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THE FCC'S UWB PROCEEDING: AN EXAMINATION OF THE GOVERNMENT'S SPECTRUM MANAGEMENT PROCESS

HEARING

BEFORE THE

SUBCOMMITTEE ON TELECOMMUNICATIONS AND THE INTERNET

OF THE

COMMITTEE ON ENERGY AND COMMERCE

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THE FCC'S UWB PROCEEDING: AN EXAMINATION OF THE GOVERNMENT'S SPECTRUM MANAGEMENT PROCESS

WEDNESDAY, JUNE 5, 2002

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ENERGY AND COMMERCE,
SUBCOMMITTEE ON TELECOMMUNICATIONS
AND THE INTERNET,
Washington, DC.

The subcommittee met, pursuant to notice, at 10 a.m., in room 2123, Rayburn House Office Building, Hon. Fred Upton (chairman) presiding.

Members present: Representatives Upton, Stearns, Shimkus, Davis, Bass, Terry, Tauzin (ex officio), Markey, McCarthy, DeGette, and Sawyer.

Staff present: Howard Waltzman, majority counsel; Will Nordwind, policy coordinator; Brendan Williams, professional staff; Hollyn Kidd, legislative clerk; Andy Levin, minority counsel; and Jessica McNiece, minority staff assistant.

Mr. UPTON. Well, good morning, everyone. Sorry we are late. We had a vote, pressing business on the House floor, a picture. Had to say cheeseburger a few times. We also have a deadline for another subcommittee using this room, so we are going to get started.

Today's hearing is entitled, "The FCC's Ultrawideband Proceeding: An Examination of the Government Spectrum Management Policy." And while to the casual observer the title of today's hearing may sound esoteric and academic, let me suggest why it is not. Ultrawideband, otherwise known as UWB, is an exciting new technology with many promising applications for Americans across the country as well as public safety officials.

One need only consider the three categories of UWB applications to see. First, there are imaging systems, including ground penetrating radar systems, which can help public safety officials detect images of buried objects; wall imaging systems, which can help public safety officials or construction companies detect the location of objects obviously contained in a wall; through-the-wall imaging systems, again help public safety officials; surveillance systems, which will help public safety officials detect intrusions into a secure perimeter; and medical systems, which will help doctors see inside an individual's body. In fact, right after September 11, through-the-wall UWB systems were deployed at Ground Zero and the Pentagon to help with the rescue efforts.

Second, there are vehicular radar systems, which will help drivers detect the locations of objects in their vehicle, enabling vehicles to automatically slow down or stop to avoid collisions in pretension seatbelts. Third, there are communications and measurement systems, which will enable wireless high-speed home and business networking devices and storage tank measurements.

Clearly, UWB has many exciting potential applications for public safety and American consumers, and since UWB devices employ very narrow or short-duration impulses that result in a very wideband transmission bandwidth, they certainly have the potential with appropriate technical standards of operating using spectrum occupied by existing radio services without causing interference; therefore, permitting scarce spectrum resources to be used more efficiently.

So why are we here today? Two reasons: First, we want to specifically examine the FCC's UWB order released on April 22. I would note that the FCC indicates through its order that based on NTIA's recommendation, it was proceeding cautiously and that it was concerned that the standards it was adopting may be overprotective and could unnecessarily constrain the development of UWB technology.

Accordingly, the FCC announced that it would review the UWB standards within the next 6 to 12 months and issue a further rulemaking to explore more flexible, technical standards and to address additional types of UWB operations and technologies. We will still want to know why the FCC feels the way that it does and what the NTIA's response is to those feelings.

Second, we are here today to use the UWB proceedings as a case study to examine how our Nation's spectrum is managed and to inquire as to whether that system of management with its bifurcated division of responsibility between the NTIA and FCC best serves the needs of the 21st century technology. Using the UWB case study, we should explore whether there is a better way to manage our spectrum.

Chairman Tauzin announced that he, along with myself, Mr. Markey, Mr. Dingell and other concerned members of the committee, would begin to focus on spectrum management questions through the creation of a Spectrum Management Task Force, and today's hearing certainly will form the task force examination.

Without a doubt, the UWB proceedings was controversial. The issues were complex, the stakes were high. Notwithstanding that, I want to particularly recognize the efforts of the Commerce Department's Deputy Assistant Secretary Michael Gallagher and the FCC's Deputy Bureau Chief Julius Knapp for all of the sweat equity, which they and their colleagues invested in the process, all under enormous pressure. And I particularly want to tip my hat to them for striking the balance which will enable vehicular radar systems to be deployed because I am convinced that these systems will save lives on America's highways and byways. I am pleased that they are here to testify along with the rest of our witnesses. I look forward to that, and I yield for an opening statement to my friend and colleague from Ohio, Mr. Sawyer.

Mr. SAWYER. Thank you very much, Mr. Chairman, and thank you for calling this hearing. There are a number of questions that

we share, and you covered most of them in your opening statement. The innovation such as ground penetrating radar and through-the-wall imaging systems, as well as the automotive applications, are very substantial. They are important not only in terms of military applications but in terms of public safety and in a lot of applications that would have commercial interest. All of them deserve our careful attention today, and that is why this hearing is important.

I would simply observe, however, that in addition to the military and public safety applications, it seems to me that electronic devices that have come into uses in both of those fields have not been far behind in coming into application in consumer settings. And it seems to me that if we are to respect one another's sense of privacy, that we need to take care with regard to those applications as well as those that you have mentioned.

With that, Mr. Chairman, I will submit my opening statement for the record and yield back the balance of my time.

Mr. UPTON. Thank you. I would announce that I will obviously allow all members to include their opening statements as part of the record and yield at this time to the chairman of the full committee, Mr. Tauzin.

Chairman TAUZIN. Thank you, Mr. Chairman. I want to thank you for convening this hearing today. I commend you for tackling this cutting-edge, complex telecommunications issue. The manner in which ultrawideband technology is fostered or stifled by government policy has huge implications, both for future technologies and for our Nation's spectrum management process, as the chairman pointed out.

Ultrawideband is an exciting new technology that has many promising applications. It has fire and rescue applications, it has military applications, it has vehicular safety applications, it has huge telecommunications applications, it has all sorts of commercial applications. And the FCC's recent ultrawideband decision can be called a major step, but it can also be called very much of a baby step.

The FCC's ultrawideband rulemaking was a hotly contested and contentious proceeding. One could argue that it accurately reflected the give and take that we should expect when any new technology comes along that defies the rigid confines in which we have previously categorized energy emissions. But that's not quite the way I see it.

I watched this proceeding with more than a small degree of horror. I watched certain government bureaucrats and certain industries try their absolute best to stifle this new technology. Ultrawideband technology terrified some people because it was different. Whether it was out of a competitive concern or because technology created intentional emissions where none had previously been encountered, ultrawideband has been met with the fiercest resistance of any technology in recent memory.

This leaves us to evaluate where we are now. We have an FCC order that permits a limited deployment of this new technology. The Commission itself acknowledged just how conservative an approach it was taking. "We are proceeding cautiously in authorizing UWB technology, based in large measure on standards that the National Telecommunications and Information Administration

found to be necessary to protect against interference to vital Federal Government operations." The Commission also stated, "We are concerned that the standards we are adopting may be overprotective and could unnecessarily constrain the development of UWB technology."

The FCC had lots of conflicting data upon which to draw its conclusions. NTIA and other agencies produced mountains of data detailing the potential interference that could be caused by ultrawideband devices. And ultrawideband developers countered with mountains of data regarding why ultrawideband devices will not cause harmful interference.

Now, hopefully, we can get to the bottom of the interference debate. The FCC will conduct its own tests, and conduct them on real devices, not by formulating hypothetical models. I hope, during the next 6 to 12 months, I hope that during the next 6 to 12 months the FCC is able to conduct enough real-world testing so that we have solid, real-world evidence as to whether ultrawideband creates harmful interference in the restricted bands.

I don't want military operations to be interfered with, none of us do, and I don't want planes to fall out of the sky; of course, none of us do. But I want real-world evidence that tells us whether ultrawideband devices, on a stand-alone or cumulative basis, could cause these things to occur.

I want to make one final comment about the implications of this proceeding on the spectrum management process. The way this proceeding was conducted makes me, and I hope other members, very nervous about the current state of how we manage spectrum. NTIA determined the outcome of this proceeding. Let there be no doubt about it, NTIA determined the outcome of this proceeding, not the FCC. The FCC's order is pretty clear about that. The Commission adopted emissions limits based on levels with which NTIA was comfortable. And the NTIA, of course, manages spectrum for the Federal Government, but the FCC is supposed to set the rules for commercial devices, even those that may intentionally emit in the restricted bands. The FCC is supposed to coordinate with the NTIA regarding emissions from commercial entities in the restricted bands.

But I wonder, and I look forward to testimony regarding, whether NTIA's coordination role was a lot more than mere coordination in this proceeding. And if it was, what are the implications of the interaction between the FCC and the NTIA for new technologies that might also intentionally emit energy in the restricted bands or somehow defy current standards in some other way that we can't imagine today?

Sound spectrum management involves a balancing of government and non-governmental interests. While balancing these interests always involves policy issues, good spectrum management requires that sound policy be supported by sound engineering. I don't think that necessarily happened this time.

And I look forward to the FCC's ultrawideband testing, and I hope it demonstrates that ultrawideband technology can flourish without causing harmful interference. This technology is simply too promising, has too many incredibly important applications to stifle it based upon unfounded and unproven concerns. We will see what

happens in the next 6 to 12 months, and I look forward to the testimony today. Thank you, Mr. Chairman.

Mr. UPTON. Recognize Ms. McCarthy.

Ms. MCCARTHY. Thank you, Mr. Chairman. Thank you for having the hearing today. Like the chairman of the full committee mentioned, I really do look forward to hearing how these devices can come to the marketplace without interfering with existing cell phone spectrum and global positioning systems.

For example, Geo Technology is a consulting company which operates in my district, and it uses ground penetrating radar to detect cracks under roads or locate ruptured pipelines without digging. This company has been using GPR technology to advise government road construction contractors where highway repairs are needed, but the FCC order would not allow Geo Technology or other consulting companies to continue the use of GPR. Since 1987, Geo Technology has used ground penetrating radar and global positioning systems side by side without any interference. The FCC has promised to revisit the order within a year of this enactment, and I hope to see changes to allow GPR consultants to continue their important work.

I agree with Mr. Tauzin's 6 months to 12 months, as he emphasized, would be a good timetable for the FCC to use its own real-world data rather than that of theoretical models to determine with accuracy any interference effects of UWB. The public safety and commercial impact of this technology has the potential to be amazing, and I hope the regulatory barriers do not prevent it from saving lives.

UWB has great potential. We must ensure that its development proceeds without interfering with existing technologies that companies have paid billions for use of exclusive uses spectrum. So I look forward to the roll-out of these defense and consumer application as soon as possible, and I am very grateful to the experts who have joined us today to help us sort through this very important technology.

I will put the formal remarks in the record, Mr. Chairman, and yield back.

[The prepared statement of Hon. Karen McCarthy follows:]

PREPARED STATEMENT OF HON. KAREN MCCARTHY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MISSOURI

Thank you Mr. Chairman and Ranking Member Markey for holding this hearing on the ultra wideband approval process. Ultra wideband has the potential to bring to market revolutionary technology previously only imaginable in science fiction works. With wideband high speed, low power devices, police officers and firemen can look through walls to assess dangers within, while cars have the option to speed up and slow down automatically if a crash is imminent. Like the Chairman, I look forward to hearing how government agencies can work together to permit these devices to enter marketplace without interfering with existing cell phone spectrum and global positioning systems (GPS).

UWB will no doubt save countless lives in the future through use of technology that can detect a human body or the smallest amount of movement under rubble or through the wall of a building. I am pleased to see that several companies, including Time Domain, which is represented here today, are ready to fill this public safety void.

I look forward to the results of the FCC tests and their follow up report within the next six to twelve months to determine if UWB causes harmful interference, and if UWB rollout should be expanded to different power levels. The FCC's use of its own real world data rather than that of theoretical models will accurately determine

interference effects of UWB. The public safety and commercial impact of this technology has the potential to be revolutionary, and I hope that the FCC's regulatory barriers do not prevent UWB from saving lives.

Geotechnology, a consulting company which operates in my district, uses ground penetrating radar (GPR) to detect cracks under roads or locate ruptured pipelines without digging. This company has been using GPR technology to advise government road construction contractors where highway repairs are needed, but the FCC order would not allow Geotechnology or other consulting companies to continue use of GPR because consultants are not specifically mentioned in the order. Since 1987, Geotechnology has used ground penetrating radar and global positioning systems side by side without any interference. I hope the FCC makes needed changes to allow GPR consultants to continue their important work.

I understand that the NTIA made a very conservative recommendation in part because the Department of Defense was worried about interference. However, the Department of Defense is eager to use UWB for military applications, and I would like to know how their planes and aircraft radar will work if used in conjunction with UWB.

The FCC has followed the conservative recommendation made by the NTIA, but I look forward to hearing how these agencies will work together to determine the effects of UWB and promote its rollout in the future, as long as there is no interference with existing spectrum users.

UWB has great potential to save lives and make life easier, and we must ensure that its development proceeds without interfering with existing technologies that companies have paid billions for exclusive use of spectrum. I look forward to the rollout of these defense and consumer applications as soon as possible.

Thank you Mr. Chairman. I yield back the balance of my time.

Mr. UPTON. Thank you. Mr. Shimkus?

Mr. SHIMKUS. Thank you, Mr. Chairman. I want to thank you for this hearing. Ultrawideband technology holds great promise, as everyone has said, for public safety and a whole host of commercial applications that would save many lives. One popular example is cited in collision detectors in cars, and I know the chairman has mentioned that numerous times in hearings we had when he was the chairman of this committee, which would also detonate airbags and actually help drivers avoid accidents.

Another is the ability to see underneath building rubble after a disaster and through walls of a burning building to detect in order to save survivors. However, ultrawideband technology sends low-powered pulses across many bands. It has raised some concern that it might cause harmful interference to spectrum bands used by the Department of Defense, Department of Transportation and GPS community. To my knowledge, the testing has shown that the emission levels are low and harmful interference is not an issue. Nevertheless, the FCC issued a very conservative ruling on ultrawideband with a promise to revisit the issue in the next 6 to 12 months.

Now, this is the high-tech committee, I think, of the whole Capitol Hill and especially the House, but we all bring our own different perspectives, and as a former active Army officer and a Reservist, I do carry some of the concerns of the Department of Defense in this debate. I do agree with the chairman that we need real science to help us clear up the confusion over the use of this technology, and I hope we see that to the benefit of all, the commercial community and our men and women who are in uniform fighting to protect us all.

I also have continued concerns over just the whole examination of our spectrum management process, and I think the chairman mentioned this also. And I am not sure if our process works or is fair and if it hinders the development of new technology and can

we improve it? I have had my battles with the NTIA, and I look forward to more battles in the future.

Thank you, Mr. Chairman, for holding this hearing this morning and for your oversight and leadership on this issue. I look forward to hearing from the distinguished panel, and I yield back my time.

Mr. UPTON. Thank you. Ms. DeGette?

Ms. DEGETTE. Mr. Chairman, in the hopes of hearing at least a little of the testimony before I have to leave for another hearing, I will submit my opening statement for the record.

Mr. UPTON. Terrific.

Mr. Bass?

Mr. BASS. Thank you very much, Mr. Chairman. And before I begin my formal statement, I want to welcome a constituent of mine, Mr. Dennis Johnson, who is on the far right there, president of Geophysical Survey Systems in Salem, New Hampshire. Good morning, Mr. Johnson, and welcome to the hearing.

Mr. Chairman, I want to thank you for holding this hearing today and inviting Mr. Johnson and these other witnesses to testify on the FCC's ultrawideband rulemaking, and I look forward to beginning our oversight of this spectrum process allocation. My interest in this issue began when Mr. Johnson first approached me to explain the effect that severely restricting the use of high bandwidth but low power ground penetrating radars would have on his firm and his clients.

He explained the enormous public safety and efficiency benefits of being able to detect and determine the integrity of underground pipes and cables prior to digging and of locating sink holes and other structural voids, defects and stresses. Indeed, several States, including my State in New Hampshire, require the use of GPR or similar technology to determine and document the integrity of new bridges, highway overpasses and other critical safety uses. And it should be noted that these applications, as the name implies, direct their transmission into solids, almost always downward and not in a manner likely to cause interference.

It seems that no one disputes the benefits of using ultrawideband transmissions for these purposes and the many additional purposes that others will describe today, but at issue are the questions about interference and the larger debate over spectrum allocation. As for interference, I will also note that several of the GPR technologies use GPS, global positioning satellites, for mapping purposes without any apparent problems.

I appreciate the Commission's cautious approach and their deference to NTIA's concerns about government interest in this spectrum space. However, I also recognize the enormous benefit to State and local governments of sharing the spectrum in such a manner that will allow all desired uses. I am also encouraged that the Commission has previously announced and am sure, I will repeat here, the intent to review the new rules, as my distinguished chairman said, and conduct the type of testing not done prior to their issuance. I urge that work begin as soon as a body of evidence can be formed, and I look forward to the testimony and yield back to the chairman.

Mr. UPTON. Thank you. That concludes our opening statements. Again, all members will have the opportunity to put their opening remarks as part of the record.

[Additional statements submitted for the record follow:]

PREPARED STATEMENT OF HON. TOM DAVIS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF VIRGINIA

First, I would like to thank Chairman Upton for calling this hearing into the FCC's UWB proceeding. I believe a close examination of this process is invaluable to obtaining a roadmap of where spectrum management efforts need to go in the future.

As Time Domain CEO Ralph Petroff states in his testimony, were it not for the contracts his company had with the Department of Defense, his company would have gone out of business waiting for regulatory approval. We cannot allow the promise of future technologies to whither on the vine while a regulatory process lumbers on. The 3.5 years it took to develop the final UWB rules are a prime example of what to avoid in the future. Most companies simply cannot afford to wait that long.

We all know the conflicts between government agencies and private industry regarding spectrum use are not going to go away. Rather, as demand for spectrum increases, we can expect an increase in the number of conflicts that arise. Therefore, there must be an objective, open system by which conflicts are resolved, concerns addressed, and policy developed. I fully appreciate that national defense and public safety issues must be taken into account in spectrum issues. However, I would hope the FCC and NTIA would do everything in their power to ensure that restrictions deemed necessary were based on sound science. Furthermore, we must acknowledge that the government is both the decision-maker regarding spectrum as well as a consumer. As we continue our efforts to efficiently manage spectrum, we must take care that one consumer—in this case government agencies—does not have approval power over FCC decisions that apply to all other consumers of spectrum.

Specifically regarding the FCC's First Report and Order, I was happy to have rules at last so we can get on with things. I realize the FCC itself feels the rules may be too conservative, but I am encouraged by the plans to conduct further review. The lowest-common-denominator approach the FCC has taken may not be the right solution—I will be eager to see the results by the end of this year and remain hopeful UWB applications will be allowed to develop to the greatest extent possible.

Let me close by saying that I appreciate the difficult task both the FCC and NTIA have in developing spectrum policy. While it will never be possible to please all concerned parties, I would hope the focus would be to determine how we can make new technologies and applications possible, rather than why we cannot.

PREPARED STATEMENT OF HON. ELIOT ENGEL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Thank you Mr. Chairman for calling this hearing. Few issues, like spectrum, are harder to get your arms around. I also want to thank the panelist for taking the time to come and testify.

Looking at how spectrum has develop in the past century, I am reminded of the Malthusian dilemma—that the ability of the world farmers to grow enough food to feed the population was running out. Malthus believed that we would have hordes of hungry people. Luckily, at least here in the United States, this has not come to pass as Malthus predicted—though I must say that we still have a worldwide problem with hunger.

One can make the same arguments about Spectrum. We have a common resource which, due to physics, has limited capacity to carry all the signals we would want it to. The explosion of the wireless industry is a truly amazing feat. It helped drive the record economic expansion during the Clinton Administration.

What Malthus did not factor into his theory was technological improvement. We must not make the same mistake. In fact, Congress and the Administration should be actively encouraging the development of new technologies that seek to exploit spectrum efficiency.

The good news is that through improvements in technology, the industry has increased the number of transmissions that can fit into the same spectrum every year.

But it is evident that spectrum needs are surpassing the efficiency capabilities of today's traditional deployed technologies—new technologies that can get more out of the same spectrum are needed to provide the advanced wireless services we have

heard so much about. We must encourage the deployment of technologies that will create more wireless services within our finite valuable spectrum.

Thus, as I have started to look at Ultra Wide Band technologies, I am greatly encouraged. I am certainly not an expert at this technology, but it seems to me to have great promise in aiding our firefighters, police officers, and emergency medical personnel.

I am quite willing to go slowly on a broad deployment of UWB networks. However, as I understand it, technologies such as Ground Penetrating Radar have been around for decades and proven invaluable in search and rescue operations. Since, this is a proven technology, we should seriously consider this in a different vein than broader deployment.

Also, since previously these devices operated under a blanket approval, the new FCC rules could actually harm existing companies. I have a letter here from a New York company called Penetradar. The President of this company writes that "We are quite concerned with the affect that the new rules will have and believe time is critical." They are concerned that the GPR industry will disappear in the short time that it takes the FCC to review these new rules.

Mr. Chairman, I would ask unanimous consent that the text of the letter be entered into the record.

Thank you Mr. Chairman. I look forward to the question and answer segment of our hearing.

Mr. UPTON. At this point, we welcome our witness guests. Mr. Michael Gallagher who is the Deputy Assistant Secretary for NTIA; Mr. Steven Price, Deputy Assistant Secretary for Spectrum at the Department of Defense; Mr. Jeff Shane, Associate Deputy Secretary from the Department of Transportation, Mr. Julius Knapp, Deputy Chief of Commissions Office of Engineering and Technology from the FCC; Mr. Ralph Gregory Petroff, CEO of Time Domain Corporation; and Mr. Dennis Johnson, president of Geophysical Survey Systems.

Gentlemen, your full statement will be made part of the record, and we would like to have you limit your remarks to about 5 minutes. Watch this little timer. And we will be off to the races.

Mr. Gallagher, welcome you first. If you wouldn't mind turning that mike on. Terrific.

STATEMENTS OF MICHAEL D. GALLAGHER, DEPUTY ASSISTANT SECRETARY, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION; STEVEN PRICE, DEPUTY ASSISTANT SECRETARY FOR SPECTRUM, SPACE, SENSORS AND C3 POLICY, U.S. DEPARTMENT OF DEFENSE; JEFFREY N. SHANE, ASSOCIATE DEPUTY SECRETARY, DEPARTMENT OF TRANSPORTATION; JULIUS P. KNAPP, DEPUTY CHIEF, OFFICE OF ENGINEERING AND TECHNOLOGY, FEDERAL COMMUNICATIONS COMMISSION; RALPH G. PETROFF, CHIEF EXECUTIVE OFFICER, TIME DOMAIN CORPORATION; AND DENNIS J. JOHNSON, PRESIDENT, GEOPHYSICAL SURVEY SYSTEMS, INC.

Mr. GALLAGHER. Thank you, Mr. Chairman. Thank you for holding this hearing. Ultrawideband is certainly on the tip of everybody's tongue these days, and it is a development I am pleased to be here to address and answer questions to. I would also like to thank in particular your staff and the staff of Mr. Tauzin. Your involvement through your staffs was much appreciated and very helpful in getting to the result we finally achieved. I would also like to thank all of the commissioners, the FCC's technical staff and the technical staff of the agencies. It took all of these minds to come together, find the answers, and strike the right bal-

ance. And also it is important to recognize the contribution of the commercial spectrum community and the very valuable input and analysis that they provided. And, finally, but not to diminish their role, I would like to commend the staff work at NTIA that went into this project over 3½ years.

Ultrawideband, we have heard today, holds great promise. The ground penetrating radar applications are already in use. Through-the-wall imaging and the applications for public safety are very compelling. Vehicular radars hold great promise. There are over 41,200 lives lost every year in automobiles, and the estimates are that 88 percent of those could be avoided through rear-end collision avoidance systems, like ultrawideband. Communications devices can have a much greater capacity and use much less battery power.

When we approached ultrawideband at the Department of Commerce, we approached with two pillars in mind. Secretary Evans and Deputy Secretary Bodman made very clear that it is our job to authorize and facilitate the creation of new, world-leading technologies; our economic security depends on it. However, we must also protect critical life and defense systems in the process; our national security depends on it. And within the scope of those systems, the concerns were very clear about weather radar, airport surveillance radar, GPS and passive earth-satellite systems, to name a few. Doing one or the other is not bold or creative. We had to achieve both, and it took leadership from the very highest levels to accomplish the task. And that leadership came from the FCC and from our leadership at the Department of Commerce, and we were pleased with the result.

Now, one of the primary reasons that there was a strong sense of urgency is we face international risk. If the United States fails to lead in deploying ultrawideband technology that fits our congested spectrum chart, then another country could develop ultrawideband technology that would not be as respectful of our systems, our critical life systems, our defense systems as what ultimately was born.

What is next? Testing. We need more facts. We need more peer-reviewed comprehensive real data, and we are looking forward to the development of that data with the Commission and with the private sector. Second, truth. Facts, not theory, should guide our decisions, and in that respect, NTIA performed six technical reports and three analyses with test protocols open to public review. We need to continue to build on that data in order to come up with the absolute best balance over time for ultrawideband. Finally is timeliness. We need to accomplish ultrawideband deployment and any modifications, if necessary, at the right time, when we have the additional real-world data, when we have a penetration more extensive market number of devices, and that will lead us to truth and to the right answer.

I am very pleased, Mr. Chairman, that we were able to adopt a regulatory framework that isn't just vertical but in fact looked horizontal. Thank you. I look forward to answering questions.

[The prepared statement of Michael D. Gallagher follows:]

PREPARED STATEMENT OF MICHAEL D. GALLAGHER, DEPUTY ASSISTANT SECRETARY FOR COMMUNICATIONS AND INFORMATION, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, DEPARTMENT OF COMMERCE

Chairman Upton, I would like to thank you and the members of the Subcommittee for inviting me to testify today about the National Telecommunications and Information Administration's (NTIA's) role in the development of rules to authorize ultrawideband (UWB) technology. I particularly want to commend the leadership of Chairman Michael Powell and the Federal Communications Commission (FCC), as well as the FCC staff, in the UWB authorization process. The process was long, the arguments were highly technical, and the record was voluminous. But, together, the FCC and NTIA were able to meet the challenge and develop a technically sound set of regulations for the safe and effective authorization of UWB technology while preserving public safety and national security.

I am very pleased that new rules adopted by the FCC will ensure that UWB devices will soon be readily available in the marketplace. It is one of the most promising technologies of our time. UWB can perform a number of useful telecommunications functions that make them very appealing for both commercial and government applications. It can be used for communications devices such as wireless networks to transmit high-speed data with low battery drain, remote sensing or tracking, and ground penetrating radar (GPR). UWB through-the-wall imaging systems can also provide great assistance in locating survivors within collapsed buildings and provide situational awareness to law enforcement personnel. UWB technology can also be used for collision avoidance radars—reducing deadly automobile accidents. With the number of invaluable applications of the technology that will soon be available, NTIA fully expects the U.S. Government to continue its role as the UWB industry's best customers.

The regulatory challenge with UWB technology is, as its name implies, that it operates across very wide bandwidths of radio spectrum in which many other commercial and governmental communications systems operate. While most conventional communications technologies are authorized within specific frequency bands to avoid harmful interference to other devices, this traditional spectrum management technique was not an option given the wide bandwidths used by UWB devices. In many cases, their average power levels may have been low enough to be authorized under NTIA's and the FCC's respective rules for unlicensed devices. However, the bandwidths of UWB devices are so wide that some of the systems emit signals in bands in which such intentional transmissions have previously not been permitted because of the potential harmful effects on safety of life and other critical governmental systems. Finding a solution for authorizing UWB devices within the existing spectrum management regime was no small feat and required groundbreaking technical research and the dedication of the professional staffs of NTIA and the FCC.

Admittedly, the outlook for UWB's authorization last fall was dim. The FCC had proposed rules that were strenuously and publicly opposed in writing by several agencies. The pressure from UWB companies was intense, and the FCC was pressing forward on a timeline to close the matter by the year's end. However, with engaged leadership, and a shared focus by NTIA and the FCC on the technical data in hand, we were able to authorize this new, world leading technology that will be sensitive to the needs of the congested U.S. spectrum environment and not imposed on us by the rest of the world.

NTIA is fully aware that with an effort this broad in scope and its potential impacts, many challenges will continue to arise. We have already begun discussion with one group of GPR users who have been unintentionally excluded by the new rules from using GPRs to determine ways to help resolve their concerns. We are also working with the Department of Transportation to complete a study assessing the compatibility of UWB devices and aviation systems operating below 1 GHz.

BACKGROUND

NTIA, like the FCC, has long been aware of UWB technology's earliest practical implementations as GPRs, which grew from research originally begun at some of the government laboratories. As early as 1994, NTIA made preliminary provisions for accommodating this developing technology within NTIA's systems review processes to encourage further developments. In 1997, a number of UWB developers, including TimeDomain, Fantasma, Multispectral Solutions, Inc., and XtremeSpectrum briefed NTIA spectrum managers and researchers on the rapid advances in the technology. These discussions heightened NTIA's awareness of the incredibly exciting opportunities the technology could present not just for commercial applications, but also for Federal agencies in their performance of critical services on behalf of the American people from law enforcement to roadbed construction. Moreover, from a spectrum

management perspective, UWB technology, if properly managed could lead to a much-needed advance towards greater spectrum efficiency.

NTIA identified the challenges and difficulties of analyzing the characteristics of this new technology and its interaction with critical spectrum-dependent public safety and national security systems, including aviation systems used for aircraft landings. These challenges were made greater by the expectation that these new UWB devices had the potential to become ubiquitous in American households and businesses, would be highly mobile, and would be offered on an unlicensed basis, making interference issues more difficult to resolve.

The spectrum managers and researchers at NTIA, however, took very seriously the agency's dual charge to foster new technology and, to assure the Federal agencies' continued protection to the spectrum necessary to perform their critical missions. Thus, in 1998 when Time Domain Corporation, U. S. Radar and Zircon Corporation filed petitions to waive the FCC's rules for low power unlicensed transmitters, referred to as the Part 15 rules, to allow them to manufacture import and sell certain UWB devices, NTIA worked very closely with the FCC to accommodate the requests. In consultation with the Interdepartment Radio Advisory Committee (IRAC), NTIA was able to devise safeguards to protect public safety and critical government systems during the period of the waiver, which the FCC approved when it granted the Time Domain, U.S. Radar, and Zircon waiver requests in 1999. These waivers provided an opportunity for all interested stakeholders to develop a more thorough understanding of the potential impacts that this technology could have on other commercial and governmental systems operating in the bands. Since that date, NTIA has routinely approved requests for Special Temporary Authority from UWB companies seeking to demonstrate the technology's capabilities from commercial technology demonstrations to emergency assistance. In all cases the waiver requests were granted under conditions that did not present a risk to critical safety-of-life or national defense systems. For example, after the September 11th tragedy, NTIA, upon coordination with the potentially affected Federal agencies, and the FCC authorized the use of through-the-wall imaging systems for first responder use at the World Trade Center and Pentagon within 8 hours of the initial request for their use.

NTIA began a significantly detailed measurement and analysis effort at its Institute for Telecommunication Sciences in Boulder, Colorado and within NTIA's Office of Spectrum Management here in Washington when the FCC issued its Notice of Proposed Rulemaking on UWB in May of 2000. These efforts first focused on determining the characteristics of UWB signals in the time and frequency domains. Once the UWB signals were characterized, the information to model the effect of receiver filters on received UWB signals was developed. Using this data with other information concerning interference thresholds, the impact of UWB signals on the critical receiving systems operated by the Federal government in the "restricted bands" was assessed. The restricted bands consist of 64 frequency bands between 90 kHz and 36.5 GHz (a span which covers over 96% of all spectrum use) and occupy a total of 13.283 GHz of spectrum protected by the FCC, NTIA, and international rules against intentional emissions because critical or sensitive receivers operate in them. Protected receivers include radio astronomy and satellite passive sensing and the systems used to land and control aircraft. NTIA focused only on the restricted bands in the 960 MHz to 6 GHz frequency range because of the high density of critical governmental use of those frequencies and the then-limitations of the UWB technology.

NTIA obtained samples of 20 UWB devices for measurement and chose five of the 20 as fairly typical of the group for detailed measurements. NTIA then started two measurement programs to determine the potential effects UWB devices could have on conventional narrowband devices operating in the restricted bands. The documents outlining the two measurement programs were made available to the public and the FCC for comment. The first program examined the emissions from several UWB devices to determine how best to characterize the many types of UWB signals and to describe procedures and methods for measuring UWB signals for developing operable certification standards and criteria. These measurements determined the interference impact of UWB devices on several sensitive devices to determine permissible power levels and corresponding required separation distances and an assessment of the impact of aggregates of several UWB devices.

As part of the first measurement and analysis program, NTIA identified relevant system characteristics and developed operational scenarios for conducting susceptibility studies on several systems that operate in restricted bands. The studies included devices as diverse as radars and other guidance devices used to navigate and safely land airplanes; receive signals from beacons transmitting from plane crash victims and mariners in distress and transmit them to rescue organizations; weath-

er radars used in forecasting and alerting the public to severe weather and floods; and earth stations receiving signals from communication satellites and satellites gathering weather data and photographs.

Recognizing the critical role the Global Positioning System (GPS) plays in the nation's infrastructure, the second portion of NTIA's measurement and analysis program focused on an assessment of the compatibility between UWB devices and GPS receivers. GPS is a satellite navigation system developed by the military that provides accurate navigation signals to any location in the world. The military uses GPS on all land, air, sea, and space platforms and for precision-guided munitions. GPS will also be used in all urban warfare operations in support of homeland defense. GPS has become the preferred navigation system for the aviation community for en-route flight, precision and non-precision approach landings and for maritime navigation. Civilian use of GPS has risen dramatically due to enhanced coverage, improved accuracy, and rapidly decreasing user equipment cost. Some examples of existing and planned uses of GPS include: car navigation, consumer and recreational location, surveying, tracking and machine control, public services, public safety (Enhanced-911 position location) in mobile phones, timing, scientific research, environmental management, precision agriculture, open pit mining, and space navigation. Although these examples are not all inclusive, they illustrate the wide spread use of GPS signals, as well as GPS's ubiquitous availability.

GPS has also proven to be a powerful enabling technology driving the creation of many new industries such as telematics and geographic information systems. A 2001 U.S. Department of Commerce Office of Space Commercialization report estimated that worldwide GPS hardware sales will exceed $9 billion in 2002. As part of the GPS modernization program two new navigation signals will be provided for civil use. Assisted GPS systems, which use local terrestrial stations to process location data, are also being developed to enhance position location inside buildings as well as in difficult propagation environments such as urban canyons.

Once the analyses were completed, NTIA sought public comment on its measurement programs and provided the results in six reports made available to the FCC and placed on the public record in the UWB proceeding. These reports are available at the NTIA website http://www.ntia.doc.gov/osmhome/uwbreports/. The conclusions reached in these reports formed the technical basis of NTIA's understanding of the limits on UWB devices necessary for compatible operation with critical government systems and GPS receivers and were used as the technical baseline for UWB emissions by virtually all parties engaged in the UWB debate.

THE FCC'S AMENDMENT TO THE PART 15 RULES

On February 14, 2002, the FCC approved amendments to its Part 15 rules to permit UWB devices to operate on an unlicensed basis under conditions that are expected to protect existing radio systems operating in the environment. The First Report and Order for UWB devices establishes different technical standards and operating restrictions for different types of UWB devices based on their potential to cause interference. The different types of UWB devices are: 1) imaging systems including GPRs, wall, through-wall, and medical imaging systems; 2) surveillance devices; 3) vehicular radar systems; 4) communications and measurement systems; and 5) mobile hand-held systems. In all frequency ranges, the UWB devices are expected to meet or fall below the emission limits permitted for narrow band Part 15 devices. Narrow band refers to Part 15 devices that operate within a specific frequency band. In the range of frequencies between approximately 1 GHz and 10 GHz additional reduction in the UWB emission levels are required to protect the critical systems discussed above (see Exhibit A). In the bands used by GPS between 960 MHz and 1610 MHz the emission limits are between 12 to 34 dB below the emission limits permitted for unintentional emissions from narrowband devices in order to protect the critical applications of base station assisted GPS. In the 1.6 GHz to 10.6 GHz frequency range, the UWB emission limits are between 10 to 12 dB below the narrowband limits for unintentional emissions. Though these limits are conservative, they are based on NTIA's measurements and comments made on the public record, and reflect the effect of UWB signals on narrowband receivers. Most importantly, these measurements and analysis reflect NTIA's commitment in encouraging UWB technology while maintaining the utmost reliability and safety of our current radio services.[1]

[1] UWB technology can be based on very short pulses of radio energy. Its wide bandwidth yields low probability of intercept and excellent multipath immunity. For more information see the NTIA Institute For Telecommunication Sciences website http://www.its.bldrdoc.gov/home/programs/uwb/.

The new UWB rules also address the needs of automobile manufacturers seeking to deploy new short-range vehicular radar systems that could provide greater automotive safety. A 1999 report from the National Safety Council estimates that a death from vehicle crashes every 13 minutes resulting in 41,200 motor vehicle deaths per year. Statistics from the National Highway Transportation Safety Administration indicates that short-range radar systems could address 88 percent of all causes of rear-end collisions. The short-range radar systems are under development as a key component of the next generation of collision mitigation systems. For example, possible applications include braking automatically to avoid an impending collision with a car ahead that is unseen by the driver, or tightening seat belts or other restraint systems for optimal safety and deployment depending on the expected severity and position of impact. The automotive industry is seeking to develop these radar devices with their frequencies centered at 24.125 GHz with intentional emissions extending between 22.125 to 26.1252 GHz.

The band 23.6-24 GHz is a restricted frequency band currently used by the Federal Government for satellite passive sensing operations because of its unique characteristics. The majority of the measurements using this band are performed over land and depends upon measurements of microwave energy naturally upwelling from the Earth's surface. The atmospheric measurements derived from the satellite sensors operating in the 23.6-24 GHz frequency band are important to Department of Defense air combat mission planners and National Weather Service numerical forecast models. Since emissions from proposed vehicular short-range radar systems will extend into the 23.6-24 GHz band, NTIA recognized the possibility that these systems could cause interference to the Federal Government's passive satellite sensing operations. NTIA worked with representatives from the automobile industry representatives, the National Aeronautical and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA) to perform an analysis examining under what conditions compatible operation would be possible. Based on this analysis, NTIA proposed to establish a time phased approach for emissions from vehicular short-range radar systems into the band, which would allow the technology to be deployed in a phase-in approach. The approach struck a balance between protecting critical Federal passive sensing operations and allowing the deployment of this potentially life-saving technology. I am pleased to note that the FCC adopted this compromise in its rules. Because of the worldwide nature of passive sensing operations, compatibility with UWB short-range radars is also being studied internationally. It is anticipated that the approach recommended by NTIA and adopted by the FCC will drive the standard worldwide.

NTIA'S IMPLEMENTATION OF THE NEW PART 15 RULES

NTIA has already begun to implement the new UWB rules. Our rules authorize Federal agencies to procure and use any device available in the marketplace that has been certified in accordance with the FCC's rules as being compliant with Part 15. When the FCC's new rules go into effect in July, government agencies may purchase and operate or contract for the operation of UWB systems that have been certified as being in conformance to those regulations with no further authorization from NTIA (See Part 7.8 of the *NTIA Manual*). Further, NTIA expects to incorporate appropriate portions of the new Part 15 text into its rules so that the government agencies may construct custom UWB devices that conform to these Rules with no further authorization by NTIA (See Part 7.9 of the *NTIA Manual*). NTIA expects that the vast majority of UWB applications used by the government will fall under either one or the other of these two cases. However, if an agency does need a UWB device that does not conform to the Part 15 Rules, it may seek spectrum support and frequency assignments through our Systems Review and Frequency Assignment processes. Operation of these latter devices will be closely controlled and coordinated with all nearby affected users.

NEXT STEPS

NTIA is quite aware that more testing and analysis is required on the impact of UWB devices on other radio systems. The FCC has indicated a desire to do additional measurements when more UWB devices are developed. We support the FCC's testing and the development of real world test data and will actively participate in these measurements. NTIA is pleased that the United States is now in a position to lead the evolution of UWB technology while protecting safety-of-life and national security systems.

In summary, Mr. Chairman, NTIA works closely with the FCC and the Federal spectrum management community to balance the spectrum needs of the government agencies with those of the private sector. We look forward to continuing to work

closely with them in the future. I thank you for this opportunity to share with you the views of NTIA on this important issue, and I look forward to answering any questions you may have.

GLOSSARY

FCC—Federal Communications Commission
GPR—Ground Penetrating Radar
GPS—Global Positioning System
GHz—Gigahertz
IRAC—Interdepartment Radio Advisory Committee
MHz—Megahertz
NASA—National Aeronautics and Space Administration
NOAA—National Oceanic and Atmospheric Administration
NOI—Notice of Inquiry
NPRM—Notice of Proposed Rule Making
NTIA—National Telecommunications and Information Administration
R&O—Report and Order
UWB—Ultrawideband

EXHIBIT A

OVERVIEW OF SYSTEMS ANALYZED BY NTIA

SYSTEM	FREQUENCY RANGE OF OPERATION
Search and Rescue Satellite (SARSAT) Satellite	406-406.1 MHz
Distance Measuring Equipment Interrogator	960-1215 MHz
Distance Measuring Equipment Transponder	1025-1150 MHz
Global Positioning System (GPS)	1164-1188 MHz; 1215-1240 MHz; and 1559-1610 MHz
Air Traffic Control Radio Beacon System Transponder	1030 MHz
Air Traffic Control Radio Beacon System Interrogator	1090 MHz
Air Route Surveillance Radar (ARSR-4)	1240-1370 MHz
Search and Rescue Satellite (SARSAT) Ground Station Land User Terminal.	1544-1545 MHz
Airport Surveillance Radar (ASR-9)	2700-2900 MHz
Next Generation Weather Radar (NEXRAD)	2700-2900 MHz
Maritime Navigation Radars	2900-3100 MHz
Fixed Satellite Service Earth Stations	3700-4200 MHz
Radar Altimeters4200-4400 MHzMicrowave Landing System (MLS)	5030-5091 MHz
Terminal Doppler Weather Radar (TDWR)	5600-5650 MHz
Satellite Passive Sensors	23.6-24 GHz

Mr. UPTON. Thank you.
Mr. Price.

STATEMENT OF STEVEN PRICE

Mr. PRICE. Thank you, Chairman Upton and members of the subcommittee, for inviting me today. I would also like to thank Howard Waltzman and the other members of your staff for helping us prepare for this hearing.

The Department of Defense truly appreciates that your committee is looking at spectrum issues, in general, and ultrawideband, in particular. Spectrum is the lifeblood of our military. Every ship at sea, every airplane conducting missions, every forward-deployed young man or woman, especially in hard-to-reach locations, depends on spectrum and radios to conduct their missions and to return home safely.

A special forces team leader operating in Afghanistan recently came back and reported to me and others on his experience during Operation Enduring Freedom. "We could go in there naked with flip-flops and as long as we have good radios, we could do our job." Information is one of our most important weapons, and our spectrum and information needs are growing rapidly.

It is critical you understand how the Department of Defense approached the FCC's ultrawideband proceeding earlier this year. As Assistant Secretary of Defense, John Stenbit, my boss, clearly stated in his letter of January 11 to Mike Gallagher at NTIA—you remember this letter—"DOD supports UWB development. However, DOD seeks to ensure that such development will proceed in a manner consistent with core national security needs and objectives."

The Department has been an early and ardent proponent, in fact a founder of ultrawideband technology and plans to use UWB to advance the Nation's defenses. In other words, DOD was not saying no, not trying to stifle anything. We worked hard to develop approaches, even suggesting filters and masks to permit commercial deployment of UWB, so long as they didn't pose risks to sensitive and vital national security systems, such as GPS. To do anything else, we felt, would have been to abdicate our responsibilities. The proceeding did produce a win-win solution to a complex problem. I think most of the people here would agree with that.

We commend the FCC and NTIA, as well as others, for their hard work in this proceeding. It raised a number of new and significant issues. It proposed to approve unlicensed and uncoordinated use of UWB in all Part 15 bands, including heretofore restricted bands. Never before had the FCC and NTIA authorized such unconstrained use across an entire horizontal slice of the spectrum, including restricted bands. This is important because the stakes were exceedingly high for national security.

Tests showed that UWB devices could disrupt GPS operations with emission levels well below the FCC's originally proposed limits. Measurements taken by NTIA and the Department of Transportation and associated government studies have clearly shown that non-licensed use of this technology without proper emission constraints could cause interference to existing radio services. Disruption of GPS by UWB operations could have potentially undermined U.S. efforts in the war on terrorism, eroded homeland defense and led directly the loss of life of forces here and abroad. In such a case, prudence was dictated and prudence was delivered.

It seems fair to argue that the burden of proof was on the UWB proponents to prove that commercial deployment would not interfere with GPS and other systems and to prove so beyond a reasonable doubt. If the goal of the UWB spectrum proceeding was to meet the twin goals of protecting vital national security systems from harmful interference and allowing for the robust development of a new commercial technology, it would seem by initial indications that the FCC accomplished that goal. It is wise public policy to go slow in the initial phases of new technology developments. The alternative, to embrace unacceptable risk with unknown consequences on the basis of conflicting science, would have been unacceptable.

We completely agree with Chairman Tauzin and others that once enough devices are out there, and we can debate the timing of when that will be, and sound science is able to be studied, what the tests show the tests will show, and we will support those tests. In DOD, we have a duty to the young men and women who defend our country, a duty to ensure that they have the tools they need to do their job. We owe them policies to ensure that lack of access

to spectrum should not be a constraint on our war fighter. Thank you very much for your time.

[The prepared statement of Steven Price follows:]

PREPARED STATEMENT OF STEVEN PRICE, DEPUTY ASSISTANT SECRETARY OF DEFENSE

1. INTRODUCTION

I would like to thank the members of this committee, and particularly Chairman Upton, for holding this hearing. Spectrum allocation decisions are timely and important issues, both for commercial interests and the Department of Defense.

The Executive branch, through NTIA and the FCC adopted a "win-win" approach to a very complex and intricate rulemaking proceeding. DoD believes that the final order and future decisions by NTIA with respect to governmental systems will ensure the protection of national security and public safety while opening the door to commercial deployment of UWB. They did not accept the alternative, which was to embrace unacceptable risk, with unknown consequences. Everyone involved should be proud that the nation's spectrum resources were, in this case at least, managed in a manner that safeguarded the national interest, particularly during a time when the country faces domestic and foreign threats while allowing for commercial innovation and technological advancement.

Let me say at the outset that it is critical that you understand how the Defense Department approached the Federal Communications Commission's ("FCC") Ultra Wideband ("UWB") proceeding earlier this year. The proceeding, which culminated in the FCC's ruling on February 14, 2002, did not come at an opportune time for our nation's military. Post September 11 and in the midst of Operation Enduring Freedom, the proceeding took considerable time and effort on the part of our nation's Defense Department. Nonetheless, DoD understood the importance of FCC priorities and DoD played an active role trying to reach consensus and we participated in all aspects of the proceeding.

Far from being an opponent of UWB development and deployment, the Department has been an early and ardent proponent of UWB technologies and plans to use UWB to advance the nation's defense systems. The Department also recognizes that it will benefit from the operational and cost improvements that will result from commercial deployment.

As Assistant Secretary of Defense John Stenbit, my boss, clearly stated in his letter of January 11, 2002 to Michael Gallagher of NTIA, "DoD supports UWB development. However, DoD seeks to ensure that such development will proceed in a manner consistent with core national security needs and objectives . . . DoD, in keeping with our national defense responsibilities, cannot accept any interference with its systems." In other words, DoD was not saying "no". DoD worked hard to develop approaches to permit commercial deployment of UWB technologies in a manner that would not pose risks to sensitive and vital defense and national security systems, such as the Global Positioning Satellite (GPS.) To do anything less would have been to abdicate our constitutional responsibility.

It is important to understand why the Defense Department takes spectrum allocation proceedings so seriously. Spectrum is the life's blood of the Department of Defense. Every ship at sea, every airplane conducting missions, every forward-deployed young man or woman—especially in hard to reach locations—depends on radios and spectrum to conduct missions and to return home safely. A Special Forces team leader operating in Afghanistan was recently quoted as saying that team members could do their jobs naked, in flip-flops, as long as they had the proper radios. Information has become our most effective weapon.

This will be even truer in the future, as DoD's ongoing transformation to a network-centric military will add new demands. A DoD spectrum requirements analysis, completed prior to September 11, 2001 (and therefore likely to be an underestimate) predicted DoD spectrum usage growth of more than 90 percent by 2005. Clearly, DoD's spectrum needs are increasing due to these new operational concepts, including more extensive use of Unmanned Aerial Vehicles, as well as evolving strategies that require joint, dispersed forces to have greater connectivity in the "last tactical mile." In addition, there will be new demands in the arena of homeland defense. These will likely include new spectrum related missions, such as military support for major events (such as was the case in the 2002 Winter Olympics in Salt Lake City), protection of critical infrastructure and emergency response. It will also include use of new technologies.

Spectrum is one of our nation's most valuable natural resources. It is not uncommon for us to use land or real estate analogies to describe spectrum. We use terms

like "beachfront property"—that's how valuable it is. The reason it is so valuable is that it enables so much of the technology that many people look to in order to solve many problems. The communications and information revolution has now resulted in technologies unimagined several years ago: tiny wireless phones, wireless LANs, Internet access from virtually anywhere in the world.

The same is true for military technology. Wireless technology is particularly important for our military forces because of their increasingly mobile and flexible nature. The ongoing revolution in military operations has made information the key component of warfare. Mass of force no longer has the power it once did because our tactics are more sophisticated, as are our warfighters and the equipment they carry. The revolution in personal communications that civilians have experienced is mirrored by a similar revolution in military communications. But these technologies are even more important to the military because of the lack of a wired alternative in many military operations. We can make a call or access the Internet on a landline, but the ship captain, bomber pilot or tank commander has no other option but wireless communications. And because of the way we fight, that information is more important than ever, both to the troops in the field and to the commanders—whether they are in theater or 12,000 miles away.

As these wireless technologies have flourished, competition for the resource that enables them has skyrocketed. One only needs to look at the amount of money bid for spectrum in the most recent auctions to notice this, though not all auctions have been a success in terms of revenues. Over the past 10 years, DoD and other federal agencies have begun to relinquish 247 MHz of prime spectrum to industry. Every re-allocation of spectrum essential to military capability from DoD reduces flexibility, requires that replacement equipment be purchased or a work-around developed and erodes our realistic training. While we recognize that there are many competing needs for spectrum, including needs for commerce, important national defense needs must be a top priority.

The pressure on government spectrum will not end. Wireless technologies and other commercial uses of spectrum will continue to proliferate. UWB, like all other new technologies, is a mere stepping-stone to other technologies—we must arrive at a sound spectrum policy that allows our commercial interests to coexist with public interests. And, at the same time as commercial demands increase, so does DoD becomes increasingly spectrum constrained. It is our view that DoD will need access to additional spectrum allocations in order to meet our long-term goals of transforming to a network-centric military and to meet our obligation to protect our citizens, at home and abroad. To quote the Chairman of the Joint Chiefs of Staff, General Myers, "True transformation must include training and education, doctrine and organizations. As we transform our forces, we need to build capabilities that allow us to defend our interests in a wide array of situations. The key to that, in my view, are flexibility and adaptability."

Before I discuss the FCC's UWB proceeding, I'd like to share the Department of Defense's principles regarding spectrum in order to put the matter in proper context. I believe that it is useful for you to understand how the Defense Department approaches spectrum policy.

2. DOD SPECTRUM PRINCIPLES

DoD spectrum policy is guided by certain core principles. DoD has been guided by these principles during our work with the NTIA and the FCC with regard to the UWB proceeding for the last year and it informs all of our spectrum policy. First, spectrum is a vital national resource. DoD understands that its needs must be balanced with other national needs. Therefore, it supports a US spectrum policy that balances military and economic security. DoD believes that the balance of authority between the President's spectrum manager, the NTIA, and the Federal Communications Commission, as implemented at a practical level, helps to achieve the appropriate balance. That balance must recognize that the Department of Defense must have sufficient spectrum to meet the nation's defense needs. This is a longstanding principal of national spectrum management and it should continue.

Second, spectrum is critical to DoD. It is a core enabler of what we do, and it is indispensable to national security. Therefore, we should not allow lack of sufficient spectrum to be a constraint on the US warfighter or on military capabilities. Senior DoD leadership recognizes that network-centric warfare and the military's ongoing transformation will depend on technology as a force multiplier and demands on bandwidth and access to spectrum will increase. This is true even without taking into account potential requirements of homeland defense. DoD spectrum needs should be driven by military requirements and capabilities, not spectrum allocations.

Third, DoD recognizes that it must be a good spectrum user. DoD must strive to be as efficient a spectrum user as it can be. Much of DoD's spectrum use is unique—unlike the commercial sector's drive for low cost, high revenue solutions, the DoD must put a premium on network and system reliability. DoD's core belief is that where lives are at stake, there is no margin for error—the "call" must get through. When an aircraft is guiding a precision weapon, or a commander is relaying life-saving information to troops on the ground, there cannot be "busy" signals. Some spectrum use that industry might label as "inefficient" is actually designed for anti-jam systems, low probability of intercept, and other "counter counter-measures." For the military, "efficient spectrum use" often translates into "guaranteed information delivery" and because of that, commercial standards that allow a certain percentage of built-in busy signals or dropped calls cannot be tolerated.

Fourth, DoD intends to continue investing in new, spectrum-efficient technologies. It will continue to seek to use technology to alleviate DoD's and the commercial sector's long-term needs for additional spectrum. DoD has been a major contributor to the birth of proven spectrum efficient technologies, including CDMA and software-defined radio, and, for that matter, those that show potential, such as ultra wide-band technologies. Significant research is ongoing within DoD in search of efficient technologies. This research includes extensive work on such topics as adaptive spectrum usage, frequency and bandwidth agility, phased-array antenna configurations, interference mitigation techniques, congestion control technologies and numerous networking projects. In addition, DoD continually seeks to better manage its spectrum allocations.

Fifth, DoD commits to actively supporting US policies and interests in international organizations and multinational and bilateral negotiations for spectrum allocation and use. To do this, however, it is vital that the U.S. national processes recognize that in allocating spectrum according to the balance of needs among Department of Defense, commercial and other users, important national defense needs must be a top priority.

3. U.S. SPECTRUM ALLOCATION PROCESS

Every time a new technology arises the same interests must be balanced against each other: commercial interests versus national security and other public policy interests, such as aviation safety and law enforcements. We can only expect more of these regulatory balancing acts in the future, as more technologies are developed to share spectrum—or reuse it, as is the case of UWB. We must arrive at a sound spectrum policy.

There is an important point that national policy makers need to consider as we make spectrum allocation decisions. The current system places asymmetric risks on the national security and other federal incumbents. From DoD's position, if we lose spectrum or are forced to share and such sharing causes interference with vital systems, as a practical matter little can be done after the fact. Once an allocation has been made, it is difficult if not impossible to put the genie back in the bottle. As the Precursor Group, an industry analyst, says, "the FCC has never repealed authorization of a technology once granted."

DoD bears all of this risk—including the risk that our systems won't operate. The fact that vital systems might be interfered with raises concerns and uncertainties. The uncertainty caused by relocations pose serious issues for our long-term planning: will we be required to move, when will we get the money to move, will we need to retrain, will we retrain in time to be prepared to deploy in an emergency, will we need to change concepts of operations to account for degraded capabilities, will we be able to get host nation approvals to use the system in the new frequency band in all of the parts of the world we might need to do so, will our allies who bought interoperable systems now also be required to modify their existing equipment and, if so, will they pay their bill, will the new spectrum be free of interference?

We believe that the current spectrum management process creates imbalances and asymmetric risks and that these must be set straight through development and enforcement of a rational, long-term spectrum management policy that mirrors national priorities. DOD believes it is important to have a spectrum management system which recognizes that important defense needs for spectrum should be a top priority in allocation, that DOD needs long-term certainty and reliability of access to spectrum, and that, in those cases in which spectrum is reallocated from defense use to commercial use, DOD should not bear costs and risks (including financial risks) associated with the reallocation. However we implement our national spectrum policy, these national security priorities must be accommodated, in terms of how competing interests are balanced, before such a proceeding not during it.

4. FCC UWB PROCEEDING

I want to stress a few key points about the FCC's UWB proceeding. First, we commend FCC for making a very hard and complex decision and doing it by striking a reasoned balance. Second, we commend NTIA for their efforts and their process and role in this complex proceeding. As you know, NTIA, as the President's spectrum manager, has the authority to make decisions regarding government use of spectrum dependent systems. To the extent the FCC February decision impacts federal government use of spectrum, the Executive branch, through NTIA, had concurred.

Third, the FCC's proceeding posed new and significant issues. The proceeding proposed to approve the nonlicensed and uncoordinated emissions of ultrawide band signals into all Part 15 bands. NTIA and FCC had previously agreed that certain narrow band systems could emit at extremely low levels into certain federal government spectrum but not into so-called restricted bands, where commercial users are prohibited from intentionally emitting. Never before had the FCC and the NTIA authorized such unconstrained use of a horizontal slice of the entire spectrum including restricted bands. To the extent that NTIA has agreed to this limited use of "restricted band" spectrum in no way diminishes NTIA and DoD's understanding that "restricted bands" Are often the appropriate mechanism to protect spectrum used for essential national interests, including national security interests. Importantly, the proposed FCC rules set precedent that has the potential to eliminate protection of Government restricted bands. These are essential to national security, safety of life and economic security. In addition, the FCC was not proposing the imposition of any aggregation controls in the licensing process.

Fourth, the stakes were extremely high for our national security. None of the systems at risk from UWB is more important than the federal government systems, including the GPS and other military systems that directly support U.S. troops and public safety officials. In fact, a recent Heritage Foundation homeland security task force report listed as its number two priority, designating GPS as a critical national infrastructure. But the Part 15 emissions originally proposed by the FCC to be allowed into all spectrum, including restricted bands, were inadequate for protection of most federal systems. UWB devices can disrupt GPS operations with emission levels well below the FCC's originally proposed limits, as well as by emission spikes that would exceed those proposed limits. As a result, the proposed rules could have, among other things:

- Degraded the ability to use GPS to navigate and land military aircraft and commercial airliners, threatening the lives and safety of military personnel and the general public;
- Degraded the operation of government airport radars, affecting flight safety;
- Risked causing interference to ground distance-measuring systems that provide vital navigation information to military and commercial aircraft, as well as to rescue stations that host military and public safety operations;
- Eroded our ability to train with precision guided munitions without which so much of our modern tactics would be impossible.

Disruption of these systems by UWB operations could undermine U.S. efforts in the war on terrorism and erode homeland defense. More to the point, disruption of these operations could directly lead to loss of life among U.S. forces and American citizens.

One other reason why the UWB proceeding proved so difficult was because the technology is so new that at the outset no hard science or empirical data existed. Some in the UWB industry said they believed that UWB devices, no matter how many in use, would never interfere with existing users such as GPS. Our view was that unconstrained, aggregated and non-licensed use of UWB devices, as originally proposed, posed a severe risk of interference to existing licensed systems and, therefore, must be governed by sensible technical parameters. Other government agencies believed that even more stringent limits were needed.

Unlike traditional wireless technologies which are restricted to a specific band of frequencies, UWB emits signal energy across an extremely wide range of spectrum bands. Thus, UWB would operate, on a non-licensed basis, across many different wireless bands, in which hundreds of government and commercial users are licensed to provide hundreds of vital and needed wireless services—including vital military, aviation safety and law enforcement systems. In theory, UWB offers "free spectrum" by thinly spreading its energy over many bands. If existing spectrum users are not adversely affected, what's the harm? Yet measurements taken by NTIA and the Department of Transportation—and associated government studies—have clearly shown that non-licensed use of this technology, without proper emission constraints, could cause interference to existing licensed radio services, including public safety

and critical national security systems. For example, even thinly spread UWB energy interferes with very low power signals from distant sources, such as GPS satellites which are over 12,000 miles away. In such a case, prudence is dictated because no one knows for sure—and that is what the FCC, with NTIA concurrence, essentially said.

It is worth considering, What if the FCC had come up with a different outcome? Suppose the following: First, the FCC had decided to allow unconstrained, uncoordinated use of commercial UWB devices throughout the spectrum. Second, UWB industry successfully marketed such devices so that there was widespread deployment. Third, we accept the DoD view that such aggregated, widespread use of UWB devices below 3 GHz could interfere with and hamper GPS operations, in addition to other systems. In such a scenario, the following would have occurred as a direct result of the FCC ruling: money spent on the constellation of GPS satellites would be wasted; safety would be compromised in civil and military aviation which uses GPS for navigation, including in the critical approach phase; spectrum-dependent warfighting systems which depend on GPS would be unusable, degrading our readiness, mission effectiveness and capability, while wasting millions of taxpayer dollars; and the substantial civil investment in GPS would be wasted, including taxpayer dollars, and irreparable harm to US industry that depends on GPS.

Is that an outcome that is in our national interest? Did the proponents of unconstrained use of UWB prove with any scientific facts and to any reasonable person beyond a reasonable doubt that this would not happen? Did they offer DoD and the nation any guarantees? Is any risk such as this worth taking?

Rather, our view and the FCC's ruling took a prudent approach. Allow a commercial industry to develop. In fact, let it thrive. Protect national security and vital systems by imposing moderate limitations that the majority of companies felt were acceptable. Then, see what happens.

In his remarks on February 14, 2001, FCC Chairman Powell stated that the rules announced that day were "fully coordinated with the U.S. Government." The Department agrees with NTIA Deputy Administrator Mike Gallagher's analysis that section 305 of the Communications Act of 1934 preserves the President's authority to authorize use of the radio spectrum for U.S. government owned and operated stations. We are confident that our colleagues at the Commission recognize the authorities and responsibilities of the President, authorities delegated to the NTIA as the Executive Branch spectrum manager, with regard to managing spectrum in a manner that protects Federal Government systems, as set forth in the May 15, 2002 letter.

In this regard, we believe that NTIA should not treat authorization of all DoD UWB device uses in the same way as nonlicensed commercial devices. Under current NTIA Manual provisions, we are required to and do provide NTIA—and all other Federal agencies—the details of our planned UWB device use and seek NTIA authorization to so operate. We intend to continue this practice. Certain DoD present and future uses of UWB will require operation at power levels greater than those allowed for the general public to perform specific missions. DoD will operate many fewer UWB devices than the public. DoD UWB devices will be operated mainly on DoD installations and training areas under the control of the Executive branch. In the case of EMI, the UWB device can easily be located and turned off by local spectrum or command personnel. No such controls exist for UWB devices mass-marketed to the public.

We do agree with NTIA that government use of commercial off-the-shelf UWB devices authorized by the FCC in the FCC proceeding should be encouraged. When possible, we want to use such systems—in part because such use may make these systems more affordable. We support NTIA's intention to update the applicable sections of the NTIA Manual to so make clear. However, we must be free to operate high power UWB—in accordance with criteria appropriate for limited use government systems in order to fulfill military missions. Some of the military missions for which we expect to use UWB include: sniper detection/location; buried weapon cache detection; unexploded ordnance detection; and tunnel complex detection. Without these devices, we would have to send our troops directly in to harm's way in very risky missions. Other uses include, runway void detection; all weather precision formation flying; ship docking radar; and precision radar altimeters for ultra-small UAVs. Without these systems the associated functions would either be impossible or much more dangerous. The NTIA, as the President's spectrum manager, must continue to have the discretion to individually authorize DoD UWB systems at specific locations for specific times and with specific technical characteristics. DoD intends to continue to coordinate the uses of such devices to ensure protection operation of all critical federal government systems and to seek to maximize the efficient use of spectrum.

5. RESULT OF FCC UWB PROCEEDING

If the goal of the UWB spectrum allocation proceeding was to meet the twin goals of (a) protecting vital national security systems from harmful interference while (b) allowing an innovative new technology to develop, then it would seem by initial indications that the FCC accomplished that goal.

DoD primarily was concerned about interference to GPS. GPS is now used by the military in almost every phase of operations. It is used in precision-guided munitions; airplanes use it for navigation; and special operations units operating in Afghanistan use it for coordination with airborne platforms and allied troops. These functions are also performed within the United States, as well. Today's military is designed to "train like they fight." This means that they use the same equipment, the same tactics and even the same frequencies in training that they will use in overseas operations to the greatest extent possible. This goal of making our training as realistic as possible is intended to prepare our troops for combat as best we can, so that when they get there casualties are minimized.

Allowing degradation to systems our troops use in the field would reduce the effectiveness of their training and increase the risk of casualties. The net effect is to cause harm to our national security. UWB operates at such a low power level, that a few UWB devices will not cause interference with critical DoD equipment. However, it is the aggregate effect of the proliferation of such devices that has the potential to cause interference. This effect is often referred to as "raising the noise level" and it occurs when the aggregate effect of many, many UWB devices raises the level of ambient noise. Correcting for this would be very difficult and expensive in systems that are currently deployed because they are engineered for the existing ambient noise level and not the heightened noise level caused by the aggregated effects of UWB devices. This aggregate effect is difficult to predict and, therefore, a "go slow" approach is the preferred way to deal with it.

The R&O contains several emission masks for the various types of envisioned UWB devices. This allows a tailored approach for each individual type of mass-marketed UWB device. The technical criteria indicated by the masks cover DoD's inputs on the draft R&O. The UWB discussion has always been "how low is low enough?" We are dealing with a new technology and feel the masks are a good compromise between allowing the technology into the spectrum on an *nonlicensed basis* and the need to protect vital current—and future federal and civil spectrum dependent services that have a good chance to be in the same operating area. In all cases, the 960-1610 MHz part of the emission mask is the most stringent, since that spectrum supports many safety-of-life radio systems—air traffic control, GPS, and others.

To allow unrestrained deployment of UWB devices could mean opening Pandora's box: once it is opened it is impossible to close and mitigating the negative effect is very difficult and expensive. There are no geographical limits on where the public might use non-licensed UWB devices or under what circumstances. For example, there isn't any reason why a mass-marketed UWB device couldn't be used in or around Reagan National Airport. The potential harm is that widespread commercial use might raise the overall noise level in localized areas to the point where RF reception by licensed services is degraded. We have practical experience with current narrowband Part 15 devices causing interference to licensed users: tactical VHF frequencies near 50 MHz are degraded at some bases due to nearby cordless phone use. This is a clear example of raising the noise floor through aggregate use—no single cordless phone can do this but together they can interfere with critical military and civil systems.

The American public would not, nor should they, tolerate such a mishandling of our spectrum resources. We, therefore, adopted sensible policies as well as technical criteria for public UWB devices that will protect the sanctity of military equipment. Nearly 90% of all federal and civil RF devices operate below 3.1 GHz—it is the most crowded part of the spectrum. Forcing UWB—initially—above 3.1 GHz is part of the Administration's overall strategy to strike a balance between the need to jump-start this technology, but in a responsible manner. One company, Kohler, currently uses UWB technology near 6 GHz, so the technical barriers must be less than envisioned for UWB use above 3.1 GHz. Building and clear path attenuation above 3.1 GHz is greater than below 3.1 GHz. Operating mass-marketed UWB devices above 3.1 GHz provides more isolation between UWB and licensed systems. Therefore, the FCC's decision that allowed for widespread deployment of UWB devices above 3.1 GHz—and out of GPS bands "was not too conservative but rather prudent and logical.

UWB technology brings great possibilities for expanding use of the spectrum because theoretically it can reuse spectrum already employed for other purposes. However, if it turns out that UWB interferes with existing users it will end up costing

us far more than it saves us. We would either have to stop the use of UWB technology or move the existing systems to another band of spectrum. Both of these solutions are highly problematic and expensive. It is much better to go more slowly in the initial phases and ensure that we have a regulatory regime in place that allows for development of a new technology while maintaining the viability of the existing technologies.

6. IMPACT OF FCC RULING

It is too early to know the ultimate impact of the FCC ruling. Only after enough UWB devices are commercially deployed, can the real empirical evidence be gathered and measured to determine whether UWB devices at certain levels cause harmful interferences to federal and commercial systems. But statements by various parties immediately prior to or following the FCC's ruling leads to the conclusion that the FCC and NTIA got it right.

Several UWB proponents issued statements prior to the FCC ruling stating that they believed that a vigorous commercial industry could develop if UWB devices were restricted to intentional emissions above 3.1 GHz. Time Domain, a UWB proponent, issued a public statement on February 14, the day of the FCC ruling, stating that, "The FCC action enables Time Domain to deliver its patented UWB technology to the company's development partners for integration into certain products and applications, including wireless broadband links and precision radar products." Martin Rofheart, chief executive officer of another UWB firm, XtremeSpectrum, Inc., said the FCC's decision was "great for the industry and good for us."

In other words, the commercial vendors do not need to operate below 3.1 GHz in order to market UWB devices commercially. And a Washington Post article last week noted that since the FCC UWB ruling, "competition is growing" and cited a Precursor Group analyst who expressed his view of UWB—"we believe that this will be a serious threat to Blue Tooth and 802.11b."

The UWB industry needs a chance to develop the technology and prove its business case. We have seen many examples where promised technology failed to succeed in the market, even when provided with the required spectrum and policy incentives. We, other federal spectrum users, NTIA and the FCC, need time to learn how to address UWB interference. We need time to gather real world data on interference incidents—or lack of them. We need to see how the coordination process works out. We also need time to do more testing and analysis. The Department has concerns that 6-12 months may not be sufficient to obtain the necessary information to make further policy or technical standards.

7. CONCLUSION

The Executive branch, through NTIA and the FCC adopted a "win-win" approach to a very complex and intricate rulemaking proceeding. DoD believes that the final order and future decisions by NTIA with respect to governmental systems will ensure the protection of national security and public safety while opening the door to commercial deployment of UWB. They did not accept the alternative, which was to embrace unacceptable risk, with unknown consequences. Everyone involved should be proud that the nation's spectrum resources were, in this case at least, managed in a manner that safeguarded the national interest, particularly during a time when the country faces domestic and foreign threats while allowing for commercial innovation and technological advancement.

Mr. UPTON. Thank you.

Mr. Shane.

STATEMENT OF JEFFREY N. SHANE

Mr. SHANE. Good morning, Mr. Chairman and members of the subcommittee. On behalf of Secretary Mineta, I would like to thank you for holding a hearing on these very important topics, ultrawideband technology, and particularly the government's spectrum management process. We appreciate very much the opportunity to participate.

The Department of Transportation is, first and foremost, a public safety and security agency with the responsibility for ensuring the integrity of our Nation's transportation system. In our continuing efforts to improve the safety, security and efficiency of all modes

of transport in these challenging times, we have become increasingly reliant on assured access to the radio spectrum in support of a broad range of what we refer to as communications, navigation and surveillance, CNS, systems. Because these CNS systems are so important today to the safety and efficiency of the movement of people and goods in all modes of transport, it is fair to say that their assured reliability is now essential to the Nation's economic well-being, to its safety and increasingly to its security.

It is from this perspective that the Department of Transportation approaches all new technologies that require access to radio spectrum. We want to explore their promise carefully, but we also want to protect against any interference that could compromise the reliability of vital existing systems. The burden must be, as Stephen Price said, on the proponents of new technologies to demonstrate their deployment will not diminish in any way the essential reliability of these systems.

Having said that, though, I want to assure the subcommittee that the Department fully supports the development and deployment of ultrawideband technology. Indeed, as several members have noted and as Mr. Gallagher noted, some ultrawideband-based applications hold enormous promise for improving transportation safety, ground penetrating radar being one, potential collision avoidance systems for vehicles being another. We simply have to have, however, the highest level of confidence that these applications will be deployed in a way that ensures the continued integrity of transportation-related, safety-of-life systems.

Mr. Chairman, because we attach such importance to the reliability of our CNS systems, they operate in bands of the spectrum that have traditionally been protected from emissions of other systems. That is why Part 15, unlicensed devices, historically have been prohibited from producing intentional emissions into these bands. Anyone seeking to use spectrum for a new purpose had to demonstrate that the newly proposed operations would not interfere with existing systems. We think that this is the appropriate approach, particularly in the case of an emerging and unique technology like ultrawideband, frankly, about which so much is still unknown.

Spectrum requirements for transportation systems are complicated by the fact that particularly for aviation and maritime transport they are often predicated on globally accepted standards. For example, spectrum allocations and standards for aviation are developed by two United Nations organizations: The International Telecommunications Union and the International Civil Aviation Organization. Another U.N. agency, the International Maritime Organization, develops standards for ocean shipping. In international fora like these, the United States has consistently advocated protection for those bands of the spectrum in which critical transportation-related and other systems operate.

The FCC's first Report and Order regarding ultrawideband transmission systems, the so-called R&O, was adopted on February 14. DOT worked very closely with both the FCC and NTIA as they prepared the R&O. Mr. Chairman, you outlined the categories of ultrawideband equipment in the R&O different technical standards apply to each category, including specific frequency bands, mar-

keting restrictions, emissions limits, operating restrictions and coordination requirements. The FCC committed in the R&O to undertake expedited enforcement action in the event of rule violations or harmful interference from UWB devices. That undertaking and the protection it represents is absolutely critical. While the details of the coordination process remain to be developed, that too is a crucial step toward addressing potential interference with our critical CNS systems.

But we already experience from Part 15 devices in the restricted bands, and we have expressed serious concern about the additional potential risk of interference that ultrawideband devices may represent, particularly given the wide swath of spectrum into which they emit energy. I might also note that no equipment is currently available that can readily detect and locate UWB devices should they malfunction. In other words, there would be no way to find and contact the user of a malfunctioning device. While we are working to identify such equipment, the fact that we have not yet done so indicates the need for great care.

We will work together with all appropriate parties to devise a process that spots and resolves cases of interference promptly and effectively, but until we have done so, we will continue to insist on caution. The FCC said in the R&O that it too was proceeding cautiously. At the same time, it indicated that prescribed standards, and I am quoting, "may be overprotective and could unnecessarily constrain the development of UWB technology." The Commission, therefore, announced its intention to review the standards within 6 to 12 months and to, "explore more flexible technical standards and to address the operation of additional types of UWB operations and technology." We are certainly prepared to explore with the FCC and NTIA whether the new standards can be relaxed, but we reserve the right to argue that they may actually have to be strengthened.

The Department also has questions about the timeframe announced by the FCC for the review because, frankly, it seems a little hasty. We will certainly endeavor to provide the needed supporting data and analyses, and in circumstances like these, we understand that there simply is just no substitute for empirical testing and hard data. But DOT's tests and probably other tests will supply only part of the data necessary to reach an informed decision on possible future UWB rules.

Additional analytical work is needed in two areas: prototype testing and aggregation effects. Unfortunately, prototypes of many UWB devices have not been available for testing. Until this equipment is more readily available, crucial data will be lacking. Before changes are made to the current rule, DOT, in conjunction with the NTIA, FCC and other Federal agencies, must be in a position to examine actual real-world results of pro-type testing.

In summary, Mr. Chairman, the Department of Transportation will continue to approach with caution the deployment of any new technology that has the potential to interfere with transportation-related safety-of-life systems. We do not think the FCC has taken too conservative an approach with the current UWB R&O. As we work with NTIA and the FCC to examine potential changes to this

rule, we will continue to demand the highest levels of protection for our transportation systems and the safety of the traveling public.

I thank you again for the opportunity to testify, and we look forward to answering any questions that the subcommittee may have.

[The prepared statement of Jeffrey N. Shane follows:]

PREPARED STATEMENT OF JEFFREY N. SHANE, ASSOCIATE DEPUTY SECRETARY, U.S. DEPARTMENT OF TRANSPORTATION

INTRODUCTION

Good morning, Mr. Chairman and members of the Subcommittee. I would like to thank you and the members of this Subcommittee for holding a hearing on this important topic. The U.S. Department of Transportation (DOT) welcomes this opportunity to present its views on ultra-wideband (UWB) technology.

DOT is first and foremost a public safety and security agency with responsibility for the Nation's transportation systems and those who use them. In our continuing efforts to modernize and improve the safety, efficiency and security of our transportation systems, we have become increasingly reliant on access to spectrum to support a broad range of communications, navigation and surveillance (CNS) systems. These systems are critical to the safe and efficient movement of people and goods in all modes of transportation and must remain absolutely reliable. It is from this perspective that we approach new technologies, exploring their promise while adhering to the imperative that they not interfere with vital existing systems. You will not be surprised to hear that, from DOT's vantage point, the assured integrity of these safety-of-life systems must be a given in the debate about new technologies. The burden should be on the proponents of new technologies to demonstrate that their deployment will not diminish in any way that essential integrity.

That is how we approach the ultra-wideband issue. DOT fully supports the development and deployment of UWB technology. Indeed, several UWB-based applications hold promise for improving transportation safety, such as ground-penetrating radar and potential collision avoidance systems. But we seek assurances that UWB applications are deployed in a way that ensures the continued integrity of transportation-related safety-of-life systems.

SPECTRUM MANAGEMENT ISSUES

The radio spectrum has become an indispensable resource. The huge demand for access to spectrum has increased the potential for interference and this is a serious concern. The Federal Government has a fundamental responsibility to ensure that the highest level of service is provided as we explore new and innovative ways to take advantage of radio spectrum.

DOT makes every effort to scrutinize proposals to introduce new systems or technologies into the electromagnetic environment if they might affect transportation systems. No matter what benefits are foreseen from a proposed new technology or application, we must be certain of its compatibility with existing systems in order to avoid potential conflicts with transportation-related services. If, for example, the FAA's management of the spectrum is affected by unwelcome changes in the spectrum environment, the problem of flight delays might well be exacerbated. FAA might have to slow down the National Airspace System to maintain safe operations.

In the past, spectrum used for navigation was largely allocated exclusively for that purpose. As pressure resulting from spectrum congestion increased, others sought to share the spectrum used for transportation safety systems—and they enjoyed some success in that regard. That success, coupled with the recent rules adopted for UWB devices and the trend towards overlay of services different from the incumbent services, may seriously limit the ability of transportation industries to modernize their systems to keep pace with increasing demands.

DOT's spectrum requirements are complicated by the fact that they are predicated on globally accepted protocols—notably in the case of aviation and maritime shipping. For example, spectrum allocations and standards for aviation are developed by two United Nations organizations—the International Telecommunication Union and the International Civil Aviation Organization. Pilots who fly U.S.-registered aircraft between continents thus can be confident today that the avionics with which their aircraft are equipped will work as well overseas as they do in the U.S. Maritime standards are developed through the International Maritime Organization and provide similar benefits for intercontinental maritime traffic. The allocations and standards have taken many years and resources to adopt and implement. It would

take at least as many years to change them if rules that govern the use of UWB devices are not adequate.

CRITICAL CNS SYSTEMS

It is important to describe at least briefly the CNS systems for which DOT is responsible, and their location in the spectrum. The importance of protecting them against the threat of interference—and the reasons for our concern about the deployment of UWB devices—are described below.

First, roughly eighty percent of CNS systems used for air traffic control operate in bands below 960 Megahertz (MHz). Additional systems operate in bands up to approximately 3 Gigahertz (GHz) to include the Global Positioning System (GPS), maritime radar, airborne collision avoidance, surveillance and communications systems. Some additional critical systems lie between 4 and 6 GHz, including systems for weather radar, landing and airborne altitude measurement. And still more scattered systems for various transportation modes use spectrum up to 90 GHz. A more complete list of transportation systems is appended to my statement.

DOT is particularly concerned about the effects of UWB emissions on the following systems:

- Global Positioning System (GPS) (center frequencies at 1176, 1227 and 1575 MHz)—GPS is being implemented in the U.S. and globally to improve the safety and efficiency of land, air, and maritime transportation. It is also used in many other applications, both civil and military.
- Various Aids to Navigation using frequencies below 960 MHz:
- Very High Frequency Omni-directional Range (VOR) equipment (108-118 MHz), one of the main en route navigation systems used globally by aircraft today.
- The Instrument Landing System (ILS) (108-111.95 MHz; 328.6-335.4MHz), an aviation precision approach and landing aid during severe weather and "no visibility" conditions. It is the main system used both domestically and globally for these as an all-weather landing aid.
- Air Traffic Control Surveillance Radars
- Air Route Surveillance Radar-4 (ARSR-4) (1215-1390 MHz), the most modern of the long-range surveillance radars.
- Airport Surveillance Radar-9 (ASR-9) (2700-2900 MHz), an air traffic control radar used at numerous airports throughout the U.S. and its follow-on ASR-11.
- Systems around 5-6 GHz:
- The Microwave Landing System (MLS) (5030-5091 MHz), an aviation precision approach and landing aid for severe weather conditions—still used at some airports in the U.S. and currently being more widely implemented in Europe.
- The Terminal Doppler Weather Radar (TDWR) (5600 to 5650 MHz) that provides critical weather advisories for windshear and microburst phenomena to aircraft on final approach.
- The Runway Incursion System (5090-5150 MHz), a system in the early stages of development aimed at reducing the number of runway incursions, a top safety issue for aviation.

PROTECTION OF VITAL CNS SYSTEMS IS PARAMOUNT

These and other safety-of-life CNS systems are critical components of the national and international transportation infrastructure. Ensuring the highest level of reliability for these systems and supporting technologies is essential to securing the safety of the traveling public. For this reason, these critical systems operate in bands of the spectrum that are currently protected from the emissions of other systems. That is why Part 15 unlicensed devices traditionally have been prohibited from producing intentional emissions—and their threat of interference—into these restricted bands.

Historically, those who sought to use spectrum for a new purpose had to demonstrate that their operations would not interfere with existing systems. We think that this is the appropriate approach. A similarly cautious approach is indicated in the case of an emerging and unique technology like UWB, about which so much is still unknown.

THE FEDERAL COMMUNICATIONS COMMISSION DECISION

The Federal Communications Commission (FCC) Report and Order Regarding Ultra-wideband Transmission Systems (R&O), issued on April 22, was the product of a coordinated effort between the FCC, which regulates those portions of the radio spectrum dedicated to the private sector and to state and local governments, and the National Telecommunications and Information Administration (NTIA), which

regulates the Federal government's portion of the spectrum. When spectrum is shared between Federal and non-Federal users, as much of spectrum is, these agencies must coordinate the exercise of their authority as co-regulators. DOT worked closely with both agencies as they prepared the R&O.

The R&O approved operation of UWB equipment in three categories: imaging systems, vehicular radar systems, and communications and measurement systems. The first category includes ground penetrating radar, wall and through-wall imaging, and surveillance and medical imaging devices. The second refers to devices mounted on vehicles to detect nearby objects. The third includes home and business networking devices as well as storage tank measurement devices.

Different technical standards apply to each—with specific frequency bands, emission limits, and operating restrictions. For example, the use of imaging systems (other than in emergencies) will be limited to law enforcement, construction companies, and other entities, and subject to coordination with NTIA. Communications and measurement systems will be allowed to operate only indoors or via hand-held devices. In the R&O, the FCC also committed to undertake expedited enforcement action in the event of rule violations or harmful interference from UWB devices. These protections—coordination and enforcement—are critical. While the details of the coordination process remain to be developed, it is a crucial step toward avoiding and addressing potential interference with critical CNS systems. As we move forward with implementing this rule, we look forward to working with NTIA and the FCC to define more fully the details of an effective coordination process.

Rigorous enforcement of the FCC rule is also critical. Such vigilance is necessary both because tests to date have demonstrated the potential for interference to CNS systems from UWB operations, and because experience with other wireless devices has shown that faulty manufacturing or design can lead to malfunctions and interference, even in equipment that is designed to protect against such interference. For example, CNS systems have experienced interference in the past from malfunctioning Part 15 devices that are specifically designed to avoid intentional emissions into the restricted bands. This interference has caused disruptions in the National Airspace System and has taken weeks or longer to find and mitigate. We will work together with all appropriate parties to devise both a responsible and a responsive process that promptly and effectively identifies and resolves cases of interference.

I might also note in this connection that DOT is not aware of any equipment currently available that can detect UWB devices, should they malfunction and need to be located. The characteristics of UWB, such as wide bandwidth, make it very hard to detect. While we are working to identify detection equipment, the lack of this equipment also argues for a cautious approach.

The FCC, in the R&O, acknowledged that it was "proceeding cautiously—based in large measure on standards that the NTIA found to be necessary to protect against interference to vital federal government operations." The FCC expressed concern as well, however, that these standards "may be overprotective and could unnecessarily constrain the development of UWB technology." The Commission therefore announced its intent to review these standards within six to twelve months and "to explore more flexible technical standards and to address the operation of additional types of UWB operations and technology."

IMPLEMENTING THE FCC DECISION

As I indicated, DOT considers it prudent to approach new technology with caution where critical CNS systems are concerned. There is no substitute for hard data, stringent analyses, and validation by tests. As we move forward to implement the FCC rule, we are certainly prepared to explore with the FCC and NTIA whether, on the basis of additional information, the new standards may be either relaxed or strengthened. The Department questions the adequacy of the timeframe announced by the FCC for this purpose, but we will strive to provide needed data and analyses.

In this regard, DOT is instituting tests and analysis in areas where additional information is needed to determine possible effects on many of the systems mentioned earlier. These efforts will focus on:

- The Global Positioning System—verifying previous test results.
- Air traffic control surveillance radars:
- The Air Route Surveillance Radar-4—validating analysis.
- The Airport Surveillance Radar-9—validating analysis.
- Systems below 960 Megahertz including:
- The Instrument Landing System—analysis and testing.
- Very High Frequency Omni-directional Range Equipment—analysis and possible testing.
- The Microwave Landing System—further analysis and possible testing.

There are two points that I would like to emphasize. First, while we appreciate that much attention has been given to protecting GPS, many of the technical solutions that would protect GPS from UWB interference are not necessarily transferable to other systems. Because of different design characteristics, results derived from GPS analyses cannot simply be extended to other systems.

Second, we must protect against even marginal degradations to our critical transportation systems. Taking aviation as an example, even minor weather or other disruptions at an airport can result in delays and ground stops at other airports throughout the nation due to the ripple effect in our congested airspace. Likewise, as policy makers, we need to be cautious of unknown impacts that may result from our decision on one issue, such as UWB technology, to be sure there are no adverse effects in other areas. I have stated some examples of impacts that we believe warrant further scrutiny, such as aggregate noise effect due to proliferation of UWB devices and direct radio frequency interference to certain transportation safety systems that have not been fully analyzed and tested. This is why the Department is so insistent that every effort is made to make the correct decision the first time.

It should be noted that some ultra-wideband vendors have indicated a willingness to constrain the frequencies of their transmissions in order to be compatible with existing uses of the radio spectrum, while others have not. The difference appears to be partly a matter of technology design and implementation, and partly of cost. It is appropriate that any further consideration of rules governing UWB devices take this capability into account.

But DOT's tests will supply only part of the data necessary to reach an informed decision on possible future UWB rules. Additional analytical work is needed in two areas: prototype testing and aggregation effects.

Prototypes of proposed equipment are commonly tested to measure the characteristics of their emissions and their effects. Unfortunately, prototypes of UWB devices have not been available for testing. The FCC had hoped to gain experience on the impact of UWB devices on existing systems as a byproduct of the waivers it granted in 1999 to several UWB manufacturers. To date none of these waivers has resulted in prototype devices for testing or useful test data. Until this omission is corrected, crucial data will remain unknown. Before changes are made to the current rule, DOT, in conjunction with the NTIA, FCC and other Federal agencies, must be in a position to examine the results of prototype testing. We look forward to working with NTIA, FCC and the industry in planning and conducting the appropriate tests.

The aggregate effect of numerous UWB devices and their effect on the noise floor remains to be determined. The noise floor is the level of background energy always present and is increased by emissions from manufactured devices. Some systems like GPS operate below the noise floor level and may suffer reduced accuracy from additional energy in the noise floor. As the use of UWB devices proliferate, we need to pay keen attention to their aggregate impact. Opinions differ about any potential impact and we simply don't know enough about UWB at this time to draw firm conclusions in this regard. We do, however, anticipate that UWB chips will increasingly be used in personal electronic devices. The airline industry already has a growing concern over these personal electronic devices on aircraft. Currently, such electronic devices are required to be turned off during certain critical phases of flight because of their potential for interference.

Experience has shown that low-level signals from a number of otherwise benign devices can, in the aggregate, cause harmful interference. A telling example of this impact has been the proliferation of microwave ovens in this country. The frequency band in which they operate—2.4 GHz—has been rendered useless for critical applications because the background noise level from microwave ovens has increased the noise floor by a thousand-fold, causing significant interference to other uses of the band.

CONCLUSION

In summary, the Department of Transportation will continue to encourage the adoption of a cautious approach to the deployment of new technologies that have the potential to interfere with transportation-related safety-of-life systems. We do not think the FCC has taken too conservative an approach. As we work with NTIA and the FCC to implement and examine potential changes to this rule, we all must continue to demand the highest levels of protection for our transportation systems and for the safety of the traveling public. I thank you for the opportunity to testify and I am happy to answer any questions you may have.

List of CNS Systems Used for Transportation

Frequency Range	System/Short Description
Aviation	
90-110 kHz	LORAN-C1 [1]—en route navigation aid
190-435 & 510-535 kHz	Non-directional Beacon—en route navigation aid
2100-28,000 kHz	High Frequency Communications—en route (mostly oceanic and remote) communications
75 MHz	Navigation Aid (NAVAID) Marker Beacon—used for approach and landing, part of Instrument Landing Systems (ILS)
108-118 MHz	NAVAID (Very High Frequency (VHF) Omni-directional range (VOR), ILS Localizer, Special Category I (SCAT-I)—ILS approach and landing aid; SCAT-1 GPS assisted landings; Local Area Augmentation System (LAAS) future precision approach and landing aid (GPS augmentation)
118-137 MHz	VHF Air/Ground Communications Pilot/controller communication; en route and terminal
162-174 MHz	Fixed, Mobile Communications—Comm. for maintenance and administrative, controlling runway lights, etc.
225-328.6 & 335.4-400 MHz.	Ultra-High Frequency (UHF) Air/Ground Communications—Military pilot/controller
328.6 & 335.4-400 MHz	NAVAID (ILS Glideslope)—Approach and landing aid
406-406.1 MHz	Satellite Emergency Position Indicating Radiobeacon [1]—Emergency beacon for search and rescue
406.1-420 MHz	Fixed, Mobile Communications—Communications for maintenance and administrative, controlling runway lights, etc.
932-935 & 941-944 MHz	Fixed Communications—Data links (radar information) between control towers and remote equipment
960-1215 MHz	NAVAID (TACAN, Distance Measuring Equipment (DME), etc)—TACAN en-route guidance for military aircraft; DME en-route navigation, UAT
1030 & 1090 MHz	Radar Beacon, Traffic Alert and Collision Avoidance Systems (TCAS), Mode S—Identification of aircraft in flight, collision avoidance
1176.45 MHz	GPS L5 Downlink [1]—Future En-route and non-precision landing aid
1227.6 MHz	GPS L2 Downlink [1]
1215-1400 MHz	Air Route Surveillance Radar—En-route surveillance
1544-1545 MHz	Emergency Mobile Satellite Comm. (Downlink)—en route/Oceanic communications
1545-1559 MHz	Aeronautical Mobile Satellite (R) (Downlink)—Safety communication
1559-1610 MHz	Satellite Navigation [1]
1575.42 MHz	GPS L1 Downlink [1]—en-route and non-precision landing aid
1645.5-1646.5 MHz	Emergency Mobile Satellite Communications (Uplink)
1646.5-1660.5 MHz	Aeronautical Mobile Satellite (R) (Uplink)—Safety communication
1710-1850 MHz	Fixed Communications (LDRCL)—radar data, air/ground communication
2700-3000 MHz	Airport Surveillance Radar, Weather Radar—Airport Surveillance Radar (ASR) terminal radar; NEXRAD weather radar
3700-4200 & 5925-6425 MHz.	ANICS (Commercial Satellite Link)—Remote communication in Alaska (leased service)
4200-4400 MHz	Airborne Radar Altimeter—Altitude measuring equipment
5000-5250 MHz	NAVAID Microwave Landing System (MLS) to 5150 MHz—Precision approach and landing aid; Runway Incursion System (future system)
5350-5470 MHz	Airborne Radar and Associated Airborne Beacons—airborne weather radar
5600-5640 MHz	Terminal Doppler Weather Radar (TDWR)—wind shear, microbursts, storms, etc.
7125-8500 MHz	Radio Communications Link—Data links (radar information) between control towers and remote equipment
8750-8850 MHz	Airborne Doppler Radar
9000-9200 MHz	Military Precision Approach Radar—Transportable landing aid; ASDE-X
9300-9500 MHz	Airborne Radars and Associated Airborne Beacons
11.7-12.2 & 14.0-14.5 GHz.	FAA Satellite (Commercial Satellite Links)—Leased service for communication between major FAA facilities
13.25-13.4 GHz	Airborne Doppler Radar
15.7-16.2 GHz	Television (Video) Microwave Link—Radar data to remote control towers
15.7-16.2 GHz	Airport Surface Detection Equipment (ASDE III)—Surveillance of airport surface area
21.2-23.6 GHz	Microwave Link (Multi-Use)—Various communication links
35 and 94 GHz	Synthetic Vision (Experimental)
Maritime	
90-110 kHz	LORAN-C [1]—Vessel navigation
283.5-315 kHz	DGPS corrections link; DGPS—used for harbor/harbor entrance and navigation on inland waterways, rail transportation; and navigation integrity
315-325 kHz	DGPS; DGPS—used for harbor/harbor entrance and navigation on inland waterways, rail transportation, and navigation integrity
415-535 KHz	MF Radiotelegraphy and data
518 kHz	NAVTEX broadcast maritime safety information

List of CNS Systems Used for Transportation—Continued

Frequency Range	System/Short Description
1605-3800 KHz	MF Radiotelephony including distress and safety communications
4-27.5 MHz	HF data/radiotelephony—Maritime distress and safety, including Global Maritime Distress & Safety System (GMDSS)
121.5-243 MHz	EPIRB/ELT distress alerts and emergency locating
156-165 MHz VHF	Radiotelephony—VHF Maritime Communications, including distress, safety, and vessel traffic control
161.975-162.025 MHz	Universal shipborne automatic identification systems (AIS)
162-174 MHz	Fixed, Mobile Communications—Communications for command and control and public safety
225-328.6 & 335.4-400 MHz.	UHF Air/Ground Communications—USCG aircraft
406-406.1 MHz	Satellite Emergency Position Indicating Radiobeacon [1]
406.1-420 MHz	Fixed, Mobile Communications—Comm. for public safety and maintenance
1176.45 MHz	GPS L5 Downlink [1]
1227.6 MHz	GPS L2 Downlink [1]
1535-1544 MHz	GMDSS maritime satellite communications (Downlink)
1544-1545 MHz	Satellite emergency position-indicating radiobeacon (EPIRB) (Downlink)—Distress alerts
1559-1610 MHz	Satellite Navigation [1]
1575.42 MHz	GPS L1 Downlink [1]—Primary maritime navigation
1602-1615 MHz	GLONASS Downlink—Maritime navigation
1626.5-1645.5 MHz	GMDSS maritime satellite communications (Uplink)
2900-3100 MHz	Shipboard and vessel traffic services radar—maritime navigation and collision avoidance (primarily foul weather)
9300-9500 MHz	Shipborne Radars—maritime navigation and collision avoidance
Surficial Transportation	
5.8 GHz	Dedicated Short Range Communications System

[1] It is the case that with these radionavigation systems, there are multi-modal user communities far beyond transportation. In addition to navigation, Loran-C is used to some extent by the telecommunications community for timing. GPS has numerous additional user communities and applications.

Mr. UPTON. Thank you.

Mr. Knapp.

STATEMENT OF JULIUS P. KNAPP

Mr. KNAPP. Chairman Upton, Chairman Tauzin, members of the subcommittee, good morning. The FCC welcomes this opportunity to discuss its proceeding to provide for the introduction of ultrawideband technology. This technology holds great promise for a vast array of new products that have the potential to provide significant benefits for public safety, businesses and consumers. Some of the applications for this technology include radar imaging of objects buried under the ground or behind walls, short-range high-speed data services and vehicle radar systems.

Ultrawideband devices operate by employing very narrow or short-duration pulses that result in very large or wideband transmission bandwidths. With appropriate technical standards, ultrawideband devices can operate using spectrum occupied by existing radio services without causing interference, thereby permitting scarce spectrum resources to be used more efficiently.

On February 14, the Commission adopted a First Report and Order, establishing rules to provide for the development and marketing of unlicensed, low-power ultrawideband devices. The Commission's rules provide for three categories of UWB devices: imaging systems, vehicle radar systems and communications and measurement systems. The first category, imaging systems, includes ground penetrating radars, wall imaging systems, through-wall imaging systems, surveillance systems and medical systems.

Imaging systems generally need to operate in the lower parts of the radio spectrum to operate properly. However, these are also the parts of the spectrum that are used most heavily by other radio services. The rules allow imaging devices to operate below 960 megahertz or above 3.1 gigahertz, preventing them from causing interference in the most sensitive frequency bands used for services such as air traffic control and global positioning systems.

The rules also restricted the users to include law enforcement, fire and emergency rescue organizations, scientific research institutions, commercial mining companies, licensed health care practitioners and construction companies. And at the request of NTIA, the FCC will coordinate the operation of all imaging systems with the Federal Government.

The second category of UWB technology permitted by these rules is vehicle radar systems. Vehicle radars can be used for collision avoidance, safer deployment of airbags and smoother suspension systems that better respond to road conditions. These systems will operate in the upper reaches of the spectrum between 22 and 29 gigahertz where the spectrum is not as heavily used as lower frequency bands.

The third category of UWB devices is communications and measurement systems. These devices can be used for applications such as high-speed home and business networking devices, in-home distribution of digital TV signals and storage tank measurement systems. Existing users of the spectrum expressed the greatest concerns about this category of devices due to the potential for widespread proliferation. The Commission restricted operation of these devices to the frequency band 3.1 to 10.6 gigahertz, thereby avoiding parts of the spectrum that are most heavily used, including the GPS band.

Because ultrawideband devices emit energy over large swaths of spectrum, emissions in the spectrum used by both government and non-government systems cannot be avoided. Therefore, the FCC and the NTIA have shared jurisdictional responsibilities. Throughout the ultrawideband proceeding, the staffs of the Commission, NTIA and other Federal agencies and departments, worked together cooperatively to develop rules that will enable initial deployment of ultrawideband technologies while ensuring that incumbent government systems are fully protected against harmful interference.

The technical rules are based, in large measure, on standards recommended by NTIA, that NTIA believes are necessary to protect against interference to vital Federal Government operations, including safety systems. We are extremely confident that the standards the Commission adopted for UWB devices will protect against harmful interference to both government and non-government operations.

The FCC plans to closely monitor the introduction of this technology through our Equipment Authorization Program. In addition, the Commission is committed to take enforcement action for noncompliance with the rules and to act expeditiously to resolve any interference.

The Commission's action is a cautious first step in authorizing ultrawideband technology. In taking its action, the Commission ex-

pressed concern, however, that the standards may be overprotective and could unnecessarily constrain the development of ultrawideband technology. Upon adoption of the First Report and Order, the Commission indicated its intent to review the ultrawideband standards within 6 to 12 months. We are currently undertaking a study at the Commission's laboratory in Columbia, Maryland to better understand whether the limits that were adopted are appropriate, particularly relative to the levels of background noise that already may exist from other devices. We plan to make the results available for public evaluation by the end of this year. We have invited other organizations to perform further studies of ultrawideband technology as well.

The reactions to the Commission's decision have generally been quite favorable. Several companies have announced that they plan to introduce ultrawideband products very soon. We recognize that some ultrawideband users have raised concerns about the new rules, in particular manufacturers and users of ground penetrating radars. However, we are confident that any remaining issues can be resolved in an expeditious manner.

I would like to thank you, Mr. Chairman, for the opportunity to appear before you today. This concludes my testimony. I would be pleased to take any questions.

[The prepared statement of Julius P. Knapp follows:]

PREPARED STATEMENT OF JULIUS P. KNAPP, DEPUTY CHIEF, OFFICE OF ENGINEERING AND TECHNOLOGY, FEDERAL COMMUNICATIONS COMMISSION

Mr. Chairman, Ranking Member, and Members of the Subcommittee:

Good morning. I am Julius Knapp, Deputy Chief of the Office of Engineering and Technology at the Federal Communications Commission (FCC). I welcome this opportunity to discuss the FCC's proceeding to provide for the introduction of ultra-wideband (UWB) devices.

INTRODUCTION

Ultra-wideband technology holds great promise for a vast array of new products that have the potential to provide significant benefits for public safety, businesses and consumers. Some of the applications for this technology include radar imaging of objects buried under the ground or behind walls, short-range high-speed data devices, and vehicle radar systems.

UWB devices operate by employing very narrow or short duration pulses that result in very large or wideband transmission bandwidths. With appropriate technical standards, UWB devices can operate using spectrum occupied by existing radio services without causing interference, thereby permitting scarce spectrum resources to be used more efficiently. To that end, the Commission reviewed extensive comments that were filed in the UWB proceeding by numerous industry stakeholders.

On February 14, 2002, the Commission adopted a First Report and Order establishing rules to allow development and marketing of unlicensed low power UWB devices. The Commission's action is a cautious first step in authorizing UWB technology. The technical rules are based in large measure on standards recommended by the National Telecommunications and Information Administration (NTIA) that NTIA believes are necessary to protect against interference to vital federal government operations, including safety systems. In taking its action, the Commission expressed concern, however, that the standards may be overprotective and could unnecessarily constrain the development of UWB technology. Upon adoption of the First Report and Order, the Commission indicated an intent to review these standards and explore more flexible technical standards to address the operation of additional types of UWB operations and technology.

OVERVIEW OF THE NEW PROVISIONS FOR UWB DEVICES

The Commission categorized UWB devices into three types: (1) imaging systems; (2) vehicle radar systems: and (3) communications and measurement systems.

The first category, imaging systems, includes ground penetrating radars (GPRs), wall imaging systems, through-wall imaging systems, surveillance systems and medical systems.

- Ground penetrating radars detect the location and image of buried objects and can be used for applications such as law enforcement investigations and for detecting flaws in bridges and roadways.
- Wall-imaging systems can be used to examine the foundations of buildings and to locate objects such as pipes inside a wall.
- Through-wall imaging devices can be used by law enforcement, fire and rescue organizations for hostage rescue and locating persons trapped inside a burning building.
- Surveillance systems, although technically not imaging, can operate as "security fences" by establishing a stationary radio frequency (RF) perimeter field and detecting the intrusion of persons or objects in that field.
- Medical imaging is used to detect the location or movement of objects within the body of a person or animal.

Imaging systems generally need to operate in the lower parts of the radio spectrum in order to work properly. However, these are also the parts of the spectrum that are used the most heavily by other radio services. The recently adopted rules generally allow imaging systems to operate below 960 MHz or above 3.1 GHz, prevent them from causing interference in the most sensitive frequency bands used for services such as air traffic control and the global positioning system. The rules also restricted the users to include law enforcement, fire and emergency rescue organizations, scientific research institutions, commercial mining companies, licensed health care practitioners and construction companies. At the request of NTIA, the FCC will coordinate the operation of all imaging systems with the federal government.

The second category of UWB technology permitted by these rules is vehicle radar systems. Vehicle radars can be used for collision avoidance, safer deployment of airbags, and smoother suspension systems that better respond to road conditions. These systems will operate in the upper reaches of the spectrum between 22 and 29 GHz, where the spectrum is not as heavily used as lower frequency bands.

The third category of UWB devices is communications and measurement systems. These devices can be used for applications such as high-speed home and business networking devices, in-home distribution of digital TV signals, and storage tank measurement devices. Existing users of the spectrum expressed the greatest concerns about this category of devices due to the potential for widespread and uncontrolled use. The Commission restricted operation of these devices to the frequency band 3.1-10.6 GHz, thereby avoiding the parts of the spectrum that are used most heavily, including the GPS band.

PROTECTION OF EXISTING RADIO SERVICES AGAINST HARMFUL INTERFERENCE

The establishment of standards to protect against harmful interference from UWB devices has been a daunting task. Most interference issues involve potential interactions between two, or perhaps a few, radio services, because the energy generated by a particular service tends to be limited to a narrow range of frequencies. In contrast, UWB devices emit energy over wide swaths of the spectrum used by dozens of services, raising the possibility of many potential interference interactions, each of which needed to be analyzed.

Since the UWB proceeding commenced in 1998, many parties filed comments in the Commission's rules making proceeding raising concerns about potential interference from UWB devices to the personal communications service, multipoint distribution service, satellite digital audio radio service, GPS, and others. The Federal Government, under the auspices of NTIA, also evaluated potential interference to a wide variety of systems such as GPS, aeronautical navigation systems, weather radars, and systems used by agencies such as the Department of Defense, the National Aeronautics and Space Administration, and the Department of Transportation.

The FCC's engineering and technology staff analyzed the extensive tests performed by NTIA, Stanford University, the University of Texas and others. We reviewed and considered more than 700 filings that were submitted in the Commission's rule making proceeding. We also coordinated extensively with NTIA.

We are extremely confident that the standards the Commission adopted will protect against harmful interference to other radio services. For example, the rules require ultra-wideband communications devices to operate above 3.1 GHz, well away from the frequency band at 1.6 GHz used for GPS. In addition, any spurious emissions in the GPS spectrum would need to be suppressed by 34 dB below the emissions limits that apply to millions of existing radio frequency devices—in other

words, more than 2000 times less than the radio noise permitted to be emitted by a personal computer.

The FCC plans to closely monitor the introduction of this technology through our equipment authorization program. In addition, the Commission is committed to take enforcement action for noncompliance with the rules and to act expeditiously to resolve any instances of interference.

COORDINATION WITH NTIA

As I previously mentioned, FCC staff coordinated extensively with NTIA staff in developing the standards adopted in the First Report and Order and in large part based the standards on measures that NTIA believes are necessary to protect against interference to vital federal government operations. Throughout the proceeding NTIA and FCC staffs were in constant dialogue. Because UWB devices emit energy over large swaths of spectrum, emissions into spectrum used by both Government and non-Government systems cannot be avoided. Therefore, both NTIA and the FCC have shared jurisdictional responsibilities. Given the multitude of radio services that could potentially be affected by UWB emissions and the complexity of the technical analyses, it should not be surprising that there were different points of view on some issues among the agencies as well as the parties. However, the staffs of the Commission, NTIA and the other Federal agencies and departments worked together cooperatively to develop rules that will enable initial deployment of some UWB technologies while ensuring that incumbent government systems are fully protected against harmful interference.

NEXT STEPS: FURTHER TESTING AND MEASUREMENTS

UWB technology is still in its infancy and it is important that the government continue to monitor the development of this technology. Additional scientific work is needed to expand our understanding of this technology and its interference potential as it develops.

As I mentioned earlier, the Commission has committed to review the standards for UWB devices in the next six to twelve months. We are undertaking a study at the Commission's Laboratory in Columbia, Maryland, to better understand whether the limits that were adopted are appropriate, particularly relative to the levels of background noise that may already exist from other devices. We plan to make the results available to the public for evaluation by the end of the year. We have invited other organizations to perform further studies of UWB technology as well.

REACTION TO THE FIRST REPORT AND ORDER

The reactions to the Commission's decision on UWB have generally been quite favorable. Several companies have announced that they plan to introduce new UWB products very soon. We recognize that some UWB interests have raised concerns about the new rules, in particular, manufacturers and users of ground penetrating radars. We also realize that some non-Government radio services may not be satisfied that they will be adequately protected against interference. We are confident that any remaining issues can be resolved in an expeditious manner.

CONCLUSION

I would like to thank you, Mr. Chairman, for the opportunity to appear before you today. This concludes my testimony and I would be pleased to answer any questions you or the other members may have.

Mr. UPTON. Thank you.

Mr. Petroff.

STATEMENT OF RALPH G. PETROFF

Mr. PETROFF. Yes. Thank you. Mr. Chairman and——

Mr. UPTON. You just need to hit that—I think you need to hit the mike button there.

Mr. PETROFF. Now? Okay. Mr. Chairman and distinguished members of the subcommittee, I am honored to testify, thank you very much. And, Mr. Tauzin, before I begin I would like to take a moment to recognize this committee and particularly your leadership on behalf of new technologies. Your advocacy has contributed

to the success of new technologies and increased choices and services for the public. I would also like to take a moment to recognize the distinguished public servants who sit here on this panel. We worked closely with FCC, NTIA and DOD throughout the approval process. I respect Julie Knapp and Mike Gallagher and Stephen Price, and they deserve praise for their work on a difficult issue. I only met Mr. Shane earlier this morning.

Mr. Chairman and members of the subcommittee, while you may hear different views from the distinguished panelists today on the specifics surrounding the UWB approval process, I believe there are two points upon which everyone will agree. First, we are all pleased the First Report & Order was adopted. It is an historic first step for a technology that will ultimately bring significant benefits to government, military, transportation and consumers. Second point is our spectrum management can be improved to promote, rather than delay, important new technologies. Our current process takes too long. We started this regulatory approval 13 years ago, including nearly 4 years of detailed regulatory proceedings, and it is not over yet. This is far too much time, if new technologies are going to have any chance of getting to market. Too often government agencies and commercial interests act based on spectrum politics, rather than spectrum policymaking. If we do not improve this process of spectrum management, we will fall behind the rest of the world in deploying new technologies.

Let me start by describing UWB. It is a new wireless technology that enables several orders of magnitude improvement in three core technologies: communications, radar and precision positioning and tracking. UWB is different from existing radio in that it emits infinitesimally low levels of power across a wide band. To put this in context, a mobile phone emits almost 7 million times the power of a UWB device into the same spectrum. Because the signal looks like the emissions from computers and has the same power level as computers, we initially sought approval to be treated like computers in FCC's Part 15 rules.

I have a chart here. You can see at the very bottom that red line that cuts across all spectrum. That is the Part 15 limit, and it is not drawn to scale. It is actually much lower than that. This is a spectrum sidewalk that cuts across every single government and commercial spectrum band. In the sidewalk, billions of devices like laptops and palm pilots have operated without interference, even in the restricted bands, since the 1980's. This sidewalk is infinitesimally small. Cell phones are allowed to put out half a watt per megahertz, while Part 15 devices are limited to 0.00000007 watts. To put things in perspective, if the power level for a cell phone was a building, it would be as tall as the Empire State Building, but the spectrum sidewalk would be only the width of a human hair.

I want to be very clear, this is issue is not about reallocation of spectrum. It is about using the same spectrum sidewalk that billions of other low-power devices use without harm to existing users and without requiring any existing user to move to different bands in the spectrum. We agree with the FCC's public statements about a conservative first step. In fact, if you examine the text in the ruling, the word "conservative" appears 30 times; "cautious," 11; "limited," 36. Despite this cautious first step, the NTIA/FCC ruling will

permit some applications of UWB technology to reach the market and benefit the public. Other applications will have to wait.

What will the public see from UWB in the short term? The first market where the public will see UWB products is for personal area networkings, wirelessly connecting consumer electronics and personal computers in the home and office. This is the focus of our commercial business. UWB can provide ultra high-speed wireless connectivity between consumer devices, wirelessly transferring video among camcorders, digital cameras and printers.

Another market where we believe the public will see product is in ground penetrating radar and through-wall radar. We have developed a through-wall imaging radar device, called Radarvision, to help military, police and fire fighters. It can help them determine the location of people on the other side of the door for policemen, fire fighters to determine in what room a victim might be located in a burning building and rescue workers to locate victims under earthquake rubble by detecting their breathing. Like GPR, it is only used in isolated instances by trained personnel. We have a waiver from the FCC to deploy a limited number products. However, we will not be able to fully do our job with this through-wall imaging under the current rules. I hope this is one quick change to the rules that we can all agree to make quickly.

How can UWB benefit the public over time? It is a remarkable new technology for all sorts of applications in medical and in military. Mr. Chairman and members of the subcommittee, with all of these unprecedented benefits to offer, UWB faced enormous hurdles getting approval. The regulatory process fell victim to spectrum politics rather than spectrum policymaking. There needs to be objective oversight of technical testing and analyses to ensure that everyone plays by the same rules.

UWB should be a win-win for incumbent government and non-government users of spectrum. After all, UWB can use spectrum efficiently without displacing existing users. For new technologies like UWB to reach the public, we need timely spectrum management that fairly balances the need to deploy new technologies with the need to protect existing users. Thank you, Mr. Chairman.

[The prepared statement of Ralph G. Petroff follows:]

PREPARED STATEMENT OF RALPH G. PETROFF, CHIEF EXECUTIVE OFFICER, TIME DOMAIN CORPORATION

Mr. Chairman, distinguished Members of this Subcommittee, I am honored to be invited to testify before you today—thank you very much.

Mr. Chairman, I would like to request that a copy of my complete remarks be entered as part of the record.

I would like to start out by recognizing the distinguished public servants who sit on the panel. I am fortunate to be appearing in the company of our nation's experts on spectrum management. We worked closely with the Federal Communications Commission ("FCC"), National Telecommunications Information Administration ("NTIA") and the Department of Defense ("DOD") throughout the UWB approval process. I respect Julie Knapp, Mike Gallagher, and Steven Price and they deserve praise for their work on this difficult issue. While we may have had differences at times during the first phase of the Ultra Wideband ("UWB") approval process, these gentlemen worked very hard on the difficult and thankless task of UWB regulatory approval. At times, they faced tremendous pressure from within their own agency or department, other agencies or departments, and parts of the private sector, yet they fought hard to find a way to respond to the participants in the process and approve UWB. Their efforts have resulted in the first step in the UWB regulatory approval process.

Mr. Chairman, Members of the Subcommittee, while you may hear different views from the distinguished panelists today on specifics surrounding the UWB approval process, I believe there are two points on which everyone will agree. First, we are pleased the First Report & Order was adopted. It is an historic first step for a technology that will bring life-saving and other benefits to the public. Second, our spectrum management process can be improved to promote, rather than delay important new technologies. Our current process takes too long to evaluate and approve new technologies. The path to UWB regulatory approval took more than 13 years, including three and one half years of regulatory proceedings. This is far too much time, if new technologies are going to have any chance of getting to market. Too often government agencies and commercial interests act based on spectrum politics, rather than spectrum policy-making. There needs to be objective oversight in areas such as testing and technical analysis that can form the basis for sound spectrum policy-making. Finally, there are often inherent conflicts within and among the government entities involved in spectrum management that diminish their ability to function independently. If we do not improve our process of spectrum management, we will fall behind the rest of the world in deploying new technologies.

This morning, I would like to briefly cover the history of the UWB proceeding, quickly discuss what the FCC's First Report & Order means for industry and the public, and then discuss in greater detail some of the challenges in the regulatory process that we faced as a company seeking regulatory approval.

I. BRIEF HISTORY OF TIME DOMAIN CORPORATION AND ITS BREAKTHROUGH ULTRA WIDEBAND TECHNOLOGY

A. History of Time Domain

Time Domain's UWB technology was discovered in 1974 by the proverbial inventor in his garage—an Arkansan named Larry Fullerton. While in college, one of Fullerton's engineering professors challenged his class by telling them that pulses of the kind now used by Time Domain could not be sent through an antenna. Larry Fullerton thought the professor might be wrong. After years of experimentation, Fullerton succeeded in sending pulses that transmitted radio programming across his workbench in Huntsville, Alabama.

Fullerton's discovery remained hidden from the rest of the world for many years as he toiled away in near obscurity. Many of the people with whom he shared his discovery told him that what he claimed the technology could do simply could not be done. Fullerton did not have the money to develop the technology for commercial deployment, so he used whatever money he could scrape together to file patents on his technology and build crude functioning prototypes.

After receiving his first patent in 1987, Fullerton founded Time Domain, with a goal of building more support for his discovery and, ultimately, commercializing the technology. While some progress was made in this regard, particularly in terms of further technology development and acquiring additional patents, Time Domain remained a struggling small business for many years.

By 1995, Fullerton had 15 patents and had built 22 prototypes, including: radar devices that could detect motion through walls, "see" underground, and create security bubbles to determine the exact size and shape of an object penetrating the bubble; location and tracking devices that worked like GPS, except that they did not need satellites, worked underground and indoors where GPS could not go, and were accurate to approximately two centimeters; and communications devices that could wirelessly send digital video through walls.

In 1996, the Petroff family, who had been involved in NASA programs and several successful start up technology companies recognized that Fullerton had potentially discovered a once-in-a-generation technology. The Petroffs did a year's worth of due diligence on the technology and the patents and concluded that: (1) Fullerton had excellent patent coverage on his UWB technology; (2) the UWB technology worked and had the potential to be a fundamental technology; and (3) the technology was enabling in that it could create entirely new products and even entirely new industries. The Petroffs proceeded to make a significant multi-million dollar investment in Fullerton's company and, convinced of the technology's significance and potential, joined the company as its management team.

By 1998, there was still no movement on obtaining regulatory approval and the Petroffs had supplemented their initial investment with a substantial portion of their net worth. In order for the company to remain solvent, the CEO was forced to take out a mortgage on his house. Then, the technology community and press began to discover UWB technology, writing stories that described a technology that could potentially change the world, and investors began to invest in the company.

Today, Time Domain has attracted the attention of corporate America and financial investors, including a number of Fortune 500 strategic investors and more than a dozen venture capital investors. The company is working on its third generation chipset and has more than 240 patents filed or granted. The company has completed or is currently working on more than 50 government contracts, most of which are for the Department of Defense. The IEEE, the governing body for standards setting in the engineering world, is working on a standard for UWB for consumer products. The military is using UWB technology in more than 100 programs.

B. Time Domain's Ultra Wideband Technology

UWB technology is different from existing radio. It does not use an assigned carrier frequency, nor does it employ sine waves using traditional concepts such as amplitude or frequency modulation. Instead, Time Domain's technology uses extraordinarily brief pulses—from 40 million to a several billion a second. These pulses emit very low energy, similar to the energy emitted by a Part 15 device such as a laptop computer. As you know, Part 15 devices are not licensed. They operate at very low power and may not cause harmful interference to other radio services. To put this in context, a UWB device emits about 1/10,000th the power of a cell phone.

We initially approached regulatory approval believing that because our technology met the Part 15 rules regarding emissions levels, UWB would be approved to operate under those same rules. The final rule does not allow UWB to operate at Part 15 power levels in key parts of the spectrum, but at power levels more than 2000 times less than Part 15 devices such as laptop computers. UWB is permitted to operate at Part 15 power levels in spectrum above 3.1 GHz. The FCC indicated, and we agree, that this very conservative decision should be revisited in coming months.

Time Domain's UWB technology produces vastly reduced wave cancellation from multipath distortion of the sort that plagues conventional radio systems. This enables incredible efficiencies and several orders of magnitude improvement in three areas: communications, radar, and position-location-tracking. This technology is unique in that all three of these capabilities can be fused into a single chipset. Time Domain's business model is to design the chipset, which the company's strategic partners will then integrate into their own products to bring substantial new benefits to consumers, businesses and government.

II. THE FCC'S FIRST REPORT & ORDER: WHAT DOES IT MEAN FOR INDUSTRY AND THE PUBLIC?

We agree with the FCC's public statements that the First Report & Order is a very conservative first step. If you examine the text of the First Report & Order, the word "conservative" appears 30 times, the word "cautious" appears 11 times, and the word "limited" appears 36 times. Despite being a cautious first step, the First Report & Order will permit some applications of UWB technology to reach the market and benefit the public. Other applications of the technology that would have been possible will have to wait for a reexamination of the limits set forth in the First Report & Order.

What will the public see in the short to medium term from UWB? The first market where we believe the public will see UWB products is for personal area networking ("PAN")—or connecting consumer electronics and personal computers in the home and office. UWB can provide wireless connectivity among camcorders, PCs, DVD players, flat screen television displays, digital cameras, printers, MP3 players and other digital devices. UWB's ability to transmit very high bandwidth over short distances offers wireless connectivity for multimedia applications that no other technology can provide. Devices with UWB will consume low power enabling the technology in hand held devices and preserving these devices' battery life. UWB will be priced low enough for equipment manufacturers to include the technology in their consumer electronic products. Finally, because of UWB's use of spectrum, it can coexist with other technologies without causing or receiving interference like other technologies operating in unlicensed spectrum. The IEEE is working on a standard for UWB in PAN and large consumer electronics companies such as Motorola, Sony, Intel, Phillips, Panasonic, Intersil, and Kodak are supporting the effort. We expect products with UWB for the PAN market to be on store shelves as early as the end of 2003.

The second market where we believe the public will see products in the near term is for automotive radar. While Time Domain does not work in this area, we are aware that Daimler Chrysler and other companies have performed considerable work on automotive radars operating in the 24 GHz frequencies. We believe that Daimler Chrysler has a working demonstration of a 24 GHz radar for automotive collision avoidance sensors and is actively developing products for this application using UWB.

A third market where we believe the public will see product shortly is in the applications for ground penetrating and through-wall radar. I am less qualified to talk about GPRs than our panelist, whose company has worked with this application of UWB for many years. As I am sure he will recount, they have been used for years by public safety and law enforcement personnel, and others. Similar to ground penetrating radar, Time Domain has developed a through-wall imaging radar device under military contract called RadarVision for the military, police, firefighters and rescue workers. This may allow, for example, police to determine the location of people on the other side of a door; firefighters to determine in what room a victim might be located in a burning building; and rescue workers to locate under earthquake rubble where a survivor may be alive simply by detecting breathing. Time Domain's RadarVision 2000 product will be ready for deployment in October this year. Time Domain has successfully demonstrated the prototype product at major law enforcement agencies including, the Fairfax County Rescue Squad and the Dade County Search and Rescue team, two of the top organizations in the country that respond to earthquakes to rescue victims.

Time Domain has had a waiver from the FCC to deploy a limited number of its Radarvision products. The FCC's First Report & Order extended the duration of the waiver for an additional year. However, like the GPR community's ground penetrating radar, Time Domain's through-wall radar would not be able to achieve full functionality under the rules set forth in the First Report & Order absent the extension of the waiver. Under the current rules, these devices would be able to be used by the military and federal, but not state and local, law enforcement and public safety personnel. Given that there will only be a limited number of these devices, operated by trained life-saving first responders, we urge the FCC and NTIA to revisit this issue as quickly as possible so these devices can save lives in the hands of state and local safety personnel, in the same manner as they will in the hands federal users. I hope this is one change to the FCC rules on which we can all agree.

III. POTENTIAL LONG TERM BENEFITS OF UWB TECHNOLOGY TO THE PUBLIC

How can UWB benefit the public over time? UWB has the potential to enable entirely new wireless applications and products, and to make significant advances in critical areas such as public safety, aviation safety, military effectiveness, medical applications, and communications.

UWB enables radar with superior clutter rejection and much higher resolution than traditional radar, achieving range resolutions of less than six inches. This facilitates new short-range radar applications such as "through-walls" radar and radar that can "see" underground; security bubbles and electronic security fences that can tell the exact size and shape of an object penetrating them; and sensors for "smart" airbag deployment. The military is evaluating UWB radar technology for terrain mapping to aid in the location and removal of landmines.

Time Domain's UWB technology enables precise-location-tracking applications that complement GPS by providing relative position information to enhance the absolute position information provided by GPS. UWB technology can provide position information indoors, underground, in urban canyons, and under foliage where GPS often cannot provide position information. The positioning information from UWB is accurate to within two centimeters. Thus, UWB can complement GPS by extending the reach of GPS locally indoors, underground, and in urban canyons based upon the last GPS reading. The applications for this functionality are numerous. UWB can be used to track which workers enter sensitive areas of hospitals, nuclear plants, and military installations. The technology can be used to track assets such as mobile, life-saving equipment in hospitals, packages and containers in a factory or warehouse, or objects in the home. The military is currently evaluating the technology to solve one of their most difficult problems—the precise location and tracking of soldiers in urban combat and training exercises.

A number of firefighters and other first responders urged the FCC to allow public safety use of UWB for tracking personnel, for example, tracking firefighters inside a burning building. If this tracking use were permitted in the future, it could be combined with communications functions to provide a dramatic improvement in firefighter safety. While we are not engaged in this business, we urge the Committee to support the approval of these public-safety tracking applications when the FCC reexamines the rules in six to twelve months.

In the area of communications, UWB can provide very high bandwidth, hundreds of megabits per second, at very short distances. In time, UWB will enable ultra high-speed indoor wireless networks across many devices for the true "smart" home and office.

IV. THE REGULATORY APPROVAL PROCESS FOR UWB: LESSONS LEARNED

A. History of UWB Proceeding

Time Domain began its quest for regulatory approval in 1989 when Larry Fullerton made his first visit to Washington, DC to the FCC. I would like to briefly summarize the process because I believe it demonstrates a number of ways that it could be improved. During the subsequent early years after Larry's first visit, and even later, Time Domain met with FCC officials to move the regulatory approval process for UWB forward. In 1992, a predecessor company that later merged with Time Domain filed a request for a pioneer's preference at the FCC which was denied that same year. In 1994, the FCC granted Time Domain a special temporary authority to test UWB and Time Domain voluntarily filed its testing data to speed up the regulatory process. In 1995, the company filed comments in the UNII proceeding urging the FCC to approve UWB. In 1996, Time Domain presented an overview of UWB technology to the FCC's Office of Engineering Technology.

During the first half of 1997, Time Domain met with FCC labs and OET staff approximately a dozen times. In April 1997, Time Domain demonstrated UWB to the Interdepartmental Radio Advisory Committee ("IRAC") at NTIA and discussed intentionally radiating into the government bands at Part 15 level power. In September 1997, Time Domain demonstrated its technology for the FCC Office of Engineering Technology "(OET"), FCC labs, NTIA, and ITS labs staff.

In February 1998, Time Domain filed a request for a waiver of Part 15 rules to permit operation of a limited number of Radarvision devices for public safety and law enforcement personnel. 14 law-enforcement, defense, public safety, and counter-terrorism entities file comments in support of granting the waiver. No party filed comments in opposition to the granting of the waiver request during the comment period. From April 1998 to March 1999, Time Domain attended approximately 25 meetings with the FCC to discuss UWB technology. On June 30, 1998, OET wrote a letter to the Office of Spectrum Management, NTIA, tentatively concluding that Time Domain's waiver request is "ripe for grant subject to coordination with NTIA." In September 1998, the FAA Administrator's office voiced strong opposition to the use of UWB devices, claiming in a letter to the NTIA Administrator and the FCC Chairman that a proliferation of UWB devices could pose potential safety problems due to interference with avionics and navigation units.

During the next several months, Time Domain repeatedly met with FAA officials. On May 11, 1999, the FAA Administrator writes a letter to the FCC Chairman in which she agreed to remove FAA's objections to Time Domain's request for waiver. On June 15, 1999, nearly a year after Time Domain first filed its waiver request, NTIA indicated that the FCC could grant the waiver for use of 2500 units with nine conditions on the use of the devices. On June 29, 1999, the FCC granted the waiver requests from Time Domain and two other companies with the NTIA conditions attached. In August 1999, Professor Per Enge, on behalf of the GPS Industry Council, filed a petition for reconsideration of the grant of the waiver requests. In September 1999, Professor Enge withdrew his petition for reconsideration of the grant of the waiver requests.

On September 1, 1998, the FCC issued a Notice of Inquiry on UWB technology. From August to November of 1999, Time Domain worked with NTIA's ITS labs to develop a test plan for testing UWB with GPS systems. On December 1, 1999, after four months of working with ITS engineers on the test plan, NTIA staff oppose moving forward with testing and the plan is set aside. On September 29, 1999, the Ultra-Wideband Working Group sponsored the first international Ultra-Wideband Conference in Washington, D.C. Representatives from more than 14 countries attend, and the Working Group expands to more than 75 members. FCC Commissioner Susan Ness delivered the keynote address in which she calls on the FCC and NTIA to: (1) issue a Notice of Proposed Rulemaking on UWB within a few months; (2) complete a rule making on UWB by the end of the year 2000; and (3) conduct joint testing with government users and industry participants concurrently with the rulemaking process.

On December 5-6, 1999, Time Domain learned that the Department of Transportation planned to sponsor a meeting at Stanford University to discuss testing for potential interference of UWB with GPS. On December 7, 1999, representatives of Time Domain attended the DOT/Stanford University meeting as uninvited participants. At the meeting, Professor Enge presented testing results that purport to show that UWB devices cause harmful interference with GPS devices. As part of his presentation, Professor Enge performed a demonstration in which he places a UWB device operating at higher power levels than Part 15 in proximity to a GPS receiver to demonstrate interference. Representatives of several of the airlines are in attendance at the meeting. On December 21, 1999, the Air Transport Association

circulated a draft letter for Members of Congress to sign to William Kennard, Chairman of the FCC, expressing concerns over UWB technology.

On May 11, 2000, the FCC released its Notice of Proposed Rulemaking on UWB. During the remainder of 2000 and the first half of 2001, NTIA, the Department of Transportation and Stanford University, and the University of Texas and Johns Hopkins University conducted compatibility studies and analysis between UWB and other radio services. Interested parties filed hundreds of comments on the test results and other issues in the FCC docket during this period.

On November 20, 2001, Deputy Secretary of Defense Wolfowitz sent a letter to Secretary Evans urging the FCC to delay its pending December decision on UWB. On December 11, the FCC pulled the UWB item from its December 12, 2001 meeting agenda citing a request of the Commerce Secretary.

On February 14, 2002, the FCC adopted the First Report & Order in the UWB proceeding. On March 20, 2002, Deputy Secretary Wolfowitz sent letter to Secretary Evans applauding his efforts in ensuring that the FCC's UWB decision contained sufficient safeguards to protect spectrum dependent military systems. On March 15, 2002, Deputy Assistant Secretary Gallagher sent a letter to Chairman Powell indicating that the government users may not be required to follow the rules in the First Report & Order for use of UWB.

B. The Process for Approving New Technologies Takes Too Long

It took 13 years, including three and one half years of intensive efforts, to gain regulatory approval for UWB. I personally made over 100 trips to Washington since 1996 to meet with regulators, and we spent several million dollars seeking regulatory approval. Often I am amazed that we are still in business. Fantasma Networks, the second largest UWB company that was backed by Intel and Paul Allen's Vulcan Ventures, went out of business last year waiting for regulatory approval. Without the ability to earn revenue from government contracts with the Defense Department, we would have gone out of business years ago waiting for regulatory approval.

In today's difficult business climate, early-stage companies have trouble raising capital to sustain their businesses. Unlike the mid and late 1990's when capital was plentiful, companies today have less operating capital and thus shorter timelines to get their products to market. No company or industry is going to be able to wait several years for regulatory approval. There must be a way to shorten this process, so that new technologies have a chance to get to market.

C. Conflicts Between Government Agencies on Spectrum Management

The UWB proceeding may have been unusual in that it involved both government and commercial spectrum and a large number of incumbent users of spectrum. However, there are other issues, such as 3G, where this dynamic exists and there are likely to be more such issues in the future. The legal requirement as I understand it, is that the FCC and NTIA must "coordinate" on issues affecting commercial and government spectrum. Throughout the UWB regulatory approval process, it appeared as though the FCC and NTIA had difficulty coordinating the views of the government and commercial users of spectrum, as illustrated by a few examples below.

It took NTIA nearly a year to obtain internal sign off by government users of spectrum to approve with conditions the requests for waivers submitted by Time Domain and other companies. This despite the fact that the devices requested by Time Domain were lifesaving instruments for public safety and law enforcement personnel, and all 2500 devices requested, if operating together in a single room, would emit less than one quarter the power of a cell phone.

The FCC and NTIA had a very difficult time agreeing on the final wording of the order on reconsideration of the waivers. The petition for reconsideration still had not been dealt with at the time the FCC issued its Notice of Proposed Rulemaking, nearly a year after the FCC first approved the requests for waivers. The FCC was sufficiently concerned about its coordination efforts with NTIA that in its final order dismissing the petitions for reconsideration, Commissioner Furchtgott-Roth expressed his views on the FCC interaction with NTIA on the item as:

> ...an unacceptable distortion of the appropriate consultative role that NTIA should play in our decision making. Although the FCC and NTIA have a legitimate obligation to coordinate their activities regarding shared spectrum, NTIA's intrusive role in this proceeding is a source of concern for all of us who value the independence of this Commission. Repeated NTIA editing of orders after adoption undermines our independence and the integrity of our processes. No other entity had repeated opportunities to review drafts of our decision. No other entity was able to "sign off" on edits from Commissioner offices. Equally

important, neither the public, the parties, nor many of the Commissioners were aware that this "process" was even going on. The process was not transparent or even discernible. Those regulated by the Commission have a right to know that FCC decisions are truly FCC decisions. When an item sits for five months after adoption, it turns our voting process into a sham.

Once the staff has a complete record and develops its final recommendation for the Commission, NTIA should not be provided with additional drafts or have "sign off" authority on revisions. The circulated Order should be the sole province of the Commissioners and the staff. NTIA has every right to be heard, but no right to edit every word.

The FCC may have found itself in a difficult position evaluating test results for compatibility between UWB and other systems when one of the major testing efforts was performed by NTIA. The raw data of the different tests were very similar, although the interpretation of data varied to produce different "results." It appears as though the FCC did not have the resources to conduct its own independent testing.

It appears as though the FCC and NTIA may have had difficulty agreeing on the rules for UWB in the First Report & Order. As reported in the trade press, the FCC appeared ready to adopt rules for UWB in December of 2001 that reportedly were significantly less restrictive than the rules ultimately adopted by the agency. As a result of strongly worded, public letters from high level officials at the Defense Department to the Commerce Department, and the Commerce Department to the FCC, adoption of these rules was postponed for 60 days to provide the Department of Defense additional time to submit their comments to NTIA. The proceeding had been ongoing for more than three and one half years at this point. During the 60-day delay, it appears as though the rules for UWB became more stringent as the FCC strove to achieve the requisite consensus with NTIA on the rules.

While conflicts between agencies are nothing new, the conflicts in the UWB proceeding in large measure revolved around spectrum politics, not policy. This resulted in a lack of objectivity in interpreting technical data that made reaching sound policy decisions more difficult.

D. The Regulatory Process Should Rely on Sound Spectrum Policy, Not Spectrum Politics

In 2000, I had the opportunity to visit with David Hendon, the head of the Radio Communications Agency in the UK, the British equivalent to our FCC Chairman Powell. The U.K. had just finished their spectrum auctions for 3G licensees and taken in more than 40 billion dollars. Mr. Hendon remarked that the North Atlantic oil rights had sold for several billion dollars in the 1970's, and, in inflation adjusted terms, the sale of spectrum in the U.K. had fetched an even higher price, perhaps making it the most valuable commodity on the planet. I think few would disagree with him that spectrum has become the most valuable commodity on the planet today for governments and commercial users. Not only is spectrum a limited commodity, but there is a finite amount of this valuable resource so that all spectrum decisions are part of a virtual zero sum game: when one player gains another player almost always loses. The battles over the last several years between government users and commercial are a good example of this phenomenon. When spectrum was reallocated from government users to auction for commercial use, government users had to find new spectrum for their services. The zero sum game creates an incentive for spectrum users to oppose all spectrum actions that might harm their interests, and even those actions that are neutral or the effect of which is unknown. The lowest-cost, rational action is to oppose all spectrum management proposals that do not directly benefit your position. This is true whether the actor in question is a government agency or a commercial user. So even when we proposed a use of spectrum that would not require any incumbent to move and efficiently shared spectrum under Part 15, there was no incentive for either commercial or government operators to support this new technology.

The Congress relies on the FCC and NTIA for spectrum management policymaking based on scientific analysis and objective assessment of competing needs and interests. In the UWB proceeding, spectrum politics, rather than sound policymaking often dictated the course of decision making. For example, there were three major testing efforts conducted on GPS and UWB compatibility: one by Stanford University/DOT, another by NTIA, and a third effort funded by Time Domain and conducted by the University of Texas and Johns Hopkins University. The results of the three tests differed greatly from finding that there was no harmful interference to GPS until the UWB devices were within one meter of each other to finding harmful interference at greater distances. The Department of Defense Joint Spectrum Center analyzed the test data and found that the data were very close on all tests.

What differed among the three tests was the interpretation of the data based on assumptions applied to the data about how UWB and GPS devices would operate in the real world and the scenarios for UWB and GPS interaction. Parties used assumptions and scenarios that would produce the results they sought. This phenomenon was not limited to the GPS testing. The same dynamic occurred with the PCS testing. In the absence of agreed upon joint testing and analysis by the NTIA, the FCC, and commercial and government users, there needs to be an objective way to evaluate the different test data, the assumptions, and scenarios. Otherwise, parties will simply spin technical data to their advantage without sound scientific basis for their positions.

After the FCC requested parties in its NPRM to submit compatibility data, Time Domain spent millions of dollars funding the University of Texas and Johns Hopkins University, two of the top GPS facilities in the country, to conduct testing under their independent control. The test plan was created through an open process in which numerous parties participated, including UWB opponents. In the final analysis in the Report & Order, the UT/JHU test data was almost entirely ignored. Whether this occurred because an interested party funded the test, or the results disagreed with preconceived philosophical positions is open to debate. If privately-funded tests are going to be dismissed, then the government needs to have the capability and the mission to test objectively and independently of even the government's own, internal interested constituents.

E. Conflicts Within Government Agencies

The Commerce Department plays a critical role in promoting new technologies and advising the President on technology and telecommunications issues. The Commerce Department, through NTIA, also plays an important role in managing the spectrum used by federal agencies and departments. When it comes to spectrum management issues, these two roles may conflict, as they did in the UWB proceeding. The Commerce Department may want to promote new technologies to save lives, benefit the public, and help the economy, but it also must protect the spectrum of its government users. When these two missions conflict, the likely losers will be the commercial interests seeking to promote new technologies. In the case of UWB, for example, the Office of Spectrum Management within NTIA played a large role in the proceeding, while the Technology Administration did not participate. This is understandable, as the Commerce Department's government agency constituents may claim that national security and public safety demand that their spectrum be protected at any cost. There is no question that government spectrum should be protected, as there are lives that depend on this spectrum being free from harmful interference. However, the question is who should make the determination as to whether there is a threat to the government spectrum, and how to balance the possibility of any effect on government spectrum with advancing new technologies?

Today, the NTIA and the FCC coordinate their views and make these decisions jointly. However, when it comes to spectrum management, the government is an interested party—it holds spectrum, fights to maintain its spectrum, and seeks to acquire additional spectrum. At the same time, however, the government also sits in judgment of what spectrum can be made available to non-government users. It is in effect operating as a party to proceedings and the judge of those very same proceedings.

The potential conflict of interest inherent in such an arrangement is obvious on its face. However, it goes one step further. Since the release of the First Report & Order, government agencies have been debating whether government users of UWB have to follow the same rules that the government has imposed upon non-government users. Paragraph 273 of the First Report & Order suggests that government users might have to follow the rules set forth in the First Report & Order. However, the Commerce Department has informed the FCC in a letter last week that they do not believe this to be the case. It appears as though Commerce was acting in its role as judge, rather than a party to the proceeding in informing the FCC of this position.

These conflicts are not unique to UWB. They have occurred in the past. They will occur in the future over issues such as 3G. In any proceeding in which the government is both an interested party due to its need to protect and increase its spectrum and arbitrating the rights of non-government users to spectrum it cares about, there is a potential conflict of interest. This potential conflict is heightened by the fact that the government does not have to reveal its views and role in shaping a proceeding to the same extent as non-government participants.

F. Secrecy on Issues of Spectrum Management Affecting Non-Government Interests.

Throughout the process we met frequently with the FCC and NTIA, and on a few occasions with DOD, NASA, and the FAA. At least one agency, even took pride in what they stated as an "open door" policy. However, while the door may have been open, the information from government agencies was not always forthcoming. The NTIA, for example, took the stance that they would meet with us and listen to our viewpoint, but they could not provide any information on their position, nor respond to any information we presented. It is difficult for commercial users to know what issues may exist with their proposed use of spectrum that impacts government spectrum or respond to proposals generated by government agencies without openness. This is not an issue when NTIA is making a decision that only affects government users of spectrum. In those instances, the issue is debated before the IRAC and a position reached. However, when NTIA is making a decision that affects both government and commercial users of spectrum, secrecy often prevents non-government users from commenting on information that directly affects them. IRAC proceedings are generally closed to non-government entities, even when the issues debated concern NTIA's views on non-government use of spectrum.

The FCC conducted a proceeding in which contacts with the agency were permitted, but were required to be disclosed on the record in the FCC docket. There were more than 900 comments filed in the first phase of UWB proceeding. However, government as a commenter to the FCC did not need to comply with the ex parte rules, and—sent letters and filings to FCC that were not made public before the decision. It was very difficult for interested parties in the proceeding to assess these filings or rebut them. Perhaps more disturbing, the government sent letters to the FCC saying their studies supported conclusions of interference, but they did not submit the studies. This prevented any evaluation or critique of these claims by parties to the proceeding.

V. CONCLUSION

There is a worldwide race to deploy UWB. Since FCC approval of UWB, startups have sprouted up in Europe, the Middle East, and Asia. Europe and parts of Asia are moving quickly to approve UWB for commercial use. Some countries, such as Singapore, are examining approval UWB at higher power levels than the levels set forth in the FCC's First Report & Order. While these parts of the world may be the first countries to enjoy the full promise of UWB, this is an undesirable outcome. UWB was invented in the United States and the U.S. should enjoy the benefits of the technology and retain technological leadership in UWB.

The United States' future with UWB and other new technologies depends on an efficient system of spectrum management. Our regulatory processes must operate in a timely manner in which the agencies charged with spectrum management collaborate to advance the deployment of new technologies, while protecting the rights of incumbents. Our proceedings must operate according to science, not spectrum politics. And the public needs to have some information on the positions government agencies are taking with regard to spectrum decisions that affect non-government users. Our global economic competitiveness depends on it.

I hope that some good will come from the process we went through with UWB approval, so future technologies will have an easier path through the regulatory process. Perhaps the lessons learned from UWB approval can help improve our spectrum management process to better advance new technologies, while protecting spectrum incumbents.

Mr. Chairman, thank you for allowing me to testify. I would be happy to answer any questions.

Mr. UPTON. Thank you.

Mr. Johnson.

STATEMENT OF DENNIS J. JOHNSON

Mr. JOHNSON. Good morning, Mr. Chairman, members of the subcommittee.

Mr. UPTON. You need to move the mike over a little closer to you.

Mr. JOHNSON. Good morning, Mr. Chairman, members of the subcommittee. I am pleased to be here on behalf of Geophysical Survey Systems, GSSI, which is one of several manufacturers of ground penetrating radar, or GPR. For the past 32 years, GSSI has designed, manufactured and sold GPR systems worldwide. We

thank you for the opportunity to be here today to speak about GPR and the recent UWB Report and Order issued by the Federal Communications Commission. The new regulations are an extremely important subject to everyone in the GPR industry.

I want to be clear that I am speaking for only a part of the UWB industry. This part is called ground penetrating radar. GPR is a very important class of UWB devices with a long history of applications relating to public safety, infrastructure inspection, and I will comment on those more shortly. First, let me explain a little bit about GPR.

Ground penetrating radar is an established technology widely used in a variety of applications in the United States and the rest of the world. GPR looks downward into the earth, fresh water, ice and man-made materials, such as concrete, to non-destructively detect anomalies. Many of these applications provide unique and significant safety-of-life and other benefits in the public interest.

I have four points to make today: One, GPR is an established technology with many important applications. GPR is different from air UWB transmitters and should be treated differently in the regulations. No. 2, there is no record of GPR interference with other receivers—32 years. The two most onerous and confusing provisions in the new rules were not contained in the NPRM, which gave us no opportunity to comment on them during the rulemaking process. We only found out about them after the rulemaking was concluded. No. 4, if the rules are not changed, the outcome and consequences for the GPR industry are extremely serious. Many companies will go out of business and the public's access to a new and useful technology will be severely limited, if not eliminated.

To amplify those four points, GPR is an established industry. We are one of several manufacturers and for the past 32 years, we have been selling equipment worldwide. In a nutshell, the business was started in 1970 in New Hampshire, developed and sold the first commercial GPR systems that same year. Average selling price is about $25,000 per system. It is not a consumer product. We have been a GSA supplier since 1984. Products have been sold to over 25 government agencies, including every military branch. We have sold products and exported to 50 countries. Some working systems are now 10 to 15 years old and still ticking.

So some of the standard applications for GPR include utility pipe detection and 3D mapping. Safety for the public is a consideration. Concrete inspection to find rebar and pipes, fiber optic lines before cutting and coring into concrete. Again, safety a consideration. Highway inspection to identify voids, pipes and required pavement thickness. Again, safety a consideration. Bridge deck inspection for quality assurance condition assessment and maintenance decisions; public safety a consideration. Geophysical surveys to locate bedrock, water tables and other geological properties, detection of voids and anomalies before construction; safety a consideration. Airport runway inspection to find voids for quality assurance of pavement thickness. Our equipment has been used at every major airport in the country during flight operations with no interference. Railroad bed inspection to find leaking pipes and voids; safety a consideration. Forensics, locating bodies and evidence in criminal cases. Environmental contamination surveys to determine location and ex-

tent of contamination, pipe leaks, waste pits; safety a consideration. Archaeology, mapping of underground sites prior to digging. Mining, location of mineral deposits, seams and water levels; safety a consideration. Measuring ice thickness in rivers, lakes and the Antarctic; safety a consideration. It is worth noting that GPR systems are compatible with GPS systems, because we have sold them together for over 10 years. No interference.

I want to give you a few of the more interesting one-of-a-kind discoveries. Discovery of the wooly mammoth in Siberia—you might have seen that on the Discovery Channel; survey of unopened royal tomb in Xian, China; discovery of unknown village near Macchu Pichu—that was on National Geographic a month ago. We have done surveys at Mount Vernon, Monticello, FDR's home; discovery of emerald deposit in North Carolina, North Americas largest emerald deposit discovery. And we are also developing a GPR system to go to Mars. The purpose, to define creek beds where remnants of life might be found.

More applications can be listed but clearly GPR technology has a high value to society in the United States and the rest of the world. We mention the rest of the world because as many of you know, the UWB standards set here will surely be followed in other countries.

GPR is different from air UWB transmitters. I see I am over my time, but if you don't mind, I will keep going, sir. During the rulemaking process, there was a tendency to treat GPR as just another UWB transmission device. There are several important distinctions between GPR and other UWB transmission devices to consider when formulating rules for UWB transmission. By definition, GPR looks downward into the earth, water, ice and man-made materials. GPR is not intended for air transmission. GPR manufacturers go to great lengths to minimize air transmission. In addition to the fact that GPR does not intend to transmit into air, GPR is also different from air UWB devices in spectrum used and in Pulse Repetition Rate.

Comments on the UWB rulemaking process. The long history of GPR and the testing of GPR equipment provide no basis for these regulations, and we were not even aware of some of them until they appeared in the final Report and Order. As I mentioned earlier, many important aspects of the published rules were a complete surprise to the GPR community, as they were not part of the public disclosure and debate. At no time in the past 30 years has the FCC recorded any GPR interference with other receivers. Indeed, one of the few areas in which all parties agreed throughout the FCC proceeding was that GPRs were not a source of interference. The proposed FCC rules published for comment did not include the NTIA coordination requirements and limits on who can buy GPRs, as one example.

The probable consequences of the new regulations will be two immediate outcomes for the GPR industry. One is substantial reduction of sales for GPR manufacturing companies; two, many GPR service providers, our customers, will go out of business. The long-term impact of the new regulations will be the end of the GPR industry.

Mr. UPTON. Mr. Johnson——

Mr. JOHNSON. In summary——

Mr. UPTON. That helps you, "In summary." All right.

Mr. JOHNSON. In summary, we propose that the FCC treat GPR differently from other UWB devices, because GPR is different from other forms of wireless communication. Surprise rules such as those encountered with the UWB regulations should not be a part of the process to regulate and allocate bandwidth. We are confident that reasonable regulatory requirements can be developed that will allow for the development and use of new wireless air transmission UWB devices, while protecting current users of the spectrum and the continued growth of the GPR industry. We look forward to working with policymakers on that subject. Thank you, Mr. Chairman.

[The prepared statement of Dennis J. Johnson follows:]

PREPARED STATEMENT OF DENNIS J. JOHNSON, PRESIDENT, GEOPHYSICAL SURVEY SYSTEMS, INC.

Good morning Chairman Tauzin, Sub-committee Chairman Upton, and members of the Sub-committee. I am pleased to be here today on behalf of Geophysical Survey Systems, Inc. (GSSI), which is one of several manufacturers of ground penetrating radar (GPR) systems. For the past 32 years, GSSI has designed, manufactured and sold GPR equipment worldwide. We thank you for the opportunity to be here to speak about GPR and the recent ultra-wideband (UWB) Report and Order issued by the Federal Communications Commission. The new regulations are an extremely important subject to everyone in the GPR industry.

I want to be clear that I am speaking for only a part of the UWB industry. This part is called ground penetrating radar or GPR. GPR is a very important class of UWB devices, with a long history of applications relating to public safety and infrastructure inspection that I will comment on shortly.

I have four points to make today:

1. GPR is an established technology with many important applications. GPR is different from air UWB transmitters and should be treated differently in the regulations.
2. There is no record of GPR interference with other receivers.
3. The two most onerous and confusing provisions in the new rules were not contained in the NPRM, which gave us no opportunity to comment on them during the rulemaking process. We only found out about them after the rulemaking was concluded.
4. If the rules are not changed, the outcome and consequences for the GPR industry are extremely serious. Many companies will go out of business . . . and the public's access to a very useful technology will be severely limited, if not eliminated.

Point #1: GPR is an established industry

Geophysical Survey Systems, Inc. (GSSI), is one of several manufacturers of GPR systems. For the past 32 years, GSSI has designed, manufactured and sold GPR equipment worldwide.

In a nutshell . .

- Business started 1970, purchased by the Oyo Group, Tokyo, 1990
- Developed and sold first commercial GPR systems in 1970
- Average selling price $25,000 per system (range $13,000 to $100,000)
- A GSA supplier since 1984
- Products sold to over 25 government agencies in the U.S.
- Products sold and exported to 50 countries
- Some working systems are 10 to 15 years old, and still "ticking"

An important class of UWB devices is Ground Penetrating Radar (GPR). GPR is an established technology widely used in a variety of applications in the United States and the rest of the world. GPR looks downward into the earth, fresh water, ice and man-made materials to non-destructively detect anomalies. Many of these applications provide unique and significant safety-of-life and other benefits in the public interest.

Standard applications for GSSI GPR equipment include:

- Utility pipe detection and 3D mapping (*safety a consideration*)

- Concrete inspection to find rebar and pipes and fiber optic lines before cutting or coring (*safety a consideration*)
- Highway inspection to identify voids, pipes and required pavement thickness (*safety a consideration*)
- Bridge deck inspection for quality assurance condition assessment and maintenance decisions
- Geophysical surveys (locate bedrock, water table and other geological properties, also detection of voids and anomalies)
- Airport runway inspection to find voids and for quality assurance of pavement thickness (used at all major airports and by NASA) (*safety a consideration*)
- Railroad bed inspection to find leaking pipes and voids (*safety a consideration*)
- Forensics (locating bodies, evidence, etc.)
- Environmental contamination surveys to determine location and extent of contamination, pipe leaks, waste pits, etc. (*safety a consideration*)
- Archaeology—mapping of underground sites prior to digging
- Mining, location of mineral deposits, seams and water levels (*safety a consideration*)
- Measure ice thickness in rivers, lakes and in Antarctic research (*safety a consideration*)

(It is worth noting that GPR systems and GPS systems are compatible; indeed GPR systems are sold with GPS systems without special modification.)

Non standard and "once-in-a-lifetime" uses/results of GPR surveys:

- Discovery of the wooly mammoth in Siberia (Discovery channel)
- Survey of unopened tomb in Xian, China
- Discovery of unknown village near Macchu Pichu (National Geographic expedition)
- Surveys at Mount Vernon, Monticello, and FDR's home
- Frozen river bed survey—Russia
- Discovery of buried murder victims, some leading to convictions
- Discovery of emerald deposit in North Carolina, North Americas largest find
- Developing a GPR system to go to Mars; purpose, to define creek beds where remnants of life might be found

More applications can be listed but clearly GPR technology has a high value to society in the United States and the rest of the world. We mention the "rest of the world" because as many of you know, the UWB standards set here will surely be followed in many other countries.

Point #2: GPR is different from air UWB transmitters

During the rule-making process, there has been a tendency to treat GPR as just another UWB transmission device. There are several important distinctions between GPR and other UWB transmission devices to consider when formulating rules for UWB transmission:

- By definition, GPR looks *downward* into the earth, water, ice and man-made materials to non-destructively detect anomalies. *GPR is not intended for air transmission.* GPR manufacturers go to some length to reduce unwanted air transmissions.
- In addition to the fact that GPR does not intend to transmit into air, GPR is also different from air UWB transmitters in Pulse Repetition Rate and in the frequency spectrum used.
- A primary issue behind rule changes centers on the protection of Global Positioning Satellite (GPS) system operations. *GPR works well with GPS systems,* as evidenced by the fact that for the past 10 years GPR manufacturers have sold GPS systems that work successfully in conjunction with their GPR systems.

Point #3: Comments on the UWB Rule-Making Process

The long history of GPR and the testing of GPR equipment provide no basis for these regulations, and we were not even aware of them until they appeared in the final Report and Order. As I mentioned earlier, many important aspects of the published rules were a complete surprise to the GPR community as they were not part of the public disclosure and debate. Isn't the rulemaking process itself designed to be the opportunity for public disclosure and debate? Surely were we to have had knowledge of these particular rules, we could have easily explained why they are inappropriate and unnecessary.

The background leading to this nexus:

- FCC Rules, Part 15, created for frequency domain transmitters to keep systems from interfering with each other
- Original Part 15 Rules did not contemplate UWB transmitters (time domain).

- At no time in the past 30 years has the FCC recorded any GPR interference with other receivers.
- All parties agreed throughout the FCC proceeding that GPRs are NOT a source of interference.
- UWB rules are now being written for the first time.
- The proposed FCC rules published for comment in 2000 did NOT include the NTIA coordination requirements and limits on who can buy GPRs—and the FCC cannot lawfully adopt rules that were never proposed.
- We believe that requirements for overly stringent rules come from (1) a perceived need to protect against in-the-wall and through-the wall radars, not GPRs; and (2) NTIA policy (not technical) concerns about "intentional" emissions into certain bands, even at completely harmless levels.
- The new UWB rules protect GPS frequency spectrum beyond reasonable limits, resulting in the elimination of an entire industry—the GPR industry.

Point #4: The probable consequences of the new regulations

The recently published regulations intended to govern UWB devices will have two immediate outcomes for the GPR industry:

1. Substantial reduction of sales for GPR manufacturing companies
2. Many GPR service providers will go out of business

The longer-term impact of the new regulations will be the end of the GPR industry.

SUMMARY AND RECOMMENDATION

We propose that the FCC treat GPR differently from other UWB devices—because GPR is different from all forms of wireless communication. (See above)

Surprise rules such as those encountered with the UWB regulations should not be a part of the process to regulate and allocate bandwidth, or for any rulemaking process.

We are confident that reasonable regulatory requirements can be developed which will allow for the development and use of new wireless air transmission UWB devices, while protecting current users of the spectrum and enabling the continued growth of the GPR industry. We look forward to working with policymakers on that solution.

Thank you.

Mr. UPTON. Thank you. I would recognize first from the panel the chairman of the full committee, Mr. Tauzin.

Chairman TAUZIN. Thank you, Mr. Chairman. Mr. Petroff did a good job of putting this in perspective when he compared the width of a human hair to the Empire State Building in terms of the relative position of Part 15 services. But let put it in layman's terms. The last time the Commission, Mr. Knapp, reviewed its Part 15 rules was 1989. In 1989, there was a big revision that followed up on actions in the 1960s and the 1980s to open up Part 15 services for Americans. I want to talk about some of the devices that came into being because the Commission was willing to open up Part 15 rules in the 1960s and 1980s.

Provisions were made under Part 15 to permit the operation of such things as wireless microphones, telemetry systems, garage door openers, TV interface devices, you know, like video recorders. Wouldn't have them but for the 1980's amendments. Such things as a field disturbance centers, you know the anti-theft systems in stores, auditory assistance devices for people with hearing defects, control and security alarm apparatus, cordless telephones. That is what we are talking about. We are talking about all these little devices that Americans use in so many different ways to make our lives comfortable and useful and to protect us in alarm systems, et cetera, that wouldn't be in existence but for Part 15 rules that say you don't need to go get a license from the FCC to buy a VCR, for heaven sakes.

That is what we are talking about, folks. We are talking about those kinds of devices under Part 15, and the Commission has generally been very good about making sure those devices come to the marketplace. In fact, in the 1989 proceedings, Mr. Knapp, I am going to read it to you: "We note that NTIA's calculations represent theoretical noise levels generated with a receiver under ideal conditions. They do not take into consideration existing background noise, et cetera. NTIA's calculations appear to represent the worst-case situation. NTIA has also not supplied any information detailing the cumulative effect referenced in their comments."

And then it goes on, "For these reasons, we are not adopting NTIA's proposal for tighter emission limits for the restricted bands." In 1989, the Commission had guts. It stood up for consumers, and it stood up for commercial use of new technologies, and it said to the NTIA, "Unless you can come in and prove to us that something is really here instead of these imagined problems, we are not going to adopt your restricted standards. We are going to give this stuff a chance to show us what it can do."

It noted in that same review that in fact there is no evidence that licensed communication services have been significantly impacted by the widespread proliferation of computing devices operating under proposed limits. You made the point, Mr. Petroff, all the computers, we don't go get a license from the Federal Government to have a PC in America. So we have got devices operating in this Part 15 area, and I suppose the first question I have to ask you, Mr. Knapp, has there ever been any documented evidence of interference by Part 15 devices to GPS or other safety-of-life systems in this country?

Mr. KNAPP. Not that I am aware of.

Chairman TAUZIN. Not that you are aware of. And I guarantee you won't find it anywhere in the record. All these devices operating, no documented evidence of any interference at these such limited low levels of operation of power with any lifesaving systems.

Now, Mr. Petroff, Mr. Price makes a comment in his written statement that commercial vendors do not need to operate below 3.1 gigahertz in order to market UWB devices commercially. Would you respond to that?

Mr. PETROFF. Well, I think that is a reference in the written testimony to one company, Kohler, the plumbing manufacturer who——

Chairman TAUZIN. Yes. In fact, Mr. Price brags about one manufacturer, Kohler, operating at 6 megahertz and say if they can do it, anybody can do it, right? What device is operated by Kohler at 6 megahertz?

Mr. PETROFF. It is a plumbing fixture.

Chairman TAUZIN. It is a toilet flusher.

Mr. PETROFF. Yes.

Chairman TAUZIN. Yes, right. It is a toilet flusher. So we are going to have to apparently walk by our toilets to operate our home video systems if we have to operate at 6 megahertz. I mean for you to cite one device, a toilet flusher, as a good example of how these tight restrictions can work, if that is all we are going to get out of

this, is toilets that flush when we walk by then instead of having to pull the handle, woopy ding.

I am serious, guys. I mean that is hardly something to brag about, and the tight restrictions that NTIA has recommended, that the Commission just adopted this time, when in 1989 they said, "No, we are not going to do that. We are not going to adopt such tight restrictions without proof that there is real problem, because we know of no problems. There has never been a documented case of a problem. So we are not going to take your advice and adopt these restrictions." But this time, Mr. Knapp, you did. This time you said, "Look, we have got joint jurisdiction here. We talk about background noise, we have got governmental uses that obviously have a problem with background noise. So we have two responsibilities here: NTIA has one and we have one." What was NTIA's responsibilities in this case, Mr. Gallagher? What was NTIA's responsibility first? What was your job?

Mr. GALLAGHER. Our job was to find the right answer, Mr. Chairman.

Chairman TAUZIN. Was to find what?

Mr. GALLAGHER. The right answer, find the right balance.

Chairman TAUZIN. But who do you represent? Don't you represent protecting the government spectrum uses?

Mr. GALLAGHER. Mr. Chairman, we have two responsibilities under our enabling statute: One is the President's primary advisory on telecommunications matters——

Chairman TAUZIN. Right. I understand that point.

Mr. GALLAGHER. [continuing] and the other is the manage the Federal spectrum.

Chairman TAUZIN. Management of the Federal spectrum. What is your responsibility in this shared responsibility, Mr. Knapp? What is the FCC's job when you have got to work with the NTIA in coming up with the right policy?

Mr. KNAPP. Certainly, one of our roles is to make sure that our rules are as flexible as possible, that they allow the technology, and in this case ultrawideband technology——

Chairman TAUZIN. Is your job simply to say that the manager of the Federal spectrum will adopt your restrictions, whatever they are?

Mr. KNAPP. When it comes to spectrum that is allocated on exclusive primary basis for the Federal Government, we provide wide deference to their recommendation.

Chairman TAUZIN. Provide wide deference to them. In 1989, you say, "No deal. We are not adopting those restrictions." But this year you did. This year you said, "Okay, we will go ahead and take the NTIA's word on it, and we will adopt such tight restrictions on the use of this new technology that in some cases, we hear testimony, it might not survive." What is the difference? What happened between 1989 and now?

Mr. KNAPP. Well, the difference was the standards that you are referring to are spurious emissions as contrasted to an ultrawideband product.

Chairman TAUZIN. The difference is intention.

Mr. KNAPP. Yes.

Chairman TAUZIN. Yes. The difference is that this technology is based upon using literally background noise. It is based upon intentional emissions. It is not just spurious, they just happen. But shouldn't the technology, the engineering question be not whether you intended it or whether it was accidental but whether it in fact causes any problem? Shouldn't that be the real question?

Mr. KNAPP. Certainly.

Chairman TAUZIN. Yes. But that is not what happened here. What happened here is that you made a different decision based upon the fact that this technology intends to do it, intends to emit into the spectrum, whereas computing services and garage door openers and cordless telephones just do it accidentally so they are okay. Where is the rationale for that, where is the engineering rationale for that distinction?

Mr. KNAPP. Part of the concern is that when we allow products to intentionally emit in particular bands there is always the risk that they will proliferate and add up.

Chairman TAUZIN. We may get a lot of computers and we may get a lot of garage door openers. Haven't we gotten a lot of computers and a lot of garage openers? Didn't the Commission in 1989 say, "The NTIA has given no information regarding the cumulative effect referred to in their comments," and haven't we found out since 1989 that there is no such thing as a cumulative effect, that all our computers and all this equipment is not having the deleterious effect that the NTIA predicted it would have in 1989.

Mr. KNAPP. Yes.

Chairman TAUZIN. Right. So the facts are that in 1989 you said, "You didn't bring us any evidence of the cumulative effect of these spurious emissions," and sure enough since 1989 the cumulative effect has not shown up, there has been no documented case of interference. But in this case, when you look at it, you said, "Even though you didn't bring us any information regarding the cumulative effect and even though the facts, reality, tells us that there has been no cumulative effect, as was predicted by the Commission in 1989, we are going to clamp down on this new technology this year." You see why I am a little confused as to the FCC's role this year?

Mr. KNAPP. Yes.

Chairman TAUZIN. This year, it looks like the FCC said to the NTIA, "Okay. We understand your hypothetical concerns, we understand your argument there may be a cumulative effect, so we will just adopt your restrictions this year." You understand.

Mr. KNAPP. Right.

Chairman TAUZIN. And all of a sudden now new technologies may not make it—may not survive, and consumers may be denied a lot of new products; worse than that, we might not find bodies in rubble, we might not find people in time to save their lives the next earthquake or the next 9/11 catastrophe. Or we may not be able to locate somebody lost inside a building or lost inside some natural disaster in Louisiana when a hurricane strikes or something, because this technology may not be there. We may not have a better alarm system, we may not have a better military protection system for our country, better military communications in the field battle, because we restricted these communications. We may

not have the home video distribution systems in broadband we want 1 day. All kind of things we may not have because you decided this year just to go ahead and adopt the NTIA restrictions without proof that their claims of potential interference were real. You see our concerns.

Mr. KNAPP. I do understand, and I——

Chairman TAUZIN. Look, I don't want to beat up on you terminably, although I enjoyed it.

I simply want to make the case that you said you could do something in 6 to 12 months to review these rules and to decide whether or not you have been too restrictive, as you think you have been, even in your own report. Now, I am counting on you, and I think America is counting on you, to do a good job and all of you to help the Commission get a good job done on here. And if you have to amend this order in order to give this technology a chance to show what it can do in a way that gives us reasonable assurance it will not interfere or that you can pull the plug on it if it does, then for heaven sake's do that. I mean the FCC is supposed to be the balance to the NTIA. It is supposed to say to the NTIA once in a while, "No, you just can't come stop something because you are scared of it. You can't stop something because you think it might be hurtful or damaging somewhere. Come show us what you got."

So let us do some quick show-and-tell over the next 6 to 12 months, and we will be watching carefully the process at the FCC, and we will be watching carefully NTIA's collaborative efforts and Defense and Transportation and all of you guys in trying to work this out. But for heaven sakes, don't let anybody out there who has a commercial product encourage you to stop a new one from coming in just because it might be better, because there are some of us who believe maybe that is going on too. Thank you, Mr. Chairman.

Mr. UPTON. Thank you, Mr. Chairman. Recognize Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman, very much. First, I would like to ask Mr. Gallagher and Mr. Knapp to explain how they intend to proceed on resolving unintended impacts with respect to ground penetrating radar systems. Please give me both your short-term and long-term suggestions on how to address the issue. And then, Mr. Johnson, I would like you to comment on their explanations. And I have one other question I want to ask, so please try to be brief in your answer. Mr. Gallagher.

Mr. GALLAGHER. Thank you, Mr. Markey. First, the process is already underway in which we are understanding the concerns and we have already met with the GPR community to address the path forward. There was absolutely no intention of limiting or inhibiting the growth of small business or overregulating any particular set of entities. We are purely concerned about the emissions above the ground from GPR receivers. And some of the specific thoughts that we have discussed with the community are enhancing our definition, which currently restricts the eligible users, also, perhaps, if it is necessary, a waiver of some sort, and, finally, more closely understanding and testing their equipment, which up to this point has not been tested by the FCC or by NTIA to understand the types of emissions that are coming out from around the device. Again, it is not the emissions that are focused into the ground,

there is no limit on those, the R&O simply speaks to what leaks around the edges.

Mr. MARKEY. What is your timetable for fixing the problem?

Mr. GALLAGHER. With all due haste.

Mr. MARKEY. What does that mean? This year?

Mr. GALLAGHER. We will work with the FCC. I think there are some technical limitations imposed by regulatory rules that we need to comply with, but as fast as we can under those constraints.

Mr. MARKEY. Okay. So you don't have like an FBI-CIA relationship, right?

Mr. GALLAGHER. No. No, absolutely not.

Mr. MARKEY. So let us go—I mean you are not putting that up as some big barrier. I mean that actually telescopes the timeframe that we have to work with the FCC, right? Let us go to you, Mr. Knapp.

Mr. KNAPP. Yes. First of all, we are very supportive of the GPR technology. We certainly don't want to shut down this industry; they are very worthwhile products. I think the immediate things we can do, part of it had to do with the wording of the usage restrictions in the rules. Certainly, what we have heard described to us is the applications, including consultant use, for example, in inspecting the foundations of buildings, were all envisioned in our Report and Order. So I think that we have some latitude to take care of that problem without a further order.

On the issue of coordination, we want to make that as streamlined as possible so that, for example, rather than getting a coordination for every individual use, you could get a coordination for statewide operation if you are a State highway department.

Mr. MARKEY. So how much time to fix this issue?

Mr. KNAPP. Immediately. I think we are already talking about how we can address those issues. The coordination issue I think we can take care of, working together between the agencies——

Mr. MARKEY. By the end of this year?

Mr. KNAPP. Certainly.

Mr. MARKEY. Certainly. Excellent. Mr. Johnson.

Mr. JOHNSON. Because of the Internet and the widespread information being transferred to everybody very fast, many of our customers that have placed orders have already canceled them because of the impending rules. We have had other potential customers call and say they are not going to place an order because of the rules. So we are already being impacted today by the rules that will go into effect. So I do appreciate—we have had some meetings with Mr. Knapp and the FCC, do appreciate their consideration in doing something immediately to give us some immediate relief.

Mr. MARKEY. Thank you. And my second and final question is I have introduced legislation, H.R. 4641, that would, among a number of other things, require NTIA and the FCC to work together to make progress in creating a spectrum commons. The Legislation asks for chunks of spectrum to be freed up and clear but not auctioned to the private sector. Instead such frequencies would remain unlicensed and therefore available for use by the general public. High-tech manufacturers, entrepreneurs and the proverbial kid in the garage could make more robust use of wireless communications

if sufficient spectrum were available in unlicensed form for the general public. Such a public set-aside could foster the formulation of an open platform for innovation, entrepreneurial activity and public communications. It would also militate against unhealthy consolidation of spectrum in the hands of too few providers. We have already seen growth in Blue Tooth and 802.11 technologies, but we need to do more. Is the spectrum commons idea a good idea or a bad idea, yes or not, that is all? Yes or no, Mr. Johnson?

Mr. JOHNSON. I am not sure how to answer that, sir.

Mr. MARKEY. Okay. Mr. Petroff?

Mr. PETROFF. Yes, an excellent idea.

Mr. MARKEY. Okay. Thank you. Mr. Knapp?

Mr. KNAPP. Yes.

Mr. MARKEY. Yes. Mr. Shane?

Mr. SHANE. It would have to be a pretty wide spectrum, a wide commons to accommodate ultrawideband.

Mr. MARKEY. But good idea?

Mr. SHANE. If it were feasible, yes, sir.

Mr. MARKEY. Okay. Yes. Mr. Price?

Mr. PRICE. It depends if part of it means taking spectrum from DOD for the commons.

Mr. MARKEY. Okay.

Mr. PRICE. If not, I support it, sir.

Mr. MARKEY. Mr. Gallagher?

Mr. GALLAGHER. Seeing how we are able to expand here, I would say that it is a good idea when you measure where the spectrum is going to come from and also that we avoid a tragedy of the commons.

Mr. MARKEY. I understand that, but if we could do that, yes?

Mr. GALLAGHER. Absolutely.

Mr. MARKEY. Okay. My point in mentioning this proposal is simply to underscore that the process that has just been completed by NTIA and FCC for so-called Part 15 devices and UWB technology is likely to be repeated again and again. We need to work well, not only for government users but also for consumers, high-tech manufacturers, innovators and entrepreneurs. Our economy is affected by how well NTIA and the FCC perform our spectrum management tasks. So my question to NTIA and FCC is whether they need additional resources to do the kind of real-world testing to distinguish between fact and fantasy, between theoretical interference and actual observed interference and to do that kind of testing in the future so that we can accelerate the introduction of new technology into the marketplace. Mr. Gallagher?

Mr. GALLAGHER. The issue of funding is always an interesting one. We are just now preparing our 1904 budgets and the like and one——

Mr. MARKEY. Do you need resources, Mr. Gallagher, or not? It is an interesting question.

Mr. GALLAGHER. We definitely need to additional testing, and I would suggest that funding in that area would be necessary and appreciated.

Mr. MARKEY. Mr. Knapp?

Mr. KNAPP. The short answer is yes, and we have been explaining to the Congress that we need resources for engineers and the

equipment for our laboratory, and we thank you for the support we have gotten so far. And I think we are certainly a lot better off now than we were a year ago.

Mr. MARKEY. Mr. Chairman, if we want to see a revitalization of a sector we now call the Nasdaq that no one heard of before 1995, I would suggest that a lot of what we are talking about here today, about technologies and companies whose names we do not know or understand yet, are central to a next generation boom that gives people a good reason to invest in companies and technologies, assuming that the accounting standards for those companies have been updated to reflect lessons learned since Enron/Arthur Andersen. But I think that, to a large extent, the key to a Nasdaq revitalization sits at our table today. Thank you, Mr. Chairman.

Mr. UPTON. Thank my friend from Massachusetts. Mr. Gallagher, how is it that you all resolve these conflicts between the business end of those knocking on the door trying to get their products out using the spectrum and folks like your neighbor, Mr. Price, looking for the domino theory of if you take this little bit of spectrum, it is all going to go? And as you look at other Federal Government incumbent spectrum users, what is the process that you all begin to look at as you weigh those——

Mr. GALLAGHER. Well, the first thing you have to do is listen, because there is a lot that we need to learn from the private sector coming in explaining what it is they are trying to accomplish, the technical data on this is extraordinary in length. Over 900 comments have been filed on the docket, multiple studies introduced by multiple parties. You have to grasp and understand and be able to translate those into concepts that normal people can understand.

Mr. UPTON. Well, Mr. Petroff had a pretty good chart that was shown, I don't know if you were able to see it at the end, of using just a very narrow red line versus the Empire State Building, and we see a lot of different examples of that, whether they be the bathroom example that Mr. Tauzin used or a whole host of things.

Mr. GALLAGHER. And I would suggest that sometimes those charts can distort the truth, because if you look at the data about ultrawideband, the testing that was done in our Boulder facility, the emissions that come from ultrawideband, the characteristics of the signal are fundamentally different. Instead of just a random spike that would appear in a restricted band under the Part 15 rules, this is an intentional, as many as a million emissions per second in that band. That is a lot of energy, and it is particularly distortive to GPS and we documented that, and it is part of the record of the rulemaking.

But I would say besides the listening and the learning, it took multiple meetings with the Commission so they could understand every db of protection that was being requested by NTIA. It took multiple meetings of NTIA with DOD and Department of Transportation making them justify and explain it, sending them back to the engineer drawing board to answer particular questions, and I think you see the benefit of that in the results. If you look back to September, the Department of Defense's position was further notice, put it all above 6 gigahertz and, you know, by the way, you have to have a high-pass filter. If you look at where we ended up in the final order, it is the need of the ultrawideband signals at 3.1

gigahertz, substantial movement, and also there is no requirement for a high-pass filter. Instead, there is agreement that the mask that was developed by NTIA was the right approach. Under those circumstances, it just shows that when you engage on a technical and a factual level and you do it with leadership, you can achieve the right results.

Mr. UPTON. Mr. Sawyer.

Mr. SAWYER. Thank you, Mr. Chairman. I guess my questions are largely all follow-up to many of the things we have heard before. Mr. Gallagher, you are telling us that this inherent conflict, this tension between your dual missions is a good thing despite the fact that it slows down the process. Is that essentially what you are saying?

Mr. GALLAGHER. I would agree it is good to have both perspectives in coming up with the right balance, yes.

Mr. SAWYER. In the post-911 situation, apparently there was a way to achieve a waiver in this extraordinary circumstance. What would happen in the event of a smaller scale disaster, a simple earthquake, the kind of bridge collapses we saw in urban highway systems? Is there a mechanism in place to achieve this sort of thing on a regular basis so that you don't have to have the kind of disaster that occurred in September? You can both answer.

Mr. GALLAGHER. The answer is yes, and we have a history of responding favorably to the types of situations you have described.

Mr. KNAPP. And I agree completely.

Mr. SAWYER. I guess I don't understand, on another subject, why the testing wasn't done before the FCC issued this rule. But just to go beyond that, if in fact the tests that will take 6 to 12 months to undergo show that the concern over harmful interference was less than necessary, does that imply a new rulemaking process? And if so, is there any reason why those can't operate in parallel instead of sequentially?

Mr. KNAPP. I think we need to develop the data through the tests and then make that public. We would probably have to issue another proposal to change the standards to allow everybody, remember these rules also affect non-government services as well, to have an opportunity, if we are going to make a change, to comment on it.

Mr. SAWYER. Considering how far this has gone, don't you have a substantial amount of information on which to condition the pathway that the new rulemaking would take?

Mr. KNAPP. I think, legally, under the Administrative Procedures Act, if we are going to change the rules, we would have to issue a proposal. So we would have to go through that administrative step.

Mr. SAWYER. And yet you largely accepted the standards that were originally issued by the NTIA. Should the NTIA be anticipating a favorable result from the testing so that you have something in hand?

Mr. KNAPP. What we are going to do is once our results are completed, we will make them public. We are going to talk to NTIA and the other agencies as we go through the process of conducting these tests.

Mr. SAWYER. Overall then, how long do you anticipate this entire process taking?

Mr. KNAPP. We still said 6 to 12 months for examining the rules. We should have our data out publicly before the end of the year.

Mr. SAWYER. Does the rulemaking under the Federal procedures is that then subsequent to that step?

Mr. KNAPP. No. No, we would have a proposal out certainly within 6 to 12 months.

Mr. SAWYER. So at least there is something that Mr. Johnson can look at and have some hope that he can deal with in a reasonable period of time. The answer is yes?

Mr. KNAPP. Yes.

Mr. SAWYER. Okay. Thank you. Thank you, Mr. Chairman.

Mr. UPTON. Mr. Shimkus.

Mr. SHIMKUS. Thank you, Mr. Chairman. I want to direct my questions to Mr. Price, and I do this out of love and admiration. I think if you all think through these questions, these are the questions that people are asking, and so let us go through them. You indicate in your testimony that the Department of Defense needs more time, and does that time also apply to the Pentagon's own ultrawideband devices?

Mr. PRICE. That is a fair question, sir. If you are talking about the time on the 6 to 12 months that was just being discussed, I would weigh in probably with a counter argument that our concern at the Department of Defense is that as we understood what the FCC said, and Mr. Tauzin said and a number of people have said this, there has been conflicting data. This was a case of, "My study is prettier than your study," to some extent. There was no hard science, there was no sound science. And part of the reason is because you can't measure the aggregation effects of ultrawideband devices, a whole bunch of them in a particular area, to see how much it raises the noise floor if there aren't a whole bunch of them in a metropolitan area out there being used as they would in commercial settings.

So I thought the point of the—we thought the point of the 6 to 12 months was to give the industry a chance to commercially deploy—manufacture, sell, deploy devices, get them out there, get people playing with them, using them, breaking them, getting new ones the way people typically use cell phones, other kind of new technologies, and then be able to examine the real science, as Mr. Tauzin said, sound testing. We agree with that. We are not sure that that can be done within the 6- to 12-month period. There won't be enough—our concern is there won't be enough devices out there." If you start the testing today, the devices aren't in widespread use.

So the first part of the question is in terms of the delay, there is no delay. Once the science is out there, we will be happy to—we have even said that we would contribute resources to help review the test plan, if that would be useful. Because, clearly, a strong safe commercial deployment of ultrawideband is in the Department's interest.

As far as the second part of your question, which is, I think, whether or not the Department of Defense is going to use or be treated the same as commercial, was that the second?

Mr. SAWYER. Well, you could skew it that way, but the basic issue is you do have the technology, you are using it. There are military applications, you like it. So if there—I mean the other question I was going to follow-up with then is if you like it but you are afraid of it interfering with aviation or GPS, wouldn't that cause you to be a little bit concerned of your own use?

Mr. PRICE. Well, our use is typically very constrained. It is only in certain places, it is limited in number, limited in area and limited in duration. It is on a range, it is in a particular place. The concern with—our concern with this proceeding was that it was unconstrained, unaggregated, unlicensed use.

Mr. SAWYER. Well, let me ask the panel, because I want to go back to the first answer to the first question, because you said there is no hard science, and I want to ask the rest of the panel, starting with Mr. Gallagher, do you agree that there is no hard science on the aggregation effects?

Mr. GALLAGHER. I would say that we tested I believe it was two devices in an anechoic chamber and built a model based on that, but even then they were UWB emitters. They were on loan from the companies manufacturing the technology or hoping to——

Mr. SAWYER. So you agree with Mr. Price.

Mr. GALLAGHER. I think we need to see real penetration of real devices and then test those devices in those settings and come up with the truth. And I think that the time to do those tests is when they have penetrated into the market.

Mr. SAWYER. Okay. Let me ask Mr. Shane.

Mr. SHANE. Absolutely, Congressman. The Department of Transportation, from the get-go in this proceeding, has been arguing for more testing and more specific prototype testing, empirical testing in the real world as a basis for making what at the end of the day is a national security decision about the allocation of a critical piece of our infrastructure—the spectrum.

Mr. SAWYER. That is fine. Let me go to Mr. Knapp. And I also follow the great discourse of the chairman, so you kind of addressed this in some of your comments, so how would you respond to that question?

Mr. KNAPP. I wouldn't agree that there was no hard science, I think there was some. This was an issue where we received information in our record. It was examined as part of the testing. But I think there certainly is a lot more to do. Ultrawideband devices are not of one consistent set of technical standards. They have different pulse rates and so forth, so there are questions about how they would add up.

Mr. SAWYER. And, Mr. Chairman, if I may finish up the panel with this one question, Mr. Petroff?

Mr. PETROFF. Yes. There was much testing done. Chairman Powell was quoted as saying there had been more testing done on this proceeding than on any other proceeding. DOD's Joint Spectrum Center evaluated the different tests, there were four of them, and found that all the data basically said the same thing, it is just a question of which assumptions were used. There are two types of ways these tests are done. One is real-world testing, and in our case we spent well over $1 million with Johns Hopkins and the University of Texas, the two foremost GPS testing labs in the coun-

try, developing. And then there is also what happens after the testing when you do assumptions.

And if you look at these assumptions, they make all the difference in the world. Because under some assumptions you can run the numbers and you can find that a baby monitor will not GPS from 200 miles away. So we need to watch carefully the assumptions. And there was aggregate testing done during this. So there has been extensive testing this time. I don't know if it is the most in FCC history but it has been a lot.

Mr. SAWYER. And, finally, Mr. Johnson.

Mr. JOHNSON. Well, speaking again from a GPR standpoint, I think GPR was not tested very extensively at all. Our pulse repetition rate is much lower than the area UWB, and I think we have got a rough number of maybe 1,000 units working in the U.S. already, so we have got units that can be tested today.

Mr. SAWYER. Thank you, Mr. Chairman. I will just end by saying that if we have this interim of 6 to 12 months and we come and we don't have an answer to that question, whether the stakeholders agree that there has been enough testing or not, then we are just going to be back here next year. So I would encourage us somehow to get a scientific basis to make these public policy decisions, and I yield back my time. Thank you.

Mr. UPTON. Thank you. Mr. Bass.

Mr. BASS. Thank you, Mr. Chairman. Mr. Johnson, I heard you in your testimony mention that you noted some surprise that several provisions were included in the rule that were not in the Notice of Rulemaking. Can you describe those? Which provisions were those?

Mr. JOHNSON. Two of them in particular. One is the limit of types of industries that we can sell to. And, second, the coordination where every user has to contact the FCC 15 days prior to use. Both of those were a surprise to us.

Mr. BASS. Mr. Knapp, can you comment on that?

Mr. KNAPP. Yes. The Notice of Proposed Rulemaking had several broad questions. Certainly, the waivers that we had issued previously included restrictions on use and a coordination requirement, and that came essentially from NTIA. NTIA's comments that they furnished that were inserted in the record requested the coordination requirement.

Mr. BASS. Mr. Johnson, do you have any rebuttal to that or not?

Mr. JOHNSON. Well, we didn't look up on the waiver given to one company as representative of what the rules were going to be, so I think we have a different viewpoint.

Mr. BASS. Mr. Price, you mentioned that there are not enough devices out there to have the full body of evidence for interference. Now, if the order places a chill or reduces the ability for devices to be created, how can you develop the evidence if they can't be created? Don't you have a chicken and egg issue here?

Mr. PRICE. I wouldn't say so, because I don't think that the order places a chill on ultrawideband deployment. I think if it is widely available above 3.1 gigahertz and with various constraints depending on the type of device and within what band. I think if you look at the web sites of the various companies and industry analysts, I think the genera consensus would be that the FCC's order al-

lowed for ultrawideband deployment. This wasn't a case where the FCC or NTIA said no; they said yes in these areas. And I think most of the companies that certainly we had met with or whose statements we read believe that there will be ample deployment of ultrawideband. So I think there will be enough science out there but just in areas that protect national security systems.

Mr. BASS. Do either of you gentlemen from industry have any comment on that? Do you agree?

Mr. JOHNSON. Well, I think, as I have stated, we have been out selling systems for some time with no interference, and I think that the R&O went a little too far.

Mr. PETROFF. And just to follow-up on that question, I think we are of two minds. On the one hand, it was good to get something out there, and it will allow some developments. We will be able to make lots of our wonderful PAN devices. But I do think that the public safety and GPR applications were unfairly penalized. There is not enough power there to do the kind of work that needs to be done. And, moreover, it sets sort of a double standard where Federal public safety will be able to use the technology at higher power but State and local will not.

Mr. BASS. I would just like to conclude, Mr. Chairman, by associating myself with the comments made by our full committee chairman. He said it better than I ever could have said it, and I hope the message is clearly received by the agencies involved. I would also note I have here the—this is a sales brochure for Geophysical Survey Systems in which there is a device here on the front called a Pathfinder, obviously emitting low-level frequencies, but it also has a computer that is connected to GPS; is that not correct? So if there was a problem with interference, how well would this device work?

Mr. JOHNSON. Yes, sir. We sell systems with both differential GPS, which has a one-inch accuracy as long as it is picking up six satellites or more, and it is an expensive system, $27,000 system, and we also sell systems that will work with a $150 GPS system. In both cases, the GPS system is working one foot away from the radar system.

Mr. BASS. Thank you very much, Mr. Chairman.

Mr. UPTON. Mr. Pickering.

Mr. PICKERING. Thank you, Mr. Chairman. I want to thank you for giving us the opportunity to address this very important issue. Mr. Price, let me ask some questions as we try to strike the balance in our policy between the commercial applications in development and innovation and investment and our national security needs. And we just want to understand the Department of Defense's concerns and this goes to the very heart of what we are trying, I think, to achieve in the end. If we set a very conservative authorization in our first decision, how quickly will we have an evolving standard testing and how quickly can we move forward on being less restrictive if in fact the testing shows that we do not have interference, especially with our national security?

Again, to understand the standard at which we are starting, my understanding is that Deputy Secretary of Defense Wolfowitz, in his letter to Secretary Evans on November 20, 2001, he took a position that approval of UWB be at a power level more than 2,000

times lower than Part 15. Now, why would DOD take the position that UWB be restricted to a power level more than 2,000 times below the level of billions of other Part 15 devices that are currently not interfering with GPS and other safety-of-life systems?

Mr. PRICE. Those devices aren't in the GPS band, sir.

Mr. PICKERING. Okay.

Mr. PRICE. So it is a little bit of a different story. The concern here is that——

Mr. PICKERING. So is it——

Mr. PRICE. I am sorry.

Mr. PICKERING. The question is not so much the power level but the band in which they operate.

Mr. PRICE. Right. Those devices aren't in the GPS band, so we have no problem with those.

Mr. PICKERING. Okay. But even if you are in a separate band, why such a conservative approach, 2,000 times?

Mr. PRICE. Well, we don't think it was conservative. We think the testing showed that it was prudent. UWB energy may seem negligible certainly compared to a TV tower or a broadcast tower or the business I used to be in, the cell phone business. But not to a receiver that is trying to measure a weak signal from GPS 12,000 miles away. And especially if you think about urban canyons and the like, this is a very sensitive area, and the testing showed that even a single UWB device can raise the noise floor at a 6-foot separation by 1 DB, causing 26 percent sensitivity decreases. So there were real risks to GPS. And the point here wasn't to say no, it was just to say that we need to protect GPS. If it is outside of the GPS bands, which is the particular area we had concerns, and I know other departments had other concerns, above 3.1 gigahertz we didn't have a problem. In fact, we are looking forward to commercial development because it will be cheaper for us to buy COTS technology. So we support that. It was just to protect the GPS bands.

Mr. PICKERING. Mr. Petroff, your response to that.

Mr. PETROFF. Well, right now there are presently billions of consumer devices putting their energy into the GPS bands. They are doing this and they have been doing it for 20 years. But they are doing it at such a low power level that they are virtually undetectable and unnoticed. And this is part of the genius of Part 15 that it has allowed so many billions of devices to be used in government spectrum and in commercial spectrum without any interference. And, indeed, the first time I met Mr. Knapp over here, almost 6 years ago, he said, "If you are going to be in Part 15, you have to remember one very important rule, and that is you are not allowed to create any harmful interference into anybody's band. That is the standard that has to be met." And all the testing that we have done has consistently showed that.

I want to take issue with Mr. Gallagher on one point. This signal is a noise-like signal that is virtually indistinguishable from what you see out of a computer. So it is very, very close in terms of what its impact is.

Mr. PICKERING. So you would disagree with Mr. Price and Mr. Gallagher. You would say that it is not only the power level, but you are also operating within GPS bands.

Mr. PETROFF. Yes. There are many, many, dozens, hundreds, thousands of consumer devices. There are probably, if you add every palm pilot, every laptop, every pocket calculator, all these devices I see over here, all of these give off ultra low-level energy, and many of them put some amount of energy into the GPS bands, and they do it on a non-interfering basis, and they have been doing it for 20 years.

Mr. PICKERING. Mr. Price, Mr. Gallagher, your defense?

Mr. PRICE. I hate to argue with Mr. Petroff because I am probably his biggest customer by a factor of 10——

Mr. PICKERING. But not 2,000.

Mr. PRICE. I would argue it is probably 2,000, but I haven't seen his financial statements. I just know everywhere we go in Department of Defense they are testing various ultrawideband devices, and for good reason because it is a great technology. But I think the argument—the discussion you are seeing here is the point. There is no hard science. We can't all go to your district and see——

Mr. PICKERING. Would you disagree with Mr. Petroff's assertion that there are thousands of devices out there operating within GPS bands?

Mr. PRICE. I would certainly disagree that there is no potential harm to GPS from ultrawideband devices. This something-for-nothing argument is one I have trouble buying across the board in life, and here as well. If there is an emission, there is a danger for interference.

Mr. PICKERING. But what he said, that there are thousands of devices operating now, is that true?

Mr. PRICE. I would have to take that for the record. I don't know the exact number and various——

Mr. PICKERING. But I guess the question is it seems like it would be a pretty easy thing to ascertain, to know, do you have, Mr. Gallagher, would you say today, thousands of devices operate in that band today? Mr. Gallagher?

Mr. GALLAGHER. I would say there are no doubt millions, but you have to listen very carefully to Mr. Petroff's words.

Mr. PICKERING. Okay. Let me ask, we acknowledge that there are now millions of devices operating in that band. So that is a fact we——

Mr. GALLAGHER. They are not operating, they are emitting energy on a spurious or out-of-band basis intermittently. These are random signals that are in or out. They are not there a million times a second at whatever level we authorize UWB operation.

Mr. PICKERING. Let me—one last question, Mr. Chairman. I thank you for your time and your patience. Mr. Gallagher, you would say that what you and the FCC authorized or your recommendations, the FCC's authorization was a starting point. We are now trying to get the testing and the penetration and the scientific facts and evidence that would allow us to then hopefully liberalize over time and evolve over time. Do you have a recommendation—does the administration have a recommendation as to what your benchmarks are, what your timetables are, when should the FCC authorize greater levels or begin to permit greater penetration and use of UWB technology?

Mr. GALLAGHER. Mr. Pickering, the first thing I would say is that, and quoting the chairman of the FCC, is that, "These numbers, these protections can go up or down—we can liberate them or we can make them more stringent depending on what the facts show us." The dial can be turned either way if the facts demonstrate that there is a greater risk.

Mr. PICKERING. But when is your benchmark, what is your timetable?

Mr. GALLAGHER. The benchmark is we need real-life devices in consumers' and professional hands which we can test. Now, we are understanding from the investor community, from the companies that we could see those devices begin to be introduced by year-end. We would want to have an adequate sampling of those devices arrive at a peer-approved measurement plan to do the test in conjunction with the Commission, do our own tests, and work with the agencies who have the affected systems.

Mr. PICKERING. Would you envision 6 months, 12 months from now whether you either liberalize or go more stringent—take a more stringent approach? What is your timetable?

Mr. GALLAGHER. I think that is a very ambitious timetable. I don't expect——

Mr. PICKERING. 6 months, 12 months, 18 months, what would you say?

Mr. GALLAGHER. Again, I go back, Mr. Pickering, to when the time is right, when we have the devices to test, and I don't have that today, and I don't control that. When they are available, we will of course move expeditiously——

Mr. PICKERING. Don't you think for the industry, for the investment that we should have benchmarks, some timetables, some certainty in this process?

Mr. GALLAGHER. But the industry, in many ways, determines the certainty, because we don't have the devices in the marketplace yet.

Mr. PICKERING. Now, I am afraid the government is going to decide the certainty or the uncertainty, and our role and responsibility is to create as much certainty as possible, and I would encourage you all to set timetables of when you are going to measure and when you will make decisions to either go more liberal or more stringent based on the facts. And with that, Mr. Chairman, let me yield back.

Mr. UPTON. Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman. We had a great debate in the late 1980's and early 1990's over the transfer of 200 megahertz of spectrum that was going to be used for the creation of something that was called the PCS revolution that would move cell phone technology from analog to digital. And at that time, Mr. Price, we used to have a two-star general who would sit here and tell us what the national security consequences would be if we moved over that 200 megahertz. And he was adamantly opposed to us doing it, and he let us know that. And there was absolutely no way, from his perspective, that we could reconcile this private sector/public sector tension. And so finally the subcommittee, and then the full committee, in 1993, as part of the Budget Act of 1993, we just moved over the 200 megahertz. And since then we have had

a third, fourth, fifth and sixth cell phone license in each one of the communities in the country license, a dramatic drop in the price, vast millions and billions made by people, Mr. Price, who are in the cell phone industry because of that decision and a revolution in communications in our country. And thus far we have had no accusation that it has undermined national security, at least no testimony I have heard.

And so when we reach this stage once again, different people representing the same interests show up to testify. And, obviously, this committee has a stake in seeing the further advancement of the private application of technology using spectrum. And it always reminds me, Mr. Price, of the movie, "Indiana Jones and the Raiders of the Lost Ark," where this relatively low-level person is sent off to find this very valuable thing, and finally they return it—Indiana returns it to Washington, and the government officials then take it, put it inside of a container, nail it down and then put it on a forklift and house it in a warehouse, knowing some day, in some way they will be able to use it. But, "Thank you, Mr. Jones. We will take it from here."

So you have all these private sector companies who have identified this incredible valuable resource, they bring their testimony here to Washington, they talk about all the marvelous things that it can do for our economy, for our economic competitiveness, and pretty much they are told, "Well, that is going to be a difficult thing to resolve." Of course, it is by the same agency that says that it is possible in a minute and a half to launch a missile using incredibly sophisticated outerspace technology to shoot down a North Korean missile in a minute and a half after it has been launched at 2:30 in the morning with no notice.

Now, many scientists say, "That is impossible," and we are 20 years into trying to prove that it is possible, that is the government who supports this technology, and so far they have been able to prove that if the actual incoming test missile yells electronically, "Yoohoo, over here," they can shoot it down if they are given the exact latitude and longitude and time that it will arrive and it is saying, "Yoohoo, over here." That is where we are with that so far.

However, when you have an issue like this that it seems has a lot of historical analogs in terms of proving that it can work, we are told that because of resource problems at FCC or NTIA, our lack of coordination between NTIA and FCC working with the Defense Department, that it could take a very long time to resolve those issues that would have a tangible near-term benefit for the American public looking for a shot in the arm in the sector that we will broadly call the Nasdaq.

And so while we are not in any way opposed to ensuring that we have the maximum amount of security for our country in using spectrum-based technologies, we also, because of past experience, know that perhaps there are people inside of some of these agencies that still have a, we will call it, pre-end-of-the-Cold-War view of these issues. And they aren't—not saying you, Mr. Price, but others to whom you report who might not have the technical sophistication. I mean you are here because many of those people who are your superiors would be afraid to undergo some of the questioning using any one of the acronyms that you use so fluently.

And so it is those people about whom we are talking, those people who we never get to testify before our committee.

So that is what we are concerned about, not your knowledge and ability brilliantly to fence with any members of our committee or any other people who are here, but it is those who are up above who have given you the orders to fence without themselves knowing anything about these technologies whatsoever. And I say that from long experience with all of your superiors that they know almost nothing about it. And it is not to denigrate them because they have many other very important that they have to work on, but they actually just want the status quo to be preserved until the point in time when they get enough time to visit these issues, which means never, because they never actually have that time. And I actually have many opportunities to talk to your superiors, and none of them ever knows anything about any of the acronyms about which you are speaking about here quite eloquently today.

So that is the message to you, Mr. Price, that we are looking for coordination and specific recommendations for resource augmentation from the NTIA and the FCC, and we understand that they have to act with some trepidation in making those requests because of the enhanced defense budget request. Now, we would hope that as part of your increased ability to get any resources that you want, Mr. Price, for anything that is related to the defense of our country, that perhaps part of the request could be to help to resolve this other issue, which could then help the civilian economy to move forward, because the NTIA and FCC is not as strong a position to make those requests as are you.

So perhaps you could do that, and using your authority, your clout, get the money that resolves the technical issues and then to share it with these other two agencies in a way that telescopes the timeframe that it will take in order to ensure that Mr. Petroff and many others here can also see the civilian benefits flow to our economy. Does that make sense to you, Mr. Price? By the way, are you the winner of the Vito Fossella look-a-like contest?

I mean that is unbelievable. I mean you are—you know, I mean I kept thinking Vito is doing a good job today testifying down there.

Mr. PRICE. I have been called a lot of things. I have never been called that before. I think that, first of all, the Department of Defense is spending a lot of money in spectrum areas. Our budget, and I am actually having people pull together the numbers, and when we get it I will send it to you, something on the order of hundreds of millions of dollars on spectrum-efficient technologies, which I think ultimately, you would agree, is one of the ways to solve the problems of the spectrum-constrained feeling by both government and non-government users.

I would also say I take issue slightly with the point that my superiors, who I gather you talk to more than I do, which is probably a fair point, don't——

Mr. MARKEY. All of your present-day superiors and all of their predecessors in their various ideological—they all kind of—where you stand depends upon where you sit, and it doesn't make any difference who gets the job at any of these Pentagon jobs, regardless of the administration, they always take the same position.

Mr. PRICE. Well, I will commend the current leadership in OSD, in the Office of Secretary of Defense, because they decided that spectrum was important enough—an important enough area to raise it to the Deputy Assistant Secretary level and to have somebody, actually it gave me a job, but to create a job that is dedicated to spectrum issues. So at least now—and it was really something that Dr. Hamre, when he was at the Department of Defense, started to raise these issues. So I think the fact that spectrum is important, needs expertise, needs to be shaped, is something that this administration has focused on, and I think we will continue to do that, looking at ultrawideband, looking at software-defined radio, some of those other things.

I think it is a little different—the ultrawideband scenario is a little different than the 200 megahertz that was decided in 1993, but I do take the point that everyone, the Department of Defense as well as the commercial interests, do need more spectrum. And if there are ways to do that, be it sharing or otherwise, or raising noise floors, as long as it doesn't constrain national security interests, like GPS, we support it, and we think we supported it in this proceeding.

Mr. MARKEY. And I appreciate that, and I think that the record will note that you did praise your superiors effusively, and I think——

Mr. PRICE. Thank you.

Mr. MARKEY. [continuing] that is absolutely something that should be noted. And my hope is that we would find evidence to justify that praise as we move forward. And, again, you know what, a good example of this whole conflict is even when Secretary Rumsfeld says that he doesn't want the crusader giganto cannon, he has to be told, "Mr. Secretary, there are limits to your power. You need this cannon, okay?" And even as he says, "No, I would rather use the same money on more high tech, more sophisticated stuff," he is being told, "No, there are real pressures here inside of the Army, the Air Force that you might not be able to control in terms of the way the ultimate process leads to a resolution of the issue."

So all we are saying here is that we are cognizant of the problem that exists inside the Pentagon, and it is very severe, it is ongoing, and it is in fundamental conflict with these other agendas which we have for America, which we believe can move forward simultaneously, but we need the resources that are dedicated to the resolution of the issue, because in the absence of that, the status quo ante, the homeostasis of an issue then puts all the weight on not moving, and then the rest of the agenda is harmed. So I appreciate, Mr. Price, that they have named someone with the level of expertise on the subject that they have, and my hope is that we can, again, resolve the issue in a way using Defense Department money to help the civilian economy get a shot in the arm. Thank you, Mr. Price.

Mr. UPTON. Thank you. Would recognize the gentleman from Florida, Mr. Stearns.

Mr. STEARNS. Thank you, Mr. Chairman. And I am sorry that I wasn't here earlier. Like you, I chaired a committee this morning for about 3 hours, so we just finished up, but I did want to get down here, obviously to pay my respects but also the staff who sat

in during this morning's hearing indicated there were two questions that were not asked that I might ask, and these are for Mr. Shane, who is with the Department of Transportation.

Mr. Shane, these questions are—the first one is I understand the Department of Transportation in a report by the Volpe Center determined that GPS is not robust enough for critical commercial aircraft use. And, further, Boeing is working on next-generation GPS, including increasing the transmit power for GPS, decreasing the self-interference of the GPS signals and adding more channels. So the question is are not the concerns with GPS overblown, given that the signal is going to be strengthened to such a great degree or are they not overblown? So I think that is the question.

Mr. SHANE. Thank you for the question, Congressman. I think the concerns about GPS are not overblown. GPS has not been strengthened. Both civilian and military applications are absolutely essential to our national security right now, and I am happy to report that as far as I can tell from the R&O there isn't a GPS problem in the FCC's decision, that the FCC and NTIA took the concern about GPS very seriously, and that is one of the issues that nobody is arguing about right now. So it seems to me that that question has been mooted by the R&O, the Report and Order issues by the FCC.

Mr. STEARNS. Anyone else like to comment? No? Mr. Shane, you indicate in your testimony that, "There is no substitute for hard data, stringent analyses and validation by test." You also expressed a lot of concern that UWB devices could interfere with critical aviation systems, but where is the hard data to support that and validation by tests?

Mr. SHANE. That is in fact our question, where is the hard data to support any final decision with respect to the deployment of——

Mr. STEARNS. No, but you have indicated a concern that these devices could interfere with critical aviation systems. How do you know that?

Mr. SHANE. Well, the burden should not be on those who are responsible for maintaining critical safety-of-life applications in spectrum.

Mr. STEARNS. No, but if you make a claim, then you should be able to substantiate or corroborate your claim.

Mr. SHANE. I don't want to substantiate it. I want to substantiate the fact that UWB equipment can be deployed without any harm to the spectrum. That is our interest. We are interested in this technology. The problem is there simply is no prototype, not sufficient prototypes available, and this has been the consensus within the panel, to support the kind of empirical testing that we could rely upon with real confidence before liberalizing the content of the FCC's Report and Order.

I don't think we really—there is no difference among any of the agencies that have participated about whether or not we need more empirical testing. This is not just the Department of Transportation. This has been a problem. The NTIA had a very difficult job in this case, and it has done a magnificent job, I think, in pulling together different threads of interest from different agencies in the commercial sector and making recommendations to the FCC, which it has adopted, for purposes of getting this technology launched.

Now the question is, is it launched with only a baby step, as someone said earlier today? Should we be liberalizing the rules? This is a brochure put out by the Federal Highway Administration, one of our agencies. It supports ground penetrating radar for the use of measuring the quality of pavement in our highways. We have talked earlier today about the importance of GPR for bridge quality and a whole host of other transportation applications. We are interested in this technology, we want it deployed, that is what the Department of Transportation is about. The only issue here is whether or not there is sufficient science right now to say that we can deploy it without the kinds of limits that the FCC and NTIA have agreed upon. Nobody at this table knows the answers to that as we sit here today, and all we seek is to find out that answer as quickly as possible.

Mr. STEARNS. I understand. Okay. Thank you, Mr. Chairman.

Mr. UPTON. Thank you, Mr. Stearns. Gentlemen, we appreciated your testimony. I can assure you that we are going to continue to look at this issue. We are going to have a number of multiple hearings over the next number of months, and we welcome your input and your thoughts on the whole range of—the whole spectrum of issues. Thank you.

[Whereupon, at 12:47 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows:]

PENETRADAR CORPORATION
NIAGARA FALLS, NEW YORK
June 3, 2002

The Honorable ELIOT L. ENGEL
United States Congress
Washington, DC Office
2303 Rayburn HOB
Washington, DC 20515

RE: The FCC's UWB Proceeding: An Examination of the Government's Spectrum Management Process

DEAR CONGRESSMAN ENGEL: In reference to the June 5, 2002 meeting of the Subcommittee on Telecommunications and the Internet hearings we would like to request your assistance in expressing our concerns to the FCC and NTIA in regard to the recent FCC Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband (UWB) Transmission Systems, FCC 02-48 Released April 22, 2002.

Penetradar Corporation is a small, high-technology business located in Niagara Falls, New York, involved in the manufacture and use of Ground Penetrating Radar (GPR) systems. GPR's are a special class of radar system designed to penetrate solid materials, such as soil or concrete and our products and services are used in a multitude of engineering as well as public safety related applications, ranging from bridge deck and highway pavement condition evaluation to detection of subsurface hazardous spills. The new FCC ruling, FCC 02-48, which restricts the domestic sale and use of Ground Penetrating Radar devices will effectively shut-down our company and many other small businesses in our industry that manufacture and/or use this technology. The result of this will be the loss of hundreds of jobs and ultimately the loss of an industry of which the United States presently leads the world.

We are quite concerned with the affect that the new rules will have and believe that time is critical.Although the FCC has indicated that the new part 15 rules represent a very conservative approach to dealing with UWB and has promised to revisit this issue in the next 6 to 12 months, with the new rules becoming law in mid-July it is unrealistic to believe that there will be a GPR industry remaining by this time the ruling is reviewed.

In our recent meetings with the FCC and NTIA, we have found the NTIA to be adverse to the GPR industry citing hypothetical cases of potential interference with government systems and GPS receivers. In over 30 years of GPR usage, there has never been a reported instance of interference caused by any GPR device on any other user of the frequency spectrum. The interference potential of GPR is negligible

as its intent is to propagate signals into the ground and not into the air. Further, the proliferation of GPR devices is low, with no more than a total of 1000 units industry wide operating in the United States.

We have reviewed NTIA publications 01-43 and 01-45 which are analyses conducted on the compatibility of UWB devices on federal systems and GPS, and are the basis for the new FCC rules. We believe that the NTIA analyses are based upon improper assumptions of "worst case'" scenarios, all of which cannot or will not occur in situ.[1] When operated in a normal manner GPR's will never pose an interference problem and to summarily eliminate an entire industry and ultimately compromise public safety for hypothetical and unrealistic scenarios proposed by the NTIA would not be in the public interest.

In the past, GPR has been supported, used and in fact developed by governmental agencies such as the DOD, for land mine detection and DOT for bridge deck, pavement and runway inspection. The GPR industry has provided critical products and services that have enhanced public safety and have been used in the development and preservation of the nation's infrastructure. Typical application of GPR includes highway pavement and airport runway condition evaluation for the detection of voids and sinkholes prior to collapse, on bridge decks, parking garages and tunnels to determine the condition of concrete and structural safety, inspection of integrity of nuclear containment facilities, power plants and buildings, detection of underground utilities such as gas and electrical lines, detection of underground chemical spills and for law enforcement in forensic investigations.

Attached is a separate statement describing the particular points in the new rules which have created considerable consternation to our company and much of the GPR industry. I am hopeful that you will be able to address our concerns in the upcoming Subcommittee on Telecommunications and the Internet and that you will support our position.

Thank you in advance for your assistance.

Sincerely,

ANTHONY J. ALONGI
President

cc: Addressed to Congressman Vito J. Fossella

May 30, 2002

Honorable FRED UPTON
Chair, Subcommittee on Telecommunications and the Internet
The Committee on Energy and Commerce
United States House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

DEAR CHAIRMAN UPTON: Thank you for the opportunity to testify before your subcommittee. Ultra wideband technology will allow for radio spectrum efficiency and development of such devices as through the wall radar, ground penetrating radar, and new wireless technology that are much faster than the current Blue tooth technology. The Federal Communications Commission approved ultra wideband at power levels significantly lower than originally requested. While this power level is minimally sufficient to operate certain devices, others will not operate at all.

Public Safety's, First Responders need power levels that will allow for through the wall radar systems and ground penetrating radar systems to work efficiently and safely. These through the wall radar detection units need to be remotely activated in most cases. Ultra wideband technology will allow a Fire Fighter to use a Video Image Display piece to display maps and other critical information such as location

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[1] For example, one NTIA analysis assumes large numbers of GPR's operating in close proximity to an E911 GPS receiver at separation distances of approximately 2 meters and at elevations of 3 meters, thereby resulting in interference. This ignores the fact that GPR's are typically used individually—not in large numbers in one area, and are in contact (or within a few inches) of the ground and not operated at 3 meters in height where the GPS receiver may be located. In normal operation, the hypothetical NTIA operational scenario would not be possible.

In another example, the NTIA proposed the possibility of interference between a UWB device and Air Route Surveillance Radar (ARSR-4), a high power, surveillance radar with sufficient radiated power to literally overload and destroy any nearby device receiving in its frequency band. This analysis was not conducted using an actual GPR but rather signals were simulated and tests performed with the ARSR-4 transmitter off, thereby eliminating its own normal clutter interference and antenna cross talk, which are greater than low level GPR emissions. We do not believe this to be a realistic analysis but rather one that was improperly designed.

technology, personnel body telemetry's and equipment status information onto the mask of his self contained breathing apparatus.

Very truly yours,

RICHARD C. NOWAKOWSKI, *Coordinator of Special Projects*
City of Chicago, Office of Emergency Management and Communications

On August 28, 2001, Chicago Police Detective Joseph Airhart Jr., was assigned to a Federal Bank Robbery Task Force that was serving a warrant on a suspected bank robber. Detective Airhart posed as delivery man and knocked on the suspects' door. When the suspect answered the door, he shot Detective Airhart in the head and dragged him into the apartment. Assisting officers were held at bay as the offender continued to fire and dragged the seriously wounded detective behind a wall. Daniel Salley also held his wife and two small children in the apartment, and out of sight of backup officers. After a two-hour standoff, Salley agreed to let paramedics remove the detective. Today, Detective Joe Airhart is still hospitalized and remains in serious condition suffering from seizure attributed to his head and brain injuries.

Had the Chicago Police Departments, Hostage and Barricade Team been equipped with remote through the wall radar devices they may have been able to secure a faster release of the injured detective and arrest of the suspect.

We welcome the February 14, 2002, ruling of the Federal Communications Commission on ultra wideband technology as a great first step. We applaud the long and arduous work of the Commission and National Telecommunications and Information Administration in their technical analysis of UWB, and also respect those companies, agencies, institutions and individuals that submitted comments.

Public safety needs UWB as a tool in their arsenal. Through the wall radar that utilizes UWB needs to deployed and remotely operated in most Police usages, while miniature units mounted on Fire Fighters helmets need to be on constant during primary and secondary searches of structures. Power levels need to be of sufficient strength to penetrate through several layers and at distances of 20 to30 feet.

A Fire Fighter responds and prepares to enter a structure. He dons his SCBA (Self Contained Breathing Apparatus) and enters the building. His SCBA immediately begins a system of tracking his location in the building and overlays a small (you are here type) dot onto a digital floor plan of the building (provided be the OEMC, Office of Emergency Management and Communications) and then transmits the images to a heads up, translucent display screen in the masks' face piece. The heads up display will also show the level of air in the SCBA Bottle. As the Fire Fighter makes his way through the building, his Motorola XTS5000 portable radio will be leaving the equivalent of digital breadcrumbs that can be tracked. As he enters a room, he turns and scans a 360-degree area while utilizing a helmet mounted UWB device that will penetrate walls and doors and display the images behind. Body acoustic sensors will monitor the firefighter's telemetry and report back on his physical condition. UWB will provide short range communications systems that will allow mobility and high data rates in order to facilitate information sharing with this Virtual Fire Fighter. This Fire Fighter must work unencumbered by hand-held devices as he searches, therefore it is important that UWB devices used by Public Safety be free from any requirement that mandates contact points on devices.

Licensing of these UWB devices under Part 90 to Public Safety Agencies will allow strict regulations and provide remedies if interference is experienced. These devices must also be free to operate in broad, pre-approved geographic areas. The operation of these devices would be limited in duration and any interference caused would be minimized, easily detected and corrected.