A Leg UP

A Kansas farmer gives college students an opportunity to help.

by ***Kathleen Ward***

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►K-State ag engineering senior Emily Beck finds that even installing the final bolt can be difficult in what at first had promised to be a simple team project — designing and constructing a way to make mounting a tractor require less flexibility and strength.

Kent Davison still doesn't think of himself as disabled.

Like many farmers, he has always thrown himself into his work. But those day-to-day tasks have taken a toll on his body.

He probably put off getting knee surgery for too long. So, he developed fairly severe rotator cuff problems in both shoulders while compensating for his legs.

After his knee surgery, a tornado ripped the huge, heavy doors off his Ness County barn. Davison couldn't find or design replacements his upper body would allow him to open and close.

Then a Kansas-wide Easter freeze destroyed his wheat crop. He'd need to plant again.

To grasp the right-hand stair rail on one of his Steiger tractors, however, the Ness City farmer had to use the limited mobility in his left arm as a way to lift his right arm above waist level. After that, his hand strength came into play, and the rotator cuff … well, that was just pain.

Plus, his repaired knees made getting a foot up to his tractor's first step a bit of a challenge.

And, balancing as he climbed was now a safety issue. So, he welded on a left-hand grip, too.

Still, he finally had become frustrated enough to start paying attention to the urgings of his wife, Alvera. A former county Extension agent, Alvera wanted her husband to contact the Kansas AgrAbility Program, based with Kansas State University (K-State) Research and Extension in Manhattan.

Today, the program is still helping Davison with access to the technology aids he needs to offset his physical limits on the job. In turn, however, Davison has already helped three K-State seniors gain practical, real-world field experience in biomedical engineering.

AgrAbility enters the classroom

Buying a lift that helps farmers get into their tractor cab costs about $5,000, said Kerri Ebert, K-State AgrAbility coordinator. She generally has to beat the bushes to find funding for that kind of purchase.

Just after Davison contacted her, however, Ebert got a call from co-worker Stacy Hutchinson.

Hutchinson teaches the capstone Senior Design II course in K-State's Department of Biological and Agricultural Engineering. She wanted to know if Ebert had a project one of her teams could tackle.

That's how Davison became acquainted with K-State students Emily Beck and Anthony Mignano, both from Manhattan, Kan., and Lindsay Ott from Mulvane, Kan.

The three-member team traveled to the Davison farm to gather data and take measurements. Then, with their new "client," they discussed and evaluated potential solutions for helping him mount a tractor more quickly, more safely and with less pain.

Back in their department's workshop on K-State's campus, the team designed an extra, lower step for the tractor that halved the distance Davison had to raise his foot. They wanted it to attach directly to the existing stairs and retract automatically after each use — up to and in-line with the original bottom step.

They decided Davison also needed two identical handrails that he could reach more easily.

When the team presented their final project report to their department in May, it revealed just how complicated a simple design can become. One major example was the spring inside the tubes that supported their step and made it retractable.

The spring had to be weak enough that Davison could bring down the step easily. Yet, it had to be strong enough to retract by itself when he'd climbed past that step. And, it had to be adjustable in case time and use made the spring stretch a little.

But even industrial-size springs aren't available on the basis of their "spring constant," which is how engineers judge

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them. So, the team had to do manual tests and math to figure out what to buy. They took known-weight objects to the hardware store and measured how different springs reacted. They calculated the pounds of force each of them needed to push a handle down with little to no effort.

Then they tested square, steel tube combinations that allowed one tube to slide (retract) over the other so easily that the process didn't add more needed pounds of force. And, they built a wood model to test whether their design actually worked, could stand up under hard use, and introduced no unwanted "bounce" or "wiggle."

The team's completed project operated perfectly in the shop. They were so excited that they decided to deliver and install it before the semester was over.

The three arrived in Ness County on one of spring's last cold, damp days.

"Mr. D. tried it right then, and he could use it. In that way, it worked," Mignano said.

Because the team had incorporated some scrap parts from the department's shop, the total cost of their project was $72.38.

All three students are now headed for careers in medicine or biomedical solutions. Davison is looking forward to the solution for his barn doors the AgrAbility program has found and is funding.

More about AgrAbility, its services, resources and practical information is available from Kerri Ebert at 785-532-2976 or kebert@ksu.edu. Information is also available on the web site *www.oznet.ksu.edu/agrability/welcome.asp*.

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Editor's Note: *Kathleen Ward is a communications specialist with K-State Research and Extension, which supplied this article.*