Technology to Increase Societal and Infrastructure Resiliency when Exposed to Major Natural Hazards

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Current Practice

Simulation tools to predict and forecast hazards improving:

- * Powerful computational tools available to predict hazard events
- Provide early warning for certain hazards (e.g., typhoons/hurricanes)

Instrumentation more common in recent years:

- Environmental monitoring (weather, seismicity, etc)
- Strong ground motion programs densely instrumented critical structures
- Understand structure behavior during strong ground motions



Hurricanes can be sensed and forcasted Hurricane Katrina, New Orleans, Aug. 29, 2005



Structures instrumented with sensors Transamerica Building (36 channels)

Jerome P. Lynch, University of Michigan (Working Group #2) US-Taiwan Workshop on the Advancement of Societal Response to Mega-Disasters afflicting Mega-Cities



Emerging "Sensing" Technologies

• Sensor networks:

- * Networks of wireless or wired sensors that are low-cost and small
- * Large numbers offset their lower levels of accuracy
- Can be deployed through out the natural and built environments
- * Peer-to-peer networking and asynchronous connectivity

Cellular "sensing":

- * Cell phones are low-cost and fairly ubiquitous means of communication
- Decentralized and more resilient to tethered communication systems
- Offer powerful new sensing modalities for natural hazard applications
- Different sensing modalities offered (movement, location, sound, picture)
- **Social networking technology an untapped resource:**
 - * Tools like Twitter, Facebook, etc could be used to sense the public
 - * Potential means of rapid information diffusion and control of public actions



Information Fusion

- Sensor deployment is a double-edge sword:
 - Low-costs driving demand for denser instrumentations
 - * Data management and decision making can be paralyzed by *too much* data
- Cyber-infrastructure solutions:
 - * Sensors and sensing data can be seamlessly integrated with modeling tools
 - Model updating of high-fidelity models
- How to handle non-traditional data regarding people and their behavior with more physics-based modeling tools?
 - Social science combined with physical sciences and engineering
- **Information is needed for decision making not necessarily data:**
 - The need for tools that successfully bridge data generation and decision making is the grand challenge going forward

