

NextGen Wireless Communications Test Bed

This white paper suggests the development of a NextGen Wireless Communications Test Bed to provide an adaptable, open architecture to harness emerging technologies and develop performance based metrics and benchmarking methodologies. The current wireless ecosystem is exploding with several technologies that have the potential to dramatically elevate transportation applications and DOT operations. ***The viability of these technologies must be assessed as early as possible in order to effectively incorporate them in deployment given the historically long lead times in procurements.*** A NextGen test bed will enable the DOT to leverage the significant research investment of other Federal agencies as well as engage the consumer industry's economies of scale, and foster economically sustainable service provider business models. A flexible infrastructure and real world roadway environment is required in concert with a safe, controlled setting in order to entice government, industry, and academia.

Examples of NextGen technology that are available today, summarized in Table 1, include software defined radios (SDR) and cognitive radio technologies, which are actively employed by other agencies such as the Federal Rail Administration and the Departments of Defense and Justice. These agencies share transportation's needs for robust, interoperable, and adaptable wireless communications. Cellular based technologies such as short range Femto cells will explode into the consumer market by late 2009. This medium along with mobile WiMAX has significant potential for vehicular communications while simultaneously engaging cellular service provider business models. Similarly, whitespace devices utilizing unused spectrum enable long range backhaul for transportation infrastructure and mobile connectivity.

Table 1. NextGen Wireless Test Bed Technologies

Technology	Benefits
SDR and Cognitive Radio (CR)	<ul style="list-style-type: none">• Enables Interoperability• Situational Awareness• Adaptable, self managing• Future proof
Whitespace	<ul style="list-style-type: none">• High bandwidth• Long range propagation characteristics• Future economies of scale
Femto Cell DSRC	<ul style="list-style-type: none">• Service provider business model• Leverage very low cost technology• Stepping stone to 4G
Mobile WiMAX	<ul style="list-style-type: none">• Specifically designed for mobility
V2V MANET	<ul style="list-style-type: none">• Optimize V2V Safety / Mobility
GPS Spoofing detection and Countermeasures	<ul style="list-style-type: none">• Safety critically dependent on GPS• Congestion pricing, location based taxing creates incentives to spoof

Along with specific technologies, a NextGen test bed must incorporate a future vision towards applications research, such as mobile ad hoc networks (MANET) which are required to fully realize the potential safety and mobility. Similarly, security vulnerabilities of critical functions must be investigated early in order to intimately integrate countermeasures with architecture development.

The success of safety and mobility systems is critically dependent on wireless communications. Several emerging technologies are available today and must be vetted in a transportation specific environment to determine their true viability. A NextGen Wireless Communications Test Bed built upon an open, flexible architecture can provide the U.S. DOT with a venue for effectively identifying and transitioning the best technologies into the transportation framework.