Promoting U.S. Leadership on the Path to 6G

The journey to the next decade begins now. While the world is exploring opportunities that will light the path to 6G, the U.S. must take timely and critical action to ensure unquestioned leadership in 6G innovation and development.

This is a "Call to Action" from the leading companies in the information and communications technology (ICT) industry to join with government in a shared commitment that will put the U.S. at the forefront of technology leadership for the next decade. Although 5G technology has only just begun delivering a revolutionary array of advanced applications for consumers, businesses and governments, it is not too early to begin preparing for what comes next in the technological journey. By working now to align government and industry on a set of core principles and actions, the U.S. will be at the forefront of 6G development and deployment. With a history of bringing together ICT companies to solve the industry's biggest challenges, the Alliance for Telecommunications Industry Solutions (ATIS) is committed to working with its industry members to address this critical undertaking with government. This Call to Action identifies a set of core technologies and recommended government actions to advance U.S. Leadership into the next decade of rapid innovation and development.

In this time of rapid technology innovation coupled with global challenges, true leadership cannot be bestowed by governments or proclaimed by market players. Global leadership is earned by fostering a collaborative spirit between government and industry, attained through a clear definition of a common national purpose and sustained through a persistent commitment to the future. Ultimately, it is a challenge that must be undertaken *now* if the U.S. wishes to advance its technological leadership over the next decade.

By leveraging the knowledge gained from the development and early deployments of 5G, the U.S. can establish itself as a global leader in ideas, development, adoption and rapid commercialization of 6G. This leadership role would complement–not abandon or usurp–global standards in the ICT sector, allowing the U.S. to take full advantage of the scale and interoperability of products and networks based on globally developed standards. An aligned regional set of objectives and technology foundations can enable the U.S. and the rest of the North American market to take full advantage of global standards and commercial products, while not being beholden to them.

This Call to Action promotes a holistic approach that begins with innovative research and relies on a commitment to standards and development that addresses U.S. needs. The result will be the introduction of 6G services and technologies that position the U.S. as the global leader for the next decade and beyond. While the realities of different geographies, populations, economics and government oversight will always influence global market demands, it is the *leadership of ideas* coupled with the commitment of the public, private and academic sectors that will deliver the power and benefits of U.S. technological leadership.

The Need for Vision

Defining the key components of U.S. technological leadership begins with identifying a vision for the next decade. Over the next few years, 5G will enable billions of hyper-connected devices, along with big data and artificial-intelligence-enabled capabilities that change how we communicate and interact with people, devices and things. This will usher in a new set of capabilities and applications that take advantage of the ultra-high-bandwidth/low-latency connectivity of 5G and massive amounts of intelligent connectivity. But history has shown that the path to the next generation of advanced networks most often begins a decade in advance, as research creates the aspirational view of *what is possible* and development translates into market reality.

What is the vision for a sixth generation of networks, devices and applications? The answer goes well beyond just more bandwidth, less latency, additional spectrum and greater reliability. 6G will apply new cognitive, predictive and contextual capabilities to deliver a *yet-to-be-imagined* level of user experience. Some examples:

- Distributed intelligence will permeate networks and devices. Massive amounts of edge intelligence will enable new microservices operating on the network edge, creating exciting and innovative opportunities for vertical markets and enterprises.

- Communications in the high GHz and THz bands will open up a new generation of embedded devices and ubiquitous connectivity that will impact every fabric of our society. Everyday objects will become sources of data and intelligence, allowing applications to autonomously predict and act on a customer's needs and preferences.

- Users will be able to self-define security and privacy perimeters, establishing a path for the U.S. to be the leader in developing and deploying secure networks and devices. 6G will ultimately harness the power of the network to augment

security and operational capabilities (detect, inform, defend) built into the networking devices themselves.

Core 6G Technologies

Leading North American ICT companies have developed the following blueprint of groundbreaking technologies and market opportunities that will fuel the next decade of investment and development. This important glimpse into the future provides a trajectory of technological advances where the U.S. can harness its research, development, standardization and production resources to lead the world. While innovation should not be limited to meet a common goal, there is a national benefit in defining a set of core technologies that will drive U.S. ingenuity and rapid development in the ICT sector. These core developments include:

- **AI-Enabled Advanced Networks and Services** – AI is already recognized as a breakthrough area of development that will significantly impact how people and things interact with one another and with their environment. Although the embedding of AI into consumer devices today provides an early view of the opportunities, those only hint at AI's full potential to improve society.

  5G and IT networks are already incorporating AI to better optimize performance and operation. But the real promise of AI will be realized as part of a holistic ecosystem, where massive network intelligence, combined with advanced device features and application awareness, enable a sea change of new capabilities that enrich our lives and make things previously deemed too complex a reality. Given the massive volume of devices and data that will connect and operate on these next generation networks, every technology component must be trustworthy from edge-to-edge. This will require the use of AI/ML to detect and defend, across the network. Early development in these areas will make the next decade the timeframe that fulfills the full promise of AI-enabled applications, with the U.S. being the innovation lab for the future.

- **Advanced Antennas and Radio Systems** – The future of wireless communications (both licensed and unlicensed) depends on rapid development and market availability of ultra-high-frequency devices that operate above 95GHz and in THz spectrum. These devices will be deployed in a highly dense manner to offer ubiquitous connectivity and optimized performance.

  This vision requires innovative approaches to design, placement and integration with networks, devices and public infrastructure. It also highlights the need for

industry, government and academic researchers to work cooperatively to leverage the full potential of advanced wireless solutions. This cooperation could include incentivized development and coordination between government and industry on issues such as placement, spectrum, safety and security. This will establish the U.S. as the commercialization leader that brings these advanced capabilities to market–*better, faster, everywhere.*

- **Multi-Access Network Services** – Integration of various types of terrestrial networks (wireless and fixed) with the growing potential for non-terrestrial solutions, such as unmanned aerial systems and satellites, will deliver ubiquitous reach over any terrain, geography or physical environment. Enterprise, consumer and government networks will leverage multiple access technologies, simultaneously, to deliver a level of performance unparalleled and nearly unconstrained.

  Equally important will be the opportunity to integrate territorial and non-terrestrial communications solutions that are self-sensing and combine ground, air and space communications to deliver applications such as ultra-high-definition positioning. This will be best achieved by encouraging research and investment in these multi-access solutions for the future. These adaptable networks, coupled with future-focused spectrum policies that encourage early development and cooperative solutions, position the U.S. to take full advantage of its resources and geographic diversity. The final component is an underlying foundation of privacy and security that is integrated into every access medium, where multi-path delivery enables an even higher level of security.

- **Healthcare** - By many estimates, healthcare spending is expected to exceed 20 percent of U.S. GDP in the next few years. These costs are directly borne by consumers, business and government. The current COVID-19 pandemic has demonstrated the need for government and industry to work together in the immediate term on innovative approaches to expanding telehealth capabilities and diagnosing patients outside of healthcare facilities. The country is taking remarkable steps to meet this challenge. As we look to the future, there will be many new opportunities for industry to partner with the healthcare industry on smart health, remote diagnostics and telesurgery, using new capabilities such as multi-sensory applications, the tactile internet and ultra-high-resolution 3D imagery.

With accelerated development in these areas, networks become a *smart and secure conduit* between providers and patients, offering the U.S. the opportunity to lead in the advanced delivery of high-quality healthcare applications. At the same time, rapid development in this area could significantly reduce the unrelenting increase in healthcare costs that depend on physical dispensing of healthcare services.

- **Agriculture** - It is estimated that the farming industry will need to produce 70 percent more food by 2050. *Agriculture 4.0: The Future of Farming Technology* (from the World Government Summit) notes the difficulty in applying water, fertilizers and pesticides uniformly across entire fields.

  In the future, technologies such as wireless sensors/IoT, robotics, autonomous farming vehicles, drones, satellite imagery, big data and AI will enable a new era of precision agriculture. This will ensure the most efficient, effective use of fertilizer, seeds, herbicides and pesticides and target very specific areas. Precision agriculture also will enable farming operations that don't require a single human to set foot in the fields. The U.S. is uniquely positioned to take on the challenge of leading the world in smart agriculture solutions that will meet future food consumption needs in both national and global markets.

Recommended Governmental Action to Spur 6G Leadership

Defining the technological breakthroughs that can lead the U.S. to sustainable technology leadership requires a commitment to a series of incentivized steps that will spur early investment, speed to market and widescale commercial adoption. Although free market principles should guide the thinking, the U.S. is competing with regions of the globe that greatly subsidize private sector development, violate intellectual property rights and sometimes inject unfair trade barriers. From an industry perspective, the U.S. can best counter these technology barriers by adopting a national plan for technological excellence that relies on a set of committed principles and actions:

First, the federal government should make available additional R&D funding focused on a core set of technological breakthrough areas where the U.S. can lead. These technologically focused areas, identified earlier in this document, leverage U.S. industry's key competency areas and promote both early consumer adoption and opportunities to sell U.S. developed and produced products and services into the global market. As highlighted in the recently released White House "National Strategy to Secure 5G" , U.S. leadership in the development and adoption of international standards,

coupled with agreement around a core set of principles and plan to incentivize market competitiveness, will lead to a responsible plan for the global development of 5G infrastructure. ATIS urges the government to acknowledge the important role that standards play in R&D and in the development and deployment of innovative technologies by confirming that the R&D funding would also include funding for enhanced governmental participation in those standards development organizations that are producing 6G standards.

Second, the government should expand R&D tax credits to encourage massive investment in a set of core technologies that will promote U.S. leadership. An expanded tier of R&D tax credits, including credits for industry participation in standards-setting, that can be directly attributed to a national framework of technology leadership areas would further incent industry to align around a set of common goals, promoting U.S. leadership in both development and adoption.

Third, the U.S. government should work with industry to develop a consumer- and business-centric solution to wireless spectrum challenges by creating a national spectrum policy. Recent experience has demonstrated that fast-tracking the availability of new wireless spectrum in both licensed and unlicensed bands can promote more rapid adoption by the market and accelerate innovation across industry. This spectrum policy should synchronize market needs with spectrum availability of low-, mid- and high-frequency spectrum to promote and encourage advanced applications to market — and realize the full benefits of U.S. leadership.

Fourth, the U.S. should explore innovative ways to promote widespread commercial adoption of U.S.-developed and -produced hardware/software through financial incentives to public and private sectors. Cities and other local municipalities can act as technology labs and innovation zones that promote U.S. technology leadership. These zones should also include rural markets, as U.S. leadership should also generate opportunities in the areas of smart agriculture, smart energy, remote learning and public safety. In addition, integration with vertical industries and enterprise markets as first adopters could be incentivized through tax credits and grant opportunities.

Conclusion: It is Time to Act

The industry is ready and willing to work with government to establish the U.S. as the unparalleled technology leader for the next decade of information technology and communications advancements. This opportunity comes at a critical time, as the country

tackles new global security and competitive challenges, while confronting the global COVID-19 pandemic. 5G will change how the U.S. defends the homeland, and the path to 6G will undoubtedly present new challenges and opportunities that can best be undertaken with strong government and industry collaboration.

The steps outlined in this call to action provide a pathway for the U.S. to embark on the next decade of unimaginable opportunity. Successful U.S. leadership demands a national commitment to technology leadership and excellence. Our future depends on it.

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