September 4, 2018

The Honorable Wilbur Ross
Secretary
United States Department of Commerce
1401 Constitution Avenue, N.W.
Washington, DC 20230

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Re: *Space Policy Directive 2, Sec. 5. Radio Frequency Spectrum*

Dear Secretary Ross, Deputy Assistant Kratsios, and Executive Secretary Pace:

The undersigned satellite, aviation and weather data industry leaders applaud the Administration's space policy leadership. As the Administration moves to implement critical new space policy directives, we write to provide our views on Section 5 of Space Policy Directive-2 ("SPD-2"),[1] which outlines critical policy objectives and specific deliverables important to continued American space leadership. Section 5(a) directs the Secretary of Commerce, in coordination with the Director of the Office of Science and Technology Policy ("OSTP"), to work with the Federal Communications Commission ("FCC") to ensure that federal government activities related to radio frequency spectrum are consistent with the overall Administration policy that "regulations adopted and enforced by the executive branch promote economic growth; minimize uncertainty for taxpayers, investors, and private industry; protect national security, public-safety, and foreign policy interests; and encourage American leadership in space commerce."[2] These are critical objectives that we strongly endorse.

We are particularly interested in the report required by SPD-2 under the leadership of the Department of Commerce and OSTP, in consultation and coordination with the Chairman of the FCC and the members of the National Space Council ("Council"), to provide a report to the President "on improving the global competitiveness of the United States space sector through radio frequency spectrum policies, regulation, and the United States activities at the International

[1] Space Policy Directive-2, Streamlining Regulations on Commercial Use of Space, at Section 5 (May 24, 2018) ("*SPD-2*"), https://www.whitehouse.gov/presidential-actions/space-policy-directive-2-streamlining-regulations-commercial-use-space.

[2] *Id.* at Section 1.

Telecommunication Union and other multilateral forums."[3] Below we detail a number of spectrum policy principles that are conditions precedent to maintaining and improving American space competitiveness. In short, America's continued space leadership depends on (1) a stable spectrum foundation for the satellite industry; (2) consistent protection from harmful interference; and (3) robust international engagement to preserve space spectrum allocations. Domestic or international policy initiatives inconsistent with these principles, such as the most recent Ligado (formerly LightSquared) proposal, should be rejected as detrimental to America's space leadership and the Administration's goals.[4] We urge you to consider these views as you prepare your report.

I. INTRODUCTION

The satellite industry today is dramatically improving lives and enhancing our nation's global competitiveness. In 2016, the U.S. satellite industry generated over $110 billion in revenues and supported over 210,000 American jobs.[5] On a global scale, in 2017, the satellite industry earned $269 billion, which translates to 79 percent of the total space economy ($348 billion).[6] And these trends are on the rise. Morgan Stanley estimates that by 2040, global space revenue will grow to $1.1 trillion.[7]

Recognizing the growth potential of this robust sector and largest segment of the space economy, the Administration has seized the opportunity to nurture the commercial and government satellite industry. Early on, the President acted swiftly and decisively to restore America's space legacy by reviving the long-dormant National Space Council to review government policies and develop recommendations to empower the commercial space industry.[8] The Council has already taken great strides in this regard, sending three sets of recommendations

[3] *Id.* at Section 5; *see also* Space Policy Directive-3, National Space Traffic Management Policy (June 18, 2018) ("*SPD-3*"), https://www.whitehouse.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy (similarly, in the context of space traffic management, including a focus on preventing unintentional radio frequency interference, stating that the United States should "continue to improve policies, processes, and technologies for spectrum use (including allocations and licensing) to address these challenges [spectrum interference] and ensure appropriate spectrum use for current and future operations").

[4] We will not detail the many interference concerns raised by Ligado's proposal in this letter, but a summary of such concerns is available in a recent letter to FCC Chairman Ajit Pai. Letter from Dr. Joel N. Myers, Founder, President and Chairman, AccuWeather et al., to Ajit Pai, Chairman, FCC, IB Docket Nos. 11-109 & 12-340 (July 18, 2018) ("July 18 Coalition Letter"), https://ecfsapi.fcc.gov/file/10718253335768/Ligado%20Coalition%20Letter%-207.18.pdf.

[5] Satellite Industry Association, 2017 State of the Satellite Industry Report, at 6 (June 2017), https://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf.

[6] Satellite Industry Association, 2018 State of the Satellite Industry, https://www.sia.org/wp-content/uploads/-2018/06/2018-SSIR-2-Pager-.pdf.

[7] *Space: Investing in the Final Frontier*, Morgan Stanley (Nov. 13, 2017), https://www.morganstanley.com/ideas/-investing-in-space.

[8] Exec. Order No. 13803, 82 Fed. Reg. 31,429 (July 7, 2017).

to the President's desk in its first year.[9] These and other policy initiatives make clear the Administration's commitment to U.S. leadership.

Indeed, from the White House to Congress, key policymakers have demonstrated thoughtful leadership on space policy. As Vice President Mike Pence noted in a speech earlier this year, "President Trump knows that a stable and orderly space environment is critical to the strength of our economy and resilience of our national security systems."[10] The Vice President reiterated those views in a speech earlier this month, stating that "space is essential to our nation's security, prosperity, and our very way of life" and offering the Administration's promise to "unleash America's burgeoning commercial space companies."[11] Secretary Ross has also made space industry initiatives a high priority, proposing to elevate and amplify the role of the Office of Space Commerce (currently housed in the National Oceanic and Atmospheric Administration or "NOAA") to coordinate all space-related activities at the Department under his direct oversight.[12] Earlier this year, NTIA Administrator David Redl extolled the impact of the satellite industry on the U.S. economy and the importance of satellite communications, noting that "the world as we know it today literally would not exist without these satellites."[13] Similarly, FCC Chairman Pai correctly observed that "we now stand at a moment of tremendous promise for [the satellite] industry – and ultimately for American consumers, who stand to benefit from [industry] efforts," and committed to help satellite companies seize these opportunities.[14]

We submit this letter to inform your consideration as you move forward with the report and evaluate spectrum policy more broadly. More specifically, these comments are provided to underscore the importance of spectrum policies centered on a stable spectrum environment, adequate interference protection and global vigilance in achieving U.S. goals. Below, as an illustrative example of the importance of such policies, we provide background on critical L-Band satellite services that are operating today and have successfully been in use for the past four decades thanks to the consistent application of these policies that have guided U.S. spectrum policy. The L-Band story is typical for the space industry – which requires long lead times for

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[9] *See SPD-3*; *SPD-2*; Presidential Memorandum on Reinvigorating America's Human Space Exploration Program (Dec. 11, 2017), https://www.whitehouse.gov/presidential-actions/presidential-memorandum-reinvigorating-americas-human-space-exploration-program.

[10] *See* Michael Pence, Vice President, Remarks at 34th Space Symposium (Apr. 16, 2018), https://www.whitehouse-.gov/briefings-statements/remarks-vice-president-pence-34th-space-symposium-colorado-springs-co.

[11] *See* Michael Pence, Vice President, Remarks on the Future of the U.S. Military in Space (Aug. 9, 2018), https://www.whitehouse.gov/briefings-statements/remarks-vice-president-pence-future-u-s-military-space.

[12] *See* Wilbur Ross, Secretary of Commerce, Remarks at the National Space Council Second Meeting: A Bright Future for U.S. Leadership of Space Commerce (Feb. 21, 2018), https://www.commerce.gov/news/secretary-speeches/2018/02/secretary-ross-bright-future-us-leadership-space-commerce.

[13] *See* David J. Redl, Assistant Secretary of Commerce for Communications and Information, Remarks at Satellite 2018: Affirming Our Partnership for Growth and Innovation in Space, Washington DC (Mar. 14, 2018), https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-satellite-2018.

[14] *See* Ajit Pai, Chairman, FCC, Remarks at the Satellite Industry Association's 21st Annual Leadership Dinner, Washington, DC (Mar. 12, 2018), https://docs.fcc.gov/public/attachments/DOC-349676A1.pdf.

research and development, investment and economic impact. Although we focus this discussion on L-Band, specifically the frequencies between 1525 MHz and 1680 MHz,[15] the analysis applies with equal force to other satellite bands, including the rapidly evolving Ka-Band and planned satellite systems in the V-band.

II. STABILITY, RELIABILITY AND GLOBAL HARMONIZATION: FOUNDATIONS OF SUCCESS FOR L-BAND SATELLITE SERVICES

Over the course of many decades, the U.S. Government has built the foundation for the success of the L-Band by providing stable spectrum allocation, protecting those allocated spectrum from harmful interference, and defending those interests around the globe.[16] The L-Band has evolved over the years to include three key services we highlight below: Global Positioning System ("GPS"), the NOAA Geostationary Operational Environmental Satellites ("GOES"), which provide positional, timing, and weather data directly to users all across the U.S, and satellite communications ("SATCOM") services provided by companies like Iridium.[17] The GOES weather satellites were first launched in 1975 after nearly a decade of successful meteorological experiments aboard other satellites. The first GPS satellites were launched in 1978. In 1987, the government first carved out this spectrum neighborhood for mobile satellite service ("MSS") use and SATCOM.[18] Thus the seeds of these successful services were sown more than thirty years ago.

All of these services have operated in their current spectrum bands for decades with considerable amounts of capital being invested into the satellite systems in reliance on the ability for continued operations free from harmful interference – and the corresponding benefits to consumers and the country have flowed from these allocations. GPS signals impact the lives of virtually every American and industry, providing safety and security at all times and providing the navigational foundation for countless services used millions of times daily. The benefits of GPS in the U.S. have been measured at $68.7 billion dollars per year[19] – a conservative estimate that does not take into account that 84% of Americans regularly use navigation apps dependent on GPS.[20] GOES satellites transmit vital data for weather and flood prediction, including

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[15] The L-Band generally denotes the spectrum from 1 to 2 GHz. For purposes of this filing, references to "L-Band" refer to frequencies between 1525 MHz and 1680 MHz.

[16] *See generally*, Lon C. Levin & Dennis C. Nash, American Mobile Satellite Corp., *U.S. Domestic and International Regulatory Issues* (Jan. 1, 1993), https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19940018275.pdf.

[17] Other SATCOM providers are also present in the band.

[18] *See* Amendment of Parts 2, 22, and 25 of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service for the Provision of Various Common Carrier Services, *Second Report and Order*, 2 FCC Rcd 485 (1987).

[19] Irv Leveson, *The Economic Value of GPS: Preliminary Assessment*, at 15 (June 11, 2015) ("Leveson Report"), https://www.gps.gov-/governance/advisory/meetings/2015-06/leveson.pdf.

[20] RJ Reinhart, *Most Americans Already Using Artificial Intelligence Products* (Mar. 6, 2018), https://news.gallup.com/poll/228497/americans-already-using-artificial-intelligence-products.aspx.

imagery of major hurricanes such as Hurricanes Harvey, Irma, and Maria.[21] For weather and climate data, government researchers found that "the overwhelming majority of people" used weather forecasts on an average of 3.8 times per day, or 301 billion forecasts consumed per year. The benefits of daily weather forecast information from GOES has been estimated to provide an average value of around $286 per household or an aggregate value of $31.5 billion per year.[22] Operating in the L-Band are also commercial SATCOM services, which enable ultra-reliable service for the most critical of communications for public safety agencies, government agencies and the aviation and maritime industries, including areas that are out of the reach of terrestrial networks.

History of GPS Allocations, Services Provided, Customers Served, Economic Impact

GPS is a satellite constellation system consisting of 24 satellites that was originally used for U.S. military purposes but was later opened up for civilian use.[23] In the early 1970s, the U.S. Department of Defense ("DoD") started work on a navigation system that used the time differences in radio signal frequency from moving satellites to pinpoint a receiver's geolocation. The DoD launched the first satellite in the system in 1978, and by 1993, the 24 satellite system became fully operational.[24] Today, GPS provides positioning, navigation, and timing services worldwide, regardless of weather conditions, mostly in the 1559-1610 MHz band.[25] These services are used for public safety, commercial, consumer, and scientific operations in aeronautical, maritime, and ground-based navigation, surveying, construction, precision agriculture, timing synchronization, emergency medical response and disaster management, and search and rescue.[26]

The economic value of these GPS services in the U.S. was valued at $68.7 billion dollars in a 2015 study.[27] Of that, more than $26 billion was from vehicle-location based services, $13.7

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[21] Thomas Powell, David Lubar & Karen Jones, *America's critical dependence on satellite-based services – and the regulatory threats they face* (Jan. 25, 2018), https://spacenews.com/op-ed-americas-critical-dependence-on-satellite-based-services-and-the-regulatory-threats-they-face.

[22] Economics and Statistics Administration, Department of Commerce, *The Value of Government Weather and Climate Data* (Sept. 2, 2014), http://www.esa.doc.gov/economic-briefings/value-government-weather-and-climate-data.

[23] FAA, *GNSS Frequently Asked Questions – GPS*, https://www.faa.gov/about/office_org/headquarters_offices/-ato/service_units/techops/navservices/gnss/faq/gps (last visited Aug. 20, 2018).

[24] NASA, *Global Positioning System History* (Thuy Mai ed., 2017) (Oct. 27, 2012), https://www.nasa.gov-/directorates/heo/scan/communications/policy/GPS_History.html.

[25] NTIA, *1559-1610 MHZ*, at 5 (Mar. 1, 2014), https://www.ntia.doc.gov/files/ntia/publications/compendium/-1559.00-1610.00_01MAR14.pdf.

[26] *Id*.

[27] Leveson Report at 15. The author notes that the economic benefit calculations are underestimated, however, because some sectors were not included due to lack of information on productivity and cost-savings, namely location-based services other than vehicle, geographic information systems and mapping other than nautical charts, forestry, fisheries, mining, and energy exploration and development, land and coastal management, weather, and scientific applications in space. *See also* Nam D. Pham, Ph.D, NDP Consulting, *The Economic Benefits of Commercial GPS Use in the U.S. and the Costs of Potential Disruption*, at 1 (June 2011),

billion was from precision agriculture, $11.9 billion was from fleet vehicle-connected communications, $11.6 billion was from surveying, and $5 billion was from GPS-based guidance of earth-moving equipment.[28] Furthermore, 3.2 million U.S. jobs directly rely on GPS technology.[29]

History of NOAA Allocations, Services Provided, Customers Served, Economic Impact

The U.S. government's interest in geostationary weather satellites dates back to the 1960s with the launch of a series of observational satellites that experimented with capturing images of the earth and transmitting data to and from ground stations.[30] From 1966 to 1974, six satellites in the Applications Technology Satellite series were launched, and after meteorological experiments performed aboard proved to be a success, the U.S. government officially started development of geosynchronous weather satellites.[31] In 1974, the U.S. government launched the Synchronous Meteorological Satellite that continuously monitored weather conditions night and day and "collected and relayed data from over 10,000 central ground stations."[32] The government's experiments with the monitoring satellites continued until the GOES program officially launched in 1975 as a joint effort by NOAA and NASA.[33] Today, GOES provides weather services in the 1675-1695 MHz band, such as natural and environmental disaster warnings and global water resource forecasts, river gauge data regarding water levels and flow rates, meteorological and oceanographic data or navigation safety services. GOES also provides weather data to consumer-facing companies such as AccuWeather and the Weather Channel, the weather insurance industry, and the weather technology-driven high-precision agricultural industry.[34]

Since the early 1900s following the tragic "Big Burn" of 1910 that charred 4,700 square miles of Washington, Idaho and Montana, the fire management community led by the National Forest Service has relied on the weather community to provide crucial information to support the safety and effectiveness of fire fighters on the ground. This relationship has been critically important in the past year as some major fires have impacted the lives of citizens and their

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https://static1.squarespace.com/static/52850a5ce4b068394a270176/t/52d84e86e4b042903508ec47/1389907590034/GPS+Report+June+21+2011.pdf.

[28] Inside GNSS, *Study: GPS Contributed More Than $68 Billion to the U.S. Economy* (June 16, 2015), http://insidegnss.com/study-gps-contributed-more-than-68-billion-to-the-u-s-economy.

[29] Press Release, J. David Grossman, GPS Innovation Alliance, *Driving America's Future through GPS* (May 15, 2018), http://www.gpsalliance.org/news/Driving_Americas_Future_through_GPS.aspx.

[30] NASA, *GOES Overview and History*, https://www.nasa.gov/content/goes-overview/index.html.

[31] *Id.*

[32] *Id.*

[33] *Id.*

[34] Economics and Statistics Administration, Department of Commerce, *Fostering Innovation, Creating Jobs, Driving Better Decisions: The Value of Government Data* at 15 (July 2014), http://www.esa.doc.gov/sites/default/files/revisedfosteringinnovationcreatingjobsdrivingbetterdecisions-thevalueofgovernmentdata.pdf.

livelihoods, the North Bay Fire in October 2017 in northern California and the southern California fires in December 2017. These fires led to 46 deaths and thousands of homes destroyed with costs exceeding $10 billion, though weather forecasts were deemed effective at predicting these vast conflagrations and could have yielded much worse damage.[35] Fire fighters facing wildfires on the ground rely on incident meteorologists who provide crucial information to characterize fires on a real-time basis, relying on "mini weather forecast offices" with satellite dishes and other technologies to get real time ground and satellite information from wherever they are in the field.[36] Unfettered access to real-time information relayed via GOES satellites operating in the 1675-1680 MHz band is crucial to keeping firefighters and infrastructure safe, especially as wildfire seasons are consistently worsening each decade.

The benefit today to private industry of reducing weather uncertainty has been roughly estimated to be around $13 billion,[37] and is projected to substantially grow due to the increased cost and frequency of billion dollar natural disasters, the increased sophistication of business models that account for more nuanced weather trends, and the utilization of big data analytics to better respond to extreme high-impact events.[38]

History of Iridium Allocations, Services Provided, Customers Served, Economic Impact

The FCC first created the Big LEO (low earth orbit) band plan in 1994.[39] At the time, the band was intended to support sharing between five MSS operators, two of which remain today, including Iridium. Iridium was originally provided with an exclusive spectrum allocation of 1621.35-1626.6 MHz to accommodate the other operators. Over the last ten plus years, Iridium has operated in the 1618.725-1626.5 MHz on an exclusive basis and shared the 1617.775-1618.725 MHz operations with Globalstar.[40] Originally envisioned in the late 1980's and fully deployed in 1998, Iridium is a truly innovative satellite system, with 66 cross-linked low earth orbit satellites (the world's largest LEO deployment). Iridium's success as a U.S. company has depended on its FCC spectrum allocation and support from federal government partners, as well as efforts to ensure international harmonization. It was, and remains, the only satellite system with complete global coverage.

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[35] Nicholas J. Nauslar, John T. Abatzoglou and Patrick T. Marsh, *The 2017 North Bay and Southern California Fires: A Case Study*, Fire 2018, 1, 18, https://www.spc.noaa.gov/publications/nauslar/2017cali.pdf.

[36] Jack Williams, *Weather Forecasters Help Keep Wildfire Fighters Safe*, Weatherwise, 71:4, 20-27 (July/August 2018).

[37] The National Weather Service, *National Weather Service Enterprise Analysis Report; Findings on changes in the private weather industry*, at 8 (June 8, 2017), https://www.weather.gov/media/about/Final_NWS%20Enterprise%-20Analysis%20Report_June%202017.pdf.

[38] *Id*. at 10.

[39] The Big LEO band consists of portions of spectrum in the L-band (1610-1626.5 MHz and the S band 2483.5-2500 MHz).

[40] Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands, *Second Order on Reconsideration, Second Report and Order, and Notice of Proposed Rulemaking*, 22 FCC Rcd 19733, 19737 ¶ 8 (2007).

Iridium has grown a highly successful business operating in its 8.725 MHz of spectrum. Today, Iridium has over one million subscribers[41] – including over 100,000 federal government customers primarily through its two-decade partnership with the Department of Defense – more than double the 427,000 subscribers it had in 2010 while relying on its first-generation MSS constellation, primarily in mobile voice and data services.[42] Iridium has since invested more than $2.5 of its planned $3 billion in the development of Iridium NEXT, a complete upgrade and replacement of its 66-satellite NGSO constellation with nine on-orbit spares and six ground spares.[43] As Iridium's satellite capabilities have advanced with this upgrade, it plans to expand its service offerings later in 2018 with a new higher capacity Iridium Certus service.[44]

Iridium's use of its spectrum has evolved and grown significantly since the system was launched as a voice and paging system. Iridium has created jobs, saved lives, and continued to innovate to improve the system's capabilities for government and commercial users alike. Many Iridium subscribers use Iridium data messaging services which are leveraged by machine-to-machine ("M2M") markets, supervisory control and data acquisition ("SCADA") applications, and personal, asset and vehicle/aircraft tracking applications. The Iridium network currently supports millions of these transactions on a daily basis, resulting in Iridium devices being deployed virtually everywhere throughout the United States. In the past decade, Iridium has seen increased profits, and doubled the number of employees in the United States. In 2017, backed by more than 300 technology partners, this growth translated to nearly $450 million in revenues.[45] These services and user growth trends will continue to expand with the completion of the Iridium NEXT upgrade, which will support all legacy services and user equipment while also providing new services.

III. SPACE POLICY SUCCESS REQUIRES STABILITY IN ALLOCATIONS, CONSISTENT PROTECTION FROM HARMFUL INTERFERENCE AND INTERNATIONAL VIGILANCE

Satellite systems in the L-band have longstanding and critical uses that require a stable spectrum environment. Satellite networks take years and substantial sums of money to develop and launch. In addition, once satellites are in orbit and operational, they must be protected from harmful interference. The investment and reliance interests are far too great for a satellite network to be launched only for its operations to be subsequently compromised by harmful interference. Finally, to promote the international nature of satellite operations, the spectrum

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[41] Press Release, Iridium, *Fifth Successful Iridium® NEXT Launch Completed as Iridium Surpasses 1 Million Subscribers* (Mar. 30, 2018), http://investor.iridium.com/Mar-30-2018-fifth-successful-iridium-R-next-launch-completed-as-iridium-surpasses-1-million-subscribers.

[42] Iridium Communications Inc., 2011 Annual Report (Form 10-K), at 38 (Mar. 6, 2012), https://www.sec.gov-/Archives/edgar/data/1418819/000119312512097807/d262216d10k.htm.

[43] As of July 25, 2018, Iridium has launched 65 of its 75 satellites planned for orbit and it expects to complete the constellation upgrade with one final launch by the end of 2018.

[44] *See* Iridium, *Services*, https://www.iridium.com/services/iridium-certus (last visited Aug. 20, 2018).

[45] Iridium Communications Inc., 2017 Annual Report (Form 10-K), at 2 (Feb. 22, 2018), https://www.sec.gov/-Archives/edgar/data/1418819/000141881918000005/irdm_12312017x10k.htm.

allocations must be protected in the United States and harmonized with international allocations. These conditions have been present in the L-Band for decades resulting in the successful launch and preservation of the services described above. Such conditions will also be essential for the success of new satellite services, including the launch of satellite broadband services on the horizon in the Ka band for example.[46] Domestic or international policy initiatives inconsistent with these principles must be rejected.

It is imperative to provide satellite operators with certainty with respect to their spectrum environment.

To ensure that commercial and government satellite operators are partners with the U.S. Government in promoting economic growth and leading the world in space,[47] America's regulatory environment must provide satellite operators with predictability in spectrum allocations in the frequency bands in which they operate. As National Space Council Policy Advisor Michael Beavin stated in a recent speech, "[r]egulatory instability is bad for business and can be especially lethal to satellites."[48] Once launched, the ability of satellite providers to alter the way in which their satellites operate or fundamentally change the way they offer services is extremely difficult, if not impossible. As demonstrated above for the L-Band, the process of allocating spectrum, achieving global harmonization, licensing systems, launching satellites, and building a customer base are inherently long-term exercises that yield substantial public interest benefits. When regulators shift direction repeatedly, or threaten to take steps that would substantially alter the operating environment for existing allocations, investment withers and space-based business cannot succeed.

To date, L-Band operators have generally been able to depend on a stable regulatory environment.[49] And other satellite allocations have enjoyed similar stability. But the task is not complete, as more satellite systems are on the drawing board. For example, a host of new

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[46] WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System, *Order and Declaratory Ruling*, 32 FCC Rcd 5366 (2017) ("OneWeb Grant"); Space Exploration Holdings, LLC, Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, *Memorandum Opinion, Order and Authorization*, FCC 18-38 (rel. Mar. 29, 2018) ("SpaceX Grant"); Space Norway AS, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission, *Order and Declaratory Ruling*, 32 FCC Rcd 9649 (2017); Telesat Canada, Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation, *Order and Declaratory Ruling*, 32 FCC Rcd 9663 (2017); Audacy Corporation, Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services, *Order and Authorization*, FCC 18-72 (rel. June 6, 2018); O3b Limited, Request for Modification of U.S. Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service, *Order and Declaratory Ruling*, FCC 18-70 (rel. June 6, 2018).

[47] *SPD-2* at Section 1.

[48] Michael Beavin, Senior Policy Advisor, National Space Council, Remarks at the Federalist Society: Modernizing American Space Policy (July 26, 2018) ("July Beavin Speech"), https://fedsoc.org/events/modernizing-american-space-policy.

[49] While generally true, we note that multiple weather technologies in the L-band have had their allocation moved and altered at considerable cost to federal agencies and industry, such as radiosondes (or "weather balloons") and the GOES-R series of satellites that had its spectrum allocation consolidated shortly before launch.

satellites – potentially several thousand – are poised to be launched using Ka band and V band spectrum. On June 23, 2017, the FCC approved an application from OneWeb for its proposed constellation of 720 satellites to operate "the first of its kind for a new generation of large, non-geostationary-satellite orbit, fixed-satellite service (NGSO FSS) systems … 'to provide high-speed, affordable broadband connectivity to anyone, anywhere' in the United States."[50] Similarly, on March 29, 2018, the Commission approved the application of SpaceX to construct, deploy, and operate a proposed NGSO satellite system comprising 4,425 satellites that "will enable SpaceX to bring high-speed, reliable, and affordable broadband service to consumers in the United States and around the world, including areas underserved or currently unserved by existing networks."[51] However, their success is not guaranteed. To repeat the L-Band success story, these companies and others must also be able to continue to rely on the stability of federal government spectrum allocations.

Satellite providers must be provided with consistent protection from harmful interference. As noted above, the satellite industry, specifically the GPS industry, users of NOAA GOES satellites and SATCOM providers like Iridium, have a significant and longstanding impact on the U.S. economy. To allow the industry to continue to flourish, the government must ensure that harmful interference is effectively prevented, regardless of its source. As a National Space Council representative recently stated, "[i]nterference prevention and management is a crucial challenge for long term sustainability of space based systems. Powerful terrestrial systems in close proximity to bands used by incumbent satellite systems and their ground facilities are problematic."[52] Allowing the deployment of interfering services in bands adjacent to critical satellite operations without adequately protecting incumbent services would significantly reduce regulatory certainty for American corporations, chill innovation and investment in existing technology, and threaten American jobs.

Satellite spectrum must be protected in the United States and harmonized internationally. It is equally critical for satellite operators to have certainty for its radio frequency spectrum and interference protection internationally as it is in the United States. Satellites operations are inherently global which requires satellite spectrum to be protected in the United States and before international organizations. For example, the World Meteorological Organization, and some of its member countries, like Canada and its provinces, expressed their concerns to the FCC about the likely interference to GOES satellites if the 1675-1680 MHz band is allowed to be shared, largely due to longstanding international policy surrounding the optimal transmission of satellite weather data in real-time in that band.[53] Transmissions from satellites do not stop at a border. In particular, Iridium and GPS operations are provided through NGSO constellations which cover and serve the globe. International consistency on allocations and interference protection is necessary to provide satellite companies regulatory certainty that save

[50] OneWeb Grant, 32 FCC Rcd at 5366 ¶ 1.

[51] SpaceX Grant ¶ 1.

[52] *See* July Beavin Speech.

[53] Comments of World Meteorological Organization, RM-11681 (June 21, 2016); Comments of Meteorological Service of Canada, RM-11681 (June 27, 2016); Comments of the Government of Yukon, RM-11681 (June 21, 2016).

costs and encourage innovation. Commercial and government satellite operators depend on the U.S. government for a predictable regulatory environment. It is equally important for satellite operators to be able to rely on the U.S. government to defend domestic allocations and interference protections internationally. Failure to do so not only affects the ability to operate abroad but harms the ability of satellite companies to continue to succeed in the U.S.

IV. THE ADMINISTRATION SHOULD REJECT DOMESTIC AND INTERNATIONAL SPECTRUM POLICIES CONTRARY TO THESE PRINCIPLES, INCLUDING LIGADO

The U.S. government has noted the focus on ensuring a stable regulatory environment for satellites while at the same time identifying more spectrum for terrestrial 5G users. Importantly, a U.S. official recently said that while they are seeking spectrum for terrestrial 5G users, "we'll be working to ensure a stable, harmonized, international regulatory environment for satellite services meeting government and private sector needs."[54] The attempt to leverage the race to 5G cannot come at the expense of billions of direct investment by the satellite industry and hundreds of millions annually in economic growth. Satellite services are an important element of providing 5G solutions and have the unique aspect of being able to deliver worldwide coverage to areas that are hard to reach by terrestrial systems. Satellites require sufficient access to spectrum to deliver the high speed connections envisioned. We appreciate the need to identify additional spectrum for 5G and that doing so will require creative spectrum policies, but such efforts cannot result in irreparable harm to the U.S. space industry and for the many government and commercial interests that depend on robust and reliable satellite offerings and harmonized spectrum available for satellite use to deliver services worldwide. Further, while the prompt deployment of 5G could no doubt benefit the weather industry that has some of the most frequently used apps in the world, the weather community is concerned about the potential interference implications of some sharing proposals due to the negative impact on weather data quality and reliability.[55]

As an example, Ligado's proposal to convert 40 MHz of prime satellite spectrum to a mobile broadband terrestrial service in the middle of the L-Band satellite spectrum neighborhood runs afoul of each of the principles described above. First, granting its request would turn upside down forty years of a predictable spectrum environment for satellite providers in the band. Satellite operators in the L-Band have depended on the knowledge that their neighbors would operate satellite systems at permitted power levels and with operational characteristics that will ensure their coexistence. After decades of successful satellite operations, permitting a terrestrial mobile broadband service to push its way into the middle of this satellite neighborhood would fundamentally change the nature of the band to the detriment of the incumbent operators and their customers. A recent letter noted that granting Ligado's request would "undermine the investment-backed expectations of those who operate commercial satellite systems by fundamentally altering the interference environment decades after licensing" and "would convert

[54] *See* July Beavin Speech.

[55] Kelcee Griffis, *Inside The Ups And Downs Of Ligado's Satellite 5G Project*, Law360 (July 31, 2018).

40 MHz of increasingly rare satellite spectrum away from satellite use, rewarding a company for underutilizing its satellite spectrum rather than investing in new satellite technologies."[56]

Second, allowing a nationwide mobile broadband service to operate directly adjacent to satellite services will cause harmful interference to the countless government and commercial entities that rely on GPS, SATCOM, and NOAA GOES satellite services. The FCC has consistently emphasized the importance of allowing incumbent operators to operate free from harmful interference.[57] For example, when the FCC adopted rules to allow MSS operators to offer terrestrial operations *ancillary to their satellite operations* (not as a complete replacement to satellite as Ligado has proposed), the agency adopted rules that were designed to prevent harmful interference from those terrestrial operations into the satellite services.[58] The Commission has explained that the rules impose an "absolute obligation on the [terrestrial] operator to resolve any harmful interference to other services."[59] Contrary to these requirements, Ligado's proposed terrestrial operations have been demonstrably proven to cause harmful interference. A July 18, 2018 Coalition letter summarized these concerns, noting that "the record, augmented by recent government reports, makes clear that the interference will be particularly impactful to the countless government and commercial entities that rely on GPS and SATCOM services for aviation safety and other critical services and the many groups that receive and depend upon real-time weather and related environmental information from [NOAA] satellites."[60] More recently, in a letter to the PNT Executive Committee, the PNT Advisory Board – led by the nation's foremost GPS experts – stated that Ligado's proposal "will create totally unacceptable interference for a great number of GPS users in the United States."[61]

Finally, granting the Ligado request will make it more difficult to protect U.S. satellite companies from ill-conceived international interference-causing proposals. Failure to protect U.S. commercial satellite interests from interference caused by U.S. operators will surely be used

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[56] July 18 Coalition Letter at 2.

[57] In 2003, the Commission adopted rules allowing MSS satellite operators to provide *ancillary* terrestrial component ("ATC") service. *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, *Report and Order and Notice of Proposed Rulemaking*, 18 FCC Rcd 1962 (2003) ("*ATC Order*") (emphasis added). Noting the important role of satellite service, the Commission took steps to ensure that ATC would remain ancillary to the provision of MSS. Despite the best intentions of the Commission, ATC has never been successfully deployed due to persistent interference concerns.

[58] *See, e.g., id.* at 2017 ¶ 104 ("We adopt technical parameters for ATC operations in each of the bands at issue designed to protect adjacent and in-band operations from interference from ATC.").

[59] *Spectrum & Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands*; *Globalstar Licensee LLC, Auth. to Implement an Ancillary Terrestrial Component*, Report & Order and Order Proposing Modification, 23 FCC Rcd 7210, 7223 ¶ 35 (2008).

[60] July 18 Coalition Letter at 1.

[61] Letter from Bradford W. Parkinson, 1st Vice-Chair, on behalf of the PNT Advisory Board, to Patrick M. Shanahan, Deputy Secretary of Defense and Jeffrey A. Rosen, Deputy Secretary of Transportation, Co-Chairs, National Executive Committee for Space-based Positioning, Navigation and Timing, at 3 (Aug. 10, 2018), https://www.gps.gov/governance/advisory/recommendations/2018-08-letter-to-excom.pdf.

against the U.S in international negotiations. Similarly, if Ligado is able to successfully arbitrage its satellite spectrum for terrestrial mobile broadband in the U.S., then they will surely seek to do the same internationally, replicating globally the interference they will cause in the U.S. and further undercutting American space leadership.

V. CONCLUSION

Today America's space industry is at an inflection point. Our commercial and government space programs are the envy of the world – with substantial investment, innovation, employment and economic growth and security derived from our leadership. World-leading operators and a new generation of space entrepreneurs stand ready to propel our space industry forward. The Administration has recognized this challenge and opportunity and already taken important steps to enhance our global competitiveness and security. Moving forward, it is critical that U.S. policy continue to value and enhance the stability of satellite spectrum allocations, protect those investments from harmful interference and robustly advocate for these principles in international fora. These principles create the solid foundation America's space industry needs to continue to succeed. Equally important, spectrum management decisions that undermine these core principles – such as the Ligado application – must be rejected if incumbents and future innovators are to continue to build and invest in American leadership. We look forward to continuing to partner with you to lead the world in space.

Sincerely,

//s//
David Silver
Vice President, Civil Aviation
Aerospace Industries Association

//s//
Maureen C. McLaughlin
Vice President, Public Policy
Iridium Communications, Inc.

//s//
Keith L. Seitter
Executive Director
American Meteorological Society

//s//
Janice Bunting
Executive Director
National Weather Association

//s//
Steven A. Root, CCM
President
American Weather and Climate Industry Association

//s//
Renee C. Leduc Clarke
Narayan Strategy
Founder & Principal

//s//
Jens C. Hennig
Vice President, Operations
General Aviation Manufacturers Association

//s//
Raymond Ban
Co-Chair, The Weather Coalition (on behalf of all co-chairs)
Managing Director, Ban & Associates, LLC

cc: The Honorable Ajit Pai, Chairman, Federal Communications Commission