

09 December 2019

Dear Chairman Pai,

I had the privilege of serving as the Administrator of NASA for three Presidents over 10 years, the longest such tenure in the agency's history. Recently, I have worked with various leaders across the government and private sector to address the alarming gap in 5G deployment and overall competitiveness that has opened between the U.S. and China. As you know, leadership in this next-generation wireless technology will have a monumental impact on national security and America's overall economic health. Our failure to close the gap with China in 5G will have dire consequences to our national well-being.

This is a seminal moment. I am writing because, like you, I care deeply about America. The U.S. and China are engaged in a new Cold War with technology and economics as the center of gravity. I fought the Cold War against the Soviets. I understand what it means to face an opponent who ignores the rules, plays the long game, controls its public and private sectors, and whose leaders are unaccountable. But unlike the Soviet Union, China is strong economically, embedded in U.S. industry, and well-situated globally.

On 5G, we have fallen behind, and badly. Of most immediate concern is the lack of available, appropriate spectrum for our wireless carriers to deploy. I have spent countless hours educating myself alongside a team of world class telecom executives and spectrum technical experts on these issues, notably L-Band's ability to drastically shorten the timeline for the U.S. to deploy 5G and truly compete with China. I am convinced the technological and policy justifications for allowing this "Ligado" modification to proceed are sound.

As Senators Blackburn (R-TN) and Warner (D-VA) wrote on 28 October 2019 to you: "Unleashing additional spectrum for mobile broadband is a key priority in maintaining American leadership vis-à-vis China, particularly for mid-band spectrum such as this." Accordingly, I am troubled by a letter from the NTIA dated December 8th which fails to recommend to the FCC the approval of the modification application to move 35 MHz of lower mid-band spectrum forward for 5G. This 35 MHz is not just one spectrum option to advance 5G. Properly understood, it is absolutely critical to a viable U.S. 5G deployment strategy.

Mr. Chairman, given the severe consequences to our national security and economy if we lose the 5G race to China—and we are losing with only a short time window to confront China's aggressive efforts—*this NTIA opinion should be reexamined immediately*. Conventional thinking and slow change are not enough.

I am aware there are concerns that some members of Commerce and/or NTIA may have internal agendas which compete with broader U.S. economic and national security priorities relative to 5G. I recall reading a letter addressed to Secretary Ross dated 24 June 2019 from Senator Ron Johnson (R-WI) suggesting that members of his department were "placing personal animosity ahead of our country's 5G goals." Similarly, you stated at a June 2019 Senate hearing that certain members within Commerce were "blocking [your] efforts at every single turn." If true, the potential impact on the NTIA position must be recognized and addressed.

I trust completely that you know what matters most at this point is clarity of vision and courage to do what is right for the Nation. More than a few times during my tenure at NASA, I have "been there." NASA is itself a large bureaucracy where successfully working through differing agendas is just part of the landscape. All the experts and advisors I have consulted with are at your service to help resolve this seemingly intractable issue.

The recent NTIA letter presents 5G spectrum issues in ways that seem compelling to those with familiarity but who lack real expert knowledge. The letter cites the “tremendous success in making available spectrum that can support 5G.” Measured against China, this is simply not true. The letter implies that L-Band’s lower mid-band spectrum is not critical for 5G—again, false. Further, the letter references 900MHz of spectrum that is currently being used for 4G, instead of focusing on the dire need for green-field mid-band spectrum for 5G. In contrast, China is not “studying” midband spectrum options, they are aggressively deploying it with 200MHz already freed up and 500MHz more in process. The U.S. has deployed no mid-band for 5G and will likely have none freed up until 2021 or later (it will then take 1-2 years to “clear” and a decade to deploy it). The sub-6GHz (mid-band) we are “studying” means we are many years away from actually deploying it within any timeline that matters—or meets that Presidential guidance of deploying 5G nationwide by 2024.

Additionally, spectrum is not “one size fits all.” Comparisons between 35-40MHz of lower mid-band spectrum and 11GHz of high-frequency mmWave spectrum “available or under study” is not apples-to-apples. Due to mmWave’s poor propagation characteristics (requiring millions of small sites to deploy), mmWave is not a 5G solution today. It is a very expensive, time and labor intensive 5G supplement suited for dense city environments, but not at all practical in suburban and more rural areas. While there are likely some mmWave adaptations and applications not yet realized—it will never be the core of 5G. Although numerically 35-40MHz seems small, it will have a game-changing impact on 5G deployment speed when paired with C-Band. Bottom line, mid-band spectrum is the solution, China knows it, and we cannot afford to delay the way forward any longer.

On 13 November, my team and I met with a senior Acting NTIA member who suggested U.S. 5G is in a good position relative to China. We were surprised, given China is so far ahead in 5G mid-band spectrum deployment and racing to embed its 5G infrastructure globally. Our team explained the innovative solution that pairs C-Band spectrum with L-Band to reduce the timeline of 5G deployment from over a decade to 12-18 months (after C-band has been auctioned and cleared). Instead of building 400K new macro sites with C-Band alone, “C+L” needs only 80K sites, most of which already exist. Critically, *this will make the U.S. 5G ready by 2024, consistent with the stated goal of our Executive Branch.* That NTIA meeting ended with the individual stating “we are aligned with your views on getting mid-band spectrum out.” The NTIA’s letter contradicts this position.

The letter further states that “GPS is fundamental to the nation’s economy, national security, and continued technological leadership.” I have steadfastly supported the GPS community and fought alongside them for many years, until now. Simply put, GPS is not at risk. I have studied the record. I have worked with an unparalleled technical team, and over 5000 hours of testing has shown there is no harmful interference. Globally recognized experts continue to refute all claims alleging actual degradation of GPS devices.

I have total confidence in your and the FCC’s ability to write an order that both protects GPS and allows for 35-40MHz of crucial lower mid-band spectrum be freed up for 5G. I understand Ligado has made extensive concessions to protect GPS (relinquishing spectrum, expanding guard-bands, reducing power and out-of-band emissions) and shown an incredible willingness to work with GPS to resolve any unforeseen issues. Undoubtedly, the FCC order will require the company to adhere to these responsibilities going forward.

As it relates to a 1DB C/N out-of-band standard for interference, I agree that we cannot and will not set this unprecedented standard. Doing so would result in the FCC having to revoke substantial amounts of other adjacent spectrum already deployed. Setting such an unreasonably restrictive standard would also have catastrophic consequences on future spectrum in the pipeline. It is possible to protect GPS and still issue the L-Band license modification order; we must do both. 1DB C/N out-of-band is not the standard, and if sustained widespread degradation to GPS were to ever

emerge, the FCC could always revoke the Ligado order. In short, we have enough information to move forward now.

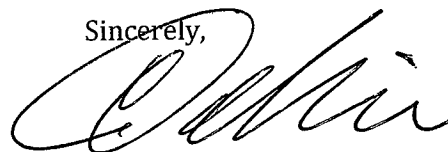
That said, allow me to share a quotation attributed to Winston Churchill that, in my experience, describes how our bureaucracy operates far too often: "*Want of foresight, unwillingness to act when action would be simple and effective, lack of clear thinking, confusion of counsel until the emergency comes, until self-preservation strikes its jarring gong - these are the features which constitute the endless repetition of history.*" We simply cannot wait until the crisis is fully upon us to fight-to-win this competition for 5G.

If we lose the 5G race, we put command-and-control of U.S. telecommunications; innovation in AI, IoT, and unmanned systems; and semiconductor supply chain security at grave risk. China could increasingly undermine U.S. interests in the world with leverage from their embedded 5G systems. Such outcomes constitute failure and violate the public trust.

Of course, historically, the U.S. has transitioned new spectrum many times. There is always a strong push to preserve the status quo. But the stakes are too high not to act. From the stakeholders I have met on various sides of the issue, I am confident all would work together to address any issues that arise. Simply put, preserving national security and unleashing the economic benefits of 5G are worthy of our very best efforts across public-private, civilian-military, and even partisan lines.

We cannot forget China is a communist regime that seeks to undermine the U.S. and dominate the world's economy. I urge you to assure the Department of Defense, the NTIA, and all U.S. interagency stakeholders that we can protect GPS and still move forward with this modification order. Risks and challenges are inevitable, which we will resolve. Let our finest innovators do what they do best—and give our country a chance to compete in this decisive 5G arena. The risk of inaction is too great.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Goldin', written in a cursive style.

The Honorable Daniel S. Goldin
NASA Administrator (1992-2001)