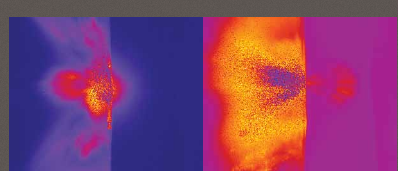

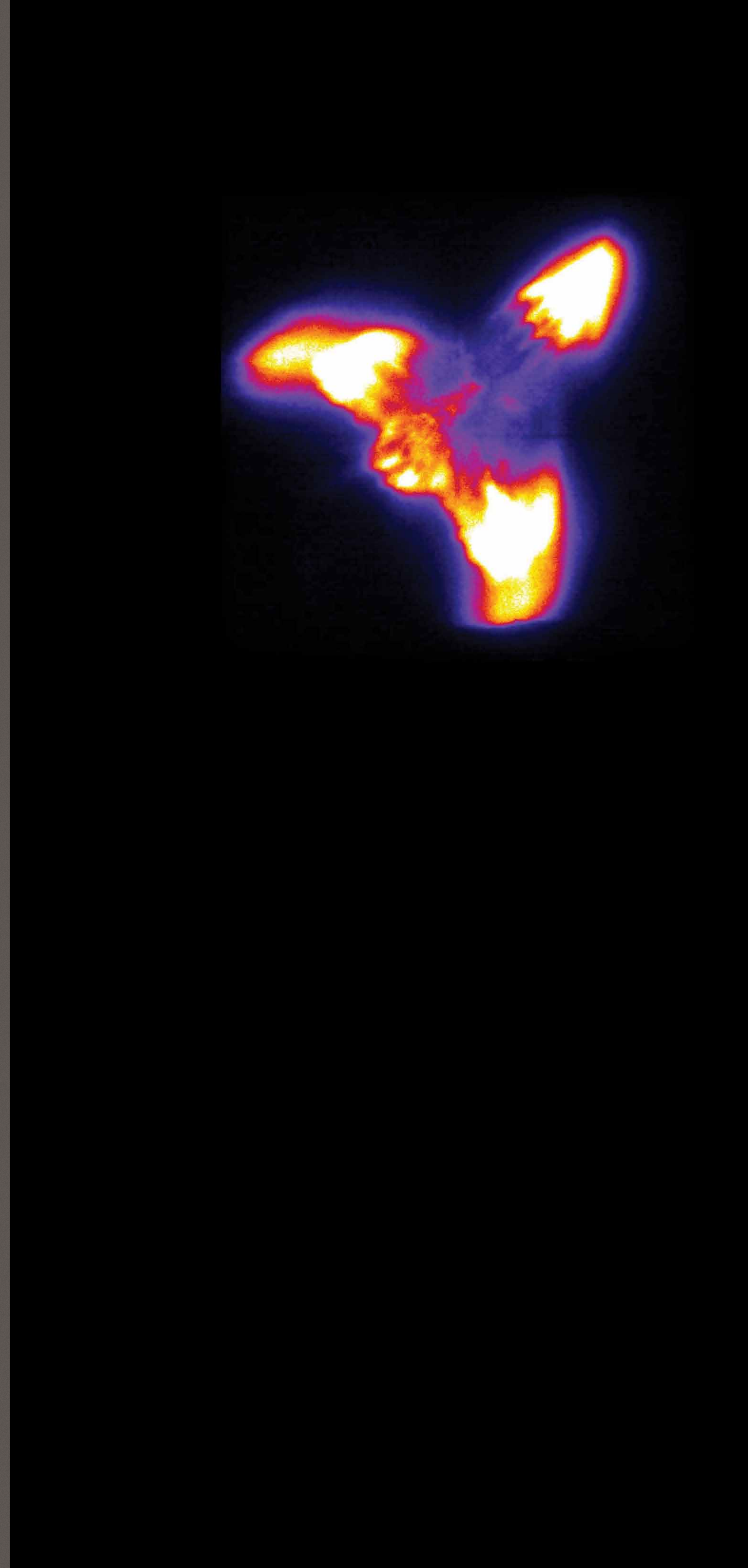

Above: *High-speed infrared (IR) images of a 1.5-mm-thick 6061-T6 aluminum target at zero-degree obliquity impacted with a 1.75-mm nylon projectile (frontal view) moving from left to right at 5.5 km/s and 6.1 km/s, respectively. The field of view of each image is approximately 25 cm wide by 20 cm high. The IR camera was exposed from 11 µs to 13 µs after impact for the first image (left) and from 13 µs to 15 µs after impact for the second image (right).* **Right:** *Optical high-speed camera image of a nylon cylinder impacting an aluminum plate at a speed of 5.5 km/s that was taken ~4 microseconds after the nylon impactor first contacted the plate. Colors in the image represent the intensity of the light being emitted from each area of the image. Purple is the lowest level of emission, and white areas are the brightest. The images were taken in the GALCIT/JPL hypervelocity impact facility. Experiments were conducted as part of the Department of Energy Predictive Science Academic Alliance Program (DOE-PSAAP) Center in Engineering and Applied Science.*

This issue of *ENGenious* features a number of our faculty, alumni, and students who are working at the edges of fundamental science to invent the technologies of the future and to tackle the biggest problems facing humanity. As you read, I encourage you to think about the Engineering and Applied Science (EAS) Division 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 training students in their area of expertise or singularities of excellence, which is 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.

One may ask how the small number of faculty in the EAS Division can have so great an impact that Caltech can maintain the top position in the *Times Higher Education* world university rankings in the area of engineering and technology for multiple years. 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 do 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.

In this 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. Indeed, engineers do best when they tackle and mitigate humanity's biggest calamities and problems.

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