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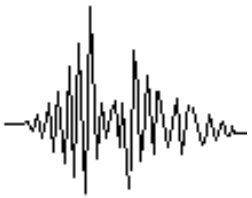
NSMP

Since 1932



U.S. NATIONAL STRONG MOTION PROGRAM

STRUCTURAL INSTURMENTATION

Dr. Erol Kalkan, P.E.

Senior Research Engineer
Manager – National Strong Motion Network

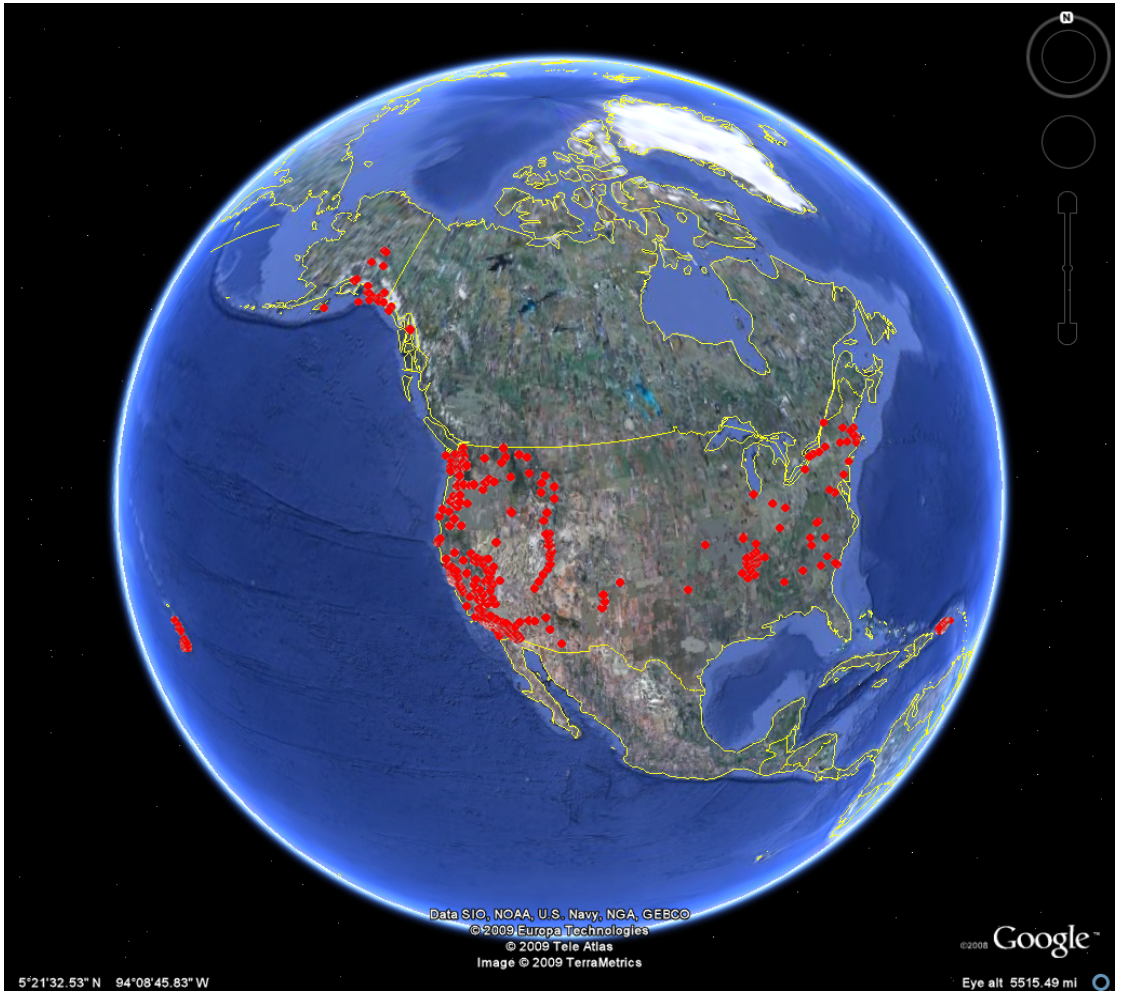
University of Southern California, Jan. 26, 2010

NSMP SEISMIC NETWORK

Over 1000 recorders in seismic zones.

Distributed over 34 states including

AK, HI, PR, the Virgin Islands and Haiti.



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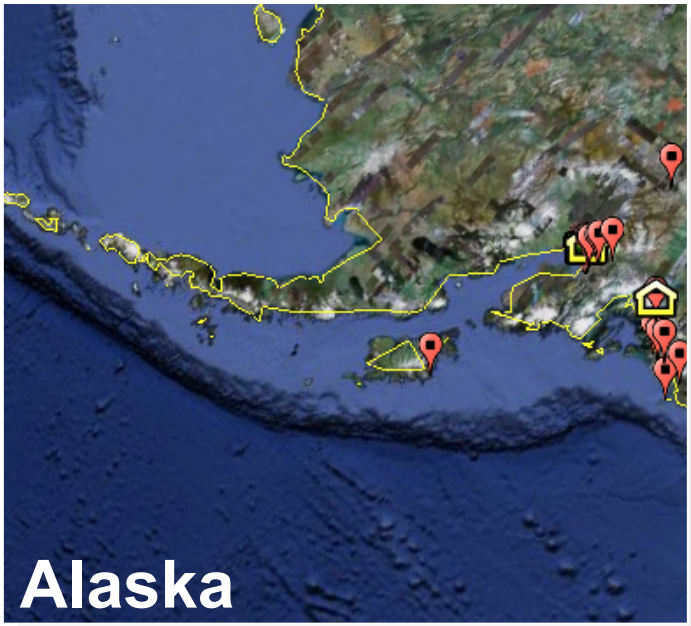

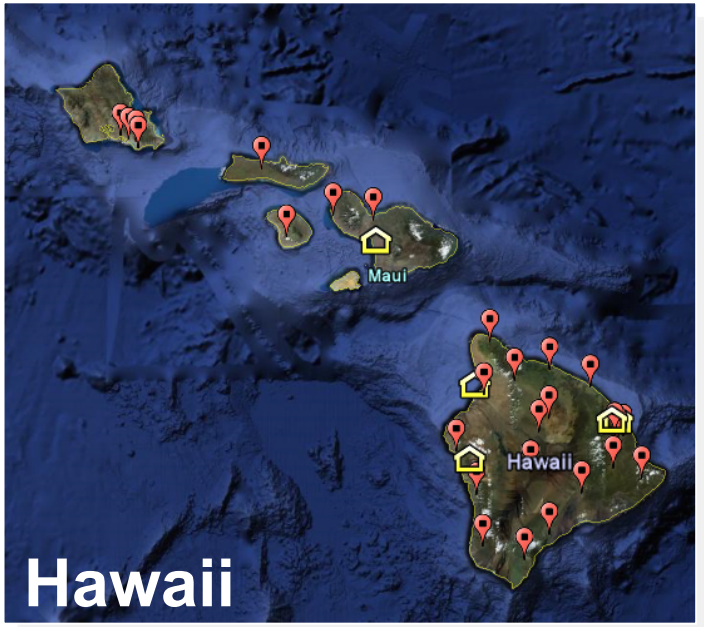

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NSMP INSTALLATION TYPES

Freefield and reference sites

485 sites (238 dialup, 96 real time, 151 no telecomm)

USGS NP-1484
CA: Lake Success Dam

USGS NP-1790
CA: Burlingame - Fire Station 36

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NSMP INSTALLATION TYPES

Building structures

137 arrays, 214 recorders (108 dialup, 7 realtime)

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NSMP INSTALLATION TYPES

Bridges and highway overpasses

17 arrays, 39 recorders (4 dialup, 3 realtime)

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NSMP INSTALLATION TYPES

Dams

73 arrays, 237 recorders (32 dialup)

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PARTNER AGENCIES

- U.S. Army Corp of Engineers (ACOE)
- U.S. Department of Veterans Affairs (VA)
- Oregon Department of Transportation (ODOT)
- University of Puerto Rico (UPR)
- U.S. General Services Administration (GSA)
- NASA, Jet Propulsion Laboratory (JPL)
- Los Angeles Department of Public Works (LDPW)
- California Department of Water Resources (CDWR)
- Metropolitan Water District of Southern California (MWD)
- Imperial County (CA) Landfill (ICL)
- County and City of San Francisco (CCSF)
- University of Alaska (UAA and UAF)
- Utah, Salt Lake City Corporation (SLCC)
- University of California, Los Angeles (UCLA)
- Utah Department of Transportation (UDOT)
- Brigham Young University (BYU)
- Utah Geological Survey (UGS)
- Washington Department of Natural Resources (WDNR)

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NSMP PRODUCTS

- **Time series**
  - Corrected (baseline removal, acausal bandpass filter)
    - Acceleration
    - Velocity
    - Displacement
    - Angular acceleration, velocity, tilt
    - Relative displacement (GPS and RDS)
- **Peak motions** (→ ShakeMap + ShakeCast)
  - PGA, PGV, PSA at 0.3, 1 and 3.0 sec
- **Response Spectra**

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DATA DISSEMINATION

- Center for Engineering Strong Motion Data (CESMD)

  Cooperative effort with the

  CGS Strong Motion Instrument Program

  (http://www.strongmotioncenter.org)

- National Strong Motion Program

  (http://nsmp.wr.usgs.gov)

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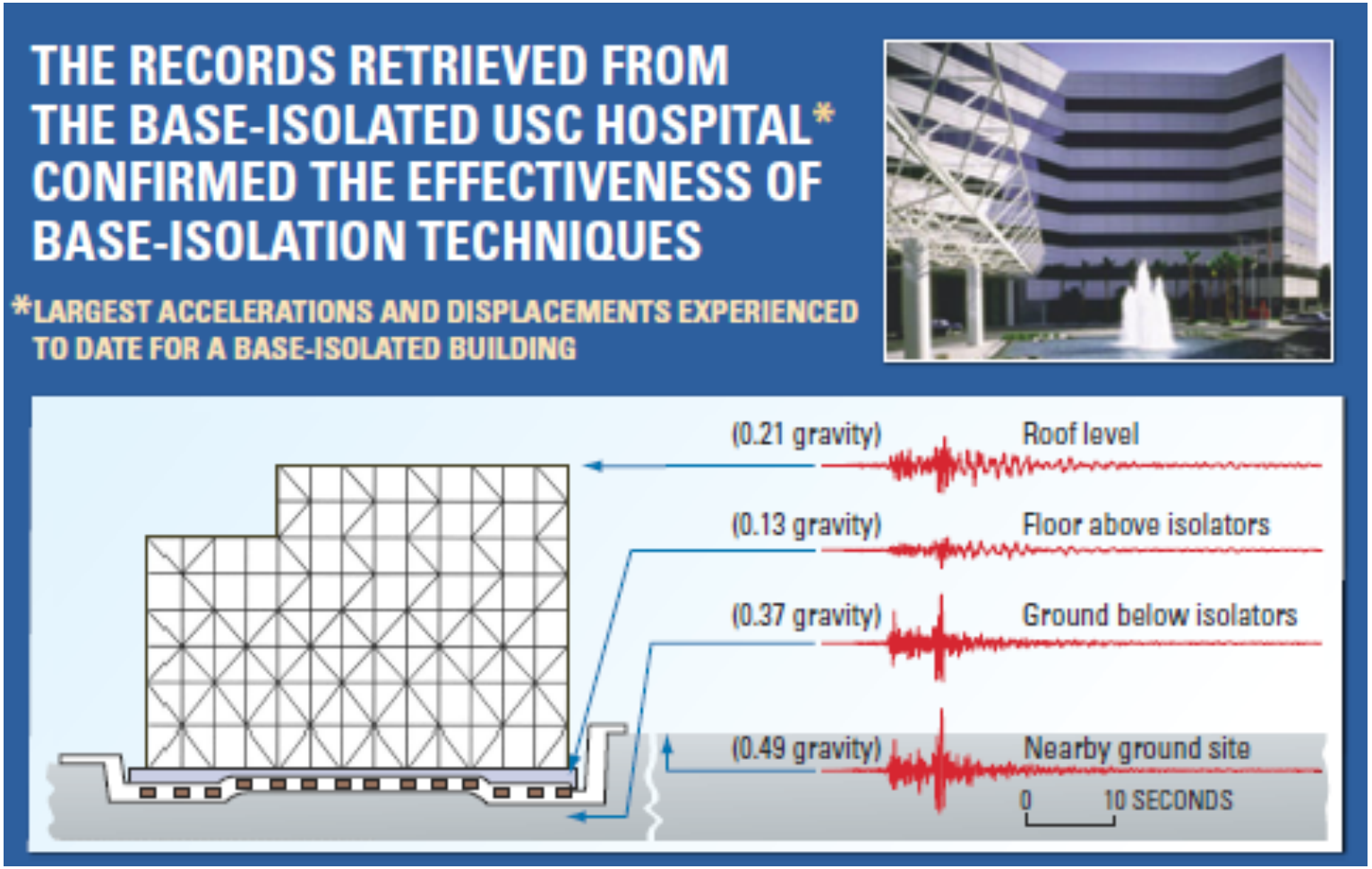
BUILDING INSTRUMENTATION



To improve design and retrofitting guidelines and facilitate research studies to understand dynamic of structures, soil structure interaction effects.

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USGS – VETERAN ADMINISTRATION COOPERATIVE WORK (CURRENT PROJECT)

- 5.9 million dollar project to be completed in 2.5 years.
- Total of 30 hospitals are planned to be densely instrumented (including free-field reference sites).
- 4 hospitals has been instrumented in 2009FY, 11 structures are planned for 2010FY and 15 for 2011FY.
- USGS - NSMP not only conducts installation but also maintenances.

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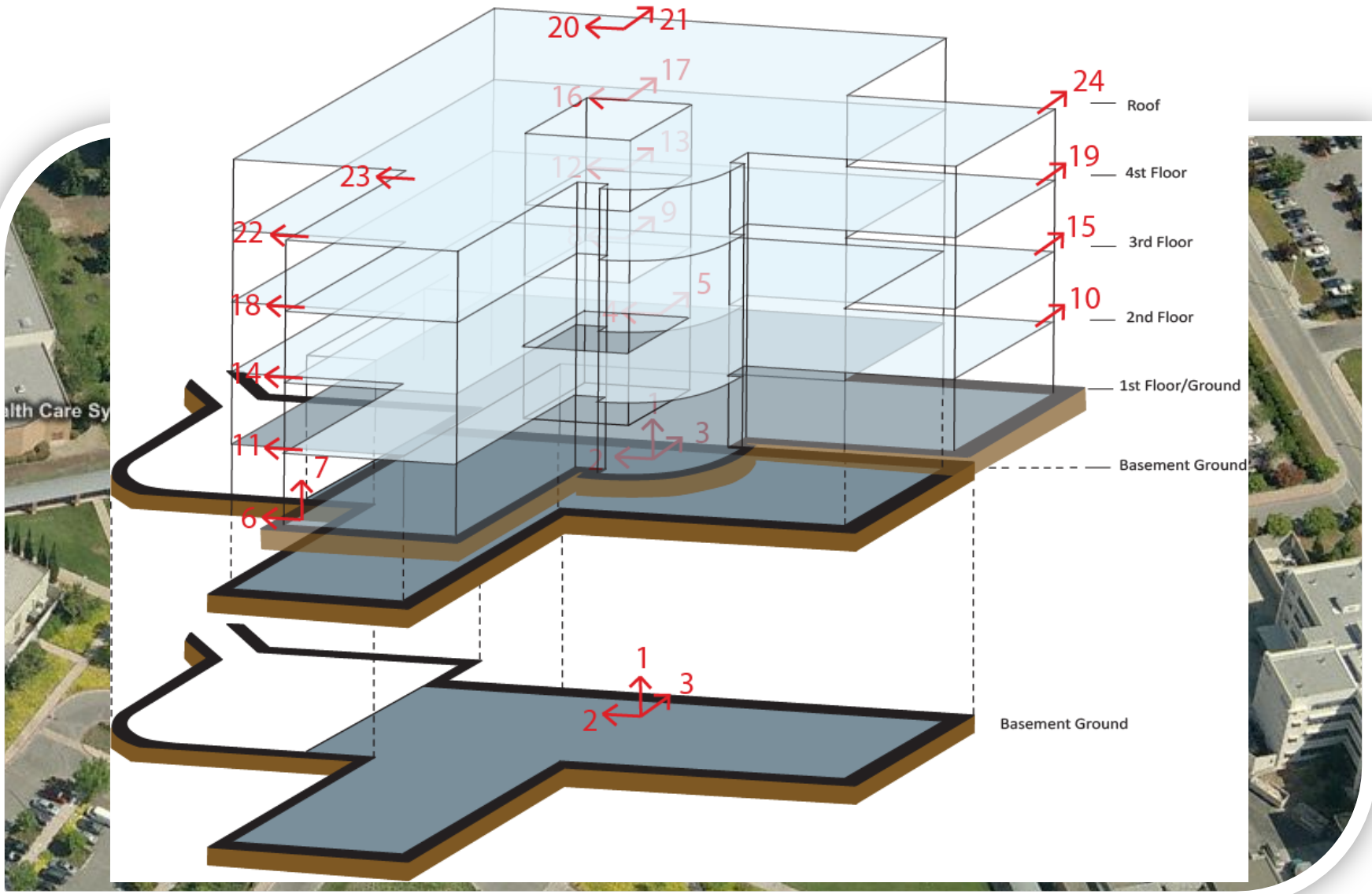

VA MEDICAL CENTER - PALO ALTO

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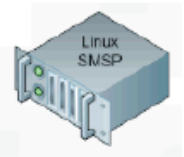
USGS - STRUCTURAL HEALTH MONITORING SYSTEM

- Local server and display in the lobby or in the engineering office.
- Web-based continuous health status monitoring.
- Real time damage alerting system (via e-mail, SMS message).
- Long-term health monitoring.

Sensor and digitizers are installed on every floor. Above are some example digitizers.

2 Structure Monitoring System Processor (SMSP)



This computer may be installed in a rack in a server room in the building, or some other non-public location.

3 On-site Display

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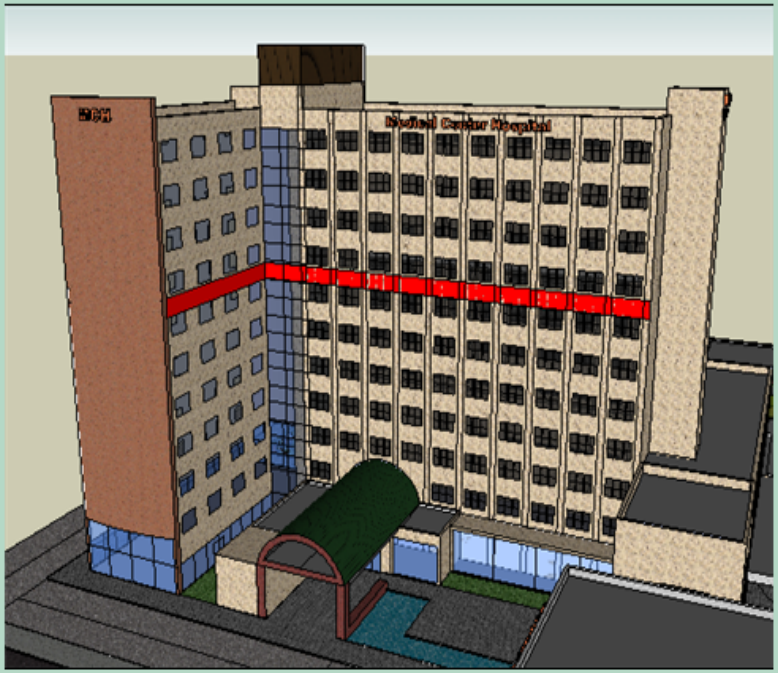
NESMP Monitoring
San Gabriel V.A. Hospital

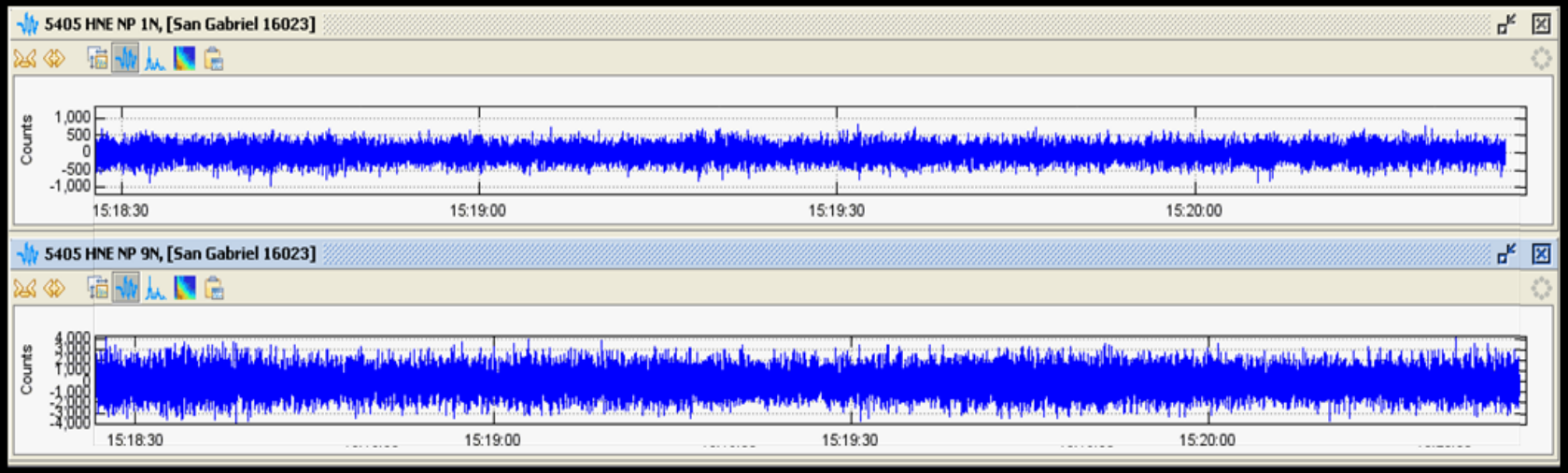
- Region: Southern California
- GPS: Thu Oct 29 01:07:08 UTC 2009
- Instrument voltage constant at 12
- 200 Samples Per Second
- 8 Sensors
- GPS lock; 7 satellites acquired

WARNING: Floor 8: drift thresholds exceeded

- ST/LT values, buffer length
- 2 trigger modules reported triggering



Click on the icons above to check different views.



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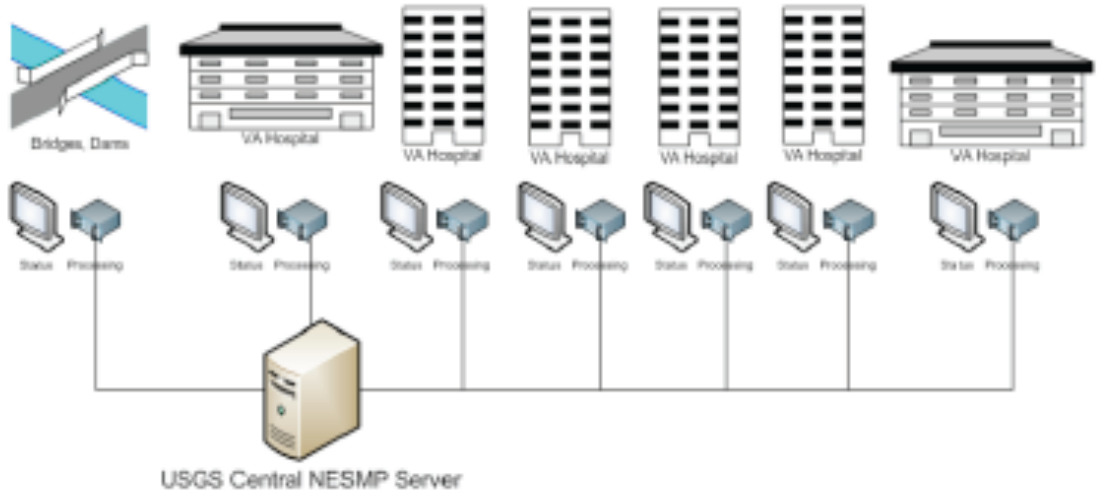

Central Engineer Monitoring

- USGS NSMP will maintain system integrity and its health in real time and keep updates.
- NSMP will also maintain the recording units (periodic battery changes – firmware updates)

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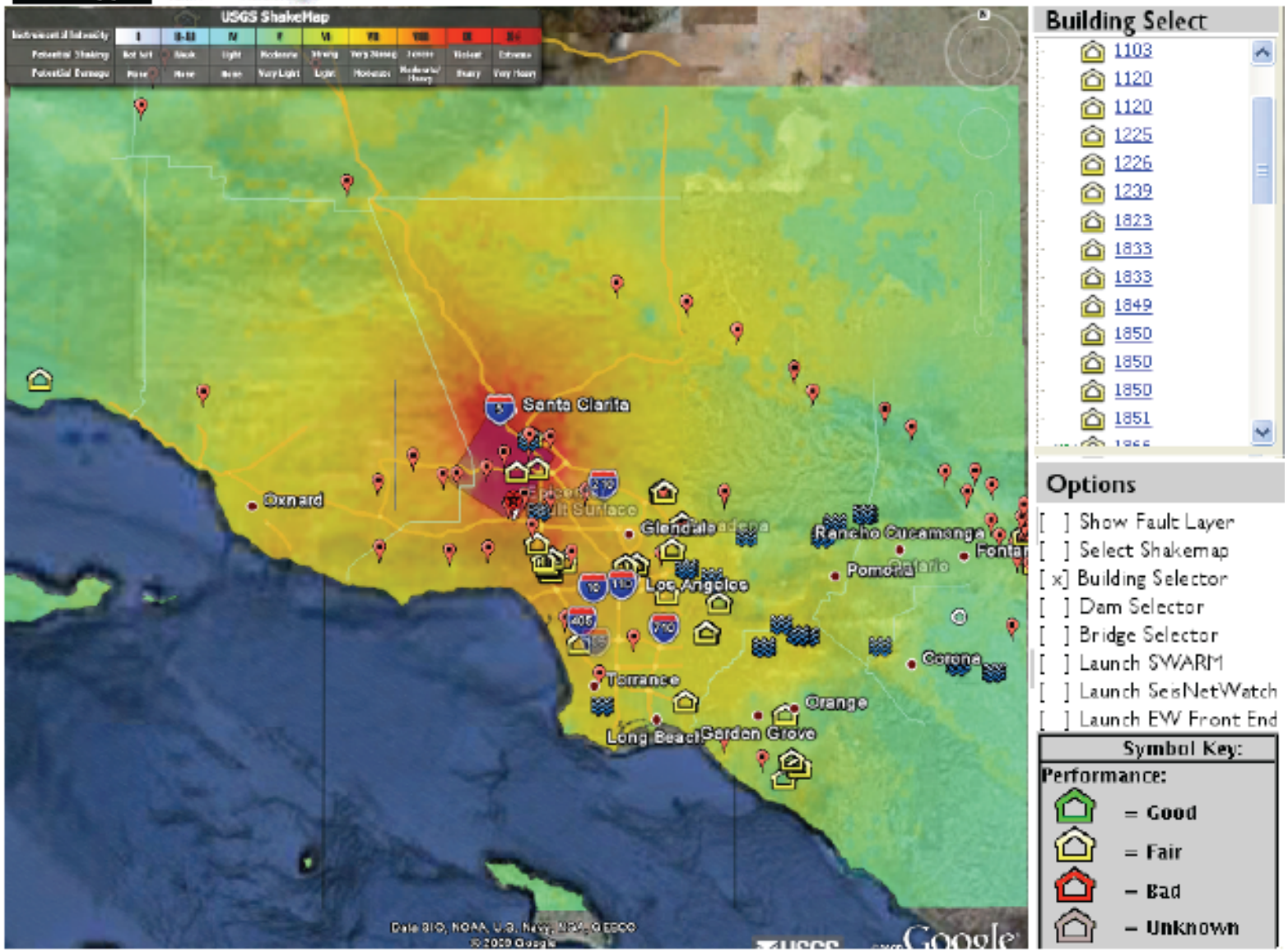
Structure Monitoring and Status Display



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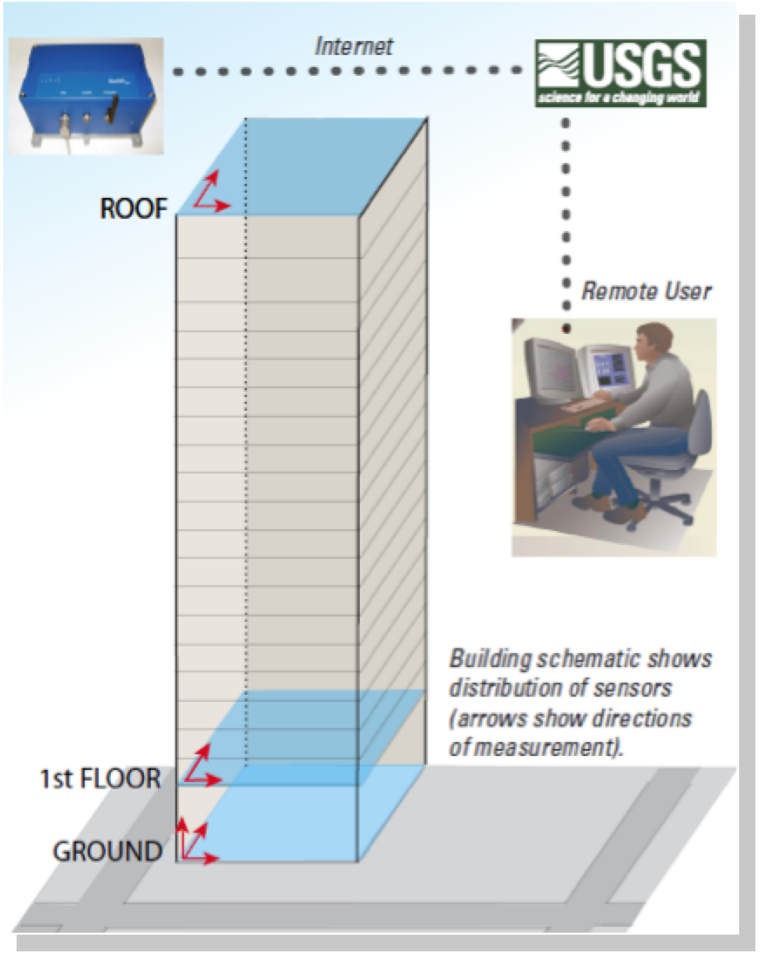
WIRELESS SYSTEM FOR HEALTH MONITORING (CURRENT EFFORTS)

Wireless units



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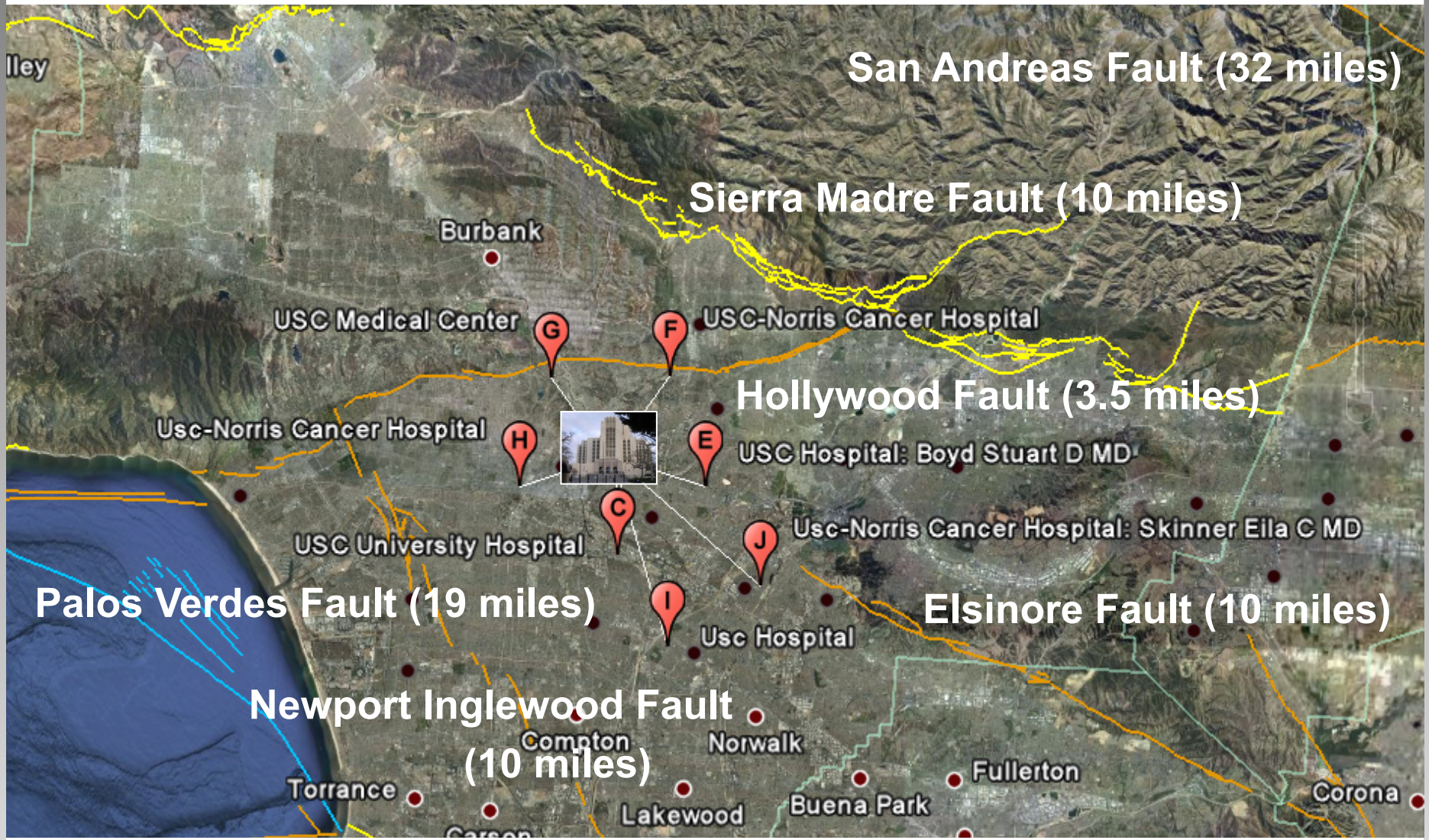

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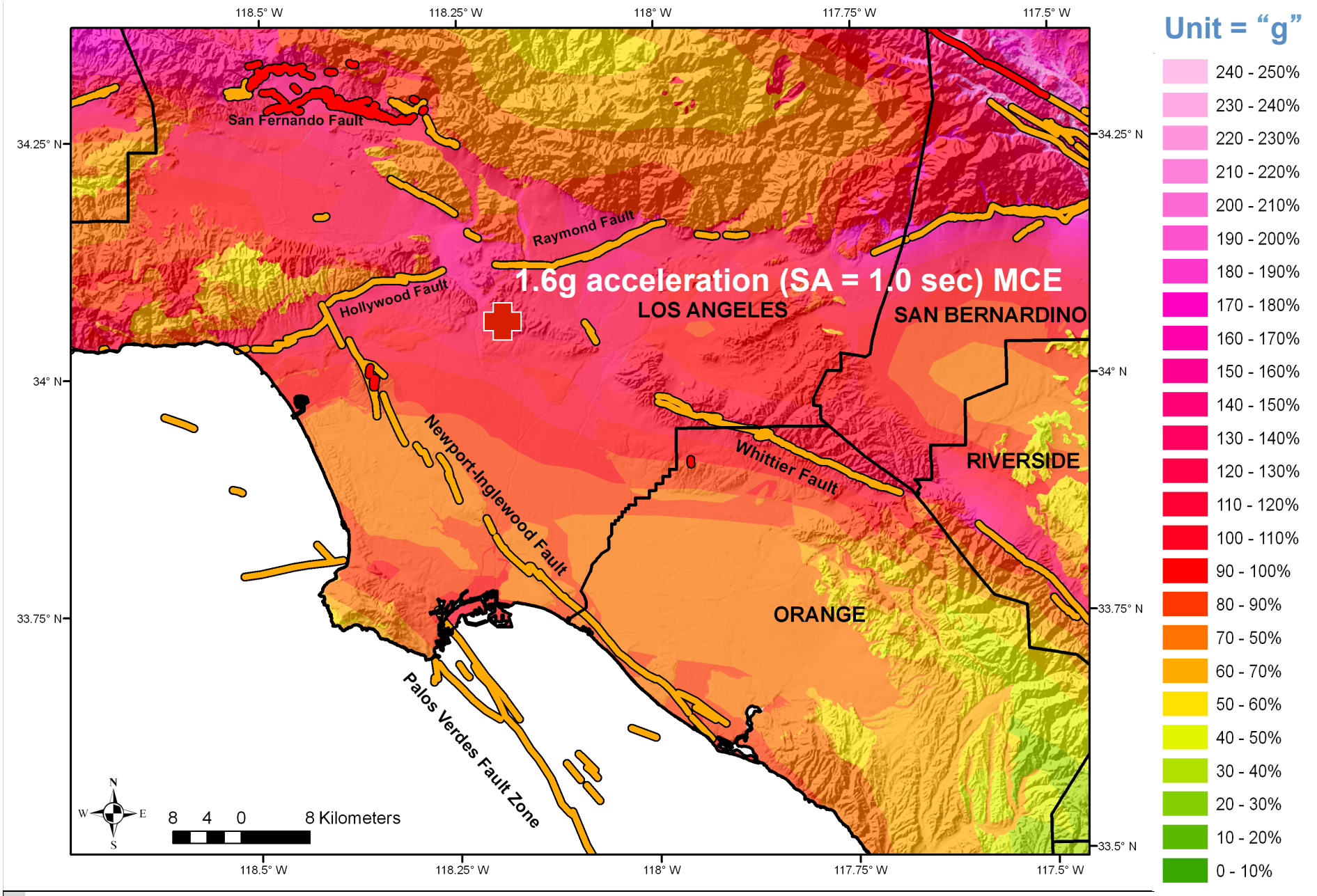

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Questions…

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