

## Enabling Robust Disaster Communications with Existing Infrastructure

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The ability of disaster victims to communicate with rescuers, as well as the ability of rescuers to communicate amongst themselves, is a key element of effective disaster response. However, even with the relatively modern and costly communications gear deployed by most emergency response organizations, experience from recent disasters has shown that significant shortcomings still exist in this area. To solve this multi-faceted problem, a variety of challenges, ranging from technology to cost to political and social issues, will have to be addressed. This research will develop an approach to enhance basic emergency communications that reduces cost and implementation time and increases acceptance by and utility to the general population, through using existing infrastructure and proven solutions of minimal complexity.

The currently fielded emergency communications infrastructure consists mainly of two different and separate systems: widespread, low-cost and easy-to-operate communications equipment (telephones and cell phones) that allow victims to communicate with the Public Safety Answering Points (PSAPs, i.e. 911 centers) operated by emergency response agencies; and relatively expensive and complex dedicated communications equipment (public safety radio transceivers and associated repeaters) that operate based on completely different technical and operational protocols. Both systems rely on bandwidth-intensive real-time two-way voice communication, but are mutually incompatible. In addition, experience has shown that in case of major disasters, telephone lines can get interrupted, cell phone networks and PSAPs can be rendered ineffective by excessive call volume, and public safety radio networks can fail due to overloading and equipment incompatibilities.

Addressing these issues directly, either by significantly upgrading the existing voice communication capabilities or by introducing new, dedicated systems for victim-responder and inter-responder emergency communication, will likely be cost-prohibitive, may face significant bureaucratic hurdles, and would introduce additional complexity. In addition, only a small fraction of the general population could be expected to acquire, maintain and carry dedicated emergency communication devices solely for the purpose of being prepared for the rare major emergency, and overall life-saving impact would therefore be minimized. Consequently, any approach should preferably be based on already-existing, disaster-proven infrastructure, and on equipment that is normally within reach of the average citizen.

This research will therefore focus on a communications mode that is available to the majority of citizens and that has proven its value in several recent disasters, from the September 11 attacks to Hurricane Katrina: the “Short Message Service” (SMS), a text messaging feature that is available on most modern cellular phones. SMS messages are transmitted by the cell phone infrastructure on a store-and-forward basis. Therefore they use very little bandwidth and cell phone battery power when compared to real-time voice traffic. Due to their text-based nature, they are particularly suited for the transmission of critical data such as emergency locations, and for automated processing by the recipient. The short message length (160 characters) is acceptable for emergency communications in major disasters, where only the location and key situational details need to be transmitted by a victim.

There are almost 200 million cell phone users in the US, and most carry their cell phone wherever they go – thus ensuring it will be available in case of emergency. Cell phones are also carried by many public safety professionals, whether as a backup in case of radio failure, or to allow them to be reached by their families and friends while on the job. This makes SMS a viable backup communications system for emergency responders as well.

However, several issues will have to be addressed before a text message-based 911 equivalent (“T911”) can be implemented. Among them are: enabling PSAPs to handle SMS traffic; advertising and promoting the use of T911; facilitating emergency text messaging by making cell phone SMS interfaces more user friendly; and (im)proving the robustness and surge capacity of existing cell phone networks with regard to SMS traffic.

This research will take a closer look at the current state of both emergency communications systems and the SMS infrastructure, define the elements needed for a basic T911 capability and any potential enhanced versions, develop solutions to the issues outlined above, and attempt to quantify the resulting improvement in emergency communication capability through agent-based modeling, simulation and analysis of the proposed T911 system.