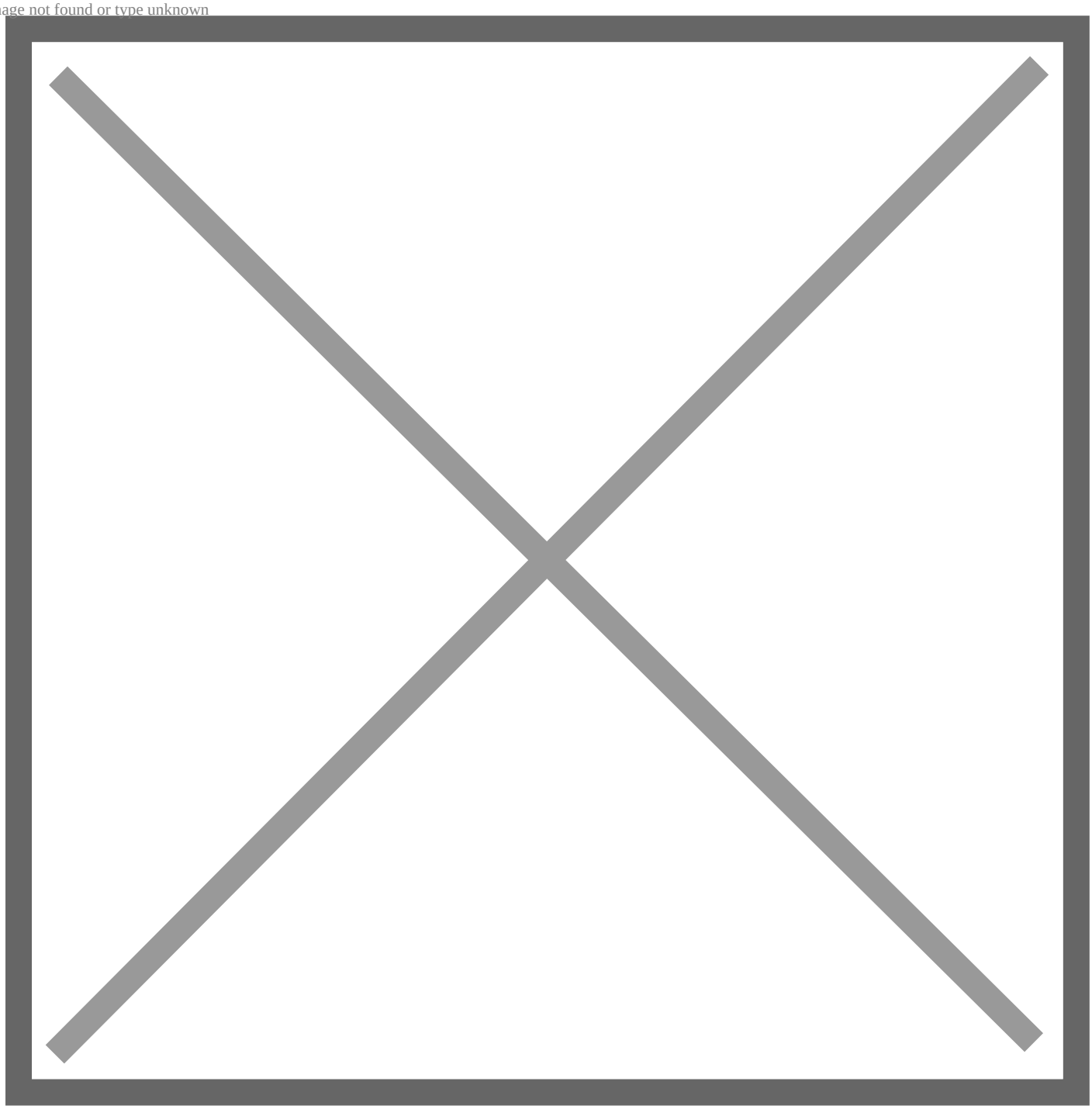
Testing, Testing...

August 30, 2019

Image not found or type unknown



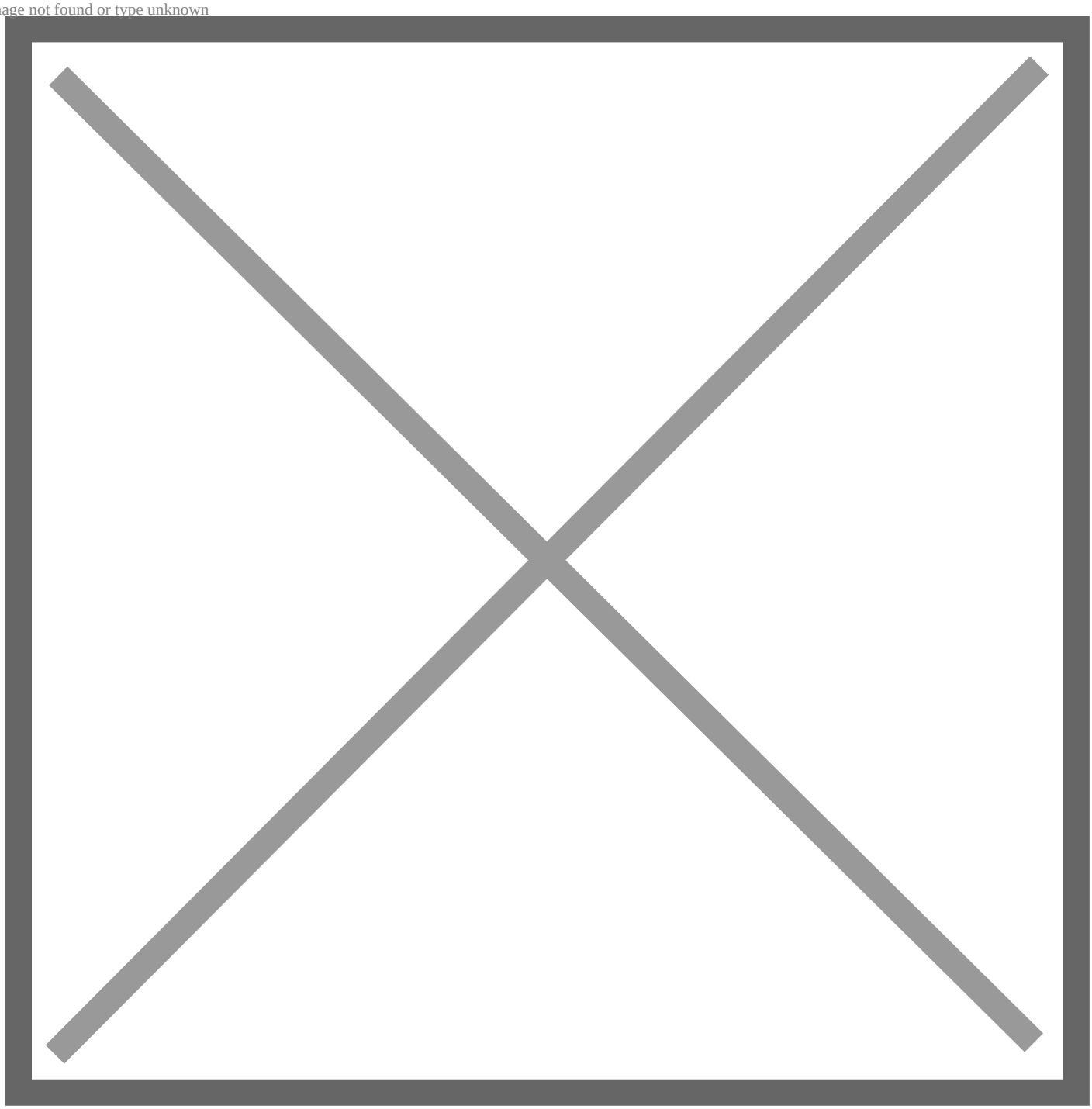
When you hear the words “crash test dummy,” you probably picture a faceless mannequin strapped into a car, barreling towards a concrete wall. They’re critically important as automakers strive to make safer cars.

But while standard crash test dummies are good, they do have some limitations. They don’t have internal organs, muscle tissue or breakable bones.

So how can Toyota engineers better predict how a vehicle will perform in a crash – and how someone would survive it? Enter THUMS – or **T**otal **HU**man **M**odel for **S**afety. THUMS is a virtual crash test dummy outfitted with its own bone structure, ligaments, tendons and vital organs – similar to the human body.

Toyota introduced THUMS in 2000 to develop a way to look for human injuries, and it’s come a long way in the nearly two decades it’s been around. R&D just unveiled an upgraded version earlier this year. Here are the highlights:

Image not found or type unknown



Preparing for the Worst – Toyota released its upgraded THUMS virtual crash test dummy software earlier this year. The newest version adds a muscle model, so engineers can better understand how to design vehicles that minimize the risk of injuries in a crash.

Sharing is Caring

Even though THUMS is a Toyota product, it's used throughout the industry. The new, updated technology will be shared with parts suppliers, researchers and even other automakers – really, anyone who could benefit from

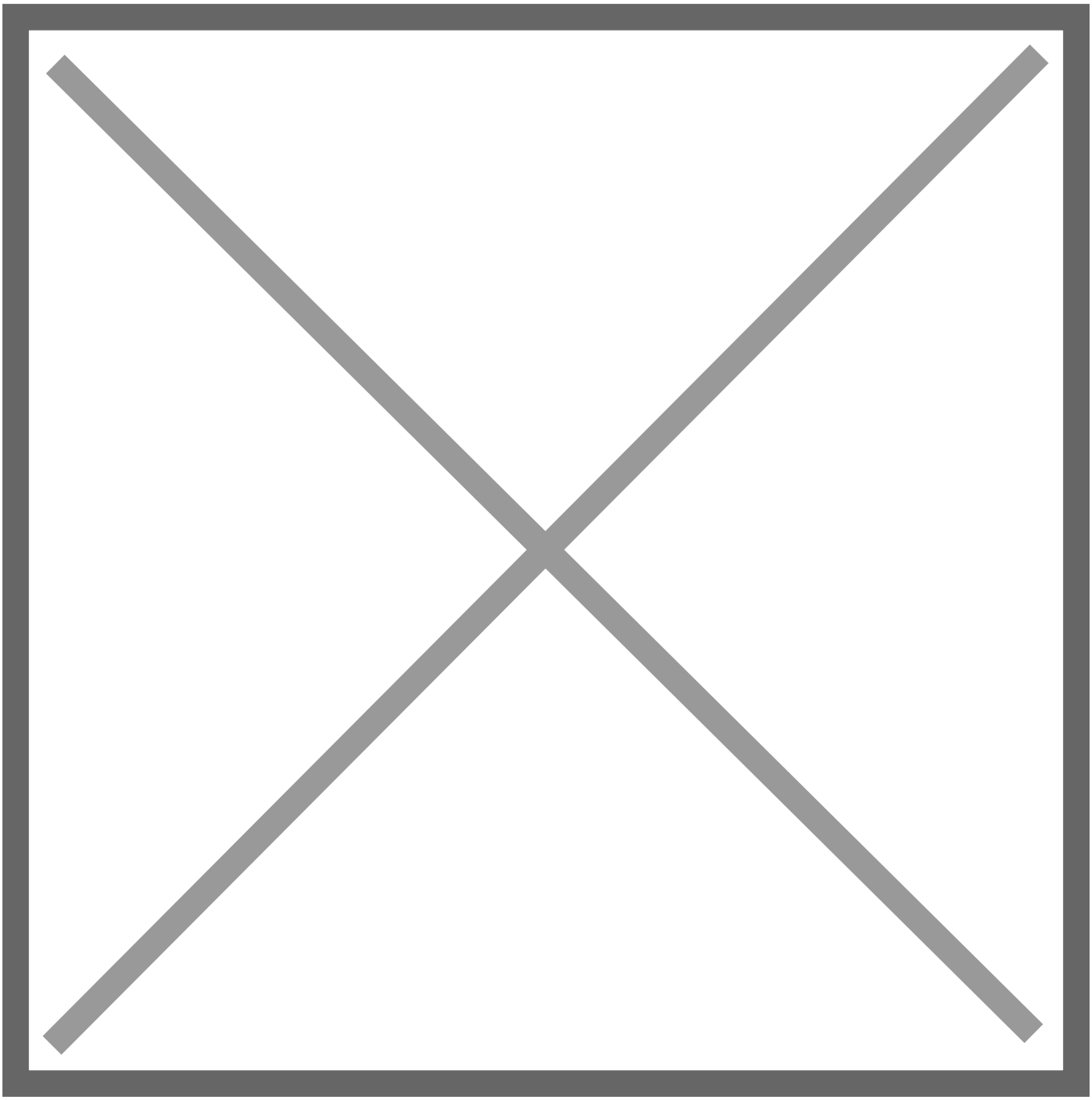
the technology – for a small licensing fee.

“It goes back to our company’s pillars,” says Jason Hallman, a safety researcher at R&D who works on the THUMS project through the Toyota Collaborative Safety Research Center. “Toyota strives to be a good corporate citizen. Technology like this benefits the industry and all of society.”

Building Muscle

The first version of THUMS was primarily designed to simulate a human’s basic bone structure and detect bone injuries – something that, until then, vehicle safety engineers didn’t really have the capability to do. Each upgrade has added new layers of understanding: face and bone detail, a model of the human brain, internal organs, etc. With the latest upgrade, engineers integrated the human muscle system. It also simulates several different postures, including “braced” and “relaxed.”

Why is that potentially important? Well, in the not-so-distant future, all vehicles are expected to have automatic braking systems. That may create a unique challenge for crash safety engineers. If your car’s braking system tries to avoid a crash, but the crash still happens, your muscles would brace for impact. By adding muscles to the THUMS model, engineers can investigate those scenarios and may learn how to improve safety even more.



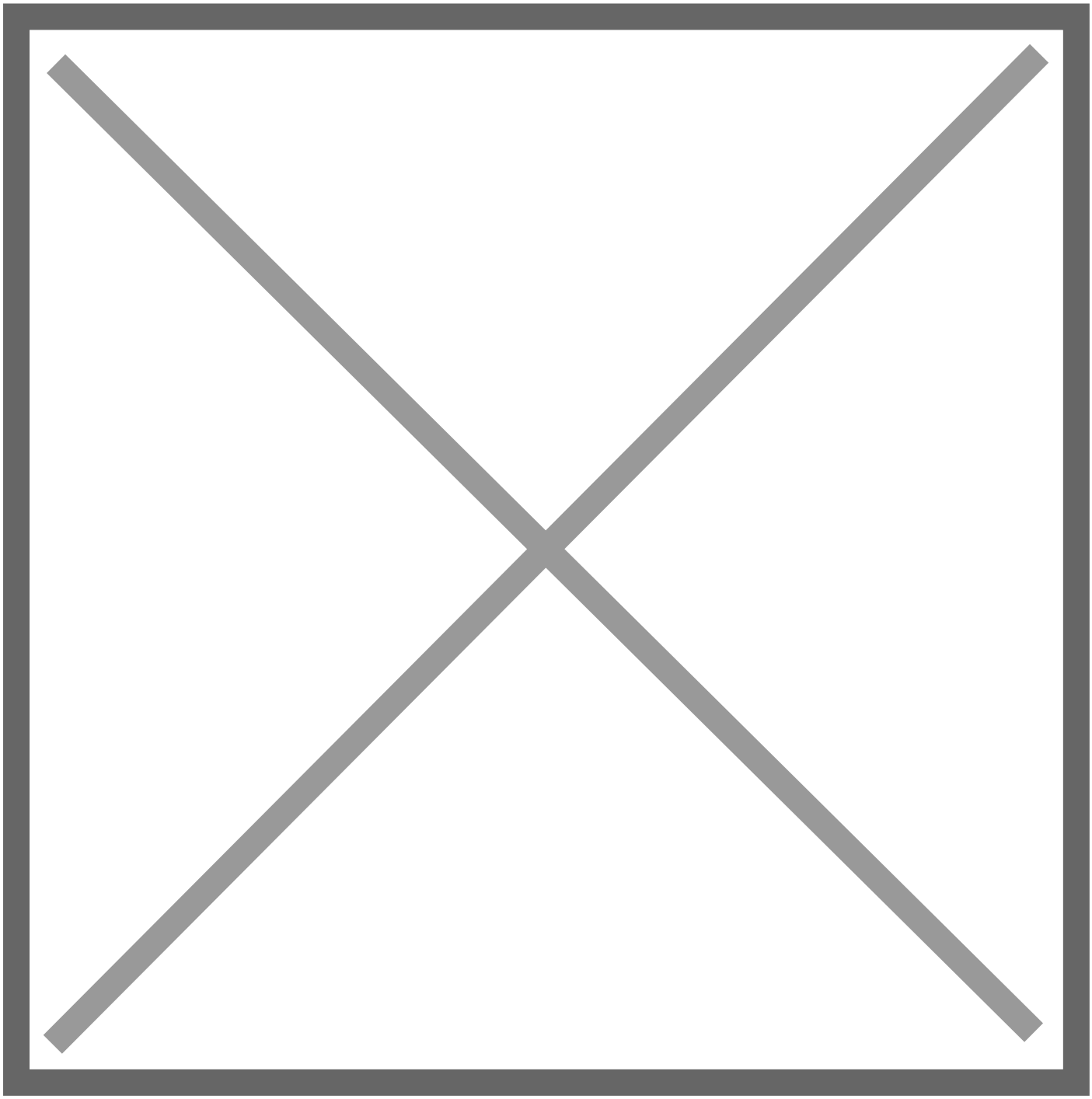
Doing Good —R&D Safety Researcher Jason Hallman believes THUMS is aligned with Toyota's commitment to respect for people. "Toyota strives to be a good corporate citizen," he says. "Technology like this benefits the industry and all of society."

Tested at Top Speeds

The THUMS virtual crash test dummy has also given engineers a better understanding of what happens to the human body when a vehicle crashes at speeds of up to 100 miles per hour.

In fact, when NASCAR wanted to improve seats and belts for their drivers and understand how they perform at high speeds, they collaborated with Toyota used THUMS technology to do it.

“There’s no safe way to crash a vehicle at that kind of speed,” says Hallman. “THUMS allows us to simulate a crash at high speed levels and really see what happens.



Planning Ahead – THUMS researchers are looking ahead to autonomous vehicle technology, and how to best protect passengers who will one day use the technology.

The Next Problem to Solve

Autonomous driving presents the next big challenge for crash test technology. If people aren't stuck behind a steering wheel while getting from point a to point b, that opens up a whole new gamut of scenarios for safety engineers like Hallman.

"People will have different expectations of what they want to do in a vehicle," he says. "It will completely change our expectations of someone's posture in a vehicle. There's an expectation that cars will look very different on the inside. But we still have to protect people in a crash, because there will still be human drivers on the road."