University of California - Humboldt State University Letter of Intent
submitted to

NSF 14-581 – Hazard SEES - Interdisciplinary Research in Hazards and Disasters

The Value of Earthquake Early Warning: Evaluating the Engineering, Business, Legal and Societal Aspects and Benefits of Broad Adoption

Synopsis: In recent years there have been great advances in the science of earthquake early warning (EEW). Anecdotal evidence from the 2011 magnitude 9 Tohoku-Oki earthquake in Japan suggests that early warning issued in seconds following the instrumental detection of the event provided enough warning for trains to decelerate, manufacturing to cease, and individuals to take cover under desks. More recently, in the 2014 Napa earthquake (EQ), the demonstration early warning system in California triggered an alert 5.1 seconds after the initiation EQ of the event. This provided 8 seconds of warning in San Francisco, but no warning in Napa. While it is now clear that EEW is viable, the issue is whether this technology should be broadly embraced and, if it should, then how it should be implemented in various settings to improve the resiliency of lifelines and other infrastructure, support business survival, and, of course, minimize the loss of life.

The proposed research project will investigate potential values and implementation issues presented by an EEW system. While the science of EEW has made significant strides in recent years, the engineering, economic/business, legal, and public policy benefits of the investment in a large scale deployment of such a system are yet to be explored. This is the thrust of the proposed multidisciplinary research effort.

Using a probabilistic framework, we will quantify the likely distribution of warning times, shaking intensities, and warning certainties for a variety of EQ scenarios. We will use simulations to evaluate the value and cost-benefit of taking a variety of actions, including both automated responses for infrastructure and facilities, and individual protective measures, and will integrate EEW into models of business resumption. We will explore the legal aspects of EEW including liability issues associated with both implementing EEW and choosing not to implement, and will consider the pubic policy actions necessary for an effective system. Finally, education will be a key factor in any EEW implementation and we will develop a plan to educate those who can most benefit from EEW.

Project Plan and Team: Developing realistic models of appropriate applications of EEW with demonstrable net benefits, requires close collaboration of researchers from a range of disciplines covering the science of EEW, engineering of structures (including both physical structures and the cybernetics of the warning system itself) and infrastructure, business model development, law, public policy, and social aspects of risk and risk communication including development of an educational plan. We will also interact with industry and government partners to assure both the validity of the assumptions about impacts of earthquakes and EEW in real-world situations, and the utility of the applications and analysis developed as part of the project. Existing partners include PG&E, BART, Cities of San Francisco and Berkeley, Google, and Deutsche Telecom; others will be added. We have assembled a team with the right skills to address this challenge in a close, collaborative fashion. Progress on the project will be accompanied by regular communication and workshops among project personnel, and with outside partners to ensure that ideas and implementation of analyses are meaningfully integrated toward a realistic and objective evaluation of the value of EEW to society.

Senior personnel:

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