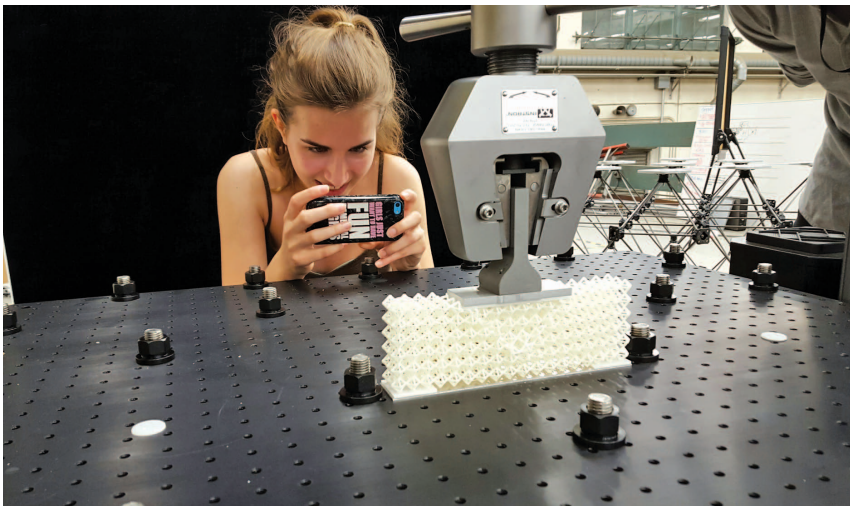
From Sewing to Bridges

Jackson turns her hobby into an award-winning engineering pursuit



Jackson stress-testing three-dimensional (3-D) printed truss bridges for her tenth-grade research project at NASA Ames.

Holly Jackson won second place in the IEEE Presidents' Scholarship in 2017 for her algorithm that performs a "virtual reading" of unopened historic European letters from the 17th century. She took computed tomography scans of unopened letters and worked for a total of eight months on a team during tenth- and 11th-grade summer internships at the Massachusetts Insitute of Technology (MIT) to come up with a way to read the letters without touching the paper.

Many of the historic documents had seals, strings, and other elements that weakened the paper over time, making them fragile and risky to open. "Opening the seals may cause the letters to crumble, losing big chunks of text and information about the time period," Jackson explains. "The algorithm can reveal the folding pattern and the text inside."

Jackson is currently finishing her senior year at Notre Dame High School in San Jose, California, and is interested in mechanical engineering. The IEEE scholarship will help when she begins college this fall.

And Sew It Goes

Jackson's love of sewing started in fourth grade when she learned how to sew from her grandmother and her aunt bought her first sewing machine. She loved sewing stuffed animals to give as gifts and tried sewing clothing, which she said "sometimes worked." She quickly started making her own patterns not out of creativity but, like many engineers, out of wanting a simpler version.

She always thought science was a cool subject at school and, by fifth grade, combined sewing with science for her required projects. In eighth grade, Jackson realized that she could add the research aspect to her hobby and found herself upstairs ripping apart 120 different sewing samples to test the strength of stiches for a science project that won her the Grand Prize at the Broadcom Masters Science Fair for middle school students.

"It resonated with people because it is about a feminine pursuit that people don't think is very scientific," Jackson says. "But the strength of stitching has many scientific applications, like space suits and parachutes."

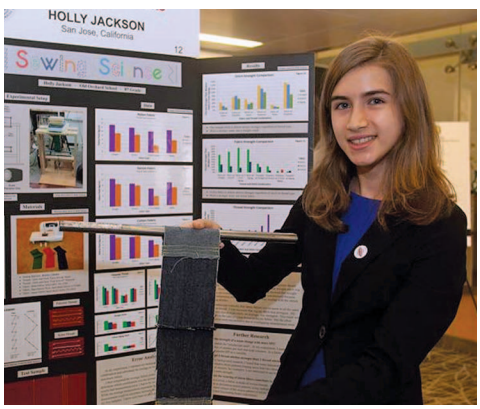
"My parents, who are both science oriented, said I was crazy," she adds. "But they were always supportive in all of my interests, helping me figure out what I liked and in school. Even though the sewing project was a little out there, they weren't going to tell me no. They said, 'go ahead, be crazy!'"

Getting This Far

Jackson's first summer internship after ninth grade was at NASA Ames, where she studied lightweight trusses for space applications. They needed to be inexpensive and strong enough to transport things to space. She wrote a genetic algorithm to optimize truss bridges and authored a paper on her work. "The algorithm was based on evolution, and I used it to create prototypes of different lightweight but stiff structures. Getting into computer science and engineering was fun," she says.

Jackson credits her interests and goals as only part of her success to date. "I kept doing what I loved to do, and opportunities came my way," She recalls. "I wasn't afraid to take risks and be myself. I didn't expect the NASA or MIT opportunities, and the way they came about seemed random. I got a tour of NASA and a supportive judge at the science fair gave me advice and confidence to ask for an internship while I was there. That was pivotal."

She recommends making friends and finding good mentors. "Mentors have helped me a lot. Find a mentor by asking. Start with a teacher you like. If you're interested in science, ask around at colleges or labs. Many people are interested



Jackson presenting her sewing science project at the Broadcom MASTERS national science fair in October 2014.

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Holly Jackson (left) at MIT in July 2016 with the letter-unfolding research group (her mentor, Amanda Ghassaei, is in the back row, second from the left).

in helping young people interested in science. You can find someone who cares and will totally change your life. My mentor at NASA got me my internship at MIT."

Inspirations and Role Models

Jackson believes the purpose of science is to help people, and politics can be an avenue for reaching that goal as well. She sees politicians who are overlapping with science to do good. So many of her inspirations are political figures. She mentions several: Hillary Clinton; Elizabeth Warren; the president of Rwanda, Paul Kagame, who completely reshaped the country in a short time with innovative and bold techniques others were afraid to try; and Angela Merkel, who got her Ph.D. degree in quantum chemistry and was a scientist for a while before starting her political career.

"There is a connection between science and politics. You can use new inventions to help people in communities or to stop global issues like climate change. And politicians are needed to legalize the new technologies or make the harmful ones illegal," she says.

Jackson also has a role model she's met in real life. Her graduate student mentor at MIT studied physics at Pomona College and worked at Instructables for a few years, leading do-it-yourself tutorials with laser cutters and 3-D printers before coming to MIT to pursue her master's degree. Jackson describes her as a confident, strong, smart person, who stands up for what she believes in, and she says they bonded during the two summers they worked together. She looks up to her and wants to be like her.

Jackson and her mentor, Dr. Kenny Cheung, during her NASA Ames internship in June 2014.

Exploring What's Next

Her research at NASA was mechanically oriented, building support structures, bridges, and mechanical components. She liked using computer science and code to build, test, and destroy the structures. So it's no wonder she chose to study mechanical engineering. But Jackson is also interested in aerospace, electrical, and materials engineering but hasn't chosen a major yet.

Although Jackson is excited to study engineering in college, she says she doesn't want to limit herself in engineering. She will minor in Spanish and wants to be involved in politics in some way. She says, "I'm not sure how it will all work or fit together. I know I want to be an engineer, but I'm not sure in what context. I may get a graduate degree of some kind. But I am excited to explore many different disciplines in school."

More Information

NASA Ames Newsletter, pp. 4–6. [Online]. Available: https://www.nasa.gov/sites/default/files/atoms/files/techbyteswt17_4.pdf

Broadcom Grand Prize for Sewing Science project. [Online]. Available: http://broadcomfoundation.org/broadcom-masters/stitching-with-stem-holly-jackson-14-awarded-2014-broadcom-masters-25000-grand-prize/

—Debbie Sniderman