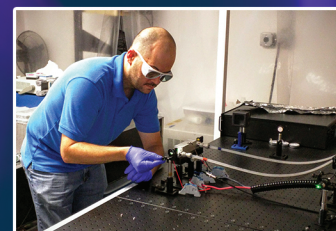
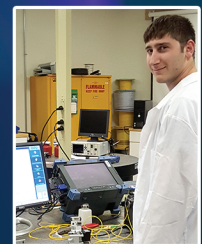
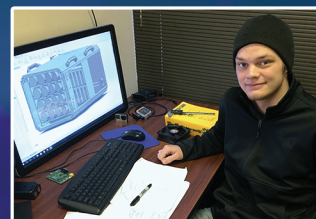
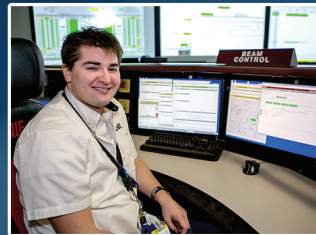
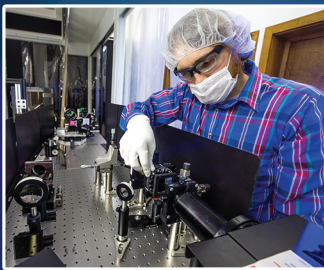
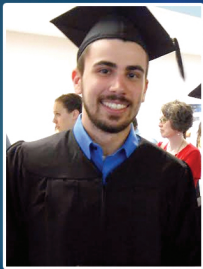


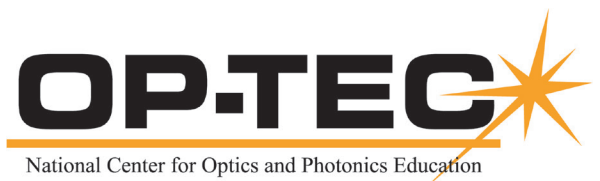
Success Stories in Photonics Careers 2015-2016 Inductees



Photonics Alumni Council for Technicians

Success Stories in Photonics Careers 2015 - 2016 Inductees

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 24 exemplary photonics technicians inducted into the **Photonics Alumni Council for Technicians (PACT)** in 2016. An earlier publication, *Success Stories in Photonics Careers* (2013), describes 34 other successful photonics technicians.¹

For over 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 donations and service on photonics education advisory committees at the colleges that educate their future employees.

This book symbolizes the fruits of our labors. Today, more than 20,000 photonics technicians are at work in businesses, laboratories, government, hospitals, defense industries, and educational institutions. A national survey of photonics companies revealed that we will continue to need at least 800 new photonics technicians each year! That demand is much greater than the number of graduates we are producing at our photonics colleges, so these colleges will be enrolling even greater numbers of capable, interested, and prepared students. Completers of these programs are receiving multiple job offers at excellent salaries—and contributing to advancements in cutting-edge technologies.

Information about the enormous impact of photonics on our country's security and technical innovation can be found in the National Research Council's 2013 publication *Optics and Photonics: Essential Technologies for Our Nation*.² 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.

Fred Seeber, PhD, Professor
Camden County College

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

May 2016

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, biomedicine, 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 2010.² The global market for lasers was nearly \$10.8 billion in 2014. This market is expected to reach \$11.7 billion in 2015 and \$16 billion in 2020, with a compound annual growth rate (CAGR) of 6.5%.³

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.

¹ OP-TEC, Success Stories in Photonics Careers (OP-TEC, 2013). Available at http://www.op-tec.org/pdf/PACT_book_2013.pdf

² National Research Council (2013) Optics and Photonics: Essential Technologies for Our Nation. Available at <http://www.nap.edu>

³ BCC Research LLC. (2015) Global Markets for Laser Systems, Components and Materials. Available at <http://www.bccresearch.com/market-research/photonics/laser-systems-components-materials-global-markets-report-pho002b.html>

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-five 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 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 nominate former students who were recognized for their technical achievements and leadership abilities. These candidates are 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 in 2013. This book presents the PACT members who were selected in 2015-16. Their profiles have been created to show the diversity, accomplishments and beneficial lives they enjoy.

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.

*Profiles of earlier PACT members can be found in *Success Stories in Photonics Careers* (2013).

Presenting the PACT

The following pages showcase the 24 newest 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. 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, or 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 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.

Trenton Northup was working for his stepfather when he first heard about the Laser and Optics Technology program at Indian Hills Community College (IHCC) in Ottumwa, Iowa from an old high school classmate. “He was telling me all the perks about his job that he has now and all the good things about Indian Hills,” Trenton recalls. Trenton’s friend had already graduated from Indian Hills and was full of praise for the Laser and Optics Technology program and the opportunities that the field affords. Trenton was won over by the glowing recommendation and decided to enroll.

Trenton says he “had no idea what to expect going in” but found himself very interested in the classes and material. He believes that studying lasers and optics is something that just about anybody can do. “You don’t have to have a background in lasers and stuff like that to fall in love with the field,” he says. Trenton’s family wasn’t familiar with lasers and optics, but they enjoyed hearing about what he did during school. His family supported him “100 percent” as he pursued his degree in a field he had come to love.



“It was so intriguing, and I never got bored with it. It kept me on my toes. I kept learning new things every day.”

Trenton speaks very highly of one of his professors, Frank Reed. “I don’t know how to put into words how great a teacher he is,” Trenton says. He found it comforting and heartwarming that someone with Frank’s experience was so passionate about new students who were just beginning to learn about lasers and optics. “He would do anything and everything for us,” Trenton says, and it was clear to him and the rest of the students that Frank was invested in them and wanted them to succeed.

Before they graduate, students in the Laser and Optics Technology program are encouraged to contact companies who have hired Indian Hills Community College graduates in the past. Trenton says that students are given a booklet that lists more than seventy-five companies and their contact information. “I was really surprised,” he says, “just how many there were and how quickly some of them responded.” Once he’d let a few places know that he was going to graduate from IHCC’s Laser and Optics Technology program, they were eager to hire him. Students from this program are so highly valued that companies travel to the Indian Hills campus every March to conduct on-site interviews for students who don’t have the time to travel and interview elsewhere in the country. Trenton had received four job offers by the time he accepted his current position at Lawrence Livermore National Laboratory in California. He also had to turn down second-round interviews with two other companies and a paid-for trip and facility visit to another company.

Trenton graduated in May 2015 and is currently a Laser Research Engineer/Technician Level 4 at Lawrence Livermore National Laboratory. He works in the control room at the National Ignition Facility (NIF), where he is responsible for laser-beam alignment. Trenton is excited to be working at NIF because he is part of groundbreaking research in the laser field. He says, “I wanted to be where the action is, and that’s what this job is.” “Any day, something new could happen, and I learn something new every day.”

Trenton says the primary goal at the NIF is to achieve ignition, which would provide a new source of sustainable energy. He loves what he does, in part because, his work has the potential to change the way people use and think about energy, and he sees himself staying in his job for a while. Since starting at Indian Hills, he says, “I’ve never looked back.” His message to students interested in the Indian Hills program: “I guarantee that you will not regret going into this field. It’s awesome, it’s challenging, and it’s so interesting.”

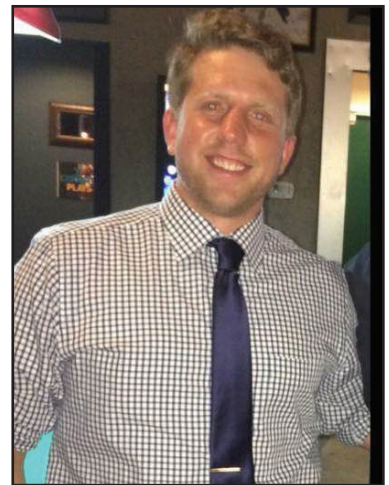
Trenton Northup graduated from Indian Hills Community College in May 2015 with an associate of applied science degree in laser and optics technology. He currently works at Lawrence Livermore National Laboratory in Livermore, California.

When **Riley Guest** started to think about going back to school, he knew he wanted to study something exciting and cutting edge. He was introduced to photonics by a couple of friends that had graduated from the Laser and Optics Technology program at Indian Hills Community College (IHCC). After inquiring about the program at Indian Hills, he quickly became fascinated by the growing photonics industry and the broad applications of lasers, and he decided to enroll in the program.

Riley had been out of school for five years. He thought that going back to school would be tough, but to his surprise, it wasn't as difficult as he expected. According to Riley, the instructors at Indian Hills were "awesome", and the learning atmosphere was one of the best parts of returning to school. The academics program at Indian Hills felt a lot like going to work, but Riley found that he didn't dread waking up for his 7:00 a.m. class. Most days, he found himself working in the laser lab doing hands-on activities with other students in his tight-knit class. A major challenge for Riley was facing the math and science he had avoided in high school. But once he started to apply himself to his photonics classes, his interest and confidence grew, and he found himself especially interested in physics and its applications.

Riley completed an associate of applied science degree in laser and optics technology in 2015 and, since then, has been working as a laser technician for Foro Energy. His responsibilities include everything from maintaining and troubleshooting laser systems to working with engineers on new design projects.

"It's definitely not the same thing every day, and I am always learning something new. I like being able to come to work every day and know that I'm not going to be doing boring work. It's funny, because you'll say to yourself when you're in college, 'When am I going to use this?' In my job, everything I learned, even stuff as small as vocabulary words, we use."



Riley finds photonics inherently fascinating; he says the best thing about working in photonics is "when you realize you are working with light! The whole thing hit me when I realized all the different things that can be done with light."

Riley's advice to others considering a career in photonics is to choose a specialty area that is personally interesting. "There is such a wide range of work you can do," he explains. "You can make a great career path in research or design or medical applications. Make sure it's something that you really want to do. If a subject interests you and you think it's something that you want to try, I highly recommend trying it." Riley appreciates the career opportunities that a technical degree provides.

"Technical degrees are in demand. Every place you go to work needs technicians. Something is always going to need to be fixed."

Riley's future is bright and definitely involves photonics. "I plan on applying my Indian Hills degree further to pursue a bachelor's degree in laser engineering and physics, with an emphasis in optics, because that's the kind of background we need here at Foro Energy. I want to definitely direct my education towards something physics related." Riley's focus and passion for photonics and physics will no doubt take him exactly where he wants to go.

Riley Guest earned an associate of applied science degree in laser and optics technology from Indian Hills Community College in 2015. He currently lives in Littleton, Colorado.



Carlos Salas was in high school when he was first introduced to optics and photonics. Gary Beasley, a professor in the Laser and Photonics Technology program at Central Carolina Community College (CCCC), gave a presentation at Carlos's high school, and his detailed explanations and compelling examples of photonics applications piqued Carlos's interest. "I didn't know anything about light, lasers, or optics," Carlos recalls. "That was a brand new world to me." By the end of the presentation, Carlos had decided to enroll at CCCC and work toward an associate of applied science degree in laser and photonics technology.

Carlos started the program with an open mind. Carlos had learned from Gary that the first year of the program would focus on electronics, and the second year on lasers and optics and how the technologies work together. What he didn't know was how exciting he would find the program. He recalls, "When

I got into the program, it was a lot better than what I expected. It was so much more interesting." At CCCC, Carlos adjusted to being a college student. "The way they teach [in college] is completely different" from what he'd known as a high school student. But the most challenging part of his tenure at CCCC was working two jobs while going to school. One of those jobs was an internship at Wasatch Photonics, where Carlos applied the skills he was learning in school through hands-on exposure to spectroscopy. Carlos didn't let anything deter him, and by May 2015 he had earned his degree.

Carlos is now working as a Process Technician at Phononic, a start-up thermoelectric company. Working for a startup company means that he wears many different hats. He works in the production area assembling heat pumps for refrigerators and computer cooling devices, and he also supports the development team. Thanks to his laser and photonics technology degree, Carlos is one of the few employees with the necessary technical skills for certain tasks. His job is a challenge, but Carlos appreciates being given tasks that he might not be able to accomplish. As he says, "It keeps things fun and interesting" and allows him to rise to the occasion.

"I ask question after question after question to find solutions. I learn something new every day; I experience new things."



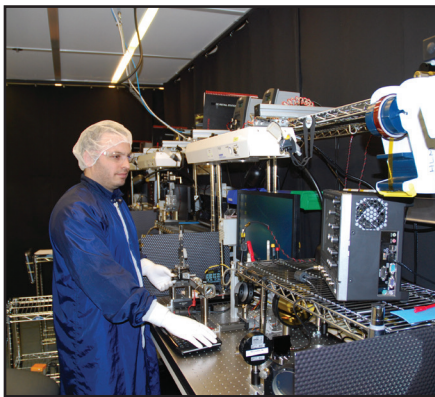
In the immediate future, Carlos would like to move up at Phononic and become a Development Technician. Later on, he wants to go back to school for an engineering degree. He hopes he could then continue working for Phononic as an engineer.

Carlos encourages interested students to research the different areas of photonics. "It's not just light," he points out. "You can go into electronics, go into thermoelectrics, or go into spectroscopy." He thinks that hands-on learners should "definitely consider" a degree in photonics. Through the Laser and Photonics Technology program at Central Carolina Community College, Carlos learned to troubleshoot and solve problems by researching and finding answers on his own.

Carlos graduated from Central Carolina Community College in May 2015 with an associate of applied science degree in laser and photonics technology, along with a certificate in electronics engineering technology. When he's not working, Carlos enjoys working on small projects and fishing. Carlos currently lives in Lillington, North Carolina.

After **Aaron Schwehofer** graduated from college in 2007, he began a career teaching industrial education at Grant Community High School in Fox Lake, Illinois. One day, Aaron's principal asked him to look into updating the curriculum to include an introduction to the field of photonics. While researching photonics, Aaron became very excited about the subject matter, as well as the career opportunities in the field. "Everything I was learning about photonics made me more assured that photonics was the career for me," he recalls. "I decided to research colleges with two-year degree programs, and was most impressed with Indian Hills Community College (IHCC)." After three years of teaching, he finally took the plunge and enrolled in the Laser and Optics Technology program at IHCC. He couldn't be happier with his choice—as he says, "Choosing a different career path to obtain an associate of applied science degree in laser and optics technology at IHCC has been the best career decision I have made at this point."

For Aaron, the most challenging aspects of completing his degree had to do with balancing work and school. To pay the bills, he needed to work three jobs, all while attending school full time. But he kept his goal in mind, and he knew that if he kept pushing forward and managed his time efficiently, his vision would become reality. Today, he recommends that students think about both financial opportunity and personal satisfaction when they're considering a career:



"I think it's important that you go for a career that you would enjoy and that pays the bills. I encourage people to look into it and see what types of careers are out there, because there are endless number of careers in photonics. Do your research, and see if photonics is for you."

After graduating from IHCC in 2012, Aaron began working as a Manufacturing Laser Technician for L-3 Insight Technology, a military contracting company located in New Hampshire. His responsibilities include troubleshooting and testing diode-pumped solid-state laser systems. He also is responsible for cleaning and grading optics, communicating with suppliers, writing work instructions for multiple production lines and training of production personnel, maintaining clean-room protocol, and testing lasers systems at the design level.

Aaron finds working at L-3 Insight Technology rewarding for many reasons. The products he's helping make have an important purpose: L-3 Insight Technology develops and produces advanced night-vision and electro-optical technology and systems for the United States military. Aaron says, "I know that what I do as laser technician contributes to keeping the men and women of the U.S. military safe, which ultimately protects everyone in the country. That, to me, is gratifying in itself." He also enjoys the challenging nature of the work. "There is always something new to learn, change, fix, or make better," he says. "I find it very rewarding to be able to discuss intricacies discovered during product- and process-improvement testing with engineers and then implement changes in production and products."

"Coming up with processes, testing them, and then implementing the results is really fun. I love what I do!"

Today, Aaron is taking courses in Electronic Engineering Technology while continuing to work as a laser technician at L-3 Insight Technologies. He expects this additional education to offer him even greater success in his field. Electronics, he says, "goes along with photonics, hand-in-hand—you need electronics to run lasers. Continuing my education is crucial to my success in working in the field of photonics." Aaron has definitely settled into his career as a laser technician, as well as working in New Hampshire. "I like where I'm at," he says. "This part of the country is beautiful! I just bought a condo and see myself building my career here."

Aaron earned an associate of applied science degree in laser and optics technology from Indian Hills Community College in 2012. He enjoys playing the guitar, skiing, running, exercising, cooking and spending time with friends and family.

Luka Papike decided early on that he wanted a scientific career when he grew up. Math always came easily to him, and he enjoyed every science class he took in high school. Several of Luka's family members have medical degrees, and watching his family in their careers furthered his own interest in science and technology. After high school, Luka took a three-year break from school to work in customer service at a bank. Soon, though he realized that he could make a lot more than \$15 an hour if he got a college degree.

Luka did some online searching and found Indian Hills Community College (IHCC), located in Ottumwa, Iowa. Based on the program description, the Laser and Optics Technology program at Indian Hills seemed like a perfect fit, so he packed up his car and road-tripped from sunny California to the fields and plains of Iowa. Luka originally thought he would use his education to become a laser technician in the medical field, especially since his first exposure to applied technology was through his family members' work in medicine. But while he was pursuing his degree, he had the chance to tour the National Ignition Facility in San Francisco. "It just blew my mind," he says. "But I felt, right when I was taking the tour, 'I need to work here.' And I made it happen."

Luka found the classes at IHCC challenging—in a good way. "The classes were hard, and the lessons were hard, and the teacher was hard on us," he explains, "but I knew it was all to make us prepared. And Luka was clearly well-prepared. He had five job interviews while he was still in school, and he was able to accept a job offer a month before he graduated. Luka told potential employers that he wanted to go back to California, and he still had his pick of jobs.

"And even after I accepted the job I still had more job offers coming in. It was a nice feeling."

Luka graduated from Indian Hills in May 2015 with an associate of applied science degree in laser and optics technology. Currently, Luka is an Engineer Tech 4 for Akima, a contractor company working with the Lawrence Livermore National Laboratory. He works at the National Ignition Facility and deals with the injection laser system (ILS), which generates low-energy laser pulses that are amplified before being injected into the NIF laser amplifiers. The ILS system plays a key role for each of the NIF's 192 beams: it determines pulse shape, adjusts the energy in each beam, and adjusts the time it takes the beam to hit the target. Luka is responsible for a lot in his job. He pulsates the laser, makes sure it has the correct wavelength, and troubleshoots any problems that arise. For Luka, the best part of working in optics and photonics is the hands-on work.

"I like looking at something that's broken and by the time that I'm done with it, it's working. That's a really good feeling. I like working with my hands a lot."

Later on down the road, Luka says he might get a bachelor's degree in optics engineering and possibly a master of business administration (MBA). "Pretty much anything that has to do with photonics needs optics," he explains—and with his associate's degree from IHCC, Luka has a solid foundation in optics that can take him any direction he wants to go.

Luka Papike earned an associate of applied science degree in laser and optics technology from Indian Hills Community College in May 2015. He was born and raised in California and currently lives in San Francisco. He hopes to stay in California as he further develops his career.



Max Schiller began his college education at the University of Iowa, where he earned a bachelor's degree in history. After graduating, he spent a few years working in a field related to his degree, but he didn't enjoy the work, wasn't making much money, and felt like he wasn't going anywhere. But Max had grown up in Ottumwa, Iowa, home of Indian Hills Community College (IHCC). Several of his friends had graduated from the Laser and Optics Technology program there, and Max's mom had encouraged him to follow the same path. So, when Max decided it was time to try something new, he knew where he wanted to go. "[The IHCC Laser and Optics Technology program] was always something I kind of had my eye on," he says. "It was always something in the back of my mind."

Going into the program, Max didn't know what to expect. "I had not had much experience with lasers or optics or anything like that," he explains. He wasn't worried about the math portion of the program, having done well in math during high school. But he had avoided science in high school and hadn't taken any science classes at the University of Iowa. He felt unprepared and a bit anxious, but he was surprised to learn that he enjoyed all his classes, in no small part thanks to his instructors, who provided helpful feedback that encouraged him to grow and improve. "I knew that I could do something in lasers and optics that I would enjoy," he recalls, "even though I was going to have to work a little harder than I would have in some other things."

Indian Hills Community College did more than just develop Max's technical skills in lasers and optics—it made him feel ready for the workforce.

"With all the mentoring and everything that I got at Indian Hills, I felt that I was really ready to go out there, and get a job, and do all the right things that I needed to do."

Max graduated from IHCC with an associate of applied science degree in laser and optics technology in 2014, and quickly found a job he wanted. "The job I'm working at is the first job offer I got," he says. "It was kind of the one that I wanted in the first place, so I took it."



Max traveling in India.

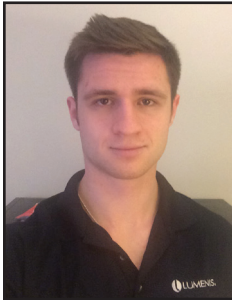
Max is employed as an Optics Technician 2 at ABS Global, a bovine genetics company. Much of the work he does is proprietary, and Max enjoys getting to work with new technology. After working for ABS Global for a little more than a year, Max received a raise of \$8,000 a year. He expects that he can make as much as \$50,000–\$60,000 per year if he continues with ABS Global.

Max is confident that lasers and optics will be important for many years to come. "It's an industry that just continues to grow," he explains. Max is looking forward to the travel opportunities his job affords; working for an international company, he has the chance to go all over the world.

Max Schiller lives in Wisconsin. He graduated from Indian Hills Community College in 2014 with an associate of applied science degree in laser and optics technology. He enjoys travel, and loves that his job provides him with the means to travel around the world.

Matthew Darden was skeptical about photonics, even after hearing great things about the Laser and Optics Technology program at Indian Hills Community College (IHCC) in Ottumwa, Iowa, from his mother's coworker. He didn't think he could be successful studying photonics, because the little he knew about it made it sound very difficult. But after he visited Indian Hills and talked with Professor Frank Reed, he felt reassured that if he worked hard, he could succeed in the Laser and Optics Technology program.

"Going in," Matthew says, "you really don't have a good idea what photonics is." But once he began to learn about the field, he was surprised to discover how much it interested him. What made the difference, he says, was "understanding how big the field is and how many different jobs I could actually go into....There are so many different fields: research development, metal cutting, military, medical, research."



By the time Matthew graduated from Indian Hills in 2015, he had received multiple job offers. He appreciated the variety of career options that his degree gave him. "You don't have to worry about going to school, getting the degree and a job, and then being stuck with it," he says, "because the field is so big, you can explore."

"Photonics is such an expanding field. You have the opportunity to really pick and choose what you want, and to me, that is one of the coolest things."

Matthew decided that he wanted to work in the medical field, and so accepted an offer from Lumenis, a medical laser company, to work in customer service engineering. He is currently training at Lumenis with other technicians. "I work on medical laser equipment, as well as installations for new equipment," he says. "As a customer service engineer, I have a given territory and am in charge of the systems within it."

Matthew knows that his work makes a real difference in medical care. He explains, "laser equipment is very important in the medical field today and requires preventative maintenance, as well as corrective maintenance, to keep the systems safe for patients, doctors and staff." He couldn't be happier to be working on medical equipment. As he says, "Working and having the satisfaction of being in a field where I know I'm helping people—that's so rewarding in itself."

"Seeing videos online of people's lives changed by Lumenis lasers makes me feel great."

The work environment at Lumenis adds to Matthew's satisfaction. "There is a lot of flexibility," he explains, "especially with our schedules—we make our own and are responsible for managing ourselves. There is trust between the managers and employees. I really enjoy that."

What does Matthew have to say to students considering a technical degree? "It's a no brainer. Pursuing a technical degree is a smart decision. Many technical degrees allow you to get a job right out of college and even receive offers before you graduate. I'm twenty years old, and I have a great-paying career. There are a lot of people still going to college at my age for a four-year degree, or they may be a little older and have a four-year degree but are working odd jobs because there is so much competition in the job market."

Matthew tells prospective students that pursuing a technical degree is not about taking the safe route or choosing something they don't want to do—instead, students should consider what the best option is for them. But no one should be inhibited by not having prior knowledge in a technical field. What Matthew lacked in experience, he made up for with passion and determination. He believes that anyone can succeed in a technical program, with enough effort and commitment. "As long as you put in the effort and you try," he says, "you are going to do well."

Matthew Darden earned an associate of applied science degree in laser and optics technology from Indian Hills Community College in 2015. He is currently focusing on learning his responsibilities as a customer service engineer at Lumenis.



Robert Kraft's interest in photonics started before he graduated from high school. His father unexpectedly came across the Laser and Optics Technology program at Indian Hills Community College (IHCC) and suggested that Robert take a look at it. Robert ended up researching the program and careers associated with the photonics industry. After seeing all the opportunities and what the photonics industry could offer someone straight out of a two-year program, Robert knew that photonics was a career he would like to pursue.

When Robert first enrolled at IHCC, he didn't know much about the photonics field or what to expect from the laser program. Robert did know that science and math would be a part of the program, and he also knew that math had never been the easiest subject for him. "Math and science have always been challenging for me," he says, "but once these subjects were applied to something I thought was interesting, it became easy to me. Math, science, and photonics—it was all intertwined together."

Robert worked hard to complete his degree. "Completing all the lab hours and work, as well as understanding the material and getting them done in a timely manner was a struggle," he recalls. "But once I got the hang of things, it was no trouble at all." No matter the challenge, Robert carried on, and as he learned more about photonics, he felt it "broaden his horizon." The more he learned about photonics, he says, the more he understood where he wanted to go in life and what he wanted to do.

After graduating in 2015, Robert accepted a job at Lawrence Livermore National Laboratory as an Engineer Technician 4. He is an operator for the ignition laser system (ILS) at the National Ignition Facility (NIF). He works on subsystems that help control experiments with the world's most powerful laser.

"I love what I do," Robert says. "I find lasers and optics incredibly interesting, plus working with the world's most powerful laser is pretty exciting."

Robert is certain that the field of photonics will continue to grow over the next few years. He plans to keep working and learning all he can as a laser technician at Lawrence Livermore National Laboratory, and he also sees himself pursuing a degree in optical engineering down the line.



"The best part about photonics is working in the field. Every day brings challenges, and every day I learn more. It sure has paid off for me."

Robert Kraft graduated from Indian Hills Community College in 2015 with an associate of applied science degree in laser and optics technology. He enjoys learning new things in his field every day.



Alex Voytik originally pursued a degree in mechanical engineering with a concentration in motorsports. After careful consideration, he realized that the racing and automotive industries weren't the best fit for him. Alex's mother was an electronics professor at Central Carolina Community College (CCCC), so he sought her advice.

"My mom told me Laser and Photonics Technology was an emerging program with smaller class sizes," Alex recalls. "She also said there were plenty of opportunities in the photonics field." Alex was intrigued; he had always enjoyed working with electronics, so he decided to investigate the program. "After researching and hearing about previous graduates from CCCC's Laser and Photonics Technology program," he says, "it was clear that there was a multitude of opportunities and plenty of room for a successful career upon completion of the program." A conversation with laser and photonics professor Gary Beasley gave him the information he needed to make a decision. "At that point," he says, "I was confident that there was a wide variety of careers available to laser technicians and that I would find my niche as I went through the program."

Alex enrolled in the Laser and Photonics Technology program. He found that his biggest challenge was simply keeping up with his work and studies, and his advice to new students reflects that experience. "Stay on top of your work when in the program." Alex recommends. "If you get behind, it's difficult to catch up. Things build—it's not like you have separate sections that are independent of each other; they all build throughout the year. Pay attention, study, and use time management."

Alex's dedication to finding a career drove him to succeed. In 2015, he graduated from CCCC with an associate of applied science degree in laser and photonics technology and launched a great career.

Currently, Alex works as a camera systems engineer for Aqueti, Inc., a startup company in Durham, North Carolina. Aqueti is the world leader in large-array camera video capture and rendering. Their biggest contract so far is with Premier Boxing Champions. He describes his work this way: "My role is fabricating and creating cameras and operating them on live television. I also help with tear down and maneuvering of the equipment from location to location."

"I love the variety of my job! Our company is constantly challenged to build custom cameras. The variety and the constant challenge of trying something new is what keeps it interesting and enjoyable."

Alex enjoys his work so much that he hopes to pursue additional education in his field. "I'm really happy where I'm working now," he says. "However, there is always the thought in the back of my mind that I would like to continue my education in electronics or photonics. If I can find a school that's close enough and that fits my work schedule, it's a possibility."



Alex expects his work to expand and change as the field grows. "If you are looking for a career that's always changing and really interesting, plus you enjoy working hard," he says, "then a career in lasers and photonics is for you."

Alex Voytik earned an associate of applied science degree in laser and photonics technology from Central Carolina Community College in 2015. He enjoys spending time with friends and family and cooking together. He also enjoys repairing his own car and traveling when his schedule permits.

Brandon Hasley decided to pursue a career in photonics because he wanted to work in a hands-on technical field. “Ever since I can remember,” he says, “I have always enjoyed taking things apart and putting them back together.” By chance, Brandon came across the Laser and Optics Technology program at Indian Hills Community College (IHCC). “They advertised that forty percent of course work was spent in the lab with hands-on experiments,” he recalls. “I had always been fascinated with lasers and enjoyed doing math,” he says, so continued to research the program, as well as the photonics industry. He was even more excited when he found out about “the huge demand for laser optics technicians in the photonics industry. I knew there would be plenty of job opportunities for me,” he says.

When he began the Laser and Optics Technology program, Brandon had few expectations aside from what he heard from other students. “I was told that the program was going to be difficult,” he remembers, “and that there would be more than one time that you were going to want to give up and quit.” But Brandon knew that if he buckled down and put forth the time and effort, he would be able to persevere. He did find the program difficult. “From the math to the lab experiments,” he says, “there were a lot of things that I encountered that were difficult to try and figure out. Plus, the instructor was not forthcoming about just giving the answer. He wanted you to try and figure it out on your own.” To get help understanding the math that the program required, Brandon took advantage of IHCC’s on-campus learning center. “I’ve always loved math,” he says, “but math was difficult in college. I didn’t take the math courses in high school that would have prepared me for college geometry.” But with the learning center’s free tutoring, Brandon was able to pass all his math classes. Today, Brandon recommends that other students persevere in the same way:

“Be prepared to encounter situations where you won’t have the answer right away. It may take some time, some thought, research, and digging around for the answer, but in the end, if you work hard and apply yourself, you’ll figure it out.”



During his last semester at IHCC, Brandon participated in Interview Week, a time when presenters visit campus to talk about their companies and interview students interested in their job opportunities. Brandon wanted to use this opportunity as a learning experience, so he decided to interview with as many companies as possible. “I didn’t care what they did, how much they were offering, or what their benefits were,” he says. “I wanted to interview with every company to help me become more comfortable during interviews.” After interviewing with about twenty-five different companies, Brandon received six offers. Brandon carefully weighed each one and accepted a position as an engineering laser electro-optics technician for Akima Infrastructure, a contractor company that works with Lawrence Livermore National Laboratory, which fulfills government contracts for the Department of Energy and the Department of Defense.

As a Laser Electro-Optics Technician, Brandon has numerous responsibilities. He works in the Optics Mitigation Facility (OMF), supporting the National Ignition Facility (NIF), which fixes damaged optics. He also works with engineers to conduct tests and collect data for development projects.

In the future, Brandon would like to go back to school and obtain a bachelor’s degree, but for now he loves the sense of purpose that his work offers. “I really enjoy the challenges in my every day work life and enjoy the opportunity to have a part in getting our company’s goal accomplished,” he says.

“I work in the Optics Mitigation Facility which supports the National Ignition Facility operations. The experiments that I do on a daily basis help the NIF be more efficient and get us one step closer to creating fusion. I love that I am a part of this.”

Brandon earned an associate of applied science degree in laser and optics technology from Indian Hills Community College in 2014. He loves that he is part of a huge team of individuals who are determined to achieve fusion ignition.

Daniel Henderson was introduced to the field of photonics at the Columbia Area Career Center in Columbia, Missouri, which offers technical classes that students can take for high school credit. Daniel and a few of his friends decided to enroll in a light science class, which Daniel found fascinating. Daniel enjoyed the class so much that, after high school, he enrolled in the associate degree program in laser electro-optics technology at Indian Hills Community College (IHCC) in Ottumwa, Iowa.

“Photonics started, for me at least, as an interesting course to take and suddenly turned into something much more. The science is very interesting to me, and I soon caught myself applying it to everyday phenomena. It is very extraordinary.”

Daniel’s high school decision ultimately led him to a position as a laser technician at Cutting Edge Electronics, a subsidiary of Northrop Grumman that provides services to the medical, industrial, research, and military sectors. At Cutting Edge, Daniel is responsible for building and analyzing commercial laser systems.

Daniel’s enthusiasm for technology and love for scientific theory led him to pursue additional education. He is now pursuing a bachelor’s degree in electrical engineering, which he hopes will help him earn a promotion from laser technician to electrical engineer at Cutting Edge. Meanwhile, Daniel is enjoying the variety in his current position.

“What I like most about what I do is the variability in the actual job. One day I will be working on laser X, and then the next day I will be working on a completely different laser meant for a completely different application, or I will be able to use these lasers in testing things that are pretty crazy to test.”

Daniel’s advice to students considering their options is “not to jump at the first opportunity” but instead to “give the future much consideration before doing any one thing.” Knowing something about his field paid off in his own life, and he recommends the same to others: “I would advise potential students to look at things like the number and quality of available jobs along with average salaries,” he says, “because not everyone can get a great job with every degree. I think it is a lot easier to get a job with a technical degree such as my own than it would be to get a different degree.”

Daniel Henderson earned an associate of applied science degree in laser and optics technology from Indian Hills Community College and graduated with honors in 2013. He is currently working on a bachelor’s degree in electrical engineering.



Jeremy Knoll didn't pursue a career in laser technology right out of high school. After graduation, he went into industrial construction. For twelve years he worked extended hours, and the money was good, but after careful reconsideration he knew that there was no amount of pay that could replace time with his family. "The field paid very well," he says. "But I had no life outside of work or time with my family. Once I found out about the Laser and Photonics Technology program at Central Carolina Community College (CCCC) through a family friend, I knew I had to check out the program."

Jeremy researched the growth of the laser and photonics industry and jobs in the field. Once he met with his advisor, Professor Gary Beasley, he knew the laser field would be a good fit. "It really was just talking to my advisor, Mr. Beasley, and learning about the field and the possibilities in the work force." Jeremy liked what he heard and thought it sounded like "a great deal," so he decided to enroll in the program.

Despite having been away from school for twelve years, Jeremy had no difficulties adjusting to college. He decided to take a remedial math course during his first semester to build some basic skills, and it didn't take long before he was back into the swing of things. "I went from taking remedial math my first semester of school to tutoring students in a mathematics survey course, Algebra, and Trigonometry," he recalls. He found his classes reasonable and challenging in a good way, and he went on to earn an associate of applied science degree in lasers and photonics technology.

"Get every bit of education you can get. Don't let your age dissuade you from what you think you can do. I was thirty-two years old when I was in the Laser and Photonics Technology program at CCCC. I was able to excel through the program, side by side with young guys, despite my age."

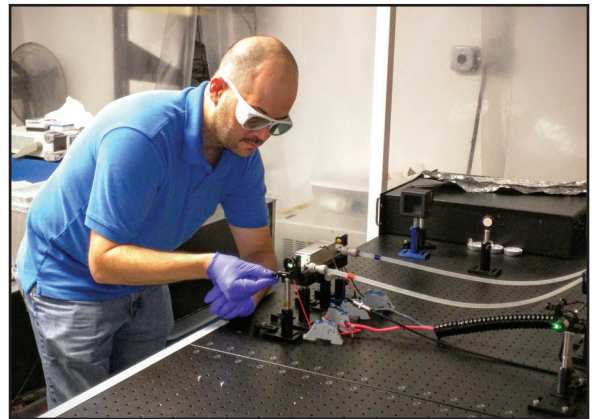
During his last semester at CCCC, Jeremy interned for MegaWatt Lasers Inc., located in South Carolina. He knew that he was interested in laser technology, and he hoped to continue working with lasers after graduation. He achieved his goal; upon his graduation, he gladly accepted a full-time position as a laser technician at MegaWatt Lasers Inc.

"There are always exciting developments in the world of lasers! I love being involved with the field!"

Working for MegaWatt Lasers Inc., a company made up of nine to ten employees, has given Jeremy an opportunity to take on more of an engineering role than a technician role. "I'm always learning," he says. "There is no set book I can turn to figure out how to solve any fickle problem that may arise in the day. I'm constantly learning new things." He has also adopted other roles in the company. For instance, he is in charge of information technology for the company. Jeremy enjoys all aspects of working with solid state lasers, from research and development to testing and maintenance.

When Jeremy looks to the future, he sees himself continuing his education within the next five years. He is considering pursuing a bachelor's degree in either electrical engineering or software engineering. "I'm torn between the two," he says, "but I'm definitely not done. This is just a start."

Jeremy Knoll earned an associate of applied science degree in laser and photonics technology and a certificate in electronics engineering technology from Central Carolina Community College in 2015. He enjoys spending time with his wife and two daughters, watching movies, reading books, and playing video games.



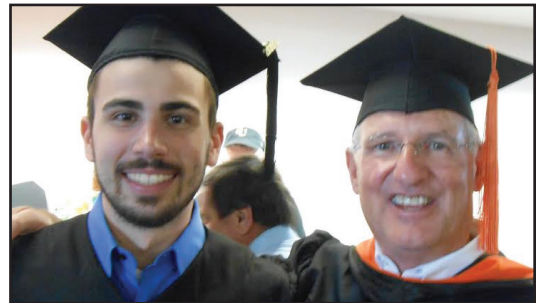
Christopher Loehr didn't start out with a plan to work in photonics. Right out of high school, he was working a patchwork of part-time jobs to create full-time income. Chris was also enrolled at Wake Technical Community College in a College/University Transfer program, but he had no idea what he wanted to do, and he felt like he was wasting his time. "I wasn't all that motivated or focused on school," he recalls, because he couldn't see where his efforts would lead him.

Things changed for the better after Chris's mom took a class at Central Carolina Community College (CCCC) as part of continuing education for her job. She picked up a brochure on the Laser and Photonics Technology program while she was on campus and brought it home for Chris. As Chris looked over the brochure, he was very interested in what he saw. He contacted the program director, Professor Gary Beasley, and set up a tour of the facilities. During his tour with Gary, Chris met students who had volunteered to stay after class and demonstrate different laser applications. Chris was intrigued by their enthusiasm for what they were learning. "It kind of impressed me," he says. "Who wants to stay after class?" Chris remembers that, as these students explained the program and described their classes, their excitement was obvious. By the end of the day, Chris knew he wanted to be a part of that program.

Chris transferred to CCCC and began the fifty-minute commute from his home to the campus—a big change from his previous college, which was just a few minutes from his house. On top of that, Chris continued working full time. "That made it really challenging to find the time to complete homework and just get everything done," he recalls. In spite of these challenges, Chris found that he was interested in his course material. "That was something I hadn't found in school before," he explains. "It really got me interested in learning and furthering my education." He graduated in May 2015 from Central Carolina Community College with an associate of applied science degree in laser and photonics technology. The program was very hands-on and engaging, and Chris remains impressed by how well-designed the curriculum was.

"I use the knowledge I gained in school....I use something from every single class I took in the program in the work that I do."

When Chris started out at CCCC, he mostly thought of a college degree as a way to get a better-paying job. But as he continued in the photonics program, he found himself enjoying learning. Now, he says, "I actually have a job I love doing, not just a job to make more money." Chris is a Slab Fabrication Operator at Northrup



Grumman Synoptics. His company grows, shapes, and polishes the crystals used as the active medium in solid-state lasers. Chris works with a variety of production parts to cut the crystals down to size and match them to specifications. Chris works with engineers to help solve problems, do testing, and provide feedback.

"The best part is I learn something new every day. It's interesting and challenging....It's something I actually enjoy doing. I never dread going to work."

Chris sees no downsides to working in photonics—or at Northrup Grumman. "It's definitely a company and environment that I feel like I can grow in," he explains.

Chris lives in Charlotte, North Carolina, and is considering furthering his education with an electrical engineering degree from the University of North Carolina at Charlotte. Thanks to his degree from CCCC, Chris has a job that will help him pursue this goal; in exchange for a few more years of service, Chris's company will reimburse the cost of another degree. He hopes to continue working for Northrup Grumman if he gets an electrical engineering degree, and he's confident he has built a foundation that will enable him to move up in the company.

Christopher Loehr lives in Charlotte, North Carolina. He earned an associate of applied science degree in laser and photonics technology from Central Carolina Community College in May 2015. Chris enjoys snowboarding, biking, and other outdoor activities.

Chris Baggett chose photonics as a second career. He started out as a private investigator and owned his own investigative company for about twenty years. Chris primarily worked on insurance and fraud cases, especially ones concerning medical malpractice and worker's compensation. His natural curiosity lent itself to his first career, and he was highly successful. However, he eventually found that he wanted to make a change.

Chris's mother was a continuing education teacher and was involved with Central Carolina Community College (CCCC). She was acquainted with Gary Beasley, the lead professor of the Laser and Photonics Technology program at CCCC. She knew of the program and recommended it to Chris, who, true to his investigative roots, did some research to investigate the program. Chris has always had a passion for learning, and he has always loved math. He is also fond of working with his hands and likes to fix up old cars. "I was always interested in fixing things," he says. Eventually, he decided that the Laser and Photonics Technology program seemed like the right start to a new career.

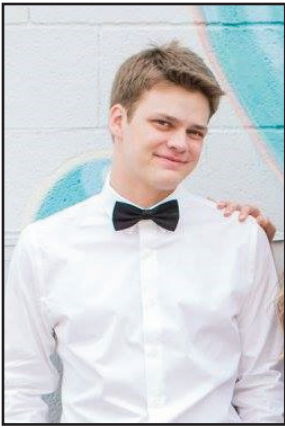


As a student, Chris enjoyed learning about optics and photonics, and he particularly enjoyed the labs and working hands-on with the equipment. He found the classwork stimulating and fun, in part because of his love of math and science. "If you like those things," Chris says, "there's nothing really hard about it. It's a fun experience. I love it, I love the challenges." Professor Beasley taught many of his classes, and Chris speaks highly of him. "Gary Beasley is one of my favorite people in the world," Chris says. "He cares about what he's doing; he cares about his students. I've never met anyone like him." The program was rigorous, but Chris graduated at the top of his class in 2015.

Chris now works for Northrop Grumman as an Operator Level 2. "My coworkers and I, we're always talking about math and different ways to do things," he says. And, thanks to his degree from CCCC, Chris has been given many responsibilities that are generally reserved for those who have been working in the field for years. Chris's two-year associate degree in laser and photonics technology gives him a significant advantage in the workplace and makes him more valuable to his company.

"If you go for a technical degree you will get a job. There is no doubt in my mind."

Chris Baggett graduated in May 2015 from Central Carolina Community College with an associate of applied science degree in laser and photonics technology. He enjoys working on cars in his free time.



Colt Dudley enrolled at Central Carolina Community College (CCCC) right after high school. As a student in the Laser and Photonics Technology program, he learned about how lasers work and the science of optics and photonics. He appreciated the program because it gave him “a firm foundation on the inner workings of every component involved” in photonics. For Colt, the hardest part of the program was the time and dedication it took. Having come to CCCC straight out of high school, Colt was one of the few students without prior college experience. That meant that he needed to take all the general education classes in addition to his photonics classes; this gave him a heavier course load than most of his classmates, but Colt persevered, even taking summer classes to keep up. In May 2015, Colt graduated with an associate of applied science degree in laser and photonics technology.

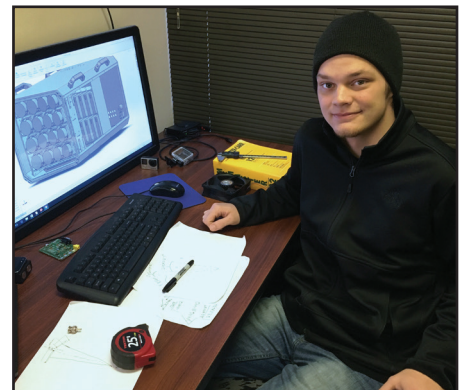
Colt’s initial involvement in photonics was unplanned and a bit spur-of-the-moment. After high school, he received a scholarship to Campbell University. Colt knew he wanted to work with technology, but he didn’t have a clear goal in mind, and he chose not to attend a costly private university without a plan. He enrolled at CCCC for their two-year transfer program, initially intending to transfer to a university as a mechanical engineering major. But during CCCC’s orientation process, Colt learned that the mechanical engineering transfer program was only available at a campus forty-five minutes from his home. When Colt heard of the Laser and Photonics Technology program at the campus nearest to him, he said “sign me up” without having any idea what he was getting himself into. He says, “I kind of expected to be shooting missiles out of the sky with lasers.”

During his time in the Laser and Photonics Technology program, Colt learned technical skills as well as a new way of solving problems and viewing the world. Colt believes that the CCCC program and other technical degrees teach students to think “in a common-sense way,” something that he says is more and more rare in the world today. Colt says he is a “firm believer in the [Laser and Photonics Technology] program and what it teaches you.” He encourages all his friends to enroll and stands by the program so strongly that he has offered to pay the program’s tuition for a few of his friends.

After graduation, Colt had no problem finding a job, and his current position was one of three jobs he was offered. Colt works for Aqueti, Inc., in Durham, North Carolina. Just after he was hired, Colt was able to recommend hiring another CCCC alum; he now has the pleasure of working with his former lab partner. When he began working for Aqueti, Colt traveled on a weekly basis to work with q360 cameras. This technology was developed by Aqueti and has been used to record Premier Boxing Champions’ matches across the country. Because of the partnership between Aqueti and Premier Boxing Champions, footage from Aqueti cameras has been featured on national networks such as ESPN, CBS, and NBC.

For the past month, Colt has been designing a new camera. The company’s president is currently reviewing his CAD drawings, and Colt expects to receive positive feedback and constructive criticism on his design. Although he’s not shooting missiles out of the sky, he enjoys his job very much.

“I love coming to work every day and not knowing what’s going to happen. There’s always something new to learn—something new you learned yesterday that you can apply today to solve a new problem. The technology is forever advancing, every day.”



Colt Dudley graduated from Central Carolina Community College in May 2015 with an associate of applied science degree in laser and photonics technology. He is engaged and planning to marry his fiancée in May 2016. He enjoys running the sound system for a band, spending time with his fiancée, and playing guitar.



T Tyler Dumbacher first became interested in photonics when he was in high school. As a junior, he chose to take an Introduction to Lasers elective class. He loved the class, and his interest grew every day; he was fascinated by how rewarding and exciting the photonics field could be. He knew that if he wanted the best opportunities to take him where he wanted to go in life, photonics was the best choice for him.

Tyler did some research online and visited the Laser and Optics Technology program at Indian Hills Community College (IHCC) in Ottumwa, Iowa. For the next two years, Indian Hills would be his home away from home. He didn't find his classes difficult, but it was the first time he had ever lived by himself, and he found it extremely tough to be on his own without any family nearby. He is thankful that he had the support of his friends and instructors to help guide him along the way, and says that their support made his experience worthwhile.

Tyler had a solid foundation in math and science, which helped him when he was faced with difficult course work. "I have always been interested in math and science, for as long as I can remember. There were times when I struggled, but because I invested the time in learning math and science, I didn't have to work as hard [in college]." Tyler didn't cut corners; he saw difficult subjects as a challenge and an opportunity to better himself and improve in areas that might need work.

In May 2014, Tyler graduated from Indian Hills Community College with an associate of applied science degree in laser and optics technology. Currently, Tyler is a laser technician for Akima Infrastructures, a contractor company working with the Lawrence Livermore National Laboratory at the National Ignition Facility (NIF) in California. NIF is the world's largest and most energetic laser facility. Tyler works in the injection laser subsystem (ILS), where he operates, maintains, and troubleshoots laser systems. For Tyler, the best part of his work as a laser technician is being on the forefront of cutting-edge technology and having the potential to help making scientific history.

"The photonics field is the best field in the world. I wouldn't trade anything to change the line of work I'm in. I love the variety and numerous job opportunities in this field—it's amazing!"

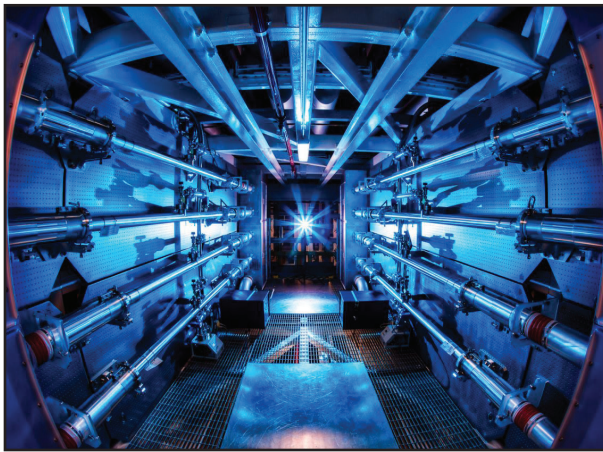


Tyler believes that students who enjoy hands-on work and problem solving and are willing to work hard and put in the necessary time will find a career in photonics very rewarding. "This is a growing field," he says, "and there are more opportunities than laser technicians to take them all. It's definitely worth it!"

Tyler Dumbacher went to Rock Bridge High School in Columbia, Missouri, and earned an associate of applied science degree in laser and optics technology from Indian Hills Community College. Tyler says that his greatest achievement has been working at the National Ignition Facility, located at the Lawrence Livermore National Laboratory in California.

Cassandra Durand was working as a tutor at Irvine Valley College (IVC) when a flyer in the tutoring center caught her eye. The flyer described a new certificate offered at IVC, a certificate of proficiency in photonics. Cassandra had always loved science, and an inspiring and encouraging teacher in elementary school had nurtured her love of mathematics. Cassandra was immediately drawn to the program and hoped that it would lead her to a fun and exciting career.

When she began taking classes in 2012, Cassandra initially thought the coursework would emphasize physics and math. She was surprised to find that IVC's program was much more hands-on—and much more fun—than she had expected. She liked all her photonics classes and particularly enjoyed studying light and optics. Her greatest challenge, she found, was balancing work and school. She was still working as a tutor, and the center preferred for her to be available in the evenings. Unfortunately, many of her classes were only offered in the evenings, and she found it difficult to align her work schedule with her class schedule. She was occasionally late to class as a result, but she found that her professors were very understanding. Cassandra graduated in 2015 with an associate of science degree in electronics technology and certificates of proficiency in photonics and precision optics.



When Cassandra first applied for a job, she was more focused on her education than on job hunting. She says the application was more of an afterthought, but she knew that if she got the job, it would be good experience. Her single job application turned into a position working for Akima Infrastructure Services at the National Ignition Facility (NIF). Her official title is Engineering Technician IV/Target Diagnostic Operator. Her responsibilities include making sure the facility's cameras and diagnostic devices are centered, working, and ready to collect data during operation. Working at the NIF gives Cassandra the opportunity to participate in physics and defense experiments that involve one of the highest-powered lasers in the world.

As a woman in a technical field, Cassandra has advice for girls and women who are considering a technical degree: ***“Don’t listen to anybody who says you can’t do it. Keep following that passion for math and science—you’ll get far.”*** She says there may be hardships and obstacles on the path to success, but she encourages girls to keep going and follow their passion.

Cassandra is happy with her position at Akima and especially enjoys being involved in “interesting projects that either have today or will have an impact on the world.” A happy perk of her job is the salary: she expects to make over \$50,000 in her first year on the job, and that will only increase as her skills and abilities improve. She would like to eventually return to school to earn a bachelor's degree, and her company may be willing to pay her expenses. Ultimately, Cassandra would like to be involved in engineering and design. She wants to improve her understanding of the physics and engineering of different devices Akima uses, as well as the process of creating those devices.

Cassandra Durand graduated from Irvine Valley College with an associate of science degree in electronics technology and certificates of proficiency in photonics and precision optics in 2015. In her spare time she enjoys hiking, reading, writing, and playing video games. She lives in California.



Photos courtesy of J. Garland/IPG Photonics Corporation

Christopher Moulton

found the Photonics and Laser Technology program at Baker College in Flint, Michigan, almost by accident. After the propane delivery company where he had worked for ten years let him go during downsizing, he went back to college and began taking classes for an associate degree in computer animation. Toward the end of his degree track, Christopher realized that computer animation wasn't the right type of career for him. He was looking for a field that wasn't as popular, whose job market wasn't already saturated with employees. One day, during his morning cup of coffee, an newspaper advertisement caught his eye: Baker College was starting a new program called Photonics and Laser Technology. Right away, Christopher was interested. "It was new, it was exciting, and it was

something I could see myself doing," he recalls. He took a leap of faith and signed up almost immediately—he signed up so quickly, in fact, that when he called Baker College to enroll, the person he spoke to on the phone hadn't even heard of the Photonics and Laser Technology program.

Initially, there was a big learning curve for everyone in the program, Christopher recalls. The most difficult part, he says, was the newness of the program and the fact that his was the inaugural class. Being the first wasn't always an advantage, because professors were still learning to teach the material and didn't always have answers on hand. Despite the bumps in the road, Christopher found his coursework interesting. His first year of classes emphasized electronics and offered a foundation that laid groundwork for the second year, by which time lasers and optics played a role in nearly every class. In December 2015, Christopher graduated from Baker College with an associate of applied science degree in photonics and laser technology.

Christopher now works for IPG Photonics as an Applications Technician. He currently spends his time learning about laser welding, laser cutting, trifocal brazing, setting up different applications in the labs for the engineers, and learning to work with the automated and robotic parts of the facility. He is slated to work on a specific piece of equipment once it arrives at the facility.

Christopher sees himself moving forward in his career with IPG. The possibilities for job placement and advancement are nearly endless, thanks to his degree in photonics and laser technology. "There are job opportunities anywhere and everywhere," Christopher says. He believes that Baker's photonics and laser technology program gave him a strong groundwork for a career because it touched on many different aspects of photonics technology. He recommends a degree in photonics as a great jumping-off point and has seen for himself how marketable and hireable technicians are.

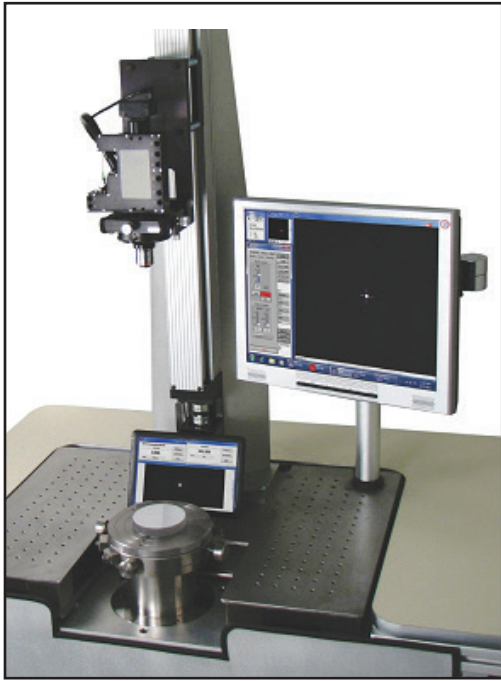


Photos courtesy of J. Garland/IPG Photonics Corporation

Christopher Moulton graduated from Baker College with an associate of applied science degree in photonics and laser technology in December 2015. He lives in Holly, Michigan, where he enjoys hunting, fishing, bowling, and spending time with his kids and family.



David Aldrich was excited when he first heard from his mother about the electronics technology degree and photonics certificate offered by Irvine Valley College (IVC) in Irvine, California. He had long enjoyed math and science, and he liked the prospect of joining a program that incorporated multiple facets of engineering, from optical to mechanical to electrical.



“The photonics industry represents the joining of a number of subject matters that I enjoyed as a child,” David says.

The coursework at Irvine Valley College blends mechanical and electrical topics with optics and photonics, creating an ideal learning setting for someone like David, who thoroughly enjoys all those subjects. David is nearing completion of his degree and has already interviewed for two jobs, both of which resulted in job offers.

David accepted an offer from Davidson Optronics, where he works as a Photonics Technician for a starting salary of close to \$60,000. David manages production of Davidson’s Point Source Microscope. He also provides technical, design, and assembly support for the Wells Research Division of Trioptics USA for electronics, motion control, and illumination. David loves that his job offers continuing challenges that require him to assess and reassess situations.

David enjoys a challenge and wants to continue to learn and grow, so he envisions eventually pursuing a bachelor’s degree in either mechanical or electrical engineering. Meanwhile, he is happy with his job at Davidson Optronics.

David Aldrich is graduating from Irvine Valley College with an associate of science degree in electronics technology and certificates of proficiency in photonics and precision optics. He lives in California.

Justin Jensen was fresh out of high school and knew he wanted a career in engineering. While searching for the right school and degree program, he came across Indian River State College (IRSC), which offered an associate of art in engineering, which is designed to allow students to transfer into an engineering program at a state university. Then, after learning about what else IRSC had to offer, he decided to also pursue an associate of science degree in electronic engineering technology and a certificate in lasers and photonics. “I wanted to get some hands-on learning,” he recalls. “I wanted to either get a job during university or have a job as a technician as back-up before doing my [university] studies.” An associate of art degree would enable him to transfer into a four-year university program, and an associate of science degree and certificate in lasers and photonics would help him get a job while he finished his studies.

Justin’s decision was also based on his own research into the field of photonics. He researched job opportunities and requirements for photonics technicians, as well as salaries and the overall job market for technicians. He also attended information sessions that explained the myriad of options available in photonics and convinced him to earn a certificate in Lasers and Photonics.

“Light has always intrigued me,” Justin says, “ever since I was a little kid and playing with laser pointers.”

IRSC’s information sessions made it clear to Justin that “everything comes down to light. With fiber optics, data transfer, and all the different applications, I could tell that light [technology] was going to grow and become very big and very important”.



When Justin started classes, he assumed that he would be spending a lot of time learning theories from a textbook. Instead, he found a challenging environment that was full of hands-on engagement.

“It was a very good blend of theory and hands-on training,” he recalls. His classes covered soldering, assembly, and testing, and all of them combined theory and application.

Justin was initially concerned about time management, but he found that IRSC made it possible for him to create a flexible schedule that included night classes and summer sessions. He says that IRSC was extremely student-friendly and helpful as he earned his degrees. He graduated in May 2010 with an associate of art in engineering, an associate of science degree in electronics engineering technology, and a certificate in lasers and photonics

During his time at IRSC, Justin came across an internship offered by MicroWatt Applications, a manufacturer of pyroelectric infrared detectors. He was hired as their first intern and eventually became a project manager at only twenty years old. That company was one of only two in the world to use a particular type of crystal, and his work with them inspired him. Justin went on to attend Florida State University, where he conducted research on the growth and characterization of an optical crystal known as DLaTGS (deuterated l-alanine doped triglycine sulfate). Justin graduated from Florida State University in May 2014 with a bachelor of science degree in chemical engineering and a specialization in materials science.

At the time of his graduation, MicroWatt Applications had merged with Laser Components, a German optics company. Now under the name of Laser Components Pyro Group, they quickly hired Justin as a Project Engineer. In the last two years, the Florida location has quadrupled in physical size and in employment. It also has a certified clean room and offers the most extensive pyroelectric catalog in the world. Justin is in charge of materials processing for the research and development division, which grows and characterizes crystals for the company’s products. Justin is also responsible for designing new products and bringing the current product line to market. Justin loves that his job is stimulating and that he is constantly challenged to improve his technical skills and people skills.

Justin Jensen graduated from Indian River State College in May 2010 with an associate of art degree in engineering, an associate of science degree in electronics engineering technology, and a certificate in lasers and photonics. He lives in Florida, where he enjoys fishing, golfing, riding four-wheelers, camping, and other outdoor activities.



Kevin Rodgers began his college life in the 1980s at Rutgers University, where he loved his role on the university's hockey team but had no academic or career goals to keep him moving forward. A family friend noticed Kevin's lack of direction and drive and called his friend, Dr. Otto R. Mauke, who was the president of Camden County College (CCC) at the time. Dr. Mauke recommended that Kevin speak to Fred Seeber, who coordinated Camden's Laser Electro-Optics Technology (LEOT) program.

Kevin remembers that during one of their first interactions, Dr. Seeber told him that he would be a good fit for the program. It was the first time anyone had said that to him during his collegiate career, and it made him feel good about himself to hear it.

Kevin entered the program expecting a cookie-cutter learning experience: a lecture hall, large classes, and tests to pass. What he found was a dynamic environment, full of hands-on projects and practical experience. "The hands-on experience was incredible," he recalls. Dr. Seeber had convinced numerous companies to donate lasers to the program, and these lasers allowed Kevin and other students to do independent studies, perform experiments, make holograms, learn how to align and operate lasers, and much more. As Kevin points out, it wasn't only the laser-based classes that offered hands-on practice: building electronics, making accurate mechanical drawings, and working in the machine shop were all integral to the program. Kevin says that the Laser Electro-Optic Technology program at Camden County College "really set me up for what I did in my future work. I can't say enough about the program."

This was the early 1980s, and lasers were still a new and emerging technology and "not something people were generally studying at the time." Kevin found his coursework exciting and challenging, especially because he decided to pursue an associate of science degree in engineering in addition to an associate of applied science degree in lasers and electro-optic technology. He earned both degrees in 1983, and in 1994, he earned a bachelor of science degree in electrical engineering from Drexel University.

Kevin is currently the President of Precision Laser Specialist Inc., where he works as an engineer in addition to his presidential duties. His company services medical lasers in offices, clinics, hospitals, and other medical facilities. One of the challenges of his position is making sure his engineers and technicians have the know-how, documentation, and parts necessary to service the many different types and models of lasers that they work on. His job also involves finding substitution parts when a manufacturer won't share parts, and he finds it highly satisfying to be able to do the research and understand the lasers well enough to find appropriate replacement parts.

Kevin takes pride in making sure that every customer need is met and that customers are satisfied with the job, but what he likes best is knowing that his employees are happy working for him. He has now been in this business for about twenty years and is proud that he still has a great reputation for doing a good job and that the service he offers is of such high quality that he's been able to keep many of the same customers for all twenty years.

Kevin Rodgers graduated from Camden County College in 1983 with an associate of science degree in engineering and an associate of applied science degree in laser and electro-optic technology (now known as associate of applied science in laser/electro-optic technology). He is very involved in his community and sits on several local boards and committees. Kevin enjoys camping and hiking with his family, golfing, and playing hockey.

After **Ray T. Collins, Jr.**, graduated from high school, he spent ten years working a string of jobs that he could get with a high school degree, the last of which was working at a factory making PVC pipe. While he was doing this physically demanding work, he decided it was time to get a college degree. He had enjoyed the electronics classes he had taken in high school, and friends who attended Texas State Technical College (TSTC) in Waco, Texas, convinced him to come to the college and learn about its Laser Electro-Optics Technology (LEOT) program. Ray took a tour of TSTC–Waco, talked to a few professors, and, as he says now, “That was the end of it. I was hooked.” The professors he talked to told him which areas of the industry were hiring and what kinds of jobs were available, and it was all very new and exciting to Ray.

Ray found the LEOT program more difficult than he had expected. “It was a lot of brutally long hours, lots of studying, and lots of lab hours,” he recalls. He was also married and working a part-time job and found that his biggest challenge was keeping it all in perspective and balancing his school life with his married life. In 1999, Ray’s hard work paid off, and he graduated from TSTC–Waco with an associate of applied science degree in laser electro-optics technology.

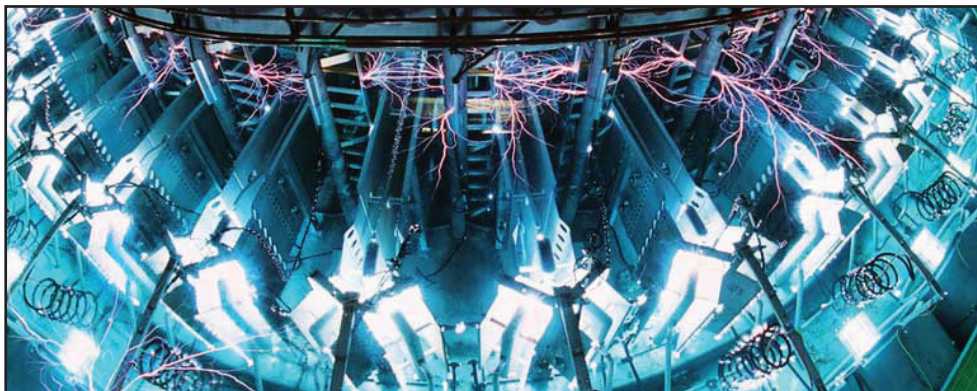
Ray currently works at Sandia National Laboratory, where his title is Principal Laser/Optical Technologist. He maintains, modifies, aligns, takes apart, rebuilds, and uses a three-hundred-joule ruby laser system.

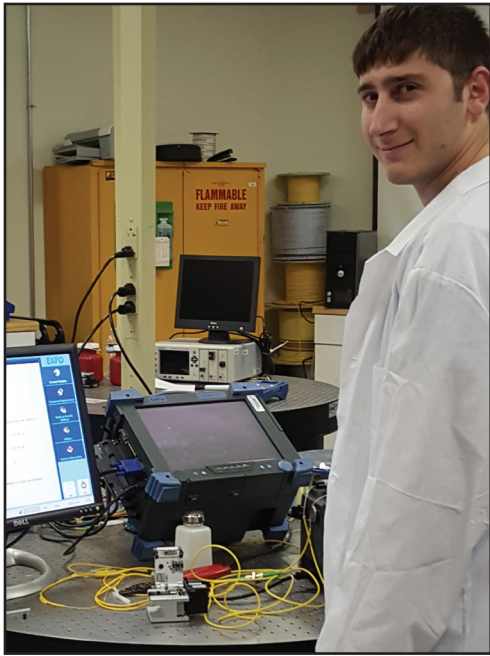
“Anything that needs to be done with that [laser], I do it,” he says. Ray loves that technology is always changing and that in

photonics, “you’re not bound to just what you learned in school. It’s always evolving.” He finds that the skills he developed at TSTC–Waco have made him a knowledgeable and reliable employee who can handle many different situations. He says “I get satisfaction knowing that I get to directly use my degree, my education, and my experiences to produce an end result.”

Ray’s future is bright, and he was recently promoted to the position of Test Operations Engineer. From there, Ray sees a lot of open doors ahead of him. When asked what he would tell someone considering a career in photonics, Ray says, “It has lots of ups and downs like any job and any career path, but it’s always exciting.”

Ray T. Collins, Jr lives in Edgewood, New Mexico. He graduated from Texas State Technical College in Waco, Texas in 1999 with an associate of applied science degree in laser electro-optics technology. He currently works at Sandia National Laboratory. His favorite pastime is spending time with his wife and daughter.





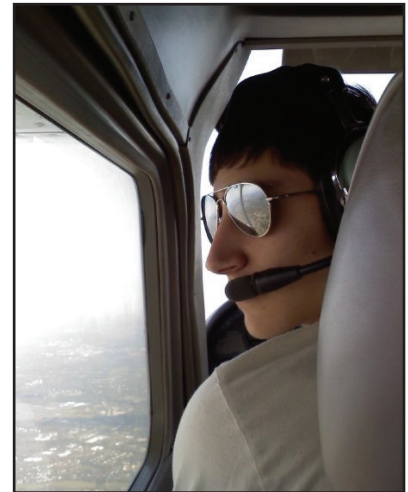
When **Stephen DiStefano** first enrolled at Camden County College (CCC) in Blackwood, New Jersey, he was a physics major. During his Introduction to Mechanics course, his professor, Dr. Leonard Khazan, gave a presentation showcasing the college's photonics department. Dr. Khazan's detailed examples of photonics applications piqued Stephen's interest. He recalls, "Instantly, it caught my attention. At that point, I decided to take Intro to Photonics the following semester. I was so fascinated by the science of light that I switched my major to photonics."

Stephen knew that his solid background in math and science would help him comprehend the more advanced concepts used in the field of photonics. What he didn't know was how exciting he would find his coursework. He recalls, "When I started taking photonics courses, I kept learning more and more about how innovative and cutting-edge the technology is and how vast the field is growing. Everything I was learning in the program was so interesting, and I saw that photonics is the future of technology." Within three years, Stephen graduated from CCC with an associate of applied science degree in laser/electro-optic technology and fiber optic technology.

After graduation, Stephen began a position as an Assistant Physics/Photonics Technician at CCC. As a technician, he would set up physics and photonics labs, organize the laboratories to ensure that they were a safe environment, assisted professors during labs, answered student questions, and fixed and aligned lasers. Stephen says the best part working as a technician at CCC was "explaining to students what photonics is." He says, "Photonics is very difficult to explain; many people do not understand photonics. With the future of technology being in photonics and fiber optics, I enjoy sharing my knowledge with others and inspiring them to learn more about photonics."

"One experience I am most proud of in my work was guiding a student taking a physics class to join Camden County College's photonics program and sharing my love for the profession."

While working at CCC, Stephen also earned a bachelor of science degree in physics at Rowan University in Glassboro, New Jersey in December 2015. Acquiring a bachelor's degree opened more opportunities for him, and he recently accepted a position as an engineer for the defense company BAE Systems. Once Stephen receives proper security clearance from the Department of Defense (DOD), he will be inspecting Aegis Combat Systems, produced by Lockheed Martin, prior to their purchase by the DOD. The Aegis Combat System is a radar system put on naval ships to track and guide missiles, and Stephen will be part of the team that ensures these systems are up to standard.



Stephen graduated from Camden County College in May 2014 with an associate of applied science degree in laser/electro-optic technology and fiber optic technology. His freshman year of college, Stephen earned his private pilot license from Aero Prep Flight School in Medford, New Jersey. He also enjoys playing hockey. Stephen lives in Glendora, New Jersey.

As a high school student, **Turner Frederick** worked part-time at an auto-body shop, where he helped restore classic cars. He enjoyed working with his hands at that job, so when he graduated from high school, he was drawn to continuing his education at a technical school. Additionally, Turner is dyslexic, and he felt like he might do best earning a vocational degree.

During a tour of Texas State Technical College (TSTC) in Waco, Texas, Turner was fascinated by the technology and applications of lasers, photonics, and electronics. Inside one of the laboratories, an instructor shone a beam of white light at a prism, which split the beam into the full visible light spectrum. Turner recalls, “That was a turning point—I wanted to go to school and learn more about why it did that.” After doing some more research on his own and talking to instructors and advisors, Turner enrolled in the Laser Electro-Optics Technology program at TSTC.

Turner remembers that before he started classes, he thought the program would be “a walk in the park, and we’d get to play with lasers all day.” In reality, it was a lot of hard work in the classroom and the laboratory. His least favorite classes were in writing and communication, but he later realized how important it was to be able to write a clear report and explain technical concepts to someone who may not have the same level of understanding. Turner found his laboratory classes challenging; his writing skills got a lot of use as he prepared lab reports after completing experiments. But he also found these classes interesting—he especially enjoyed learning about the versatility of lasers. He recalls a series of eight laboratory assignments, each dealing with a different type of laser: “Each laser did something different in the industry. They used the same concepts, but with different applications.”

The most difficult part of earning his degree was the increased workload compared with high school. For Turner, going to school was like having a full-time job. The professors held their students to a high standard, testing their knowledge with exams and quizzes in addition to the labs. At times, it was a challenge to keep up, but Turner recalls thinking, “If you can make it through here, you can make it [in a career].” He worked hard and even made the dean’s list during his time at TSTC–Waco, and he graduated with an associate of applied science degree in laser electro-optics technology in 2014.



When asked what he would say to a student considering studying photonics, Turner says, ***“The rewards are unimaginable. It may not seem like it in school, but once you get out, the sky’s the limit.”***

Turner works as a Team Lead/Field Service Technician at NovaCentrix, which sells and uses photonic curing systems and materials that are used in printed electronics. Since he began working for NovaCentrix, Turner has been promoted twice and has traveled to China to provide field service, quality control, support, and maintenance for NovaCentrix clients. He excels at his job and is repeatedly chosen for field-service situations that require dynamic analysis and response. Turner says that in photonics, “there’s always

something new to be found. It’s exciting.” He enjoys learning on the job and appreciates that photonics has opened so many doors for him. Turner would like to keep doing field-service work and travel around the country and the world for his job. He would like to go back to school at some point, possibly for a degree in engineering.

Turner Frederick graduated from Texas State Technical College in 2014 with an associate of applied science degree in laser electro-optics technology. He lives in Austin, Texas, and enjoys hiking, kayaking, and traveling.

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

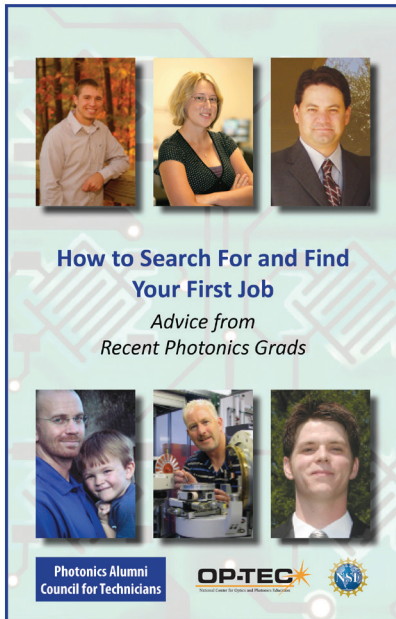
PACT members have valuable and relevant experience that can help those who may follow them:

- 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:

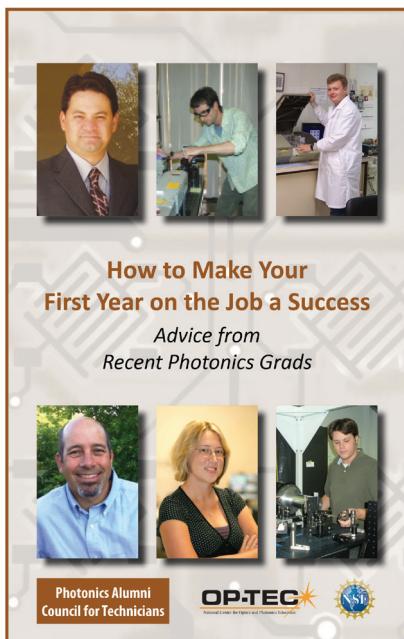
How to Search For and Find Your First Job



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.