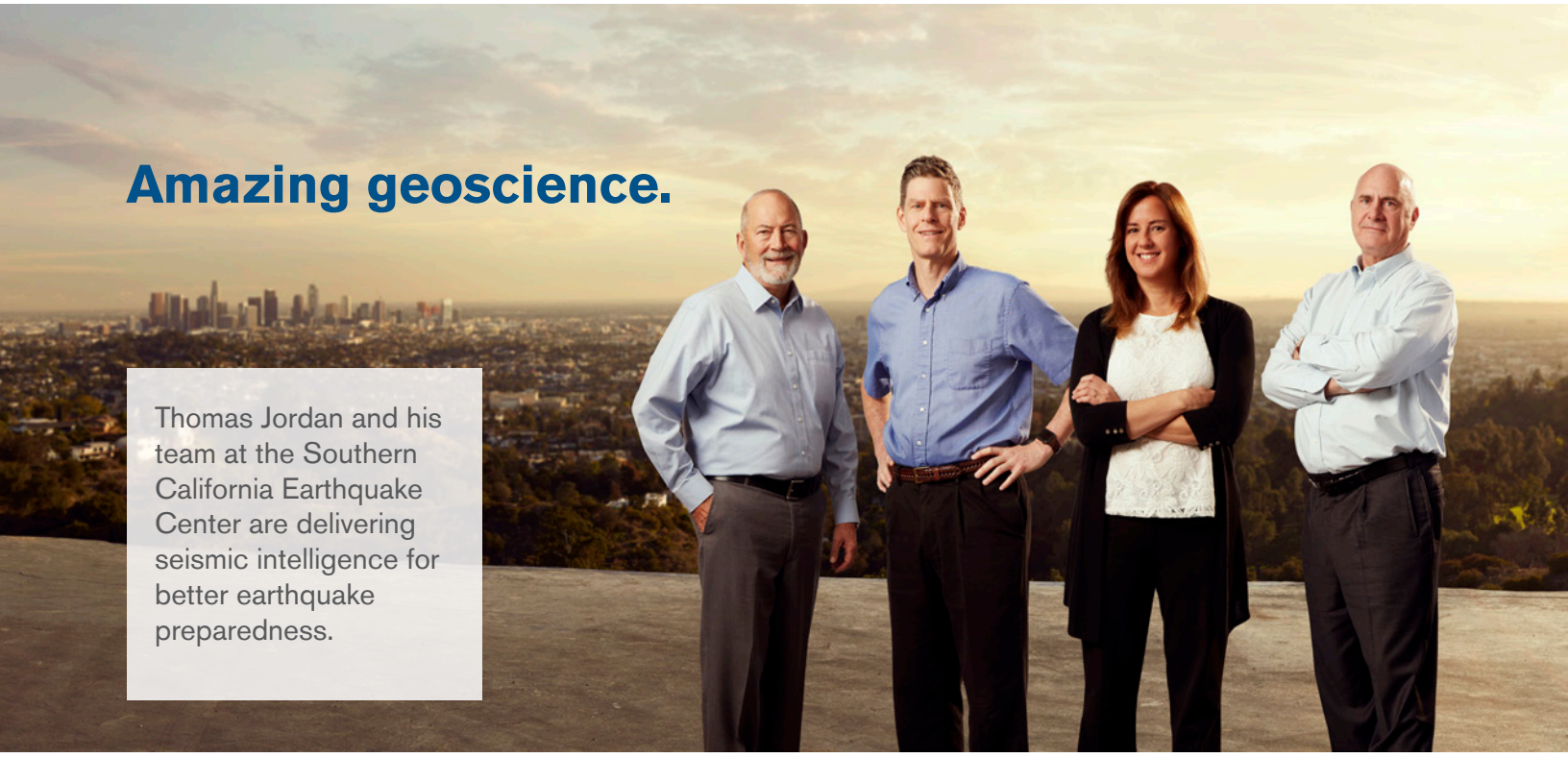
Amazing geoscience.



Thomas Jordan and his team at the Southern California Earthquake Center are delivering seismic intelligence for better earthquake preparedness.

So far, science hasn't found a way to predict when earthquakes will happen. But Jordan's team is working on the next best thing … being prepared for them.

Specifically, Dr. Jordan and his team at the Southern California Earthquake Center (SCEC) are developing methods to simulate how the ground will move in the event of an earthquake.

Their research is producing more accurate seismic hazard information that communities can use to prepare for earthquakes such as retrofitting existing structures and supporting better building codes for new construction projects.

"We can't predict earthquakes," says Jordan. "But what we're doing is a much better job of predicting what will happen when they occur."

Key to making these predictions starts with knowing how the ground will move in specific locations. Thus, the linchpin of SCEC's research effort is CyberShake — a new physics-based computational approach to calculating how, and where, earthquake waves will produce ground motion as they propagate through the earth's complex crust.

Ground motion is notoriously difficult to model, Jordan says, and getting an accurate view of ground motion takes more than the standard empirical techniques.

"We can't predict earthquakes, but we're doing a much better job of predicting what will happen when they occur."

CyberShake takes those standard techniques and builds on them, integrating advanced physics, boosting the model frequency range, and aggregating a vast amount of data and wave motions to produce the most complete earthquake models yet.

"The holy grail of hazard maps is to minimize uncertainties [about the ground motions]," says Jordan. "CyberShake lets us really understand those ground motions in a systematic way. And when we can compute ground motions more accurately, we can make infrastructure more resistant and society more resilient to earthquakes."

The CyberShake project's success to date has been supported by its access to two leading Cray supercomputers — Blue Waters at the National Center for Supercomputing Applications (NCSA) and Titan at Oak Ridge Leadership Computing Facility.

"These calculations are so large in scale," says Jordan's teammate and SCEC science director Christine Goulet. "But they're blazingly fast on supercomputers." Their latest run generated two sets of seismic maps expanding from the original Los Angeles basin area into central California and covered 438 computation sites including public utility stations, historic sites and key cities.

These calculations, says Jordan, are a "pretty awesome thing" and representative of a giant leap forward in earthquake science. Does it mean that as computing advances we might one day be able to actually predict an earthquake? Jordan pauses and then answers: "We're not holding our breath, but I wouldn't rule it out."

NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS (NCSA)/BLUE WATERS

The Blue Waters supercomputer, housed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign, is the fastest university system in the world. It's used for a wide range of research problems, from predicting the behavior of complex biological systems to simulating the evolution of the cosmos.

SYSTEM DETAILS

- Cray® XE™/XK™ hybrid supercomputer
- 288 cabinets
- 13 PF peak performance
- 22,640 XE compute nodes
- 4,228 XK GPU accelerators

OAK RIDGE LEADERSHIP COMPUTING FACILITY

The Oak Ridge Leadership Computing Facility (OLCF) is home to Titan, the U.S.'s most powerful supercomputer for open science.

SYSTEM DETAILS

- Cray® XK™ hybrid supercomputer
- 200 cabinets
- 27 PF peak performance
- 18,688 compute nodes
- 18,688 GPU accelerators

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