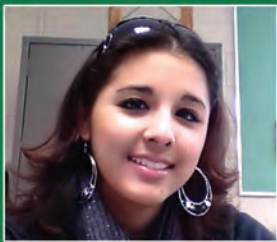


Success Stories in Photonics Careers



Photonics Alumni Council for Technicians

Success Stories

in

Photonics Careers

Photonics Alumni Council for Technicians



The National Center for Optics and Photonics Education is a National Center of Excellence sponsored by the National Science Foundation's (NSF) Advanced Technological Education (ATE) program. The mission of OP-TEC is to increase the supply of well-prepared photonics technicians by building and strengthening the capacity and quality of photonics education in U.S. two-year colleges.

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Preface

Photonics technicians and laser/electro-optics technicians: Who are they? What do they do? Where do they come from? How are they prepared? What can they become? Why do we need so many of them? This book answers these questions by examining the lives and careers of 34 exemplary photonics technicians: the **Photonics Alumni Council for Technicians (PACT), 2013**.

For almost forty years, the two of us have focused our energies and our professional careers on the education and training of photonics technicians. And so have dozens of educators at more than thirty community and technical colleges throughout our country. Countless photonics employers, scientists, and engineers have also contributed to this effort by helping develop skill standards for photonics technicians, by preparing and reviewing educational materials, and most of all, by serving on photonics-education advisory committees at the colleges that educate their future employees.

This book symbolizes the fruits of our labors. Today, more than twenty thousand photonics technicians are at work in businesses, laboratories, government, hospitals, defense industries, and educational institutions. A 2012 survey of photonics companies revealed that we will continue to need at least eight hundred new photonics technicians each year for the next five years! That demand is much greater than the number of graduates we are producing at our photonics colleges, so these colleges need to enroll even greater numbers of capable, interested, and prepared students.

Information about the enormous impact of photonics on our country's security and technical innovation can be found in the National Research Council's 2012 publication *Optics and Photonics: Essential Technologies for Our Nation*.¹ Photonics offers incredibly rewarding career opportunities for deserving young people. Technicians are an essential component of the photonics team: scientists, engineers, and technicians. Technicians are uniquely qualified to be the geniuses of the lab and the masters of the equipment. And these professionals provide a backbone for an industry that is keeping our country safe, healthy, and economically competitive.

We also recognize the vision and dedication of two pioneers who gave so much to photonics-technician education: Dr. Arthur H. Guenther (Chief Scientist, United States Air Force) and Dr. Leno S. Pedrotti (Emeritus Professor, Air Force Institute of Technology, and Chief Scientist, Center for Occupational Research and Development).

Fred Seeber, PhD, Professor
Camden County College

Dan M. Hull, Executive Director
The National Center for Optics and Photonics Education
(OP-TEC)

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Introduction

What is Photonics?

We live in a world bathed in light. We see with light, plants draw energy from light, and light is at the core of most emerging technologies. The field of optics deals with phenomena, components, systems, and techniques that control light and enable it to perform useful tasks. Lasers provide coherent light and are a part of numerous electro-optic devices and applications, which together make up the field of photonics, encompassing optoelectronics, micro-optics, lasers, digital imaging, spectroscopy, optical instruments, and optical systems.

As this century is unfolding, light is playing an even more significant role than it has in the past. Today, photonics is not only a technology field in and of itself but also an enabler of nearly every other technology field, including solar energy, telecommunication, micro- and nanotechnology, information technology, biotechnology, bio-medicine, precision measurements, materials processing for manufacturing, remote sensing, solid state lighting, electro-optics displays and imaging, national defense, and homeland security. Advanced photonics technology is enabling a revolution in world fiber-optic communications, new modalities in the practice of medicine, enhanced scientific research, a more effective national defense system, advanced manufacturing, and much more.

Photonics has become an important focus for new businesses in the global economy. Companies that focus on optics and photonics create more than \$3 trillion in revenues—ten percent of all U.S. public company revenues. They create 7.4 million jobs—six percent of public company jobs. \$4.9 billion worth of laser sales enabled \$7.5 trillion of the U.S. gross domestic product in 2009 and 2010.¹ And according to a National Research Council report, “In the United States, both large and small businesses are significant players in emerging photonics business activity. Photonics-related companies number more than 5000 and their net financial impact amounts to more than \$50 billion annually.”²

Photonics Technicians

The technical teams that create and improve photonics devices and systems in our country’s industries and laboratories are composed of a “three-legged stool”: scientists, engineers, and technicians. Scientists explore and discover new phenomena; engineers design new devices, systems, and processes; and technicians make these new devices, systems, and processes work. Technicians are the “geniuses of the lab” and the “masters of the equipment.”

Photonics technicians are educated and trained in the practical aspects of photonics. They are proficient in the principles and applications of optics and lasers, as well as components, devices, equipment, techniques, and safety aspects used in the development, systems integration, operations, and maintenance of photonics equipment. They work in laboratories, manufacturing facilities, hospitals, field service, sales, and a variety of places where lasers and other photonics devices are used. Some photonics technicians work in teams composed of engineers, scientists, and possibly marketing or sales people. Other technicians work independently. Some photonics technicians own their own businesses.

Most photonics technicians are educated and trained in two-year, Associate of Applied Science (AAS) degree programs at community and technical colleges. Photonics technician graduates may choose to continue their education in science, engineering, or business at universities. Some have earned bachelor’s, master’s, and PhD degrees. All photonics technicians have great opportunities for rewarding careers. U.S. photonics employers need about eight hundred new photonics technicians each year. This demand far exceeds the supply of AAS-degree graduates in photonics.

¹National Research Council, Optics and Photonics: Essential Technologies for Our Nation (Washington, DC: The National Academies Press, 2012), <http://www.nap.edu>

²National Research Council, Overview: Harnessing Light: Optical Science and Engineering for the 21st Century (Washington, DC: The National Academies Press, 1998).

THE PHOTONICS ALUMNI COUNCIL FOR TECHNICIANS (PACT)

Community and technical colleges have been offering AAS degrees to prepare men and women as laser/electro-optics and photonics technicians since 1971. In the last forty-two years, these institutions have graduated several thousand laser/electro-optics and photonics technicians. Some of these technicians work in communities near these colleges; others are working throughout the country and in other parts of the world. All the graduates of these programs have found employment, and most are still engaged in highly rewarding careers.

In early 2009, The National Center for Optics and Photonics Education (OP-TEC) founded the Photonics Alumni Council for Technicians (PACT). Faculty from technician-education programs in the OP-TEC Photonics College Network nominated former students who were recognized for their technical achievements and leadership abilities. These candidates were asked to complete a questionnaire and submit a resume. Sixteen photonics technician graduates were selected for the 2009 class of PACT, five more were added in 2011, and thirteen more have been added in 2013. This book presents these PACT members' names and profiles.

The Purposes of PACT are:

- To recognize excellence and success in photonics technicians.
- To show the diversity of employment opportunities for photonics technicians.
- To provide role models and mentors for photonics students and for high school students who are considering a career in photonics.
- To advise OP-TEC and other educators about perceived strengths and weaknesses in photonics-technician curricula, teaching materials, and instructional strategies.
- To advise photonics-technician students on how to be successful while in school, why they should complete a degree or certificate, how to get a job after graduation, and how to be successful at work.
- To advise OP-TEC of emerging applications in photonics, particularly in the specialty area of the technician's employment.

Presenting the PACT

The following pages showcase the 34 members of the Photonics Alumni Council for Technicians. As you read these biographies, you will learn about the wide variety of career opportunities for photonics technicians, and you will also see the character and diversity of these men and women. You'll read about how they were attracted to this field, the struggles they had to overcome to complete their education, and the mentors who helped them along their journey. In some cases, you will also learn how their careers—and education—have advanced.

- Some of these PACT members are recent graduates; others graduated over twenty years ago.
- Some have advanced to high levels of responsibility in their organizations.
- Some have formed companies that they own.
- Some have transitioned to related careers.
- Some have continued their education and earned bachelor's, master's, and PhD degrees in science, engineering, business, and education.

If you are a friend, a relative, an employer, or a coworker of one of these PACT members, you will likely learn something new about them—and you will certainly feel pride in celebrating their achievements.

If you are a young person considering your educational and career options, these model technicians will provide you with practical insight into the field of photonics—and probably inspire you to further investigate your career opportunities in photonics.

If you are a parent, teacher, guidance counselor, school administrator, or policy maker, you may be pleasantly surprised to learn of the career opportunities and benefits available to very capable, deserving students who are applied learners.

Karen Diaz considers herself lucky: she gets to experience firsthand the incredible way that electronics, mathematics, and physics work in harmony. As a student at Central Carolina Community College (CCCC), Karen initially completed an associate of applied science program in electronics and computer engineering technology. Upon earning her degree, Karen decided that an additional degree in laser photonics would offer an even broader spectrum of job opportunities, so she continued at CCCC, ultimately earning an associate degree in lasers and photonics technology. Once she enrolled in the program, she found herself fascinated by what she was learning. “I took the chance to try something new,” she says, “and found that I loved it.” Karen was also eager to take advantage of the many opportunities available to women in technology. “As a female,” she explains, “there are so many opportunities for me in the engineering field. At the time I graduated, photonics seemed to be an up-and-coming field with lots of options.”



On taking risks: ***“I took the chance to try something new and found that I loved it.”***

While Karen was enrolled at CCCC, she also focused on gaining valuable work experience. At first, she worked as an information and communication intern for Progress Energy, where she did everything from building a relay-testing panel to designing electrical schematics. Later, she worked as a contractor for both Power Equipment Maintenance and The Atlantic Group. As a contractor, she calibrated plant equipment and performed maintenance activities. The variety of experience she gained confirmed her suspicions that photonics was the right subject matter for her. “This field is so broad,” she explains, “that I have found myself in situations where I have to apply the knowledge that I learned in electronics and computer engineering.” By the time she graduated in May 2012, she was ready to advance her career and continue her education.

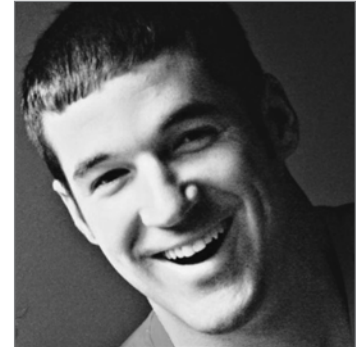
Currently, Karen is pursuing a bachelor’s degree at Duke University, where she works as an intern in the photonics and spectroscopy lab. Karen’s internship has given her additional experience in Python and MATLAB programming, optics handling, and components testing. At Duke, Karen is able to apply everything she has learned in her education so far, including electronics engineering, computer engineering, and laser and photonics technology. One of the things she most appreciates about her photonics career is the opportunity to face something new and interesting every day. For example, she is currently working on the revolutionary MOSAIC gigapixel camera. “I am proud to be involved in such a revolutionary project,” Karen explains. This camera “can potentially change the way we take photographs, as well as the media industry.”

Karen believes that students considering a career in photonics will be amazed by the many opportunities that the field offers. She acknowledges that many students are intimidated by the amount of physics and mathematics involved in photonics. Initially, she, too, was worried about her physics courses, but she stuck with them and now says that physics is “really not that hard.” She urges those interested in a technical field to stick with their studies so that they can see all that photonics has to offer.

Karen has been offered the opportunity to work in Research Triangle Park, but she has decided to focus instead on earning her bachelor’s degree. She believes that a bachelor’s degree will give her career an extra boost and allow her to advance more easily.

Karen lives in Durham, North Carolina. She happily dedicates most of her time to her education and her work, but in her spare time, she enjoys reading and watching movies with her family.

Tanner Rupe began building motorcycles for a living after high school. Though he enjoyed riding motorcycles, he found himself unsatisfied with building them as a career. Instead, he wanted a job that would allow him to support a family. He had friends who had attended Indian Hills Community College (IHCC), earned degrees in laser/electro-optics technology, and proceeded to develop stable careers. Inspired by their outcomes, Tanner decided to follow their example. He found a “stable growing technical field that I knew I would constantly be challenged in.” Tanner saw that the young technology was not going to dwindle away any time soon, and he knew that the field offered what he was looking for.



On his enthusiasm for his work: ***“Who doesn’t want to be part of cutting-edge technology?”***

At IHCC, Tanner served as secretary of the Laser/Electro-Optics Club and worked as a design engineer at Fat Baggers, Inc., where he focused on advancing techniques for reverse engineering. For example, he “reverse-engineered motorcycle parts for reference points to design new and improved parts for manufacturing.” Tanner recalls that the most difficult part of completing his degree was having the discipline to stay focused. However, he found that his interest in the technology gave him the discipline he needed. He was in a research-and-development environment, so he was able to work with various cutting-edge lasers right off the bat. Tanner finds laser technology “unreal,” and as he says, “Who doesn’t want to be part of cutting-edge technology?”

After completing the IHCC program in 2011, Tanner worked as a laser technician for General Atomics Aeronautical Systems, Inc., in San Diego. He was excited to have found a career path that would “provide never-ending learning.” As a laser technician, Tanner reviewed engineering ideas and drawings, fabricated pieces to complete experiments, and trained employees in various fabrication projects. His varying work assignments allowed him to develop a “strong background in managing and planning projects simultaneously.”

Today, Tanner works as a manufacturing engineering associate for Exotic Electro-Optics, where he designs and creates test setups and procedures, does SolidWorks modeling, and troubleshoots electronics. Tanner’s work has helped to save “thousands of dollars in touch time” by means of new process design and implementation. Tanner is most proud of helping develop a cutting-edge rubidium-vapor laser system that will eventually be used in high-energy laser weapon systems.

Even though Tanner began his career in a field that was very different from photonics, he has managed to advance quickly. “I came in this field as a laser/electro-optics technician, and in just over a year, I moved myself in to more of an engineering role.” Tanner believes that his broad background helps him advise new technicians on how to advance toward their career goals. He is thankful for the friends who motivated him to pursue such a promising career path, and would like to serve as a similar role model to others.

Tanner lives in Temecula, California. In his spare time, he visits the beach and plays outside with his children. He likes to spend time with his wife and friends, ride his motorcycle, and enjoy the outdoors.

John A. Crawford learned about photonics while he was studying engineering at the Pennsylvania State University. One day, he had lunch with a photonics student from Indiana University of Pennsylvania (IUP). “We started talking about the project he was working on . . . and I was hooked. I ended up working with him the next year on a project utilizing a High-Definition Survey System to model physical structures.” John decided to study electro-optics at IUP. That one conversation has led John to a rewarding career in optics at Primatec Advanced Ceramics, where he is an optical engineer.



On why he chose to pursue a career in photonics: *“I wanted to be part of something that is exciting, interesting, and personally challenging. The industry is young and rapidly growing, so the professional possibilities are boundless.”*

The road to completing a photonics degree was not without its challenges for John. Though he came into the field with no previous experience, he was ready to learn. John remembers that his hard work in math and science courses paid off when he took advanced courses in photonics. Based on this experience, he now tells students, “Once you build a solid foundation in the fundamentals of math and physics, everything else seems to fall into place.” John recognizes a strong link between math and photonics: “Math is the tool that makes physics work, and physics is the tool that makes photonics work; so one needs to start by having a good understanding of mathematics.”

As John continued to advance in his education at IUP, he faced another challenge. “The hardest part of completing my photonics education was trying to make a decision about what specialty to focus on. “The photonics industry is so diverse and specialized that I felt I needed to be completely competent in a specific component before I entered the workforce.” John has also learned that “one needs a broad range of knowledge to do a job well.”

John continues to rise to the challenges that his work presents. He enjoys his job’s fast-paced environment. “Research is continually pushing the boundaries of what we are able to manufacture, and the industry is always trying to keep up.” One particular achievement that John takes pride in is the completion of a nine-inch, conventionally polished, ceramic parabolic mirror. “Using a spindle and lapping tool is not the easiest way to produce an aspheric mirror, but the end result is astonishing.”

In the future, John would like to create larger, more specialized optics. Specifically, he would like to work on optics projects for astronomical telescopes. “In the past, I have worked with optical technicians and engineers who have worked on some exciting projects like the James Webb Space Telescope.” A career in optics that started out as a lunch conversation may one day allow John to reach the stars.

John A. Crawford lives in Worcester, Massachusetts, with his dogs. He enjoys spending time outdoors, no matter what the season, and giving back to his community. He volunteers with Earn-A-Bike, where he teaches kids to build and repair bikes so that they can earn credit toward a bike of their own. He also volunteers with the New England Mountain Bike Association (NEMBA) and United Way.

Derrick Thomann was taking courses in the Indian Hills Community College technical core curriculum when it came time to make a choice. He had to choose a technology field in which to specialize. Derrick had several options, but a course demonstration in photonics helped him make his decision. Each department hosted an open house to showcase their course offerings, but Derrick was most drawn to the laser electro-optics department. Derrick found the various types of lasers intriguing; he wanted to learn more. “Once I went to the course demonstration, I was hooked. I have not looked back.” Derrick earned an associate of applied science degree in laser electro-optics from Indian Hills College and now works for CVI Melles Griot.



On the nature of his work: ***“Many of the machines I design go into the medical field. I help save lives.”***

The coursework at Indian Hills kept Derrick on his toes. “When I started,” he recalls, “I did not have any background in the field of photonics, but I was interested in lasers, and I wanted to understand the entire realm of photonics.” But the realm of photonics changes all the time. “Even while I was in school, new photonics applications were being discovered.” Derrick was constantly keeping up with technology, even while he was in school.

Derrick finds his work personally rewarding. Many of the projects that he works on at CVI Melles Griot are used in the medical field. For Derrick, the best part of his job is that he helps save lives. “Knowing that keeps me motivated to do the best job possible,” he says. “I know that people’s lives are affected; I’m not just creating another product.” When Derrick works on a project, he knows that what he creates will make a difference in people’s lives.

Medicine is just one of many fields that use photonics technology. Derrick encourages students to make the most of their education by learning as many facets of the field as they can. “Learn as much as possible,” he advises, “so that upon entering the workforce, you can apply your knowledge to your job.”

Derrick recommends a career in photonics to any student considering a career in technology. “The photonics job market has stayed strong even during the recession. There will always be a need for photonics technicians.”

Derrick intends to keep moving up in the industry. In the future, he would like to work more with management and engineering. He has also considered starting his own business. “Photonics is a small industry where everybody knows each other,” he says. Derrick wants to make the most of this support network so that he can succeed no matter where his career takes him.

Derrick Thomann enjoys biking with his dog, surfing, snowboarding, working on cars, and enjoying the many opportunities to be outdoors in Southern California. He lives in Vista, California.

Michelle I. Redish goes to work knowing that what she's doing will make a difference. As a laser technician and proud employee of Northrop Grumman Corporation, her work contributes directly to our nation's homeland security.

A family connection inspired Michelle to focus her studies on photonics. "I went to a four-year university," she explains, "but I didn't know what I wanted to do. I spent two years switching around from chemistry to psychology to accounting. I came home for spring break and saw that my mom, who is now also a laser technician, had signed up at Central Carolina Community College (CCCC)



**On doing what it takes to reach her goals:
"I challenged myself. I said, 'I'm going to be the top of my class.' That was my goal, my focus: not only to learn what's necessary, but to be the best at it."**

and was taking laser and photonics courses. She told me a little about lasers and photonics and set up a tour with Mr. Gary Beasley. I saw some of the applications for which a laser can be used, and I was hooked. I wanted to do that. It was like that little light bulb going off. The same day, I transferred from the university to CCCC."

At first, classes were a little awkward. "The classmates didn't know each other, so they were very quiet in class," Michelle recalls. "They didn't know we could talk to one another. But as the year went on, we realized that if we wanted to make it through, and most did, we had to work together. Teamwork is a major factor." And Michelle was determined to do everything she must to succeed. She challenged herself to be at the top of her class. Her goal was not just to learn what was necessary, but also to be the best at it. Michelle achieved her goal and, as a result, was able to get exactly the job she wanted.

Michelle describes her work this way: "I build the lasers that are a part of the protective defense of airplanes for soldiers going to Iraq and Afghanistan. I can't tell you exactly what it does, for security reasons, but the laser redirects any oncoming missiles." Having recently been promoted from laser technician I to laser technician II, Michelle also works on a program for land forces, creating thermal-view range finders. "It is a measuring device for both short and long distances," she explains. "A soldier can look through the range finder and tell his commanding officer, 'We see an enemy at this location, this many feet away.'"

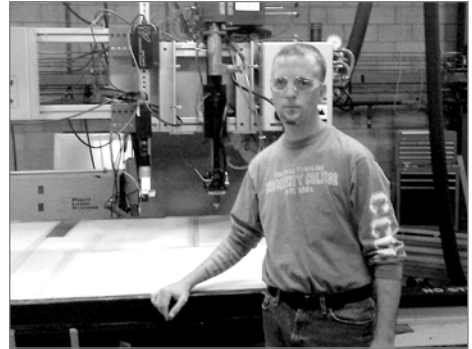


Michelle's future is bright, and full of photonics and optics. "I'm planning to go back to school to get a bachelor's degree in either optical engineering or chemical engineering," she says. "There are certain coatings that go on optics components. I'd like to be a part of devising new and better ways to make those coatings." No doubt Michelle's focus and passion for photonics will take her exactly where she wants to go.

Michelle I. Redish earned an associate in applied science degree in lasers and photonics technology and a certificate in electronics engineering technology in 2006 from Central Carolina Community College in Lillington, North Carolina. She lives in Sorrento, Florida, goes to the beach every weekend, and regularly sings at Disney World with her music group Sing Live USA.

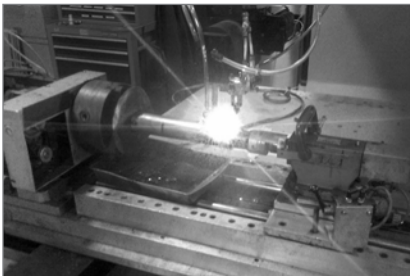
Alex Dawson decided to pursue a career in photonics because he wanted to work in a field that would allow him to advance in his career. Before studying photonics, Alex had worked in manufacturing, maintenance, and construction, and he even drove a tractor-trailer for a while. “I went back to school after the job market slowed down. I researched my options and found that the photonics job market had not slowed down at all.” In researching the photonics industry, Alex discovered a field in which he could use his talents to build a successful career.

On the photonics industry: “This is the leading edge in a new era of technology. If you can get into this career now, with all of the changes in the past five years, just imagine what it will be like in the future.”



Alex also chose photonics out of dedication to his family. “I was recently married and had a growing family. My wife and I were not earning enough to support our children like we wanted to.” Alex chose a photonics career because he knew that there was a need for technicians. He knew that a job in photonics would allow him to provide for his family the way he wanted.

Alex knew very little about photonics at first. “I knew just enough to catch my interest. I had very few expectations going in, really, but I thought photonics would make for an exciting career.” Alex went back to school ready to learn as much as he could and dove into the material.



Alex received a hands-on education at Central Carolina Community College (CCCC), where he learned about the wealth of job possibilities that would be available to him upon graduation. He was surprised to learn about the many applications of laser technology. “I realized I had only discovered the tip of the iceberg when I was doing my research before going into photonics.” He describes the number of laser applications as “overwhelming.” Photonics opened up a whole new world for Alex, not just in career mobility, but also in variety of job opportunities.

Alex’s education in photonics has paid off well at Preco, Inc. where he works as a laser tech I. Alex aligns and sets up production welding and cutting with a ten-kilowatt fiber laser and a twelve-kilowatt carbon-dioxide laser. He also runs test studies and maintains the machines. Working at Preco gives Alex the career mobility that he had sought as a student. “After only two months of working with Preco, I was able to move to the more profitable side of the company. That was a great step up from where I started, and it also gives me more opportunity to move up within the company.”

In the future, Alex would like to go back to school to get a bachelor’s or even a master’s degree in photonics. Research and development in photonics excites Alex; he would like to earn advanced degrees to go even farther in the field. According to Alex, “the new era of technology is in lasers.” His story is one of encouragement and success for anyone considering a career in photonics.

Alex Dawson lives in New Richmond, Michigan, with his wife and two children, aged thirteen and nineteen. They enjoy spending free time together by going to a nearby park.

Darrell M. Hull's success may have come about partially by accident. He holds degrees in laser technology, business, and educational psychology. How did he start on this path? By messing up.

"I was a struggling student," Darrell recalls. "I wasn't interested in pursuing higher education. I discovered I liked working more than going to school, so I ended up blowing my GPA (at Southwest Texas State University in San Marcus, now Texas State University) while working at a psychiatric hospital." He left school and returned to his hometown of Waco, Texas, where he went to work for Engineering Technology Institute (ETI), which created professional-development courses for physicists and engineers in lasers and optics. But Darrell's employer decided that if he was going to be working with people who use laser and optics equipment, he needed more education. He had to go back to school.



On following your instincts: "We often find that our best abilities are in the very things we are most interested in doing. If you work in a technical field that you find interesting you will probably be good at it, enjoy your work and have a very successful career."

At Texas State Technical College (TSTC), Darrell enrolled in the laser electro-optics technology (LEOT) program. "I began to discover that I can learn this stuff and perform well," he says. "TSTC was the first place I was able to perform well in an academic setting. I began to realize the importance of higher education and what it could offer." Within three months of completing his associate degree, Darrell was offered a job at Texas Instruments (TI). He started in quality control, but as soon as he received security clearance, TI put him to work on secret military optics applications. Darrell says, "We were responsible for damage testing the optical coatings on the components in the forward-looking infrared (FLIR) systems for aircraft. One part of the job was testing the coatings until they failed. I got to go to work and blow stuff up!"

Eventually, TI's military contracts waned and Darrell saw an opportunity to get a bachelor's degree. He started out in physics, but found that he did not have the necessary mathematical background, and so switched to business. Once he received his bachelor's degree, he returned to ETI. "I was very fortunate," he says. "One of the benefits of working for ETI is that the company paid for me to get my MBA at Baylor University." While working on his third degree, Darrell helped develop laser-safety standards for photonics educators. After completing his master's degree, he helped develop skill standards in optics and photonics and helped create OP-TEC, the National Center for Optics and Photonics Education.



Darrell's penchant for education led him to pursue a doctorate in educational psychology. "My job now is to teach doctoral students at the University of North Texas how to develop research designs and how to analyze them with statistics," he explains. Darrell's current research seeks to determine just how much students' abilities and personality traits influence their choices in pursuing technical versus nontechnical degrees.

Darrell earned each of his four degrees while working full time. From struggling student to professor, Darrell's career is a reminder that it is always possible to forge your own path, even if it takes some sharp turns along the way.

Darrell M. Hull received his Ph.D. in educational psychology from Baylor University in Waco, Texas. He also holds a master's degree in business administration from Baylor, a bachelor's degree in business administration from the University of Texas in Dallas, and an associate in applied science degree in laser electro-optics technology from Texas State Technical College in Waco. In his spare time, he enjoys thirty- to seventy-mile bicycle rides and competing as a category-three bicycle racer in Texas.

Tanner C. Hutchings's first choice was not photonics when he was deciding on his educational and career goals, but it is a choice that he is grateful to have made. Tanner's father, a mechanic, was a big influence on him. Tanner became interested in mechanics because of his father, and he excelled in his efforts. When Tanner began to consider his career options, his father counseled him to "go beyond working on cars for a living." This advice led Tanner to consider engineering and technology.

On working in the photonics field: "The thing I love the most is that I'm always doing a different project, and when it is finished, I feel like another milestone has been reached."



Tanner is not one to settle for the ordinary; he wanted a career that would be interesting, yet would still provide him with distinctive qualifications in the workforce. According to Tanner, "I like to work with tangible things." Consequently, he chose to study the fabrication and testing of precision optics. He explains that this field was attractive because it was "a high tech job that would certainly challenge me, and I wanted to do something different."

Tanner chose to attend Indiana University of Pennsylvania to pursue a two-year associate in applied science degree in electro-optics. He describes his initial expectations for the program: "Honestly, I was a little terrified, knowing that the subject involved extensive study in math and physics. I worried that it would be difficult for me, but in the end, I did quite well." During his years at school, Tanner scheduled classes for Mondays through Thursdays. On Fridays, he worked as an apprentice at Hampton Controls, Inc., to apply what he learned in school.



Tanner greatly enjoys his apprenticeship, which has continued for four years. He works as an astro-optician in Hampton Controls's optics division, where he helps manufacture space-based mirrors, lenses, and other optical equipment. He greatly enjoys his work, in part because he continues to work—and learn—with a "master optician with over forty years of experience." He likes knowing that even his master teacher learns new things every day. As Tanner says, "The technology field is changing; therefore, you can be certain you will learn and experience new things. It's such an impressive field." He continues, "As far as my career goes, I'm trying to learn as much as possible through my continued apprenticeship. It really is a unique practice that doesn't have a manual to follow. My boss always tells me, 'Precision optics

technicians are worth their weight in gold,' so I continue to give it my all."

He admits that the precision-optics field can be challenging, "Since you are working in a high-tech field, room for error is minimal. If a mistake is made, it may cost dearly." Even with these challenges, Tanner enjoys the variety that his job offers. He explains, "With any project, there is a process involved. Unlike other optical manufacturers, where employees may perform only one step in the process, I am able to take the raw materials through all the steps in production to a finished product. That includes planning the manufacturing steps and performing tests on the finished product." He says with enthusiasm, "What I like most is that nothing is repetitive, and every project has its own problems. This is where I get to be creative and use some innovation."

Tanner C. Hutchings earned an associate in applied science degree in electro-optics from Indiana University of Pennsylvania. He lives in Irwin, Pennsylvania, and owns two Australian cattle dogs, Jethro and Kallian. Tanner enjoys tinkering with classic cars, rock climbing, running, and snowboarding.

Colt Jesse didn't know he'd landed a photonics job until after he'd started working at Infrared Associates, Inc. He was pursuing an associate degree in electronics engineering technology at Indian River State College when he got the job. "I didn't realize that it was optics-related when I started working here," he recalls. "That actually made me move toward the optical side of the engineering courses." But Colt is glad he stumbled into the world of photonics. "You can see things using photonics that you couldn't normally see," he says. "Especially working at Infrared Associates with all the infrared detectors, you can tell what some mysterious substance is, just by looking at it with spectroscopy."

"You can do all sorts of weird and interesting things with light. You can change it into electrical energy and change it back into light energy. With infrared devices, you can see things you couldn't normally see."



Getting a degree didn't come easy for Colt. He was working forty or more hours per week at Infrared Associates and trying to complete his degree at the same time. "The hardest part was trying to get classes to fit around my work schedule," he says. But the classes were interesting and fun for him. In high school, he had struggled with liberal arts classes but understood science and math easily. In college, he was able to focus on the studies he enjoyed and understood best.

Colt's work consists of a flurry of activities that involve him with many different stages in the creation of infrared light detectors. He describes his job this way: "I start by growing the material we use to make the detectors. It's a crystal matrix that's actually grown from mercury, cadmium, and telluride. It usually takes one whole day to grow and cool the crystals, so I begin by mixing the appropriate metals and putting them into the furnace to let them do their thing. Then I assemble detectors into final units, or I perform spectroscopic analyses on the materials I'd grown the day before to determine the cut-off wavelengths of their response. Sometimes I dice up the detectors into their final chips or design new arrays for new products we're making."

Infrared light detectors have many applications, but one of the coolest can be seen on TV. According to Colt, "Infrared Associates' detectors are mainly used for measuring temperatures and spectroscopy in scientific and medical equipment. If you've ever seen the television show Mythbusters, they use a touchless thermometer to point at something and measure its temperature. Our detector is in that thermometer."



Colt loves his job. And he's eager to show others the potential of the photonics field. "If you're science-minded and looking for a field that's new and interesting, that is always advancing, always changing, then look into photonics," he says. "We need more people to discover how interesting photonics is and how great a career it can be. Even now, with a tough economy, photonics is still rewarding and advancing."

Colt's education took an unusual route. For him, "the cart came before the horse." He got a job in photonics, realized how much photonics interested him, and then pursued the education that would assure him of a rewarding, advancing career.

Colt Jesse earned an associate in applied science degree in electronics engineering technology from Indian River State College in Ft. Pierce, Florida. He lives in Stuart, Florida, where he is also an amateur computer programmer.

Christopher Pluemer is all about efficiency. When he sets a goal, he likes to accomplish it as quickly and as purposefully as possible. He's happy to chat, as long as there's a good reason for it. He's hoping to continue his education, as long as he can apply it to his job.

On choosing a photonics education: "A photonics technical degree is a very good choice. It's a great field with endless possibilities. The more I found out about lasers, the more excited I got. You can work wherever you want, and the pay will allow you to live there."



When Christopher was choosing a career to pursue, the end result was important to him. He didn't want to go to school and not be able to get a job when he had finished. When he found out that the laser electro-optics program at Indian Hills Community College (IHCC) in Ottumwa, Iowa, had a job placement rate of 100 percent, he decided that this was the path for him. "At first, I was kind of intimidated," he recalls. "Lasers seemed really complicated and complex, but the more I got to know about them, the more excited I got. They aren't nearly as complicated as I thought. There are just so many things you can do with lasers. It's a really good field to be in."



Even before Christopher graduated, he'd been offered several jobs. "I had offers in Chicago, one in Colorado, and another in California," he says. He took the job in Colorado a week and a half after he graduated and has been working for Epilog Laser Company for a year and a half. Epilog manufactures laser engravers, and Christopher's job is to manufacture the lasers. The finished product can engrave, cut, and inlay materials such as metals, glass, and wood. "You never know what to expect," he says. "We have new things to deal with every day, so it never gets boring."

When Christopher considers the future, he feels good about his educational choices. The degree he received from IHCC gives him ample opportunity to choose where he works. "Epilog provides many opportunities for growth," he says confidently. "I think the possibilities for advancement are really good." Christopher's focus and directness are distinct assets in what is sure to be a bright career in photonics.

Christopher Pluemer lives in Golden, Colorado, with his wife and daughter. They enjoy many outdoor activities, including biking, camping, and bicycling. Christopher received his associate in applied science degree in laser electro-optics technology in 2007 from Indian Hills Community College in Ottumwa, Iowa.

Terry Smith doesn't have a photonics job. But that's OK for now. He's glad he got a degree in laser and photonics technology from Central Carolina Community College (CCCC). Terry has only positive things to say about CCCC's laser and photonics technology program. "Being able to learn in the classroom and then go apply it was amazing," he says. "You learn so much, and it prepares you well for real-world experience."

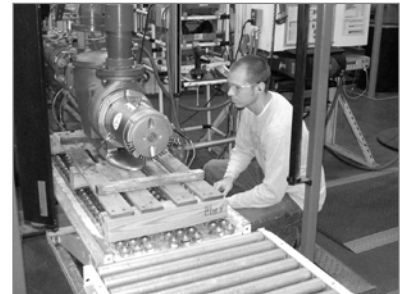


On choosing a college: "At first, I didn't know where I wanted to go. I was accepted to a four-year university, but I realized there's a lot of money involved in that. I decided to go for a two-year degree. It was like going to school every day to play. I had fun every day."

Terry looks forward to finding that perfect job, which to him is a blend between using what he learned about photonics and electronics engineering technology at college and using what he's learning now in his job managing quality control in the manufacturing division of Pentair Pool & Spa. "I'm twenty-two years old, and I don't know what I want to do yet," Terry laughs. "I'm still opening doors here and there."

But Terry's education at CCCC prepared him for whatever door he chooses to go through. Terry describes his CCCC experience this way: "College helped me to become goal oriented. I received a lot of discipline within my education. In high school, it was a lot of busy work. It didn't really have a purpose for me. When I got to college, I was working toward a career. It made me want to work harder and do better. I learned I needed to do certain things at certain times."

When Terry graduated, he was offered several laser-technician positions, but they were all far away from where he lived. "After I graduated, I was getting married, so I couldn't move away," he says. "My wife was still in school at the time." He decided it wouldn't be fair to ask his wife to move away from her education, so he chose to stay where he was. But he's hopeful that photonics job opportunities will come to his area in the near future. "I don't think fiber-optics communications has reached its peak yet," he says. "I think it's going to grow for some years to come. There are a lot of job opportunities opening up with start-up companies that have their own niche they're trying to create."



For the time being, Terry is looking forward to getting back into the photonics field but feels confident and prepared in his current job, thanks to his college education.

Terry Smith lives in Sanford, North Carolina, with his wife, Laura. He received an associate in applied sciences degree in laser and photonics technology and an electronics engineering technology certificate from Central Carolina Community College in 2007. Terry plays on three men's softball teams and is very involved in his church. He and Laura enjoy taking their Labrador retrievers Zeke and Denali to the park.

Robert Aguilar, Jr., has been changing people's vision for eleven years. "I got into the beginning of Lasik eye surgery," he explains. "Ten years ago, it was in its infancy. It was an amazing procedure, being in the O.R., assisting doctors in surgeries." But helping people see clearly isn't all Robert does. He loves to give people bright visions of their futures.

On being successful: ***"If you're not dedicated, you're not going to succeed. If you're dedicated, the sky is the limit."***



Robert began work on a four-year engineering degree but, like many people, ran into financial and family issues. He went home to help his parents and started a construction company with his father. While there, he met his wife, who was studying at Texas State Technical College (TSTC). He recalls, "I saw the brochure about laser electro-optics and thought, 'Wow! I like lasers! I've always liked working with my hands.'" Robert decided to pursue an associate in applied science degree in laser electro-optics technology (LEOT) at TSTC. Just before he graduated, he was offered a job working with cutting-edge technology applications. He says, "A company called LaserVision Centers picked me up for my laser background. They worked with lasers that perform Lasik eye surgery."

Ever since, Robert has been in the medical field of laser applications. Now he trains people to service medical lasers and follows up with continuous-improvement programs. Robert has strong feelings about post-school learning. "Working with photonics, you're looking at a lot of on-the-job training," he explains. "You're always learning something new. You're never just taught one thing and then do that for ten or twenty years. You're always broadening your mind. Eleven years after completing my AAS degree, I'm still learning, still trying to better myself."



Robert's philosophy of self-improvement has helped him skyrocket from level-one technician to director of operations at WaveLight, a company that was recently bought by AlconLabs. He explains, "With Alcon, there's room for even more advancement. They're such a huge company, the sky's the limit."

Robert wants to give back to the industry that has given him so much. One of his future goals is to return to TSTC as an instructor. He says, "All you do, as some of the instructors say, is play with lasers and instruments all day."

Balancing work, study, and raising a family almost overwhelmed him at times. "The hardest part of completing my degree was working a full-time job while taking classes," he remembers. "But it was because of the instructors' encouragement that I stayed. They were amazing mentors and showed me guidance in a way I never expected. That's what pushed me to stay and work long hours to complete the program. Now it's paid off, not just economically, but mentally. It's been wonderful."

Robert's quick laugh and genuine smile make it clear that he loves what he does. "I enjoy it so much," he says, "I have a smile on my face every day." In fact, he tells many of the people he meets about the opportunities available in photonics. "I met a gentleman at the airport whose son didn't know what he wanted to do," he says. "I recommended he visit TSTC and take a tour. He did, and graduated with a 4.0 GPA. Just five years ago, he didn't know what he wanted to do. To know I had a hand in that is very fulfilling."

Robert Aguilar, Jr., graduated from Texas State Technical College in 1999 with an associate in applied science degree in laser electro-optics technology. He lives in Woodway, Texas, with his wife Anjanette Aguilar and sons Alexander Aguilar and Jordan Carey.

Jessica Hudson is very proud of her career in photonics. During her time as a cashier at a grocery store, she reflected on which career would be right for her. She decided to attend Central Carolina Community College (CCC), but was unsure about what degree she wanted to pursue. “I’m not one of those people who studied photonics and knew that it was the field I wanted to go into,” Jessica says. “Student services recommended the laser and photonics program after I completed my placement test.” Photonics was something new for Jessica, and she was impressed by the endless job opportunities that the field offered. The advice she received from student services convinced her that photonics would be right for her.



On lifelong learning: “I am very proud of the field I have chosen, because it has been a great learning experience. Every day, I learn something new, and that makes my job more interesting.”

As a new student in CCC’s laser and photonics program, Jessica had no idea what to expect, but she did expect to learn a lot about lasers. Initially, the program was harder than she had expected, since she had begun the program without any prior experience with photonics. “Almost everyone else had already been in there taking workshops,” she recalls, “So I felt behind.” Instead of letting these feelings discourage her, Jessica stayed focused on her goal to finish the program successfully. She studied hard, and she started getting the hang of it. She explains, “I began the classes, and the semesters went by, and I realized how much I enjoyed learning about lasers and how they worked.”

Jessica says that the hardest part of the laser and photonics program was the amount of time and studying that it demanded. “You have to put yourself in that mindset,” she explains. Jessica was clearly in the right mindset, because as the semesters went by, she became increasingly interested in “how light can be used to our advantage.”

Jessica completed her associate degree in laser and photonics technology in 2012, and since then, she has been working as an engineering technician with Wasatch Photonics. Her responsibilities include using computer programs to assemble, test, and calibrate spectrometers. Jessica is proud of what she has learned about spectrometers, and she explains that “assembly includes circuit-board population, bonding optics, alignment, and collimation.”



Jessica enjoys photonics because it allows her to constantly learn and face new challenges. “I am very proud of the field I have chosen, because it has been a great learning experience,” she says. “Every day, I learn something new, and that makes my job more interesting.” Jessica admits that the commute to and from work is not the most pleasant part of her day. However, she loves where she lives, and she loves where she works, so she finds her job to be worth the time spent in traffic.

Jessica is excited about the future at Wasatch Photonics. When she first started working there, the company was relatively small. Lately, though, the company has been considering expanding, and Jessica hopes to be a part of this growth and development.

Jessica’s career and education have taught her to believe that anyone with the willpower to study and work hard can succeed. She believes that if students are interested in pursuing photonics, “they should go for it.” Jessica’s experience shows that a student does not need a background in the subject to successfully learn the material. What Jessica lacked in experience, she made up for with passion and determination. She believes that students who share her interest in photonics can do the same.

Jessica lives in Bunnlevel, North Carolina. While she is not working as an engineering technician, she likes going out with her friends. Because she lives in the country, she frequently enjoys driving four wheelers.

Scott Mettlen became interested in photonics during high school. His stepfather had been in the field for over twenty years, so he had always been aware of the field. Scott's high school physics teacher, Jim Einsporn, also encouraged him to consider an education and career in photonics. The idea had been simmering in Scott's head for a while when he received the push he needed from Pennsylvania State University's Electro-Optics Center (EOC), which showed him just what photonics had to offer. "I was sold on wanting to work in optics," he recalls, "when the EOC put on a demonstration at my high school."

After high school, Scott proceeded to pursue an associate of science degree in electro-optics through the physics department at Indiana University of Pennsylvania (IUP). The program met Scott's expectations. He learned more and more about lasers, and he also learned that the knowledge he wanted would only come if he put the necessary time and effort into his coursework. He recalls that once he had himself in the mindset to work hard, the most difficult part of completing his degree related to his commute and his work hours. He was working as a sales person at RadioShack while commuting forty minutes each way to IUP, and his days were exhausting. But Scott was determined to persist—not only because the interesting subject matter intrigued him, but also because of the support he received from his professors. Dr. James Sherman and Dr. Feng Zhou, who were his two primary mentors throughout his years at IUP, "continued to be a solid source of guidance and encouragement."

On the best thing about his work: ***"Lasers are awesome."***

After graduating in 2006, Scott landed his first job working in the industry at nLight Photonics. As a fiber laser engineering technician, Scott builds and troubleshoots high-power fiber lasers. He explains that he is "also becoming well-versed in high-power fiber slicing and combining," and that his proudest achievement was the completion of his first fiber laser. What does he enjoy most about working in photonics? As he says, "Lasers are awesome." He explains that his job always provides him with new tasks to accomplish, and that it's an exciting challenge to try to stay up to date with the fast-paced technology. Scott finds that the most frustrating aspect of his work also relates to its experimental, cutting-edge nature: he and his team sometimes work hard to develop new and cutting-edge lasers and then find that "the things we do don't work." But whether he is troubleshooting a laser or creating something new, Scott feels that the joy of eventually succeeding is more than worth the hard work.

While working with nLight, Scott came to realize that, while he loves being a technician, he would prefer to be an engineer. He decided to pursue an engineering degree at Washington State University while continuing to work for nLight. Scott's commitments reflect his passion for photonics and lasers: he is currently a full-time student and a full-time employee at nLight. Scott hopes that a bachelor's degree in electrical engineering will add to the solid foundation that he gained in his earlier education.

Scott expects to receive his BS in 2015, but first, he will face a personal milestone: later this year, he will be getting married. Scott's list of goals includes a happy marriage, the completion of his degree, and advancement in his company.

Scott lives in Vancouver, Washington. During his rare moments of free time, he enjoys a variety of recreational activities, including recreational shooting, martial arts, and gaming. He also appreciates good novels, so he will often find himself reading several per week.

Ra'ef Mikhail became interested in the physics of light during high school: for a science project, he attempted to measure the speed of light. His interests vacillated between chemical, mechanical, and aeronautical engineering, so upon graduating from high school, he decided to keep his engineering studies general by pursuing an applied engineering degree at Camden County College (CCC). During a physics class at CCC, his professor, Dr. Leonid Khazan, introduced a small section in photonics. Ra'ef recalls being "completely engrossed" by this brief exposure to photonics. Within five minutes of that class, he knew exactly what he wanted to do. "From that point on," he says, "I strictly pursued a path in optics and photonics."



On deciding to pursue a career in photonics: "[Photonics] completely engrossed me. . . . Give it a real chance, and look at some applications and real-life scenarios where optics has changed the world."

So, from 2005 until 2008, Ra'ef worked to complete three of CCC's photonics programs. He earned associate degrees in both fiber optics technology and laser/electro-optic technology. He also completed CCC's fiber optic technical specialist program. In 2008, Ra'ef transferred to University of Rochester, where he pursued a bachelor of science in optics. He wanted to finish his degree in two years, and recalls, "I was overloading each semester." He successfully completed his degree, and believes that the dedication, time, and effort that he put into each assignment were crucial to his success.

Ra'ef continued to pursue photonics as a career, and he now works with groundbreaking applications every day. He enjoys being able to use optics and photonics to push past the boundaries of present-day science. Though Ra'ef considers his job exciting and fun, he admits that a career in photonics is not necessarily easy. He and his colleagues have the privilege of handling cutting-edge tools, but because there is always the risk of breaking expensive equipment, they must follow important precautions. Ra'ef explains that problems and processes become complicated quickly, so those working in photonics have to think outside of the box.

Ra'ef says that photonics is not the easiest education path, and recommends that students interested in photonics devote a great deal of effort, diligence, and consistency to their studies. He finds the field exciting, though, and advises interested students to "give it a real chance," and specifically, to "look at some applications and real-life scenarios where optics has changed the world." Ra'ef describes optics as an enabling tool that can be used to solve a variety of things that affect people personally. He suggests that by pursuing a career in optics, students may eventually help advance the field even beyond the current state of the art.

Ra'ef only began his career in photonics three years ago, but he has already achieved a great deal. He has worked on a variety of sophisticated problems, "from sending a radiometer to space with NASA to protecting our troops with standard-issue sights and night-vision goggles." He and his coworkers have also succeeded in developing an optical metrology test bench "to measure lateral chromatic aberration of imaging systems at nanometer spatial resolution." Out of all of Ra'ef's achievements in photonics, he is most proud of this one.

Ra'ef is enjoying his job, and has not planned to make any changes: as he puts it, "My life is in God's hands." He says that as long as he continues to learn new things every day and keeps developing his engineering abilities, he will be happy. He explains that if he ever feels that he is no longer learning, he will search for a new calling. But for now, the research and development group at Edmund Optics still challenges him every day.

Ra'ef Mikhail lives in Barrington, New Jersey. He spends his spare time with family and friends and is very active in his community and his church. He often plays the piano at his church, and he participates in its youth programs. He is also extremely active, especially when traveling. He enjoys skydiving, scuba diving, rock climbing, and mountain biking. He loves to be in the outdoors during any season of the year and in any part of the world. He explains, "I work to support my travel."

Bruce W. Allen has his dream job. It is obvious from the way he talks about his company, Newport Corporation, that he would be hard pressed to find a job that he would enjoy more. Bruce is the Newport's Midwest regional sales manager, in charge of ten states' worth of sales accounts from Indiana to the Dakotas. But he started out as a photonics student.

“From a very young age, I was intrigued by photonics, lasers, and optics. It all stemmed from the Star Wars movies. I thought, ‘Wow! Those guns are cool!’ I wanted to figure out how lasers worked and what they did. At that age, I didn’t realize the Star Wars applications weren’t real! But I still love the mystery of light itself and what you can do with it.”



“When I graduated from high school a half-year early, I started college at Indian Hills Community College (IHCC) as a seventeen-year-old student,” he recalls. “I graduated from IHCC when I was nineteen and embarked on my career in photonics, lasers, and optics—a career I’ve enjoyed for over twenty years.” Bruce explains that it wasn’t as easy as it sounds. “The first year of classes was called ‘core,’ and we did all the fundamentals: algebra, physics, AC/DC, and analog circuits. I was overwhelmed with information.” Students who weren’t serious or persistent were weeded out; they wouldn’t become dedicated employees. “But after the first year, classes were a breeze—a lot of fun. Once we were taking courses in our majors, it was of great interest to us. We were studying what we were going to do in future jobs. If you can stick out the first year of a technical program, then you’ve got it whipped and you’re going to make it through the program.”

Bruce secured a job before he graduated. Upon receiving his degree, he began work as a laser technician for Hutchison Technology. After three years, he moved to Spectralytics, where he became chief laser technician, in charge of maintaining twenty-one different laser systems. The technicians who were installing new LASAG industrial lasers for Spectralytics were so impressed with his work that LASAG’s vice president called Bruce and offered him a sales position. “Ultimately, I had always wanted a sales job. So I took the job with LASAG,” he says. “They made lasers for precision cutting, welding, and drilling. I was there for two years, and Newport came to recruit me. They offered me a home office, a company car, a bigger salary, and commission. Newport has treated me very well. I’ve been there twelve years now.”

Bruce loves being able to work from home. But it has its drawbacks. He loves the freedom a home office offers him. “But as long as you’re home,” he says, “you’re never away from work. I find myself sitting in my office at 1:00 or 2:00 AM sometimes. But I don’t think I could give it up to go back into a corporate office. I consider it the golden handcuffs. Where else am I going to do what I do, make the money I make, and live in Iowa?”

Bruce sells lasers and laser components to universities, aerospace labs, and other companies throughout the Midwest. “I sell all the optics that are used with lasers—motion control components, power meters, detectors, fiber optics, and cables,” he explains. “I’m responsible for over fifteen thousand products. But the best part is seeing all the systems and components being developed before anyone else sees them. It’s very interesting to see what new technology is coming—what’s going to be on the horizon next.”

Bruce has dreams of someday becoming a director of sales. But if that doesn’t happen, he’s content doing his current job for another twelve years. As Bruce puts it, “This is the perfect job for someone who is interested in the next thing they’re going to use this crazy beam of light for.”

Bruce W. Allen earned an associate in applied science degree in laser electro-optic technology from Indian Hills Community College in Ottumwa, Iowa, in 1991. He lives in Ottumwa and has two daughters, Brea and Kiah. Bruce coaches his daughters’ fast-pitch softball team and, on weekends, umpires state softball tournaments.

Lee L'Esperance enjoys connecting people to the future. In the beginning of his career, he did this by working with fiber optics. Later, he sought out opportunities to be "a little bit closer to the customer." Now, he works to bridge the gap between future technology and today's consumers.

Lee entered Camden County College's (CCC) laser electro-optics technology program immediately after high school. "When I was coming out of high school, the laser program was brand new," he recalls. "It sounded like the thing of the future." Lee has always been a forward thinker, so being on the cutting edge of technology appealed to him. After receiving an associate in applied science degree from CCC, Lee started on what is now a twenty-nine-year career with the same company. "My first job right out of school was fiber optics measurement in the engineering research center at Western Electric," he says. "We've gone through mergers, spin-offs, and name changes, so it's called Alcatel-Lucent now, but I've fundamentally been with the same company for all those years."



On fiber optics: "I feel very proud to have had a part in developing the online capabilities we have nowadays. My kids enjoy YouTube, and I use Google all the time. The reason we can have all these things at our fingertips is fiber optics."

While working full-time, Lee earned two more degrees: a bachelor's in electrical engineering from Drexel University and a master's in systems engineering from Rensselaer Polytechnic Institute. It was tough, but working and going to school had its perks, as Lee explains: "The company paid for my education. I have three degrees and never paid anything for them. Some large companies have tuition-reimbursement plans. As long as you're taking classes that will help you do your job, the company usually pays for it. That was actually part of my strategy. I knew I wanted to go to school beyond the associate degree, and I thought it would be great if someone else paid for it."

Although Lee has been with the same company for twenty-nine years, he hasn't done the same job all that time. "Photonics was what got me in the door, but there are other things you can branch out into as you move forward in your career and as technology changes." After working in fiber optics, Lee got involved in the production of undersea optical communication repeaters. "There are undersea cables that go from the United States to Europe, and they're all based on fiber optics," he explains. "They have repeaters at certain intervals, and inside those repeaters are lasers."

In the mid-nineties, Lee's company went through a major change. As he describes it, "AT&T spun off a number of independent companies, and I went with Lucent Technologies. I was put in an organization that looked at how we manufactured things, such as photonics components. My job was called manufacturing systems engineering. That transformed into estimating how much a product needed to cost to provide the right amount of profitability to the company. That was called market-based target costing. I'm currently part of Bell Labs, and we use market data to create business models that help us to understand consumers' willingness to pay and what the market wants." One of Lee's favorite aspects of his long career is that he has successfully remade what he does several times over.

Lee's career began with photonics and progressed in unexpected ways. But it has always been exactly what he wanted to do. "Don't look where you are now," he says. "Don't look behind. Look ahead." When Lee looks ahead to his retirement from the industry, he wants to teach in a program like CCC's where he can help prepare people for "the technical careers of the future." For future-focused Lee L'Esperance, that would certainly be coming full circle.

Lee L'Esperance lives in Erial, New Jersey, with his wife, Susan, and their two children. He received his associate in applied science degree in laser electro-optics technology from Camden County College in Blackwood, New Jersey, in 1980. He received his bachelor of science in electrical engineering from Drexel University in Philadelphia, Pennsylvania, in 1989 and his master of science in systems engineering from Rensselaer Polytechnic Institute in Troy, New York, in 1993. Lee enjoys hiking and mountain biking and is starting a car collection with his 1999 Mustang Cobra and his 1997 BMW Z3.

David Olive worked in manufacturing for seventeen years before he discovered his interest in photonics. He was a utilities operator for Performance Fibers, where he was responsible for operating the plant's water and waste treatment systems, boilers, air compressors, chill water systems and other systems. But a family outing led David to change directions. "I had taken my son to one of the laser workshops that Gary Beasley (a professor at Central Carolina Community College [CCCC]) puts on," David recalls, "and I was immediately fascinated with the program." At the time, he was looking for a new direction that would be a little more technical than his work as a utilities operator. Photonics offered that opportunity, and it also appeared to be a growing field. David decided to follow his interest and pursue a degree and eventually a career in photonics. "It took me a few years to get the opportunity to attend classes," he says, "but the program and my current job are both very rewarding."

On the versatility of a degree in photonics: "It is a great training ground that prepares a student to be successful in a variety of jobs. [Photonics] is used in everything," he says. "It's a good field to be in."



In 2009, David began working for Harnett County Public Utilities in North Carolina, and he also began to take classes at CCCC in pursuit of a degree in lasers and photonics. For David, the most challenging aspects of completing his degree had to do with "being older, having a family and a home, and working full time." With all of these responsibilities piled on top of the commitment of being a full time student, David faced a very busy three years. But he wanted a career that would remain challenging to him and that would continue to teach him new things, so he persisted.

When he began the laser and photonics program, David expected to learn about light, lasers, and photonics, but he did not realize how practical his coursework would be. He recalls that his program put "most of its emphasis on lab work and hands-on experience, using electronics-testing equipment." He learned to build, test, and troubleshoot analog and digital circuitry. Students also operated and maintained gas, solid-state and semiconductor lasers. David is grateful that his education was so hands-on; he explains that what he learned at CCCC "really comes in handy."

David graduated in 2011 with an associate degree in lasers and photonics, as well as a certificate in electronics engineering technology. Now that he is working with real-life applications, David is convinced that CCCC's laser and photonics program "is a great training ground that prepares a student to be successful in a variety of jobs." David is still impressed by "how many different fields you can work in" with a technical degree. He explains that a background in photonics gives students the opportunity to work with medical applications, electronics, and many other technical areas. "It's used in everything," he says. "It's a good field to be in."

After David graduated, he began working with Cree as a research and development technician "in the wafer fabrication facilities" at their plants in Durham and Research Triangle Park in North Carolina. His responsibilities included developing new products and working with engineers and scientists on new equipment qualification. He also was responsible for collecting data, operating vapor deposition tools, and handling etch and photolithography equipment. Today, David works in research and development at Cree's Durham plant, where he collaborates with scientists and engineers to alter the color and increase the brightness of LED lighting applications. He conducts and documents experiments, and he works with production operators to improve and streamline the production process. David sees a bright future with Cree, and true to his original goal, he continues to learn something new every day.

David lives in Mainers, North Carolina, with his wife and two sons. He and his sons play instruments in their church's band, and the whole family enjoys traveling together.

Larry Padavich, Jr., has a heart for mentoring. Larry considers his greatest achievement to have come while he was working as a manager at Northrop Grumman. “I was able to mentor fifteen individuals,” he recalls, “resulting in their personal and professional growth. Five of my former team members are less than six months away from attaining a BS degree. In my eyes, this is the most rewarding part of my job.” Working in the photonics industry has given Larry the opportunity to do what he loves: help others succeed.

Larry began his career working in various technology sectors on projects ranging from electronic systems for US Air Force jets to high-speed digital imaging. When he lost his position after 9/11, Larry decided that it was time for a new start. “I picked up an Indian Hills Community College brochure,” he explains, “looked through the courses, and decided lasers sounded interesting. I went for it.” Larry would be going back to school for the first time in more than fifteen years.

At first, Larry was worried about the age difference between himself and his classmates. “I knew I was academically capable, but I did have some apprehension,” he remembers. “At my age, some of my classmates were young enough to be my children.” However, the age difference proved to be a blessing for Larry and his fellow students. Larry discovered something about himself: he loved teaching. “Many times, I found myself relaying information to my younger classmates. They, in turn, taught me as well.”

On working in a team: *“I have always strived to make my team better by sharing experiences with others and, in turn, learning from them.”*

Larry’s ability to work as a member of a team is apparent in his personal life as well as in his professional life. While Larry worked full time toward his associate of applied science degree in laser electro-optical technology at Indian Hills Community College, his wife, Chris, supported their family. Chris worked six to seven days a week while Larry took extra courses each semester so that he would be able to graduate early. Chris’s support allowed Larry to succeed.

Larry advises photonics students to continue their education so that they can grow in the photonics industry, and he has followed his own advice. While working full time, he completed a bachelor’s degree in management and a master of business administration degree at the University of Phoenix.

Currently, Larry works as a senior manufacturing engineer at L3 Communications. He has moved through various positions within the photonics industry, from technical lead II to manufacturing engineer to his current position as senior manufacturing engineer. Larry says, “My career has been rewarding, both personally and professionally.”

Larry lives in Orlando, Florida, with Chris—his wife of twenty-five years—and their two sons. Larry enjoys designing and building high-powered rockets with his sons. He also enjoys building gaming computers, fishing, kayaking, and playing the violin. He is currently restoring a Camaro with his sons.

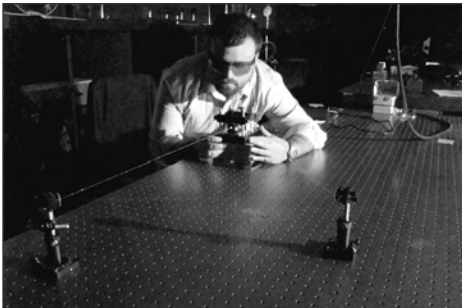
Jason Troyano's desire to pursue an associate degree in electrical and engineering technology began when he was fueling airplanes at a local airport in Florida. He was a line service technician for Key Air Inc., where he was responsible for all pre-flight services of aircrafts, including meeting safety regulations, performing maintenance and quality control inspections, and documenting his work. It suddenly dawned on Jason that he should pursue an education in electronics. "I have always been interested in the study of light," he says, and he recalls the moment he learned "that everything we see has no color until the light bounces off of the object."

"My professors guided me and gave me excellent knowledge to better myself, not only in photonics, but in life as well."



Jason visited Indian River State College (IRSC) and found that "they had the exact program I wanted to get into: electronic engineering technology." Jason embraced this opportunity and immediately signed up for their Robotics and Photonics Institute. Jason began his studies eager to learn about the nature of light and determined to succeed. Looking back now, he says, "Nothing could have prepared me for the series of events that would take place after that." While Jason was in school, Key Air Inc. went out of business, which left Jason unemployed. "With my new frame of mind, I did not despair," Jason recalls, and he instead focused on his new goal.

"Once I began the robotics and photonics program, my positive attitude and hard work really began to pay off," Jason says. In 2012, IRSC's Robotics and Photonics Institute offered Jason a job as an instructional aide, which allowed him to learn even more and gave him additional hands-on lab experience. Jason was responsible for maintaining inventories of parts and components, ensuring that equipment was functioning properly, assisting in the design and development of lab experiments, and helping students perform their labs. "I enjoyed myself thoroughly," he recalls. In fact, one of Jason's proudest moments was when he fixed the projector system in his school planetarium. He experienced how it felt to use his knowledge in a real-life application, and "it was very rewarding."



Jason believes that his education helped prepare him for the real world. He explains, "My professors guided me and gave me excellent knowledge to better myself, not only in photonics, but in life as well." Jason graduated from IRSC in May 2013 with an associate degree in applied science in electrical engineering technology.

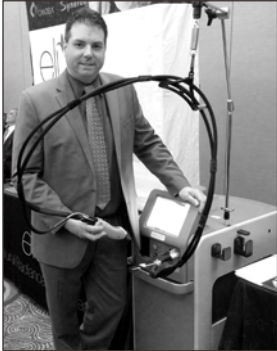
As his education was nearing its end, Jason began applying for jobs both in photonics and in healthcare, keeping in mind that his ideal career would involve a mixture of both. Though he was unsure which job he would land, he explains, "I knew I would hear back from the right job." General Electric contacted him for a job interview and

offered him a job a few weeks later. "Needless to say, I took it," Jason recalls, "and I was beside myself." In his new job, Jason is responsible for maintaining MRIs for General Electric. "This career is the perfect combination of healthcare, photonics, and cutting edge technology that I was hoping for," Jason says. Jason's talent for troubleshooting and repairing electrical equipment is not the only advantage that he brings to General Electric; he also has strong communication skills and enjoys working with teams.

Looking back on how far he has come, Jason has become convinced that as long as people stay focused on their goals, "a positive attitude will take you anywhere and everywhere in this life." With a bright future ahead of him, Jason is grateful for his decision to pursue a technical education. "Technology is everywhere," he explains. "It impacts your everyday life now." He believes that to overlook technology as a career prospect is to miss out on a great opportunity. "It's worth taking a second look at," he advises.

Jason recently moved to Miami, Florida to pursue his career with General Electric. In his spare time, Jason enjoys fishing, kayaking, playing board games and cards, and watching movies.

Mark Shaw was considering his career options twenty years ago, when he decided that photonics would be a growing industry that would also allow for his personal growth. Judging from where he stands today, he was right on both counts. Mark has more than seventeen years of experience in the medical-device industry, and while he began his career in field service, his work responsibilities have consistently evolved over the years. With the help of his competitive and passionate nature, he has advanced to the role of senior national sales manager.



On his colleagues in the laser industry: ***“[They are] the brightest and the best in the world”***

Mark began his education by pursuing an associate of applied science degree at Camden County College. Mark was working two jobs at the time, and as he explains, “I did not have the resources to attend a four-year college,” so “the laser electro-optics program was the perfect opportunity.” He had planned to pursue a bachelor’s degree in engineering immediately after earning his AAS in 1993, but when the time came, he was extremely eager to land a job in the field and begin applying what he had learned. So after graduating, he began working for the Pennsylvania Air National Guard as a photo sensor specialist. He serviced and maintained the guard’s photo sensor equipment, in addition to inspecting and testing avionics sensor systems. During his five years with the air force, he was able to earn a certificate of training in avionic system technology.

In 1994, while he was in the air force, Mark became a field service technician for HoyaConBio Lasers in California. Though his responsibilities at ConBio evolved, he found that without a bachelor’s degree, he eventually “hit a ceiling.” Mark believes that any education can create good opportunities, but that a bachelor of science in a specialized area provides good growth potential. Mark wanted to continue to advance in his career, so he enrolled in the University of Phoenix to earn a bachelor of science in business management. By the time he earned his BS in 2003, he had already served ConBio as a field service technician, technical trainer, and international and domestic service coordinator. But earning his bachelor’s degree allowed him to break through the ceiling that had temporarily hindered his growth. He advanced to the position of eastern regional sales manager, and in 2008, he became the senior national sales manager.

Having advanced so far in one of the world’s largest medical laser companies, Mark says that he has become very experienced “in sales, marketing, public relations, partnership building, and product management in the medical-device arena.” Mark explains that in his current position, his primary responsibility is to “create the growth strategy” for the products and to “ensure the execution required to achieve the business plan.” Mark works “collaboratively but assertively with the sales team to achieve [their] financial commitments.” Mark is very satisfied with his work—especially his ability to produce “consistent customer success with mutually beneficial relationships.”

After all his years of experience, Mark still feels honored to work in such an exciting field. He enjoys the opportunity it gives him to travel around the world and to meet and work with new and interesting people in the process. Mark describes others in the industry as “the brightest and the best in the world.” The medical and aesthetic laser industry is small, and Mark enjoys being part of a “close-knit group.” As his career continues to progress, Mark hopes to remain director of sales with ConBio—unless he decides starts his own company.

Mark lives in Voorhees, New Jersey, and he loves to travel. In his spare time, he enjoys riding motorcycles, dirt bikes, and street bikes, as well as scuba diving and skiing. Mark loves spending time with his two teenage children.

David M. Batsche wanted a new career. He felt stuck in restaurant management, unable to advance or make enough money to support his family. “I tried getting other jobs, even retail,” he recalls. “But I’d be starting from scratch, all the way at the bottom, and that really wasn’t a good option.”

So David made the decision to return to school, despite uncertainties about completing his degree on time and managing school and work. “At first I actually thought it would be easy,” David laughs. “I’d been to a four-year college, so I was familiar with the expectations. I thought this was going to be keyed down from that. But I had to study. The workload was intense. It wasn’t just busy work. It was necessary in order to get a good understanding of things. The classes were very thorough, and I studied hard.”

On returning to school: *“I was very intimidated by going back to school. Managing my time between being the sole provider for a family of six, spending time with them, and attending college full time seemed impossible. I was most proud of finishing a two-year degree with honors. I gained a lot of confidence through that. I can do whatever I want and be successful!”*



Luckily, David got help from local scholarships and a teacher’s assistantship position at his school, Central Carolina Community College (CCCC). For working in the school’s photonics department, he received a small paycheck and tuition payment. His family motivated him to overcome his concerns about returning to school. “I wanted a better life for my family. That was my sole purpose,” he says. “Doing well wasn’t a choice for me. It was something I had to do. In addition to that, I was really enjoying myself! I really loved studying the things I was studying.”

David didn’t even have to wait for graduation for his photonics education to begin paying off. He started his job in January 2008 before graduating in May and now works as a semiconductor process technician for Cree, Inc., which manufactures LED lights. “I get to work in the research and development group, so I don’t just work on one process,” he says. “I get to work on all the processes and steps from beginning to end. My job is really interesting. Almost every night is different.”

For David, the future looks bright, not only for Cree’s LED lights, but for his advancement and the prospect of even more jobs in technical and scientific fields. “Science is where it’s going to be,” he says. “For one thing, people with technical or scientific jobs will have a very secure financial future.” Classmates of David’s who, unlike him, completed photonics degrees just after high school, are now making more than \$45,000 per year at the average age of twenty-one. And even though David found his way to photonics a little later in life, he feels he has a lot of options to discover. “There are opportunities out there I haven’t explored, so my imagination wanders over what I might be doing five years from now. I really enjoy the choices I have.”

Perhaps the greatest change has been David’s ability to spend time with his family. “There was my life before school and now there’s this life. They’re completely different,” he says. “My kids remember my working in the restaurant business. I wasn’t around very much. I worked six days a week, and when I had time off, I was too tired to do anything. Now, I spend a lot of time with my kids. I really love that.”

David M. Batsche lives in Bear Creek, North Carolina, with his wife, Andrea, and four children, Elliot, Kailie, Forest, and Emerson. After receiving his bachelor’s degree in business administration from the University of Houston in 1992, he returned to school and earned an associate in applied science degree in laser and photonics technology from Central Carolina Community College in 2008. David enjoys gardening, Frisbee golf, and helping his son build tree houses.

Ryan Renfrew did not have to struggle to figure what he wanted to pursue. At the age of thirteen, as he began to work with his father on classic cars, he discovered what would become an intense fascination with electronics and optics.



On following your instincts: “If more people just did what they enjoyed, they’d be more successful at it. I feel confident in saying there’s something of interest for many people in photonics. Anyone can succeed in whatever career field they feel confident in.”

Thanks to that early discovery, Ryan was able to get a jump start on his photonics education. “My high school had a collaborative program that I was able to complete during my senior year,” he recalls. “The accreditation program allowed me to complete my first term of college while still in high school. The day I graduated, I started my second term of college at Indian Hills Community College (IHCC).” Ryan was nineteen when he graduated from IHCC—at the time, the youngest graduate the college had ever had. Even before he graduated, he had been offered thirteen very different jobs from companies throughout the United States, with annual starting salaries ranging from \$32,500 to \$58,000. Ryan could choose from fields as diverse as semiconductor manufacturing, laser applications for the automotive industry, and medical laser installation and maintenance. Whatever he chose, Ryan would earn enough money to make him financially independent—as a teenager!

Ryan now works for Cymer, Inc., at the site where the computer company Intel conducts the majority of its research and development. “At Cymer, we are in charge of all specifications, all installations, and all upkeep on the lasers used by Intel,” he explains. “It is an exceptionally high-pressure group, because all the development is done here.” While Ryan obviously thrives in high-pressure environments, he sees the pressure as both the most fun and the most challenging part of his career. “Once you’re responsible for a particular project or a particular individual, it’s very hard to walk away. I’m on call twenty-four hours a day most days. That is probably the least favorite part of my job, but it’s also what keeps me here.”



From Ryan’s perspective, photonics is an extremely competitive field. “Everybody is advancing and trying new and different things to try to stay in front of the other guy,” he says. “It’s all a bit of a competition. I believe if you go back and look at people like us in sixth or eighth grade, we were all like that even then. I think it requires a particular personality, whether good or bad!” If there is some particular personality trait that causes people to thrive in photonics, it’s safe to say that Ryan Renfrew has it.

Ryan Renfrew received an associate in applied science degree in laser electro-optics technology from Indian Hills Community College in Ottumwa, Iowa, in 2000. He now lives in Hillsboro, Oregon, with his wife, Rachael, and son, Clayton. Clayton likes to do whatever Dad likes to do, which includes bowling, softball, fishing, biking, and working on cars.

Jeremy Johnson loves a puzzle. The best part of his job is, as he puts it, “solving a good problem. When we solve a problem at work, it makes me feel so rewarded.” Jeremy is a design engineer at Sony Ericsson Mobile Communications, where he designs the next generation of cell phones. But how did he get here from a photonics degree?

“For your life to be successful, you need to be able to react to your environment. In that sense, we’re kind of like light, because we have to react and find a way to get where we’re going.”



Jeremy started at a four-year university but soon realized that it didn’t fit him just right. A friend told him about the very popular laser electro-optics technology program at Central Carolina Community College (CCCC). From the moment he enrolled, he enjoyed the challenges that the degree presented. He liked one class in particular. “There was a class called Electronic Troubleshooting,” recalls Jeremy. “It inspired me to pursue an engineering degree at North Carolina State University. It was a really challenging class in which the professor would put out circuit boards with certain faults in them. Our goal was to find out what parts were bad. Once we figured out what’s wrong with the first configuration, we went to the next configuration, and so on. Once we finished all the configurations, we were done with the lab. I really enjoyed it. My lab partner and I finished the class well ahead of everyone else, maybe several weeks before the end of the course.”

As a result of Jeremy’s fascination with troubleshooting, he went on from CCCC to earn a bachelor of science degree in electrical engineering from NC State. “Now I play a leading role in the engineering team at Sony Ericsson,” he says. “It’s as fast-paced as I want it to be. I could sit back and do one level of work, but I like to stay busy. My team solved a couple of problems today, and it really makes me feel good.”



Jeremy’s associate degree is serving him well. “In the cell-phone industry, we look at optics as a peripheral device,” he explains, “but I do deal with optical components like displays and cameras. I use the basic troubleshooting I learned at CCCC every day. One key to being a good engineer, whether you’re an optical, electronics, or mechanical engineer, is knowing how to troubleshoot. You have to know how to follow processes and troubleshoot systems.”

Jeremy’s love for solving puzzles has shaped itself into a career that interests him greatly. He loves to go to work every day, to work on the giant jigsaw puzzle that is designing new mobile communications devices.

Jeremy Johnson earned an associate in applied science degree in laser electro-optics technology from Central Carolina Community College and a bachelor of science degree in electrical engineering from North Carolina State University. He lives in Fuquay Varina, North Carolina, with his wife, Caryn, and two daughters, Elizabeth and Ava. Jeremy likes to mountain bike, play Frisbee golf, and watch his little girls grow up.

Bill Holtkamp did not plan to study lasers and electro-optics. After graduating from high school, he first studied welding. However, upon graduating, he found that his job opportunities were limited as the economy was in a downturn. He then decided to go into farming with his dad. Though farming full-time for eight years, he had always had a strong interest in electronics and finally decided to go back to school.



**On the value of his technical education:
“Being a nontraditional (older) student, IHCC was a great launching pad for me. The small class sizes, knowledgeable instructors and in-depth, hands-on training provided a great knowledge base and confidence in my abilities.”**

Bill chose Indian Hills Community College (IHCC) to study laser and electro-optics, so he began the electronics program while continuing to farm part-time. Bill explains the outcome of his decision to enroll at IHCC: “Being a nontraditional (older) student, growing up in Iowa and attending IHCC was a great launching pad for me.” He found the coursework and the required studying very difficult. He explains, “It was both exciting and challenging to absorb that much information.”

He began his studies in IHCC enrolled in the electronics program, but his interests gradually shifted toward lasers and photonics. “President Reagan’s focus on developing a ‘Star Wars’ defense system and the United States’ fascination with laser technology (such as the 1986 Liberty Weekend lighting the Statue of Liberty with a Copper Vapor laser) piqued my interest.” It was at that point that Bill decided to change his course of study and join the laser electro-optics program. He explains that this program shared the same core classes as the electronics program, so the time that he had already spent at IHCC did not go to waste. Bill highly values his time at IHCC. As he says, “The small class sizes, expert instructors and in-depth, hands-on training provided a great knowledge base and built confidence in my abilities.”

Bill believes that photonics offers an exciting future to students interested in the field, because new applications are discovered every day. Bill believes that students should pursue their interests. He recognizes that a technical degree can be intimidating, but he believes that if a student is interested in photonics, that interest will drive the student to succeed in the required coursework.

Bill’s passion for photonics drove him to succeed: in 1988, he graduated at the top of his class with an associate degree in laser/electro-optics technology. Upon graduating, he immediately began his first job in the field as a technical sales engineer. Bill explains that even though earning his degree gave him the skill set to work as a technician, he was immediately drawn toward sales. One of his proudest career achievements was when he was the vice president of worldwide sales for Multiwave Photonics. He explains, “Although everything was a team effort, my responsibilities included establishing a U.S. corporate office, identifying value-added laser applications, redefining our laser product offerings, identifying and engaging new target customers, upgrading the worldwide distribution network, and successfully growing the business.”

Bill’s work in the photonics industry has allowed him to see and experience much of the world. He has lived in Germany and travelled extensively throughout Europe and Asia, but he is most fond of living in the San Francisco Bay area, where he now resides. In his current position as director of sales for Coherent, he manages a ten-person team. He explains that at Coherent, he has “settled into the largest laser manufacturer in the industry and enjoys being part of the team.” He is looking toward the great opportunities that the future is bound to present.

Bill lives in San Jose, California, with his wife Mary, and twelve-year-old son, Jason. Because his wife grew up in Athens, it has become a tradition that the family spends summer vacation in Greece. Bill enjoys spending quality time with his family, traveling, running, and bicycling.

Peter Kazunas's interest in photonics began in high school. As a participant in his school's Physics Olympics, he "enjoyed building and improving projects." Peter explored his interest in physics by enrolling in the applied physics/electro-optics program at Indiana University of Pennsylvania (IUP). Peter chose to study photonics because he believed that the knowledge he would gain would be "more concentrated than a general physics background would provide."

On figuring out whether a technical degree is right for you: "Take a single laboratory course in an introductory class like geometric or wave optics. That will give you a general feel for the types of skills you will be expected to develop. Then continually upgrade your skill set to keep up with technology."



Before the program began, Peter was expecting to get a general understanding of optics and electronics design. His expectations of the program at IUP were exceeded: "I got more hands-on experience than I expected because many classes had labs." After Peter's first year, he began a photonics internship at Pennsylvania State University. Peter recalls that this internship "sparked" him to continue his education in the field. He explains that "many jobs in photonics were hands-on laboratory work" and with that in mind, he purposefully built his skill set around practical applications.

For Peter, the hardest part of completing his degree was managing his time. Because he continued his internship with the electro-optics center at Penn State until graduation, time management was especially important. "I often had a full class load with labs," he explains, "and I worked three full days a week around them." Even with his demanding schedule, Peter was able to successfully complete his education. In 2009, Peter earned a bachelor of science degree in applied physics and electro-optics. The following year, he earned a master of science degree in optics from the University of Rochester.

Today, Peter continues his work as a research engineering intern for Penn State's electro-optics center, where he has been since 2006. Of all his work so far, Peter is most proud of "building, maintaining, and improving a laser system that has been successfully demonstrated in the field for the navy on multiple occasions." Peter says that he "performed lethality testing on targets; developed software to simulate beam-on-target-based diffraction, turbulence, and overlap quality; and developed Beam Alignment Diagnostic Control hardware and software for this laser weapon system." Over the course of his many years in the field, his hardware operation and software proficiency have both improved greatly.

Having worked in a university laboratory for over six years, Peter has been involved not only in the laser weapon system, but also in other projects. He has worked on laser survivability testing, laser characterization studies, and CMC laser machining. Also, he works with his organization's high school outreach programs, which include demonstrations and camps. He regularly works with an intern, so he gets to see "how skills learned in school translate into skills used in industry."

To Peter, the best parts of working in photonics are performing laser demonstrations and creating his own software for laser-beam analysis. Currently, Peter is working on many government-funded projects, and he admits that a challenging part of his career is that "equipment can be expensive to procure and maintain."

Peter suggests that students considering a career in photonics begin by taking one single laboratory course in an introductory class such as geometric or wave optics. He believes that this will give students a general feel for the types of skills that they will be expected to develop. He advises that students then continually upgrade their skill sets to keep up with technology. Peter believes that technical coursework is valuable even for students who are not interested in pursuing a technical degree; as he explains, "it is a good way to diversify your skill set," and a good way to "broaden the opportunities you will be qualified for after school." He believes, though, that "if you do not enjoy technical work, then it is not for you."

Peter currently lives in Natrona Heights, Pennsylvania. He enjoys traveling, taking apart and putting together computers and electronics, and hiking.

Woodrow D. (Woody) Morrison III has had some hard knocks in life. For nearly twenty years, he worked as a millwright, construction worker, and bartender. But an accident in April 2004 that crushed his right foot ended his ability to do heavy physical labor. As a result, he had to consider a new career path. “I went back to school and decided to study photonics,” Woody recalls. “Technology industries will continue to grow, even with the recession.”



About the field of photonics: “It’s a precise science that will never be exact. Things are always changing.”

But before Woody could graduate from Indian Hills Community College (IHCC) and get a photonics job, there were a few hurdles in his path. Two of the largest were his changed physical condition and his struggle to understand college-level math. “The doctors say I’m disabled or handicapped. I don’t think I am,” he insists. “I still have issues: I walk with a limp, my foot swells and bruises. But I couldn’t let that stop me. Bruce Allen at the Vocational Rehabilitation Center, located on the IHCC campus, showed me I could do it.”

Returning to school for the first time in twenty-three years, Woody knew that the math would be the greatest hurdle for him. But he was lucky enough to find someone who was able to tutor him, and it turned into a good friendship that he still has today. The hard work and long study hours that he put into Tech Algebra 1 and 2 prepared him well for college algebra. “Don’t be afraid of math,” he advises. “It’s doable. I like to say that I’m an example that you can. Once I had completed core classes and began the study of photonics, it all came together.” In Woody’s mind, there’s only one prerequisite for a successful college career: You have to have the desire to succeed.

Now Woody works for Spectra-Physics building imaging lasers. It didn’t take long for him to go from an entry-level laser tech II to his current position. “I’m the lead technician in Spectra Physics’ Vanguard division,” he says proudly. “We build the Vanguard 350mw and the 2.4 watt lasers.”

Woody lives by the principle that “you reap what you sow.” He also takes his responsibilities to his coworkers and his family very seriously. “Your own will can take you as far as you want to go,” he says. “If you treat a person like a human being, they’re going to treat you the same way. It’s all about the team. The more and better teamwork you have, the more successful you will be.” This frame of mind is a huge factor in Woody’s success at work and in life. “The best thing about my job is the people with whom I work,” he says. “We all get along. I see my rewards in different ways. Spectra-Physics is letting me have some time to take physical therapy for an injury that happened five years ago. I really appreciate that. I’m giving them my heart and soul, and I think they know that.”



Woody is a prime example of someone who works as hard as he can and receives great benefits from it. His advice is this: “If you see the goal and you want it, don’t let something like math, or even a life-altering injury, put you on the sideline. There are ways to get past them. Not around them, not over them, but through them.”

Woodrow D. Morrison III received an associate in applied science degree in laser electro-optics technology from Indian Hills Community College in Ottumwa, Iowa, in 2007. He and his daughter, Oleeta, live in Sunnyvale, California, and love to scavenge the beach and play sports together.

Michael Bass is only twenty-six years old, but he already wants to mentor students. “Outreach and mentoring is probably one of the most valuable things we (technical-school alumni) can do,” he says. Michael has good reason to reach out to future laser optics technicians: If not for his mentor, he wouldn’t have gone into photonics.

On overcoming disagreements: “Although your co-workers are actually trying to accomplish the same thing as you, they may be approaching a task in a different way. Remember that someone you disagree with is still your teammate; you’re working for the same company, and you’re still trying to accomplish the same goals.”



After high school, Michael began a program in electronics engineering technology at Central Carolina Community College (CCCC). But Gary Beasley, head instructor for laser and photonics technology at CCCC, saw Michael’s potential and spent two years recruiting him. “Gary recruited me to the photonics curriculum right after my electronics curriculum,” Michael recalls. “He’s an extremely passionate person for photonics and education in general. It was fascinating to see the demonstrations he did. He understood the photonics industry, how huge the growth and market are. If it wasn’t for Gary’s passion and dedication to the student, then I would not be where I am today.”



Michael inherited his mentor’s passion. He says, “Photonics is such a young industry. Most photonics jobs are on the cutting edge of technology. That’s one of the things I find most interesting, working with technology and taking it from the research-and-development stage to a practical-application stage, whether it is manufacturing, medical, or telecommunications. The applications of photonics are almost endless, which means the opportunities that can be opened for you are very broad.”

But other aspects of Michael’s education at CCCC play major roles in his job every day. “The associate degree wasn’t just about learning one type of math or very specific physics laws,” he explains. “It was really building the technical foundation and learning how to be a good employee, how to work in a team, and how to solve normal everyday challenges that face technicians in the field.” At CCCC, Michael says, he learned about “having a foundation of technical knowledge and learning to be a self-motivated person who has the desire to be successful.”

And “successful” describes Michael’s career to date. He works for BrightView Technologies, a start-up company that manufactures optical films for the management of light distribution. Michael started as a technician three years ago for BrightView’s main technology platform, called E-lamps. He says, “Today, I am responsible for the well-being of this whole system: everything from the optics alignment and calibrations of the system all the way to manufacturing, logistics, and process controls. It’s very interesting; I’m in a world between research/development and manufacturing.”

Michael wants to pass on his passion for photonics to students, and he also wants to help students learn people skills. “A significant portion of my job is working with people,” he explains. “One of the greatest challenges I have in my career is being able to work side-by-side with people, disagree on things, but still be able to support them. Being successful in any career, I believe, is not a matter of knowing more math or more physics theories than somebody else. It’s being able to work with people, being optimistic, and being able to solve problems.”

Michael Bass lives in Fuquay Varina, North Carolina. He received an associate in applied science degrees in electronics engineering technology and laser and photonics technology from Central Carolina Community College in Sanford, North Carolina. He and his wife enjoy supporting the Carolina Panthers and Hurricanes.

Michael L. Smith, Jr., had a bit of a false start after high school. “I thought I was going to college, but I wasn’t really well prepared,” he recalls. “My home life wasn’t great. My studying habits weren’t really there. I started at the University of New Mexico and found out really quickly that I wasn’t ready.”

Michael knew that he needed to further his education, and heard about Albuquerque Technical Vocational Institute (ATVI, now Central New Mexico Community College) from friends. “I checked it out, talked to a counselor, and was really interested in the laser electro-optics technology (LEOT) program,” he says. “It had good job placement, a good starting salary, and potential for growth in the area. It was an amazing program, and I fit in with the people. They were either older, with a change-of-life event, or young, like myself at the time, and looking for a path alternative to a four-year university.”



“You can always find people who have the skills on paper. But it’s the skills in life that play into the job market more than anything. It’s being able to understand the dynamics of working with other people. It’s great news when an employer hires a person and finds out he or she is able to work without supervision. People like

that are worth their weight in gold!”

Michael struggled a little at first, but once he got his study habits down, “it was a lot of fun.” The differences between ATVI and Michael’s short university stint were clear. “The teachers at ATVI seemed to care more about the students,” he says. “The teachers expected us to study, but they coached us on what and how to study. We had study groups to help each other.” As a result, Michael’s efforts at ATVI met with great success.

“Before I graduated, I was offered a position at Texas Instruments in Dallas to work in quality control of optics, lasers, and electro-optics manufacturing,” he says. Today, Michael works at Sandia National Labs. Sandia develops applications for the U.S. Department of Energy and technologies that support our national security. Michael works in semiconductor materials and device sciences, in Sandia’s energy laboratory.

Michael is a principal technologist and works with engineers on cutting-edge applications. “Many of my peers have bachelor’s, master’s and PhD degrees,” Michael says. “I’m the least educated person in my group.” But Michael is capable and confident. “I’m OK with that,” he says. “I feel good about my abilities. I’ve been trained well.” In his mind, Michael gets to do the most exciting part of research: turning ideas into realities. “The technologists do most of the hands-on work,” he says, while scientists interpret the theories and engineers create the designs. “We get to see if it works.”

One reason for Michael’s career success is his ability to work with people. According to Michael, “Eighty percent of the job is the ability to get along with coworkers. When I interviewed people for jobs, I’d say, ‘Tell me about how you liked your previous job. How was your manager?’ You can tell a lot about people by how they react to those questions.” Michael emphasizes the importance of mutual understanding between coworkers. “People react to situations differently,” he says. “There are different personality types.” From his clear communication and unflappable outlook, it is obvious that understanding people is one of Michael’s greatest strengths.

Michael L. Smith, Jr., earned a diploma in laser electro-optics technology from Albuquerque Technical Vocational Institute in 1986. He lives in Albuquerque with his wife, Dana, and children, David and Danielle. Michael loves to play basketball and racquetball, ski, golf, and garden. He serves the community through volunteer work in schools and non-profit organizations.

Dr. Bruce Brinson describes his life as “a random walk.” At first, photonics was not a driving passion. “I didn’t have visions of Star Wars,” he recalls. “I was looking for schools.” A coworker at his auto-repair shop told him about a man in Germany who worked with lasers and had been educated in Waco, Texas, at Texas State Technical College (TSTC). “I looked into it,” he says, “and talked to John Simcik (a former TSTC faculty member), who is a motivating guy, to say the least. I drove over to Waco, talked to John and some other people in the department, and moved into the dormitory that day.”

On teamwork: “Problems are rarely solved by individuals working alone. There are almost always two or more people involved.”



Upon completing his associate degree, Bruce was hired by the Department of Electrical and Computer Engineering at Rice University in Houston, Texas. “I was working with lasers and electronics,” he says. “I saw systems that people like Jerry Reay (a former TSTC faculty member) said we would learn about but were ‘never going to see in the real world.’ Well, I saw them, and I built them.”

Bruce had hoped to finish an optical engineering degree at the University of Houston at Clear Lake, but the program was dropped soon after he began working at Rice. “I kind of let that go,” he recalls, “but then while at Rice, I said to myself, ‘You know, I can take classes at Rice for free. It could take ten years to get a degree out of this, but what the heck?’” Eventually, Bruce earned a bachelor’s degree based on his coursework at TSTC and Rice.

In his bachelor’s degree program at Rice, Bruce researched Bucky balls, nanotubes, and other carbon nanostructures. This research fueled his desire for a master’s degree. “I could take this and run with it,” he thought. But no Rice employee had ever been allowed to earn a Rice degree while working for the university. Bruce planned to resign his position and enroll as a graduate student at Rice. He explained his plan to Professor Naomi Halas, for whom he would be working. As far as Professor Halas was concerned, Bruce’s plan was a “no brainer,” so she “rocked the foundation” at Rice, and Bruce was accepted without having to resign. Bruce followed his master’s degree with doctoral work. “All in all, the pieces were in place,” he says. “I was simply blessed.”

Bruce was blessed by circumstance, but he was also blessed by a tenacious patience that allowed him to slowly but surely find the means to further his education. Plenty of encouragement came from mentors and friends as well. Concerns about the cost of tuition were eased by words of wisdom from Dr. Dial Martin, a retired faculty member of Texas A&M University. He said to Bruce, “If you really want to go back to school and you find a way to get in, you’ll find a way to stay.” He was right.

In his spare time, Bruce has become one of the top amateur country and western dancers in the Houston area. “I danced and danced,” he says, “and when you practice, you excel.” That philosophy has served Bruce in many parts of his life. Now, TSTC can count among its alumni one of today’s most promising researchers and developers of new photonics and nano technologies.

Dr. Bruce Brinson of Pasadena, Texas, recently received his Ph.D. in photonics and nano engineering from Rice University in Houston, Texas. He also holds a master’s degree in photonics and nano engineering from Rice, a bachelor’s degree in optical technology from Regents College in Albany, New York, and an associate in applied science degree in laser electro-optics technology from Texas State Technical College.

Reese A. Jernigan didn't pursue a career in laser technology at first. He had a job in route sales. But a car accident that left him with a back injury forced him to reconsider his career path. "One of my route-sales accounts was AT&T," he recalls. "That's how I first heard about the laser and photonics program at Central Carolina Community College (CCCC). They told me if I wanted to get into fiber optics, I could go to CCCC and take their laser and photonics curriculum. During the time I was on worker's compensation, I decided to continue my education."



On making the best of obstacles: *"I was in a car accident that put me out of work because of a back injury. But during the time I was out of work, I decided to use this opportunity to continue my education."*

Despite the pain and tedium of a long recovery from his injury, Reese is glad that it gave him the chance to get a college degree and put him on a road to job advancement and a secure future. While in school, he struggled with some of the concepts, but he worked through it. "It's all relative to how much effort you put into it," he says. "I don't think anything was too difficult about the program, because I really applied myself." Along with an associate degree in laser and photonics technology, Reese earned a certificate in electronics engineering technology.

Upon his graduation, Reese knew that his real interest lay in lasers. "I had a couple of job offers in electronics positions," he says, "but I wouldn't have had a chance to exercise the laser and photonics portion of my degree. At first, I was hoping to get into fiber optics, but at the time, interest in fiber optics was slumping. I'm glad about that now, because it steered me to being a laser technician at Northrop Grumman."

Now, Reese works as a laser technician for Bright View Technologies. He describes his work this way: "My job is to assist other technicians and engineers in the custom design of any of the equipment we need to process specialized optical films for lighting and displays. There are several departments that use lasers, but I usually work in the aperture-creation department." Much of Reese's job is hands-on research and development. "Since it's a small, start-up company, I get to wear many hats," he says. "If I have a good suggestion, it's really taken into consideration. I had an idea to improve one of our processes. I proposed it to upper management, they liked it, and my idea went from a prototype into a full-scale manufacturing machine that we have now sold to a manufacturing partner in Japan."



When Reese looks to his future, he sees plenty of options. "I'd really be happy maintaining a career in a small company like Bright View where I can wear a lot of hats and learn a lot. But if I didn't go that route, I would like to get a government-contract position where I could do Department of Defense work. There's a level of pride that comes along with knowing you're doing something to help our nation's defense and homeland security."

As the field grows, Reese expects an expanding horizon of opportunities. "Every day, more and more applications are being discovered in manufacturing and other processes that use lasers," he says. "As lasers change and become more advanced, they open more doors. Opportunities are fresh and new. This field has only just begun."

Reese A. Jernigan earned an associate in applied science degree in laser and photonics technology and a certificate in electronics engineering technology from Central Carolina Community College in 2004. He lives in Cary, North Carolina, and loves to read in his spare time.

Landon Greenfield developed a passion for technology as a child, that continues to grow today. “It started out when I was 7 years old,” Landon recalls. “I would save up all my allowance, just so I could go out and buy one of those ten-dollar 5mW laser pointers.” He was a child who liked technology so much that he was not content to simply wonder how it all worked. “Before I could get it home, I would have it torn apart and put back together, just because I was so amazed to find out how the laser light was formed.” Once Landon realized how strongly he was interested in technology, he decided to attend “tech camps” to see what more there was to learn. The more tech camps he attended, the more his interest in laser technology developed into a passion.

On his desire to give back to the laser-optic industry: ***“I would be nowhere near where I am today without the help of IHCC and their exceptional Laser-Optic program. So to have a chance to give back to the industry and possibly be able to help future laser technicians like myself, I would be absolutely honored.”***



Landon’s mother had been working at Indian Hills Community College, which gave him an excuse to visit and explore the tech center. He is thankful that his hometown in Southeast Iowa offered an opportunity for him to “eventually take that big step into the photonics industry by obtaining a Laser-Optic degree from IHCC.” Though he did not know what to expect when he began his studies, Landon was encouraged by the words of his professor, Frank Reed, who often spoke of the endless jobs in the photonics industry. His weeks were long and difficult, and the forty-minute commute to school every day made them even more exhausting. Instead of being discouraged by this, Landon found himself increasingly interested in working in the lab at school. It felt more rewarding than simply getting an education.

In 2010, Landon completed his Associate of Applied Science degree in Laser/Electro-Optics Technology. While Landon focused on his education, he was also able to exercise his leadership skills. His professors and peers elected him student body president, and he began to organize campus events and fundraisers. As if he didn’t have enough on his plate, he was elected to serve as vice president of the Laser-Optics Club, where he helped coordinate additional fundraising and community service outreach events.

After Landon graduated, he began working at MC Machinery Systems - Mitsubishi Laser, where he was one of the youngest field service engineers the company had ever employed. The promise of job security had been an important motivator for him during his education, and that promise was fulfilled. He entered the field as an entry-level install technician, but within a few years, he quickly advanced to become a lead install technician, then a service engineer, and eventually a lead service engineer.

Landon is very happy in his current position as Laser Field Service Engineer with MC Machinery Systems - Mitsubishi Laser. His work days are always interesting, because each day involves a unique application of technology. Landon is proud of how quickly he has reached a professional level in his field, and he plans to continue pursuing his career as well as his education.

As a member of the Photonics Alumni Council for Technicians, Landon is eager to do everything possible to make a difference in the photonics industry. “I would be nowhere near where I am today without the help of IHCC and their exceptional Laser-Optic program. So to have a chance to give back to the industry and possibly be able to help future laser technicians like myself, I would be absolutely honored.”

Landon travels often, but is currently living in Minnesota as he continues to advance in his career. He hopes to continue his education and obtain a four-year degree in electronics or optics. In his spare time, he enjoys playing basketball and golf, running, pursuing his interest in motorcycles, going camping, and participating in other outdoor activities.

Paul Leech worked as an auto technician at General Motors before deciding to pursue a photonics degree at Camden County College (CCC). He had just finished high school at the time, and the work and pay seemed decent for a young person just starting out. Because he was a skilled technician, Paul quickly rose to the top of his field. He realized, though, that the top came a bit too quickly. “I found the salary was starting to plateau quite quickly, and it was too low for my liking.” When Paul looked into the future, he realized that his chosen career path wouldn’t offer him the kind of ongoing challenge that he was looking for. Paul’s good friend had completed the photonics program at CCC and “started a nice career that showed a lot of promising success.” Paul realized that the careers that his friends had chosen gave them “unlimited opportunity to grow.” Wanting the same for himself, Paul decided that his next step would be to earn an associate of applied science degree.



On opportunities in technology: “I obtained a job before I even graduated. I’m now the co-owner of Photonics Services Group.”

Paul was excited to start this part of his life over, and eager to discover the opportunities and challenges that his education would give him. He went into the photonics program with few expectations other than “learning a lot of science, math, and physics,” but soon found an excellent job opportunity. “That good friend helped me obtain a job at (scientific and medical laser manufacturer) ConBio before I even graduated from CCC,” Paul explains. With such a great opportunity lined up, Paul was extremely motivated to complete the program

successfully. For two years, he spent his nights working at UPS and his days working even harder to earn his education. When Paul completed his degree and had the opportunity to work as a field service technician at Hoya ConBio, he was thankful that his friend had helped him pursue his dream of working toward a rewarding career.

After working with ConBio, Paul worked as a urology laser technician for Mackin Medical and then as a field service technician for ICN Pharmaceuticals. Eventually, he and three others cofounded a company called Photonics Service Group, Inc. The recession was as hard on his company as it was on most companies, but Paul stuck with it. “I was proud to get through the recession and hit our ten-year anniversary of the company,” he says. Now, Paul is not only a co-owner and field service technician for his company, but also its vice president. Eventually, Paul expects to either sell the company to a larger corporation or take the company public.

Paul is proud of how far he has advanced and believes that his story can serve as an inspiration for those just beginning their careers. Paul’s three core values are integrity, honesty, and communication, which he believes help him create strong and prosperous relationships with clients, customers, and partners. Paul believes that these three qualities, combined with hard work, will allow anyone to grow and succeed.

Paul lives in Haddon Township, New Jersey where he grew up. He often takes his family camping in Jersey Shore. He also enjoys outdoor sports and mountain biking.

Jared Bruce Mills's path toward photonics was a roundabout one. Early in his education, Jared was strongly interested in airplanes. But while pursuing a bachelor's degree in aerospace engineering at Embry-Riddle Aeronautical University, he "became intrigued with the probabilities and possibilities of lasers within the engineering fields of manufacturing and research."

"One of the achievements I am most proud of is my role in building a new research lab at the University of Nebraska. [I gained] knowledge and skills in laser equipment, research requirements, system factor analysis, and negotiating and assessing companies from around the world."



In 2002, Jared immediately began working with Mercedes-Benz in Omaha, Nebraska. In his first four years at Mercedes-Benz Jared earned a master certification in the company's standards of excellence certification program. Jared also managed, developed, and administered a warranty program while formulating and improving quality control on repair orders. Meanwhile, Jared began pursuing a master of science in project management and business management, which he earned in 2006. He continued working with Mercedes-Benz until 2009.

At this point, Jared already had bachelor's and master's degrees. But he found that the interest in lasers that he had developed while pursuing his bachelor's degree had expanded and developed due to a family connection. As he explains, "My brother pursued a degree in laser electro-optics through Indian Hills Community College (IHCC) and worked for a defense contractor building lasers for navy aircraft." Jared's longstanding interests in airplanes and lasers made this career path extremely appealing to Jared. After watching his brother succeed in such a promising and interesting field, Jared decided to pursue the same degree at IHCC so that he might become a part of the "unfolding discoveries and advancements in photonics," just as his brother had done.

During his time at IHCC, Jared worked at IHCC's Student Success Center, where he provided individual and small group tutoring to help his fellow students "clarify learning problems and work on study skills." He also served as student senate representative and vice president of the laser optics club. As vice president, he helped organize and manage the laser optics club's Fiftieth Anniversary of Lasers celebration. For the celebration, Jared "learned how to program a laser light show," and told audience members about "the history of the laser and the men behind the exciting advancements in this field." Jared's involvement in the college community allowed him to learn even more about lasers.

In 2011, Jared earned an associate of applied science degree in laser/electro-optics technology from IHCC. A couple of months later, he began working at the University of Nebraska's Lincoln Diocles Extreme Light Laboratory, where he is now happily employed as a laser optical engineer associate. As the laboratory's laser safety officer, he has also developed and managed its laser safety and radiation program to ensure that the laboratory meets all standards and regulations.

Jared is constantly challenged in his job, and he takes pride in his accomplishments. "One of the achievements I am most proud of," he says, "is my role in building a new research lab at the University of Nebraska." He extensively researched necessary equipment for the new lab, and with the assistance of a trained technician, purchased "pump lasers, oscillators, amplifiers, optics, opto-mechanical components, test equipment, and tools." Jared explains that his current project has expanded both his "knowledge and skills in laser equipment, research requirements, system factor analysis, and negotiating and assessing companies from around the world." After multiple degrees, years of education, and extensive training on laser systems, Jared is now working in the cutting-edge career that he loves.

Jared lives in Lincoln, Nebraska. When he is not exercising his creativity on the job or training in other countries, Jared enjoys bicycling, ballroom dancing, hunting, and brewing his own beer. He hopes to one day start a family, and he plans to continue his successful career with the University of Nebraska.

THE WORK OF THE PACT

Models and Mentors

Presentations to High School Students

PACT members visit high schools and tell their story. They not only describe the field of photonics, but also tell their own experiences, including

- How they chose this career.
- Their educational experience in preparing to be a technician.
- How they identified and selected their particular field of photonics.
- Their experiences in their first job and the opportunities they had to advance in their career.
- If they chose to continue their education, what coursework did they pursue? (technical, business etc.) How did this change their career plans?
- What experiences and coursework would they recommend for a high school student to confirm this career choice and to prepare for entry in a nearby college that teaches photonics?

Often, PACT members speak to students in high schools near the college that they attended. PACT members who are working in a different area of the country from their college speak at high schools near their employers.

Reviewing AAS-Degree Photonics Programs and Suggesting Possible Improvements

Many PACT members serve on advisory committees for the photonics program in the college where they completed their education.

- They relate the education that they received to their needs after employment, and often suggest program improvements that would strengthen future graduates.
- They explain critical technician knowledge and skills that their employer needs.
- They identify changes in the workplace and emerging technical topics that the college should consider as it makes changes to its curriculum.

Sharing Experiences and Giving Advice to Students

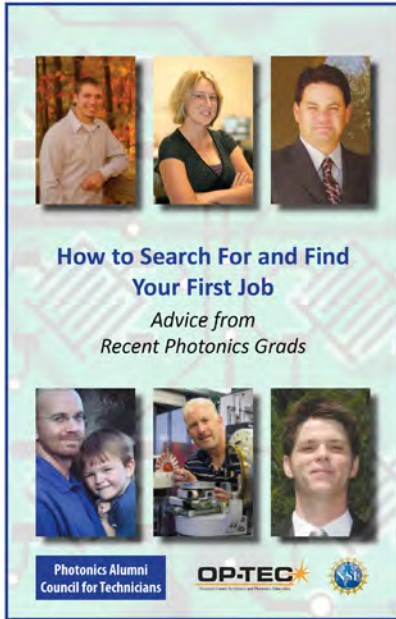
PACT members have valuable and relevant experience that can help those who may follow them:

- High school students and friends who are choosing and planning for additional education or training that will prepare them for a career.
- Tech students at colleges who are beginning their technical studies or are nearing graduation and searching for jobs
- Recent graduates of technical colleges who are adjusting to the world of work.

PACT members visit the college that they attended and speak to the tech students. They serve as guest speakers in class seminars, telling students about their work, and encourage students to complete their studies. On occasion, PACT members are asked meet with interested high school students to explain photonics and the nature of their jobs as technicians.

PACT members also provide suggestions and advice to create informative booklets that allow high school and college students to benefit from their experiences. Faculty at photonics colleges are currently distributing two such booklets to their students:

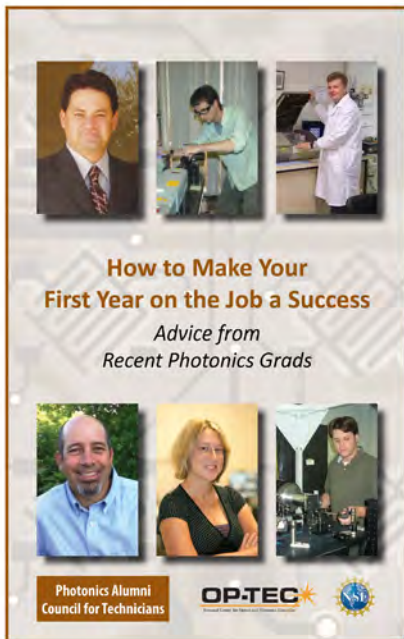
How to Search For and Find Your First Job



Topics include:

- “Money isn’t everything”, but it helps.
- Where do you want to live? Where would you be willing to live?
- What kind of work do you want to do?
- Have you prepared a resume?
- What do you hope will happen in the interview?

How to Make Your First Year on the Job a Success



Topics include:

- You haven’t learned everything when you graduate.
- Your mother doesn’t work here, so learn how to survive on your own.
- You’re personally responsible for the quality and timeliness of your work.
- Your value to an employer will depend as much on your “soft skills” as your technical knowledge.
- When possible, volunteer to represent your employer in community and charitable events.

Additional booklets that will be created soon include:

- What Types of Jobs are Available for Photonics Technicians?
- How to Prepare to Enroll and Be Successful in an AAS Degree Photonics Program