

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
LightSquared Subsidiary LLC)	IB Docket No. 11-109
Request for Modification of its Authority)	
for an Ancillary Terrestrial Component)	
)	
In re the Application of)	
)	
LightSquared Subsidiary LLC)	File No. SAT-MOD-20101118-00239
Request for Modification of its Authority)	
For an Ancillary Terrestrial Component)	

COMMENTS OF THE COALITION TO SAVE OUR GPS

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Dated: August 1, 2011

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SUMMARY

The Coalition to Save Our GPS (the “Coalition”), which has over 70 members and 130 associate members representing more than 100,000 companies and millions of employees in a broad range of industries, including aviation, agriculture, transportation, construction, engineering, surveying, and GPS-based equipment manufacturers, and service providers submits these comments to urge the FCC to withdraw the conditional authority it provided to LightSquared Subsidiary LLC (“LightSquared”) to operate a stand-alone, high-powered terrestrial wireless network. LightSquared’s proposed operations pose an immediate and direct threat to the Coalition’s members, the United States economy, and the safety of life and property.

While LightSquared promises to deliver billions of dollars of consumer benefits which have no basis in reality, it will cause very real disruption to Global Positioning System (“GPS”), which today serves critical personal, governmental, and public safety functions, and is responsible for between \$68 billion and \$122 billion of economic activity per year. While the Coalition appreciates the importance of introducing additional broadband capacity to the marketplace, the introduction of that capacity cannot come at the expense of the critical needs supported by GPS. Instead, the FCC must adhere to principles of sound spectrum management and not permit LightSquared to operate in spectrum adjacent to that used by GPS receivers.

While the FCC’s International Bureau granted LightSquared an unprecedented waiver of its ancillary terrestrial component (“ATC”) rules, it conditioned grant of the waiver – and therefore LightSquared’s initiation of terrestrial commercial operations – on the technical working group (“TWG”) finding that LightSquared’s proposed operations will not interfere with GPS. The TWG testing process – reflecting the joint efforts of over 100 engineers and advisors – is complete. The TWG’s test results conclusively demonstrate that LightSquared’s initial proposal would cause harmful interference to all types of GPS receivers tested. LightSquared’s

last-minute proposal to commence operations using only its lower 10 MHz channel block was tested by multiple TWG sub-teams, none of which was able to conclude that LightSquared's proposed terrestrial network would be compatible with adjacent band GPS operations. Other studies evaluating the test results came to the same conclusions. Only LightSquared – through its creative reinterpretation of the test results released in a document prepared wholly outside of the working group process – was able to find support for its lower 10 MHz plan. The TWG also evaluated whether filters could be used to ameliorate the effects that LightSquared's system would have on GPS receivers. The TWG results, however, found that such filters generally do not exist (and therefore could not be tested), the only one that worked did so only under an extremely limited set of circumstances, and even if an effective filter did exist (which it does not), retrofitting existing devices would be nearly impossible.

LightSquared also attempts to blame others for its failed business and engineering plans; blame that should not be given any weight in evaluating either its original proposal or its alternative lower 10 MHz proposal. In particular, LightSquared blames the GPS industry for the design of GPS receivers which LightSquared itself required and has profited from, begs the FCC to consider the considerable sums of money it has already spent on its unworkable business plan when it knows that policy decisions must be made based on the public interest and not private investment decisions, and characterizes the interference issues as a “fight” between LightSquared and the “GPS industry” when a variety of stakeholders representing both the public and private sector have been actively involved and have significant interests at stake in these proceedings.

Further, LightSquared again urges the Commission to accept its skewed view of history that the GPS community acquiesced in LightSquared's plans when the ATC rules were designed specifically to prevent the type of operations now proposed by LightSquared. To the contrary,

the FCC has repeatedly expressly committed to protecting the government's substantial investment in GPS, and LightSquared itself engaged in past transactions which recognize interference problems similar to the interference problems with GPS.

The bottom line is that LightSquared's proposed service is incompatible with adjacent operation to GPS and must not be allowed to operate in the L-Band. Allowing LightSquared's high-powered terrestrial operations would have a devastating impact on GPS services critical to the government, the private sector, and the public.

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COMMENTS OF THE COALITION TO SAVE OUR GPS

The Coalition to Save Our GPS (the “Coalition”) respectfully submits these comments in response to the Public Notice released by the Federal Communications Commission (“FCC” or “Commission”),^{1/} seeking comment on the final report of the Technical Working Group (“TWG”)^{2/} that was organized following the Commission’s Order and Authorization released January 26, 2011.^{3/} The *January 2011 Order* granted LightSquared Subsidiary LLC (“LightSquared”), a Mobile Satellite Service (“MSS”) licensee in the 1525-1559 MHz and 1626.5-1660.5 MHz bands (the “L-Band”), a waiver of the Commission’s ancillary terrestrial component (“ATC”) “integrated service” rules in order to allow LightSquared to deploy a proposed stand-alone, non-integrated, high-power terrestrial network. The *January 2011 Order* conditioned grant of the waiver on the completion of the TWG testing process designed to

^{1/} See *Comment Deadlines Established Regarding the LightSquared Technical Working Group Report*, Public Notice, IB Docket No. 11-109, DA 11-1133 (rel. June 30, 2011) (“*Public Notice*”).

^{2/} See *Technical Working Group Report, Final Report*, IBFS File No. SAT-MOD-20101118-00239 (filed June 30, 2011) (“*TWG Report*”).

^{3/} *LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component*, Order and Authorization, 26 FCC Rcd 566 (2011) (“*January 2011 Order*”).

determine whether LightSquared's proposed terrestrial network would cause harmful interference to Global Positioning System ("GPS") receivers.^{4/}

For over three months, the TWG tested more than 130 devices in seven different receiver categories in multiple testing environments.^{5/} The testing conclusively demonstrated that LightSquared's proposed terrestrial network would cause harmful interference to GPS. Other entities – governmental and non-governmental – also conducted testing and, like the TWG, concluded that LightSquared would cause massive interference to GPS.

Toward the end of the testing period and presumably as a result of the negative test results, LightSquared announced a new "solution" to the interference problem, proposing to begin its terrestrial operations using its lower 10 MHz channel only (the 1526-1536 MHz band).^{6/} While this proposal was not included in the plans initially submitted to the working group, many of the working group sub-teams were able to test LightSquared's alternative lower 10 MHz proposal, generally finding that even the alternative proposal raised significant interference concerns. The sub-groups also considered mitigation techniques suggested by LightSquared – mainly the use of filters – and found them to be unproven, untested, unavailable, and unverified.

Concurrent with the release of the TWG Report, LightSquared released its own "Recommendations," reinterpreting the TWG test results and characterizing its lower 10 MHz proposal as the "solution" to the interference problem.^{7/} However, LightSquared's Recommendations do not provide real solutions and will not alleviate the interference concerns

^{4/} *Id.* ¶ 41.

^{5/} *Public Notice* at 2.

^{6/} Press Release, *LightSquared Solution to GPS Issue Will Clear Way for Nationwide 4G Network*, June 20, 2011.

^{7/} See Recommendation of LightSquared Subsidiary LLC, IBFS File No. SAT-MOD-20101118-00239 (filed June 30, 2011) ("Recommendations Document" or "Recommendations").

confirmed by the TWG. Worse, its Recommendations attempt to shift to the “GPS industry” the blame for the devastating impacts of LightSquared’s proposed deployment .

A number of Coalition members – representing a wide variety of industries concerned about the future of GPS – have been active participants in the working group process and these proceedings, and therefore are pleased to have the opportunity to submit these comments addressing the TWG Report and LightSquared’s Recommendations Document.

I. INTRODUCTION

The Coalition was formed in March 2011 to safeguard the reliability and viability of GPS. The Coalition consists of representatives from a broad range of industries, including aviation, agriculture, transportation, construction, engineering, surveying, and GPS-based equipment manufacturers and service providers. It has over 70 members and 130 associate members, representing more than 100,000 companies and millions of employees.^{8/} Some of its most active members, separated by industry, are briefly described directly below.

Agriculture

- **AGCO** – A leading global manufacturer of agricultural equipment, offering a full line of tractors, combines, hay tools, sprayers, forage and tillage equipment, which are distributed through 2,600 independent dealers and distributors in more than 140 countries worldwide.
- **Agricultural Retailers Association** – A non-profit trade association representing the interests of retailers across the United States on legislative and regulatory issues. As the political voice of agricultural retailers, ARA not only represents its membership but also educates members on the political process and important issues affecting the industry.
- **National Agricultural Aviation Association** – An organization representing more than 1,500 members in 46 states, including businesses and pilots that use GPS-enabled aircraft to aid farmers in producing a safe, affordable, and abundant supply of food, fiber, and bio-fuel, in addition to protecting forestry, controlling health-threatening pests, and implementing environmentally friendly practices.
- **National Cotton Council** – The central forum for assisting producers, ginner, warehouse, merchants, cottonseed crushers, cooperatives, and textile manufacturers

^{8/} A full list of members and associate members can be found on the Coalition’s website at: <http://www.saveourgps.org/coalition-members.aspx> and is attached hereto as Appendix A.

with reaching consensus and ensuring that cotton's interests are considered by the U.S. government.

- **USA Rice Federation** – The global advocate for all segments of the U.S. rice industry with a mission to promote and protect the interests of producers, millers, merchants, and allied businesses.

Aviation

- **Aeronautical Repair Station Association** – A trade association with a distinguished, 25-plus year record of devoted service to the unique regulatory needs of the worldwide civil aviation community, representing aviation maintenance and manufacturing companies.
- **Air Line Pilots Association** – The world's largest pilot union, representing more than 53,000 pilots at 39 airlines in the United States and Canada.
- **Air Transport Association** – The nation's oldest and largest airline trade association representing the leading U.S. airlines and airline-related companies. The Association's fundamental purpose is to foster a business and regulatory environment that ensures safe and secure air transportation and enables U.S. airlines to flourish, stimulating economic growth locally, nationally and internationally.
- **Aircraft Electronics Association** – An organization representing more than 1,300 aviation businesses, including manufacturers of avionics equipment, aviation GPS systems, and repair stations that specialize in maintenance, repair and installation of avionics and electronic systems in general aviation aircraft.
- **Aircraft Owners and Pilots Association** – The largest, most influential aviation association representing a membership base of more than 400,000 pilots and aviation enthusiasts.
- **Association for Unmanned Vehicle Systems International** – The world's largest non-profit organization devoted exclusively to advancing the unmanned systems community.
- **Delta Air Lines** – One of the most admired airlines worldwide, offering services to 355 destinations in 65 countries on six continents and serving more than 160 million customers each year.
- **Experimental Aircraft Association** – An international membership organization and leader in recreational aviation that encourages and supports members with a wide range of aviation interests and backgrounds.
- **General Aviation Manufacturers Association** – An organization that represents 70 of the world's leading manufacturers of fixed-wing general aviation airplanes, engines, avionics, and components.
- **International Air Transport Association** – An international organization representing some 230 airlines, comprising 93% of scheduled international air traffic.
- **National Business Aviation Association** – An association representing business aircraft operators in the U.S. and supported by 8,000 entities operating 11,000, primarily turbine powered aircraft.
- **Regional Airline Association** – A representative of North American regional airlines and the manufacturers of products and services supporting the regional airline industry.
- **Southwest Airlines** – A major domestic airline that provides primarily short-haul, high-frequency, point-to-point, low-fare service. Southwest Airlines is the nation's largest

carrier in terms of originating domestic passengers boarded and operates over 500 Boeing 737 aircraft in 72 cities.

Equipment Manufacturers and Distributors

- **American Rental Association** – An international trade association for owners of equipment rental businesses and manufacturers and suppliers of rental equipment. Current membership includes approximately 7,500 rental businesses and nearly 900 manufacturers and suppliers.
- **Associated Equipment Distributors** – An international trade association representing companies involved in the distribution, rental and support of equipment used in construction, mining, forestry, power generation, agriculture and industrial applications.
- **Association of Equipment Manufacturers** – A U.S.-based international trade group serving the off-road equipment manufacturing industry, with over 800 member companies that manufacture equipment or products and provide services used worldwide in the agriculture, construction, forestry, mining, and utility fields.
- **Avidyne Corporation** – An innovative manufacturer of certified avionics for use in general aviation airplanes and helicopters, making flying safer, more accessible and more enjoyable for pilots and their passengers.
- **Case New Holland** – A global leader in the agricultural and construction equipment businesses. It has 40 manufacturing facilities located throughout Europe, North America, Latin America, and Asia.
- **Caterpillar** – The largest and most respected manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and a wide array of products and services in earth-moving industries across the world.
- **Deere & Company** – One of the world's most admired equipment producers for agriculture, construction, surveying, and many other operations across the country.
- **Experimental Aircraft Association** – An international membership organization encouraging and supporting recreational aviation.
- **Farm Equipment Manufacturers Association** – An international not-for-profit trade organization representing more than 300 manufacturers of specialized farm equipment, more than 260 industry supplier companies and 40 marketing firms.
- **Garmin Ltd.** – A leader in satellite navigation that designs, manufactures, markets, and sells navigation, communication, and information devices and applications – most of which are enabled by GPS technology.
- **Magellan GPS** – A recognized industry innovator and leading portable GPS navigation consumer electronics company, with over 200 key patents in GPS technology.
- **National Association of Manufacturers** – The largest manufacturing association in the United States representing manufacturers in every industrial sector and in all 50 states.
- **National Marine Manufacturers Association** – The nation's leading trade association representing boat, marine engine and accessory manufacturers.
- **National Truck Equipment Association** – An organization representing nearly 1,600 companies that manufacture, distribute, install, sell and repair commercial trucks, truck bodies, truck equipment, trailers and accessories.
- **North American Equipment Dealers Association** – One of the longest running trade associations in North America providing a wealth of services to approximately 5,500

equipment dealers.

- **Trimble Navigation Limited** – A leading provider of advanced positioning solutions, such as GPS technologies that maximize productivity and enhance profitability.
- **TomTom** – A rapidly growing international telematics service provider specializing in GPS solutions for automobiles, mobile phones and other personal devices.

Geographic Information System (“GIS”) Mapping/Surveying

- **American Congress of Surveying and Mapping** – An international premiere professional membership society for the spatial data information industry.
- **American Council of Engineering Companies/Council of Professional Surveyors** – A representative of America’s engineering industry, with members numbering more than 5,000 firms representing more than 500,000 employees throughout the country engaged in a wide range of engineering works that propel the nation’s economy, and enhance and safeguard America’s quality of life.
- **California Land Surveyors Association** – An organization dedicated to promoting the highest possible standards of professional practices in the public’s interest.
- **Esri** – The world leader in GIS modeling and mapping software and technology.

Transportation

- **American Assoc. of State Highway & Transportation Officials** – An international non-profit, non-partisan association representing highway and transportation departments in the 50 states, the District of Columbia, and Puerto Rico.
- **American Car Rental Association** – A premier collaboration of the American auto rental industry, with a membership that conducts more than 80% of all rental car transactions in the U.S.
- **Association of American Railroads** – An organization representing North America’s freight railroads and Amtrak with operations over a 140,000 mile network. Its members include the major freight railroads in the United States, Canada and Mexico, as well as Amtrak.
- **ATX Group** – The largest independent provider of personalized telematics services that enhance safety, security and the overall driving experience.
- **FedEx** – A global network of companies providing customers and businesses with specialized services that represent the broadest array of supply chain, transportation, business and related information services.
- **Intelligent Transportation Society of America** – The nation’s leading transportation technology association, representing over 400 member organizations including private companies and industry leaders, government agencies at all levels, universities, and research institutions.
- **UPS** – A multi-billion-dollar package delivery company and leading global provider of specialized transportation and logistics services. Every day, UPS manages the flow of goods, funds, and information in more than 200 countries and territories worldwide.

Other

- **American Petroleum Institute** – The only national trade association that represents all aspects of America’s oil and natural gas industry, with more than 400 corporate members, from the largest major oil company to the smallest of independents, from all segments of the industry.
- **Associated General Contractors of America** – The leading association for the construction industry, with a nationwide network of exceptional chapters, representing more than 33,000 leading firms in the industry – including general contractors, specialty contractors and service providers and suppliers.
- **Association of American Geographers** – A non-profit scientific and educational society founded in 1904, with members from more than 60 countries that share interests in the theory, methods, and practice of geography.
- **Boat U.S./The Boat Owners Association of the United States** – The largest organization of recreational boaters in the country with more than 520,000 active members.
- **Edison Electric Institute** – The association of U.S. Shareholder-Owned Electric Companies, with members serving 95% of the ultimate customers in the shareholder-owned segment of the industry and representing approximately 70% of the U.S. electric power industry.
- **Fire Department of New York** – The largest combined fire and EMS provider in the world.
- **National Rural Electric Cooperative Association** – A national service organization for more than 900 not-for-profit rural electric cooperatives and public power districts providing retail electric service to more than 42 million consumers in 47 states and whose retail sales account for approximately 12% of total electricity sales in the U.S.
- **National Utility Contractors Association** – The oldest and largest national trade association working solely for the excavation and utility construction industry, representing a nationwide network of chapters and company members that provide the workforce and materials to advance the water, sewer, gas, electric, telecommunications, excavation and construction site development industries across the U.S.
- **Payment Assurance Technology Association** – An organization serving the starter interrupt/GPS tracking industry, seeking to unify, standardize and validate the activities of the industry and markets engaged in the manufacture, sale and use of technology for monitoring or disabling vehicles and for other applications.

Many of the Coalition’s members or their representatives have actively participated in these proceedings, urging the FCC not to allow LightSquared to operate in a manner that would disrupt GPS signals. In addition, as the Commission is well aware, thousands of comments have already been filed in this proceeding by members of the Coalition, other interested parties, and the general public. The overwhelming majority of these comments highlights the importance of

GPS and caution the Commission against taking action that would jeopardize the reliable reception of GPS.^{9/}

GPS technology has become a vital resource affecting nearly every facet of modern-day life. GPS enables users on the ground to determine their location by using radio signals that are received directly from distant satellites. Since the first GPS satellites were launched more than 30 years ago, the system has become a critical part of our national infrastructure. It is utilized by federal agencies, state and local governments, first responders, airlines, farmers, pilots, boaters, surveyors, construction workers, and everyday consumers to do their jobs and conduct their everyday activities. For instance, aircraft pilots and boaters use GPS systems to navigate and determine their routes in the air and on the sea. Surveyors utilize GPS applications to develop map designs, locations of topographic features, and conduct city planning. Farmers similarly rely on GPS systems to plant crops and spread fertilizer, helping them to maximize the growth and output of their products. In addition, millions of individuals utilize GPS technologies for recreational and personal use.

GPS technologies have transformed government operations, commercial industries, and personal lifestyles, creating efficiencies and reducing operating costs. It has also provided critical improvements to public safety, emergency response times, environmental quality, and has delivered many other significant public benefits.

^{9/} See, e.g., Letter from T.W. Knorr Construction, LLC, to the Federal Communications Commission, IB Docket No. 11-109 (filed July 18, 2011) (asserting that “[a] loss of GPS signal could serious[ly] jeopardize this safe [vessel] navigation, especially in adverse weather conditions”); Letter from Dennis R. Baker, PLS, Director of Land Surveying Services, J.W. Morrisette & Associates Inc., P.S., to the Federal Communications Commission, IBFS File No. SAT-MOD-20101118-00239 (filed July 20, 2011) (noting that without GPS technology, many surveying projects would be rendered “infeasible”); Letter from Mark Maslyn, Executive Director, Public Policy, American Farm Bureau Federation, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109 (filed July 21, 2011) (arguing that “[d]isruption to GPS has the potential to reduce farm profitability by raising production costs and affecting farm and ranch operations.”)

The federal government has invested \$35 billion in the GPS satellite constellation alone and much more in critical systems, such as those employed by the Department of Defense and other federal agencies, which use GPS. Businesses and consumers have also spent billions on GPS-based technologies and devices. The United States is now the world's leader in satellite navigation technology due to this steady stream of investment.

There are significant economic benefits being delivered by GPS that are at risk in these proceedings. A recent economic study by Dr. Nam D. Pham of the Washington D.C.-based NDP Consulting Group shows that the direct economic benefits of GPS technology on commercial GPS users alone is estimated to be over \$67.6 billion annually in the United States, with that figure increasing to \$122.4 billion when penetration of GPS technology reaches 100 percent in the commercial GPS-intensive industries.^{10/} More than 3.3 million U.S. jobs in agriculture and related industries rely heavily on GPS technology. In addition, the GPS industry is large and growing, with annual GPS equipment revenues in North America increasing more than 55 percent from \$25.5 billion in 2005 to \$39.6 billion in 2010 for an annual average of \$33.5 billion during that time period.^{11/} While the largest costs that would be imposed by the LightSquared network's interference with GPS are the lost benefits noted above of between \$68 billion and \$122 billion per year, there would be other costs to U.S. commercial GPS users and manufacturers.^{12/}

^{10/} Nam D. Pham, Ph.D., *The Economic Benefits of Commercial GPS Use in the U.S. and the Costs of Potential Disruption*, NDP Consulting, at 1 (June 2011) ("*NDP Study*"). A copy of the *NDP Study* is attached as Exhibit A to the comments submitted today in this proceeding by Trimble Navigation Limited.

^{11/} *Id.* at 3-4.

^{12/} *Id.* at 2; *see also* Edward Morris, Director, Office of Space Commercialization National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Statement at Hearing on Space and U.S. National Power (June 21, 2006) (emphasizing that "[e]quipment sales represent only the tip of the economic iceberg. As with personal computers, the true value of GPS is not in the cost of the equipment,

The *NDP Study* makes clear that its analysis focuses on the economic benefits of GPS technology to commercial GPS users and GPS manufacturers, mainly high precision GPS users, and the economic costs of GPS signal degradation to only those sectors. The report therefore does not capture the considerable additional benefits and costs to consumer users of GPS, other non-commercial users, or military users.^{13/} Indeed, the economic benefits to the U.S. economy outside of the commercial sector are substantial – GPS manufacturers create employment, provide earnings, add value, and generate tax revenues for governments, and GPS technology improves productivity and produces cost-savings for end-users.^{14/} The study also underestimates the impact of GPS technology in that it does not account for the benefits provided to community safety in improving response time and location accuracy for emergency responders and public safety officials.^{15/} For example, the use of GPS-enabled equipment installed in emergency response vehicles is estimated to improve response time by 20 percent.^{16/} The study cites one local government estimate that a quarter of its staff would be required to spend two hours per day correcting coordinate and other location errors if GPS use were disrupted.^{17/}

Consequently, the stakes of causing interference with GPS are high. And while the Coalition does not disagree with the benefits wireless broadband services may bring to consumers,^{18/} the \$120 billion in hypothetical benefits LightSquared repeatedly asserts its

but in the productivity and growth it enables. U.S. industry has created new services and enhanced existing products by accessing GPS capabilities.”).

^{13/} *Id.*

^{14/} *Id.* at 6.

^{15/} *Id.* at 10.

^{16/} *Id.*

^{17/} *Id.*

^{18/} *See Recommendations Document* at 20-24.

terrestrial network will create^{19/} does not come close to offsetting the real benefits GPS delivers daily to millions of users and the costs that would be incurred by LightSquared's interference with such systems.

The Coalition also recognizes that the MSS spectrum has been historically underutilized. However, that underutilization cannot justify threatening GPS, which is one of the most ubiquitous and significant communications services in existence today. The FCC recently issued a Public Notice which seeks input on how the FCC may promote greater terrestrial use of the 2 GHz MSS service.^{20/} The Commission can and should undertake this evaluation because the 2 GHz MSS band is also allocated for fixed and mobile operations and there is generally compatible neighboring spectrum use. The opposite is true with the respect to the L-Band. Both it and its neighboring bands are allocated only for satellite operations. ATC service in the L-Band was always intended as a minor accommodation to that primary satellite use. This is, therefore, not a case of preventing spectrum from being fallow. It is a case of sound spectrum management. If the L-Band MSS spectrum is not being fully utilized, the FCC should evaluate how it may be used for additional compatible satellite operations, not an incompatible, ubiquitous terrestrial service.^{21/} For example, the L-Band could be utilized for relocating and consolidating other satellite services in underutilized spectrum bands. This would allow more

^{19/} *Id.* at 4 (stating that if LightSquared's proposal fails "an estimated \$120 billion in benefits to consumers . . . would be lost").

^{20/} See *Spectrum Task Force Invites Technical Input on Approaches to Maximize Broadband Use of Fixed/Mobile Spectrum Allocations in the 2 GHz Range*, Public Notice, ET Docket No. 10-142, WT Docket Nos. 04-356, 07-195, DA 11-929 (rel. May 20, 2011) ("*Spectrum Task Force Public Notice*").

^{21/} The Coalition does not suggest that terrestrial and satellite services can never use adjacent spectrum. However, in this case, the FCC failed to consider the impact of a new densely-built high-power terrestrial service on a well-established, ubiquitous, and economically significant satellite service that is used to support personal, industrial and public safety needs.

intensive use of the L-Band without creating harmful interference, forcing performance degradation and massive disruption on a ubiquitous, successful, and efficient spectrum use.

II. THE TWG TEST RESULTS CONCLUSIVELY SHOW THAT LIGHTSQUARED’S PROPOSAL WOULD CAUSE MASSIVE INTERFERENCE TO EVERY CATEGORY OF THE 500 MILLION GPS RECEIVERS IN USE IN THE UNITED STATES

The Technical Working Group – mandated by the FCC and reflecting the joint efforts of over 100 engineers and advisors representing both LightSquared and the GPS community of manufacturers and users – evaluated LightSquared’s proposal and presented the test results in the TWG Report submitted to the Commission on June 30, 2011. The TWG Report concluded that LightSquared’s proposal would cause devastating interference to hundreds of millions of GPS receivers, including those used in aviation, cellular phones, general location and navigation (including automotive, public safety, personal, and marine navigation), high-precision networks (including agriculture, surveying, construction, mining, energy, oil and gas, utilities, government, and monitoring of dams, structures, earthquakes, and volcanoes), and GPS timing used in communications and broadcast networks, power grids, and timing of financial transactions.^{22/} As part of the testing conducted by the TWG, “live sky” tests were performed where a sample of actual cell towers were erected and operated in the Las Vegas area. Such testing found that LightSquared’s signal would jam its own and other satellite services within the MSS band, causing interference to services used in many important land- and marine-based industrial and safety applications and in safety critical maritime distress systems.^{23/}

^{22/} See TWG Report at 6.

^{23/} See *id.* at 22, 247, 266. In particular, testing found that LightSquared Base Station signals would cause harmful co-channel interference with FCC-licensed StarFire and OmniSTAR augmentation systems. See *id.*

A. The TWG Evaluated LightSquared’s Proposal, Which Will Produce an Entirely New and Unprecedented Interference Environment

The TWG found that LightSquared’s proposed operations would result in destructive interference to GPS. TWG sub-groups tested over 100 different GPS devices in carefully calibrated laboratory, anechoic chamber, and “live sky” test environments, using extremely low power levels – a 90 percent reduction from the FCC’s authorized levels of almost 16,000 watts.^{24/} Even at these drastically reduced transmission levels, however, power levels of up to *hundreds of billions times* the received GPS signal were recorded next to GPS receivers on the ground at around 500 feet from a single cell tower at the Las Vegas “live sky” tests.^{25/} Power levels of up to 200 million times the distant GPS signals were even recorded at one mile from the tower.^{26/} GPS receivers in outer space, over 500 miles in orbit, also could not escape harmful interference.^{27/} Given typical cell tower spacing,^{28/} GPS users clearly would be unable to avoid these extreme power levels anywhere inside the network, which is planned to cover 92 percent of the population within four years.^{29/}

B. Each of the Sub-Teams Found That LightSquared’s Operations Would Cause Harmful Interference to Various Types of GPS Receivers

Each of the TWG sub-teams – Aviation, Cellular, General Location/Navigation, High-Precision, Timing, Networks, and Space – conducted extensive testing and analysis of LightSquared’s proposed operations, and concluded that its original proposal would cause

^{24/} See *id.* at 48 (utilizing an EIRP of 62 dBm per channel per sector rather than the authorized power of 72 dBm).

^{25/} See *id.* at 276, Figure 58.

^{26/} See *id.* (reporting power levels at 1.6km or 1 mile = -45 dBm or 200 million times GPS -128.5 dBm).

^{27/} See *id.* at 24, 300.

^{28/} See *id.* at 259, Table 13.

^{29/} See *id.* at 279.

significant widespread harmful interference to all types of GPS receivers and that its lower 10 MHz proposal would also create significant interference. Many of the sub-teams' reports, discussed in further detail below, point to the real world effects that would result from large scale interference to GPS receivers. For instance, GPS used in E911 location for emergency purposes and for "officer down" alarm systems would be affected. Interference would also disrupt GPS receivers used for critical navigation in the air, on the water, in vehicles, and on foot by more than one hundred million Americans.^{30/} In addition, harmful interference to GPS receivers would have a financial impact affecting the billions of dollars that have already been invested in commercial GPS used in agriculture, construction, fleet management, surveying, and public administration, and reduce or eliminate nearly \$100 billion in annual benefits to the economy.

1. Aviation Sub-Team Results

The Aviation sub-team concluded that large areas of the United States would lose airborne GPS service as a result of LightSquared's original proposal, in which all deployment scenarios utilized the upper L-Band, and that safe flight operations would be at risk under LightSquared's new proposal to operate in the lower 10 MHz channel.^{31/} The sub-team explained that, under LightSquared's original proposal, analysis showed interference power levels of -36.6 dBm from LightSquared's signals.^{32/} Those levels are 79,433 times more powerful than the -85.6 dBm limit that an aviation GPS receiver is required to withstand, making LightSquared's signals incompatible with aviation GPS operations.^{33/}

^{30/} See *id.* at 167-74, 200-12, 274-86 (discussing implications and impact of interference to safety of life and critical economic and government activities relying on GPS receivers).

^{31/} *Id.* at 15, 28 (stating that "GPS-based operations are expected to be unavailable over entire regions of the country at any normal operational aircraft altitude").

^{32/} See *id.* at 47-49.

^{33/} See *id.*

Contrary to LightSquared's assertions, the Aviation sub-team did *not* conclude that LightSquared's new proposal to operate in the lower 10 MHz channel would be compatible with safe aviation operations. The sub-team observed that, for operations in the lower 10 MHz band, there is a small positive margin for GPS positioning.^{34/} However, the TWG Report adds that this margin is not safe enough to allow an aircraft GPS receiver to perform an initial acquisition of GPS satellites in the event of, for example, a restart of the GPS receiver or after loss of satellite tracking in a steep turn.^{35/} Accordingly, the Aviation sub-team reported that "[c]ompatibility of aviation GPS operations with a single lower 10 MHz channel could not be determined definitively without additional study."^{36/}

2. Cellular Sub-Team Results

The Cellular sub-team similarly reported that the original planned use of the upper MSS band channels by LightSquared would cause failure for hundreds of millions of GPS receivers embedded inside cell phones. The sub-team explained that enough test data was available to demonstrate that LightSquared signals in the higher 5 MHz and 10 MHz band (1545.2 to 1555.2 MHz) caused GPS failure for a significant number of the tested devices.^{37/} The sub-team added that such harmful interference to and failure of devices receiving GPS has the potential to adversely impact E911 and Location-Based Service by causing location fixes that are either delayed or inaccurate.^{38/}

^{34/} See *id.* at 50.

^{35/} See *id.* (declaring that "[t]he lower 10 MHz channel shows compatibility with a small margin for tracking functions, but not necessarily for initial acquisition").

^{36/} *Id.* at 15, 28.

^{37/} *Id.* at 16-17.

^{38/} *Id.* at 113.

In considering operations in the lower 10 MHz channel, the Cellular sub-team determined that “operations in the lower bands (1526 to 1536 MHz) may be possible without harmful interference to existing cellular GPS devices” using filtering technologies.^{39/} The sub-team, however, could not conclude that “100% of cell phones” would be free from harmful interference even in the lower 10 MHz scenario. In fact, significant test data in the TWG Report shows interference in the lower 10 MHz channel to cell phones. For instance, the Cellular sub-team’s data demonstrate that at least 6 and potentially up to 10 out of 41 GPS receivers inside cell phones failed the sub-team’s defined test at power levels that were observed on the ground inside the LightSquared network, in the lower 10 MHz configuration.⁴⁰ Extrapolating the sub-team’s test results for the lower 10 MHz scenario to the U.S. cell phone base, 25 percent of LightSquared’s estimate of 300 million U.S. GPS-enabled cell phones, or 75 million users, would suffer interference, impacting such critical functions as E911 calls.^{41/}

3. General Location/Navigation Sub-Team Results

The General Location and Navigation sub-team’s data also indicates that LightSquared’s operations would cause interference and denial of positioning to GPS receivers used in public safety, automotive, personal navigation, marine, portable aviation, and other applications in the U.S. The sub-team concluded that “all phases of the LightSquared deployment plan will result in

^{39/} *Id.* at 15, 55.

^{40/} *Id.* at 78, Figure 3.2.2 (showing that 6 devices failed at -25 dBm or lower, which are power levels that would be seen inside the network, even after removing 5 dB for antenna gain, an assumption adopted by the group which may or may not apply in practice; a further 4 devices failed at high power levels between -15 and -20 dBm, which could be experienced in practice depending on antenna gain, proximity to tower, and other parameters).

^{41/} LightSquared Recommendations, Technical Appendix at 2.

widespread harmful interference to GPS signals and service and that mitigation is not possible.”^{42/}

Further, the General Location and Navigation sub-team concluded that significant harmful interference would still occur in the lower 10 MHz channel and that there is no viable mitigation strategy. The sub-team found that “many devices suffered from harmful interference from the lower 10 MHz channel,” specifically, 20 out of 29 receivers tested still experienced harmful interference.^{43/} According to these results, many GPS receivers used for safety of life and critical economic and government activities would be seriously affected.

4. High-Precision, Networks, and Timing Sub-Teams Results

The High-Precision, Networks, and Timing (“HPNT”) sub-teams joined together to issue a single report to address the extent of harmful interference to their respective receivers. The HPNT sub-teams all agreed that “[t]he LightSquared Base Station 4G LTE signals harmfully interfere with . . . [HPNT] GPS receivers over long ranges.”^{44/} According to their data, 100 percent of high-precision receivers tested would suffer harmful interference, at power levels observed on the ground in Las Vegas. LightSquared’s originally planned configuration would even result in harmful interference to high-precision, wideband GPS receivers well beyond 2 km (1.25 miles) from each tower.

The HPNT sub-teams also noted that significant harmful interference was observed in the testing of the lower 10 MHz channel and that there is no a viable mitigation strategy. The sub-teams’ testing showed that even in the lower 10 MHz channel, harmful interference could be encountered at 1.2 km (0.75 miles) or more from each tower, with complete loss of high

^{42/} *Id.* at 18, 122.

^{43/} *Id.* at 19, 123.

^{44/} *Id.* at 22, 180.

accuracy positioning within one-half mile of any tower. Given typical cell tower spacing, a GPS user is never likely to be more than one-fourth to one-half mile from a tower in urban settings, a mile in suburban settings, and 1.5 to 2.5 miles in rural settings. This means that blanket interference to high-precision GPS receivers could be expected in large areas of the United States, even in the lower 10 MHz-only scenario.

5. Space-Based Sub-Team Results

The Space-Based sub-team led by NASA and supported by the Jet Propulsion Laboratories found that GPS receivers on satellites in outer space would receive interference in all of the LightSquared deployment scenarios, including in the lower 10 MHz band.^{45/} GPS receivers on satellites are often oriented in space to look down at earth or obliquely through the earth's atmosphere, in order to make measurements of the atmosphere used in U.S.-led scientific research, such as weather forecasting and global climate change benchmarking and measurement. Because of its height above the earth, the entire LightSquared network of up to 40,000 towers, or large parts of it, could be visible instantaneously from certain orbital positions. The peak power levels seen in space from the massive LightSquared network would cause harmful interference to GPS receivers in orbit.

Even if the LightSquared network used only the 10 MHz lower channel, the sub-team observed that these power levels would be sufficient to cause harmful interference to GPS receivers in orbit 500 miles above the earth. Although the sub-team acknowledged that limiting the LightSquared signal to only the lower 10 MHz channel would result in improved GPS

^{45/} *Id.* at 25, 300 (stating that “[i]n NASA’s view, the interference to space-based GPS receivers . . . would be severely disruptive to NASA’s science missions based on the test and analysis conducted in the TWG.”).

receiver performance relative to operations using both the upper and lower MSS bands, such receivers would “not benefit substantively from this mitigation technique.”^{46/}

C. Other Studies Evaluating the Interference Potential of LightSquared’s Proposed Network to GPS Devices Reached the Same Conclusions

In considering the results of the TWG Report and whether LightSquared can be permitted to proceed with its 4G terrestrial network, the Commission must also take into consideration the other independent studies evaluating LightSquared’s proposal – including those briefly summarized below – which determined that harmful interference would occur to many GPS receivers from LightSquared’s operations under both its original and lower 10 MHz proposal.

1. The NPEF Report

The National Space-Based Positioning, Navigation, and Timing Systems Engineering Forum (“NPEF”) prepared and submitted a report concluding that testing of all phases of LightSquared’s proposed deployments demonstrated “significant detrimental impacts to all GPS applications assessed,” including U.S. government and commercial GPS applications.^{47/} The NPEF found that LightSquared’s signal in the upper band caused degradation for all GPS applications assessed at distances of approximately one kilometer to several hundred

^{46/} *Id.* at 315.

^{47/} See *Assessment of LightSquared Terrestrial Broadband System Effects on GPS Receivers and GPS-dependent Applications (“NPEF Report”)*, filed as an attachment to Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information and Administrator, National Telecommunications and Information Administration, U.S. Department of Commerce, to Julius Genachowski, Chairman, Federal Communications Commission, IBFS File No. SAT-MOD-20101118-00239, at 12 (filed July 6, 2011) (“*July 6, 2011 Strickling Letter*”); see also *July 6, 2011 Strickling Letter* (asserting that the *NPEF Report* “clearly demonstrate[s] that implementing the LightSquared Subsidiary LLC (LightSquared) planned deployment for terrestrial operations poses a significant potential for harmful interference to Global Positioning System (GPS) services”); Letter from Barry Schaffter, Senior Vice President, Intelligent Solutions Group and Chief Information Officer, Deere & Company, to Marlene H. Dortch, Secretary, Federal Communications Commission, IBFS File No. SAT-MOD-20101118-00239 (filed July 5, 2011) (“*Deere Report*”) (supporting the *NPEF Report* and finding that “the operation of LightSquared terrestrial base stations in the 1525-1559 MHz band, even with placement in the lower portion of the band and/or reduced power, will create immitigable interference for high-precision GPS receivers.”).

kilometers.^{48/} These distances, the NPEF explained, are even greater than LightSquared’s planned spacing between base stations for almost all of its proposed areas.

The NPEF evaluated a number of possible mitigation techniques, but most were deemed impractical. The NPEF determined that LightSquared’s new proposal to limit its operations to the lower 5 or 10 MHz channel would protect only a limited number of GPS applications, primarily those with greater receiver selectivity.^{49/} The majority of GPS receivers would still be susceptible to interference. The NPEF concluded that the mitigation technique that would offer “the greatest long-term benefit to the GPS community” would be the “relocation of LightSquared’s terrestrial operations to a band more suitable for such applications and less disruptive to adjacent band space services such as GPS.”^{50/}

2. The RTCA Report

The report prepared by RTCA, Inc. (“RTCA”), a non-profit organization formed to develop consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management systems, concluded that LightSquared’s original proposal in the upper channel spectrum would be incompatible with the current aviation use of GPS and would result in “complete loss of GPS receiver function.”^{51/} RTCA found that GPS-based operations would be unavailable over large areas at certain altitudes because of the size of the single-city

^{48/} See *NPEF Report* at 4.

^{49/} See *id.* at 10-11.

^{50/} See *id.* at 10.

^{51/} *Assessment of the LightSquared Ancillary Terrestrial Component Radio Frequency Interference Impact on GNSS L Band Airborne Receiver Operations*, IBFS File No. SAT-MOD-20101118-00239 (filed June 7, 2011) (“*RTCA Report*”). The Aviation sub-team results rely heavily on the *RTCA Report*, so the Coalition notes that the findings described in each document are consistent.

station deployment. RTCA added that in some situations “GPS-based operations will likely be unavailable over a whole region at any normal aircraft altitude.”^{52/}

RTCA suggested that there would be a “small positive margin” for GPS tracking in the event that LightSquared operated at the lower 10 MHz channel.^{53/} However, RTCA also indicated that the margin would not necessarily be safe enough to allow an aircraft GPS receiver to perform an initial acquisition. As a result, RTCA recommended conducting further studies to confirm acceptable receiver susceptibility for GPS initial acquisition and signal tracking under LightSquared’s proposal to use the lower 10 MHz band.

3. The NPSTC Report

The National Public Safety Telecommunications Council (“NPSTC”), a federation of public safety organizations whose mission is to improve public safety communications and interoperability, agreed that the testing of LightSquared’s proposed deployment confirmed interference to public safety operations.^{54/} According to the report, individual company laboratory testing and “live sky” testing revealed that “terrestrial use of L-Band allocations near accepted and utilized Satellite Navigation allocations (1559 – 1610 MHz), including GPS, does diminish location accuracy and/or preclude, under certain circumstances, GPS service entirely.”^{55/} NPSTC noted that although LightSquared believed it could operate at the lower 10

^{52/} *Id.* at Executive Summary.

^{53/} *Id.*

^{54/} See Letter from Ralph A. Haller, Chair, National Public Safety Telecommunications Council, to Julius Genachowski, Chairman, Federal Communications Commission, IBFS File No. SAT-MOD-20101118-00239 (filed June 15, 2011) (“*NPSTC Report*”).

^{55/} *Id.* at 3.

MHz channel without negatively impacting current public safety, there was not enough information to make that conclusion since only the 5 MHz bandwidth had been tested to date.^{56/}

NPSTC emphasized that public safety and its supporting services have unique needs that are critical to the public welfare. For instance, public safety relies on the reception of GPS for wireless 911 location and for rapid dispatch of the closest officer to an emergency.^{57/} Further, a considerable amount of public funds have been invested at the Federal, State, and local levels to build out communications networks for the “protection of human life of the civilian population as well as the responding officers and officials.”^{58/} Accordingly, NPSTC asserts that public safety use of GPS must be protected from potential interference that could result from LightSquared’s system deployment.^{59/}

4. Clearwire Corporation Report

Clearwire Corporation (“Clearwire”), which utilizes commercial GPS technology to provide a stable timing reference for Time Division Duplex based transmissions and various portable and handheld GPS based devices, submitted an interference report to the Commission conclusively demonstrating that LightSquared’s operations under its original plan “will cause catastrophic interference and loss of lock to Clearwire base station GPS units.”^{60/} Clearwire explained that during testing in Las Vegas, within minutes of the activation of LightSquared’s upper band channel (1550.2-1555.2 MHz), the GPS receiver at the co-located Clearwire site lost

^{56/} See *id.* at 8.

^{57/} See *id.* at 2, 4.

^{58/} *Id.* at 4.

^{59/} See *id.* at 1, 3.

^{60/} *GPS Interference Report of Clearwire Corporation*, IBFS File No. SAT-MOD-20101118-00239 (filed July 14, 2011) (“*Clearwire Report*”).

the satellite lock causing the Clearwire base station to automatically shut down its transmitter.^{61/} Even when testing stopped and GPS coverage resumed for a few minutes, its GPS receiver lost its satellite lock immediately when testing resumed.^{62/}

Clearwire added that the tests performed were not sufficient to ascertain whether mitigation measures, such as the recently proposed power “reduction” by LightSquared, would be adequate to reduce or eliminate harm to GPS caused by LightSquared’s operations, and that mitigating GPS interference “is not possible in many locations.”^{63/} Clearwire noted that preliminary tests of the lower 10 MHz proposal, even at the proposed power reduction, demonstrated a “strong probability of interference” from the lower band for several classes of devices.^{64/} Such probability of interference would be increased particularly at co-located rooftops where there is greater cell density and shorter separation distances.

Contrary to LightSquared’s assertion, Clearwire did not acknowledge that harmful interference to GPS receivers can be “easily mitigated.”^{65/} Not only did Clearwire note that mitigating GPS interference is not possible in many locations, it also explained that the cost of purchasing new filtered GPS antennas would be quite substantial.^{66/}

5. Deere Report

Deere and Company (“Deere”), one of the largest manufacturers of high precision GPS technologies for the agriculture, construction, and surveying industries, also conducted an

^{61/} *See id.* at 7.

^{62/} *See id.*

^{63/} *Id.* at 1, 11.

^{64/} *Id.*

^{65/} *See* Letter from Jeffrey Carlisle, Executive Vice President, Regulatory Affairs & Public Policy, LightSquared, to Marlene H. Dortch, Secretary, the Federal Communications Commission, IB Docket No. 11-109, at 3 (filed July 27, 2011).

^{66/} *See Clearwire Report* at 11.

independent study of LightSquared’s proposal. It found that LightSquared’s network “would cause substantial harmful interference to the high-precision systems upon which Deere and others in the agriculture, construction and surveying sectors rely.”^{67/} Deere also concluded that any proposal by LightSquared to reposition its network in the lower 10 MHz of the L-Band, or reduce its power, would not effectively eliminate the interference to high precision GPS users.^{68/}

Deere suggests that no interference mitigation mechanism has yet been introduced that would eliminate or substantially mitigate damaging interference to high-precision GPS users.^{69/} Consequently, Deere warns that if LightSquared is permitted to proceed with its proposal, the resulting degradation to high precision GPS signals could have a significant adverse impact of \$14 billion to \$30 billion annually on farmers around the nation.^{70/}

D. Mitigation Techniques Examined by the TWG Do Not Solve the Significant Interference Problems Caused by LightSquared’s Terrestrial Operations

As noted above, the TWG sub-groups also studied potential mitigation measures that might alleviate the effects of LightSquared’s operations on GPS receivers. The TWG Report results show that the tested mitigation measures were unsuccessful in alleviating the interference concerns caused by LightSquared’s proposed network. In particular, the sub-groups found that operation on the lower 10 MHz channel would still cause harmful interference to many GPS users. Other technical mitigation possibilities, such as filters, proved to be purely speculative – unproven, untested, unavailable, and unverified.

^{67/} *Deere Report* at 2.

^{68/} *See id.*

^{69/} *See id.*

^{70/} *See id.* at 5.

1. The TWG Results Demonstrate That Filters Are Not a Realistic Mitigation Measure

Radio frequency filters were extensively investigated and rejected as a mitigation possibility by the TWG. Filters strong enough to counter the effects of the proposed terrestrial network were found to be merely theoretical concepts, and therefore could not be tested or verified as part of the study. The only actual device that could be tested was shown to work only in extremely limited cases for a few ultra-narrowband timing receivers; it did not alleviate the interference to GPS and, in fact, filtered out and lost over 96 percent of the GPS signal.^{71/} The TWG found that requiring the entire GPS community to leave unused 96 percent of the 32 MHz GPS band in order for LightSquared to use an adjacent 20 MHz of spectrum to serve fewer users would not be either an efficient or effective use of such precious spectrum. Even if an effective filter did exist, the TWG found that retrofitting existing GPS devices would be nearly impossible.^{72/}

The Coalition notes that LightSquared's previous claims that the GPS industry had simply been using poor or cheap filters were not substantiated anywhere in the official TWG Report.^{73/} In reality, the results show that the high-quality filters in GPS receivers can withstand interference in the adjacent bands from signals many thousands or even millions of times more powerful than the GPS signals. Nonetheless, even high-quality receivers will be overwhelmed by interfering signals billions times more powerful.

^{71/} See TWG Report, Appendix H.1.8 at 23.

^{72/} See TWG Report at 28, 177.

^{73/} See Recommendations Document at 18.

2. LightSquared's Late-Introduced Proposal To Operate in the Lower 10 MHz Channel Would Not Resolve Interference Concerns

The TWG found that LightSquared's proposal, introduced late in the testing process, to use the exact same frequencies and power levels in the original test plan, but to change the order in which those frequencies are deployed, starting with the lower 10 MHz channel in the band adjacent to GPS, also would not resolve the interference problem for "99% of GPS receivers" as LightSquared claims.^{74/} Operations using the 10 MHz lower band would add only 10 MHz of separation from the GPS band relative to operations using the upper 10 MHz channel. In spectrum terms, particularly in light of the difference in signal strength between satellite signals received by GPS units and a LightSquared base station transmitter, a 10 MHz separation is the equivalent of moving only a short distance away. High-powered wireless networks are typically separated from GPS by *hundreds* of megahertz of spectrum. Given power differentials of up to hundreds of billions of times between LightSquared's transmissions and GPS signals as received on Earth, this minimal increase in separation would not solve the fundamental problem of incompatible power levels, and simply is insufficient to ensure the safety and productivity of the massive U.S. GPS user community.

Further, LightSquared reinterprets the TWG Report test results in its favor in part by dismissing as "unduly conservative" the threshold used by most sub-teams to define harmful interference as a 1 Decibel (dB) loss in GPS signal power.^{75/} With respect to the General

^{74/} See *id.* at 10.

^{75/} See, e.g., TWG Report at 129, 187-188 (stating that the use of a 1 dB threshold "as a quantification of harmful interference to GPS has a well-recognized basis in the products of seven years of technical work on protection of radionavigation-satellite service receivers, which are now up for final approval within the ITU's Radiocommunication Sector"); *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 3857, ¶ 12 (2003) (analyzing harmful interference from ultra wideband transmissions "based on a 1 dB increase in the noise floor of the GPS receiver"); see also *NPEF Report* at 4 (determining that a 1 dB degradation "is not necessarily a tolerable level of degradation

Location and Navigation sub-team results in particular, LightSquared found support for its lower 10 MHz proposal by defining harmful interference as a 6 dB degradation in the Carrier-to-Noise ratio, which translates to an unacceptable 75 percent loss in received GPS signal power. Such degradation is unacceptably large for GPS users, particularly many GPS applications critical to safety of life, and is inconsistent with the threshold traditionally used by the FCC and the international community.^{76/}

Finally, the TWG found that there is no data to support LightSquared's claims that operations restricted to the lower 10 MHz channel will not cause harmful interference to GPS receivers. In fact, the test results that are available provide substantial evidence to the contrary. The available data show that more than 50 percent of all GPS receivers tested in the study were reported to still suffer harmful interference or loss of function in the presence of transmissions in the lower 10 MHz band.^{77/}

from LightSquared emissions but is useful to highlight the onset of severity associated with these emissions.”).

^{76/} The GPS industry has already agreed to reduced signal power and increased noise for GPS users in order to accommodate users in the adjacent MSS band, for example, by agreeing to out of band emission limits that allow LightSquared to increase the radio noise within the GPS band by 20 percent due to the high-powered cell sites “bleeding” into the GPS spectrum. *See Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, IB Docket Nos. 01-185, 02-364, Report and Order and Notice of Proposed Rulemaking, 18 FCC Rcd 1962, ¶ 184 (2003).

^{77/} TWG Report at 177 (20 of 29 General Navigation and Location devices); *id.* at 245, figure 36 (33 of 33 High Precision devices); *id.* at 78, figure 3.2.2 (6 of 41 Cellular phones); *id.* at 315, figure 3.5.11.11 (1 of 2 Space-based receivers). In total, 60 out of the 105 devices tested were found to experience harmful interference from the lower 10 MHz channel, equal to 57 percent of all devices tested. The Aviation sub-team results are excluded because the sub-team could not conclude compatibility or non-compatibility in the lower block without more study.

III. LIGHTSQUARED’S RECOMMENDATIONS DOCUMENT PROVIDES NO SOLUTIONS TO THE PROBLEMS CREATED BY ITS OWN PLANS FOR NON-INTEGRATED USE OF THE MSS BAND

A. LightSquared’s Recommendations Document Ignores the Working Group Process and Misrepresents Regulatory History

As noted above, faced with the imminent release of the TWG Report demonstrating overwhelming evidence of massive interference – and likely in order to preempt these highly negative results – LightSquared simultaneously released a 37-page “Recommendations” document that it developed outside of the TWG process.^{78/} Because it was developed outside the working group process, LightSquared’s “solution” was not subject to the rigorous analysis that the process entailed. Nothing in the Recommendations Document, therefore, has been considered by industry experts – it is merely LightSquared’s self-serving attempt to deflect attention from the massive interference that the TWG sub-groups demonstrated.

In the Recommendations Document, LightSquared “changes the subject” to discuss an alternative deployment scenario, not included in the initial scope of the TWG testing and analysis. In particular, LightSquared proposed to: (1) operate at a lower power than permitted by its existing FCC authorization; (2) agree to a “standstill” in the terrestrial use of its upper 10 MHz frequencies immediately adjacent to the GPS band; and (3) commence terrestrial commercial operations only on the lower 10 MHz portion of its spectrum and to coordinate and share the cost of “underwriting a workable solution” for the installed base of GPS precision measurement devices that would be at risk, making the unsubstantiated assumption, contrary to the evidence in the TWG report, that there is a “workable solution.”^{79/} In addition, LightSquared used its Recommendations Document to reiterate its baseless claims that the GPS industry

^{78/} See Recommendations Document.

^{79/} *Id.* at 24; see also *Public Notice* at 2 (requesting comment on LightSquared’s Recommendations Document).

should have been aware of its intended use of MSS L-Band spectrum for a stand-alone, densely deployed terrestrial network and that the GPS industry is somehow complicit in LightSquared's inability to offer its desired service without creating massive interference to hundreds of millions of GPS receivers.

1. The FCC Should Not Give Any Weight to LightSquared's Rhetoric and Instead Should Consider the Fully Developed Record in These Proceedings

In addition to presenting its proposed "solution" outside of the working group process, LightSquared's Recommendations Document continues to make excuses for its failure to fully evaluate the potential use of a high-power, densely deployed terrestrial network in spectrum adjacent to GPS. In particular, LightSquared blames the GPS industry for not addressing potential interference to GPS (an assertion unsupported in the TWG Report test results) and accuses the GPS industry of "doom[ing] an innovative American start-up company that has devoted more than 10 years of effort and billions of dollars" in reliance on its plans to build a new terrestrial wireless broadband network in the L-Band.^{80/} LightSquared's finger-pointing and dramatizations are unjustified. Concerned stakeholders have operated in good faith throughout the process, recognizing the importance of wireless broadband to consumers and acknowledging that LightSquared should be able to pursue its plans as long as it can be conclusively shown that such plans will not interfere with GPS. However, LightSquared has been unable to make that demonstration. That is LightSquared's fault, and not the fault of Coalition members. If anyone has doomed LightSquared's proposal, it has been LightSquared itself. Therefore, rather than doom its introduction of terrestrial broadband services, LightSquared should use other

^{80/} Recommendations Document at 3; *see also id.* at 24 ("LightSquared must begin to deploy its network immediately or it may not survive.").

portions of its “nationwide ubiquitous spectrum in advantageous frequency position” that its website asserts it controls to provide the proposed terrestrial services.^{81/}

In addition, LightSquared’s Recommendations Document repeatedly reminds the FCC of how much money it has invested in its proposed network, for example, stating that “LightSquared and its investors have already invested \$4 billion in the development of its business and it is prepared to invest an additional \$22 billion over the next seven years to develop its wholesale terrestrial network.”^{82/} While no one disagrees that this is a large sum of money, it is not the FCC’s responsibility to rescue LightSquared from the billions of dollars it has invested in a faulty business plan. LightSquared fundamentally misinterpreted the FCC’s rules governing ancillary terrestrial services and the fact that the L-Band spectrum is intended for MSS services.^{83/}

The *January 2011 Order* made clear that LightSquared could not commence operations if such operations would cause interference to GPS users. In saying this, the FCC simply restated what is already in the Commission’s rules, which clearly obligates MSS licensees that wish to conduct ATC operations in the MSS band to cure interference to other services such as GPS.^{84/} Given this, LightSquared’s self serving revisionist history about who knew what was going to happen when, even if it were true, is simply irrelevant, and LightSquared was on clear notice that

^{81/} Our Investors: Spectrum Assets and Financing, <http://www.lightsquared.com/about-us/our-investor>.

^{82/} See, e.g., Recommendations Document at 16.

^{83/} The fact that LightSquared simply failed to understand the nature of the L-Band is evidenced by the FCC’s recent release of a Public Notice which seeks comment on the future use of terrestrial operations in the MSS 2 GHz band. See *Spectrum Task Force Public Notice*. The Commission is able to evaluate how to introduce terrestrial services in those bands because they are domestically and internationally allocated for, among other things, terrestrial use and there are no incompatible adjacent band operations. The same is not true of the L-Band, and LightSquared should have known that.

^{84/} 47 C.F.R. § 25.255 (“If harmful interference is caused to other services by ancillary MSS ATC operations, either from ATC base stations or mobile terminals, the MSS ATC operator must resolve any such interference.”).

it could not conduct terrestrial operations in a manner that would disrupt GPS. The fact that it elected to spend billions of dollars on its new business plan before the FCC and its own engineers addressed the critical question – whether its planned new terrestrial operations could coexist with continued operation of a government owned satellite constellation representing an investment of tens of billions of dollars of taxpayer money – speaks only to LightSquared’s own lack of due diligence and understanding of the FCC’s rules. Rather than rescuing LightSquared from its mistakes, the FCC should quickly and clearly send LightSquared in a different direction now.^{85/}

LightSquared also uses its Recommendations Document to characterize the interference issue as a fight between LightSquared and “the commercial GPS industry,” stating that “the commercial GPS industry wants the Commission to shut down an unprecedented effort to establish a nationwide wireless broadband network built with private funding.”^{86/} As noted above, this is not a “fight” between LightSquared and anyone else and if anyone is to blame for the potential shut down of LightSquared’s network, it is LightSquared. Moreover, characterizing those who wish to protect GPS as only the “commercial GPS industry” is inaccurate. As set forth in detail above, the primary stakeholder in GPS is the U.S. government, which built and owns the GPS constellation, and whose major agencies are among the largest current and future users of GPS. An overwhelming number of other stakeholders beyond

^{85/} Prior to the *January 2011 Order* and after, GPS parties cautioned that the FCC should make clear that any further investment by LightSquared was entirely at its own risk pending the outcome of the interference study process that the FCC mandated. *See, e.g.,* Application for Review, The U.S. GPS Industry Council, IBFS File No. SAT-MOD-20101118-00239, at 20-22 (filed Feb. 25, 2011) (urging the Commission to “declare that any expenditures LightSquared makes in pursuit of terrestrial mobile broadband service prior to release of the GPS-related condition are at LightSquared’s exclusive risk and are without prejudice to contrary Commission action”). In fact, despite the fact that this is clear Commission policy, LightSquared has continued to gamble with its investors’ money while this process has been ongoing.

^{86/} Recommendations Document at 4.

commercial GPS device manufacturers and providers from across the country have expressed significant concerns regarding the impact LightSquared's proposed operations could have on GPS. Even the Coalition, which was founded initially by leading GPS manufacturers, has grown to include companies and trade associations cutting across every sector of the U.S. economy.

International organizations have expressed concern as well. For example, the International Civil Aviation Organization recently wrote the FCC to state: “[T]he potential disruption to aviation use of GPS caused by the LightSquared system would have far-reaching impact on current and future aviation operations. The impact would not only be limited to the United States. The international aircraft fleet flying into the United States would be directly affected and also similar developments could arise elsewhere and propagate the disruption beyond their borders.”^{87/} The European Commission similarly submitted a letter stating that, according to its analysis, LightSquared's proposed network “presents a grave threat to the viability of providing a Galileo service covering US territory.”^{88/}

2. LightSquared's View That the GPS Industry Acquiesced in LightSquared's Business Plans Is Revisionist History

In the Recommendations Document, LightSquared also argues yet again that the GPS industry has known and acquiesced in LightSquared's business plans.^{89/} This claim merely recycles LightSquared's *post hoc* view, endlessly repeated by LightSquared and consistently refuted by the GPS industry, about the history of the FCC's ancillary terrestrial component rules.

^{87/} Letter from Roberto Kobeh González, President, and Raymond Benjamin, Secretary General, International Civil Aviation Organization, to Julius Genachowski, Chairman, FCC, IB Docket No. 11-109 (filed June 13, 2011).

^{88/} Letter from Heinz Zourek, Director General, European Commission, to Julius Genachowski, Chairman, FCC, IB Docket No. 11-109 (filed July 19, 2011).

^{89/} Recommendations Document at 6-7, 11-17.

LightSquared's tactics are to shift to the GPS industry the blame for its failure to adequately understand the pre-existing uses of the L-Band or the devastating interference that non-integrated terrestrial operations would cause to the base of GPS users. The Coalition will not rehash in detail the prior submissions by the U.S. GPS Industry Council and others showing that LightSquared's assertions in this regard are unpersuasive and inaccurate. The inconvenient fact that LightSquared required, and the FCC prematurely granted, a waiver of the ancillary terrestrial component rules to tentatively authorize its plans alone demonstrates that there was no way for the GPS community to anticipate that LightSquared would be allowed to operate in a manner outside the purview of the FCC rules.

First, as confirmed numerous times by the FCC, the ancillary terrestrial component rules were adopted to allow satellite providers to operate terrestrial facilities that would be ancillary to, and integrated with, the underlying primary satellite service.^{90/} While LightSquared's predecessors repeatedly communicated to the FCC that they expected to use ATC as a supplemental service,^{91/} LightSquared, for the first time in late 2010 indicated that it planned to offer terrestrial-only services as well as terrestrial-only handsets (through the thin veneer of its "wholesale" carrier customers), in clear violation, as the Commission found, of the Commission's integrated service requirements for ancillary terrestrial operations. Similarly, this filing noted that the terrestrial network would be "tens of thousands of times the capacity" of its

^{90/} See, e.g., *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, Memorandum Opinion and Order and Second Order on Reconsideration, 20 FCC Rcd 4616, ¶¶ 19, 33 (2005) ("2005 ATC Decision") (reiterating that to "ensure that ATC will be ancillary to provision of MSS . . . [w]e require[] the offer of MSS and ATC services to be integrated" and "will not permit MSS/ATC operators to offer ATC-only subscriptions, because ATC systems would then be terrestrial mobile systems separate from their MSS systems").

^{91/} See, e.g., *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, Notice of Proposed Rulemaking, 16 FCC Rcd 15532, ¶ 15 (2001) (explaining that LightSquared's predecessor sought authority to use terrestrial base stations integrated with the satellite network specifically to provide service to areas where satellite coverage would be difficult to achieve).

satellites.^{92/} Despite the Commission’s longstanding precedent requiring terrestrial operations to remain ancillary to, and integrated with, the underlying satellite service, it granted LightSquared a waiver of this rule in January 2011, eliminating the protection provided to GPS by the limits previously consistently imposed on terrestrial operations of MSS providers operating in the adjacent band.^{93/}

Second, in addition to it being impossible for the GPS industry to have predicted that the FCC would allow terrestrial operations prohibited by its rules and decisions, the GPS industry also relied on the published regulatory requirement that LightSquared’s terrestrial component would have to be limited in order to ensure terrestrial operations would not cause harmful interference to LightSquared’s own underlying satellite service.^{94/}

Third, the GPS industry also reasonably relied on the FCC’s express commitment to protect the federal government’s use of and investment in GPS. For example, in 2005 the FCC promised to engage in discussions and coordination efforts “to ensure that all FCC services provide adequate protection to GPS.”^{95/} This commitment has been reemphasized again and again.^{96/}

^{92/} See Letter from Jeffrey J. Carlisle, Executive Vice President, Regulatory Affairs & Public Policy, LightSquared, to Marlene H. Dortch, Secretary, FCC, SAT-MOD-20101118-00239 (Nov. 18, 2010).

^{93/} *January 2011 Order*.

^{94/} The TWG test results confirmed the underlying wisdom of this requirement by establishing that LightSquared’s proposed terrestrial network would in fact cause harmful interference to its satellite services. See TWG Report at 22, 247, 266.

^{95/} *2005 ATC Decision* ¶ 70.

^{96/} See, e.g. *National Space Policy of the United States of America*, at 5, June 28, 2010, available at http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf (stating that the U.S. “must maintain its leadership in the service, provision, and use of global navigation satellite systems” and listing as a critical objective “invest[ing] in domestic capabilities and support[ing] international activities to detect, mitigate, and increase resiliency to harmful interference to GPS”).

Lastly, LightSquared states that resolving interference issues “already has cost LightSquared over a hundred million dollars to shift the timing of its access to portions of the frequency bands it shares with Inmarsat.”^{97/} In fact, a key component of the deal LightSquared entered into with Inmarsat was to compensate Inmarsat for the costs of addressing the interference that Inmarsat expected to receive from LightSquared’s operations. Consequently, LightSquared had to have known about the potential for causing interference to systems like GPS, which are also located in bands directly adjacent to those used by LightSquared, as well as its own existing services, such as GPS augmentation services provided using LightSquared’s and Inmarsat’s frequencies.

B. LightSquared’s Three-Pronged “Solution” Will Not Alleviate the Significant Interference Concerns Documented in These Proceedings

As described above, at the very end of the TWG testing process LightSquared abandoned its earlier proposal and offered a new proposal to (1) operate at a lower power than permitted by its existing FCC authorization, (2) delay operating in its upper 10 MHz channel, and (3) commence operation in its lower 10 MHz channel and cooperate with interested stakeholders in underwriting a solution for at-risk high precision GPS devices.^{98/} LightSquared claims that this proposal offers a workable “solution” to the massive interference that LightSquared’s initial proposal would cause to GPS. LightSquared’s rosy statements notwithstanding, it has presented no solution at all.

LightSquared’s plans have received unprecedented study and the benefit of every doubt. Following submission of its new, non-integrated business plan in November 2010, GPS parties

^{97/} Recommendations Document at 5.

^{98/} *Id.* at 24.

submitted extensive technical data showing the potential for massive interference to GPS.^{99/} In January 2011, NTIA submitted strong expressions of concern over the potential for interference on behalf of every major Cabinet-level agency of the Federal Government.^{100/} The FCC elected to proceed to grant LightSquared a waiver without addressing the interference issue on the merits and mandated an unprecedented, massive, and extremely accelerated study group process to determine whether interference would occur and whether it could be mitigated. After four months of extraordinary effort by over 100 technical experts from the leading companies in the relevant industries, it has been shown that the plans LightSquared originally presented to the Commission would be an unmitigated disaster for the public and private sector, something LightSquared should have known long before it asked the FCC to sanction its plans. The FCC has given LightSquared an extraordinary opportunity to prove that its plans will work. After thousands of hours of opportunity to convince independent technical experts, LightSquared is left with nothing but unilateral assertions that its “new” plans will work, and idiosyncratic and aggressive interpretations of the technical data regarding these plans. This simply isn’t enough to put a national asset like GPS at risk, and LightSquared should not get further extraordinary opportunity to do the technical homework it should have done long ago. It is time to move on.

^{99/} See, e.g., Comments of the U.S. GPS Industry Council, IBFS File No. SAT-MOD-20101118-00239 (filed Dec. 2, 2010); Scott Burgett and Bronson Hokuf, *Experimental Evidence of Wide Area GPS Jamming That Will Result from LightSquared’s Proposal to Convert Portions of L Band 1 to High Power Terrestrial Broadband* (Jan. 16, 2011), filed as an attachment to Letter from Stephen D. Baruch, Counsel for the United States GPS Industry Council, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20101118-00239 (filed Jan. 20, 2011).

^{100/} Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information and Administrator, National Telecommunications and Information Administration, to Julius Genachowski, Chairman, Federal Communications Commission, IBFS File No. SAT-MOD-20101118-00239 (filed Jan. 12, 2011).

1. Operating at a Lower Power Will Not Sufficiently Mitigate the Harmful Interference Caused by LightSquared’s Proposed Terrestrial Network

The first prong of LightSquared’s new proposal is to operate at a power level of 32 dBW per carrier, which is below that permitted by the FCC in 2010.^{101/} The offer to operate at 32 dBW is meaningless. LightSquared apparently never anticipated operating at a higher power level, even though it was authorized to do so by the FCC. To the contrary, the 32 dBW power level is exactly what LightSquared told the TWG it would use. Therefore, the 32 dBW level is what has already been tested – with disastrous results – by the TWG. In particular, all of the TWG “live sky” testing used power levels at or below 32 dBW. At this power level, as discussed above, the test results demonstrate that either harmful interference will result or further testing is needed for all types of GPS receivers evaluated by the working group. Consequently, the TWG has already demonstrated that this prong of LightSquared’s proposal will not be successful in mitigating the harmful interference that LightSquared’s terrestrial operations will cause to GPS.

2. Agreeing to a “Standstill” in the Terrestrial Use of the Upper 10 MHz Frequencies Only Amounts to a Request To Revisit the Testing That Has Already Been Performed

In addition to promising to operate at a lower power, LightSquared expressed its commitment to delay operating in the upper 10 MHz band until it receives further approval from the FCC.^{102/} However, the test results conclusively demonstrate that operating in the upper 10 MHz band will cause harmful interference to GPS – a promise to delay using this spectrum does not change that fact. In addition, LightSquared promises that it will “commence a process of working with the Commission and NTIA to explore options that ensure that GPS operations are

^{101/} Recommendations Document, at 25.

^{102/} *Id.*

protected.”^{103/} LightSquared and numerous other interested experts just participated in extensive tests of all types of GPS devices and considered all types of mitigation measures to “explore options that ensure that GPS operations are protected.” It is unclear what LightSquared expects to gain by revisiting tests already performed and issues already addressed. LightSquared also states that as part of its “standstill” commitment, “GPS device manufacturers must begin the process of improving their equipment by adding the appropriate filtering and other technology necessary to reject signals that operate outside the GPS frequencies.”^{104/} That does not constitute any commitment from LightSquared. To the contrary, it is further evidence that LightSquared continues to look to others to rescue it from inadequate engineering analyses and its mis-reading of the FCC’s rules and decisions. Further, while LightSquared’s statements in this regard imply that current GPS devices are somehow deficient in their designs, such devices – which are relied upon by millions of users in both the public and private sector – use state-of-the-art filtering technology.^{105/} In any case, as discussed above, the “appropriate filtering and other technology” that LightSquared believes the GPS industry should incorporate into GPS devices generally do not exist and to the very limited extent that they do (for less-precise narrowband receivers only), they were wholly rejected as a viable mitigation strategy by the working group process.

3. Commencing Terrestrial Commercial Operations Only on the Lower 10 MHz Portion of LightSquared’s Spectrum and Promising To Share the Cost of Underwriting a Solution for the Installed Base of GPS Devices That May Be at Risk Is Not a Workable Solution

Last, LightSquared proposes initially to restrict its terrestrial operations to its lower 10 MHz band and share the cost of underwriting a solution for the installed base of high precision

^{103/} *Id.*

^{104/} *Id.* at 26.

^{105/} The most sensitive precision GPS devices typically have at least five stages of state-of-the-art filtering in an effort to preserve the GPS signal.

GPS devices that will be affected by such operations.^{106/} LightSquared contends that its proposed solution “is identical to the primary mitigation measure suggested by the commercial GPS device industry when it raised the receiver overload issue with the Commission in September 2010.”^{107/} LightSquared’s reliance on comments filed by the U.S. GPS Council is unfounded. First, the comments that LightSquared cites were submitted in the context of a rulemaking proceeding regarding the leasing of capacity on satellite systems.^{108/} The issue of more extensive terrestrial use of MSS spectrum was not directly addressed in that proceeding. Because that proceeding did not propose changes to the ATC rules that would allow for increased, non-integrated terrestrial operations in the MSS spectrum, the GPS industry had no reason to suspect that the fundamental protections that the FCC established for ATC operations – such as the requirement that terrestrial services must be ancillary to and integrated with the underlying satellite component – would cease to exist.

Moreover, the FCC’s leasing rules state that a lessee cannot provide a service different from the licensee, so it was reasonable for the GPS industry to expect that any lessee would provide the same protections to GPS, like ancillary and integrated service, which the MSS licensees were required to provide.^{109/} In fact, because the FCC’s Notice of Proposed Rulemaking and the U.S. GPS Industry Council comments in the satellite leasing proceeding were submitted prior to LightSquared’s November 2010 modification proposal that was the subject of the *January 2011 Order*, the GPS commenters could legitimately expect the existing

^{106/} *Id.* at 27.

^{107/} *Id.* at 5.

^{108/} See Comments of the U.S. GPS Industry Council, Docket No. 10-142, at 13-14 (filed Sept. 15, 2010); *Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz*, Notice of Proposed Rulemaking and Notice of Inquiry, 25 FCC Rcd 9481 (2010).

^{109/} 47 C.F.R. § 25.149.

protection criteria to remain in effect. In any event, in light of the TWG test results, it now is clear beyond a doubt that the use of the lower band would negatively affect GPS operations. The U.S. GPS Industry Council's position at the time – albeit based on the premises that LightSquared changed when it filed its modification application – has been validated by testing showing massive interference even using just the lower band spectrum.

LightSquared also incorrectly claims that its lower 10 MHz proposal will eliminate interference to more than 99 percent of GPS receivers.^{110/} LightSquared has cited absolutely no data from the TWG Report or elsewhere to support this claim; rather, it seems to be basing its assertion on the premise that lower band operations will not affect mass market GPS devices such as personal navigation devices or cell phones. However, as noted above, that premise is not consistent with the working group's findings. In particular, the section of the TWG Report that included the findings of the General Navigation sub-group, which studied mass market personal navigation devices, stated that “lab testing revealed that many devices suffered from harmful interference from the lower 10 MHz channel; specifically, 20 out of 29 devices experienced harmful interference.”^{111/} Similarly, data from the Space-Based sub-team demonstrates that even if LightSquared limited its operations to the lower 10 MHz channel, GPS receivers several hundreds of miles in orbit would still experience harmful interference.^{112/}

While the FCC should reject LightSquared's proposal on the basis that it is unworkable and fails in every respect to resolve the significant interference issues evaluated by the working group, the FCC also should be wary of this latest *post hoc* solution given how reckless

^{110/} Recommendations Document at 2 (“[T]ransmissions in the 10 MHz band at the bottom of LightSquared downlink frequencies — the band farthest away from the GPS frequencies — will not adversely affect the performance of over 99 percent of GPS receivers. Exceptions are mostly limited to those precision measurement devices used largely in agriculture, mining and construction. . . .”).

^{111/} TWG Report at 19, 123.

^{112/} See TWG Report at 24, 300.

LightSquared's initial proposal turned out to be. The failure of LightSquared's initial deployment plans to pass interference tests raises fundamental questions about whatever assurances LightSquared may have made to the FCC prior to its *January 2011 Order* that apparently convinced the FCC to grant the waiver and convene the working group process in the first place, and raises significant questions about the credibility of LightSquared's various claims through the present. In all of its documents and public statements, LightSquared professes a long history of familiarity with the technical rules of the MSS band and a wealth of technical expertise on interference issues. Yet, in February 2011 it proposed only deployment scenarios which used the upper MSS bands, that overwhelming technical evidence has now shown will cause massive interference to every GPS receiver studied. Since LightSquared was completely wrong in formulating its initial deployment plans and claiming that they would not cause interference, the FCC should give no weight to its sweeping technical claims about its "new" deployment plan. In fact, as set forth above, the available technical data does not support these claims. Just as LightSquared was wrong in 2010 and the first six months of 2011, it is wrong now.

C. LightSquared's Attempts To Blame the GPS Industry for Failing To Build Resistant Receivers and "Effectively Appropriating" LightSquared's L-Band Spectrum Are Inappropriate and Contrary to the Facts

In the LightSquared Recommendations Document, LightSquared repeatedly blames the GPS industry for failing to design receivers that adequately reject LightSquared's proposed transmissions.^{113/} However, such technology simply does not exist. In order to be able to receive faint satellite signals, GPS receivers must be designed to be highly sensitive. GPS receivers incorporate filters that reject transmissions in adjacent bands that are millions of times more powerful than the signals that are transmitted within the band they are designed to receive.

^{113/} See, e.g., Recommendations Document at 1, 9, 17.

LightSquared, however, is proposing to transmit signals in the band adjacent to GPS that are billions of times more powerful than GPS satellite signals. As discussed above, the TWG recorded power levels were *hundreds of billion of times* the power of the GPS signals. There has never been, nor will there ever be, a filter that can block out signals in an immediately adjacent frequency band that are so much more powerful, nor has LightSquared put forward any credible, independent expert opinion or other evidence that this is possible.

The FCC mandated that LightSquared initiate a process to consider possible ways to “mitigate” interference. As the TWG Report confirms, the only filter LightSquared produced for testing was an antenna with filters so extreme that they would filter out more than 95 percent of the GPS signals as well, with a severe penalty to receiver performance. Other than that, LightSquared did not produce a single filter for testing – only presentations and conceptual vendor proposals. Even these theoretical filters did not address the insurmountable technical problem presented by extremely high powered signals immediately adjacent to GPS. Further, if LightSquared’s theoretical filters ever made it off of the drawing board, they would force GPS receivers to retreat into only a tiny portion of the legitimate GPS band and would render useless millions of GPS devices and billions of dollars of investment by government, industry, and consumers.

And even real filters are not a solution for the 500 million receivers in use in the United States. The entire population of GPS users would require a minimum of 15 years to prepare for such a change. For example, factory-installed GPS systems in automobiles are typically not replaced during the 10-15 years life of the vehicle and the same can be said for aircraft, trucks, ambulances, and agricultural and construction machinery to name but a few. The idea of effecting such a transition in a matter of months or even a few years is unrealistic.

In addition, aside from integrated MSS-GPS equipment designed to use L-Band satellite communications, the idea that GPS receivers are “using” LightSquared’s spectrum^{114/} has no basis in any established or generally accepted concepts of spectrum usage or radio frequency engineering. Many high precision GPS devices are in fact intentionally designed to receive signals in the MSS band, but not because GPS manufacturers “fail[ed] to build receivers resistant to lawful transmissions” in this band.^{115/} Rather, many high precision receivers are designed this way to take advantage of services that LightSquared itself provides. As LightSquared knows well, but elects not to explain, LightSquared itself earns revenue by selling satellite capacity for the very same GPS augmentation services that high precision receivers are designed to receive. LightSquared also fails to disclose that its own contracts with satellite customers reserve the right to transmit signals anywhere in the entire MSS band upon notice, so GPS receivers which use LightSquared MSS services *had to be designed to receive signals in the entire MSS band*. In other words, the “design decision” to make high precision GPS receivers that were vulnerable to interference from high powered terrestrial interference in the MSS band *was imposed by LightSquared itself*.

The fact is that LightSquared’s original plans, as well as its new “recommended” plan, create massive interference to customers from which LightSquared has been collecting revenue for years. And LightSquared adds insult to injury by blaming GPS manufacturers for designing high precision GPS receivers in a way that allowed their customers to pay money to LightSquared.

^{114/} *Id.* at 18 (“GPS devices, such as wideband precision measurement receivers, deliberately use LightSquared’s L-Band frequencies. Their receivers employ wideband front-ends in order to increase precision and in order to receive satellite augmentation signals throughout the 1525-1559 MHz L-Band.”).

^{115/} *Id.*

The proven potential for interference to high precision GPS receivers that use MSS-based augmentation services, interference which LightSquared acknowledges, also raises fundamental questions about LightSquared's business practices: If it knew since 2001 that it was planning a service that was incompatible with GPS augmentation services, what did it do to disclose this fact to customers? Has it disclosed this fact to customers recently based on its current plans? Based on all reports from the affected users, the answers are "nothing" and "no."

The suggestion that design decisions by commercial GPS manufacturers created the interference problem through "bad" design decisions is also belied by the fact that many of the GPS receivers with which LightSquared will interfere are designed according to the demanding specifications of the Department of Defense or in accordance with the exacting standards applicable to national and international aviation navigation imposed by the Federal Aviation Administration, the International Civil Aviation Organization, International Telecommunication Union, and other regulatory and industry standards bodies.

D. Although Announced After the Recommendations Document, LightSquared's Rural Initiative Is Unlikely To Have Any Meaningful Impact on Rural Consumers' Access to Broadband

Shortly after the release of the TWG Report and LightSquared's Recommendations Document, LightSquared announced the creation of an "Empower Rural America Initiative" to be comprised of three former Members of Congress. While the Coalition does not disagree with the need to close the broadband gap in rural America, this public relations initiative cannot resolve the significant GPS interference issues evaluated by the TWG and discussed in these comments.

In addition, this initiative is unlikely to bring broadband to rural America. LightSquared by its own admission does not intend to use its terrestrial network to provide service to rural

areas for the foreseeable future. In particular, LightSquared's Recommendations Document states that "LightSquared's terrestrial deployment plans necessarily focus initially on population centers and only gradually begin to cover less densely populated areas Indeed, LightSquared's terrestrial deployment plans project coverage of almost 270 million Americans or 86 percent of the U.S. population by the end of 2014, but this population would be located in densely populated areas that cover only 12 percent of the U.S. land mass."^{116/} Consequently, while the provision of broadband to rural areas is a laudable goal, LightSquared's proposal is unlikely to further it.

IV. THE HYPOTHETICAL BENEFITS BEING TOUTED BY LIGHTSQUARED DO NOT OUTWEIGH THE REALIZED BENEFITS GPS IS PROVIDING TO MILLIONS OF USERS EVERY DAY AND THE SIGNIFICANT COSTS THAT WOULD BE INCURRED IF GPS IS DISRUPTED

In its Recommendations Document, LightSquared asserts that its terrestrial network will provide consumers with \$120 billion in benefits, citing a research paper sponsored by LightSquared and prepared by the Coleman Bazelon of The Brattle Group, Inc.^{117/} The NDP Consulting Group evaluated the *Bazelon Study*, and a copy of which analysis is attached hereto as Appendix B.^{118/}

The *NDP Analysis* explains how the *Bazelon Study* arrived at this \$120 billion figure.^{119/} Briefly, the *Bazelon Study* claims that LightSquared's L-Band spectrum is worth approximately \$12 billion based on an estimate contained in a prior, unrelated Brattle Group study that the

^{116/} *Id.* at 32.

^{117/} *Id.* at 20; Coleman Bazelon, The Brattle Group, Inc., *GPS Inteference: Implicit Subsidy to the GPS Industry and Cost to LightSquared of Accommodation* (June 22, 2011) ("*Bazelon Study*").

^{118/} NDP Consulting Group, *Comments on Coleman Bazelon's Research Paper* (July 29, 2011) ("*NDP Analysis*").

^{119/} *Id.* at 1-2.

AWS-3 band spectrum may be worth anywhere from \$3.6 billion to \$12 billion.^{120/} Nowhere does the *Bazelon Study* explain why the highest estimate of the \$12 billion is used. In order to arrive at the \$120 billion figure regarding alleged benefits, the *Bazelon Study* simply multiplies the \$12 billion by a multiple of ten, including a footnote stating that “wireless broadband spectrum is typically thought to generate consumer surplus equal to at least 10 times the original value of the original spectrum,”^{121/} citing a reference that “is not in any way advocating, supporting, or defending a particular multiplier” but rather simply states that the increase in consumer surplus “*may be*” ten times higher than the sales value of licenses.^{122/}

While LightSquared overestimates the benefits of its proposed network by reliance on an unsupported multiplier, it understates the cost of GPS signal impairment by reliance on the lowest possible cost estimate of \$0.30 per device.^{123/} As explained further in the *NDP Analysis*, this \$0.30 device figure was taken from an article that appeared in *The Guardian*, which reported various consultants’ estimates of the GPS signal fix, including the lowest estimate of \$12 million (or \$0.30 per device) and the highest estimate of approximately \$1 billion.^{124/} The *Bazelon Study* provides no discussion regarding the rationale for adopting this approach. Further, and as discussed above, there currently is no viable option for “retrofitting” GPS devices, so all affected GPS devices would have to be replaced. Likewise, and as also discussed above, there is no viable replacement option either, so it is entirely unclear how such devices *could* be replaced much less how the costs associated with such replacement could possibly be estimated.

Moreover, these figures do not include the significant cost of forgone benefits to GPS users or

^{120/} *Id.* at 2; *Bazelon Study* at 1.

^{121/} *Bazelon Study* at 1 n.2.

^{122/} *NDP Analysis* at 2.

^{123/} *Bazelon Study* at 4; *NDP Analysis* at 2-3.

^{124/} *NDP Analysis* at 3.

the potentially catastrophic costs of GPS signal disruption, such as those that could result from an airplane crash or car accident.^{125/}

In sum, LightSquared's completely arbitrary \$120 billion number and \$0.30 per device cost figure are completely unsupported, and in any event, cannot come close to countering, as discussed above, the realized benefits of between \$68 billion and \$122 billion being delivered to this country by GPS every year and the approximately \$96 billion in costs that would be imposed by LightSquared's disruption of GPS.^{126/}

LightSquared also contends that the "commercial GPS device industry has built an entire business based on a large subsidy from taxpayers – estimated to be worth \$18 billion – in the form of free access to the government's GPS satellite infrastructure and frequencies"^{127/} mirroring the "implicit subsidy" suggested in the *Bazelon Study*.^{128/} This country's ability to leverage government investment in GPS technology to benefit the private sector does not amount to a "government subsidy" as LightSquared contends, but rather it is the product of calculated economic and policy decisions designed to benefit the public interest. As the Coalition has recently documented, the U.S. government has already invested approximately \$35 billion of taxpayer money in the GPS constellation alone and continues to invest at a rate approaching \$1 billion per year.^{129/} The fact that this investment has created synergies in the private sector is irrelevant to the issues being evaluated in this proceeding and in any case is no different than the government's support of similar endeavors, such as the development of the U.S. computer industry or the Internet.

^{125/} *NDP Analysis* at 2-3.

^{126/} *NDP Study* at 2.

^{127/} *Id.* at 6.

^{128/} *Bazelon Study* at 5-9.

^{129/} *NDP Study* at 15.

The *NDP Analysis* further demonstrates that this “assertion relies on a tortured definition of ‘subsidy’ so expansive as to include, seemingly, all manners of public goods.”^{130/} As an initial matter, the GPS infrastructure – created originally by the U.S. military – was not used by non-governmental users until many years after the initial, fixed public investment.^{131/} In addition, extrapolating the *Bazelon Study*’s interpretation of the term subsidy would necessarily lead to the conclusion that the U.S. interstate highway system amounts to a subsidy to the oil, automobile, transportation, hospitality and fast food industries.^{132/} And as the *NDP Analysis* notes, in fact, “the terms of and public policy push behind LightSquared’s acquisition of its L-Band spectrum fits the conventional definition of a subsidy,” given that LightSquared’s spectrum assets were purchased for only a fraction of what the *Bazelon Study* estimates this spectrum is worth – in other words, there was a financial contribution by the government that conferred a benefit.^{133/}

V. THE ONLY VIABLE SOLUTION IS FOR LIGHTSQUARED TO OPERATE ITS PROPOSED TERRESTRIAL NETWORK OUTSIDE OF THE L-BAND

As discussed above, the TWG tests conclusively show that LightSquared’s planned deployment – whether as initially proposed or using only the lower 10 MHz channel – is incompatible with GPS. As a result, the condition that the International Bureau established in its *January 2011 Order* granting LightSquared a waiver of the FCC’s ATC rules – that LightSquared cannot commence commercial operation of its proposed terrestrial network until the Commission is satisfied that the proposed network will not interfere with GPS – has not been met.^{134/} Consequently, LightSquared must not be allowed to operate as it proposes.

^{130/} *NDP Analysis* at 3-4.

^{131/} *Id.* at 4.

^{132/} *Id.*

^{133/} *Id.* at 5.

^{134/} *January 2011 Order* ¶ 41.

LightSquared instead should be allowed to operate its satellite services in the L-Band and operate its new dense high-powered terrestrial component of its network in a different band. Many of the TWG sub-teams found this to be a feasible – if not the most or only feasible – mitigation strategy. For instance, the Aviation sub-team observed in its report that “a shift in the LightSquared ATC frequency to spectrum that is not adjacent to the GPS band could eliminate all interference concerns for aviation GPS.”^{135/} The General Location/Navigation sub-team similarly concluded that a shift of LightSquared’s base station transmissions to another frequency band outside of the MSS L-band “might potentially eliminate all interference effects with GPS receivers and allow both existing and future devices to coexist peacefully with LightSquared transmissions.”^{136/}

While the nation needs more wireless broadband services, there are many places in the radio spectrum already identified or allocated to 4G cellular uses where interference to adjacent space-based communications such as GPS would not occur. The satellite component of LightSquared’s network – serving rural and public safety users outside of cellular coverage – is fully compatible with the adjacent uses and is already available. To allow a new, unproven use for fewer users to diminish a long-established, highly productive spectrum use for the majority is not in the public interest and should not be allowed.

^{135/} *TWG Report* at 16, 28.

^{136/} *Id.* at 176.

VI. CONCLUSION

LightSquared must not be allowed to operate pursuant to its original or alternative proposals. After months of extensive testing, the TWG could not find a way for LightSquared's high-powered proposed terrestrial network to operate in a way that would not harmfully interfere with GPS. While the Coalition recognizes the importance of wireless broadband services, such services cannot be permitted at the expense of hundreds of millions of GPS users in every sector of the economy. Consequently, the Coalition urges the Commission to rescind the waiver of its ancillary terrestrial component rules it granted to LightSquared in January 2011 and prohibit any terrestrial operations in the L-Band that would cause harmful interference with GPS.

Respectfully submitted,

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Dated: August 1, 2011

APPENDIX A

List of Coalition Members

Coalition to Save Our GPS

Coalition Members

- Aeronautical Repair Station Association (ARSA)
- Ag Leader Technology
- AGCO
- Agricultural Retailers Association (ARA)
- Air Transport Association (ATA)
- Aircraft Electronics Association (AEA)
- Aircraft Owners and Pilots Association (AOPA)
- Air Line Pilots Association, International (ALPA)
- American Association of State Highway and Transportation Officials (AASHTO)
- American Petroleum Institute (API)
- American Car Rental Association (ACRA)
- American Congress on Surveying and Mapping (ACSM)
- American Council of Engineering Companies/Council of Professional Surveyors (ACEC/COPS)
- American Rental Association (ARA)
- American Sailing Association (ASA)
- Associated Equipment Distributors (AED)
- Associated General Contractors of America (AGC)
- Association for Unmanned Vehicle Systems International (AUVSI)
- Association of American Geographers (AAG)
- Association of American Railroads (AAR)
- Association of Equipment Manufacturers (AEM)
- ATX Group
- Avidyne Corporation
- BoatU.S. - The Boat Owners Association of The United States
- California Land Surveyors Association
- California Space Authority (CSA)
- Canadian Owners and Pilots Association (COPA)
- Case New Holland
- Caterpillar
- Deere & Company
- Delta Air Lines
- Edison Electric Institute (EEI)
- Equipped to Survive Foundation, Inc. (ETSFI)
- Esri
- Experimental Aircraft Association (EAA)
- Farm Equipment Manufacturers Association (FEMA)
- FedEx
- Fire Department of New York (FDNY)
- Garmin
- General Aviation Manufacturers Association (GAMA)

- GROWMARK, Inc.
- Hemisphere GPS
- Inside GNSS
- International Air Transport Association (IATA)
- Intelligent Transportation Society of America (ITS America)
- Leica Geosystems
- MACHINE CONTROL Online
- Magellan GPS
- Mid-Atlantic Aviation Coalition-New Jersey (MAAC-NJ)
- National Agricultural Aviation Association (NAAA)
- National Association of Manufacturers (NAM)
- National Business Aviation Association (NBAA)
- National Cotton Council of America (NCCA)
- National Marine Manufacturers Association (NMMA)
- National Rural Electric Cooperative Association (NRECA)
- National Utility Contractors Association (NUCA)
- Networkfleet
- New World Systems
- North American Equipment Dealers Association (NAEDA)
- OmniSTAR
- Orienteering USA
- Payment Assurance Technology Association (PATA)
- PeopleNet
- PocketGPSWorld.com Ltd
- Regional Airline Association (RAA)
- Reinke Mfg. Co. Inc.
- Southwest Airlines
- SurveyorConnect
- The Manitowoc Company, Inc.
- TomTom
- Topcon Positioning Systems
- Trimble
- UPS
- USA Rice Federation

Associate Members

- Abraham Land Surveying
- Accurate Services, Inc.
- Accurate Surveying & Mapping
- Advanced Concepts Electronics
- AGPS
- Ag Technologies, LLC
- AgriService Company
- Antares Navigation

- Allen Geomatics, P.C
- Atrivu, Inc
- Aviation For Humanity
- AVIDwireless
- B & L SURVEYS, P.A
- Bailey Land Group Inc.
- BHI
- BKRADIO.COM
- Bowles Farming Company
- Bradshaw Consulting Services, Inc.
- Burns Land Surveying, Inc.
- Calhoun County Implement
- CartoPac Field Solutions
- Cain & Barnes, L.P.
- CARLILE MACY, INC.
- CDK Geomatics, PC
- CESI
- Charles E. Shoemaker, Inc.
- City of Lewiston
- City of Westminster
- City of Winston-Salem
- Cochran Technologies Inc.
- Columbus Consolidated Government
- Contemporary Monitoring
- Crabtree Land Surveying
- Critigen
- C & C Technologies Inc.
- DBS Productions
- Earth Vector Systems, LLC
- Eldredge Surveying & Engineering, LLC
- ELS, Inc.
- Engineering, Surveying & Mapping & G.I.S.
- Epoch Professional Surveying, LLC
- Erdman Anthony
- EricColburn.com
- Fairmont State University
- Fleming Engineering
- Florida Permanent Reference Network
- GEODECA LLC
- Global Traffic Technologies
- GPS Insight
- GPS Source
- Halfmile Media
- Henderson County Local Government

- Henen Land Surveying Co.
- Hiway Service
- Holmes and McGrath, Inc.
- Howard County Government
- Huntingburg Airport
- Hybrid Propulsion LLC
- iGuide Robotics Inc.
- Illinois Professional Land Surveyors Association
- Inland Surveying, LLC
- Isthmus Surveying LLC
- Jindabyne Aero Club
- John Chance Land Surveys Inc.
- Jordan Geomatics, PLLC
- JS Engineering
- Land Map, Inc.
- LandMark Implement
- Land Surveyors United
- Light Power Solutions
- Lowery and Associates Land Surveying, LLC
- Lakeland Aviation
- Land-Tech Surveying and Mapping Corp.
- MapTel
- Martinek Leasing
- Maryland Society of Surveyors
- Mathiesen Marine
- Martinek Leasing
- McNeely & Lincoln Associates, Inc.
- McWhinney
- Mesa County
- Michael L. Petit PLS
- Micronet Ltd.
- Mid-Atlantic Aviation Coalition-New Jersey
- Mississippi Department of Transportation
- mPower Innovations Inc.
- Mueller Consulting Land Surveyors
- Navigation Electronics, Inc.
- NC Geodetic Survey
- North Carolina Society of Surveyors
- North Line GIS
- Northwest Environmental Services
- PANBO.com
- Pathfinder Surveys
- Peak Surveying, Inc.
- Pierce County Public Works

- Porter Henderson Implement Co.
- Productivity Products and Services, Inc.
- Professional Land Surveyor
- Providence Land Group
- Puget Sound GIS
- RF Analytical
- Rose Point Navigation Systems
- R.H. Batterman & Co., Inc.
- Savoy Company, P.A.
- SCSPLS
- Seiler Instrument
- Semi-Local Publications LLC
- Simulcast Solutions LLC
- South Carolina Geodetic Survey
- Southeastern Lung Care
- Southern Engineering Services Inc.
- Southern Surveyors Group, LLC
- Spatial Data Partners
- Spicer Group Inc.
- Sprite Island Yacht Club
- Stalcup Agricultural Service
- Storm King Surveying and Mapping, Inc.
- SubCarrier Systems Corp (SCSC)
- Team Self Storage LLC
- Territorial Boundaries and Mapping LLC
- The Sidwell Company
- The Sigma Group
- Topographic Land Surveyors
- Triad Engineering, Inc.
- Triangle Ag-Services
- United Power
- VanRay Cousins
- Waters Land Surveying
- Waterway Guide
- West Central Ag-Air, Inc

APPENDIX B

**Analysis of the *Bazelon Study*
NDP Consulting Group**

Comments on Coleman Bazelon's research paper titled "GPS Interference: Implicit Subsidy to the GPS Industry and Cost to LightSquared of Accommodation," the Brattle Group, Inc., June 22, 2011.

Summary

- The central premise of the Brattle Group (BG) paper is that LightSquared is being restrained from fulfilling its promise of delivering enormous national economic benefits because GPS equipment manufacturers are unwilling to implement a relatively inexpensive fix to a signal impairment problem that is entirely of the GPS industry's making.
- To support that premise, the BG paper posits very questionable estimates of costs and benefits, while peddling an unflattering narrative about the GPS equipment industry; in short, the paper reads like a hastily-produced public relations piece devoid of rigorous economic analysis and defensible economic assumptions.
- Among the questionable assertions and characterizations posited in the BG paper are that:
 - The economic benefits of LightSquared amount to \$120 billion to consumers.
 - The cost of fixing the problem of signal degradation is \$0.30 per device, amounting to a total of roughly \$12 million.
 - No-fee use of the taxpayer-funded GPS satellite network amounts to an implicit subsidy of \$18 billion for GPS equipment manufacturers.
 - A technical argument is that the signal impairment problem derives from the fact that GPS equipment use intrudes into the L-Band spectrum, which was not a problem until the rightful owners of that spectrum decided to put it to use.

Analysis of the BG Paper

The proposed operations of LightSquared have raised many concerns regarding signal interference from government officials to GPS equipment producers to commercial GPS end users. Consequently, numerous tests and evaluations were undertaken pursuant to mandates from the Federal Communications Commission (FCC). Although uncertainty about the scope and magnitude of the problem remains, reports based on those tests and evaluations confirm that LightSquared's operations will disrupt GPS signals, imposing real economic costs to GPS end users, and the broader economy.

Alleged Benefits of LightSquared

In a report published on June 22, 2011, Coleman Bazelon, a principal with the Brattle Group, asserted that LightSquared's operations will contribute an estimated \$120 billion to American

consumers and that the hold-up in those operations is attributable to a minor problem that can be fixed at an insignificant cost. Both of those assertions are unsupported and highly questionable.

First, Bazelon claims that LightSquared's L-Band spectrum where it proposes to deploy a 4G Long Term Evolution (LTE) network is worth approximately \$12 billion based on prior auction values, with potentially 10 times that amount or \$120 billion in benefits to consumers. The \$12 billion figure derives from an April 2011 Brattle Group paper, in which Bazelon, under various assumptions, estimated values of the AWS-3 band ranging from \$3.6 billion to \$12 billion (and including points of \$5.3 billion, \$6.4 billion, and \$7.3 billion).¹ Nowhere in the June 2011 BG paper commissioned by LightSquared does Bazelon explain his rationale for using the highest estimate of \$12 billion.

Second, without any clear explanation for his methodology for estimating the benefits of LightSquared to consumers, Bazelon simply multiplied that highest value \$12 billion by ten to come up with a consumer benefits figure of \$120 billion. There is no analytical assessment, no discussion of assumptions, and no consideration of possible objections to his methodology. Instead, Bazelon footnoted that "wireless broadband spectrum is typically thought to generate consumer surplus equal to at least 10 times the original value of the original spectrum" and offered a reference presumed to be the basis for that quote. However, the reference cited does not support the use of a multiple of ten.² Rather, the author of the cited reference, Gregory L. Rosston, emphasizes two important points: first, that the increase in consumer surplus "may be" ten times as high as the private value, and; second, that these numbers may be subject to criticism. Rosston emphasizes that he is using his numbers only to illustrate that the magnitude of the differences between the sales value of licenses and the ultimate consumer surplus can be quite large. He is not in any way advocating, supporting, or defending a particular multiplier.

Thus, Bazelon's estimate of \$120 billion in benefits to consumers is not rooted in empirical evidence; it is simply an estimate as plausible as any other random number, and is thus, as Bazelon's source Rosston put it, "subject to criticism."

Alleged "Minimal" Cost of the Signal Impairment Problem

Bazelon's assessment of the cost of signal impairment is confined to the costs of developing, producing, and retrofitting better GPS receivers. And as the benefits of LightSquared were overestimated by reliance on an unsupported multiplier, the costs of signal impairment are underestimated by his selection of the lowest published estimate of that cost.

For example, Bazelon asserts that the life-cycles of most GPS equipment is short enough that replacement, rather than retrofitting, will be the norm. He asserts that only 224,475 active general aviation aircraft in the U.S. require GPS receivers. While it may be true that there are fewer GPS receivers on airplanes than there are in mobile phones and recreational GPS car

¹ Bazelon, Coleman. 2011. "The Economic Basis of Spectrum Value: Pairing AWS-3 with the 1755 MHz Band is More Valuable than Pairing it With Frequencies from the 1690 MHz Band," The Brattle Group, Inc. <http://www.brattle.com/documents/UploadLibrary/Upload938.pdf>

² Rosston, Gregory. 2003. "The long and winding road: the FCC paves the path with good intentions," Telecommunications Policy.

navigators, the economic costs of GPS signal disruption for airplanes are much more significant, and include the difficult-to-estimate costs of a crash or other accident or mishap.

In estimating the cost of the problem, Bazelon cites a column written by Charles Arthur, a technology editor for *The Guardian*. In an April 6, 2011 article, Arthur commented that estimates on the costs of a GPS signal fix vary hugely, and offered the examples of Dan Hays, a consultant with PRTM, and Tim Farrar, a consulting with TMF Associates to illustrate the wide range. Hays estimated the cost at no more than \$12 million—or \$0.30 per device—to install better filters for 40 million standalone GPS units made worldwide each year. In contrast, Farrar estimated the price tag to be as much as \$1 billion.³

Bazelon adopted the lowest estimate in Charles Arthur's column for his projections, ignoring other cited estimates without devoting any ink to discussing the merits or rationale for his approach. The truth is that no one fully understands the magnitude of the problem or the cost of the best fix. Bazelon, at least, concedes that numerous estimates would be necessary to determine the cost of retrofitting GPS devices, which very much undermines his adoption of the smallest estimate.

Though his report grants that some equipment will have to operate in a state of uncertainty—working sometimes, other times not—until receivers are retrofitted or the equipment itself replaced, he gives no consideration to the far more significant cost of foregone benefits to GPS users. But any serious assessment of the economic cost of GPS disruptions would have to include the foregone economic benefits.

GPS Equipment Producers Benefit from an Implicit Subsidy

Finally, Bazelon claims that the commercial GPS industry in the United States benefits from an implicit subsidy of \$18 billion. But that assertion relies on a tortured definition of “subsidy” so expansive as to include, seemingly, all manners of public goods. On the contrary, however, a review of the economic literature reveals that the nature of the transaction by which LightSquared obtained its L-band spectrum comports much more closely with the only definition of a subsidy that is accepted under the terms of international treaty.

The GPS infrastructure, created originally by the U.S. military for purposes of national defense, represents a large fixed public investment. It was not until years after this public investment was initially made, that the U.S. government decided to permit non-governmental commercial users to take advantage of signals that were already being transmitted for governmental purposes. Doing so easily implemented modifications to system features that had previously intentionally degraded publicly accessible “over the air” GPS signals.

This experience does not even come close to being characterized as a subsidy. Subsidies are usually granted as incentives to align the behavior of firms with a particular policy objective. Some prominent examples of policy-driven subsidies granted by the U.S. government include: direct payments and price supports to the agricultural sector, ostensibly to insure against food

³ Arthur, Charles. “US wireless network could drown out GPS, experts warn,” *Guardian*, April 6, 2011 <http://www.guardian.co.uk/technology/2011/apr/06/us-wireless-network-lightsquared-gps>

and other commodity shortages; tax credits to ethanol producers, to promote domestic, “environmentally-friendly” energy supplies; cash grants, loan guarantees, and research and development credits to manufacturers of green technology products, such as solar panels, windmill components, and lithium ion batteries; the provision of below market-rate financing and public assumption of the marketing expenses of U.S. companies seeking to cultivate markets abroad, as part of the administration’s goal of doubling U.S. exports between 2009 and 2014.

According to the terms of the World Trade Organization’s Agreement on Subsidies and Countervailing Measures, as a definitive reference point, a subsidy is deemed to exist if a government provides a direct transfer of funds (grants, loans, equity infusions), loan guarantees, tax credits and other fiscal incentives, goods or services (other than general infrastructure) without requiring proper payment, or any form of income or price support, and this activity (or these activities) are deemed to confer a benefit to the recipient.

There is little question that GPS equipment producers benefit from their “free” access to the infrastructure that was put in place for purposes of national defense. But that benefit hardly fits the definition of a subsidy. Considering that investment a subsidy to GPS producers is akin to considering the U.S. interstate highway system a subsidy to the oil, automobile, transportation, hospitality, and fast-food industries. Although some industries have benefited more than others from the advent of the interstate highway system, the system was created for purposes that transcend the promotion of any one or two or several industries.

Likewise, the GPS satellite infrastructure was created for the purpose of enhancing a public good: national defense. When the Clinton administration began to promote commercial use of the infrastructure, it was not promoting particular products or particular industries. In fact, any company (whether an incumbent producer or a new market entrant; whether in a mature industry or an emerging one) that wishes to produce GPS-related products stands to benefit from the existing infrastructure, much like a Holiday Inn benefits from its proximity to Interstate 80.

According to a study published by the World Trade Organization, it has been argued in the subsidy literature that “payments for public goods may not be considered subsidies and most definitions limit the use of the term ‘subsidy’ to transfers to firms, including producer households, not-for-profit organisations, state-owned enterprises, such as hospitals, and the government as a provider of goods and services that could be supplied commercially.”⁴ Under the WTO agreement, “general infrastructure investments” are not considered subsidies.

So the benefit of free access to the GPS infrastructure – what Bazelon sees as an \$18 billion subsidy – is really not a subsidy at all. Consider the following. If GPS producers had to pay user-fees to offset the original public investment in national defense, there would be far fewer GPS producers in business. The higher hurdle rate would reduce the number of firms. Accordingly, the prices of GPS equipment and the profits of GPS producers would likely be much higher. But free access to the GPS infrastructure has encouraged more firms to participate in the market, which has increased competition, and driven down prices and profits among GPS producers. As a result, the public welfare has been enhanced. If free access to the GPS infrastructure was really

⁴ World Trade Organization. 2006. “World Trade Report 2006: Exploring the links between subsidies, trade and the WTO.”

to be considered a subsidy that benefits the GPS industry as a whole, then the economic rents (the producer surplus) would be expected to be larger than they are.

It seems, however, that Bazelon's assertions about subsidies may be a case of Freudian projection. Indeed, the terms of and public policy push behind LightSquared's acquisition of its L-Band spectrum fits the conventional definition of a subsidy, as described above. LightSquared's spectrum assets, which Bazelon values at \$12 billion, were purchased for only "several hundreds of millions" of dollars.⁵

Had that spectrum space been auctioned off to interested bidders instead of reserved for a particular company that was willing to fulfill the Obama administration's objective of bringing broadband service to rural America, the price likely would have been much higher. In the case of LightSquared, it seems that the definition of a subsidy is met: there was a financial contribution by a government (provision of a good or service at below market rates) that conferred a benefit.

07/29/11

⁵ De Selding, Peter B. 2011. "LightSquared Plans Hinge on Outcome of GPS Interference Debate," Space News, Friday, March 4 2011.