

The Promise of Cognitive Radio for Communications and Remote Sensing for Critical Infrastructure, Disaster, Safety, and Risk Management

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Public safety and disaster communications are hampered by problems of interoperability and dependence on critical infrastructure, particularly base stations and repeaters requiring fiber or wire backhaul and reliable primary power. Under normal conditions these are masked by workarounds (mutual aid agreements between nearby agencies, multiple radios in police cars, batteries and gasoline powered generators at base stations, etc.), but they become very obvious when disaster strikes, as in the case of New Orleans during Hurricane Katrina. Cognitive radios (transceivers that are aware of their RF and physical environments, able to take intelligent action based on that awareness to perform their mission and capable of learning from experience) offer attractive solutions to the interoperability and infrastructure problems. Integrating cognitive radios with small autonomous aerial vehicles (which like the radios survey their environments and take intelligent action) enhances the value of both, allowing the vehicles to consider communications requirements like propagation conditions and interference when they position themselves while providing real-time three-dimensional data from their sensors to track smoke, toxic plumes, structural damage, etc. This presentation reviews practical cognitive radio technology, particularly as applied to public safety and disaster management, and describes both some recent prototypes and ongoing research toward networks of autonomous vehicles that combine environmental sensing, intelligent response, and learning in a single “brain” that controls many aspects of motion control and radio operation.