



Solar Rollers Derby Rallies Bright Young Minds

Roaring Fork High
Solar Rollers 2015
team with Advisor
Jay Engstrom.

A Race to Learn about Energy

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The mini Daytona 500 that will be held outside of the Roaring Fork High School (RFHS) this month isn't just about the clash of a dozen remote-controlled, solar-powered cars hurtling along at speeds of up to 28 miles per hour. It is, in the words of founder Noah Davis, a race to educate students about energy.

Davis dreamed up Solar Rollers to engage high school kids in learning about renewable energy. By designing, building, testing, refining their cars and finally competing in multi-race derby day, students learn about energy efficiency, photovoltaics (solar electricity), motors, batteries, material properties, gearing and friction, not to mention planning and teamwork.

Davis, who worked for Solar Energy International in Carbonale before founding the nonprofit Energetics Education, moved to here from southeast Australia. He lived in an area that has been

identified as a "hotspot" for climate change and saw it devastated by drought, brush fires and choking smoke.

"I'm a teacher, and I have taught a lot of subjects," he says. "But that showed me that there's really no point in teaching anything but solutions to climate change right now. And that means understanding energy." The RFHS Solar Rollers team has already learned a thing or two about energy, both solar and human.

"We didn't win last year because our car had less efficient solar cells," says Jimmy Serrano. "But Jayvin's driving was great!"

Jayvin Krzych nods. "Up until the last hour, we were seven laps ahead. Then our battery started to die..."

As Davis tells it, "The Roaring Fork team built their car early in the season when we had solar cells that were good, but not great. Later, we got great cells, and we told the team that they could rebuild. It



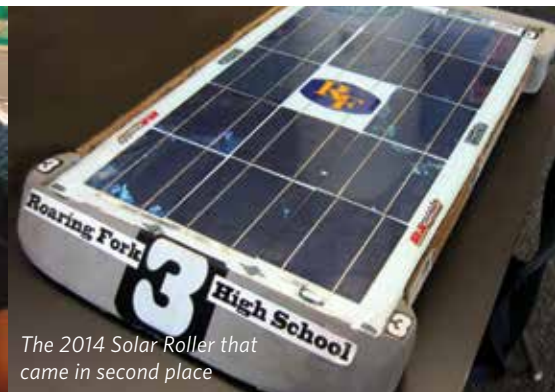
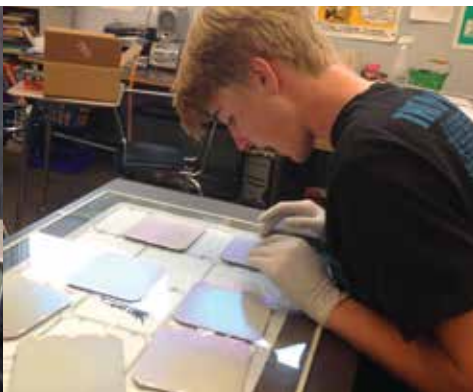
Redesigning the chassis.



The box of junk from which the roller will be built.

was going to cost them a couple afternoons of soldering to do that, and the Roaring Fork team said, 'No, we can win on these cells.'

"It was painful. The Roaring Fork team had 17 percent efficiency in their cells and the others had 20 percent. Every other car had something break. Meanwhile Roaring Fork kept going and going, hundreds of laps. But all of the broken cars got fixed, and sure enough, those cars caught up and passed them," says Davis. "If Roaring Fork had had the right cells, they would have won by a long shot."



The 2014 Solar Roller that came in second place

This year, they mean to win. It's now March, and the team is meeting in a not-for-credit STEM class that is guided by Jay Engstrom, who works for Roaring Fork Engineering. Last year, he taught math as a substitute teacher at RFHS. Engstrom greets eleventh graders Serrano and Krzych as old friends. They have returned to this year's RFHS team along with tenth grader Wesley Engstrom, another alum, plus new members Nick Penzel, a tenth grader, and Luke Klotz and Matthew Wampler, both in eleventh grade.

As the team huddles around last year's roller, they vow to do a few things differently. Serrano recounts the lessons learned in 2014.

"There are a lot of solar components, and the panels are fragile," he explains. "They break just like tortilla chips when you handle them. Once they are on a flat surface they are pretty strong. So this year, we are going to focus on craftsmanship in soldering and linking components."

"And, aerodynamics," adds Krzych.

Penzel has already modeled the team's redesigned Solar Roller on AutoCAD computer-aided design software. The model sports an F1 wing like those found on Formula 1 race cars, and the software reveals the air flow and pressure on it.

"The wings create down-force," he says. "That makes the car more stable and able to turn faster."

Nearby, Wesley Engstrom has dumped what he terms "the box of junk" out onto a table. "This is a totally new experience for me," he confides to a visitor. "This is the first time I have worked with solar panels. And I have never worked with RC components before."

"What's RC?" asks the visitor.

"Remote control," he answers, confidently reviewing items from the box: a rear-end axle, hubs and differential, purple striped wheels, a brushless power system, bus wires, foam tapes, epoxy, a steering servo and a Nanotech battery.

"To call it a 'kit' is a little misleading," says Energetics Educa-

tion Board Chair Susy Ellison. "It's a box of parts. And it's not a step-by-step process. The teams have to design the car and then solder and wire everything together. Initially, they look in the box and say, 'What is all this stuff?'"

But the RFHS team is building on experience. Serrano, Krzych and Klotz have turned last year's roller upside down and are discussing how to reduce weight, how to protect the solar panels from rocks thrown up while racing and how to provide more pow-

er during the derby day's one-hour endurance race. Last year's RFHS roller was powered by 14 solar panels.

"It was the biggest amount we could have without overcharging the battery," explains Krzych. "If it's overcharged, it can bubble up and die. But this year, we might add an extra panel that can be covered during the direct-panel event that doesn't use the battery. That's the race that is run on solar power only."

Whether RFHS decides to add a 15th panel or stick with 14, they will be using the more-efficient black solar panels this year. They are following the Y-shaped pattern of last year's fiberglass chassis, but adding a few enhancements. The chassis will be cut from a sheet of lighter-weight carbon fiber rather than fiberglass and it will sport a weight-reducing hole. And then, there may be that F1 wing.

Whatever design RFHS creates, it won't be an industrial secret. Each spring, Davis makes a movie of the RFHS team to show to other aspiring teams.

"We're the best of the best!" laughs Wesley Engstrom. "We're building to help everyone else."

The RFHS team's help is needed. Solar Roller teams from Aspen, Glenwood Springs, Eagle and Summit County have participated in past years and the program is now expanding to other states. Student teams in Austin, Texas, and Reno, Nevada, are building their first cars for Trophy Races in 2016, using an online course that features videos of Roaring Fork's construction process. Those teams can also post online, asking questions of the more-experienced Colorado teams. Many out-of-state schools have signed up, and Energetics Education is seeking funding for remote Trophy Races.

The 2015 Colorado Solar Rollers Trophy Race will take place May 16 at Roaring Fork High School. (See *Lifestyle calendar for details*.) Spectators are encouraged to come and support the teams.