Emerging Capabilities White Paper

What are Emerging Capabilities?

Technological advancements have shaped the transportation system, with new transportation technologies constantly occurring and making their way into the mainstream. These emerging capabilities have a way of re-shaping how we travel, live and move around. The use of mobile phones and Internet commerce are examples of emerging capabilities that are now widespread. These innovations provide enormous benefits, but their success cannot take place in a vacuum. Ensuring that emerging capabilities are properly examined and safely adapted for transportation use is an important part of the U.S. Department of Transportation's (USDOT) mission to ensure a fast, safe, efficient, accessible and convenient transportation system.

The USDOT's ITS Joint Program Office (ITS JPO) is responsible for the research, development, adoption and deployment of ITS work across the United States. The *ITS Strategic Plan 2015-2019* serves as the ITS JPO guide for ensuring ITS related work is implemented in a consistent and efficient manner. Within the Strategic Plan, the ITS JPO Emerging Capabilities program initiatives "focus on future generations of transportation systems." The JPO Strategic Plan recognizes that as technology continues to advance and as CV implementations increases, there is a need to assess emerging technologies to determine what, if any relevance they have to the Nation's transportation system. The ITS JPO not only examines emerging work taking place domestically, but works in partnership with international organizations to monitor advancements taking place across the world. The United States transportation system benefits when the best technologies and advancements can be implemented, regardless of where they come from.

Emerging Capabilities Benchmarks

The ITS JPO Strategic Plan identifies three main benefits of the Emerging Capabilities Program, which can be viewed as the high level benchmarks for the program:

- Forge strong relationships and partnerships with private industry and universities;
- Provide the ITS JPO with the ability to adapt existing or upcoming programs to accommodate new ITS technologies; and
- Stimulate economic growth through innovation and technological leadership.

The Emerging Capabilities Program will use these benchmarks as a guide to "track technological, market and demographic trends throughout the globe and across industries to seek and evaluate emerging capabilities that demonstrate the potential to transform transportation." As promising technologies are identified, the USDOT will conduct research, development, and technology adoption in a systematic manner, including identifying specific benefits to be obtained.

Forge strong relationships and partnerships with private industry and universities

The Emerging Capabilities Program starts by forming strong relationships with academia and private industry, from across the globe. The Emerging Capabilities program is specifically examining long-range

technological advances developed in the private sector and within research labs/organizations that can be applied to transportation. New technologies designed and invented for one purpose, such as cell phones and wireless communication, are rapidly being adapted for new purposes applicable to transportation, such as mobile phone travel applications and freight delivery systems. The Emerging Capabilities looks at all forms of capabilities, such as crowdsourcing and social media that might be applied to transportation.

Private industry and universities are important drivers of innovation. Cutting edge research often spurs the next big idea or product. Examples include technology companies and automobile manufacturers that are working to develop the next generation of autonomous vehicles or unique ridesharing platforms. Private industry has the capital and the capabilities to disrupt entire industries by revolutionizing how we move and get around. The ITS JPO stays abreast of these developments and considers their technical, policy, and institutional implications on the Nation's transportation system.

Provide the ITS JPO with the ability to adapt existing or upcoming programs to accommodate new ITS technologies

An area of particular interest to the Emerging Capabilities is the use of information and communications technology to improve mobility for people with disabilities, older adults, and other traditionally disadvantaged travelers, an area that might not be adequately addressed by private sector research. The Emerging Capabilities monitors research that might someday evolve into a more extensive research program. In addition, the ITS JPO is continually working towards discovering the next travel advancement which could become the next JPO focus as was the case with connected and automated vehicles. Examples of work the JPO is considering include changes in alternative vehicle fuels, potential increases in electric vehicles, and changes to mobility and demand including effects on a jurisdiction's revenue stream.

Stimulate economic growth through innovation and technological leadership

Innovation is what has allowed the United States to become a leader in global transportation. The USDOT is positioning itself to maintain this leadership through the next level of transportation advancements, both technologically and demographically driven. The future of transportation has the potential to significantly change the way we get around, and the JPO is ensuring that the USDOT and the nation is prepared for these transformations.

Emerging capabilities have the potential to create entirely new products, services and information that will require research and development. Manufacturers of current technologies face the challenge of hiring new generations of engineers and technologists to stay ahead of current trends. Other economic impacts arise from the manufacturing of new devices and vehicles as well as the sales and maintenance of next generation ITS and connected, autonomous, and electric vehicles.

Current Emerging Capabilities Projects

The Emerging Capabilities program comprises a portfolio of research projects undertaken by the ITS JPO:

- **The Accessible Transportation Technologies Research Initiative (ATTRI)** is focusing research on ways that technology can improve the mobility of travelers with disabilities by leveraging recent advances in vehicle, infrastructure, and pedestrian-based technologies, as well as accessible data, mobile computing, robotics, artificial intelligence, object detection, and navigation.
- The **Decision Support Systems (DSS)** project is a system-centric research initiative which leverages connected travelers and multimodal transportation management to develop real-time operational decision-making, optimizing performance. Under DSS, the system is not just focused on Transportation System Management and Operations (TSMO), but instead serves all users of the transportation network, recognizing the interaction between all users of the transportation system.
- The **Saint Lawrence Seaway ITS** Concept project represents emerging work in the use of ITS technology in maritime transportation. Other work involves Innovative Research Solutions and Small Business Innovative Research which seek to take advantage of projects and technology work being undertaken by outside organizations and small business.
- Research into the rapid acceleration of the **Internet of Things (IoT)** is creating a connected environment where any "thing" has the ability to be remotely connected into the Internet. This potentially allows for numerous connected devices to be on the network. IoT work is being undertaken by manufactures in industries as varied as automobiles to refrigerators, and has the potential to connect vehicles and travelers in new and dynamic ways. This connectivity will play an important role in the USDOT's Smart Cities Challenge project.
- Advances in **robotics** have the potential to influence JPO project work and to revolutionize mobility and travel. The ATTRI program is studying innovative ways that robotics can be implemented in a way to increase the mobility for persons with disabilities and eventually transfer that knowledge to benefit all travelers. JPO staff members have held meetings with other federal agencies such as NASA to discuss collaboration and the potential for cross overs between project works.
- Advances **in virtual reality** and **artificial intelligence (AI)** show promise for the nation's transportation network. Potential uses of these technologies include human factors research with heads-up display units (HDU's) for transit or private motor vehicles and new ways of creating visualization aids to aid drivers and other transportation system users. Artificial intelligence holds the potential for creating revolutionary changes in predictive modeling, and is another area of study.

Collaboration between the JPO and both other Federal agencies and private organizations is an important aspect of the Emerging Capabilities program. Currently, the Emerging Capabilities projects are working with in partnership with Federal agencies such as the Department of Labor, National Institute on Disability, Independent Living and Rehabilitation Research (NIDILLR), US Army, and many others to tackle the challenging issue of accessible transportation. Other work involves partnerships with academia, international groups such as the European Union's City Mobil2 project, and private industry.

What is the USDOT Role in Emerging Capabilities?

Technology and advancements are extremely fast paced. Technology trends are rapidly evolving, and new products and ideas are constantly appearing on the market. The ITS JPO's Emerging Capabilities Program allows the USDOT to stay ahead of trends and to be constantly seeking out new, innovative and disruptive ideas to improve the transportation system. The USDOT is positioning itself to serve as a leader in guiding the research, development and technology adoption of these innovations in a systematic manner.

Successful ITS research has increased our ability to monitor incidents on highways, which has allowed for rapid response to vehicle incidents or security events for safety. Environmental benefits can be seen in new transportation technologies which lower fuel consumption, reduce emission output, and reduce our overall impacts on the environment. By supporting innovative technologies, there is the potential to create and expand new industries and markets. For example, advancements in connected vehicles are producing new market needs for engineers, computer programmers, application developers and technologists.

The USDOT is committed to ensuring that new transportation technologies are used in ways to improve and increase accessibility for all. Many of the advancements that are becoming available have great potential to increase benefits for travelers with disabilities and older adults. It is the role of the government to encourage manufactures and technologist to ensure that opportunities and benefits can be shared by all.

What is next?

The JPO is a forward looking organization that involves the evaluation and research of intelligent transportation systems. The JPO sees the Emerging Capabilities program area as a way to evaluate and examine what the next big breakthrough in transportation will be and how it can be harnessed to benefit our nation's transportation network. As transportation trends continue to change and expand, the JPO will strive towards ensuring all advancements are evaluated and considered. While connected vehicles and autonomous travel are beginning to gain traction in both the automobile and technology industries, the JPO recognizes the need to stay ahead and be prepared to answer the question of "what comes next?"

For more information please visit the JPO website: http://www.its.dot.gov/