

What it's Like to be an Earthquake Scientist

Talking with USGS Geophysicist Ross Stein

By Tania Larson

In a field where the work is critical to saving lives, earthquake scientists often operate at a dizzying pace, collaborating with partners around the world as they try to solve the many mysteries of the Earth's processes. And just when they least expect it, they are thrown into the public spotlight, expected to respond to the fear and confusion that inevitably follow natural disasters with answers they may or may not have. It is tough, challenging work; but for most, the rewards of scientific discovery and knowing that they are giving something back to society make it all worthwhile.

USGS geophysicist Ross Stein sums up his average day with two words: "collaborative chaos." Ostensibly, Stein says, his job is to examine how one earthquake sets up the next, how one earthquake can promote or inhibit another. In reality, he does much more.

"In some ways," he says, "I'm an entrepreneur. I have to raise funds, account for them and make sure they are being used responsibly. In some ways, I'm a teacher, working with high school, college and post-doctoral students, making sure they learn the trade and take wing. And in some ways, I'm a student, learning from my colleagues and trying to do a better job of understanding earthquakes."

Stein is currently working on roughly half a dozen projects, and his office is virtually a revolving door as colleagues, post-docs and student interns come and go with questions, problems and ideas.

One of the joys of the job, Stein says, is simply being a research scientist, following his ideas to wherever they lead. "I have the opportunity to follow my own hunches, to raise the funds, do the research and make it happen — and that's my shot," he says.

One of the challenges, Stein says, is trying to figure out the strengths and weaknesses of your ideas, finding competing ideas and testing them against your own. Stein makes no bones about the fact that science research is competitive. Considering the innate bias of wanting to prove your own theories right, he feels the competition is healthy.

"There is a competition of ideas," he says. "You need to be constantly surveying alternatives, examining them for strengths and fine tuning your theories. It's a process that is very competitive and very open."

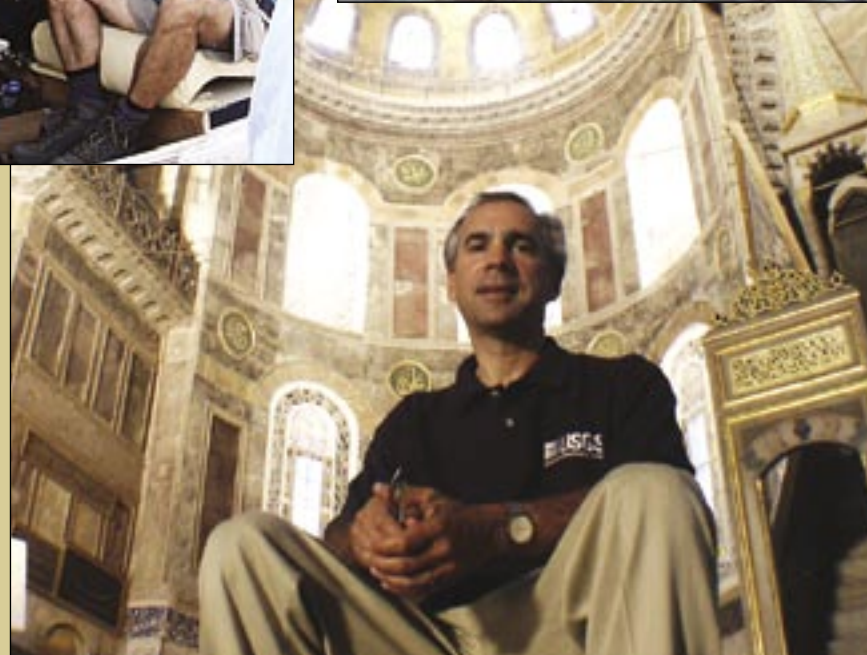
Earthquakes are complicated events, and discovering how the pieces fit together takes not only collaboration and inge-



Above, Ross Stein prepares for a flight to film the fault and the city of Istanbul for the IMAX/National Geographic film "Forces of Nature." Stein wears a climbing harness underneath his jacket so he can lean out of the helicopter, and the chopper's doors are removed in order to fit the IMAX camera inside.



Above, Ross Stein with Professor Mustafa Erdik at the Bosphorous University earthquake engineering shake table.



At left, Ross Stein sits in Istanbul's Aya Sofya, which was the largest domed structure in the world for 600 years. It has sustained 12 large earthquakes in 15 centuries, serving as an ancient seismometer for earthquake scientists. Built as a Christian cathedral by Justinian in A.D. 537, becoming an Islamic mosque in 1453 and a secular museum in 1938, it is one of the world's great religious, architectural and scientific marvels.

nity, but also a balance of knowing when to look for a new piece of the puzzle and when to stick with the piece you are already working with.

As Stein points out, however, earthquake science is peculiar in that it is largely an experimental science, yet earthquake scientists cannot set up their experiments. Because they do not know when and where earthquakes will occur, they do not have the preparation and careful planning afforded to other experimental sciences. It is difficult to have the right equipment set up in the right spot at the right time.

In earthquake science, opportunities come unexpectedly. "Usually," Stein says, "when you are working frantically to finish up something else." This creates a dilemma. "When they hit," says Stein, "you have to make a decision about whether to drop what you're doing to chase something new, something that could turn out to be a phantom, or stick to what you're doing and possibly miss the bus for something that could be a new breakthrough."

Stein believes that in order to be successful, earthquake scientists need to find a balance. He says, "You can't always chase something new or you'll never finish. And you can't always finish what

you're working on or you'll never discover anything new."

"It's a painful choice," he admits. "But if you can't handle that choice, this isn't the field for you."

Although some scientists are happiest working close to home, Stein seems to jump at opportunities to cross an ocean. This is because he believes international efforts are imperative to advancing the science. He says, "We're never going to fully understand earthquakes in the United States unless we go to places where the earthquakes are big, frequent and well-recorded."

He is currently working on projects connected to Japan, Algeria and Turkey. "Japan," Stein says, "is lush in the quality of records." Algeria and Turkey, on the other hand, are more vulnerable. He says, "They have numerous earthquakes, but their records are not as good. So, international work is some giving and some taking. We're learning in some places and offering something back in others."

Communicating to the public is another way earthquake scientists give back. It is also a big responsibility. "There is a strong connection with the public," Stein says. "They are interested in what we do, and we have a responsibility to speak hon-

estly. We have a twin responsibility: to tell what we know and what we don't know."

In times of disaster, there can be a lot of pressure for information. "When you are least prepared is when you will have to talk to the public," Stein says. "Fifteen minutes after an earthquake, there will be 30 cameras on you. And that's when you know the least. You have to be honest, clear and straight with people."

"We have to play it straight," Stein emphasizes, "not pretend what we don't know and not hold back what we do know. That's our contract with the public. That's an important element of being a government scientist and one I enjoy and value."

At the end of the day, however, it is scientific discovery that Stein enjoys most about being a USGS scientist. He says, "I'm not principally responsible for teaching, but for discovery. I am responsible for conducting research, and when we make discoveries, for making sure they are published. And I'm happy with that."

This is because, for Stein, discovery is the best part of the job. He says, "To discover something new — that's the intoxicating part, finding out something about how the Earth works. That's what drives all scientists."