Optics Career Ladder Takes Shape in Albuquerque

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Female students make up thirty percent of the 2002 entering class in the photonics academy. Attracting minority and female students is one of the academy's primary goals.

Schools, businesses and civic leaders in Albuquerque, New Mexico, have launched a unique educational program for high school, college and graduate students interested in pursuing careers in optics and photonics. The program trains entry-level workers, technicians with an associate of applied science degree, and optical scientists and engineers with qualifications ranging from the baccalaureate to the doctoral level.

The growing need for a skilled optics and photonics workforce has been manifest nationwide for several years. A recent study by the National Academies of Science and Engineering underlines the fact that more optics workers will be required in the future in fields including biomedicine, information technology, defense and manufacturing. A survey conducted in 2000 by the Waco, Texas Center for Occupational Research and Development (CORD) predicted a nationwide shortfall of approximately 6000 trained photonics technicians each year between 2002 and 2005.

Although the events of September 11 and their aftermath have had a profound effect on some segments of the optics industry, a lack of qualified workers in key sectors will still pose important challenges for the country's educational institutions in coming years.

Building the team

Work in Albuquerque got underway in 1991 with the creation of the Alliance of Photonics Technology (APT), a loosely knit organization formed by Sandia and Los Alamos National Laboratories, the Air Force Research Laboratory at Kirtland Air Force Base, the Center for High Technology Materials at the University of New Mexico, and New Mexico State University. Working on the assumption that most students are unaware of the opportunities available in the field of optics, the organizers of the initiative decided to create a "career ladder" with rungs in high school, a two-year technical school, and the University of New Mexico (see Fig. 1). Participants can follow a photonics training path stretching from ninth grade to the Ph.D. level.

From the ground up

The ladder begins at the three middle schools that feed into West Mesa High School (WMHS). To make parents and students aware of optics career opportunities, WMHS counselors and teachers provide career guidance at the middle schools during orientation sessions. They explain that, upon graduation from high school and completion of an industry internship, students can go into an entry-level job in optics, a two-year photonics associate degree program at Albuquerque's Technical Vocational Institute (TVI) or a four-year program in optical science and engineering at the University of New Mexico (UNM). The transition into the vocational institute is facilitated by a program that allows the high school students to earn advanced credits in mathematics, science, electronics and photonics.

With a degree from TVI, many graduates move into industry and federal laboratories. For those interested in continuing their education, a choice which is encouraged by teachers and counselors, the next step is UNM,* which offers master's and doctorate degrees. (A new baccalaureate program in optical science and engineering, being developed with the help of a NSF-funded planning grant, is expected to be ready around 2007).

The authors believe that to guarantee a successful transition from the lab-heavy two-year TVI course into a standard science/engineering optics program at a four-year university, for most students, an additional "bridge" year of university-level mathematics and science courses would be helpful.

The photonics academy

Sponsors of the alliance decided a photonics academy would be an appropriate vehicle to start WMHS high school students on the optics career ladder. This belief was motivated by the fact that an Advanced Manufacturing Academy (AMA), formed at WMHS in the 1990s, had met with success. Today, the AMA partners with Sandia

* UNM has a longstanding graduate program in optical science and engineering. Its Ph.D. program was introduced in 1983. UNM's program will be discussed in detail in a future article.

and other local industries to provide students with internships and mentors. Close contact with lab workers has helped raise the achievement levels of students in the internship program.

The photonics academy officially opened its door this September to 60 students from the three middle schools that feed into WMHS. Classes include core high school math—algebra 1 and 2, geometry and precalculus—science, history and English, with an added technology component focused on electronics and metallurgy. Figure 2 shows the curricula of the four-year WMHS program and the two-year TVI photonics program. Graduates of the TVI program receive the associate of applied science (AAS) degree in photonics.

Competition for entry into the photonics academy is intense, according to its director, Tom Daley. "We're producing a group of kids who are highly motivated and highly qualified," he says. "One problem with kids who are smart is they have trouble finding each other, but here they can find each other quickly and establish relationships and contacts."

Attracting minority and female students is one of the academy's primary goals. Female students made up a third of the AMA's first class and held the top two spots among students in the class that will graduate in 2003. Nikki Trino, who was first in her 10th grade class, said "I like working with my hands and with machines. I'd like to go to a four-year college when I graduate. And I'd like to be an intern at Sandia. I think it would be fun." Victoria Fowler, second in her 10th grade class said, "I like getting dirty. I want to be either an engineer or a doctor. I think this will help me everywhere." Thirty percent of the photonics academy's entering class this September is made up of female students.

Attracting capable students is another important goal. Dominique Foley Wilson of Sandia observes: "At West Mesa in the academies we've seen the average GPA of intern applicants to Sandia go from 2.5 to 3.85. That's the average. We're getting very high-caliber individuals and we've found a way to keep them from getting lost in the system."

Once a class is formed, Daly works to build a "family" with high morale. "The kids get T-shirts and things, and they get to go on field trips to the labs. So very quickly in their high school career they're drawn into this web of high-level people in photonics. The Sandia people take them out to lunch and talk to them. It's a good thing for the kids—really eye-opening."

The graduation rate for the AMA students is higher than that of the typical high school class and continues to rise. Says Wilson: "In the five-year history of the manufacturing academy, the drop-out rate has declined by 15 percent."

The future looks bright for the two academies. Both have received endorsements from the National Coalition of Advanced Manufacturing, which calls them good models for other schools nationwide. The photonics academy has also captured the interest of the Department of Energy, as is evidenced by the involvement of Sandia National Laboratory and the laboratory's internship program. And the two premier professional societies in optics—OSA and SPIE—are lending valuable recognition and support.

The career ladder in optics is a model for others, says WMHS Principal Milton Baca. "Parents in the community are beginning to realize how their children can flourish here. They understand that the photonics academy is serious business and that it's our job to see that students are prepared for the next step in their careers when they finish their classes here."

Acknowledgments

Considerable credit for the effective implementation of the WMHS Photonics Academy goes to Principal Milton Baca; Assistant Principal Essel Baca; Academy Director Tom Daly; and Carmen DiGregorio, physics teacher. At the Technical Vocational Institute, credit is due to Director of Electronics and Manufacturing Technology Robert Hall and Department Chair Joel Gellman. Dominique Foley Wilson of Sandia National Laboratories and the authors played supporting roles in the creation of the photonics academy.

References

1. "Harnessing Light, Optical Science and Engineering in the 21st Century," National Academies of Science and Engineering, Washington, D.C., 1998.
2. Navarra, A., Hull, D., Guenther, A. and Pedrotti, L. S., "Whence the Technicians?" Photonics Spectra, pp. 115-118, April 2001.

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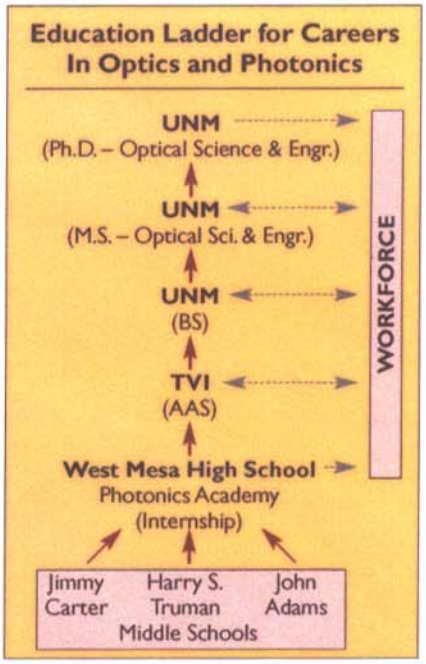

Figure 1. Organizers decided to create a "career ladder" with rungs in high school, a two-year technical school and the University of New Mexico. Participants can follow a photonics training path stretching from ninth grade to the Ph.D. level. Along the way, they can choose to enter the workforce or continue with their education.

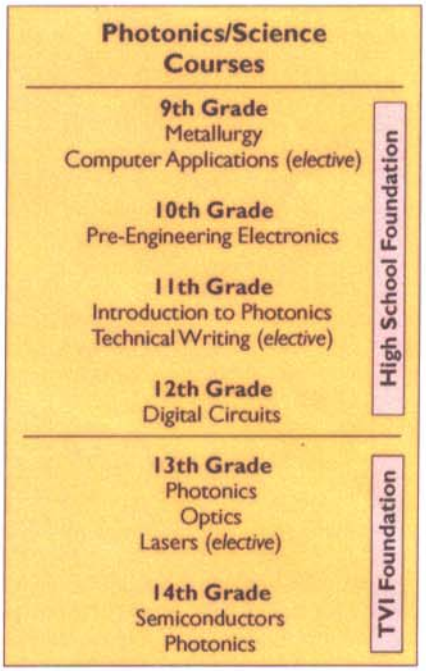

Figure 2. Photonics academy courses are founded on a standard college preparatory high school curriculum. In addition, the photonics portion of the program features the prerequisites and electives listed above.