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UNIVERSITY

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The space shuttle Columbia disintegrates as it hurtles across the sky on Feb. 1. UNC faculty members and Duke engineering experts are part of a group of scholars studying ways to make the U.S. space program safer.

Rethinking exploration

THE HERALD-SUN | KEVIN SEIFERT

UNC freshman Dimple Patel (right) handles a heat resistant tile made for use on space shuttles. She was taking part in chemistry professor Edward Samulski's Feb. 3 seminar at the Johnston Center for Undergraduate Excellence.

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CHAPEL HILL - Chemist Ed Samulski is part of a small group of UNC science faculty members working under a NASA grant to find new technology to improve space travel.

UNC is one of four universities sharing the $15 million, five-year grant. As part of the research, NASA gave Samulski a space shuttle tile to use in his research. The tile was similar to those that came under scrutiny after the Feb. 1 shuttle disaster.

Samulski, 59, the Cary C. Boshamer Professor of Chemistry, has been at UNC for 15 years. He specializes in polymer physical chemistry.

The Herald-Sun: *What are you working on these days?*

Ed Samulski: Generally speaking, it's trying to develop new materials for the next generation of aerospace vehicles. That can mean ordinary civilian aircraft, or space vehicles. We're interested in making composite materials, ultra lightweight, high-strength materials, with the long-range goal of fabricating materials that might have the option of self-healing.

If you can, imagine you're out on an unmanned mission several hundred miles from here and you're hit by a very small meteor. It would be a tragedy to have a multi tens-of millions of dollars operation stop because of that. And so, NASA is looking for new materials that might have the capability of repairing themselves.

It sounds space age.

It is far out. But nevertheless, there are some practical materials that already exist. There are plastics that you can hit with a bullet at a very high velocity, and there will be a hole for a few fractions of a second. Then, because of the local heating caused by the collision, things will flow and it will heal itself.

They use it as the backup for these targets. When you blast away at paper targets for a while, whatever's back there gets blown to smithereens.

You mean on shooting ranges?

Yes, there's a self-healing polymer behind there so it repairs itself and stays there for a long period of time. I hadn't appreciated the practical use.

So, in this example, it's your job to take this use and adapt it for use in aerospace travel?

Can we take this idea, put stronger reinforcements in this polymer, more intelligent reinforcements so not only do you have the healing capability, [but] it would be able to tell you where it gets damaged? It would be electrically conducting or have sensors embedded in the sensors so you're aware not only that there is an impact, but where it's located.

It sounds, on the one hand, like imagination running rampant. But on the other hand, it sounds real.

It sounds like imagination running rampant, but you know, there are all these amazing things that happen naturally. Your body heals naturally when it's wounded. And NASA has asked us to look at it from that vantage-point and see if we can get ideas from natural systems and implement it as synthetic and self-healing.

Then, for practical applications of these new materials, NASA has a dream of having the next generation of airplanes sort of morph their shape to account for whatever it is they're going to do. If they're going to land, for example, they want the wing to curl in a particular manner in order to slow the plane down and make a landing. It's the kind of thing that is done mechanically with wing flaps extended. They would like to see the entire wing re-form itself in some way.

Now, this material doesn't exist yet?

It doesn't exist yet. But that's the kind of thing they want us to think about.

Do you, as a scientist, think that's possible?

In the beginning, I sort of laughed. ... But if you start looking at it just from a single component point of view, maybe you can do something. You can get a piece of plastic that changes shape, you can demo it in a lab, then there are engineers who can take this and actually make real things out of it. ... While I laugh when I see this picture of a plane changing shape, it's just because I don't have the vision to see the little piece of polymer change shape on a lab bench, and then see other people take it and turn it into a technological reality.

Let's talk about the tile. It came from NASA for you to study. It turns out that it's the same type of tile that was being talked about so much after the shuttle disaster.

It was always very curious. It's a rather soft piece of material. You can easily scratch it with your fingernail. It has ... a very thin layer of fiberglass on the outside. It's a fabulous insulator and NASA gave it to us to use as an insulator for an experiment we were doing. We were working at high temperatures and needed an extremely good insulator.

So I had this tile sitting on my desk and it was a curiosity all along. And then it became much more meaningful when I realized that, gee, it wouldn't be very difficult at all to damage this. I could probably, with my finger, break through it.

Did that, somehow, help drive home the reality of the shuttle disaster for you?

Everything is on the edge in that space shuttle ... right on the edge of technology. I think the people who fly know that. It's a very high-risk occupation and they know that.

You've said before that the tile is a technological marvel. Why?

It has extreme insulating capability and yet it's basically sand. It's silica, basically sand, processed in a way to make it very light, compacted together. It's 98 percent air. It's just fabulous that we're able to develop such things. You could take a blowtorch to one side and keep your hand on the other side and you'd never know this side was red hot. It does its job extremely well. It's a real compliment to our society to know we can actually do things like this.

It's simple, but at the same time it's a marvel. We just have to keep doing things like this.