

Using Technology to Build Solar-Powered Drag Racers

By Jerry Fireman

The Colfax High School Design Tech program incorporates both academic instruction and practical use of advanced technology to prepare students for the wide range of occupations that involve working with metal, wood, computers and electronics.

Students at Colfax High School in Colfax, California, apply academic learning, develop flexible thinking and acquire marketable skills in the school's Design Tech program. Thirty students rotate through four classes—metal shop, wood shop, computers and electronics—spending four-and-a-half weeks in each discipline. In each of these classes they contribute to their final project—a solar-powered drag racer featuring a metal chassis, custom-made circuit board, student-designed sticker package and a molded wood body. The students learn to use advanced manufacturing technology like a computer numerical control (CNC) router that is used to build the wooden body as well as a CNC plasma cutter that is used to build the metal chassis of the drag racer. Near the end of the class, students and their cars face off in a school-wide race.

A Unique Technical Education Program

Traditional vocational training courses like wood and metal shop focus on preparing students for careers like cabinet-makers, machinists and auto mechanics. Today's working world offers a much more varied range of technical and vocational careers, but whether traditional or new, these careers do have one thing in common. They all require the ability to use advanced technology tools in order to succeed and advance. The Colfax High School Design Tech program incorporates both academic instruction and

practical use of advanced technology to prepare students for the wide range of occupations that involve working with metal, wood, computers and electronics. The students can aim for some of the less traditional technical or vocational careers like jewelry making, repairing ski lifts, designing green buildings and building robots. "Our vision is to engage all students in applied learning," says Jonathan Schwartz who teaches the Design Tech course. "Students have the opportunity to imagine, design and make something while applying academic principles learned in science, math, English or any subject."

Wood Shop Technology

Colfax High School has used two of Techno Inc.'s LC CNC routers for several years in its wood shop program. Students use computer-aided design (CAD) software to define the geometry of their projects to extremely high levels of accuracy and detail. The software allows them to also zoom in and out on their projects and view them from any angle. After they are satisfied with the design, the students convert the geometry into a CNC program and download it to the router, which then produces the design by removing material from a block of wood or plastic. The resulting accuracy is far greater than the student could have achieved by using traditional hand or power tools. Building a prototype also forces the students to resolve issues that would be too easy to gloss over in a computer model, such as:

- Just exactly how do the pieces fit together?
- How does the user hold the product?
- How does it fit in with other products it is to be used with?

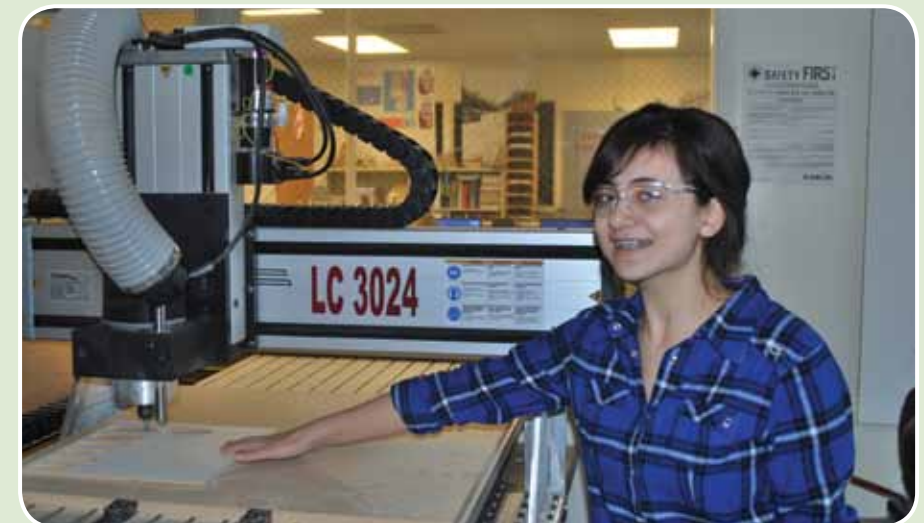
Metal Shop Technology

The solar-powered drag racer project is interesting because it utilizes the full range of technologies taught in the Design Tech program. As stated earlier, students rotate through four classes: electronics, wood shop, metal shop and computers. In each class they work on a contribution to their drag racer. In the wood shop class for example, students use CAD software to design the body of their car and a toolbox. Then they use the CNC router along with a table saw, band saw and sanders to build the car body and toolbox.

Creating the metal chassis of the drag racer involves cutting-edge technology. The school purchased a CNC plasma cutter from the same manufacturer that provides the CNC routers. The plasma cutter cuts steel and other materials with a plasma torch. The torch blows a gas at high speed out of a nozzle while an electrical arc is formed through that gas from the nozzle to the surface being cut. The energy begins to break apart the gas molecules. The electrons separate from the nucleus, forming a type of matter called plasma. When the fast-moving electrons collide with other electrons and ions, they release large amounts of energy. This energy is what gives plasma its unique status and amazing cutting power. The plasma is sufficiently hot to melt the metal being cut and moves fast enough to blow molten metal away from the cut. A plasma cutter can pass through metals with little or no resistance.

The CNC plasma cutter is easy for the students to learn because it uses the same industry standard G-code files used for programming most CNC machines. G-code is a language used to control the motion of computerized machine tools, which in turn determines the geometry

PHOTO COURTESY OF JONATHAN SCHWARTZ, COLFAX HIGH SCHOOL



▲ Rosie Ororzco using the Techno LC CNC router.

PHOTO COURTESY OF JONATHAN SCHWARTZ, COLFAX HIGH SCHOOL



▲ Design Tech instructor Jonathan Schwartz and student Christian Topper building components of a drag racer.

PHOTOS COURTESY OF CHRISTIAN KINSEY, COLFAX HIGH SCHOOL



▲ One of the race cars with the body removed.



▲ The same race car with the body attached.

Not Just for Cars

Caitie Pedersen, a former student at Colfax High School, used the CNC router to make Corian® molds that she used to design chocolate bars. "I made candy bars with the school name on it," Pedersen said. Pedersen is currently going to culinary school and planning to be a pastry chef. She sees the potential for starting a business based on making the chocolate bars and other types of candy to customer specifications. The customers could submit either sketches or their own designs in the form of CAD files. Pedersen would then use the router to cut a mold that exactly matches the customer's design. "The CNC router greatly reduces the cost of making custom food designs," Pedersen added. "As a result, it should open up the potential for people to create many interesting new businesses."

of the parts they produce. The machine's automatic torch height control helps maintain cut quality on both thicker and thinner materials.

Race to the Finish

In addition to the CNC plasma cutter, students use the drill press and various hand tools to create the metal chassis, display stands and a tool tray. Students learn how to solder and build the circuit boards in the electronics section of the class. After the students complete all four sections of the class and build their racers, they race their cars against the other students.' The cars are also judged based on their creativity, color schemes, body design and workmanship. Approximately 120 cars compete against each other and are judged for the final event.

"Technology is becoming increasingly important to a wide range of industries and careers, and knowledge of technology

is also important in starting many types of businesses," Schwartz said. "That's why we have done a complete makeover on the traditional metal shop, wood shop and other vocational training classes. Our classes combine the academics needed for students to understand the technology with practical skills that are essential for success in a wide range of careers and businesses. Using the same brand of equipment for routing and plasma cutting gives us great consistency throughout our shop. The equipment is very easy to use and rugged, which makes it ideal for use in the educational environment. Yet we also have the accuracy to produce industrial-quality products, so in many cases, our students will be using the same equipment on the job." **I**

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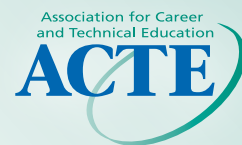
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