# Improved Throughput Coverage in Natural Disasters:  Unmanned Aerial Base Stations for Public-Safety Communications

**Names: …**

**Background of the Problem and Motivations:**

Communications play an important role during public-safety operations. Because the current communication technologies heavily rely on the backbone network, the failure of base stations (BSs) due to natural disasters or malevolent attacks causes communication difficulties for public-safety and emergency communications. Recently, the use of unmanned aerial vehicles (UAVs), such as quadcopters and gliders, has gained attention in public-safety communications (PSCs). They can be operated as unmanned aerial BSs (UABSs), which can be deployed rapidly as a part of the heterogeneous-network (HetNet) architecture. However, due to their mobile characteristics, interference management in the network becomes challenging.

PSCs are vital to saving lives, property, and national infrastructure in case of incidents such as fires, terrorist attacks, and natural disasters. Until recently, PSCs have been handled through narrowband communication technologies [such as the land mobile radio (LMR)], which can deliver reliable voice communications but do not support broadband data and are also often limited in terms of coverage and interoperability. The National Broadband Plan by the U.S. Federal Communications Commission states that a cutting-edge PSC shall make use of broadband technologies “to allow first responders anywhere in the nation to send and receive critical voice, video, and data to save lives, reduce injuries, and prevent acts of crime and terror.”

Broadband wireless technologies, such as fourth-generation long-term evolution (LTE), have a strong potential for revolutionizing communications during public-safety situations. Although the legacy LMR technology can provide better cell coverage and range compared to LTE for PSC applications, LTE technology can offer substantially higher data rates, which are critical for services such as real-time situational awareness. Exploiting the features of LTE systems will be essential for transforming the PSC infrastructure from a capacity-limited platform into a high-speed communication infrastructure. For example, efforts to develop the first nationwide, LTE-based, high-speed PSC network, FirstNet, are in progress in the United States.

**Objectives:**

In this work, we aim to explore the use of UABSs for PSCs during natural disasters, where part of the communication infrastructure becomes damaged and dysfunctional (e.g., as in the aftermath of the 2011 earthquake and tsunami in Japan). Through our (planned and expected) simulations, we (will) analyze the throughput gains that can be obtained by exploiting the mobility feature of the UAVs. We (will) use a genetic algorithm (GA) to optimize the locations of UABSs. Our simulation results (may) show that, when there is loss of network infrastructure, the deployment of UABSs at optimized locations can improve the throughput coverage and the fifth-percentile throughput of the network.