short run, we will participate in the further testing required to establish whether there are any mitigation strategies that can enable LSQ operation in the lower 10MHz of the band. We also encourage commercial entities with interests to work with LightSquared toward a possible resolution, though any proposed mitigation must be subjected to full testing. We hope that testing can be complete within 90 days. The challenge of meeting the President’s goal also depends on long-term actions by Federal agencies in the area of research and development, procurement practices that encourage spectrally-efficient applications, and new policy development.”

- a. Who, specifically, asked that this be included?
- b. If you declined to include the language, in whole or in part, please describe why.
- c. Did anyone in the Administration attempt to persuade you to include the language? Who?

General SHELTON. 1a. As the hearing was rescheduled from 3 August to 15 September, my written testimony entered the formal review process twice. Both times the testimony followed a normal review process. For the 3 August scheduled date, we received a paragraph to add to the testimony from the Office of Management and Budget (OMB), relayed through our Air Force Legislative Liaison office (SAF/LL). The specific author of the paragraph is unknown to us.

1b. I chose not to concur with this edit because I didn’t feel an Administration comment was appropriate for a military officer’s testimony. I was also concerned about the suggested timeline for testing.

1c. This OMB paragraph was the only issue from the Administration or other Government agencies that we were not able to resolve for the 3 August hearing (which was later postponed). We were in the process of seeking resolution when the hearing was rescheduled and the review process ended. During the testimony review process for the 15 September hearing date, there was no suggested paragraph from OMB and the testimony moved forward without significant issue.

Mr. TURNER. 2. Are your responses to these QFRs your own views or those of your agency? Have your responses been approved/edited by anyone other than yourself or someone reporting to you?

General SHELTON. 2. These responses are my own. The QFR responses are sent forward for Air Force policy review and for the Office of the Secretary of Defense policy review as part of the standard process for Questions for the Record.

Mr. TURNER. 3. Please describe when you and your agency became aware of the LightSquared network proposal and its potential for significant interference.

General SHELTON. 3. In the January/February 2011 timeframe, AFSPC became significantly concerned about LightSquared plans and began to engage our higher authorities on the issue. This coincides with the January 2011 order from the Federal Communications Commission granting LightSquared a conditional waiver.

Mr. TURNER. 4. LightSquared has recently announced that it has solved the interference issue for 99.5 percent of GPS users.

- a. Do you agree with this statement?
- b. What is the solution?
- c. Is it a solution for uses of GPS for which you are responsible?
- d. Has it been tested by the Federal Government? If so, please provide details.

General SHELTON. 4a. We have insufficient data at this point to assess the potential effectiveness of LSQ’s proposed solution and have not seen substantiation of the 99.5% figure. Even if the 99.5% figure is statistically accurate, the .5% of affected GPS users represents a group of military and high precision receivers that con-

tribute significantly to national defense, economic, business, scientific, safety of life, and precision agriculture.

4b. The LSQ proposed solution includes transmitting on only the 10 MHz low channel (which is further away from the GPS spectrum), operating at reduced power, and use of a filter for high precision and timing devices.

4c. Further testing is required to determine the efficacy of these solutions.

4d. The proposed filter is not yet available for testing so we cannot draw any conclusions about its effectiveness. Additionally, we have not done sufficient testing against LSQ's revised plan to determine conclusively whether it will mitigate the risk to military receivers. Initial testing identified significant interference even at the 10 MHz low channel. We are in the process of planning and executing follow-on testing on the revised plan as directed by the National Telecommunications and Information Administration (NTIA). This round of follow-on testing is focused on general navigation receivers and cell phones. Additional testing on high precision and timing receivers will be accomplished once the proposed LSQ filters are available.

Mr. TURNER. 5. General Shelton, you stated that you believed that LightSquared's filter "solution" could cost billions of dollars over more than a decade.

a. Are you in a position to elaborate specifically as to costs, timing, and potential degradation effects to military GPS receivers from these filters?

b. And please describe what testing has occurred thus far with LightSquared's filters and military GPS receivers.

c. Who would be obligated to pay for the costs of adding filters?

General SHELTON. 5a. The estimate of billions I stated is based on the required modification of a typical platform that uses GPS (an F-15 and associated precision weaponry for example). The typical costs and timing factors include: development, manufacturing, installation and testing. As we rotate platforms and devices between CONUS and OCONUS, all affected platforms would require implementation of the filters which could be expected to have significant mission impact. At this point it is too early to describe specific costs, scope and impact of the fixes that will be required by DOD systems because we have not been able to comprehensively test weapons systems with the proposed mitigations against the revised LSQ deployment plan.

5b. As the filters are not yet available, no testing has been done.

5c. Determination of who will be obligated to pay for adding the filters has not yet been made.

Mr. TURNER. 6. My understanding is that Mr. Russo solicited all Federal Government agencies with GPS equities on their concerns with the LightSquared proposal. Are you aware of any Government position papers on LightSquared interference which have been provided to the National Coordination Office or to the NTIA that have not been forwarded to the FCC and then made public? If so, why were they not made public immediately?

General SHELTON. 6. We are not aware of any undisclosed position papers; however, that question would best be answered by the National Coordination Office or the NTIA.

Mr. TURNER. 7. Mr. Nebbia—based on my reading of the Public Notice, the FCC seems to be putting the weight of the Department of Defense's equities entirely on your agency. In turn, in Assistant Secretary Strickling's letter to Deputy Secretaries Lynn and Porcari, the NTIA is instructing DOD and DOT to conduct additional testing and develop solutions to the LightSquared problem. General Shelton, we are counting on you to keep this committee informed of the results of testing and we seek your expert and impartial judgment about the results of those tests. Will you please contact the Subcommittee staff or Ms. Sanchez or myself to provide us your recommendation as to whether it is necessary to schedule another classified briefing with you on GPS interference test results.

General SHELTON. 7. We will keep the committee informed of developments.

Mr. TURNER. 8. We have heard that LightSquared believes the FCC process, including all testing, can be wrapped up by November 30th. However, the Strickling letter to Deputy Secretaries Lynn and Porcari clearly describes a second phase of testing "to evaluate proposed mitigation plans for high precision and timing receivers which would commence once LightSquared develops a filtering solution to avoid interference with those classes of devices."

Are you operating under any sort of commitment or obligation to wrap up testing under a November 30th or other arbitrary date?

a. Do you have an expectation for when both phases of testing will conclude?

b. Might there need to be further testing beyond the two phases suggested in the Strickling letter of September 9th?

General SHELTON. 8a. The PNT EXCOM 5 October letter to Mr. Strickling (NTIA) acknowledged that the 30 November test deadline, for cellular and personal/general navigation receivers, is ambitious and the actual testing may be completed by the deadline date, but analysis and final report may take longer. The NPEF test team is working expeditiously to complete the testing of general navigation devices and to have an initial executive draft report available by 30 Nov. At present we expect the first phase of testing to be completed on 4 Nov. The second phase of testing is dependent upon LSQ filter availability. We do not have an estimate for the filter availability at this point so I cannot provide an estimate for completion of the second phase testing.

8b. NTIA's intent as expressed in their 9 September letter is for testing to be "conclusive and final" with respect to assessing the impact of LSQ's revised proposal. Our understanding is LSQ's final deployment plan may still require the upper 10 MHz channel. If true, further testing would be required.

Mr. TURNER. 9. LightSquared has proposed, as part of its "lower 10 MHz" option a "standstill" on the upper 10 MHz of the spectrum adjacent to the GPS signal. At the same time, LightSquared is said to believe that it needs access to its full spectrum, both the lower and the upper, to be profitable.

a. Please explain what the "standstill" means and what terms LightSquared is proposing for the "standstill."

b. Has LightSquared indicated the "upper 10" of the spectrum is completely, permanently off-the-table? Is that what the "standstill" means?

c. If the "standstill" was only a matter of a few years, what would that mean to your agencies?

d. Should Congress, or the FCC, codify somehow the terms of the "standstill" if it is ultimately determined that the "lower 10 MHz" option is acceptable?

e. Please provide a specific description of the defense equities regarding LightSquared's "lower 10" proposal, for the near term and into the future.

General SHELTON. 9a. While we interpret "standstill" to mean temporary halt to deployment and operation in the upper 10 MHz band of LSQ's two authorized bands, we expect FCC to clarify.

9b. LSQ has not given any formal indication that they intend to remove the upper 10 band from their final deployment plans.

9c. It has been agreed by both LSQ and the GPS community that the upper 10 MHz band causes unacceptable interference to GPS. Until an acceptable mitigation solution is identified and implemented, operation in that band would result in the level of interference described in my testimony. Assuming an acceptable solution can be found, I estimate it would take many years to implement across DOD.

9d. I believe it is essential the FCC clearly codify the terms of the "standstill."

9e. We are still in the process of assessing the impacts of the "lower 10" proposal. Initial NPEF testing of the proposal indicated significant interference concerns for DOD receivers. The initial testing was limited with respect to the types of devices tested but the interference noted was applicable to aviation and maritime applications.

Mr. TURNER. 10. Please give us an idea of the size and scope of the GPS system to include applications and users. Please elaborate to the extent possible in an open hearing on the military capabilities that rely on GPS.

General SHELTON. 10. The Global Positioning System is DOD's largest satellite system currently consisting of 30 operational satellites. Total expenditure for the GPS program since its inception is \$34B. It provides 24/7 positioning, navigation and timing services to the entire world, free of charge. GPS is integrated into nearly every facet of U.S. military operations and is essential to Federal aviation, first responders, precision agriculture, banking, cell phone service, and automobile/personal navigation systems. There are over a million DOD GPS receivers and it has been estimated that there are more than 4 billion users worldwide.

Mr. TURNER. 11. Describe how GPS is used by the military and the degree of dependence the military has on GPS. Is the military's use of GPS primarily overseas and in theater, or is the military also dependent on GPS within the continental United States (where LightSquared plans to deploy its communications services)?

General SHELTON. 11. GPS is integrated into nearly every facet of U.S. military operations. Combat troops, military aircraft (manned and unmanned), naval vessels, high speed communications networks, and precision guided munitions all depend heavily on the accuracy, availability and reliability of GPS. Our primary military uses are overseas but our aircraft support CONUS and North American defense missions. The military also supports CONUS search & rescue and drug interdiction operations (Coast Guard operations are a prime example). Additionally, our training missions, development and testing of new and modified systems take place primarily in CONUS. Military equipment and platforms rotate between CONUS and

OCONUS and must therefore be completely interoperable with other U.S. equipment as well as with that of our allies. As LSQ's deployment covers a significant portion of the U.S., the vast majority of our CONUS operations, to include combat training and preparation, would be impacted.

Mr. TURNER. 12. What is the DOD's total investment in GPS, including satellites, ground stations, receivers, etc?

General SHELTON. 12. We estimate the total expenditure for the GPS program since its inception at \$34B.

Mr. TURNER. 13. LightSquared would operate in a different part of the spectrum (1525–1559 megahertz) than GPS (1559–1610 megahertz). Why is there an interference problem when the two systems would operate in different, but neighboring, parts of the spectrum?

General SHELTON. 13. The original deployment calls for nearly 40,000 transmitters operating in the frequency band immediately adjacent to GPS. With potential transmitter spacing of .25 to .5 miles apart in cities, the LSQ transmit signal will be over 5 billion times more powerful than the GPS signal received from space. Essentially, the LSQ signal would overpower the GPS signal causing receivers to become unable to isolate the GPS signal from the "noise" caused by the more powerful LSQ signal. It is also important to note that in order to achieve the greatest possible accuracy, high precision GPS devices are designed to "listen" to sidelobes of the GPS signal that extend outside of the GPS band. This design feature has not been an issue in the past as GPS receivers can easily distinguish the GPS signal from those in adjacent bands so long as the signals are of comparable strength. Previously, only such signals were allowed in these frequency bands.

Mr. TURNER. 14. What is the magnitude of the harmful interference and the national security implications of such interference? Discuss the results of the Department's testing and any specific examples that substantiate these observations.

General SHELTON. 14. GPS is used by all Services, from ground forces, to precision-guided munitions, to synchronization and security of communications networks, to search and rescue operations, to humanitarian relief operations. GPS is also used by the Department of Homeland Security for National border and maritime security.

As discovered during testing of the original LightSquared deployment plan, aviation receivers operating as far as 7.5 miles from LightSquared transmitters completely lost the GPS signal and were degraded out to distances of more than 16.5 miles. For two representative receivers tested by the FAA, results also showed GPS would be completely unusable for an aircraft 500 feet above the ground in an area spanning Stafford, Virginia through Washington and Baltimore, and out to Frederick, Maryland.

High precision GPS receivers such as those used for surveying and geological study requiring precise measurements were adversely affected out to 213 miles and totally lost the GPS signal out to 4.8 miles.

Based on testing performed at the Jet Propulsion Laboratory, a class of receivers used in space to conduct certain types of atmospheric measurements would be unusable up to 12% of the time while in their typical orbits.

The State of New Mexico E-911 Program Director, who sent several GPS-equipped emergency and police vehicles to the test, stated in a letter to AFSPC that their equipment showed "the LightSquared network will cause interference to GPS signals and jeopardize 911 and public safety."

Actual test results for the original LightSquared deployment plan indicated significant degradation to every receiver-type tested. Most units tested completely lost their GPS service at some point. The specific military receiver test results are classified, but the results were consistent with the other receiver test results.

Mr. TURNER. 15. The reviews undertaken suggest that there are certain GPS applications that, even with modification or complete redesign, would still not be able to perform their current mission in the presence of such network broadcasting directly adjacent to the GPS L1 band. What applications?

General SHELTON. 15. At present there is no proven/tested mitigation that will resolve the interference issues for high precision devices even under the revised LSQ deployment plan ("Lower 10"). Proposed filters have not yet been made available for testing. It is unclear if the proposed filters would impact military receiver accuracy for our high precision systems. This would be determined through extensive testing. No mitigations have been identified to resolve interference issues for any type of receiver with respect to LSQ operations at the upper 10 MHz band.

Mr. TURNER. 16. Assuming FCC provides authorization for LightSquared to move forward with its deployment plans, as outlined in its November 2010 filing, how would this build-out affect military systems and users in the near-term?

General SHELTON. 16. Testing results demonstrated empirically that the LightSquared signals operating in the originally proposed manner would signifi-

cantly interfere with all types of receivers tested. Specific military receiver test results are classified, but the results were consistent with other receiver results. Impacts would be expected to all Services' and Allies' ground forces, over 290,000 hand-held navigation receivers, combat aircraft, search and rescue aircraft, remotely piloted aircraft and precision guided munitions.

Mr. TURNER. 17. Does LightSquared's June 30, 2011, submission to the FCC provide sufficient information on its "lower 10" proposal for your organizations to determine whether the proposal mitigates GPS interference?

General SHELTON. 17. We have sufficient information on the lower 10 to begin initial testing. For the longer term, we need to better understand specific LSQ deployment plans to determine potential impacts.

Mr. TURNER. 18. Is your organization concerned that the FCC can provide final approval for LightSquared operations prior to resolving the GPS interference issues?

General SHELTON. 18. Thus far, the FCC has not granted final approval and has indicated that it will not do so until the GPS interference issues are satisfactorily resolved. The NTIA reported in a September 9, 2011, letter to Deputy Secretary of Defense Lynn and Deputy Secretary of Transportation Porcari that there is agreement by both LSQ and the GPS community that operations in the lower 10 MHz signal will cause unacceptable interference to high precision receivers. This letter also documents LSQ statements that it will not commence commercial operations unless and until Federal agencies test the LSQ proposed filter and conclude that it is an effective mitigation for the high precision receivers. It is acknowledged by all parties, including LSQ, that operations in the upper 10 MHz band are currently unacceptable for all GPS applications.

I agree with the NPEF recommendation to rescind the FCC's waiver. Although high precision receivers are a small percentage of all receivers in use, their functions are vital to military operations in support of national defense. At an absolute minimum it would be helpful for the FCC to formally order that operations in the upper 10 MHz band be prohibited until an acceptable solution can be found and implemented. The implementation timeline should be based on input provided by the impacted users.

Mr. TURNER. 1. I have learned that during the testimony coordination process, you were asked to include the following in your prepared remarks:

"The Administration believes that we must protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the President's instruction to identify 500 MHz of new spectrum for innovative new mobile broadband services, we will continue our efforts at more efficient use of spectrum. Therefore, in the short run, we will participate in the further testing required to establish whether there are any mitigation strategies that can enable LSQ operation in the lower 10MHz of the band. We also encourage commercial entities with interests to work with LightSquared toward a possible resolution, though any proposed mitigation must be subjected to full testing. We hope that testing can be complete within 90 days. The challenge of meeting the President's goal also depends on long-term actions by Federal agencies in the area of research and development, procurement practices that encourage spectrally-efficient applications, and new policy development."

- a. Who, specifically, asked that this be included?
- b. If you declined to include the language, in whole or in part, please describe why.
- c. Did anyone in the Administration attempt to persuade you to include the language? Who?

Mr. NEBBIA. 1. My testimony went through the standard review process overseen by the Office of Management and Budget (OMB), which includes review by other Federal agencies and entities of the Executive Office of the President. As with all testimony and other similar documents, the National Telecommunications and Information Administration (NTIA) welcomes input from other Federal entities but determines on its own which, if any, suggestions to incorporate, in full or in part. We received the text cited above both from the standard legislative interagency clearance process that is overseen by the Office of Management and Budget and through the Office of Science and Technology Policy. NTIA chose not to include the statement regarding the completion of testing within 90 days in its final testimony. The final NTIA testimony reflects the views of the NTIA as the Administration's technical and policy expert on telecommunications and information policy.

Mr. TURNER. 2. Are your responses to these QFRs your own views or those of your agency? Have your responses been approved/edited by anyone other than yourself or someone reporting to you?

Mr. NEBBIA. 2. The responses to the QFRs reflect my views, which are consistent with the views of the NTIA.

Mr. TURNER. 3. Please describe when you and your agency became aware of the LightSquared network proposal and its potential for significant interference.

Mr. NEBBIA. 3. NTIA became aware of the potential for interference in November 2010, when LightSquared submitted to the Federal Communications Commission (FCC) an application for modification of its existing Ancillary Terrestrial Component (ATC) authorization to enable it to deploy, on a wholesale basis, a nationwide 4th generation (4G) terrestrial wireless broadband network with handsets that do not include the satellite service. Following the application for modification, several Federal agencies expressed concerns relating to potential interference. In light of these concerns, NTIA wrote the FCC in January 2011 stating the Administration's position that LightSquared should not be allowed to move forward to commence commercial operations unless interference issues were resolved.

Mr. TURNER. 4. LightSquared has recently announced that it has solved the interference issue for 99.5 percent of GPS users.

a. Do you agree with this statement?

b. What is the solution?

c. Is it a solution for uses of GPS for which you are responsible?

d. Has it been tested by the Federal Government? If so, please provide details.

Mr. NEBBIA. 4. In response to LightSquared's revised proposal to operate in only the lower 10 megahertz signal of the Mobile Satellite Service (MSS) band, NTIA requested, in a September 9, 2011, letter, that the National Executive Committee for Space-Based Positioning, Navigation, and Timing (ExCom) work with LightSquared to develop a test plan and conduct tests to measure interference to cellular and personal/general navigation receivers by November 30, 2011. This testing on cellular and personal/general navigation receivers is now complete. NTIA has received the test data and is analyzing it as expeditiously as possible. In addition, NTIA's letter noted that LightSquared acknowledged that its modified operating proposal to use only the lower 10 megahertz signal would cause unacceptable interference to high-precision and timing receivers. Accordingly, LightSquared is proceeding to procure the design and manufacture of a filter to mitigate these impacts. LightSquared agreed that it will not commence commercial operations unless and until the Federal agencies test the filter and conclude that it is effective at eliminating unacceptable overload without degrading the precision performance of the receivers. With respect to timing receivers, LightSquared has identified the PCTEL antenna as a possible solution to mitigate interference. LightSquared has acknowledged that the Federal agencies need to perform a more rigorous review of the effectiveness of this antenna in mitigating interference without degrading the performance of timing receivers. Accordingly, even if the analysis of the tests we requested on September 9 shows that impacts to general navigation and cellular can be mitigated, there will need to be additional testing to evaluate proposed mitigation plans for high-precision and timing receivers which would commence once LightSquared develops a filtering solution to avoid interference with those classes of devices. However, if analysis does not point a path to mitigation of interference effects to general navigation and cellular, the testing of high precision and timing devices may not be warranted.

Mr. TURNER. 5. General Shelton stated that he believed that LightSquared's filter "solution" could cost billions of dollars over more than a decade. Who would be obligated to pay for the costs of adding filters?

Mr. NEBBIA. 5. While LightSquared has indicated that it would share the cost of any proposed interference mitigation approach for Federal users, the precise extent of the cost and the responsibility for paying such costs has not been determined. State and local governments as well as commercial users may be responsible for the full costs of the filters.

Mr. TURNER. 6. In a September 29, 2011, *Washington Post* article by Cecilia Kang, it was reported that LightSquared chief executive Sanjiv Ahuja said during an interview on C-SPAN's "The Communicators" that the company is offering Federal agencies "a sufficient amount of money to replace most receivers or fix most receivers out there."

a. Please provide an estimate of how much money LightSquared would have to spend to "replace most receivers or fix the Federal Government's GPS receivers."

b. How much has the United States Government spent on its GPS receivers?

c. How much have GPS users other than the United States spent on their GPS receivers?

Mr. NEBBIA. 6. NTIA does not have the information, including the extent and cost of agency GPS uses as well as sufficient detail regarding LightSquared's proposed deployment plan, all of which would be necessary to estimate the replacement costs you describe.



Mr. TURNER. 7. My understanding is that Mr. Russo solicited all Federal Government agencies with GPS equities on their concerns with the LightSquared proposal. Are you aware of any Government position papers on LightSquared interference which have been provided to the National Coordination Office or to the NTIA that have not been forwarded to the FCC and then made public? If so, why were they not made public immediately?

Mr. NEBBIA. 7. NTIA received input from some Federal agencies regarding the potential impact of LightSquared's original plan. Other agencies provided input regarding the FCC public notice in July. NTIA has also requested information regarding agencies' use of precision and timing receivers. Consistent with NTIA's mission to ensure efficient and effective use of spectrum while protecting critical Federal Government operations, NTIA regularly consults with agencies on important spectrum policy matters. NTIA values the candid input of agencies, which NTIA, as the manager of Federal spectrum use, utilizes as a critical input into its decision-making. NTIA does not typically release to the public the pre-decisional agency input it receives. NTIA's final views will be provided to the FCC and made part of the public record in this proceeding.

Mr. TURNER. 8. Based on my reading of the Public Notice, the FCC seems to be putting the weight of the Department of Defense's equities entirely on your agency. In turn, in Assistant Secretary Strickling's letter to Deputy Secretaries Lynn and Porcari, the NTIA is instructing DOD and DOT to conduct additional testing and develop solutions to the LightSquared problem.

a. Can you please lay out what options are available to the NTIA to ensure that the FCC does not finalize a rule that allows interference with the DOD's precision receivers?

b. Is there any circumstance in which General Shelton would say he believes there to be harmful interference to GPS, regardless of the mitigation solution offered by LightSquared, and the FCC would be permitted to go ahead and remove the condition on the January 26 waiver? Put another way, what are the NTIA's options to block the FCC from finalizing the LightSquared waiver?

Mr. NEBBIA. 8. Beginning last January and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities regarding potentially harmful interference to GPS-reliant systems from LightSquared's proposed terrestrial operations and has urged the FCC not to permit LightSquared to commence operations until those concerns are resolved. NTIA continues to work with the FCC, Federal entities, and industry on a data-driven, engineering-based approach to addressing interference concerns. The FCC's January 26, 2011, Waiver Order stated that the FCC would not allow LightSquared to commence operations until "the Commission, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete."<sup>1</sup> NTIA appreciates that the FCC takes very seriously the concerns raised by NTIA and the Federal agencies in this matter, as well as its commitment to ensure that these concerns are resolved before permitting LightSquared to begin commercial operations. We look forward to providing thorough, expert input to the Commission as it moves toward a final decision in this matter.

Mr. TURNER. 9. We have heard that LightSquared believes the FCC process, including all testing, can be wrapped up by November 30th. However, the Strickling letter to Deputy Secretaries Lynn and Porcari clearly describes a second phase of testing "to evaluate proposed mitigation plans for high precision and timing receivers which would commence once LightSquared develops a filtering solution to avoid interference with those classes of devices." Please explain the significance of November 30th.

Mr. NEBBIA. 9. In response to LightSquared's revised proposal to operate in only the lower 10 megahertz signal of the MSS band, NTIA requested, in a September 9, 2011, letter, that the ExCom work with LightSquared to develop and implement a test plan to measure interference to cellular and personal/general navigation receivers by November 30, 2011. Based on NTIA's technical expertise, we believe this is an appropriate amount of time for the testing. This phase of testing on cellular and personal/general navigation receivers is now complete. NTIA has received the test data and is analyzing it as expeditiously as possible. NTIA will consider all available data before proposing any recommendations on behalf of the administration with respect to commercial deployment of the LightSquared network. But that is not all the testing that needs to be done. As described in the September 9 letter and in my response to Question 4, there will later need to be an additional phase

<sup>1</sup>LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD-2010118-00239; Call Sign: S2358, Order and Authorization (Order), 26 F.C.C. Rcd. 566 (2011).

of testing to evaluate proposed mitigation plans for high-precision and timing receivers which would commence once LightSquared provides a filtering solution to avoid interference with those classes of devices. The testing will also evaluate the impact of the filtering solution on receiver performance. However, if analysis does not point a path to mitigation of interference effects to general navigation and cellular, the testing of high precision and timing devices may not be warranted.

Mr. TURNER. 10. LightSquared has proposed, as part of its “lower 10 MHz” option a “standstill” on the upper 10 MHz of the spectrum adjacent to the GPS signal. At the same time, LightSquared is said to believe that it needs access to its full spectrum, both the lower and the upper, to be profitable.

a. Please explain what the “standstill” means and what terms LightSquared is proposing for the “standstill.”

b. Has LightSquared indicated the “upper 10” of the spectrum is completely, permanently off-the-table? Is that what the “standstill” means?

c. If the “standstill” was only a matter of a few years, what would that mean to your agencies?

d. Should Congress, or the FCC, codify somehow the terms of the “standstill” if it is ultimately determined that the “lower 10 MHz” option is acceptable?

Mr. NEBBIA. 10. LightSquared has not yet clearly explained its definition of temporary “standstill” and if or when the standstill would cease. However, LightSquared’s December 12, 2011, filing with the FCC indicated that they would not use the upper 10 MHz without the concurrence of the PNT ExCom. We anticipate that this would be among the items that the FCC should clearly and fully articulate in its final determination in this matter.

Mr. TURNER. 11. LightSquared’s business plan calls for providing service to 260 million people by 2015. If LightSquared limited its network operations to its “lower 10” proposal, including lower power levels, how much of its business plan does it achieve? Does it need both the “lower 10” and “upper 10” megahertz bands to realize full coverage of 260 million people?

Mr. NEBBIA. 11. NTIA defers to LightSquared for specific questions relating to its business plan.

Mr. TURNER. 12. Part of this proposal is a “standstill” on the use of the upper 10 MHz spectrum. What is a “standstill” and how would it work?

Mr. NEBBIA. 12. LightSquared proposed to modify its original deployment plan to use only the lower 10 megahertz signal of the MSS spectrum in its initial deployment and operate its base stations at lower power. In addition, LightSquared agreed that it would not operate (*i.e.*, “standstill”) its terrestrial component signal in the upper 10 megahertz immediately adjacent to the GPS band. LightSquared has not yet clearly explained its definition of “standstill” and if or when the standstill would cease. However, LightSquared’s December 12, 2011, filing with the FCC indicated that they would not use the upper 10 MHz without the concurrence of the PNT ExCom.

Mr. TURNER. 13. It has been said by the FCC, including the Chairman, that the FCC handles interference issues all the time, so we can trust it to handle this one. This is a troubling statement, as it seems to be suggesting that this case is a routine matter. Mr. Nebbia, is it the public interest for the United States to have a GPS system that operates free of harmful interference? Is it the public interest for the U.S. to have set the global standard in precision, navigation and timing?

Mr. NEBBIA. 13. GPS provides services and benefits of great utility and value to the nation and NTIA is committed to protecting GPS users from disruption. As the manager of Federal agency spectrum use, NTIA is focused on enabling Federal agencies to perform their missions while ensuring, to the greatest extent possible, that those agencies use and share spectrum efficiently and effectively. Beginning last January and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities regarding potentially harmful interference to GPS-reliant systems from LightSquared’s proposed terrestrial operations and has urged the FCC not to permit LightSquared to commence operations until those concerns are resolved. At the same time, NTIA is collaborating with the FCC to identify and make available over the next decade an additional 500 megahertz of spectrum for fixed and mobile wireless broadband by either reallocating or creating opportunities to share spectrum currently used by commercial or Federal users. The goal is to nearly double over the next decade the amount of spectrum that is currently available for commercial wireless broadband. By doing so, the NTIA and FCC will help spur innovation, expand economic growth and job creation, and preserve America’s global technology leadership. NTIA is working diligently to consider all available data in order to address these goals in the most rapid and responsible manner possible.

Mr. TURNER. 14. The subcommittee has asked Mr. Knapp if the FCC has discussed with LightSquared whether it will include technology by two firms linked to

the Communist Chinese People's Liberation Army, Huawei and ZTE Corp., in this 4G nationwide network, assuming it is approved in some configuration. Will you please take this back to LightSquared and provide a written response to this Committee for the record of the hearing?

Mr. NEBBIA. 14. NTIA recommends that the Committee request such a written response directly from LightSquared.

Mr. TURNER. 15. Please give us an idea of the size and scope of the GPS system to include applications and users. Please elaborate to the extent possible in an open hearing on the military capabilities that rely on GPS.

Mr. NEBBIA. 15. GPS, and the innovation derived from its application, provides services and benefits of great utility and value to the nation, including for military and public safety purposes that protect the homeland and save lives. GPS technologies impact finance, agriculture, military, public safety, transportation, maritime, energy, and nearly every critical economic and social activity. NTIA is committed to protecting GPS users from disruption and continues to work with the FCC, Federal entities, and industry on a data-driven, engineering-based approach to addressing interference concerns.

Mr. TURNER. 16. LightSquared would operate in a different part of the spectrum (1525–1559 megahertz) than GPS (1559–1610 megahertz). Why is there an interference problem when the two systems would operate in different, but neighboring, parts of the spectrum?

Mr. NEBBIA. 16. LightSquared's existing satellite operations utilize relatively low-powered, satellite-based transmissions that do not create harmful interference to GPS operations in the adjacent band. By contrast, LightSquared's proposed terrestrial-only operations would utilize a very large number of high-powered, ground-based transmitters. It is the combination of significantly more high-power, ground-based transmitters, combined with the proximity to GPS receivers, that result in the interference. For a more detailed explanation of the causes of this interference, please see my September 15 testimony before your Subcommittee, available at: <http://www.ntia.doc.gov/speechtestimony/2011/testimony-karl-nebbia-hearing-sustaining-gpsnational-security-0>.

Mr. TURNER. 17. The reviews undertaken suggest that there are certain GPS applications that, even with modification or complete redesign, would still not be able to perform their current mission in the presence of such network broadcasting directly adjacent to the GPS L1 band. What applications?

Mr. NEBBIA. 17. The tests performed thus far indicate that many precision and timing devices would be impacted by LightSquared's use of the lower 10 MHz. However, these results are based on current technology and do not take into account any proposed filter solution. Unless and until LightSquared proposes a filtering solution, we cannot say whether the precision and timing systems would be impaired even after making modifications or redesigning the devices.

Mr. TURNER. 18. Is LightSquared allowed to build out a terrestrial network today? What are the limitations, if any? Under what circumstances could/would buildup be stopped? Assuming FCC provides authorization for LightSquared to move forward with its deployment plans, as outlined in its November 2010 filing, how would this build-out affect military systems and users in the near-term?

Mr. NEBBIA. 18. Under its existing authorization, LightSquared is permitted to offer dual-mode MSS/ATC devices and/or services (*i.e.*, handsets that can communicate both with orbiting satellites and terrestrial base stations). In November 2010, LightSquared requested a modification to its current authorization to deploy terrestrial-only handsets and services that do not utilize the satellite signal. LightSquared is not permitted to commence operations on this terrestrial-only network until interference concerns have been adequately addressed. The FCC's January 26, 2011, LightSquared Order stated that the FCC would not allow LightSquared to commence operations until "the Commission, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete."<sup>2</sup> Beginning last January and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities, including military users, regarding potentially harmful interference to GPS-reliant systems from LightSquared's proposed terrestrial operations and has urged the FCC not to permit LightSquared to commence operations until those concerns have been resolved.

Mr. TURNER. 19. Are FCC and the NTIA looking at other parts of the spectrum for possible LightSquared operations?

<sup>2</sup>LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD-2010118-00239; Call Sign: S2358, Order and Authorization (Order), 26 F.C.C. Rcd. 566 (2011).

Mr. NEBBIA. 19. NTIA is not currently looking at other spectrum bands for LightSquared's operations. In June 2010, President Obama directed NTIA to collaborate with the FCC to identify and make available over the next decade an additional 500 megahertz of spectrum for fixed and mobile wireless broadband by either reallocating or creating opportunities to share spectrum currently used by commercial or Federal users. The goal is to nearly double over the next decade the amount of spectrum that is currently available for commercial wireless broadband. By doing so, the NTIA and FCC will help spur innovation, expand economic growth and job creation, and preserve America's global technology leadership. To date, NTIA has identified 115 megahertz of Federal spectrum for reallocation and is currently evaluating another 95 megahertz of spectrum with the goal of making a recommendation on that band in the coming weeks.

Mr. TURNER. 20. DOD briefings to the committee suggest that the part of the L-Band spectrum in question was intended primarily for space-to-ground transmissions. Can you explain the history here and why decisions were made to allow significant terrestrial transmissions in this band?

Mr. NEBBIA. 20. In 2003, the FCC granted MSS providers flexibility in how they could deliver their communications offerings by enabling them to integrate an ATC into their MSS networks. As envisioned, the ATC would augment MSS services by utilizing ground stations and mobile terminals that re-use frequencies assigned for satellite communications in order to enhance MSS coverage. By granting providers flexibility to integrate MSS and ATC, the FCC sought to maximize spectrum efficiency and expand communications capabilities in the United States by filling in the "gaps" in satellite coverage. However, the FCC stated that in order to meet its "integrated service rule," the added terrestrial component had to remain ancillary to the principal MSS offering. This ancillary requirement was particularly important to users of GPS since emissions from terrestrial base stations represent a significantly different interference threat to GPS than the far weaker signals emitted from satellites to the ground.

In November 2004, the FCC's International Bureau granted a predecessor company to LightSquared Subsidiary LLC (LightSquared) the authority to operate ATC facilities providing voice and data communication for users equipped with dual-mode MSS/ATC devices (*i.e.*, handsets that could communicate both with orbiting satellites and terrestrial base stations). Additionally, in subsequent Orders in 2005 and 2010, the FCC afforded LightSquared additional flexibility for the technical design of its ATC network by, for example, waiving the requirement for the handsets to seek a satellite connection before connecting to a terrestrial base station, by waiving the requirement for a fixed number of base stations, and by allowing increased power.<sup>3</sup>

Mr. TURNER. 21. Does LightSquared's June 30, 2011, submission to the FCC provide sufficient information on its "lower 10" proposal for your organizations to determine whether the proposal mitigates GPS interference?

Mr. NEBBIA. 21. No. In response to LightSquared's revised proposal to operate in only the lower 10 megahertz signal of the MSS band, NTIA requested, in a September 9, 2011, letter, that the ExCom work with LightSquared to develop and implement a test plan to measure interference to cellular and personal/general navigation receivers by November 30, 2011. This phase of testing on cellular and personal/general navigation receivers is now complete. NTIA has received the test data and is analyzing it as expeditiously as possible. There may later need to be a second phase of testing to evaluate proposed mitigation plans for high-precision and timing receivers which would commence once LightSquared provides a filtering solution to avoid interference with those classes of devices. However, if analysis does not point a path to mitigation of interference effects to general navigation and cellular, the testing of high precision and timing devices may not be warranted.

<sup>3</sup>See Federal Communications Commission, Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands, IB Docket Nos. 01-185, 02-364, 18 F.C.C. Rcd. 1962, 1964-65 (2003); *see also* Federal Communications Commission, Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands, IB Docket No. 01-185, 20 F.C.C. Rcd. 4616 (2005); *see also*, Federal Communications Commission, SkyTerra Communications, Inc., Transferor and Harbinger Capital Partners Funds, Transferee Applications for Consent to Transfer Control of SkyTerra Subsidiary, LLC, IB Docket No. 08-184, Memorandum Opinion and Order and Declaratory Ruling, 25 F.C.C. Rcd. 3059 (March 25, 2010); Federal Communications Commission, SkyTerra Subsidiary LLC Application for Modification Authority for an Ancillary Terrestrial Component, File No. SATMOD-20090429-00047, Call Sign: AMSC-1, File No. SAT-MOD-20090429-00046, Call Sign: S2358, File No. SES-MOD-20090429-00536, Call Sign: E980179, Order and Authorization, 25 F.C.C. Rcd. 3043 (March 26, 2010).

Mr. TURNER. 22. How are DOD comments and concerns addressed at this point in the process?

Mr. NEBBIA. 22. As the manager of Federal agency spectrum use, NTIA is focused on enabling Federal agencies to perform their missions while ensuring, to the greatest extent possible, that those agencies use and share spectrum efficiently and effectively. Beginning last January, and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities—including the Department of Defense—regarding potentially harmful interference to GPS-reliant systems from LightSquared’s proposed terrestrial operations and has urged the FCC not to permit LightSquared to commence operations until those concerns have been resolved. NTIA values the candid input of agencies, and considers it a critical input into its decision-making. The Department of Defense co-chairs the Executive Steering Group of the ExCom, which NTIA has requested work with LightSquared to undertake additional testing. The results of the additional testing will serve as a critical input as NTIA develops the Administration position on this matter.

Mr. TURNER. 23. The National Positioning, Navigation & Timing (PNT) Engineering Forum (NPEF) report recommends that the U.S. Government should “conduct more thorough studies on the operational, economic and safety impacts of operating the LightSquared Network.” What additional studies and analysis do your organizations (or, you in your professional opinion) believe need to be conducted and why?

Mr. NEBBIA. 23. Please see my answers to Questions 4, 9, 17, and 21, as well as NTIA’s September 9, 2011, letter, which is available at: [http://www.ntia.doc.gov/files/ntia/publications/stricklingletter\\_09092011.pdf](http://www.ntia.doc.gov/files/ntia/publications/stricklingletter_09092011.pdf).

Mr. TURNER. 24. Describe your organization’s involvement in the FCC process leading to the FCC’s January 2011 conditional waiver to LightSquared. Was the Department of Defense, in particular, able to register its concerns with the FCC prior to its decision in January, and if so, how were those concerns addressed?

Mr. NEBBIA. 24. Beginning last January, prior to the FCC’s Order, and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities—including the Department of Defense—regarding potentially harmful interference to GPS-reliant systems from LightSquared’s proposed terrestrial operations. On January 12, 2011, NTIA advised the FCC that the LightSquared proposal raised significant interference concerns that warranted a full evaluation to ensure that LightSquared’s proposed terrestrial network would not adversely impact GPS and other critical Federal systems.<sup>4</sup> The FCC’s January 26, 2011, Waiver Order stated that the FCC would not allow LightSquared to commence operations until “the Commission, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete.”<sup>5</sup> NTIA appreciates that the FCC has taken very seriously the concerns raised by NTIA on behalf of Federal agencies in this matter. We look forward to providing thorough, expert input to the Commission as it moves toward a final decision in this matter. Please see my September 15 testimony before your Subcommittee for further elaboration on NTIA’s involvement with this issue.

Mr. TURNER. 25. Are your organizations concerned that the FCC can provide final approval for LightSquared operations prior to resolving the GPS interference issues?

Mr. NEBBIA. 25. From the outset, the Federal agencies expressed a desire to resolve all interference concerns prior to granting a waiver. However, the FCC’s January 26, 2011, Waiver Order clearly stated that the FCC would not allow LightSquared to commence operations until “the Commission, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete.”<sup>6</sup> Both the NTIA and the FCC have requested additional testing to determine the extent of interference from LightSquared’s proposed network. NTIA appreciates that the FCC has taken very seriously the concerns raised by NTIA on behalf of Federal agencies in this matter, as well as its commitment to ensure that these concerns are resolved before permitting LightSquared to begin commercial operations. We look forward to providing thorough, expert input to the Commission as it moves toward a final decision in this matter.

<sup>4</sup> See Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information and NTIA Administrator, U.S. Department of Commerce, to Julius Genachowski, Chairman, Federal Communications Commission (Jan. 12, 2011), available at <http://www.ntia.doc.gov/fcc-filing/2011/letter-regarding-lightsquaredsapplication-provide-mssatc-service>.

<sup>5</sup> LightSquared Subsidiary LLC; Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD-2010118-00239; Call Sign: S2358, Order and Authorization (Order), 26 F.C.C. Rcd. 566 (2011).

<sup>6</sup> *Id.*

Mr. TURNER. 26. There appears to be a tension between national space policy, which seeks to mitigate harmful interference to GPS, and national broadband policy, which in this particular case, would cause harmful interference to GPS. How do we reconcile these two policies?

Mr. NEBBIA. 26. GPS provides services and benefits of great utility and value to the nation, and NTIA is committed to protecting GPS users from interference. As the manager of Federal agency spectrum use, NTIA is focused on enabling Federal agencies to perform their missions while ensuring, to the greatest extent possible, that those agencies use and share spectrum efficiently and effectively. Beginning last January and continuing to this day, NTIA has expressed serious concerns on behalf of Federal entities regarding potentially harmful interference to GPS-reliant systems from LightSquared's proposed terrestrial operations and has urged the FCC not to permit LightSquared to commence operations until those concerns have been resolved. At the same time, NTIA is collaborating with the FCC to identify and make available over the next decade an additional 500 megahertz of spectrum for fixed and mobile wireless broadband by either reallocating or creating opportunities to share spectrum currently used by commercial or Federal users. The goal is to nearly double over the next decade the amount of spectrum that is currently available for commercial wireless broadband. By doing so, the NTIA and FCC will help spur innovation, expand economic growth and job creation, and preserve America's global technology leadership. NTIA is working diligently to consider all available data in order to address these goals in the most rapid and responsible manner possible.

Mr. TURNER. 27. Is LightSquared the only current or planned broadband provider where the GPS interference concern is an issue? How are other interference issues being resolved to enable co-existence of broadband and GPS services?

Mr. NEBBIA. 27. NTIA leads and manages the IRAC, which is comprised of representatives from 19 Federal agencies that provide advice to NTIA on spectrum policy matters. As part of its Federal spectrum management duties, NTIA, in consultation with the IRAC, regularly reviews systems coming into use to determine their potential for interference into other spectrum bands used by Federal agencies. NTIA has reviewed a number of operations for potential interference to GPS. NTIA is not aware of another MSS provider with proposed operations that pose similar interference concerns for GPS users.

Mr. TURNER. 1. I have learned that during the testimony coordination process, you were asked to include the following in your prepared remarks:

"The Administration believes that we must protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the President's instruction to identify 500 MHz of new spectrum for innovative new mobile broadband services, we will continue our efforts at more efficient use of spectrum. Therefore, in the short run, we will participate in the further testing required to establish whether there are any mitigation strategies that can enable LSQ operation in the lower 10MHz of the band. We also encourage commercial entities with interests to work with LightSquared toward a possible resolution, though any proposed mitigation must be subjected to full testing. We hope that testing can be complete within 90 days. The challenge of meeting the President's goal also depends on long-term actions by Federal agencies in the area of research and development, procurement practices that encourage spectrally-efficient applications, and new policy development."

a. Who, specifically, asked that this be included?

b. If you declined to include the language, in whole or in part, please describe why.

c. Did anyone in the Administration attempt to persuade you to include the language? Who?

Mr. RUSSO. 1a. As part of the normal Legislative Referral Memorandum (LRM) process, I received guidance to include this paragraph in my testimony from the Office of Management and Budget (OMB) on August 1, 2011. I understand that the language was informed by the Office of Science and Technology Policy (OSTP).

1b. I included this entire paragraph exactly as written with the exception of the one sentence that established a target deadline for completion of testing. I expressed my reservations about including this sentence to OMB on August 2, 2011. I objected to only this one sentence because I had low confidence testing would be completed by November 3, 2011, as implied. At the point in time when I was testifying, we had not even begun test planning and therefore I believed this was an unrealistic target.

1c. No one pressured me to include the language. I omitted the one sentence I did not agree with and subsequently the testimony was cleared by OMB through the standard process.

Mr. TURNER. 2. Are your responses to these QFRs your own views or those of your agency? Have your responses been approved/edited by anyone other than yourself or someone reporting to you?

Mr. RUSSO. 2. These QFR responses are my own views, although I sought input from representatives from all the agencies that are stakeholders in GPS. Once I drafted the responses, I sent them out to a wide array of GPS experts across the Federal Government for fact-checking and editing. And like all Federal agency witnesses, I submitted my final draft for approval to OMB and incorporated comments received back from the LRM process to get final clearance.

Mr. TURNER. 3. Please describe when you and your agency became aware of the LightSquared network proposal and its potential for significant interference.

Mr. RUSSO. 3. The National Coordination Office (NCO) is an administrative office serving the National Space-Based Positioning, Navigation and Timing Executive Committee (EXCOM). The NCO itself is not a decision-making or policy-making body. The EXCOM is comprised of the Deputy Secretaries of the nine different Federal departments or agencies that are the principal Government stakeholders in GPS and systems that augment or back-up GPS.

The issue was brought to the NCO's attention on December 21, 2010, in the context of LightSquared's application for a waiver to the integrated service rules, which would have resulted in a *de facto* re-purposing of the spectrum for terrestrial broadband instead of Mobile Satellite Service (MSS). This represented a significant change to the interference environment in terms of the number and density of the Ancillary Terrestrial Component (ATC) base stations we would expect to see. I immediately brought the issue to the attention of the EXCOM's Executive Steering Group (Assistant Secretary-level) and on December 27, 2010, I wrote to NTIA to request any action on LightSquared's request for waiver be deferred until testing could be performed. On January 3, 2011, I provided a point paper to all the members of the EXCOM (Deputy Secretary-level) and requested the Deputy Secretary of Defense engage the FCC Chairman to seek a delay to the waiver decision until specific interference effects and mitigation actions could be identified.

Mr. TURNER. 4. LightSquared has recently announced that it has solved the interference issue for 99.5 percent of GPS users.

a. Do you agree with this statement?

b. What is the solution?

c. Is it a solution for uses of GPS for which you are responsible?

d. Has it been tested by the Federal Government? If so, please provide details.

Mr. RUSSO. 4a. No.

4b. LightSquared's 99.5 percent number is associated with their "Recommendation Paper" filed with the FCC on June 30, 2011. I included a summary of this Paper's recommendations in my written testimony to this subcommittee on September 15, 2011, and discussed its implications in both the oral and written testimony. The LightSquared recommendation paper has three main points:

- a) **Lower Power.** LightSquared proposes operating at significantly lower power than currently authorized by FCC. They propose to operate at a maximum base station EIRP per sector for a single carrier at 32 dBW. This was the power level authorized for LightSquared's predecessor in 2005 and it was also the maximum level used for live-sky transmission tests done this past April through June. However, the current power authorized by the FCC is 10 times higher than this level to allow for future growth.
- b) **Standstill Period.** LightSquared proposes they will not deploy the upper 10 MHz of its terrestrial network without receiving explicit approval from the FCC. The standstill period is undefined, but not less than six months. The purpose of the standstill period is to allow GPS device manufacturers time to improve their equipment to coexist with LightSquared.
- c) **Initial Operations Restricted to the Lower 10 MHz Channel.** LightSquared will start operations in the lower channel instead of the upper channel as originally planned. This channel is separated from the GPS frequency by 23 MHz, which greatly reduces interference.

4c. The Executive Committee I serve is responsible for helping to implement the President's policy with respect to GPS use "... for U.S. national and homeland security, civil, scientific, and commercial purposes."

No, the recommendation is not a solution for these uses, primarily because of the "standstill" provision, which means LightSquared will still transmit high power terrestrial signals near the GPS L1 spectrum at some point in the future. In addition,

even the lower channel transmission, with the lower power limitation still interferes with some GPS users.

4d. The Government conducted extensive testing of the LightSquared system in April 2011. The power tested was the same “lower power” in the recommendation, which is actually the current technical limit of the LightSquared hardware. Most of the data points conducted during the “live-sky” tests in Las Vegas were significantly below this level. The tests also included a dual-channel (upper and lower 10 MHz) and therefore fairly represented what we understand to be the end-state configuration (after “standstill”). However, the Government tests did not extensively test operations in only the lower 10 MHz, which is a key part of LightSquared’s current recommendations. Some data was collected in what the Government test report refers to as an “initial exploratory evaluation,” but it must be remembered this signal configuration was not proposed by LightSquared until several months after the Government testing.

The Government tests conclusively demonstrated that LightSquared’s proposed dual-channel deployment causes unacceptable interference to all types of GPS applications. However, the testing of the “10 MHz Low” now proposed as the first phase of LightSquared’s new deployment was insufficient to reach a conclusion. Therefore, the Government has requested additional testing on this recommendation. The details of the Government testing conducted earlier this year were attached to the written version of my testimony in the document called “Assessment of LightSquared Terrestrial Broadband System Effects on GPS Receivers and GPS-dependent Applications” from the National Space-Based Positioning, Navigation and Timing Systems Engineering Forum (NPEF).

Mr. TURNER. 5. General Shelton stated that he believed that LightSquared’s filter “solution” could cost billions of dollars over more than a decade. Who would be obligated to pay for the costs of adding filters?

Mr. RUSSO. 5. The FCC has not yet made a determination as to who will pay for the mitigation of LightSquared interference to GPS.

The Executive Committee for Space-Based Positioning, Navigation and Timing believes the public sector should not bear any financial responsibility for the cost of retrofitting any filters (if they prove to be effective). In the original 2003 Order granting the Ancillary Terrestrial Component (ATC) license to LightSquared’s predecessor, the FCC clearly placed the responsibility for ensuring compatibility on the ATC service provider:

“We [the FCC] adopt technical parameters for ATC operations in each of the bands at issue designed to protect adjacent and in-band operations from interference from ATC. We fully expect that these operational parameters will be sufficient. Nevertheless, in the unlikely event that an adjacent MSS or other operator does receive harmful interference from ATC operations, either from ATC base stations or mobile terminals, the ATC operator must resolve such interference.”

This responsibility is still placed upon the ATC service provider in the FCC Rules, specifically in 47 CFR § 25.255.

If, for any reason, the FCC concludes 47 CFR § 25.255 does not apply, then the costs of mitigation would likely be borne by the Federal, State, and local agencies that own and operate the GPS systems and by commercial users. LightSquared has offered to pay up to \$50 million for retrofitting or reequipping Federal agencies.

Mr. TURNER. 6. In a September 29, 2011, *Washington Post* article by Cecilia Kang, it was reported that LightSquared chief executive Sanjiv Ahuja said during an interview on C-SPAN’s “The Communicators” that the company is offering Federal agencies “a sufficient amount of money to replace most receivers or fix most receivers out there.”

a. Please provide an estimate of how much money LightSquared would have to spend to “replace most receivers or fix the Federal Government’s GPS receivers.”

b. How much has the United States Government spent on its GPS receivers?

c. How much have GPS users other than the United States spent on their GPS receivers?

Mr. RUSSO. 6a. The cost is unknown because the number and types of GPS receivers that would have to be replaced or fixed is unknown. This will depend on the outcome of the additional testing requested by the FCC and will also depend very significantly on whether the end-state signal configuration is dual-channel (“upper and lower 10 MHz”) or single channel (“lower 10 MHz only”). It will also depend on how long the “standstill” period is before LightSquared deploys its upper channel, if the lower 10 MHz-only regime is not permanent.

6b. The U.S. Government as a whole does not track the total amount it spends on GPS receivers, but the Department of Defense alone has spent \$9.3B on receivers



according to an October 2011 report by the Congressional Budget Office. The FAA reports it has already invested more than \$3B in GPS equipment through FY 2011, with another \$8B planned in GPS infrastructure investments planned through FY 2018.

Industry sources put the total Government figure at a minimum \$47B for GPS infrastructure and devices, although this likely includes more than just GPS receivers.

6c. According to the Space Foundation, the total global expenditures are over \$55B per year. The U.S. portion of those expenditures is between 23–28 percent.

Mr. TURNER. 7. Mr. Russo, my understanding is that you solicited all Federal Government agencies with GPS equities on their concerns with the LightSquared proposal. Please detail which agencies did and did not respond to your solicitation. If an agency did not respond, please explain, to the best of your understanding, why. Are you aware of any Government position papers on LightSquared interference which have been provided to the National Coordination Office or to the NTIA that have not been forwarded to the FCC and then made public? If so, why were they not made public immediately?

Mr. RUSSO. 7. All member agencies of the National Executive Committee for Space-Based Positioning, Navigation and Timing (EXCOM) have provided information to NTIA about their concerns with the LightSquared proposal. I am unaware of the manner and extent to which NTIA will factor in these concerns in its recommendation to the FCC.

At the request of the EXCOM, I tasked each member agency to quantify the economic and operational impact of mitigating GPS interference and to provide their statements to NTIA. Not all agencies were able to provide the requested statements because of the uncertainty of the final end-state signal configuration and of the unknown effectiveness of mitigation techniques. Some were able to answer only in general terms, while others did make an “order of magnitude” estimate. DOD did not provide a response at all, citing insufficient information as described by Ms. Takai in her testimony to this Subcommittee. NTIA has asked Federal agencies not to make any of these statements public yet because they are considered pre-decisional and part of the deliberative process of the Executive Branch.

Mr. TURNER. 8. LightSquared has proposed, as part of its “lower 10 MHz” option a “standstill” on the upper 10 MHz of the spectrum adjacent to the GPS signal. At the same time, LightSquared is said to believe that it needs access to its full spectrum, both the lower and the upper, to be profitable.

a. Please explain what the “standstill” means and what terms LightSquared is proposing for the “standstill.”

b. Has LightSquared indicated the “upper 10” of the spectrum is completely, permanently off-the-table? Is that what the “standstill” means?

c. If the “standstill” was only a matter of a few years, what would that mean to your agencies?

d. Should Congress, or the FCC, codify somehow the terms of the “standstill” if it is ultimately determined that the “lower 10 MHz” option is acceptable?

Mr. RUSSO. 8a. I believe LightSquared intends the “standstill” term to mean that they wish to have approval to operate their network on the “lower 10 MHz” channel immediately, but agrees the current conditions on the upper channel should remain in place for an undefined period of time (but not less than six months).

During the standstill period, LightSquared would expect to continue to work with the FCC, the NTIA, and Federal agencies on GPS receiver engineering and design solutions to allow LightSquared to be able to use the upper channel for their future capacity requirements.

The removal of the conditions for the upper channel would require FCC approval, in consultation with NTIA.

8b. No, this is not what “standstill” means. Standstill indicates that LightSquared seeks to use the “upper 10” at some point in the future. The standstill period is meant to give the Government and the GPS community time to find solutions to permit coexistence.

LightSquared has referred to the “upper 10” being off-the-table in numerous public statements, but has not indicated this in any official filing with the FCC.

—On June 23, Mr. Carlisle, Executive Vice President of LightSquared testified to the House Committee on Transportation and Infrastructure that LightSquared would delay operations in the upper 10 MHz and sought a “glide path” of 2–3 years before using this portion of their spectrum.

—In its June 30 “Recommendation Paper”, LightSquared states:

*“While LightSquared intends ultimately to deploy a network using a full complement of terrestrial frequencies operating at appropriate power levels, in order to provide LTE capacity and service levels to its customers, it will delay*

*incorporating into its terrestrial network the upper 10 MHz of its frequencies*

—On September 8, Mr. Carlisle repeated in testimony to the House Committee on Space, Science and Technology the concept of a “standstill” period for eventual upper 10 MHz operations. In follow-on answers to Congressional Questions for the Record, Mr. Carlisle indicated this standstill period was on the order of 5–6 years.

“Standstill” clearly implies eventual use of the upper 10 MHz.

8c. Given the lengthy process for Agency budgeting, authorization and equipment procurements, most agencies would reequip based only on the projected end-state configuration. Unfortunately, the target date for the end-state is undefined. This makes it nearly impossible to build credible cost and impact estimates and to initiate requests for the required funding.

Certainly Federal agencies do not want to begin lengthy and expensive procurement actions, only to have to reinitiate them again in a few years.

8d. Yes, the FCC should codify all terms in their final ruling. If “lower 10 MHz” is a permanent configuration, that needs to be specified. If it is approved as a temporary state, then the nature and timing of the final configuration need to be specified.

Mr. TURNER. 9. LightSquared’s business plan calls for providing service to 260 million people by 2015. If LightSquared limited its network operations to its “lower 10” proposal, including lower power levels, how much of its business plan does it achieve? Does it need both the “lower 10” and “upper 10” megahertz bands to realize full coverage of 260 million people?

Mr. RUSSO. 9. Our office has not been involved in any analysis or evaluation of LightSquared’s business plans. However, an important point to consider is the difference between “coverage” and “capacity.” LightSquared tells us that approval of the “lower 10” will allow them to realize full coverage of 260 million people as required by their agreement with the FCC. But just because someone is in the coverage area, does not mean they will be using LightSquared’s service. The number of people actually using the service, as well as how they are using the service, determines the capacity needs. LightSquared projects the “lower 10” band is insufficient to meet their future capacity needs as demand for their broadband service grows.

Mr. TURNER. 10. Part of this proposal is a “standstill” on the use of the upper 10 MHz spectrum. What is a “standstill” and how would it work?

Mr. RUSSO. 10. I believe LightSquared intends the “standstill” term to mean that they wish to have approval to operate their network on the “lower 10 MHz” channel immediately, but agrees the current conditions on the upper channel should remain in place for an undefined period of time (but not less than six months).

During the standstill period, LightSquared would expect to continue to work with the FCC, the NTIA, and Federal agencies on GPS receiver engineering and design solutions to allow LightSquared to be able to use the upper channel for their future capacity requirements.

The removal on the conditions for the upper channel would require FCC approval, in consultation with NTIA.

Mr. TURNER. 11. It has been said by the FCC, including the Chairman, that the FCC handles interference issues all the time, so we can trust it to handle this one. This is a troubling statement, as it seems to be suggesting that this case is a routine matter.

Is it the public interest for the United States to have a GPS system that operates free of harmful interference? Is it the public interest for the U.S. to have set the global standard in precision, navigation and timing?

Mr. RUSSO. 11. The answers are clearly “yes” to both. President Obama’s Space Policy (June 2010) states:

*“Provide continuous worldwide access, for peaceful civil uses, to the Global Positioning System (GPS) and its government-provided augmentations, free of direct user charges;”*

And,

*“The United States must maintain its leadership in the service, provision, and use of global navigation satellite systems (GNSS).”*

Mr. TURNER. 12. The subcommittee has asked Mr. Knapp if the FCC has discussed with LightSquared whether it will include technology by two firms linked to the Communist Chinese People’s Liberation Army, Huawei and ZTE Corp., in this 4G nationwide network, assuming it is approved in some configuration. Will you please take this back to LightSquared and provide a written response to this Committee for the record of the hearing?

Mr. RUSSO. 12. On October 24, 2011, I received this response from Mr. Jeff Carlisle, Executive Vice President for LightSquared:

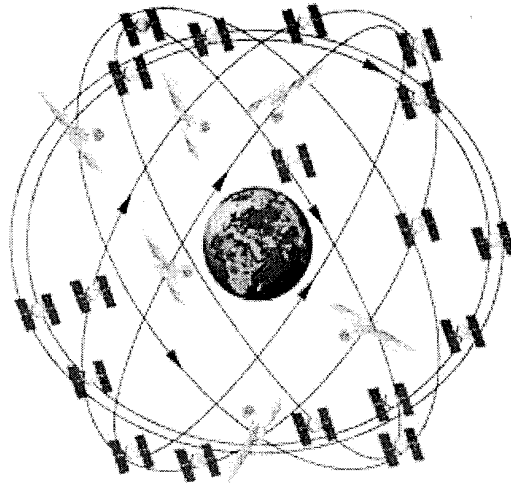
*"The FCC has not discussed with LightSquared any specific sourcing of the technology in our network. Regardless, LightSquared will not include any technology from Huawei or ZTE Corp. in any part of its network."*

Mr. TURNER. 13. Please give us an idea of the size and scope of the GPS system to include applications and users.

Mr. RUSSO. 13. The Global Positioning System (GPS) is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. This system consists of three segments: the space segment, the control segment, and the user segment. The U.S. Air Force develops, maintains, and operates the space and control segments.

Space Segment:

GPS satellites fly in medium Earth orbit (MEO) at an altitude of approximately 20,200 km. Each satellite circles the Earth twice a day.



The satellites in the GPS constellation are arranged into six equally-spaced orbital planes surrounding the Earth, each containing four "slots" occupied by baseline satellites. This 24-slot arrangement ensures there are at least four satellites in view from virtually any point on the planet.

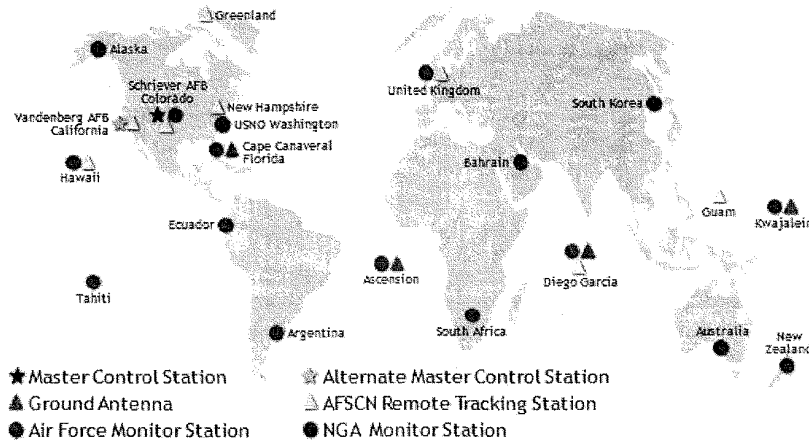
The Air Force normally flies more than 24 GPS satellites to ensure coverage whenever the baseline satellites are serviced or decommissioned. The extra satellites may increase GPS performance but are not considered part of the core constellation. Currently, there are 30 satellites operating with an additional four satellites still functional, but considered to be in "residual" status and not actively contributing to user navigation solutions.

The GPS constellation has now attained the most optimal geometry in its 42-year history, maximizing GPS coverage for all users worldwide.

Control Segment:

The control segment consists of worldwide monitor and control stations that maintain the satellites in their proper orbits through occasional command maneuvers, and adjust the satellite clocks. It tracks the GPS satellites, uploads updated navigational data, and maintains health and status of the satellite constellation.

## Control Segment



### User Segment:

The user segment consists of the GPS receiver equipment, which receives the signals from the GPS satellites and uses the transmitted information to calculate the user's three-dimensional position and time. Most of the GPS receiver equipment is not built or owned by the U.S. Government. There are over a billion GPS receivers worldwide.

### Augmentations:

To date, U.S. taxpayers have invested over \$35B in GPS infrastructure and this figure does not include the extensive investment in systems that augment or enhance GPS services. These services include the FAA's Wide Area Augmentation System (WAAS), Department of Commerce's Continuously Operating Reference Stations (CORS), the U.S. Coast Guard and Department of Transportation's Nationwide Differential Global Positioning System (NDGPS), NASA's Global Differential GPS (GDGPS), or any of the many international and commercial augmentation systems.

### Applications:

GPS is used for many diverse applications; it would be impossible to adequately cover them in this response. A sampling of the civil applications include: agriculture, roads and highways, aviation, shipping/asset tracking, space, recreation, surveying/mapping, weather, disaster preparedness, public safety and disaster relief, rail safety, marine operations, and a host of environmental programs. In addition, the GPS timing service is critical to energy exploration and distribution, telecommunications, cyber networks, banking and finance, and numerous scientific and research applications.

Mr. TURNER. 14. Please elaborate to the extent possible in an open hearing on the military capabilities that rely on GPS.

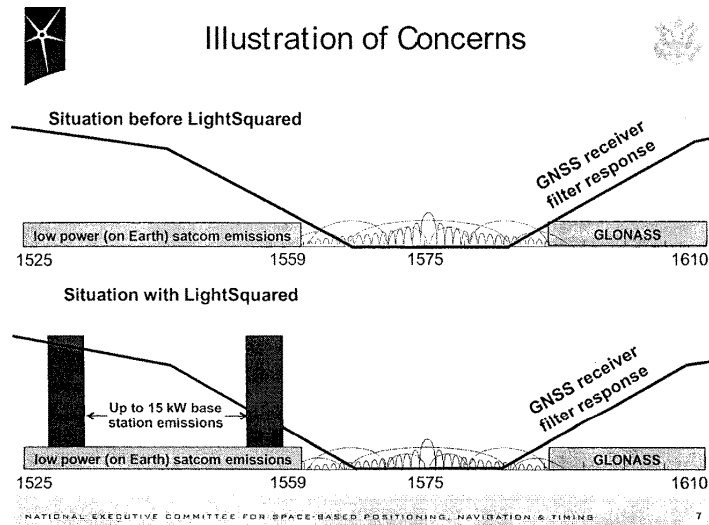
Mr. RUSSO. 14. GPS provides a constant worldwide source for highly precise position and time, both of which are critical for the safe and efficient conduct of military operations and for a transformation to net-centric operations. GPS enhances interoperability in all aspects of military combat operations because of its common-datum, common-grid, and common time capabilities. GPS has also been the catalyst for precision operations by increasing individual weapon effectiveness and minimizing collateral damage. GPS military applications are numerous and include: navigation, target tracking, precision munitions, communications, asset tracking, search and rescue, missile and projectile guidance, aviation, reconnaissance, delivery of humanitarian aid, blue-force tracking, and battlefield management.

Mr. TURNER. 15. LightSquared would operate in a different part of the spectrum (1525–1559 megahertz) than GPS (1559–1610 megahertz). Why is there an interference problem when the two systems would operate in different, but neighboring, parts of the spectrum?

Mr. RUSSO. 15. The issue has to do with the differences between digital radio communications and digital radio navigation. For a communications signal, the receiving device must determine whether each bit is a zero or a one. Determining the se-

quence of zeros and ones, determines the message, which is the point of the transmission.

For navigation, the incoming, one-directional signal sequence of zeros and ones is already known. What the receiver must determine is the precise time of the transition between the ones and zeros. In communications, a message with errors, or missing information, can be retransmitted. For navigation, errors create integrity issues and missing information cause a continuity issue that is critical to some real-time applications. For communications purposes, you only need to see one portion of the transmitted signal to be able to determine the message. For navigation purposes you need to see the full width of the signal. The wider the filter response, the more accurate the solution. However, if the filter receives too much unwanted energy (noise) it can experience something called “overload” or “desensitization” interference. Current GPS filters work fine in an environment where the neighboring signals are weak transmissions from other satellites. Many existing GPS filters are inadequate for the much higher power signals from ground-based towers.



The notional chart above illustrates that GPS filters as they exist today allow full use of the entire width of the GPS signal and still reject the low power satellite transmissions from the band right below GPS. However, the much higher power terrestrial transmissions proposed by LightSquared overload the receiver (particularly for the upper channel transmission).

It may be possible to build a filter system that excludes the higher power signals and still allows the receiver to see the full range of GPS signals. JAVAD GNSS claims to have a system of filters that can do this for the lower of the two LightSquared transmission channels (the one furthest to the left on the chart above), but not the closer of the two channels (or “upper band”).

Federal agencies are concerned even if the lower band filter solutions work, they will increase the cost, weight and power requirements of the GPS receiver, and negatively impact performance characteristics. In addition, it is unclear how the current installed user base would be addressed or who would bear the cost. FCC and NTIA have asked for additional testing to determine the effectiveness of LightSquared’s proposed mitigation strategies and the impacts to application performance requirements.

Mr. TURNER. 16. What is the magnitude of the harmful interference and the national security implications of such interference? Discuss the results of the Department’s testing and any specific examples that substantiate these observations?

Mr. RUSSO. 16. The testing the Government did on the original LightSquared proposal earlier this year conclusively indicates harmful interference to every category of GPS user, including national security users. Gen. Shelton mentioned several specific examples in his testimony before this Committee in both the closed and open

sessions. I defer a more specific discussion of national security implications to Ms. Takai, who testified on behalf of DOD.

In my original written testimony, I included the unclassified portion of the Government's test report. Here are some excerpts relative to the civil applications (all of which assume LSQ operations in both the upper and lower band):

- 1) LightSquared's out-of-band emissions were within the limits they had agreed to with GPS industry and significantly better than what is required by the FCC
- 2) All GPS receiver applications (but not all receivers) were impacted by the proposed network
  - a. Aviation receivers degraded between 0.9 and 19.3 km (for a single tower)
    - i. Aggregate effects would deny aviation use of GPS for hundreds of km
  - b. Space receivers degraded as far as 305.5 km which includes certain NASA satellites in low Earth orbit
  - c. Maritime receivers lost satellite tracking between 0.3 and 1.0 km
  - d. High Precision receivers lost satellite tracking between 1.7 and 6.1 km
- 3) Anecdotal observations from single data points during live transmission test
  - a. New Mexico State Police cruiser lost reception 600 ft from LSQ tower
    - i. Police HQ also lost the location of the cruiser on their tracking system
  - b. An ambulance lost GPS tracking 1,000 ft from the LSQ tower
    - i. Also indicated speed of 9 MPH, while vehicle was actually stationary
  - c. Fire Department vehicle lost GPS at 1,000 ft from LSQ tower
    - i. Last reported location was not near actual location

Some information was collected on LSQ's new proposal for starting operations in only the lower 10 MHz, but was insufficient for a conclusion.

Mr. TURNER. 17. The reviews undertaken suggest that there are certain GPS applications that, even with modification or complete redesign, would still not be able to perform their current mission in the presence of such network broadcasting directly adjacent to the GPS L1 band. What applications?

Mr. RUSSO. 17. Certain applications use not only GPS L1 signals but also signals from the Mobile-Satellite Service (MSS) band right below it—the band where LightSquared operates. Since the augmentation signals they receive in the MSS band can come from any portion of that band, just redesigning the receiver cannot solve this issue. Applications that incorporate these MSS band augmentation signals include precision farming, military reconnaissance drones, surveying, and GM's "On-Star" automobile services.

In other instances, applications may not achieve the extremely high precision they require, even if the proposed filters work properly. These applications may include natural hazard and environmental monitoring, and scientific/research functions. Further testing is needed to determine the effectiveness of proposed receiver modifications and their ultimate impact on mission performance.

Mr. TURNER. 18a. Is LightSquared allowed to build out a terrestrial network today?

18b. What are the limitations, if any?

18c. Under what circumstances could/would buildup be stopped?

18d. Assuming FCC provides authorization for LightSquared to move forward with its deployment plans, as outlined in its November 2010 filing, how would this build-out affect military systems and users in the near-term?

Mr. RUSSO. 18a. Yes.

18b. There are many limitations and conditions on LightSquared's build out of a terrestrial network. One of the most significant is that LightSquared may not commence offering commercial service until the GPS interference issues are resolved. On September 13, 2011, the FCC issued a Public Notice stating "... *additional targeted testing is needed to ensure that any potential services offered by LightSquared will not cause harmful interference to GPS operations.*"

18c. My understanding is only the FCC would have the authority to stop the buildup. I am not knowledgeable about the criteria they would use to decide this or the procedures they would use to implement their decision.

18d. I believe Gen. Shelton covered this in his testimony to this Subcommittee when he testified that tests based on the original LightSquared deployment plans and original FCC authorization "... *demonstrated empirically that the LightSquared signals interfere with all types of receivers in the test.*" His testimony referenced 29 different types of military receivers. I defer discussion of specific mili-

tary system impacts to Ms. Takai and Gen. Shelton, and would expect that the details would be classified at SECRET or above.

Mr. TURNER. 19. Does LightSquared's June 30, 2011, submission to the FCC provide sufficient information on its "lower 10" proposal for your organizations to determine whether the proposal mitigates GPS interference?

Mr. RUSSO. 19. Even LightSquared admits in their June 30, 2011, submission that the "lower 10" proposal does not mitigate GPS interference for all users. In numerous technical interchanges with FCC, NTIA, and LightSquared we have learned more about LightSquared's mitigation strategies which do not solely rely on the "lower 10" proposal. Their proposal partially relies on development of filters and antennas for GPS receivers which we will need to test.

Mr. TURNER. 20. The National Positioning, Navigation & Timing (PNT) Engineering Forum (NPEF) report recommends that the U.S. Government should "conduct more thorough studies on the operational, economic and safety impacts of operating the LightSquared Network." What additional studies and analysis do your organizations (or, you in your professional opinion) believe need to be conducted and why?

Mr. RUSSO. 20. In my professional opinion, the following additional studies and analyses need to be done:

- 1) Comprehensive testing of GPS receivers against the actual proposed LightSquared signal configuration. The signal configuration LightSquared states will mitigate interference for 99.5 percent of GPS users was not part of the original plan.
- 2) Systems-level testing in the expected operational environment. Most of the testing to date has been component-level. Over the past decade, we have seen harmful interference occur on integrated systems in tests, exercises and real-world incidents that were difficult to create in the laboratory environment.
- 3) Test and/or analysis of aggregate effects. With the exception of Aviation-certified receivers, most of the data reported so far has been based on a single LightSquared base station. Under real conditions, interference effects from multiple base stations can produce a larger effect.
- 4) More thorough testing of LightSquared handsets. To date, actual handsets have been unavailable and the simulations we have done are of questionable fidelity. The handsets are much weaker in terms of power compared to base stations, but much more numerous and are expected to be in close proximity to GPS receivers.
- 5) Realistic testing of the effectiveness of LightSquared's proposed mitigation solutions for both high-precision receivers and GPS timing. LightSquared has proposed several different timing antennas and filter systems that appear promising. Government tests need to verify these can be incorporated in high precision receivers and still permit the receivers to meet their mission requirements.
- 6) Once the final end-state is determined, high-fidelity cost estimates need to be done for the costs of retrofitting or replacing existing GPS receivers and associated infrastructure.

Mr. TURNER. 21. Describe your organization's involvement in the FCC process leading to the FCC's January 2011 conditional waiver to LightSquared. Was the Department of Defense, in particular, able to register its concerns with the FCC prior to its decision in January, and if so, how were those concerns addressed?

Mr. RUSSO. 21. The National Coordination Office (NCO) is an administrative office serving the National Space-Based Positioning, Navigation and Timing Executive Committee (EXCOM). The NCO itself is not a decision-making or policy-making body. The EXCOM is comprised of the Deputy Secretaries of the nine different Federal departments (including DOD) or agencies that are the principal Government stakeholders in GPS and systems that augment or back-up GPS.

The issue was brought to the NCO's attention on December 21, 2010, in the context of LightSquared's application for a waiver to the integrated service rules, which would have resulted in a *de facto* re-purposing of the spectrum for terrestrial broadband instead of Mobile-Satellite Service (MSS). This represented a significant change to the interference environment in terms of the number and density of the Ancillary Terrestrial Component (ATC) base stations we would expect to see. I immediately brought the issue to the attention of the EXCOM's Executive Steering Group (Assistant Secretary-level) and on December 27, 2010, I wrote to NTIA to request any action on LightSquared's request for waiver be deferred until testing could be performed. On January 3, 2011, I provided a point paper to all the members of the EXCOM (Deputy Secretary-level) and requested the Deputy Secretary of Defense engage the FCC Chairman to seek a delay to the waiver decision until specific interference effects and mitigation actions could be identified.

The Department of Defense registered its concerns on several levels prior to the FCC decision. Mr. Price, the chief spectrum officer for the DOD, wrote to NTIA on December 28, 2010, to request deferment of action on LightSquared's waiver request and also to request formal Notice of Proposed Rulemaking (NPRM) to allow for a robust public record and adequate interference analysis. Ms. Takai, the DOD Chief Information Officer, personally engaged the NTIA Administrator to express national security concerns. The Deputy Secretary of Defense, Mr. Lynn, wrote to the FCC Chairman on January 12, 2011, to assert there was a "... strong potential for interference to these critical National Security Systems." The Deputy Secretary strongly recommended deferral of the waiver decision until interference studies could be done.

The concerns of DOD, and other Federal agencies, were also registered with the FCC in a January 12, 2011, from the NTIA Administrator to the FCC Chairman recommending that LightSquared not be permitted to offer service until the interference issues were resolved.

The FCC did not agree to use the NPRM process or to defer the waiver as requested by DOD. However, it did address their concerns by making the waiver conditional on resolving the GPS interference concerns raised by DOD and others.

Mr. TURNER. 22. Are your organizations concerned that the FCC can provide final approval for LightSquared operations prior to resolving the GPS interference issues?

Mr. RUSSO. 22. Yes, the organizations are concerned. However, FCC representatives at every level have assured us they will not provide final approval until the GPS interference issues are resolved. The FCC liaison to the Executive Committee made that statement unequivocally to the Deputy Secretaries that sit on the Committee. FCC also testified to this intent to this Subcommittee. And the FCC Chairman himself has said, "... *the commission will not permit LightSquared to begin commercial service without first resolving the commission's concerns about potential widespread harmful interference to GPS devices ... Under no circumstances would I put at risk our nation's national defense or public safety.*"

Mr. TURNER. 23. There appears to be a tension between national space policy, which seeks to mitigate harmful interference to GPS, and national broadband policy, which in this particular case, would cause harmful interference to GPS. How do we reconcile these two policies?

Mr. RUSSO. 23. These policies are not mutually exclusive. The President issued a comprehensive Space Policy in June 2010, which supported maintaining U.S. leadership in space-based positioning, navigation and timing services and also reinforced a long-standing commitment to offer these services on a worldwide, continuous basis free from interruption. Also in June 2010, the President issued an Executive Memo seeking to make available additional spectrum for wireless broadband, but included a provision to "... *ensure no loss of critical existing and planned Federal, State, Local and Tribal Government capabilities.*"

Therefore, the Administration's guidance to Federal agencies seems clear: We should do what we can to collaborate with FCC to find ways to improve the efficiency of spectrum use, but not at the expense of existing and planned GPS services.

Mr. TURNER. 24. Is LightSquared the only current or planned broadband provider where the GPS interference concern is an issue? How are other interference issues being resolved to enable co-existence of broadband and GPS services?

Mr. RUSSO. 24. The Executive Committee requested a briefing on this topic from FCC and NTIA last year after the Presidential Memorandum on Spectrum was issued. On November 5, 2010 the Associate Administrator of NTIA briefed the Executive Committee on the implications of the Broadband initiative on GPS and indicated there were no known impacts. The Chief of the Office of Engineering and Technology for the FCC was also present and had no concerns. However, as the Broadband plan is implemented and evolves, the Executive Committee will continue to work closely with NTIA and FCC on any new developments that could impact GPS service. The Committee's Executive Steering Group has opened an Action Item to create a Spectrum Protection Plan for GPS.

Mr. TURNER. 1. I have learned that during the testimony coordination process, you were asked to include the following in your prepared remarks:

"The Administration believes that we must protect existing GPS users from disruption of the services they depend on today and ensure that innovative new GPS applications can be developed in the future. At the same time, recognizing the President's instruction to identify 500 MHz of new spectrum for innovative new mobile broadband services, we will continue our efforts at more efficient use of spectrum. Therefore, in the short run, we will participate in the further testing required to establish whether there are any mitigation strategies that can enable LSQ operation in the lower 10MHz of the band. We also encourage commercial entities with inter-



ests to work with LightSquared toward a possible resolution, though any proposed mitigation must be subjected to full testing. We hope that testing can be complete within 90 days. The challenge of meeting the President's goal also depends on long-term actions by Federal agencies in the area of research and development, procurement practices that encourage spectrally-efficient applications, and new policy development."

- a. Who, specifically, asked that this be included?
- b. If you declined to include the language, in whole or in part, please describe why.
- c. Did anyone in the Administration attempt to persuade you to include the language? Who?

Mr. KNAPP. 1. I did not receive any requests to include this language, or any other statement from the Administration in my testimony.

Mr. TURNER. 2. Are your responses to these QFRs your own views or those of your agency? Have your responses been approved/edited by anyone other than yourself or someone reporting to you?

Mr. KNAPP. 2. Based on an agreement with your staff on September 14, 2011, FCC Chairman Genachowski designated me as the Commission witness for the September 15, 2011, hearing before the Strategic Forces Subcommittee. I drafted my own testimony in consultation with other Commission staff consistent with standard procedure, and I stand by the contents of my testimony. Since I served as the Chairman's designee, his staff also reviewed the testimony before it was submitted.

Mr. TURNER. 3. Please describe when you and your agency became aware of the LightSquared network proposal and its potential for significant interference.

Mr. KNAPP. 3. The specific answer to your question is that prior to December 2010, I was unaware of the potential for receiver overload of GPS devices, although I now know that the GPS industry raised some concerns in comments and provided assurances of mitigation in September, 2010. To assist the Committee in its understanding of this matter, a more complete explanation of the procedural history is warranted. The relevant timeframe at issue is 2001 to the present. During 2001, I served as Chief of the Policy and Rules Division in the Office of Engineering and Technology (OFT) and became Deputy Chief of OET in 2002. In 2006, then-FCC Chairman Kevin Martin appointed me as OFT Chief.

Additionally, it should be understood that the Commission typically addresses interference issues by setting parameters for transmitters to ensure that they do not emit excessive energy into frequency bands used by other services. The Commission then relies upon equipment manufacturers, service providers, and other stakeholders to ensure their receivers comply with those technical parameters. We also look to these equipment manufacturer and service providers to provide technical information on the performance characteristics of their receivers. They are best positioned to know of their limitations and specifications and should notify the Commission if overload interference is a potential issue as a result of receiver characteristics. Because terrestrial transmitters were expected to operate with some frequency separation from the edge of the GPS band, the potential overload problem was not one that the FCC would have examined in the ordinary course of the proceeding.

Below is the procedural history of the LightSquared matter:

- Commission issues *Notice of Proposed Rulemaking* to permit mobile satellite service providers to offer an ancillary component in response to requests filed by Mobile Satellite Ventures Inc. and New ICO Global Communications.
- Proposal invites comment on whether the proposed rules would protect GPS systems. See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band and the 1.6/2.4 GHz band, Notice of Proposed Rulemaking*, TB Docket No. 01-185, 16 FCC Rcd. 15,532 (2001).

### 2003

- Commission adopts rules permitting MSS licensees to integrate ATC into their satellite networks to provide mobile service to areas where satellite signals are degraded or blocked (*i.e.*, urban areas and inside of buildings). See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, TB Docket Nos. 01-185, 02-364, *Report and Order*, 18 FCC Rcd. 1962 (2003), *as modified by Order on Reconsideration*, 18 FCC Rcd. 13,590 (2003).
- Rules require MSS licensees to offer an integrated satellite and terrestrial service.
- They must maintain a viable satellite service and cannot offer terrestrial service separately.

- Rules also allow up to 1,725 terrestrial base stations to be deployed in the L-band, which includes the spectrum adjacent to and below the GPS band.

**2004**

- Commission's International Bureau authorizes SkyTerra (formerly MSV), to offer an integrated MSS/ATC service to users equipped with dual-mode MSS/ATC mobile devices. Authorization provides for expansive ATC, including the deployment of thousands of terrestrial base stations. *See Mobile Satellite Ventures Subsidiary LLC Application for Minor Modification of Space Station License for AMSC-1, File Nos. SAT-MOD-20031 118-00333, SAT-MOD-20031 118-00332, SESMOD-20031 118-01879, Order and Authorization, 19 FCC Rcd. 22,144 (Int'l Bur. 2004).*

**2005**

- Commission modifies the MSS ATC rules in response to petitions for reconsideration of the 2003 *Order*.
- Adopted rules were (and remain) consistent with the recommendations of the GPS industry and the Executive Branch, which included input from the Department of Defense.
- Commission removes the previously adopted limitation on the number of terrestrial base stations that may be deployed. *See TB Docket Nos. 01-185, Memorandum Opinion and Order and Second Order on Reconsideration 20 FCC Rcd. 4616 (2005) (ATC Reconsideration Order).*
- Extensively discusses the potential overload interference from L-band (SkyTerra) ATC base stations to Inmarsat mobile satellite terminals as well as potential overload interference from 2 GHz ATC mobile devices operating above 1995 MHz to PCS mobile receivers operating in the adjacent band below 1995 MHz.
- No one raises receiver overload interference issue.

**2009 (March-April)**

- Harbinger and SkyTerra together file an application for transfer of control of SkyTerra to Harbinger. SkyTerra subsequently files an application for modification of its authority for an ancillary terrestrial component, including requests for waivers of a number of the Commission's rules for ATC operation. Commission invites public comment on both requests, triggering extensive comments.

**2009 (July-August)**

- GPS industry raises concerns about SkyTerra's application for ATC modifications, stating that the existing out-of-band emissions limits would be insufficient to protect against interference to GPS from LightSquared's planned low power base stations and indoor "femto-cells." Note out-of-band emissions are not the same as receiver overload, which is the basis of the current controversy. No one raises receiver overload issue. SkyTerra and the U.S. GPS Industry Council submit a joint letter to the Commission stating that the out-of-band emissions interference issues had been resolved. No commenter raises any other concerns about GPS interference.

**2010 (March 15)**

- National Broadband Plan Recommendation 5.8.4 calls for the FCC to accelerate terrestrial deployment in the MSS spectrum.

**2010 (March 26)**

- Commission's bureaus and offices issue two orders addressing the 2009 Harbinger and SkyTerra requests and comments:

**(First Order)** SkyTerra Subsidiary LLC Application for Modification Authority for Ancillary Terrestrial Component, *Order and Authorization, 25 FCC Rcd. 3043 (Int'l Bur. 2010).*

- > Authorizes the transfer of control from SkyTerra to Harbinger, explaining Harbinger's plans to construct a hybrid-satellite-terrestrial network and noting terrestrial component would cover 90 percent of the United States.
- > Notes Harbinger's plans to deploy a network that will cover 100 percent of the U.S. population via the satellite component and ultimately over 90 percent of the population via its terrestrial component.
- > Observes that if Harbinger successfully deploys its integrated satellite/terrestrial network, it would be able to provide mobile broadband communications in areas where it is difficult or impossible to provide coverage by terrestrial base stations.
- > Does not waive or alter MSS/ATC rules.

**(Second Order)** See SkyTerra Communications, Inc., Transferor and Harbinger Capital partners Funds, Transferee Applications for Consent to Transfer Control of SkyTerra Subsidiary, LLC, IB Docket No. 08–184, *Memorandum Opinion and Order and Declaratory Ruling*, 25 FCC Rcd. 3059 (TB, OET, WTB, rel. March 25, 2010).

- > Modifies SkyTerra’s authorization to provide ATC, applying conditions to address all technical concerns raised in the comment cycle and granting a request to increase the power level of the base stations.
- > Commission’s bureaus coordinate *Order* with relevant Executive Branch agencies. Notes DOD’s concerns about potential interference to national security systems in certain circumstances and instructs the licensee to continue to work with DOD to resolve these concerns.
- > No one raises receiver overload interference issue.

#### 2010 (July–September)

- Commission follows National Broadband Plan recommendations and initiates a rule making to provide greater flexibility to deploy terrestrial service in the mobile satellite service. See *Notice of Proposed Rulemaking and Notice of Inquiry*, ET Docket No. 10–142, 25 FCC Rcd. 9481.
- GPS Industry Council files comments in September that include reference to the possibility of receiver overload interference to GPS receivers at a distance of about 100 meters from ATC base stations based on state-of-the-art filtering, and notes that for much of the mobile consumer UPS in use, including public safety (e.g., 911 cellphones), the harmful interference effect would be somewhat worse than this case.
- UPS Council notes “[i]n earlier Commission proceedings, the Council has worked collaboratively with MSS operators of ATC to seek mutual agreements that facilitate successful MSS ATC operations and avoid interference to the UPS installed base. The Council believes that solutions are available to mitigate the otherwise unavoidable harmful effects described in these comments and looks forward to working collaboratively with interested parties to explore these issues and potential solutions.”

#### 2010 (November–December)

- November 15: LightSquared announces the successful launch of its first next-generation satellite, SkyTerra 1.
- November 18: LightSquared files a request to modify its ATC authority to accommodate its business plan of selling data network capacity at wholesale, rather than retail (as SkyTerra had done). The request seeks to allow wholesale service providers to offer terrestrial-only handsets at the same power levels and conditions previously granted. See LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, SAT-MOD20101118–00239.
- Commission places November 18th request on *Public Notice*. See Policy Branch Information, Satellite Space Applications Accepted for Filing, Report No. SAT0073 8, *Public Notice* (rel. November 19, 2010); see also LightSquared Subsidiary LLC Request for Modification of its Authority for Ancillary Terrestrial Component, SAT-MOD 20101118–00239, *Order*, DA 10–2243 (TB, Sat. Div., rd. Nov. 26, 2010).
- GPS industry, GPS users and Federal interests object to LightSquared’s planned terrestrial deployment alleging that the GPS environment will be changed by LightSquared’s wholesale model because it will no longer be motivated to be cognizant of the impact on its own satellite service—based on a concern about major potential GPS interference due to “receiver overload.”
- Limited technical data is submitted related to the scope of the receiver overload problem and no mitigation is submitted.

#### 2011 (January)

- International Bureau issues January 26th *Order* modifying LightSquared’s authorization. *Order* provides a conditional waiver of the ATC “integrated services” rule to allow wholesalers to offer mobile terminals with only terrestrial capability, rather than “dual mode” capability (i.e., the ability to communicate in a single handset or terminal via either a satellite or a terrestrial network). *Order* establishes a process to investigate the GPS interference issue that had been raised and stipulates that LightSquared may not offer commercial service until the process is complete and the risk of harmful interference has been resolved.
- *Order* imposes numerous other conditions to ensure that LightSquared will continue to provide a commercially competitive satellite service and will continue

to develop and make available in the marketplace dual mode MSS/ATC-capable devices.

**2011 (July)**

- Technical Working Group submits report concerning results of testing on the GPS receiver overload issues.
- LightSquared states it will not utilize the upper 10 MHz of the L-Band in order to satisfy interference concerns.
- Commission issues a *Public Notice* requesting comment on the report.

**2011 (August)**

- Commission receives over 3,000 comments in the proceeding.

**2011 (September)**

- Commission releases *Public Notice* requiring additional testing. See *Public Notice*, Fed. Commc'ns Comm., Status of Testing in Connection with LightSquared's Request for ATC Commercial Operating Authority (Sept. 13, 2011).

I should also note that I only recently learned that John Deere & Co. (Deere) in 2001 filed comments opposing the proposed merger between LightSquared's predecessor companies (Motient and TMI) based on concerns that this would reduce competition in the provision of mobile satellite service. Deere mentioned in a filing to that proceeding that terrestrial service contemplated under the merger could cause receiver overload interference to GPS. Inmarsat Ventures also filed an opposition to this merger and mentioned the possibility of overload interference to GPS. Neither party provided any data or analyses on this point in their filings a decade ago.

As noted in the timeline above, the Commission subsequently issued a *Notice of Proposed Rulemaking* in 2001 seeking comment on proposals to deploy terrestrial service using the MSS spectrum. To my knowledge, neither Deere nor Inmarsat raised the issue of overload interference to GPS receivers within the context of the subsequent industry-wide MSS/ATC rulemaking proceeding. I am unaware of any other filings that would have advised the Commission of potential interference caused by GPS receiver overload.

Mr. TURNER. 4. LightSquared has recently announced that it has solved the interference issue for 99.5 percent of GPS users.

- a. Do you agree with this statement?
- b. What is the solution?
- c. Is it a solution for uses of GPS for which you are responsible?
- d. Has it been tested by the Federal Government? If so, please provide details.

Mr. KNAPP. 4. LightSquared proposes several mitigation measures. First, LightSquared has proposed to initially use only the lower 10 MHz channel in its spectrum, a step that it believes would avoid harmful interference to the vast majority of existing GPS equipment without any modification. Second, LightSquared has stated that it has developed filters for certain types of GPS equipment that would otherwise still experience interference from its use of the lower channel.

In accordance with the Commission's September 13 *Public Notice*, further tests and evaluations are underway relative to operation on the lower 10 MHz. NTIA currently is analyzing the results of tests designed to gauge whether LightSquared's proposed network will interfere with the operation of GPS receivers in cellphones, car navigation systems, and other consumer-oriented devices used for marine and outdoor recreation activities.

NTIA also will review the results of separate tests planned for GPS receivers used for high-precision and timing applications. Those tests will include GPS devices modified with new filtering technology that LightSquared and other companies have said will solve interference and would need to be added to existing GPS devices. We cannot assess the effectiveness of these measures until the agencies have evaluated and tested the solution and LightSquared or the Executive Branch presents the data to the Commission.

Mr. TURNER. 5. General Shelton stated that he believed that LightSquared's filter "solution" could cost billions of dollars over more than a decade.

- Who would be obligated to pay for the costs of adding filters?
- Will the FCC lift the conditional waiver and allow a final waiver to go forward if the costs of the proposed filters are to be borne by the Federal Government?

Mr. KNAPP. 5. I have not been provided with the data or other sources of information General Shelton relied upon for his statement, and I have not been provided with any specific cost assessments. As I noted during the hearing, it would be premature to attempt to determine costs without first establishing and testing an engineering solution to the problem.

- Until an engineering solution is tested and vetted in the public record, any potential cost analysis or allocation would be premature.
- Under the January 26, 2011, *Order*, LightSquared must resolve all harmful interference claims before it can offer commercial service. The threshold question in any analysis of a filter solution would be whether the filter is effective and viable to retro-fit existing equipment.

Mr. TURNER. 6. In a September 29, 2011, *Washington Post* article by Cecilia Kang, it was reported that LightSquared chief executive Sanjiv Ahuja said during an interview on C-SPAN's "The Communicators" that the company is offering Federal agencies "a sufficient amount of money to replace most receivers or fix most receivers out there."

a. Please provide an estimate of how much money LightSquared would have to spend to "replace most receivers or fix the Federal Government's GPS receivers."

b. How much has the United States Government spent on its GPS receivers?

c. How much have GPS users other than the United States spent on their GPS receivers?

Mr. KNAPP. 6a. See my answer to Question 5, above.

6b. The Commission does not have access to any information on expenditures by other Government agencies for GPS equipment.

6c. The Commission does not have data on the amount of money the public has spent on GPS equipment.

Mr. TURNER. 7. My understanding is that Mr. Russo solicited all Federal Government agencies with GPS equities on their concerns with the LightSquared proposal. Are you aware of any Government position papers on LightSquared interference which have been provided to the National Coordination Office or to the NTIA that have not been forwarded to the FCC and then made public? If so, why were they not made public immediately?

Mr. KNAPP. 7. I am not aware of any such papers.

Mr. TURNER. 8. LightSquared has proposed, as part of its "lower 10 MHz" option a "standstill" on the upper 10 MHz of the spectrum adjacent to the GPS signal. At the same time, LightSquared is said to believe that it needs access to its full spectrum, both the lower and the upper, to be profitable.

a. Please explain what the "standstill" means and what terms LightSquared is proposing for the "standstill."

b. Has LightSquared indicated the "upper 10" of the spectrum is completely, permanently off-the-table? Is that what the "standstill" means?

c. If the "standstill" was only a matter of a few years, what would that mean to your agencies?

d. Should Congress, or the FCC, codify somehow the terms of the "standstill" if it is ultimately determined that the "lower 10 MHz" option is acceptable?

Mr. KNAPP. 8a. Although LightSquared is best positioned to explain its own proposals, I understand LightSquared's current proposal is to initially deploy terrestrial operations on the lower 10 MHz channel. Further, the Commission's September 13, 2011, *Public Notice* specifically states that further targeted testing will focus on the lower 10 MHz channel.

8b. LightSquared is not now proposing to use the upper 10 MHz channel.

8c. The answer to this question would depend on the engineering solutions and the population of devices and their characteristics.

8d. The current conditional waiver contained in the January 26, 2011, *Order* appropriately addresses any potential use of this spectrum, by requiring that all harmful interference issues be resolved. LightSquared would not be permitted to use that spectrum absent satisfaction of the condition.

Mr. TURNER. 9. LightSquared's business plan calls for providing service to 260 million people by 2015. If LightSquared limited its network operations to its "lower 10" proposal, including lower power levels, how much of its business plan does it achieve? Does it need both the "lower 10" and "upper 10" megahertz bands to realize full coverage of 260 million people?

Mr. KNAPP. 9. LightSquared is best positioned to answer questions concerning the implementation of its business plan.

Mr. TURNER. 10. Part of this proposal is a "standstill" on the use of the upper 10 MHz spectrum. What is a "standstill" and how would it work?

Mr. KNAPP. 10. See my answer to Question 8, above.

Mr. TURNER. 11. It has been said by the FCC, including the Chairman, that the FCC handles interference issues all the time, so we can trust it to handle this one. This is a troubling statement, as it seems to be suggesting that this case is a routine matter.

a. I have to ask, is it routine for the Deputy Secretary of Defense to warn the FCC two weeks before it takes an action that that action “has strong potential for interference to . . . critical National Security Systems”?

b. Is it routine for the Deputy Secretary of Defense to have to have to say to the FCC that it and another Department “were not sufficiently included in the development of . . . [a] work plan and its key milestones” and that “we are concerned with this lack of inclusiveness regarding input from federal stakeholders”?

c. We’ve been told that bureaus are permitted to grant waivers of the Commission’s rules instead of initiating a rulemaking where a waiver will serve the public interest and good cause has been shown. Please explain the “public interest” or “good cause” where significant national security concerns were known two weeks before the waiver was issued by the FCC on January 26th.

Mr. KNAPP. 11a. The Commission takes all concerns about the potential for harmful interference seriously, especially those involving public safety, national security, and defense. Indeed, the Commission has successfully resolved many issues in the past where the Department of Defense initially raised concerns about harmful interference. The radio spectrum is a crowded and complex environment, and changes in the use of any particular band of frequencies often lead to disagreements about the potential for interference, including from the Executive Branch. A review of the U.S. Table of Frequency Allocations (available at <http://www.ntia.doc.gov/osr/home/allochrt.html>) gives a visual illustration of why we continually engage other Government entities in discussions about this issue and why the *Memorandum of Understanding* with NTIA exists. NTIA manages Federal spectrum and is advised by the Interdepartment Radio Advisory Committee (IRAC). Among the members of IRAC are DOD, DOE, NASA, DOT, and the State Department. DOD often raises concerns about spectrum matters in this forum, and NTIA takes these concerns, along with other considerations, into account in its deliberations with the Commission on any spectrum proceedings that could affect Federal operations.

11b. The January *Order* established a process that called for LightSquared to form a Technical Working Group including all interested parties and representatives of the Federal Government. The Commission coordinated the *Order* with NTIA and the Federal agencies so they were aware of this process, and they were encouraged to participate. The Department of Defense and the other Federal agencies with GPS interests participated in the Technical Working Group. At the time that the Department of Defense raised its concern about the test plan in March, it believed that the process was moving too quickly and it had not been provided sufficient opportunity to shape the test plan. We contacted the interested parties to ensure that these concerns were addressed. In addition to the report submitted by the Technical Working Group, Federal agencies conducted their own tests under the auspices of the National Positioning, Navigation & Timing (PNT) Engineering Forum (NPEF) that were submitted to the FCC by the NTIA and were inserted in the public record for comment.

11c. The Commission’s staff acted responsibly by taking the unusual step of preventing LightSquared from deploying its network until concerns about potential harmful interference could be resolved. Prior to that point, and based on its current license, LightSquared could have deployed its terrestrial base stations, as long as its handsets included dual satellite and terrestrial capabilities, instead of singular terrestrial capabilities. The staff’s waiver condition addresses this issue. The waiver standard for all Commission activities is longstanding and dates to 1972. See *WAIRadio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972).

Mr. TURNER. 12. The FCC has attempted to assure Congress all along the way, including in the *Public Notice* dated September 13, 2011, that it won’t permit any national security harm. What does that mean? How will that be enforced? Does this mean General Shelton, the general officer in charge of assuring GPS reliability and effectiveness, will have to give a thumbs up to any final action with respect to LightSquared? If not, why not?

Mr. KNAPP. 12. The Commission’s January 26, 2011, *Order* specifically stated that LightSquared may not deploy commercial service until concerns of harmful interference to GPS have been resolved. The Commission is working pursuant to its *MOU* with NTIA to determine whether LightSquared’s proposal can satisfy this requirement. The testing and evaluation process remains ongoing pursuant to the September 13, 2011, *Public Notice*. NTIA currently is analyzing the results of tests designed to gauge whether LightSquared’s proposed network will interfere with the operation of GPS receivers in cellphones, car navigation systems, and other consumer-oriented devices used for marine and outdoor recreation activities.

NTIA also will review the results of separate tests planned for UPS receivers used for high-precision and timing applications. Those tests will include GPS devices

modified with new filtering technology that LightSquared and other companies have said will solve interference and would need to be added to existing GPS devices.

The Commission deals directly with NTJA, which represents the Executive Branch on spectrum management and negotiates on behalf of the Federal agencies. Under the *MOU*, the Commission will continue to work with NTIA directly to resolve this matter. The Department of Defense and General Shelton will have the opportunity to continue to work with the NTIA to ensure that his concerns about interference are adequately addressed through the longstanding and consultative process. It should be noted, however, that we have reached out to individual agencies, including DOD, to discuss their concerns.

Mr. TURNER. 13. Can you tell us if the FCC has discussed with LightSquared whether it will include technology by two firms linked to the Communist Chinese People's Liberation Army, Huawei and ZTE Corp., in this 4G nationwide network, assuming it is approved in some configuration? Will you please take this back to LightSquared and provide a written response to this Committee for the record of the hearing?

Mr. KNAPP. 13. The Commission's Public Safety and Homeland Security Bureau and Office of Legislative Affairs have been working closely with the appropriate congressional offices to ensure that they are aware of the FCC's role in addressing telecommunications equipment importation issues. Questions related to LightSquared's vendor selections are best directed to LightSquared.

Mr. TURNER. 14. LightSquared would operate in a different part of the spectrum (1525–1559 megahertz) than GPS (1559–1610 megahertz). Why is there an interference problem when the two systems would operate in different, but neighboring, parts of the spectrum?

Mr. KNAPP. 14. Out-of-band interference and in-band interference may occur when two systems operate in adjacent spectrum allocations. These two forms of interference have been raised in the context of the LightSquared matter.

Out-of-band emission limitations ensure that a licensee's signal does not bleed into the other frequency band and cause interference to receivers in the adjacent band. The Commission fully considered the issue of out-of-band emissions into the GPS band during the 2001–2005 rulemakings. At that time, the Commission adopted the out-of-band emissions limits recommended by the GPS industry and the NTIA. As noted in the timeline set out to Question 3, the GPS industry raised concerns about "out-of-band" emissions from indoor consumer terminals as a potential problem during the SkyTerra-LightSquared transfer of control process but told the Commission in a 2009 letter that these concerns had been resolved.

In-band interference can cause "receiver overload." This type of interference occurs when a receiver that is intended for reception in one band picks up signals in an adjacent band. In the current case, the primary issue is that GPS receivers will experience "receiver overload" because they do not have sufficient capability to reject signals legally transmitted in the adjacent mobile satellite band from LightSquared's high power base stations.

The FCC does not regulate receivers. As discussed in Question 3, the Commission typically addresses interference issues by setting parameters for transmitters to ensure that they do not emit excessive energy into frequency bands used by other services and relies on equipment manufacturers, service providers, and other stakeholders to ensure their receivers comply with those technical parameters.

It should be noted that other testimony in this hearing suggested that a change in LightSquared's business plan in late 2010 created the receiver overload issue. To correct the record, LightSquared's ATC business plan is based on the FCC's original MSS/ATC rules and on LightSquared's 2004 authorization. LightSquared's planned terrestrial deployment was described plainly in the Commission's March 2010 *Order* authorizing the transfer of control from SkyTerra to Harbinger. Concurrently, the March, 2010 *Order* that modified LightSquared's authorization to provide terrestrial service applied technical and operational conditions to address concerns raised by commenters.

LightSquared's waiver request in November 2010 sought authority to operate on the same channels, with the same network, and at the same power levels, as currently authorized for ATC and required under the March 2010 *Order*, but serving some handsets designed for solely terrestrial service, rather than dual-mode (terrestrial and satellite) communications. The radio frequency environment affecting GPS is technically identical whether the handsets served by LightSquared's network have the ability to provide terrestrial or combined terrestrial-satellite operations.

Mr. TURNER. 15. The reviews undertaken suggest that there are certain UPS applications that, even with modification or complete redesign, would still not be able to perform their current mission in the presence of such network broadcasting directly adjacent to the GPS L1 Band. What applications?

Mr. KNAPP. 15. The Commission's September 13, 2011, *Public Notice* states that further targeted testing will focus on the lower 10 MHz channel. Since the testing and evaluation and review process is still ongoing and the Commission's record remains open, I cannot predict the outcome of that process.

Mr. TURNER. 16. Is LightSquared allowed to build out a terrestrial network today? What are the limitations, if any? Under what circumstances could/would buildup be stopped? Assuming FCC provides authorization for LightSquared to move forward with its deployment plans, as outlined in its November 2010 filing, how would this build-out affect military systems and users in the near-term?

Mr. KNAPP. 16. Until the Commission issued its conditional waiver in the January 26, 2011, *Order*, LightSquared had authority to build out its network as long as the handsets served by its network had dual-mode terrestrial and satellite capability. LightSquared's November 18, 2010 filing requested permission to allow wholesaler customers of LightSquared's network capacity to offer their retail customers terrestrial-only handsets. As noted earlier, as a condition of the waiver, LightSquared was required to maintain a competitive mobile satellite service and to develop dual-mode MSS-ATC mobile terminals that would be available at retail.

The *Order* took the unusual and stringent step of stopping commercial deployment until all harmful interference issues raised in the comment period were resolved. The harmful interference concerns raised in December 2010 involved receiver overload problems. The Commission's *Order* in January 2011 states that no deployment is permissible absent the resolution of harmful interference concerns. This requirement includes protection for military systems and users.

Mr. TURNER. 17. Are FCC and the NTIA looking at other parts of the spectrum for possible LightSquared operations?

Mr. KNAPP. 17. The FCC is not, and there have been no such discussions with NTIA.

Mr. TURNER. 18. DOD briefings to the committee suggest that the part of the L-Band spectrum in question was intended primarily for space-to-ground transmissions. Can you explain the history here and why decisions were made to allow significant terrestrial transmissions in this band?

Mr. KNAPP. 18. My answer to Question 3 provides a timeline that illustrates the historical background of this matter. To summarize, as early as 2001 the Commission proposed to permit ancillary terrestrial service in the mobile satellite spectrum. In 2003, the Commission permitted mobile satellite service (MSS) licensees to integrate ancillary terrestrial components (ATC) into their satellite networks to provide mobile service to areas where the satellite signal is degraded or blocked (*i.e.*, urban areas and into buildings). The Commission determined in 2003 that this change in policy would encourage innovative techniques and better services. In 2004, SkyTerra, the predecessor to LightSquared, was given ATC authorization, which provided for expansive ancillary authority, including authorization to deploy thousands of terrestrial base stations to provide terrestrial services on its authorized satellite spectrum.

Mr. TURNER. 19. Does LightSquared need to submit a formal modification to its November 2010 application outlining its "lower 10" proposal? If not, how will the Federal agencies have sufficient information about the details of its revised plans to provide assessments on potential interference? Does LightSquared's June 30, 2011, submission to the FCC provide sufficient information on its "lower 10" proposal for your organizations to determine whether the proposal mitigates GPS interference?

Mr. KNAPP. 19. LightSquared has not requested a modification to its authorization, and the Commission's record is open on this issue. I believe that sufficient information has been submitted for parties to evaluate LightSquared's proposals, and whatever provisions are necessary to avoid causing harmful interference can ultimately be included in any modification to its authorization.

The Commission's September 13, 2011, *Public Notice* indicates that further targeted testing related to the lower 10 MHz channel is necessary in conjunction with the written request of NTIA and in compliance with the January 2011 *Order*. NTIA is appropriately positioned to take into account Federal agency concerns about harmful interference to GPS. Under the *MOU*, the Commission will continue to work with NTIA and other interested agencies to resolve this matter.

Mr. TURNER. 20. How are DOD comments and concerns addressed at this point in the process?

Mr. KNAPP. 20. NTIA represents Federal spectrum users, including DOD. Under the long-standing *MOU* and as noted in the January 26, 2011, *Order*, the Commission will work with NTIA to resolve all Executive Branch concerns about interference issues. In this instance, we also have engaged in direct discussions with all affected agencies, including DOD.



Mr. TURNER. 21. Section 911 of H.R. 1540, the FY11 National Defense Authorization Act, provides that the conditional waiver for LightSquared issued by the FCC on January 26, 2011, may not be lifted until “the Commission has resolved concerns of widespread harmful interference by such commercial terrestrial operations to the Global Position System devices of the Department of Defense.” How would the Commission comply with this provision? Please be specific.

Mr. KNAPP. 21. Section 911’s language is consistent with the Commission’s January 26, 2011, *Order*. As stated in the *Order*, the Commission is not permitting LightSquared to deploy commercial service until the resolution of harmful interference issues.

Mr. TURNER. 22. In April of this year the Commission issued a Report and Order where it reallocated portions of the 2 GHz spectrum from primary Mobile Satellite Service (MSS) to coprimary MSS and Fixed Mobile uses. This reallocation increased the amount of spectrum available for terrestrial mobile broadband operations by a significant 40 MHz. Why did the Commission not undertake a similar reallocation with the L-Band spectrum that is the subject of the LightSquared conditional waiver of the MSS Ancillary Terrestrial Component (ATC) gating rules? Are the results of these two processes not effectively the same when it comes to the amount of mobile broadband spectrum being made available?

Mr. KNAPP. 22. The circumstances for the L-Band are different from those for the 2 GHz MSS spectrum, which accounts for why they were handled differently. LightSquared shares the L-Band spectrum with Inmarsat. Both LightSquared’s and Inmarsat’s spectrum was fragmented into narrow slices. Consistent with Commission policies to encourage satellite licensees to cooperate in their use of the spectrum, LightSquared reached an agreement to fund the reorganization of Inmarsat’s spectrum to better enable deployment of LightSquared’s integrated satellite and terrestrial service. In short, this was a situation that only the two parties could resolve.

In contrast, the 2 GHz MSS spectrum is authorized to licensees in contiguous blocks so there was no need to untangle use of the spectrum by multiple licensees. The Commission’s April 2011 order was largely a ministerial action. The Commission modified the Table of Frequency Allocations to add a co-primary Fixed and Mobile allocation to the 2 GHz MSS band to make it consistent with the International Table of Allocations. This action for the 2 GHz band laid the groundwork for more flexible use of the band, including for terrestrial broadband services, in the future. See ET Docket No. 10–142, *Report and Order*, 26 FCC Rcd. 5710.

Substantive changes to the Table of Frequency Allocations are generally made through the rule making process. Since there is no international fixed and mobile allocation for the L-Band, the Commission did not propose to change the allocations for this spectrum and rule making was not required.

The Commission has received requests from Dish Network for approval of a transaction to transfer the licenses for the existing 2 GHz MSS spectrum and grant a waiver to deploy terrestrial service under conditions similar to LightSquared. The Commission has not determined how it will address these requests. The Commission has put Dish’s proposed transaction and waiver requests out for public comment, and that proceeding remains open.

Mr. TURNER. 23. Is it not FCC policy enshrined in several orders absolutely to prevent un-integrated terrestrial service in the MSS band, and to ensure that any ATC offered is compatible with co-coverage MSS? If that isn’t the policy, when did the policy change?

Mr. KNAPP. 23. LightSquared has never proposed to provide un-integrated terrestrial service in the MSS band. LightSquared continues to integrate its services and grow its satellite-based services. For instance, using MSAT–1 and MSAT–2, LightSquared provides voice and low-speed data services to customers for various applications, including (1) land-based applications (e.g., voice, asset tracking); (2) maritime applications; and (3) Government applications (e.g., disaster relief). These services are available in North and Central America, the Caribbean, Hawaii and coastal waters.

LightSquared’s satellite system currently serves Federal, state, and local agencies involved in public safety and emergency response operations, including organizations such as the Federal Emergency Management Agency, the Coast Guard, and local fire and police departments. LightSquared also provides fleet management and other services to the transportation and natural resources industries. LightSquared also has entered into an agreement with the Indian Health Service of the U.S. Department of Health and Human Services to provide satellite service to American Indian and Alaska Native communities until 2020.

The waiver granted to LightSquared is based on existing Commission policy and a 2005 *Order* related to its number of base stations and power levels, as well as

the language in the 2010 *Order* permitting the transfer of control from SkyTerra to LightSquared. In granting LightSquared's proposal and the waiver request, the International Bureau considered several factors demonstrating an integrated satellite and terrestrial service: (1) LightSquared's provision of substantial satellite service in the L-Band; (2) its ongoing efforts to coordinate with other L-Band operators and make substantial investments to rationalize operations in the L-Band to enable use of this spectrum for both MSS and ATC broadband services; (3) the steps it has taken to promote dual-mode satellite/terrestrial devices; and (4) its deployment of a 4G satellite/terrestrial network in the L-Band pursuant to unique and substantial terrestrial build out requirements. The Bureau determined that these factors together satisfied the integrated service requirement for ATC, which applies to LightSquared as well as other MSS providers.

Mr. TURNER. 24. When LightSquared filed its request to provide terrestrial-only mobile broadband services in November 2010, was the Commission aware of the GPS receiver overload problem?

- If not, when did the Commission first become aware of this problem?
- Was it ever addressed in the context of the various MSS ATC rulemakings and licensing orders?

Mr. KNAPP. 24. Please see my answer to Question 3, above, for a thorough history of this matter. I first became aware of the receiver overload issue in December, 2010, although I have learned that GPS filed comments that mentioned possible overload interference and mitigation in September, 2010. Also, to clarify and as discussed in my response to Question 23, above, LightSquared will provide integrated satellite and terrestrial services on a wholesale basis. It will not provide terrestrial-only service.

Mr. TURNER. 25. The L-Band and 2 GHz MSS licensees did not pay upfront fees for their use of valuable spectrum. When they operate in ATC mode, especially if the gating rules are waived and they are allowed to operate within their assigned MSS spectrum in terrestrial-only mode, in effect they will be providing a service identical in nature to that provided by the terrestrial carriers.

- Is it fair that the MSS spectrum users in ATC mode will not have paid for use of their spectrum, when others such as ATT and Verizon were required to spend billions of dollars for access to their spectrum?
- Does this disparity not skew the market and place the terrestrial carriers at a disadvantage? Were the gating rules not adopted in large part to avoid this disparity? Please explain.

Mr. KNAPP. 25. The assumption that terrestrial providers such as AT&T and Verizon paid the Government for all of the spectrum they use is mistaken. Prior to the implementation of the Budget Reconciliation Act of 1993, entities receiving FCC licenses did not pay the Government for the value of their spectrum. Licenses were assigned through a range of methods, including comparative hearings and lotteries. AT&T and Verizon hold licenses from the pre-auction period, although they have expanded their networks since that time and acquired spectrum through the auction process.

LightSquared's predecessor in interest (SkyTerra) obtained its licenses in 1995 and assigned them to Harbinger in 2010 in a financial transaction in which Harbinger paid \$1.8 billion. At the time of the initial licensing process, the Orbit Act forbade the auction of MSS spectrum.

Mr. TURNER. 26. The National Positioning, Navigation & Timing (PNT) Engineering Forum (NPEF) report recommends that the U.S. Government should "conduct more thorough studies on the operational, economic and safety impacts of operating the LightSquared Network." What additional studies and analysis do your organizations (or, you in your professional opinion) believe need to be conducted and why?

Mr. KNAPP. 26. The Commission's September 13, 2011, *Public Notice* calls for additional targeted testing and adopts by reference the NTJA's letter concerning additional testing requirements. NTIA currently is analyzing the results of tests designed to gauge whether LightSquared's proposed network will interfere with the operation of GPS receivers in cellphones, car navigation systems, and other consumer-oriented devices used for marine and outdoor recreation activities.

NTIA also will review the results of separate tests planned for GPS receivers used for high-precision and timing applications. Those tests will include UPS devices modified with new filtering technology that LightSquared and other companies have said will solve interference and would need to be added to existing GPS devices.

Mr. TURNER. 27. There appears to be a tension between national space policy, which seeks to mitigate harmful interference to UPS, and national broadband policy, which in this particular case, would cause harmful interference to UPS. How do we reconcile these two policies?

Mr. KNAPP. 27. I do not believe that the two policies are in conflict. Rather, one of the goals in the interference-resolution process has been to bring all of the parties together to develop engineering solutions. From an engineering standpoint, I believe that technical and operational solutions will bring closure to this matter.

Furthermore, the 2004 Presidential Policy on Position, Navigation and Timing (PNT Policy) states that the United States shall, among other things, “improve the performance of space-based positioning, navigation, and timing services, *including more robust* resistance to interference for [emphasis added], and consistent with, U.S. and allied national security purposes, homeland security, and civil, commercial, and scientific users worldwide,” which is consistent with the 2010 National Space Policy stating that the United States will “support international activities to detect, mitigate, and *increase resiliency to harmful interference to GPS*” [emphasis added].

