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The Race for Global 5G Leadership: Where Are We Now?

by

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I. Introduction and Summary

With all of the FCC Commissioners strongly rejecting in the last day or so the latest, albeit oblique, suggestion from someone in President Trump's campaign orbit that perhaps there should be a government-run wholesale 5G network, it's a good time to assess "where are we now." It's clear that a government-run 5G network is not appropriate in the U.S. And it is not necessary for the U.S. to maintain 5G leadership, especially if the FCC and NTIA follow the recommendations in this *Perspectives*.

In April 2018, Analysys Mason published a study, "[Global Race to 5G – Spectrum and Infrastructure Plans and Priorities](#)," that assessed the ability of various countries to become the leader in deploying 5G mobile services. It based this analysis on five criteria, including government support, which included spectrum allocation; a national plan; infrastructure policy; and industry efforts. The latter included testing and planned 5G deployment. The study concluded that the United States ranked third using these factors, placing it narrowly behind China and South Korea, primarily based on positive infrastructure policy issues and to a lesser extent on spectrum allocations.

As we approach the first anniversary of the release of the Analysys Mason study, it is useful to evaluate whether U.S. steps taken both since the study's release in April 2018 and in 2019 might change the assessment.

At the outset, it should be acknowledged that the evidence is convincing that 5G will make mobile broadband faster, with greater capacity and lower latency. These characteristics will produce life-changing advances in numerous industries, including health care, education, vehicular automation, communications, and entertainment. Estimates of consumer welfare impacts vary, but the trajectory of these estimates are all in agreement that the consumer benefits will be enormous. These welfare impacts will surely increase if the U.S. industry leads the global 5G race through the ability to dictate standards, drive investment and innovation, and reap first-to-market economic benefits in GDP growth and employment.

The prospects for the U.S. mobile industry winning the global 5G race are promising. But, as with any race, winning depends on the determination to win no matter what happens in the middle of the race.

5G Race Criterion 1. Although the 2018 Analysis Mason study indicates China and South Korea have allocated spectrum at a quicker pace than the U.S., the U.S. is making good progress. The U.S. has been implementing the reallocation of low-band spectrum harvested from the over-the-air TV broadcasting incentive auction, which appears to be on schedule. The FCC is concentrating efforts in a number of current proceedings to locate and reallocate additional mid-band spectrum, all of which is currently used by other spectrum users. Finally, it has reallocated high-band spectrum for mobile broadband use, and several auctions of that spectrum are scheduled to be completed during 2019.

5G Race Criterion 2. The FCC published detailed plans in its various spectrum reallocation rulemaking orders and notices regarding 5G-usable spectrum. The Administration tasked NTIA and federal agencies with developing a national spectrum plan during 2019 that is expected to include 5G deployment plans. The Free State Foundation filed [comments](#), together with many other interested parties, suggesting principles that should be identified in such plan and actions that should be taken.

5G Race Criterion 3. The federal government clearly backs 5G deployment as a national policy. Government backing also requires ensuring access to infrastructure to site the numerous small cells that are characteristic of 5G networks. The FCC has adopted streamlined requirements that encourage local zoning authorities to quickly process siting applications with reasonable fees. Nearly half the states have passed legislation that aims to accomplish similar objectives. And the federal government convened a task force that is taking steps to promote access to federal sites for small cells, using streamlined processes and a common application form to aid in such efforts.

5G Race Criteria 4 & 5. U.S. mobile providers have either conducted or are conducting a number of trials and announced plans over the near term to deploy 5G in their mobile broadband networks.

Although many of the actions recited above bode well for maintaining U.S. global 5G leadership, certain issues still must be addressed. Even though spectrum reallocation is proceeding apace, the relinquishment of federal government spectrum not needed for efficient operations is lagging. For its part, the FCC should bring to decision particular spectrum proceedings that have been pending for a very long time. For example, the FCC, in coordination with NTIA, should act on the long-pending applications of Ligado to modify its L-Band spectrum licenses in order to deploy a hybrid terrestrial-satellite network. This will likely accelerate the arrival of 5G networks that will deliver “Internet of Things” (IoT) services and applications. From all the evidence, it appears that over the past several years Ligado has worked diligently to resolve all claimed interference concerns, even though some objections purportedly are based on interference metrics that have never been accepted by the FCC.

Local governments need to become partners in the 5G infrastructure deployment process. Although the FCC has taken steps to streamline small cell siting, local governments continue litigation on multiple fronts that hinders the FCC’s efforts. Such intergovernmental bickering should cease, or at least be kept to a minimum, in the interest of developing a national policy that can produce the government backing that 5G deployment needs to flourish.

As this *Perspectives* demonstrates, significant advances in spectrum reallocation and government backing of 5G site locations occurred during 2018. Still, both the federal government, with its spectrum reallocation and assignment actions, and local governments, with a renewed commitment to take actions that remove unreasonable impediments to 5G-related infrastructure deployments, should increase their efforts so that the U.S. will be the global leader in 5G. If they do, consumer welfare will improve significantly to the benefit of the U.S. economy and consumers.

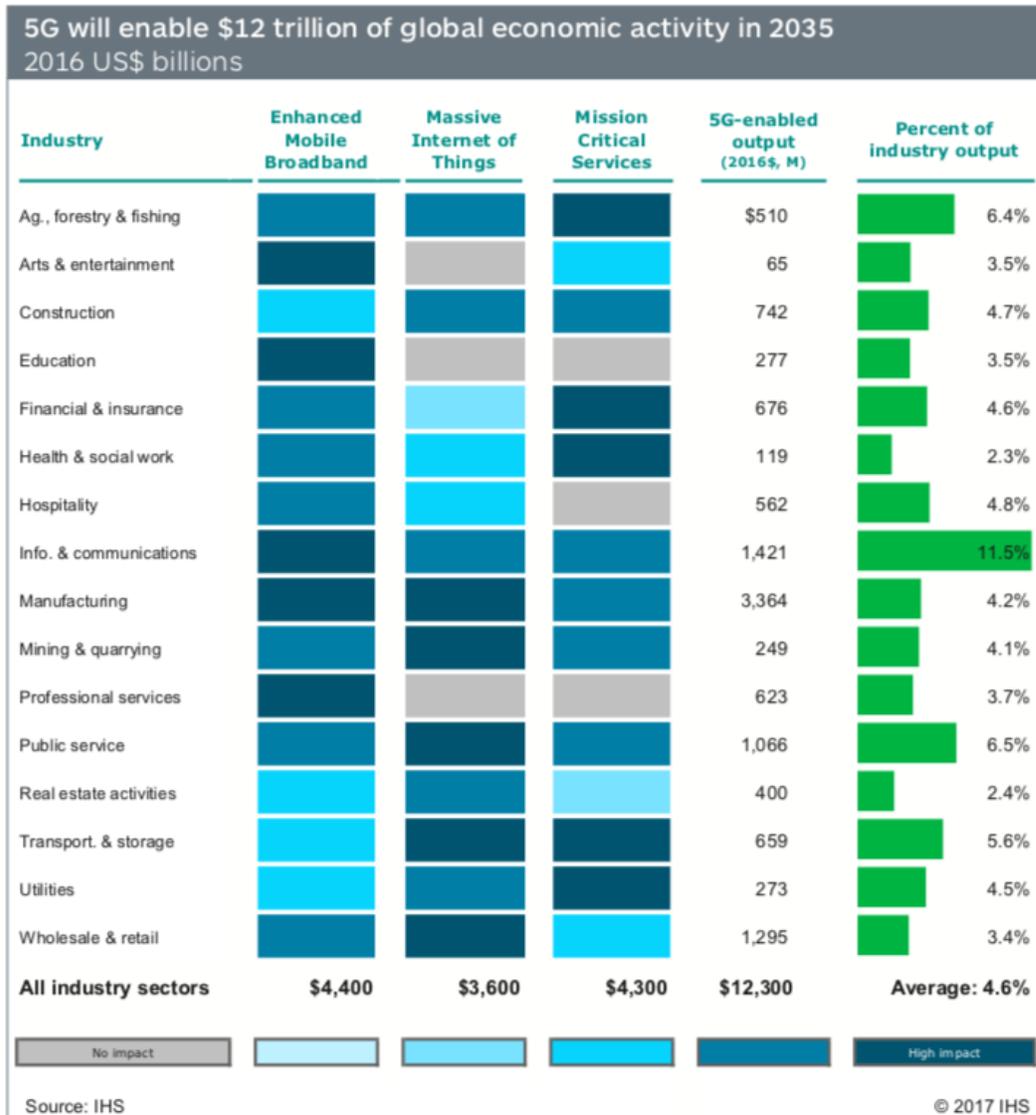
II. The 2018 5G Race Assessment Report

In April 2018, Analysys Mason [published](#) an assessment ranking individual country preparations with respect to become the global 5G leader. It based its assessment on the following criteria: (1) the amount and timing of the release of spectrum; (2) a detailed regulatory roadmap for 5G deployment; (3) government backing for 5G; including access to infrastructure for 5G small cell deployment; (4) industry trials; and (5) industry commitment to 5G network launches. At that time, Analysys Mason concluded that China was leading 5G efforts both in spectrum allocation and government backing, followed closely by South Korea, U.S., and Japan, all four of which were in the top tier of potential 5G leaders worldwide.

III. Winning the 5G Race Will Create Enormous Consumer Welfare Benefits

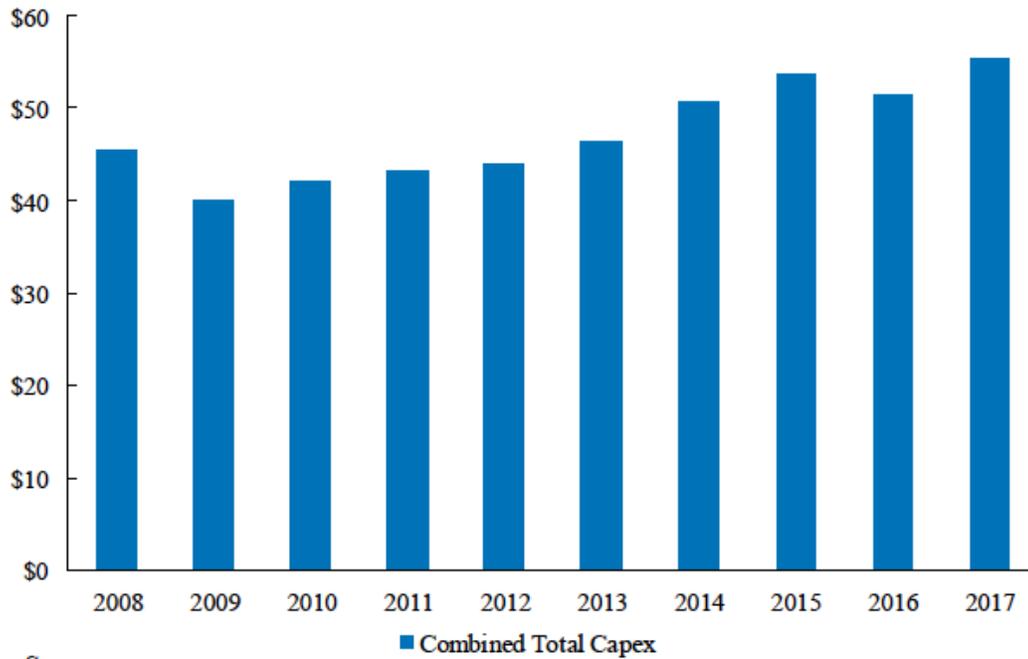
Consumer welfare benefits demonstrate that the 5G race is worth winning. 5G enables a variety of new and innovative developments for wireless networks due to its lower latency and higher bandwidth, as I pointed out [here](#). In addition to improved communications capabilities, 5G promises to transform industries from healthcare to education, and from automated vehicles to video entertainment. The number of IOT devices is estimated to be from 35 to 50 billion by 2020. This significant growth in demand promises to produce a number of economic benefits, both in America as well as worldwide.

5G promises to enhance consumer welfare significantly. IHS Economics & IHS Technology [estimated](#) in January 2017 that by 2035, the economy could produce up to \$12.3 trillion in goods and services enabled by 5G network-based services. That value is estimated to provide some 22 million jobs and up to \$3.5 trillion in revenues by 2035. IHS breaks out the potential impacts to various industry segments as follows:



A number of econometric studies have demonstrated the huge enhanced consumer welfare value associated with wireless services. In February 2019, the Analysis Group studied potential impacts, and it [concluded](#) that approximately \$274 billion in GDP growth and over 1.3 million new jobs would occur with the reallocation of just 400 MHz of mid-band spectrum. Broadband capex from such spectrum allocation is estimated to be in excess of \$154 billion, based on modeling from the following historical data.

Total Wireless Provider Capex Spending (in Billions)

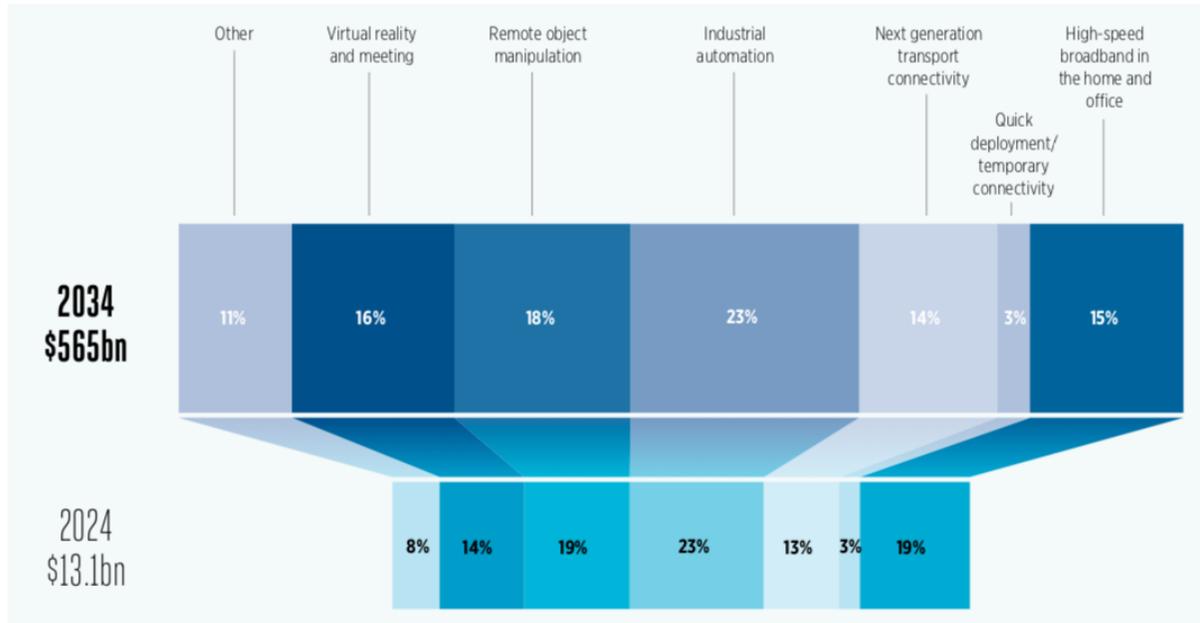


Source:

Capex figures are from the five selected wireless providers' financial filings (the five providers are Verizon, AT&T, Sprint, T-Mobile, and U.S. Cellular).

These results are echoed by GSMA, which [estimates](#) that by 2034, global GDP attributed to millimeter-wave 5G will increase by about \$565 billion per year. New and expanded uses of the technology can be demonstrated in the following chart:

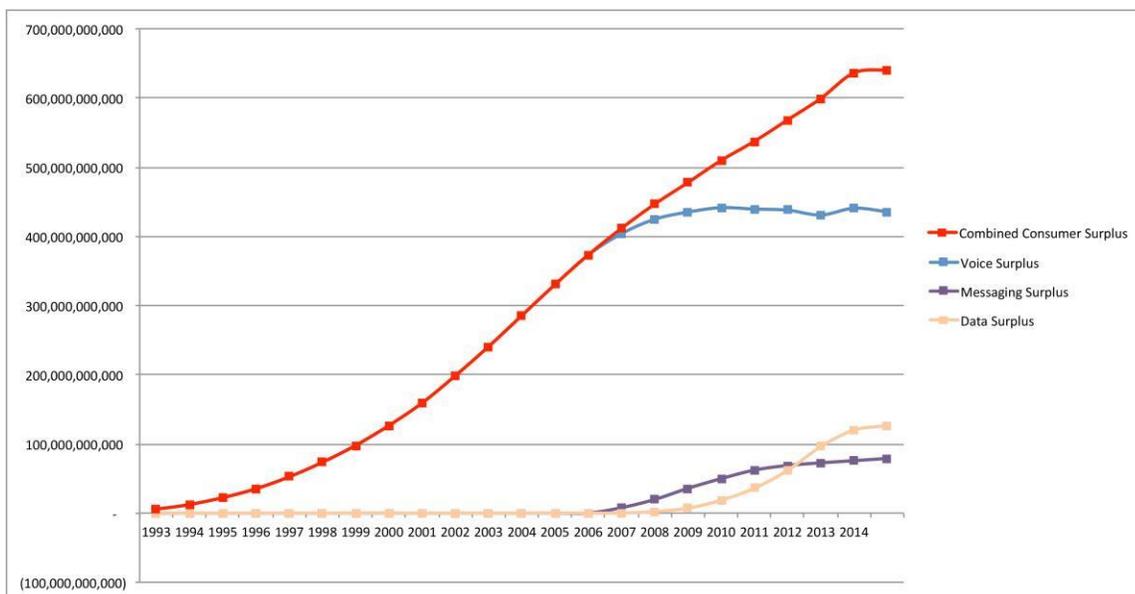
FIGURE 6. PROJECTED GLOBAL CONTRIBUTION OF MMWAVE SPECTRUM TO GDP BY USE CASE



Source: TMG.

More generalized wireless service data support these 5G value estimates. An April 2016 Recon Analytics [report](#) indicated that the U.S. wireless industry in 2014 generated \$282.1 billion in U.S. GDP, up 44 percent since 2011. The same 2016 Recon Analytics report estimated that the combined annual consumer surplus represented by mobile voice, messaging, and data services is \$630.9 billion, as indicated in the following chart:

Exhibit 20: Annual Consumer Surplus—Combined, Data, Messaging and Voice (in US\$)



IV. Positive 5G Race Accomplishments

Spectrum, spectrum, spectrum (5G Race Criterion 1)

The big promises that 5G technology holds for the American consumer can only be fulfilled with sufficient low-, mid-, and high-band spectrum to deliver efficiently 5G services and parallel unlicensed services. Congress has now passed the RAY BAUM'S Act, which mandates that new spectrum be found for mobile broadband, which I've described in greater detail [here](#). The FCC has taken significant steps to locate and reassign spectrum for mobile broadband use in accordance with this statute.

The FCC has now completed the TV broadcast incentive auction, freeing up some 80 MHz of additional low-band spectrum for mobile broadband use. FCC Chairman Pai [reports](#) that the TV station re-pack that will vacate currently used spectrum is ahead of schedule.

The FCC has refocused efforts to identify and reassign mid-band spectrum for mobile broadband use. In October 2018 the FCC [modified](#) the Citizens Band Radio Service (3.5 GHz) rules to increase the usefulness of the band for 5G, while preserving the ability of smaller providers to use that band in innovative ways. The FCC [is seeking](#) comments regarding a potential reallocation of up to 300 MHz of C-band spectrum between 3.7 and 4.2 GHz currently held by satellite providers as well as other users. The FCC has also opened up proceedings to determine whether (1) [4.9 GHz](#) (T-band) spectrum can be opened for sharing between mobile broadband providers and local governmental users; (2) the [2.5 GHz](#) licensing scheme can be made more efficient; (3) various bands between [3.7 and 24 GHz](#) can be opened up for mobile broadband; and (4) [6 GHz](#) (5.925-7.125) spectrum can be freed up for unlicensed use.

As to high-band, or millimeter wave, spectrum, the FCC recently [concluded](#) an auction for 28 GHz, and auctions for 24, 37, 39 and 47 GHz bands are planned for 2019. The FCC continues [to explore](#) other millimeter wave bands for reallocation.

All of these efforts are commendable. It is no easy task to locate usable spectrum in the nation's crowded spectrum landscape. The FCC's important efforts to identify vacant and lightly or inefficiently used spectrum should be continued.

5G Roadmap (5G Race Criterion 2)

The FCC continues to publish plans promoting 5G deployment in various orders and notices of proposed rulemaking. And, pursuant to an October 2017 [Spectrum Presidential Memorandum](#), NTIA and other federal agencies, including the FCC, are developing a national spectrum strategy. Commendably, NTIA [solicited](#) comments on development of the national spectrum plan in December 2018. As the Free State Foundation recently suggested in [comments](#) to NTIA, there are a number of steps NTIA can take to improve government responsiveness to use spectrum more efficiently. First, NTIA should issue an annual report calculating the market value of federal government spectrum. Second, the Office of Management and Budget should audit federal spectrum holdings. Third, the spectrum relocation fund should become a spectrum

incentive fund, and the government should consider substantially increasing the financial incentive to relinquish spectrum. Fourth, agencies should be assessed spectrum fees. Fifth, the government should allow agencies to use spectrum holdings to offset budget appropriations. Sixth, the government should increase the transparency and accountability of government spectrum decisions.

NTIA’s report appears to be on schedule. If the promised completion date is met, the government would appear to substantially meet this race criterion, including FCC published orders to date, during 2019.

Promote government backing promoting 5G and infrastructure access (5G Race Criterion 3)

The federal government has clearly supported the need for 5G leadership. The Administration repeatedly has declared its importance. Frequent bipartisan support is proclaimed in Congress. The FCC unanimously and continuously has recognized 5G’s importance. 5G is one of today’s true bipartisan policies.

Although agreement on principles is crucial, government backing of 5G deployment also has rightfully focused on wireless facility access to the infrastructure needed to create reliable and robust 5G networks. The FCC has made major strides during 2018 to increase infrastructure access by 5G small antenna structures (often called small cells).

In particular, the FCC preemptively established guidelines that local zoning authorities must use in evaluating and approving small cell siting proposals. In March 2018 the FCC [streamlined](#) regulatory requirements by holding that historic preservation and environmental reviews are not required for certain types of small cell deployments. The Commission also modified and clarified required notifications to Tribal Nations to improve process efficiency. The FCC noted that these improvements would help to speed 5G services to market.

The Commission also [adopted](#) other mechanisms to make state and local permitting processes for small cells more streamlined and cost-effective. The FCC noted that some localities have taken inordinate time to review small cell applications and sought exorbitant fees for such deployment. To correct these inequitable circumstances, the FCC adopted a 60-day shot clock for processing small cell applications for use of existing structures, 90 days for new structures. It also capped permit fees by requiring them to be nondiscriminatory and based on the locality’s reasonable costs. The agency based these new rules on its authority to preempt state and local actions that have the effect of prohibiting the provision of services in violation of Sections 253(a) and 332(c)(7) of the Communications Act.

As the chart below shows, many states have also been stepping up to the 5G plate. As of the end of 2018, 22 state legislatures passed legislation (which governors have signed into law) that require localities to improve local zoning permit processing.

Arizona	S.B. 1214	Requires small cell fees to be non-discriminatory and cost-based
Colorado	H.B. 17-1193	Requires small cells permits to be processed in 90

		days, and restricts fees
Delaware	H.B. 189	Grants access to state rights of way and requires applications to be processed in 60 days and permit fees to be non-discriminatory and cost-based
Florida	H.B. 687	Requires small cell applications to be processed within 60 days, and permit fees are limited
Hawaii	H.B. 2651	Small cells applications deemed granted if not acted on in 90 days
Illinois	S.B. 1451	Small cells applications deemed granted if not acted on in 90 days (existing structure) or 120 days (new structure) and limits permit fees
Indiana	H.B. 1050	Regulates ability of local zoning authority to restrict small cell placement.
Iowa	S.B. 431	Limits ability of local zoning authorities to prohibit siting of small cells, requires processing through non-discriminatory procedures, and limits permit fees
Kansas	KS Stat. 66-2019	Requires processing of small cells applications in a non-discriminatory fashion in 90 days for existing structures, 150 days for new structures, and limits permit fees to actual costs and specified total amounts
Michigan	S.B.637	Requires processing of small cells applications in 60 days and limits yearly fees
Minnesota	Chapter 94, S.F. No. 1456	Requires processing of small cell applications within 90 days, and fees must be non-discriminatory and cost-based
Missouri	H.B. 1991	Requires small cells applications to be processed in a non-discriminatory fashion and limits permit fees
North Carolina	H.B. 310	Small cells application deemed granted if not acted on within 45 days of being deemed complete (30-day deadline), requires permit fees to be cost-based and imposes other limitations
New Mexico	S.B. 14	Requires processing of small cells applications within 90 days and permit fees must be non-discriminatory and within annual limits
Ohio	H.B. 478	Small cells application deemed granted if not acted on within 90 days, and limits permit fees
Oklahoma	S. B. 1388	Small cells applications deemed granted if not acted on in 75 days, and limits permit fees
Rhode Island	H.B. 5224	Small cells applications deemed granted unless acted on in 60 days, and requires permit fees to be reasonable and competitively neutral
Tennessee	H.B. 2279	Small cells applications deemed granted if not acted on in 60 days, and limits permit fees
Texas	S.B. 1004	Limits permit and occupancy fees, small cells applications deemed granted if no action in 60 days
Utah	S.B. 189	Small cells applications deemed granted if not acted on in 60 days (existing structure) or 105 days (new structure), and limits application and occupancy fees
Virginia	S.B. 1282	Small cells applications must be acted on in 60 days and limits permit fees

Other states are also actively considering such legislation. For example, "small cell" bills are pending in Maryland that would enable speedier processing of 5G-related applications and would

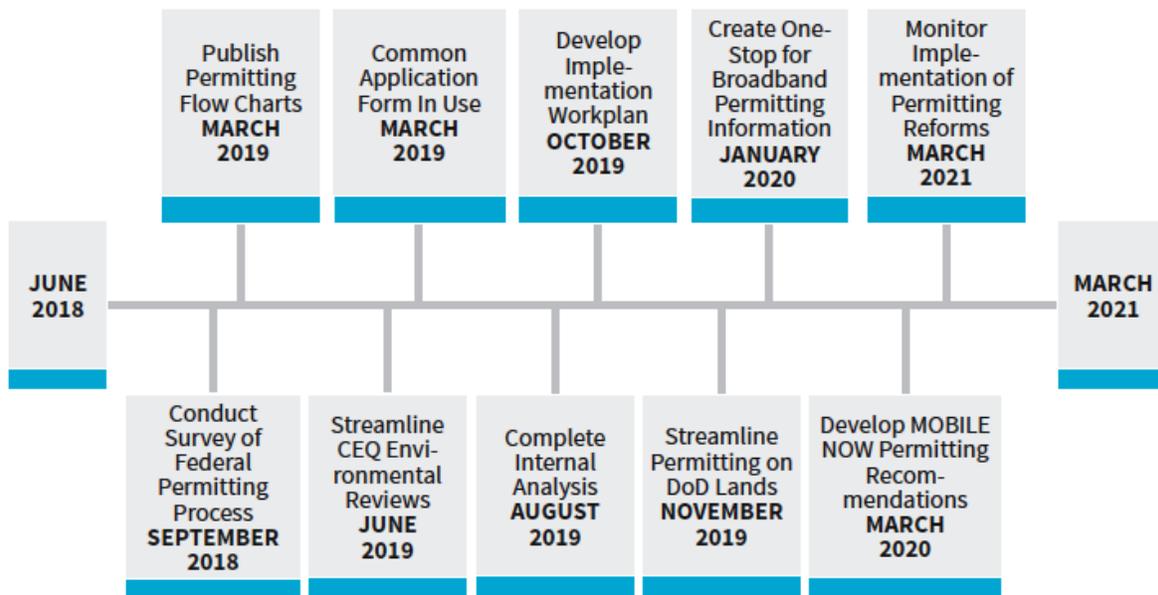
prevent the imposition of unreasonable fees. On February 21, 2019, Free State Foundation scholars submitted [testimony](#) in favor of one of these Maryland bills.

In support of these state efforts, the FCC-chartered Broadband Deployment Advisory Committee [published](#) a model code for localities to follow in adopting improved processing of small cell permits. The model code is the subject of many compromises among committee members, as well as some controversy. But it appears to be a reasonable effort to further speed processing, transparency, and consistency among localities, while continuing to recognize the legitimate interests of localities in managing rights-of-way.

The American Broadband Initiative, a group of executive agencies led by NTIA, this month [published](#) a milestones report on how the federal government could leverage federal assets to improve mobile broadband access to infrastructure on federal lands. The initiative was borne of Executive Order 13821, issued in January 2018, which mandates that agencies streamline and expedite access to federal government facilities in rural America. In addition to promoting \$600 million investment in broadband in Rural America, the report outlines the following steps to be taken by federal agencies: (1) leverage use of Department of Interior towers for communications use; (2) identify federal assets that could be used by commercial broadband; (3) create a single location for accessing broadband permitting information across the federal government; and (4) revise the common application form for accepting permit requests across federal agencies.

The milestones report also identified ongoing several workstreams. The first would ultimately streamline federal permitting processes:

STREAMLINE FEDERAL PERMITTING | MILESTONES



This Trump Administration effort goes hand in hand with provisions of RAY BAUM’S Act that require executive agencies to create a common siting application, and to act on permit requests

for access to communications infrastructure on federal property within 270 days. Implementation of the Initiative's cross-agency program is targeted for completion by March 2020. If successful, these efforts will be useful for allowing private operators to navigate the currently opaque and complicated federal permitting process.

Government regulation streamlining (5G Race Criterion 3)

One of the beneficial regulatory attributes of the wireless industry is the historic decision of Congress and regulators to limit regulatory burdens on wireless carriers. Although the FCC under the Obama Administration began to reverse that trend, the current FCC steadfastly has eliminated a number of those ill-considered regulatory impediments, including its *Restoring Internet Freedom* decision. In terms of regulations attached to spectrum decisions, e.g., in its millimeter wave spectrum allocations, the FCC refused to adopt increased and inflexible spectrum screens applicable to specific spectrum bands. Such streamlined regulations bode well for the ability of the U.S. to win the 5G races.

Industry investment and technological development plans (5G Race Criteria 4 and 5)

Every major wireless carrier has announced that it has concrete plans for 5G deployment and trials have either been conducted or are underway. Given the U.S. leadership in bringing 4G to reality, U.S. industry is at the forefront of 5G developments. Even the Analysys Mason Report concludes that the American mobile industry achieves a perfect score in focusing their 5G development efforts.

V. Negative 5G Circumstances

Spectrum reallocation snags (5G Race Criterion 1)

The most significant failure on the spectrum front is the serious slowdown in identifying and reallocating or sharing government spectrum with commercial mobile broadband. RAY BAUM'S Act requires NTIA to locate specific amounts of government controlled spectrum that can be repurposed for private commercial wireless use, either on an exclusive or shared basis. The Act requires both the NTIA and FCC to accomplish the reallocation of the remaining 255 MHz of the 500 MHz of spectrum the Obama Administration originally sought in 2010. The implementation of that plan faltered, first through an overemphasis on shared spectrum, and then on government foot-dragging in the waning years of the Obama Administration as Randolph May and I described [here](#). It is true that NTIA last year [identified](#) the 3.45 to 3.55 GHz band, currently allocated to the Department of Defense for military radar systems, as a potential candidate for use by commercial mobile use. But little has been said publicly about potential sharing in that band a year after that announcement was made.

The Administration needs to adopt fundamental changes to the way it assesses and values federal government spectrum to improve efficient spectrum use. Hopefully, as indicated above, creating the national spectrum plan can achieve these changes. Ultimately, government spectrum users should be given an incentive to relinquish spectrum that it does not absolutely need to bring its spectrum use efficiency up to par with that of the private sector.

The FCC itself shares some of the blame in permitting some spectrum decisions to lag. One example is its 5.9 GHz band proceeding, initiated in 2013, seeking to free up a portion of that band for unlicensed use. The FCC [asked](#) that the record be refreshed in 2016, but still there is no decision. FCC Commissioners O’Rielly and Rosenworcel have been outspoken that the Dedicated Short Range Communications service currently licensed to 5.9 GHz 20 years ago is underutilized by the transportation industry and should be opened up to unlicensed use. The FCC has conducted some testing of whether unlicensed use can coexist on that band without producing harmful interference, with future testing promised, but the proceeding is languishing and needs to be resolved.

Another proceeding, seemingly relegated to "slow motion," regards Ligado's proposal to modify its satellite license to allow it to provide a terrestrial mobile service. Ligado's license applications have been pending for nearly four years and still have not been decided. From all the evidence, it appears that over the past several years Ligado has worked diligently to resolve all claimed interference concerns, even though some objections purportedly are based on interference metrics that have never been accepted by the FCC. It's time for the government to act on Ligado's license applications.

Delay from local governments on infrastructure access (5G Race Criterion 3)

Despite the fact that the FCC and other federal government agencies have taken affirmative steps to ensure small cell access to infrastructure as described above, numerous cities have taken the FCC to court to stop some of those process efficiency rules.

In particular, numerous cities and other local jurisdictions have appealed the FCC orders that streamline local siting review of small cell deployments. One appeal, *United Keetoowah Band of Cherokee Indians in Oklahoma v. FCC*, in the D.C. Circuit Court of Appeals challenges the FCC’s legal conclusions that limits local and tribal reviews of small cell applications based on environmental and historical consideration. In another case, a number of appeals from the Commission’s September 2018 shot clock and cost-based permit fee rules have now been transferred to the Ninth Circuit Court of Appeals. In yet another case, some appeals challenge an August 2018 order that adopted new pole attachment rules and forbade local moratoria on construction of broadband facilities. Others appeals of these two separate orders remain pending in other circuits, which may ultimately be transferred to the Ninth Circuit as well.

Although parties with standing have the legal right to challenge FCC actions in the courts of appeals, such local authority actions do not advance U.S. readiness to deploy 5G technology and networks. 5G deployment is a national priority that should not be undermined by inconsistent local and federal policies. While FCC orders remain in effect during the appeals, the overhang created by the cloud of uncertainty interferes with certainty, which in turn impedes investment and innovation.

Conclusion

A number of positive accomplishments have been made since the April 2018 Analysys Mason study that demonstrate U.S. government readiness to promote 5G. Those efforts bode well for helping the U.S. to win the race to global 5G leadership. The FCC, and particularly NTIA, should continue to step up their efforts to locate spectrum to meet expected 5G demand. To their credit, the FCC and other federal government entities have demonstrated their willingness to support access to infrastructure. But much more needs to be done by local and state authorities to further 5G efforts so that there is truly a partnership at all levels of government.

Wireless networks, services, and applications have been uniquely American-driven efforts that redound to the benefit of every American, enhancing their lives, while increasing GDP, adding jobs, and adding to tax revenues. Government at all levels can help to implement the next generation of 5G services to improve the nation's overall social well-being economic growth.

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