

Teacher: Roberta Ludwigsen

Course: Aeronautics Engineering Applications

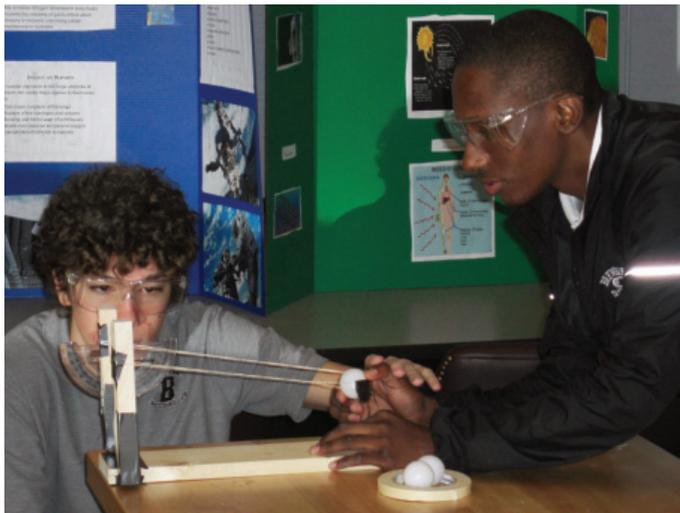
School: Brewbaker Technology Magnet High School, Montgomery, Alabama

Principal: April Lee

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## Hands-On, Project-Based Learning: It Reaches Students

You might call some students at Brewbaker Technology Magnet High School rocket scientists, and you wouldn't be far off base. The students at the Montgomery, Alabama school are designing a rocket nose cone in their aeronautics engineering class. It's part of a four-course sequence offered in the school's Aerospace Engineering Academy. The curriculum was developed by the Southern Regional Education Board (SREB) in partnership with the state of Alabama through SREB's Advanced Career initiative. The curriculum is designed to provide students with rigorous and relevant career/technical courses with authentic, real-world projects. The goal is to prepare students with options beyond high school, including advanced training, industry certification, college and careers.



Aeronautics engineering students test launch and range angles on their ballistics apparatus.

Students say they are sketching, measuring and designing a rocket nose cone, and they will test for height, weight and drag. "We are going to do that [test drag] in a wind tunnel. We are going to put it in a wind tunnel and see how much drag it actually creates, and see if we can get it down to the least drag we can without compromising the rocket. We are going to use a 3D printer to actually create our nose cone," said one student.

Other classes in the Aerospace Engineering sequence are: fundamentals of aerospace technology, advanced aerospace technology and astronautics engineering applications. Teacher Roberta Ludwigsen said, "What I see with these core technical courses that I have not seen with traditional academic core courses is that they really have a very integrated curriculum for students. The math is integrated into the science, but students get literacy components as well, and it really gives them relevant experiences that they are going to see in their work environment. It is not compartmentalized the way we see it in traditional core courses."

Ludwigsen said she was really concerned about how students would handle the math part of the course work. "We did Kepler's math. We are really talking about higher level mathematics — calculus. We have students at a variety of different levels in their core course work in math. One of my students was a little concerned in one class because he wasn't at the same math level that other students were. But what was really neat was the way the course worked and the fact that you [the student] could connect it to what was really going on," said Ludwigsen. After getting hands-on experience, the student quipped, "Oh, this is why the math worked." "He actually understood the math, and he was able to work through the problems and understand how math is used," said Ludwigsen.

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The course also focuses on literacy. Ludwigsen said she teaches students how to read technical information first by looking at unfamiliar terminology. “We use strategies similar to that used in any kind of reading course ... but sometimes we read much slower ... but we sort it out together,” Ludwigsen maintained.

## At First Students Feel a Disconnect, Then They Put It Together

“This is my ninth year teaching. These last two years of teaching this course have probably been the most enjoyable, because I see it reaches students. Even when they think they can’t get something like math or science or there is that disconnect, they are really putting it together. They get skills that are really relevant to what they are going to be doing, no matter what it is, whether they are going to go right out into the job market, whether they are going on to a training school, a two-year technical school or whether they are going to take a traditional four-year route,” said Ludwigsen.

*“It doesn’t feel like the typical classroom.”*



Students participate in a videoconference with the command post for the International Space Station (ISS) about the diverse experiments on the ISS and careers at NASA.

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One student said, “It doesn’t feel like the typical classroom where we are listening to the teacher lecture. We can actually ask questions and learn, and it is a more open environment.” “It is a more real-world situation and real-world applications,” said another student. The student also expressed seeing a connection between what’s going on in the aeronautics engineering class and how it ties to math and science classes. “I kinda missed that last year,” said the student, but not anymore.

“We have fun,” said Ludwigsen. She continued, “I have told them [students] if nothing else, they will walk out of this course and be good problem solvers because that is the training, and it makes you valuable no matter where you are going.”

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