



**Investing in Telecom for Tomorrow's Innovations:**  
**Recommendations for Telecommunications Research and Development**  
**Addendum, December 17, 2009**

In this brief addendum we expand on two points raised in our recommendations; namely, Telecom Research in Other Countries and Focus and Benefits from Research in Proposed Technical Areas.

**Telecom Research in Other Countries**

Our initial comment provided an overview of telecom research efforts and programs underway in other countries. Many TIA member companies have considerable investments in both production facilities and research programs outside of the U.S. A major driver for this activity is the availability of funding and related investment incentives for ICT and broadband networking in other parts of the world. The European Union has significant funding available in telecom and ICT, in addition to many national programs in these areas (see example below). Importantly, these programs are industry-led and industry-focused with significant coordination with economic development offices, reflecting the criticality of a vibrant ICT industry for economic productivity across all sectors.

The leading countries in high-speed, nation-wide, fiber-based broadband networking are well-recognized. These countries, many in Asia, are attractive locations for research and innovation in services, service assurance, applications, security, and a number of other key areas, precisely because of their advanced networking infrastructure. This infrastructure provides a critical platform for continued advancement in areas such as telematics and tele-health. Lastly, it should be noted that it is increasingly possible to attract top-notch talent with training and experience in ICT in other parts of the world. This reflects not only other countries' investments in education in STEM, but also the wealth of opportunity in ICT and broadband networking that make these countries attractive locations for building and sustaining careers in telecom and engineering.

*Example: The European Framework Program*

The EU instituted the First Framework Program (FP) in 1984, which has been succeeded by six additional efforts, including the Seventh FP which began in 2007. These initiatives are intended as a blueprint for the future of research in Europe. They typically require 50/50 cost sharing and are joint efforts between the academic, research and industrial organizations. Over the past 10+ years, a number of U.S. companies including Motorola and Telcordia have participated in the FP through their European-based laboratories. The FP's have had a significant focus in the area of applied research and have themes; a common theme among the first six FPs was information society technologies (IST) which included networking, wireless communications. The amount of funding for IST has varied but has consistently exceeded 25% of the FP budget.

Examples of the major European telecommunication advances made possible through the EU Framework programs include:

- Advances in IPv6 technology
- Software defined Radio
- 5GHz WLAN
- 3G Wireless [from the 4<sup>th</sup> Framework CODIT and FRAMES projects)
- 60GHz wireless LAN technology (5<sup>th</sup> Framework BROADWAY project)

### **Focus and Benefits from Research in Proposed Technical Areas**

In our initial comment we identified four main technical areas, each with a number of sub-areas, for which additional research is needed. Below we provide some additional detail on the focus and benefits for each of these areas. To set the stage, however, we first offer the following quote from “High-Tech Industry Productivity and Hedonic Price Indices,” which speaks to the fundamental nature of the value delivered by advancements in high-tech industries such as ICT.

Technical change produces two kinds of improvements. In the first place one can lower the cost of doing what was done before. ... The second type of improvement wrought by technical change permits the user to do some task that was technologically impossible *at any price* in an earlier period.<sup>1</sup>

In each of the areas below part of the proposed research agenda is focused on doing existing things ‘cheaper, faster, better’ and part is focused on enabling fundamentally new capability. Both of these advancements are necessary if the U.S. is to attain and maintain leadership in critical broadband technologies.

**Universal Broadband:** Achieving affordable broadband access will substantially increase the participation in our economy for all citizens and businesses, regardless of geography, age, level of training, or disability status. This goal requires research to produce cost and performance breakthroughs in fundamental access technologies and deployment processes, as well as devices and interfaces to connect all Americans easily and inexpensively. Failure to achieve this goal leaves members of our society disenfranchised, depriving our economy of the benefits of their participation. Critical to achieving this goal, as broadband becomes ubiquitous and demand on the networks grow, additional research in key areas will be necessary to ensure sufficient capacity to meet escalating consumer demands. A number of these areas are itemized in our previous filing.

**Security:** America’s cyber-infrastructure is both the critical enabler of our information society and one of our most significant economic vulnerabilities. Strengthening the robustness and resilience of our broadband networks is necessary not only to protect against attacks, but also to reduce the current drag on productivity caused by malware and attacks. The negative impact of the ever-present and evolving viruses, worms, spam, hackers, and other intrusions, is significant, as is the effort currently expended to try and identify, isolate,

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<sup>1</sup> See “High-Tech Industry Productivity and Hedonic Price Indices,” Chapter 4 by Jack E. Triplett, Bureau of Economic Analysis, U.S. Department of Commerce, 1996.

patch, and work-around these security problems. Research is needed to significantly improve the security of operating systems and wireless networks and to develop better mechanisms for protection against malicious software and for restoration of network services. Research is also needed on fundamentally new architectures that are designed for security and robustness.

**Interoperable Mobility:** Interoperability of mobile networks, devices, and services is a key requirement of the public safety, emergency response, and law enforcement sectors. Considerable benefits in health, welfare, and safety can be achieved when these sectors have universal and coordinated access to all relevant information, including not only geo-location and health status data for both victims and first responders, but also information on local conditions (environment, weather, physical locations, etc.). Federally-funded research on interoperable mobility will also yield substantial value outside of the public safety arena in enabling any-time, any-where access to network services for commercial and business use.

**Telecom for Homeland Security:** As noted in our original filing, this area is a superset which encompasses a number of the topics above. Telecom underlies all components of our society and economy, from transportation, energy, and healthcare, to government and public safety. As part of the research agenda in telecom for homeland security, interrelationships and interdependencies among our critical infrastructure need to be identified and characterized, so that new protective mechanisms can be developed and deployed to resist attacks, mitigate vulnerabilities, and proactively defend our cyber-infrastructure.

ICT and broadband networking are fundamental drivers and enablers across the U.S. economy. To paraphrase a recent report by the National Academy of Engineering<sup>2</sup>, information and communications technology (ICT) “has transformed, and continues to transform, all aspects of our lives: commerce, education, employment, health care, manufacturing, government, national security, communications, entertainment, science, and engineering. [ICT] also helps drive the economy — both directly (the [ICT] sector itself) and indirectly (other sectors that are powered by advances in [ICT]).” Appropriately directed research and development in broadband delivers not only direct benefits to the telecom and ICT industries, but also substantial multiplier effects as innovations yield advances and productivity improvements in all other sectors.

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<sup>2</sup>National Academy of Engineering, Assessing the Impacts of Changes in the IT R&D Ecosystem: Retaining Leadership in an Increasingly Global Environment, 2009.

### Research Area #1 Universal Broadband

	Research Initiative	Description	Benefit
1	Deployment & operational cost	Research component, system, operational and application cost elements	Lower deployment and operational costs support sustainable broadband adoption
2	Improved access backhaul-wireless and wireline	Develop new technologies optimized for wide scale use in backhaul all users to the core network	Improves network performance and operational cost
3	Power efficiency in the data center	Investigate new means to reduce network power consumption by all electronic elements	Reduces operational cost, improves carbon footprint
4	Spectrum utilization and re-purposing	Develop new modulation technologies and allocation plans to optimize spectrum usage	Accommodates increasing number and capacity of broadband users.
5	Advanced last mile access	Research new means for accessing broadband users, including copper, fiber, RF and power lines	Allows network growth and fosters competition among various providers
6	Network interconnect speeds	Research into leading edge and core access speeds	Allows continued evolution of network speed and capacity
7	Network capacity- bandwidth to the user	Research into faster network and application processing speeds	Allows continued evolution of network speed and capacity
8	Next-generation test beds	Develop standard test facilities and methods for next gen. networks	Offers common evaluation criteria for various network topologies

### Research Area #2, Network Security

	Research Initiative	Description	Benefit
1	Secure operating systems	Develop enhanced, highly secure operating systems based on trusted sources	Assures network integrity and access only by those authorized
2	Wireless network security	Develop enhanced, highly secure wireless networks based on trusted sources	Assures network integrity and access only by those authorized
3	Digital rights management	Investigate novel means to manage copyright issues for users of voice, video and data	Delivers new means to avoid illegal copying of software
4	Complex network restoration	Research means to assure high network resilience at all layers	Improves network assurance in the face of terrorist attacks or natural disasters
5	Virus and malware protection	Continue research into elimination of unauthorized software or hardware virus	Improves network assurance and integrity

### Research Area #3: Public Safety Mobile Interoperability

**Research initiative:** Develop new technologies to unify mobile, land and fixed operations of fire, police, EMS and federal emergency agencies across the country.

**Benefit:** Improves effectiveness of these public safety agencies in the event of terrorist attacks or natural disasters.

### Research Area #4: Homeland Security Networks

**Research Initiative:** Develop a unified system to assure network interoperability, security, survivability and encryption specifically for US homeland security and critical infrastructure.

**Benefit:** Assures operation of critical electronic infrastructure in the event of attack or natural disaster.