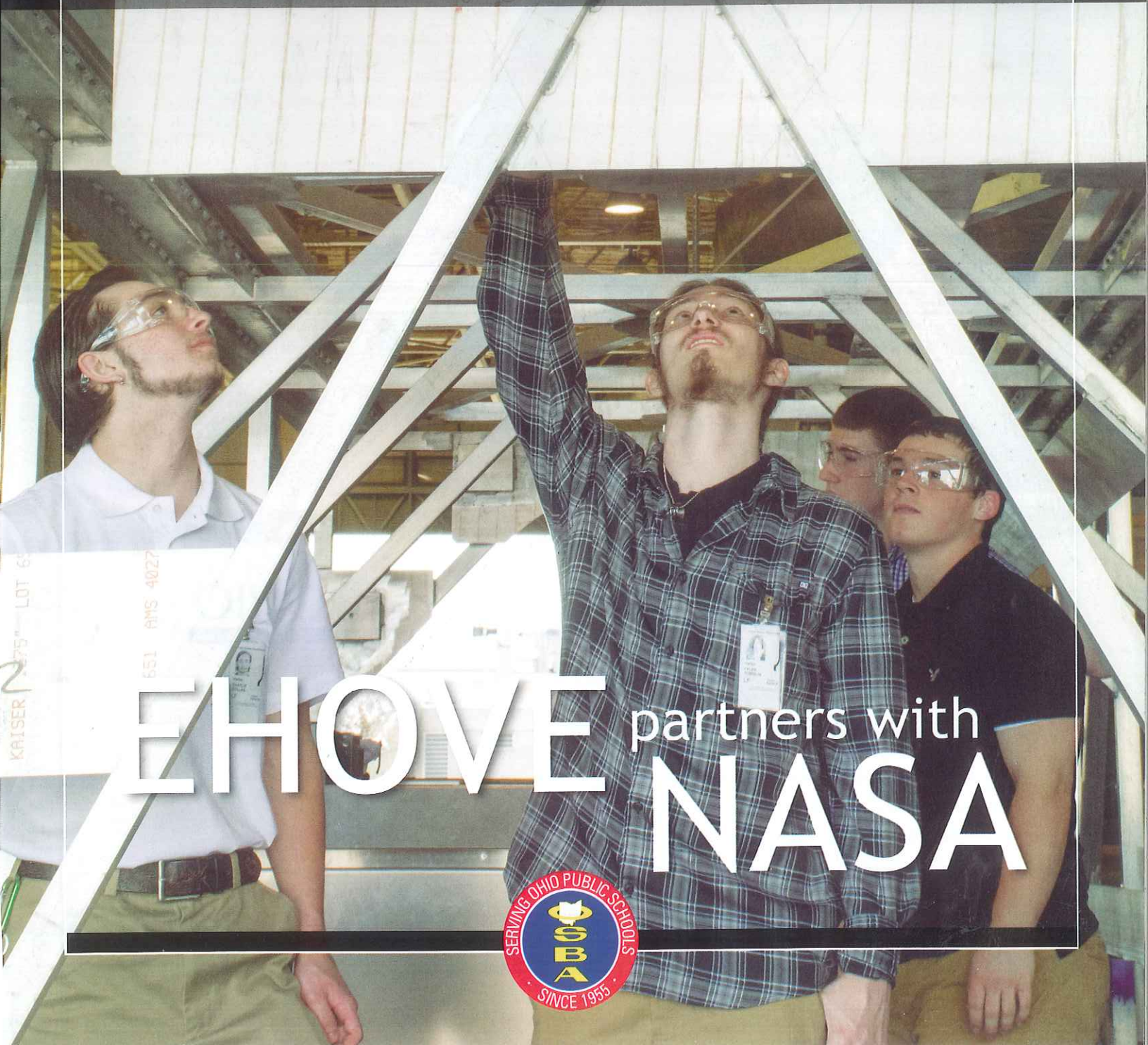


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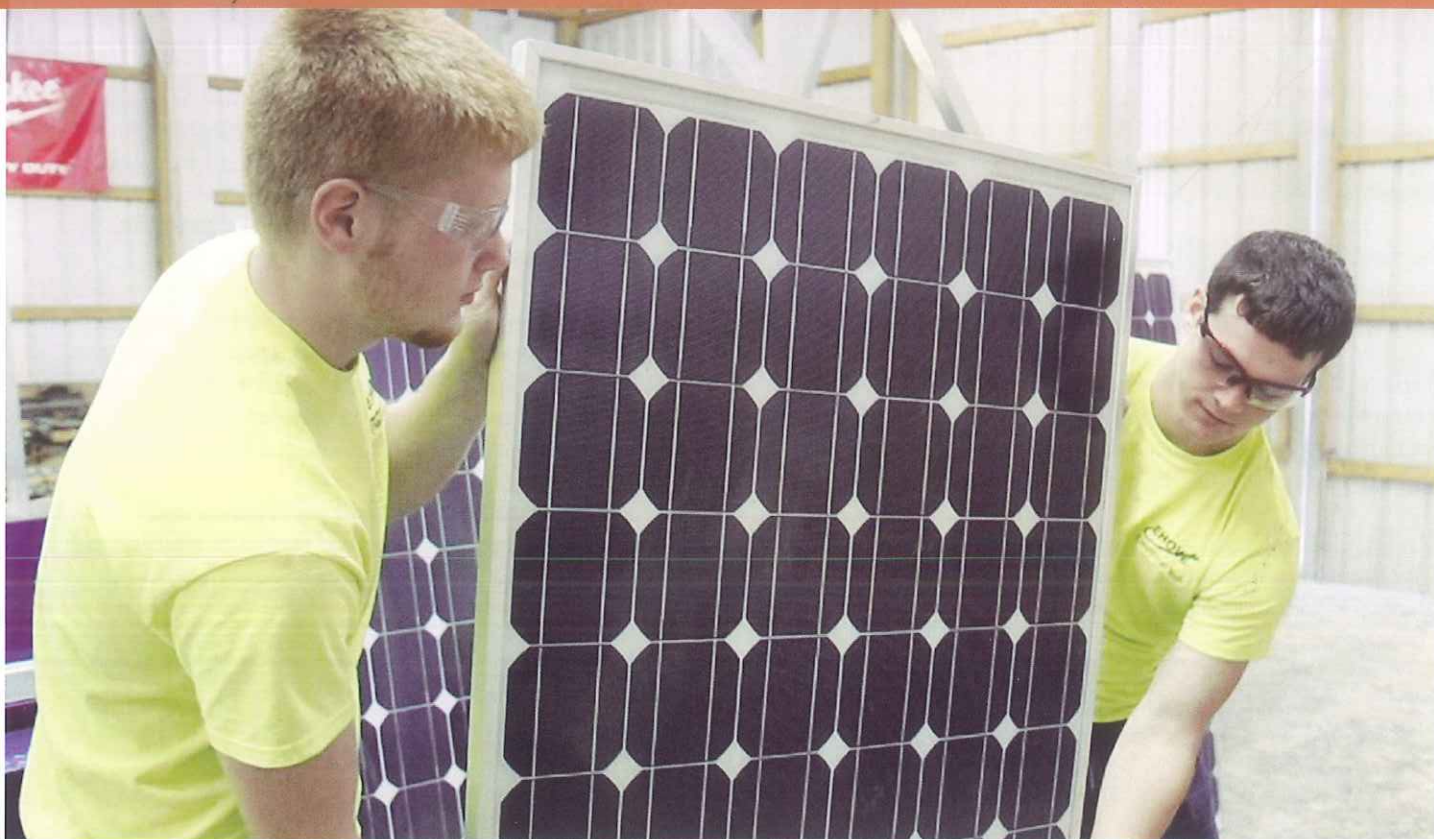
OHIO SCHOOL BOARDS ASSOCIATION



EHOVE partners with
NASA



Students power up



EHOVE Career Center students Austin Martin, left, and Jeremy Schafer move a solar panel in a workshop at the career center. EHOVE recently completed a project with the NASA Glenn Research Center in Cleveland to build a mobile solar power plant.

EHOVE collaborates on mobile solar power plant

Time was, vocational education amounted to little more than simple projects in a sawdust-strewn shop class.

But those days are long gone. Vocational training has transformed into 21st century career-technical education, encompassing myriad skills, experiences and professions.

A great example of that can be found in a project recently completed by **EHOVE Career Center** students. And although much of their work was done in a shop, it was anything but “shop class.” They were working alongside aerospace engineers from the NASA Glenn Research Center in Cleveland to build a mobile solar power plant.

Mounted on a 16-foot trailer, the plant can produce three kilowatts of power. The solar panel array is folded up while being transported, but when open, the panels span 512 square

feet. The device is made up of the same technology as space-based solar plants, and NASA plans to use it to run tests that will have actual space applications.

“Before the EHOVE program had started, we had built a similar trailer as a power system to simulate space solar power systems,” said NASA Research Engineer **Tony Colozza**.

“That trailer produced one kilowatt. We used it in Arizona to simulate operations on the moon. We also took it the Johnson Space Center in Texas and used it as a power system for a deep space habitat project.”

Although NASA engineers found plenty of uses for the one-kilowatt trailer, they were interested in building a more powerful plant that could take on bigger projects. The problem was, funding was hard to come by. They were able to buy some

NASA project

*Gary Motz,
managing editor*

of the components, but didn't have the funds to assemble them.

Colozza contacted **Carol M. Tolbert**, a NASA project manager, and discovered she was seeking an organization in the Toledo area willing to collaborate on a solar power project as part of NASA's community outreach. That outreach led her to EHOVE in Erie County, which previously had worked with Glenn's Plum Brook Station in Sandusky.

EHOVE initially connected with Plum Brook via a process called Innovation Camp, based on the concept of human-centered design, said EHOVE Assistant Director **Matt Ehrhardt**.

"What we've done over the years is train students and faculty in the human-centered design process," Ehrhardt said. "They learn interviewing techniques, problem-solving skills and how to listen to and engage stakeholders. It uses real-world applications that enable our students and staff to work with businesses or nonprofits to help support or grow their companies.

"Students and instructors started the innovation process with NASA when they first met with **Brian Willis**, lead for mentoring, diversity and inclusion at Plum Brook Station. This meeting provided the opportunity for our students and instructors to interview Plum Brook Station Director Gen. **David Stringer** and his team.

"This process identified three areas of collaboration: safety awareness for public visitors to Plum Brook Station; bio-sustainability of native Ohio prairie ecosystems; and the NASA 3kVA photovoltaic (solar) power plant project. EHOVE entered into a Space Act Agreement with NASA, just like a commercial firm doing business with the space agency would do. The agreement laid out the roles, responsibilities and goals of the projects."

Involving EHOVE in the solar power plant project was just what NASA needed to move ahead with its plans. The collaboration provided the space agency with what it had been missing — a means of building the solar trailer.

"We saw that it would be a good fit if we could produce the design, supply the hardware and have EHOVE put it together and get it working," Colozza said. "Then we could bring it

back here and use it. That would help us out and give them a chance to work on technology they don't ordinarily see."

Students in EHOVE's electrical tech, industrial tech and collision & refinishing classes, advised by NASA staff, worked on the project, both at the career center and the Glenn facility. Electrical students installed wiring and related equipment, industrial students were responsible for the welding and collision & refinishing students painted the trailer. Their goal was to get the trailer ready for the installation of the solar panels, which NASA purchased. In all, about 200 juniors and seniors participated in the three-year project.



Above is a drawing of NASA's 3kVA photovoltaic power plant. Mounted on a 16-foot trailer, the solar panels span 512 square feet when open and produce three kilowatts of electricity. NASA will use it to test different ways the technology might be used in space.

"The big thing in education is trying to find, No. 1, real-world projects, and No. 2, trying to work with local businesses and community partners," said **Chuck Oeder**, EHOVE electrical tech instructor. "This project ties all of that together and also is cross-curricular with the electrical, the mechanical and the welding. The kids also learned a lot of soft skills like communications, skills they don't always get to touch on in the classroom."

For the students, the experience was memorable on many levels. They learned new skills, worked side by side with NASA engineers and technicians, and grew more confident in their abilities. And, they now can add "collaborated on a NASA photovoltaic project" to their résumés.

"This project has given me a lot of real-life experience, especially



NASA Glenn Research Center is one of 10 major NASA field facilities. Its primary mission is to develop science and technology for use in aeronautics and space.

with reading prints (drawings)," said EHOVE senior **Charlie Collas**, a welder who has already landed a job with a Sandusky firm. "It was pretty difficult at first, but I'm OK with it now. It got me out of my comfort zone, which is something I'm going to need when I'm out in the real world working."

"The drawings were on a level that I don't ordinarily provide the kids in the classroom," said **Dan Langdon**, EHOVE industrial tech instructor. "They were on a level of what they would see in industry and maybe even a little above some shops they might go to. So they're going to come out leaps and bounds ahead of some of the students from other programs."

Senior **Tyler Tomblin** also found reading the complex prints difficult at first. In addition, he, Collas and two other students had to earn a NASA certification in aluminum welding before starting work on the project. NASA Manufacturing Engineer **Tim Reed** said the certification test is the same that professional welders at the Glenn center must pass.

"I wanted to work with aluminum, so this gave me an amazing opportunity to advance in that," Tomblin said. "I also had a limited knowledge of prints when I first started, but Tim helped me out a lot and I think I progressed immensely with it."

The electrical piece of the project also posed challenges. But

those challenges only served to expand students' knowledge and skills.

"We do some solar in our curriculum, but not to the scale of this project," Oeder said. "The two students I brought here today worked quite a bit on the trailer. They came into the project with a very limited knowledge of solar power systems and, at this point, both of them have a pretty good understanding of how this thing should go together."

Those two students, seniors **Jeremy Schafer** and **Bryan Hickey**, were part of a team that installed most of the electrical system to get it ready to connect to the solar panels. Electrical equipment included a conversion system, extensive wiring, a battery charge controller, fuse boxes and an insulated cabinet to house the components and protect them from the elements. One problem they had to solve was how to put everything together without any design plans.

"One of the biggest challenges was that we didn't have any drawings for our trailer," said Schafer, who will attend Terra Community College in the fall. "We just went by looking at the one-kilowatt trailer and what the NASA staff told us. We had to use a kind of reverse engineering."

Hickey, who plans to study electrical engineering at the University of Toledo, has been working as an intern at Plum Brook Station since December.

"I'm working with one of their engineers on some smaller projects," Hickey said. "One of those was to design and build a small model rocket launch control system."

Colozza described the trailer as a "test bed system," which means it can be modified for different purposes. One use he anticipates for it is to power a spacecraft system design project at the Johnson Space Center. And now that the Glenn facility has two mobile solar plants, the one-kilowatt and three-kilowatt systems can be used in tandem.

"There's a NASA grid project that's probably going to want to take a look at this since we have two trailers now," Colozza said. "We could try to build our own little AC (alternating current) network between them and start simulating what you would do on the lunar surface if you had multiple power systems."

In August, EHOVE and NASA staff members will take the solar trailer to Boston for Fab11, the 11th annual International Fab Lab Conference at the Massachusetts Institute of Technology (MIT). The trailer will help power some projects conducted by **Cleveland Municipal Schools'** MC² Stem High School's Fab Lab trailer team. Fab Lab is the educational outreach component of MIT's Center for Bits and Atoms, and an extension of its research into digital fabrication and computation. It provides a platform for learning, innovating creating, mentoring and inventing.



EHOVE Career Center student Charlie Collas welds a part for the NASA mobile solar power plant. EHOVE students worked on the project at the career center and NASA's Glenn Research Center.



EHOVE Career Center student Charlie Collas, left, and instructor Dan Langdon inspect a part Collas just welded. EHOVE students had to earn a NASA certification in aluminum welding prior to working on the power plant project.

NASA has a history of reaching out to schools and communities. The agency collaborates with schools and other organizations on projects and has a speakers' bureau of experts who deliver presentations on a variety of topics.

"We're responsible for a six-state region here at Glenn, so we have various projects going on," said **Darlene Walker**, STEM engagement and education professional development manager. "In a couple of weeks we're going to bring 190 interns here to work in various areas. We also have a partnership with Cleveland Municipal Schools' MC² Stem High School, as well as with the **Cleveland Heights-University Heights** [City school] district. One of our strategic goals is to share NASA and our unique assets with the community. And specifically in education — we're trying to reach 1 million students through STEM engagement."

The EHOVE students are glad they had the opportunity to be among those 1 million. They had the unique experience of working with NASA technicians, acquiring new, top-flight skills and gaining valuable real-world experience that will help launch their careers.

"I really enjoyed working here; it was a great opportunity," Tomblin said. "The knowledge I gained from this is very rewarding. And now I can say I helped NASA with a project, which will look great on my résumé."

"I really like that what we worked on actually could become

a big project," Schafer said, "and it was a great experience working with NASA. I hope to see the trailer out in use someday and be able to say I helped build that."

The students weren't the only ones who found working on the project rewarding. The feeling was mutual for their teachers and NASA staff.

"It's satisfying to see the sense of pride these kids have, knowing their welds are on par with what the NASA techs are doing," Langdon said. "And the experiences that they get out of something like this, things they might see when they're successful later in life, the interviews and meetings with higher-ups. Those things prepare them to, not necessarily be a welder for the rest of their lives, but to move up in management and develop other skills in the professional world."

"It's rewarding to know that these students will go on to touch others as a result of their experience here and it will spread and make a difference that way," Tolbert said. "When they look back on these years, they'll say 'Wow, I did work like this with NASA.' That's the most important thing — it's going to make a difference in their lives and that's what we really want." ■

Editor's note: To view a brief EHOVE-produced video on the solar project, visit <http://links.ohioschoolboards.org/99076>. The video features students working on the solar trailer as well as interviews with NASA staff and EHOVE teachers and students.