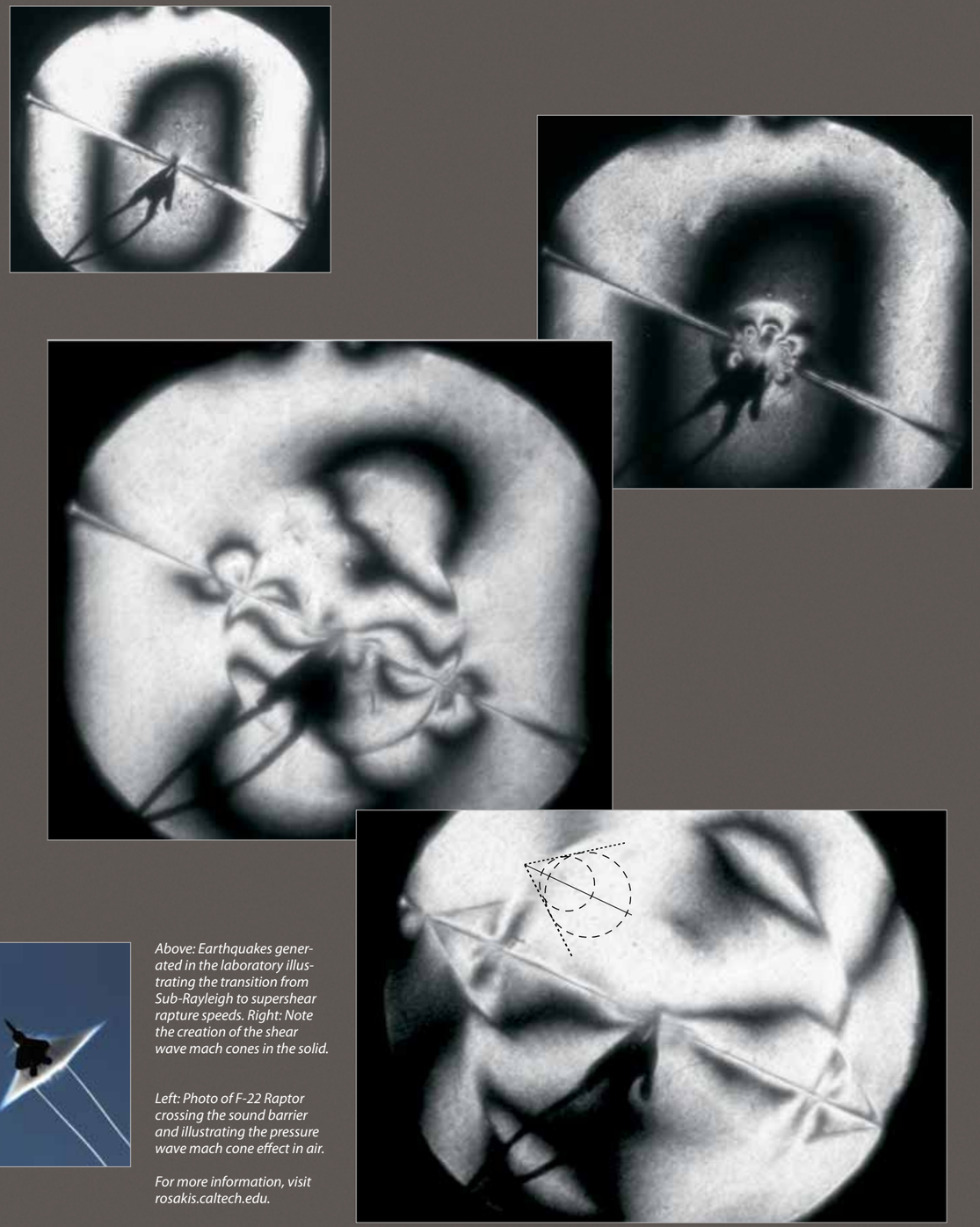

Above: Earthquakes generated in the laboratory illustrating the transition from Sub-Rayleigh to supershear rapture speeds. Right: Note the creation of the shear wave mach cones in the solid.

Left: Photo of F-22 Raptor crossing the sound barrier and illustrating the pressure wave mach cone effect in air.

For more information, visit rosakis.caltech.edu.

The 75-faculty-strong Engineering and Applied Science (EAS) Division at Caltech may be home to the biggest group of faculty at the Institute, but it is tiny compared to the other famous engineering schools around the world. In order to compete and thrive with such numbers, we have adopted two basic principles. First, by design, we don't cover all areas in engineering and applied science. We dynamically choose only the ones that we consider the most important and we are ready to retire the ones that are not intellectually stimulating. Our faculty does not represent a continuum of research interests and specialties. We are, in the words of my old Caltech mentors, Professors Jim Knowles and Eli Sternberg, a **collection of isolated singularities**. However, in order for these isolated areas of excellence to be effective, the second principle has to be introduced. This principle dictates that the barriers between disciplines, Departments, and even Divisions remain very low so that both faculty and students can cross them, if they wish, without spending unnecessary energy. This is a principle that is also shared throughout the Institute and necessitates the existence of a truly interdisciplinary culture in which turf and labels become secondary to intellectual exchange. Other major engineering schools speak of the value of interdisciplinary research; our difference is that we have practiced it since our founding over 100 years ago. It was simply critical to our survival.[1]

In the above analogy, the isolated singularities of excellence represent our chosen disciplinary strengths in research and teaching while our interdisciplinary research groups and centers can be viewed as sparks created between the disciplines. These energetic sparks of interdisciplinary brilliance may or may not be short-lived, but they are triggered by our desire to tackle society's big problems and are facilitated by low barriers to enter new fields. New challenges, such as renewable energy, and new ideas, such as bioinspired engineering, create new and sometimes unexpected sparks. Long-standing problems, such as terrestrial hazards involving both the fluid and the solid earth, represent longer-lasting sparks. I, for example—a solid mechanician and aerospace and mechanical engineer by training—now spend much of my time in research interacting with geophysicists and seismologists working on shockwave-induced ground motion generated by supershear earthquakes. The sparks between these particular disciplines have the potential for great societal impact in California and other seismogenic areas around the world. Indeed, engineers do best when they tackle and mitigate humanity's biggest calamities and problems.

This issue of *ENGenious* features a number of our faculty, alumni, and students who are tackling the biggest problems facing and challenging humanity. As you read, I encourage you to think about EAS and Caltech's greatest achievement—**the creation of new schools of thought**. These schools of thought reflect our combined achievements and excellence in both research and education. It starts with the faculty's dedication and commitment to train their students in their singularities of excellence supported by mastery of the fundamentals. Then these students become the next generation of academics, researchers, technologists, and leaders who in turn train their own students and associates, and in the process they influence industry, the economy, and even government policy and societal perceptions. They are the inheritors and carriers of both our educational and our research philosophies.

Ares J. Rosakis
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[1] *One of the fruits of these strategies, sustained over decades, is that Caltech is one of the top universities worldwide. Indeed, Caltech was just rated number-one in the* 2011–2012 Times Higher Education *world university rankings of the top 200 universities. In addition, it has been ranked first in the subject of engineering and technology.*