


# High School Students

Find a Rewarding Career in Photonics



Photonics Alumni Council for Technicians

**OP-TEC**   
National Center for Optics and Photonics Education



## **About OP-TEC**

The National Center for Optics and Photonics Education (OP-TEC) 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. Thirty-five U.S. colleges are offering associate degree programs in Laser and Photonics Technology.

## **About PACT**

Since 1980 these colleges have graduated several thousand laser/electro-optics and photonics technicians. Some work in communities near these colleges; others are working throughout the country and in other parts of the world. All the graduates of these programs have found employment, and most are still engaged in highly rewarding careers. In early 2009, OP-TEC founded the Photonics Alumni Council for Technicians (PACT). Faculty from colleges teaching photonics nominated former students who were recognized for their technical achievements and leadership abilities. Fifty eight alumni were selected. This booklet presents interesting and informative bios from a selection of these PACT members.

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 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.

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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 11 exemplary photonics technicians.

These technicians were all educated in two year associate degree programs at U.S. community and technical colleges. While they were still in high school they discovered that rewarding careers in lasers and optics were available for hands-on learners who complete these college programs. In college they found the technical courses interesting and achievable. When they completed their coursework they had multiple job offers that paid good salaries. They are now employed in interesting jobs, with unlimited career opportunities.

Today, more than twenty thousand photonics technicians are at work in businesses, laboratories, government, hospitals, defense industries, and educational institutions. U.S. employers need at least eight hundred new photonics technicians each year! 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

# 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.

Companies that are focused on optics and photonics create more than 10% of all US public company revenues and 6% of public company jobs. 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%.<sup>1</sup>

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. Recent advances are 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.

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. 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. Photonics-related companies number more than 5000 and their net financial impact amounts to more than \$50 billion annually.”

## 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.”

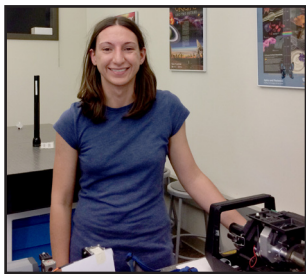
Photonics technicians are educated and trained in the practical aspects of photonics. They are proficient in the principles and applications of optics and lasers, as well as components, devices, equipment, techniques, and safety aspects used in the development, systems integration, operations, and maintenance 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.

<sup>1</sup> 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>

# Cassandra Durand

Irvine Valley College

**C**assandra Durand had always loved science, and an inspiring and encouraging teacher in elementary school had nurtured her love of mathematics. Cassandra 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 was immediately drawn to the program and hoped that it would lead her to a fun and exciting career.

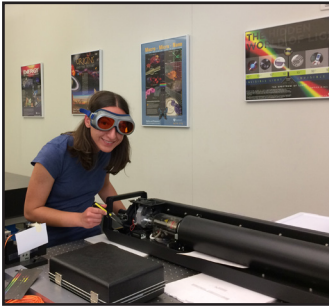


When she began taking classes in 2012, Cassandra initially thought the coursework would emphasize physics and math. She was surprised to find that IVC's program was much more hands-on—and much more fun—than she had expected. She liked all her photonics classes and particularly enjoyed studying light and optics. 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.

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.



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 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.*



# Carlos Salas

Central Carolina Community College



**C**arlos 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.



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.

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

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.*

# Tyler Dumbacher

Indian Hills Community College



**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.*

# Ra'ef Mikhail

Camden County College

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



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

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

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

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

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

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

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

# Turner Frederick

Texas State Technical College

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.

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 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.

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.*



# Justin Jensen

Indian River State College

**J**ustin 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.*

# Christopher Pluemer

Indian Hills Community College

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

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



When Christopher was choosing a career to pursue, the end result was important to him. He didn't want to go to school and not be able to get a job when he had finished. When he found out that the laser electro-optics program at Indian Hills Community College (IHCC) in Ottumwa, Iowa, had a job placement rate of 100 percent, he decided that this was the path for him. "At first, I was kind of intimidated," he recalls. "Lasers

seemed really complicated and complex, but the more I got to know about them, the more excited I got. They aren't nearly as complicated as I thought. There are just so many things you can do with lasers. It's a really good field to be in."



Even before Christopher graduated, he'd been offered several jobs. "I had offers in Chicago, one in Colorado, and another in California," he says. He took the job in

Colorado a week and a half after he graduated and has been working for Epilog Laser Company for a year and a half. Epilog manufactures laser engravers, and Christopher's job is to manufacture the lasers. The finished product can engrave, cut, and inlay materials such as metals, glass, and wood. "You never know what to expect," he says. "We have new things to deal with every day, so it never gets boring."

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

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

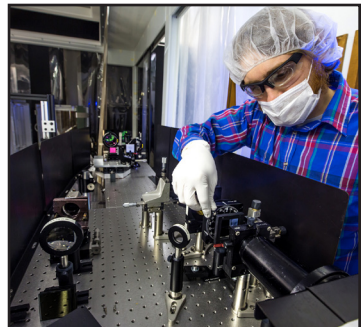
# Brandon Hasley

Indian Hills Community College

**B**randon 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.

*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.*

# Mark Shaw

Camden County College

**M**ark Shaw was considering his career options twenty years ago, when he decided that photonics would be a growing industry that would also allow for his personal growth.

Judging from where he stands today, he was right on both counts.

Mark has more than seventeen years of experience in the medical-device industry, and while he began his career in field service, his work responsibilities have consistently evolved over the years. With the help of his competitive and passionate nature, he has advanced to the role of senior national sales manager.



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

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

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



service coordinator. But earning his bachelor's degree allowed him to break through the ceiling that had temporarily hindered his growth. He advanced to the position of eastern regional sales manager, and in 2008, he became the senior national sales manager.

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

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

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

# Robert Kraft

Indian Hills Community College



**R**obert 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.

***"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."***



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.

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.

*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.*

# Colt Dudley

Central Carolina Community College

**C**olt 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.

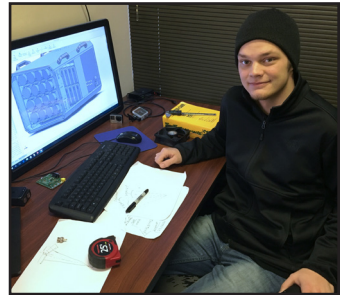
Colt’s initial involvement in photonics was unplanned and a bit spur-of-the-moment. After high school, he received a scholarship to Campbell University. Colt knew he wanted to work with technology, but he didn’t have a clear goal in mind, and he chose not to attend a costly private university without 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.

***“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.”***



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.

*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.*

