



CSPC

CENTER FOR THE STUDY OF THE  
PRESIDENCY & CONGRESS

# 5G AND BEYOND TO 6G: OPPORTUNITIES FOR THE BIDEN ADMINISTRATION AND 117TH CONGRESS

---

JULY 2021



CENTER FOR THE STUDY OF THE  
PRESIDENCY & CONGRESS

# 5G AND BEYOND TO 6G: OPPORTUNITIES FOR THE BIDEN ADMINISTRATION AND 117<sup>TH</sup> CONGRESS

## *CSPC Geotech Program Report July 2021*

THE HON. GLENN NYE  
THE HON. MIKE ROGERS  
*Program Leaders*

DAN MAHAFFEE  
*Project Director*

JOSHUA HUMINSKI  
MICHAEL STECHER  
*Report Contributors*

MANUKA STRATTA  
*CSPC Presidential Fellow, Stanford University*  
*Research Contributor*

ANDY KEISER  
*CSPC Senior Advisor*

MILES ESTERS  
ARIK GULATI  
LIAM MILLER  
SARAH NAIMAN  
JACQUELINE RUIZ  
MARIA RUIZ DEL MONTE  
ANNMARIE YOUTT  
*Researchers*

# TABLE OF CONTENTS

- Introduction ..... 1**
- The Importance of 5G—and Beyond to 6G ..... 2**
  - The Importance of 5G ..... 2
  - The Lessons from 3G to 4G to 5G ..... 3
- Applying the Lessons to 5G and Beyond ..... 6**
  - Testing & Deployment ..... 6
  - Open RAN & Vendor Diversification..... 6
  - Spectrum & a Strategic Approach ..... 7
- The Biden Administration, 117th Congress, & Cooperation with Allies..... 9**
  - Cooperation with Allies..... 9
- Conclusion & Recommendations..... 13**

## INTRODUCTION

The Biden administration has taken office at a critical juncture in the Geotech competition, while the 117<sup>th</sup> Congress has the opportunity to make Geotech legislative proposals reality. Growing consensus about the competition of democracy vs. authoritarianism and the importance of innovation leadership are breaking through partisanship in Washington while opening opportunities for cooperation with allied partners. At the same time, lessons that we have already learned from the early stages of this competition can be applied to the decisions we make today, which will, in turn, set the path for future innovation leadership.

Over the past two years, the Center for the Study of the Presidency & Congress (CSPC) has examined these issues. Through in-person and virtual roundtables, interviews, and research, CSPC seeks perspectives from policymakers, private sector leaders, and academic experts from the United States and key Geotech allies and partners. While a range of technologies are important parts of the Geotech portfolio, 5G technologies—and the future beyond to 6G technologies—are of particular interest due to its vital importance for future connectivity. This report looks at current Geotech proposals with a particular focus on 5G and its future beyond to 6G.

5G is a field where this challenge was recognized in the early stages of Geotech competition, yet one where important decisions still remain for the future of 5G and the path towards leadership in 6G technologies. 5G technology provides higher speed connections with lower latency and energy use. Beyond providing faster connections for smartphones, 5G has the potential to reshape entire industries and fuel economic prosperity and job growth. Even as 5G's roll out is underway—and should not be considered “finished” in any way—many are turning attention to 6G leadership, including the Chinese Communist Party. Fortunately, many of the actions that we can take for 5G success serve to put us on the path to 6G leadership, while many of the lessons from the 5G race can serve as guideposts for 6G policy making.

Successive administrations have recognized Beijing's Geotech challenge to the United States and our allies, but the most significant shift in policies came during the Trump administration. The Biden administration has continued many of these policies, identifying it as a generational challenge and, ultimately, a verdict on democracy. In his first press conference, President Biden said of his China policies, “Your children or grandchildren are going to be doing their doctoral thesis on who succeeded, autocracy or democracy, because that is what at stake. We have got to prove democracy works.”<sup>1</sup> At the other end of Pennsylvania Avenue, the 117<sup>th</sup> Congress also has the opportunity to build on past bipartisan Geotech lawmaking and current proposals to address this competitive challenge and foster innovation leadership. These efforts, along with cooperation with our allies and partners, serve to counter Beijing's influence and foster democracies' innovation leadership. Together, these opportunities provide the future investments, partnerships, and planning for needed leadership in current 5G and future 6G technologies.

---

<sup>1</sup> Gavin Bade, “Biden: U.S. locked in ‘battle’ with China for global influence.” *POLITICO*, March 25, 2021. <https://www.politico.com/news/2021/03/25/biden-china-press-conference-478052>

# THE IMPORTANCE OF 5G—AND BEYOND TO 6G

For many of us, the 5G story has just begun, as new handsets and network upgrades roll out. However, behind the scenes, the race for leadership in 6G network technologies is already underway. With a timeline focused on 6G technology in 2030, the next decade will feature a competition for 6G leadership with many of the same themes of 5G and Geotech competition we already understand, but with an ever-hastening tempo and greater magnitude of technological change. As we roll out our 5G networks and lay the hardware, software, and policy frameworks for critical technologies, the decisions we make today shape our ability to lead in 6G networks in the future.

## *The Importance of 5G*

5G and telecom leadership are vital for our economic prosperity. A recent Accenture report commissioned by Qualcomm estimated that “5G will generate up to \$1.5 trillion in additional GDP between 2021 and 2025, and will create or transform up to 16 million American jobs, including full-time, part-time and temporary jobs in the United States.”<sup>2</sup> While we mainly see this in the faster connections in new smartphones, the truly revolutionary applications and platforms lie ahead as 5G allows for greater networking and connectivity and other innovations yet to come. Many of these innovations unlocked by 5G will come from “Internet of Things” (IoT) technologies. As acting FCC Chair Jessica Rosenworcel says, “The real revolution when it comes to 5G is not going to be centered on our phones...In fact, if we do this right, our phones may be the least interesting thing when it comes to 5G.”<sup>3</sup>

Beyond our handsets, the connectivity made possible by 5G technology will transform key industries. Be it transportation, agriculture, finance, manufacturing, healthcare, or even entertainment, the connectivity of 5G-enabled platforms will provide the data collection, industrial control, or other capabilities not yet innovated to reshape these sectors:

- **Transportation:** From improved networking of mass transit to data links in vehicles to real-time monitoring of transportation infrastructure, 5G technologies can provide the connectivity for future transportation innovations.
- **Agriculture:** 5G connectivity for farm equipment and sensors can provide improved crop and resource management, while the rollout of 5G to rural America can address the digital divide.

---

<sup>2</sup> “5G is driving economic growth, resiliency, and sustainability in a post-Covid economy.” Qualcomm, March 1, 2021. <https://www.qualcomm.com/news/onq/2021/03/01/5g-driving-economic-growth-resiliency-and-sustainability-post-covid-economy>

<sup>3</sup> Drew FitzGerald, “FCC Chief in Charge of America’s 5G Rollout Confronts a Long To-Do List.” *The Wall Street Journal*. March 22, 2021. <https://www.wsj.com/articles/fcc-chief-in-charge-of-americas-5g-rollout-confronts-a-long-to-do-list-11616423421>

- **Finance:** 5G technologies and enabled IoT platforms will allow for greater real-time data collection about the economy, while also providing the platform for more reliable and high-speed connections both between institutions and with customers.
- **Manufacturing:** IoT connectivity throughout supply chains and on manufacturing floors can better synchronize and automate manufacturing processes and supply chains to consumer and client demand.
- **Healthcare:** IoT connectivity for sensors and wearables will improve telemedicine, as will 5G's high speed connections for more advanced telemedicine such as remote surgery or critical communication between first responders and trauma centers.
- **Entertainment:** 5G technology will further disrupt traditional in-home entertainment provided via wired connections, provide the bandwidth needed for mobile virtual and augmented reality, and bring true mobility to high-speed, high-bandwidth entertainment like gaming and 4K content.
- **Defense & Security:** 5G technology will help with the further networking of military and security forces' operations, connecting sensors and communication tools for police and military operators, manned and unmanned platforms, and smart munitions.

While these are just some brief examples of how 5G will impact and transform specific sectors, the lesson for policymakers is that 5G is not simply a technology, telecommunications, or cybersecurity issue. Rather, it is the vital digital infrastructure of the future, and policymakers face important decisions about supporting its deployment and ensuring its security. Fortunately, the lessons that are now understood from the 4G to 5G transition can be applied to next steps on 5G and planning for 6G leadership.

### *The Lessons from 3G to 4G to 5G*

As policymakers look to the future of 5G and the race for 6G leadership, there are lessons that we can already understand from the transition from 3G to 4G and onto the race for 5G. These lessons demonstrate the importance of a clear recognition of the inherent Geotech issues, the impact of the first mover advantage, and the need to understand the shape of the broader innovation ecosystem.

- **Recognizing the Geotech Challenge:** While the U.S. government and private sector did not approach 4G with the same policy focus that we now apply to 5G, there was a recognition of the competitive issues involved. The U.S. had lagged behind Europe and Japan in 2G and 3G, respectively, but innovations in smartphones and regulatory frameworks to speed 4G deployment helped the United States move

ahead in 4G.<sup>4</sup> While competition in 2G to 4G with Europe and Japan did not have the same geopolitical ramifications as the current competition with China, the story of these previous generations illustrates the intersection of technological innovation and policymaking for leadership in these technologies.

Another important lesson in recognizing the Geotech challenge is the role that Congress can play. In 2012, the bipartisan leadership of the U.S. House Permanent Select Committee on Intelligence, then Chairman Mike Rogers and Rep. Dutch Ruppersberger, issued a report on Huawei and ZTE ties to the Chinese government, their subsidization, intellectual property theft, and security risks.<sup>5</sup> While it would unfortunately take some time longer before further momentum was established on addressing Huawei and ZTE, it is an example of how Congress can raise the profile of specific Geotech issues.

- **First Mover Advantage:** The combination of technological innovations and 4G-friendly policies in the United States set the stage for the growth of the smartphone-based digital economy that transformed the early 21<sup>st</sup> century. The U.S. marketplace, with 4G leadership, was the fertile ground for app stores and businesses made possible by 4G connections like ride sharing, social media, and how we now use phones to find everything from dinner recipes to dating partners.

Beyond the consumer-facing side, moving first in 4G technologies also gave U.S. firms an advantage in real-world experience with hardware and software. This advantage, and the resulting follow-on innovations, helped U.S. companies and U.S. economic growth beyond 4G hardware itself.

- **Innovation Leadership Ecosystem:** While this has also been covered in previous CSPC Geotech reports, these combinations of factors create innovation leadership ecosystems. While the U.S. government was not directly responsible for the leaps ahead in smartphone technology, it did create the policies that sped 4G adoption and deployment. While policies created a friendly environment, consumer demand would create the momentum. This successful ecosystem was also part of a longer heritage of policies like promoting the rule of law, protecting intellectual property, and encouraging fair and reciprocal trade policies. Government support for basic research and public education helps to build knowledge and the workforce, while the private sector can draw on its profits for future innovations.

When this ecosystem is thriving, it can foster continued generations of innovation leadership—both in product lines and personnel. However, its success is not always guaranteed. Hubris or short-sightedness can bring down great companies, while agile innovators take their place. This creative destruction is natural to the capitalist

---

<sup>4</sup> “How America’s 4G Leadership Propelled the U.S. Economy.” Recon Analytics via CTIA, April 16, 2018.

<https://www.ctia.org/news/how-americas-4g-leadership-propelled-the-u-s-economy>

<sup>5</sup> Mike Rogers and C.A. Dutch Ruppersberger, “Investigative Report on the U.S. National Security Issues Posed by Chinese Telecommunications Companies Huawei and ZTE.” U.S. House of Representatives, 112<sup>th</sup> Congress, October 8, 2012.

<https://www.hsdl.org/?view&did=723367>

ecosystem, but the artificial impact of state-supported champions like Huawei and ZTE proved far more disruptive. While policymakers should avoid picking winners, they should be aware of the predators, and may need on occasion to step in and shield companies from unfair predation. Finally, as history shows, these ecosystems are stronger when U.S. and allied companies compete on a global stage. Therefore, better policies to secure our innovations should focus on security, not protectionism.



## APPLYING THE LESSONS TO 5G AND BEYOND

The lessons from past generations of wireless communication technology illustrate the need to move more quickly on 5G deployment and facilitate future 5G innovations, while taking necessary steps to secure future 6G leadership. It is important to note that there are many outstanding questions about 6G that remain unresolved, as well as the fact that it would be premature to consider the matter of 5G to be settled. It will be some time before 6G technologies are ready—2030 and beyond by most estimates—but this report seeks to identify areas that both encourage 5G deployment and innovation, while providing the sound foundation for future 6G innovation leadership.

Important near-term measures that are needed are those that encourage 5G testing and deployment for further real-world experience, wireless equipment and software vendor interoperability, and eventual 5G- and 6G-based innovations.

### *Testing & Deployment*

Where possible government should support efforts to test, integrate, and deploy 5G technology. This includes not only continuing to hasten the roll out of infrastructure for 5G coverage, but also supporting the test bed programs and facilities for further 5G and 6G development and testing.

One significant example, also highlighted in greater detail in the late 2020 CSPC Geotech report, was the mmWave testing underway by Qualcomm in Wisconsin, demonstrating long-range 5G coverage with using mmWave spectrum and technology.<sup>6</sup>

Testing centers are also important to establish interoperability between equipment vendors and network operators, especially as Open RAN architectures and technology (described in further detail below) are increasingly adopted and deployed. These facilities can be utilized by U.S. and allied multinational telecom providers, hardware manufacturers, and other important firms to test component integration, reliability, resilience, and security.

### *Open RAN & Vendor Diversification*

As stated by the Open RAN Policy Coalition, “The key concept of Open RAN is ‘opening’ the protocols and interfaces between the various subcomponents (radios, hardware and software) in the [Radio Access Network (RAN)].” Thus, moving towards Open RAN for 5G can break the stranglehold that some wireless equipment vendors have on the traditional

---

<sup>6</sup> “U.S. Cellular, Qualcomm and Ericsson Achieve Extended-Range 5G Data Call Over mmWave.” Qualcomm, September 17, 2020. <https://www.qualcomm.com/news/releases/2020/09/17/us-cellular-qualcomm-and-ericsson-achieve-extended-range-5g-data-call-over>

single-vendor network architectures.

To better understand this, it is important to understand the key players: network equipment vendors—e.g. Huawei, Ericsson, Samsung—and the network operators—e.g. Verizon, AT&T, and T-Mobile (in the United States).

By allowing for a diversity of network equipment vendors for various components and software, 5G and future 6G network operators could enjoy the same diversity of vendors that is seen in other IT fields. This represents an opportunity to disrupt the business model used by Huawei, but other U.S. and allied firms will also have to adapt to this Open RAN model as well. At the same time, open architectures provide an avenue for new market entrants and innovators to enter the 5G and 6G marketplace.

While concerns about 5G have often focused on the power of Chinese firms in the network equipment vendor marketplace, a shift to Open RAN puts the power in the hands of the purchasers—the network operators. With U.S. and allied telecom operators leading in revenue, their preferences can help to promote competition among 5G equipment vendors and shape their demand.<sup>7</sup>

Open RAN models will also be increasingly important as an alternative to Huawei or other Chinese 5G equipment vendors as U.S. and allied vendors compete in the global south.

### *Spectrum & a Strategic Approach*

Another opportunity to build on past lessons is to understand where a strategic approach to 5G, and beyond to 6G, is helpful. While this does not mean that the United States and its allies should try to pursue programs of coordinated military-civil fusion, Belt and Road Initiatives, or Made in China 2025, it does argue for greater coordination between policymakers and the private sector on technology policy and a strategic approach by policymakers to do their part to tend to the innovation ecosystem. While innovations in smartphone design and use were key to 4G adoption by consumers, decisions about spectrum allocation, network build-out, and other matters had already been addressed by policymakers. Fast forward to recent years, in the early stages of the U.S. 5G build out, the Defense Industrial Board identified its concerns about U.S. spectrum allocation as a disadvantage compared to other competitors.

While some of the initial concerns about spectrum allocation are being addressed by technological innovations, the issues of spectrum management must be addressed for future 5G deployment and leadership in 6G. While leading U.S. telecom companies have sought to acquire more spectrum for their 5G deployment, the cost of this spectrum has added to their already leveraged balance sheets, at a time when the 5G build out of

---

<sup>7</sup> Sachin Katti interview with Manuka Stratta. December 3, 2020.

hardware is a significant capital expense.<sup>8</sup> Furthermore, the government and other private sector players—especially the Department of Defense—already have significant existing claims to various spectrum bands. Addressing the concerns of existing spectrum stakeholders can be time and cost intensive, thus, discussions about spectrum for 6G—and other related standards—should be addressed as soon as possible in terms of both technology and policymaking.

The FCC has laid out a bold approach to spectrum, and as FCC Commissioner Carr has pointed out:

[W]e need to be clear eyed about our spectrum policy going forward. Whether we like it or not, freeing up more spectrum requires FCC leadership that accumulates political capital and has the willingness to spend it. This is the reality of spectrum policy these days, and the FCC must show strong leadership to free up more airwaves.<sup>9</sup>

Thus, it is important that Congress continue to support the FCC as it addresses spectrum allocation.

While spectrum is one key example, it is part of the other aspects of a broader strategic approach to 5G deployment and 6G leadership. Many of these factors are also part of a broader Geotech strategy and are not solely applicable to 5G and 6G: support for research and development, workforce education, supply chain security, and support for technology testing and deployment.

Given the importance of 5G, the future need for 6G leadership, and the lessons from our previous experience with technology policymaking, how these factors are addressed in Washington, as well as in partnership with our allies, is a vital part of the Geotech competition.

---

<sup>8</sup> Drew FitzGerald, “AT&T, Verizon Vow to Boost Sales Before 5G-Fueled Debt Comes Due.” *The Wall Street Journal*, March 12, 2021. <https://www.wsj.com/articles/at-t-verizon-vow-to-boost-sales-before-5g-fueled-debt-comes-due-11615573287>

<sup>9</sup> “Keynote Remarks of FCC Commissioner Brendan Carr at the American Enterprise Institute, Washington, DC, ‘Extending America’s 5G Leadership.’” March 15, 2021. <https://docs.fcc.gov/public/attachments/DOC-370781A1.pdf>

## THE BIDEN ADMINISTRATION, 117TH CONGRESS, & COOPERATION WITH ALLIES

The Biden administration has moved quickly to address the Geotech competition, while the 117<sup>th</sup> Congress has continued to build on the bipartisan consensus surrounding the Geotech competition and strengthening the United States to address China. The Biden administration's appointments to key posts—based on analysis of their professional writings and confirmation hearings—have a shared skepticism of China, push for investments in critical technologies, and argue for cooperation with allies. The administration has also moved rapidly on supply chain security, with an executive order focused on key sectors.

Despite myriad political differences and the deepest partisanship in modern U.S. history, many in Congress, on both sides of the aisle, share the assessment of the administration and agree on the approach. Legislative proposals in the past Congress started to address strengthening U.S. capabilities and address both near-term and long-term Geotech issues. This momentum has continued as the Senate recently passed, with bipartisan support, the U.S. Competition & Innovation Act.

The recently released CSPC report, “Geotech in the Early Biden Administration,” covers the White House efforts in more detail, and CSPC is preparing an updated report on further Biden administration Geotech efforts and the various proposals in Congress, including as attention turns to the future of the U.S. Innovation & Competition Act in the Senate.

Finally, both the Biden administration and key leaders in Congress have emphasized the importance of cooperation with our allies on Geotech issues. While Washington is reemphasizing this approach to allies, it is also helped by Beijing's increasing assertiveness. Still, there are areas where our interests diverge from those of our allies and partners. In 5G and 6G cooperation, as well as broader Geotech cooperation, it is important to understand how the United States, its allies, and its partners may all differently weigh the human rights, commercial, and security interests inherent in Geotech competition.

### *Cooperation with Allies*

While the Biden administration has reemphasized cooperation with international allies on technology policy, challenges remain in terms of coordination—especially on 5G policy. Furthermore, while the Trump administration did not emphasize cooperation with allies in the manner of the Biden administration, there was working-level cooperation such as the Prague Conference on 5G and the Clean Network initiatives from the State Department. It is also worth noting that the transactional approach by, and blending of economic and security arguments, the Trump administration undercut efforts to convince allies of the threat from Huawei and ZTE, and the Chinese Communist Party more broadly. These are

initiatives that the Biden administration can build on as it announces its own efforts to cooperate with allies.

The Biden administration has placed particular emphasis on the “Quad”, with the first ever Quad meeting of the leaders of the four nations: Australia, India, Japan, and the United States.<sup>10</sup> This meeting has established a Quad Critical and Emerging Technology Working Group to address shared technology policy concerns. Within the Quad, Japan has served as an important Geotech partner and player, with its own government support for 5G test beds, proposals on data management like former Prime Minister Abe’s proposal for “Data Free Flow, with Trust”, digital diplomacy efforts in major international fora, and Prime Minister Suga’s visit to Washington—as the first foreign leader hosted by the Biden White House. Similarly, Australia has long-standing military and intelligence ties with the United States, including Five Eyes membership, and has borne the brunt of China’s “Wolf Warrior” diplomacy and economic retaliation. India is more complicated. On the example of 5G, the U.S.-Japan-Australia position has clearly blocked Huawei, while India appears to be taking a tougher stance on the firm, though short of a formal ban. However, India is vital to the success of the Quad and continued engagement with Delhi on shared military, economic, and technology interests is important for policymakers in Canberra, Tokyo, and Washington.

On 5G and beyond, as well as other critical technologies, bilateral cooperation serves as a useful starting point, but for scale, cooperation with Quad allies as well as other international partners is key. The G7 has turned its attention to this issue, with an April G7 Digital and Tech ministerial meeting highlighting the importance of secure and transparent telecom supply chains.<sup>11</sup> The Communique of the 2021 Carbis Bay G7 Summit specifically identified ICT supply chain security as a priority for tech cooperation.<sup>12</sup> Finally, during the recent U.S.-EU summit, the announcement of a joint U.S.-EU Trade and Technology Council to coordinate tech policy and establish dialogue over digital trade disagreements is a welcome step in transatlantic tech cooperation, though disagreements remain.<sup>13</sup>

As the following chart demonstrates, there are areas where U.S. policymakers can best identify common ground with key partners, note areas of disagreement, develop the diplomatic approaches, foster the commercial partnerships, and coordinate U.S. and allied efforts in international standards-setting bodies.

---

<sup>10</sup> “Quad Leaders’ Joint Statement: ‘The Spirit of the Quad.’” The White House, March 12, 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/12/quad-leaders-joint-statement-the-spirit-of-the-quad/>

<sup>11</sup> Zach Marzouk, “G7 leaders discuss 5G infrastructure security for the first time.” *ITPro*. April 29, 2021. <https://www.itpro.com/security/359378/g7-discuss-5g-infrastructure-security-for-first-time>

<sup>12</sup> “Carbis Bay G7 Summit Communique.” The White House. June 13, 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/13/carbis-bay-g7-summit-communique/>

<sup>13</sup> “EU-US launch Trade and Technology Council to lead values-based global digital transformation” European Commission. June 15, 2021.

## Identifying common ground and disagreement to establish promising areas for collaboration with allies

Partner	Priorities & Strengths the U.S. can leverage	Disagreements & Weaknesses
<b>EU</b>	<ul style="list-style-type: none"> <li>-Strong history of <b>international standards contributions</b> and telecommunication leadership (2G, GSM standards)</li> <li>- Home to two <b>major vendors</b>: Nokia (Finland), Ericsson (Sweden); #2 and #3 in contributions to 5G standards</li> <li>-Focus on <b>international cooperation</b> with bilateral 5G agreements (Brazil, China, Japan, South Korea, India)<sup>14</sup></li> <li>-Close collaboration between private and public sectors through 5GPPP (EU Public-Private Partnership)</li> </ul>	<ul style="list-style-type: none"> <li>-Divided stance on Huawei due to economic ties with China (e.g. Germany's car exports to China, Huawei's low prices): tensions exist as the EU is one of Huawei's largest markets while a major source of U.S. allies</li> <li>-EU lags behind in 5G trials and spectrum allocation due to regulatory challenges</li> </ul>
<b>United Kingdom</b>	<ul style="list-style-type: none"> <li>-Major focus on <b>security</b>; ranked #1 in ITU Global Cybersecurity Index (2018)<sup>15</sup></li> <li>-Long history of <b>intelligence-sharing</b> (Five Eyes)</li> <li>-<b>International leadership</b>; proposed creation of Democracy-10 (D-10) group for 5G collaboration</li> </ul>	<ul style="list-style-type: none"> <li>-Mixed agreement on whether to ban Huawei equipment (2019/20); public disagreements among U.S. / U.K. officials on Huawei ban</li> <li>-Financial influence: Chinese FDI of EUR 50.3 billion since 2000<sup>16</sup></li> </ul>
<b>Japan</b>	<ul style="list-style-type: none"> <li>-Experience with first-mover advantage, took the lead on 3G</li> <li>-Early <b>R&amp;D</b> investments: 2014 5G Mobile Forum (5GMF)</li> <li>-Early experimental 5G trials, with both sub-6 &amp; mmWave: understand <b>practical challenges</b>, push for pragmatism<sup>17</sup></li> <li>-Focus on not only urban areas but also rural Japan with 5G System Trial, bridging digital <b>urban/rural divide</b></li> </ul>	<ul style="list-style-type: none"> <li>-Distinct challenges due to very different population density and geographical footprint compared to U.S.; Japan is more comparable to U.S. dense urban areas than the country as a whole</li> </ul>
<b>South Korea</b>	<ul style="list-style-type: none"> <li>-5G maturity, 2017 national spectrum plan, early auction; can leverage first-mover advantage in the sector globally<sup>18</sup></li> <li>-Centrally planned <b>industrial policy</b>; strong government support with tax benefits to operators who collaborate</li> <li>-Close <b>collaboration</b> with Verizon/AT&amp;T on 5G mmWave</li> <li>-Samsung #2 &amp; LG #3 in number of 5G patents</li> </ul>	<ul style="list-style-type: none"> <li>-As with Japan, very different population density and geographical footprint</li> <li>-Face security-trade dilemma; dependent on China for trade &amp; investments; 27% of 2018 exports went to China vs just 12% to U.S.<sup>19</sup></li> <li>-Many companies, including competitor Samsung, wish to collaborate with Huawei</li> </ul>

<sup>14</sup> "International Cooperation on 5G." *Shaping Europe's Digital Future*. European Commission, September 2020, ec.europa.eu/digital-single-market/en/5G-international-cooperation.

<sup>15</sup> *Global Cybersecurity Index 2018*. International Telecommunication Union (ITU) Publications, 2019.

<sup>16</sup> "Chinese FDI in Europe: 2019 Update." Rhodium Group and the Mercator Institute for China Studies, April 2020.

<sup>17</sup> Colin Blackman and Simon Forge. *5G deployment: State of play in Europe, USA and Asia*. European Parliament, 2019.

<sup>18</sup> *The 5G ecosystem: Risks and opportunities for DoD*. Defense Innovation Board (DIB), 2019.

<sup>19</sup> John Hemmings and Sungmin Cho. *South Korea's Growing 5G Dilemma*. CISAC. July 2020.

<b>Australia</b>	<ul style="list-style-type: none"> <li>-Major focus on <b>security</b>; ranked #10 in ITU Global Cybersecurity Index (2018)</li> <li>-Huawei ban and tough stance against China</li> <li>-Long history of <b>intelligence-sharing</b> with U.S. (Five Eyes)</li> </ul>	<ul style="list-style-type: none"> <li>-Complex Sino-Australian relations; deteriorating diplomatic relations with China which still holds powerful economic influence as Australia’s #1 trading partner</li> </ul>
<b>India</b>	<ul style="list-style-type: none"> <li>-#2 Largest <b>smartphone market</b>; potential for collaboration in the production of devices powered by 5G</li> <li>-Increasing focus on <b>national security</b>; banned 50 Chinese apps due to national security threat (2020)</li> <li>-Existing <b>alliances</b>, 2+2 ministerial dialogue. India, US, and Israel collaborating on 5G tech<sup>20</sup></li> <li>-Attempts to leverage <b>Open RAN</b> architecture to build low-cost 5G network</li> </ul>	<ul style="list-style-type: none"> <li>-Cannot fully prioritize security due to financial concerns: operators face massive debt (AGR crisis 19’) and lower price points</li> <li>-Limited presence in 5G standards bodies</li> <li>-Security issues: ITU Global Cybersecurity Index dropped from 23 to 47 (2018)</li> </ul>

That said, a major challenge continues to be what nations would be included in such a grouping, depending on how matters of security, commercial interests, and shared values are weighed. How the group orients itself is also an outstanding question, as are matters of prioritizing securing vital networks, building resilient supply chains, protecting commercial interests, competing with Chinese firms and diplomats in the Global South, and/or advocating for human rights and shared values. At its most basic level, whether this is a one-off or the start of a new series of summits is unclear. Still dialogues with the Quad partners, as well a channel for tech dialogue with Brussels are welcome developments.

In terms of major international fora, U.S. policymakers should also pay critical attention to the role played by international standards setting bodies (ISSB). As mandated in the USA Telecoms Act, ISSBs are of particular interest to Congress, and rightfully so. They will be important players in setting future 5G and 6G standards, and Beijing has sought to exercise its influence in these bodies—particularly the International Telecommunications Union.<sup>21</sup> Other bodies like 3rd Generation Partnership Project (3GPP), the European Telecommunications Standards Institute (ETSI), and the O-RAN Alliance are other ISSBs and telecommunications fora where U.S. and allied influence is vital for 6G leadership.

Finally, cooperation with allies means building deeper ties in terms of technology development and communicating technology policy priorities. In terms of deeper ties, international partnerships to encourage 5G and 6G testing and development, and to encourage and test interoperability with other Open RAN architectures can help U.S. and allied technology companies work together on the global stage with interoperable products and standards that win at ISSBs as well as when customers make their choice. At the same time, these international agreements and partnerships can serve as a powerful message of cooperation and highlighting the importance of shared values and interests in terms of technology and its application.

---

<sup>20</sup> Pti. “India, U.S. and Israel Collaborating in 5G Tech: Official.” The Hindu, September 8, 2020.  
<sup>21</sup> Tung Cheng-Chia & Alan H. Yang, “How China is Remaking the UN in its Own Image.” *The Diplomat*, April 9, 2020. <https://thediplomat.com/2020/04/how-china-is-remaking-the-un-in-its-own-image/>

## CONCLUSION & RECOMMENDATIONS

Policymakers have the opportunity now to address not only the future of the 5G rollout, but also set the path towards future 6G leadership. Understanding the importance of these technologies and their potential impact is just one step towards their implementation. Further resourcing of efforts and building of partnerships is key to U.S. and allied innovation leadership in ICT and other important Geotech fields.

While 5G is a revolutionary leap ahead in connectivity, and, while technical questions remain, 6G has the potential to truly blend the physical and digital worlds. The impact of this technology, its importance to our security and prosperity, and the values we share with our allies make 5G and beyond a critical field in the Geotech challenge. These recommendations for policymakers and private sector leaders reflect that aim.

- **Fully Fund USA Telecommunications Act & Other Geotech Measures:** While Congress debates further measures, it should fund those it already agreed to. Providing the necessary resources for USA Telecoms Act and other Geotech measures in the FY21 NDAA is a key step ahead for 5G and Geotech.
- **Support Open RAN Architectures:** Wherever possible, the Biden administration and Congress should support Open RAN architecture and its adoption by U.S. and allied firms. This architecture can address concerns about vendor security, while disrupting the single-vendor network architecture model, empowering the network operators, and encouraging greater competition in 5G hardware and software.
- **Reauthorize FCC Spectrum Auction Authority:** Strategic and innovative approaches to vital and limited swaths of spectrum are vital for 5G deployment and facilitating deployment of future innovations. Congress should reauthorize the authority of the FCC for spectrum auctions, which will expire at the end of FY22.
- **Support U.S. and Allied R&D & Other Joint Testing:** As lawmakers in Washington consider support for U.S. R&D in critical technologies, these measures should also be accompanied with support for joint research and investments and coordinated with allied capitals for maximum impact. Joint testing measures should also be supported for U.S. and allied multinationals to ensure interoperability and adoption of Open RAN standards and architectures.
- **Coordination in International Standards Setting Bodies:** Coordination and leadership with allies in ISSBs is also of vital importance for future 5G and 6G leadership. As China has sought to institutionalize its influence in these bodies, the United States and allies should seek to push back where possible and prevent the adoption of international standards that solely reflect Beijing's values.
- **Further Formal and Ad-Hoc Cooperation on Critical & Emerging Technologies:** Be it the efforts of the past administration like the Clean Networks, or the Biden



administration working with others to create the Quad working group on critical and emerging technologies and the U.S.-EU Tech Council, these efforts, both formal and ad-hoc, create useful ties between the U.S. and allies and partners on technology issues. As the Biden administration formalizes these, more robust and established future avenues of cooperation can provide the readiest partners with a platform for cooperation on 5G, 6G, and other Geotech issues. At the same time, not all nations will be able to be so assertive or public, yet may share some of the same concerns about Chinese influence. In these circumstances, ad-hoc dialogues and actions may be useful for the pursuit of shared interests.

- **Address Supply Chain Concerns:** Critical for 5G, 6G, and Geotech is ensuring that there are secure and resilient supply chains for critical technologies. Supply chain security requires examinations beyond immediate ICT to also understand other technologies and critical infrastructures upon which the sector is reliant.
- **Build a Strategic Approach for 6G:** Looking ahead to 6G and understanding the lessons of the 4G to 5G race, there is an opportunity to coordinate many of the factors such as spectrum allocation, network build out, and R&D support into a strategic approach. While this need not rise to the level of industrial policy, it can provide policy frameworks and a cooperative approach—both with U.S. stakeholders and international partners—to take steps today for future 6G leadership.
- **Educate U.S. Diplomats for their Geotech Role:** As international competition increasingly focuses on technology policy, U.S. diplomats will increasingly play a role in technology policy issues and representing U.S. technology interests—both from the government and private sector. Borrowing from models such as “digital attachés” in Embassies of Japan, the U.S. Foreign Service should be better positioned for Geotech competition, while programs to encourage temporary foreign service stints for those in the tech industry and tech policy should also be considered.