

OPTICS & PHOTONICS

"Photonics is growing its own sector, and also an enabling technology that is being utilized in and enhancing most other high tech sectors. As a result, Photonics will continue to see significant steady growth and have a major impact on products, processes, and savings in most industries."

— Dr. James Pearson, Special Consultant
CREOL, The College of Optics & Photonics, UCF

Metro Orlando is a nationally recognized leader in the optics and photonics industry, and local companies within this sector have a rich history of innovation and expansion. Since the early 1960s, the optics and photonics industry has grown from a highly specialized military pursuit to a strong, diverse sector.

Today, the sector features:

- Approximately 95 optics and photonics companies
- 15,000+ workers
- Over \$2 billion in gross regional product

These companies enjoy an environment fostering progress through collaboration with internationally recognized academic institutions, a highly skilled workforce and numerous community and government agencies dedicated to facilitating industry growth throughout Metro Orlando. The optics and photonics industry in Metro Orlando is clearly poised to flourish well into the future.

Source: Florida Photonics Cluster

Overview and History

In recent years, the Metro Orlando optics and photonics sector has experienced unprecedented success. With a highly-skilled workforce, significant research resources and a progressive business environment, optics and photonics organizations in the region have experienced consistent annual growth. Metro Orlando currently boasts one of only three National Centers of Excellence in Photonics and is one of the few communities to establish a research center dedicated to the field.

The history of optics and photonics in Metro Orlando is rich and diverse and reflects the region's commitment to excellence in the industry. In the early 1960s, Martin Marietta—now Lockheed Martin—began conducting applications research for a new technology, the laser. From this cornerstone event, Metro Orlando's optics and photonics industry was born. Over the next 20 years, numerous companies, subsidiaries and spinouts were spawned, including:

- Northrop Grumman
- OSI LaserScan, LLC
- Advanced Laser Systems Technologies

The success of these companies, and the large purchasing power of aerospace and defense companies such as Lockheed Martin, have enticed other optics and photonics companies to Metro Orlando.

Another factor in the explosive growth of the region's optics and photonics sector was the establishment in 1986 of the University of Central Florida's Center for Research and Education in Optics and Lasers (CREOL). Today, CREOL, which is now part of the College of Optics and Photonics, is arguably the top academic photonics school in the country and is world recognized for excellence, along with the college's two other research centers: the Florida Photonics Center for Excellence (FPCE), and the Townes Laser Institute. Many optics and photonics companies are choosing to locate in Metro Orlando to capitalize on the UCF College of Optics and Photonics, CREOL and FPCE endeavors.

In addition to optics and photonics applications for the defense industry, this technology is impacting a wide number of fields, including:

- Telecommunications
- Medical
- Agriculture
- Entertainment

In telecom, a laser developed by a UCF professor of optics recently broke the speed record for data transmission by sending more than a terra bit (one trillion pieces) of information per second from a single laser diode.

Medical advances include work by another UCF researcher who is pioneering the use of liquid crystals—the substance used in video game displays—to increase the clarity and effectiveness of eyeglass lenses.

The Metro Orlando business community is closely knit and works together to foster an environment that encourages information exchange and breeds success. Research, community, and business organizations unite to enhance the optics and photonics industry within the region. One result of such collaboration is the Florida Photonics Cluster (FPC), whose mission is to support the growth and profitability of this industry throughout Florida by providing a unified voice for the field and a network for communication and collaboration, and by raising public awareness of the contributions the industry makes to the region. Through this and other avenues, industry leaders meet frequently to discuss the business climate, as well as to develop partnerships and strategies to accelerate the growth of their individual businesses and the overall photonics sector in Metro Orlando.

Marketplace

Over the years, the optics and photonics industry has become an integral part of the Metro Orlando economy, and continues to make significant contributions toward increasing the region's reputation as a high tech leader. Currently, more than 95 optics and photonics companies are located in the Orlando region:

- Estimated gross regional product is more than \$2 billion
- Employee base of more than 15,000 direct and indirect workers

Additionally, many other businesses are directly linked to the optics and photonics industry, providing services and support which enable the industry to prosper. From manufacturing to leading-edge applications research and development, optics and photonics businesses in Metro Orlando cover a broad range of products and applications including:

- Proprietary laser diode manufacturing
- Optoelectronic packaging technology
- Fiber optics applications and design

- Solid state laser manufacturing and application
- Long-range laser range finders
- Custom refractive assemblages
- Optical components and thin film coatings

Workforce

One of the most frequently cited strengths of Metro Orlando is its workforce. Metro Orlando provides a quality pool of employees necessary to meet the needs of the optics and photonics industry and further its innovation, production and growth within the region. The high concentration of talented employees in Metro Orlando bring with them the dedication, education and experience necessary to contribute to the success of the strong cluster of more than 95 optics and photonics companies collectively employing more than 15,000 individuals.

The University of Central Florida's College of Optics and Photonics and its Center for Research and Education in Optics and Lasers (CREOL) provide a constant supply of new, well-trained engineers and technicians, as well as master's and Ph.D. graduates. Since its founding in 1987, CREOL, The College of Optics and Photonics at UCF has conferred more than 500 MS and PhD degrees in optics and photonics, and the University of Central Florida recently conferred several thousand undergraduate, masters and doctoral degrees in fields relating to or is important to the optics and photonics industry, encompassing many interrelated disciplines such as:

- Optics & photonics
- Engineering, particularly electrical engineering and mechanical engineering
- Chemistry
- Physics
- Biology
- Material
- Nanoscience
- Mathematics
- Computer Science

In addition, strong programs at local community colleges train students to enter the field in various capacities and help to create a complete workforce pool, including:

- Engineers
- Analog Circuit Designers
- CAD Engineers and Technicians
- Fiber Measurement Specialists
- Laser Technicians
- Manufacturing Process Specialists
- Optical Coating Technicians
- Opto-Mechanical Technicians
- Product Managers
- Program Managers
- Project Managers
- Quality Assurance Specialists
- R&D Specialists
- Systems Analysts

Education

A great deal of the success of the Metro Orlando optics and photonics sector is attributable to educational programs designed specifically to prepare people for work in the field. Most notable is the University of Central Florida's (UCF) world-renowned College of Optics and Photonics and its three research centers: the Center for Research and Education in Optics and Lasers (CREOL), the Florida Photonics Center for Excellence (FPCE), and the Townes Laser Institute. CREOL, The College of Optics and Photonics, recognized as one of the top three optics academic units in the nation and the first college-level institution in the US, offers an interdisciplinary program with MS and PhD degrees in Optics and has strong partnership ties to industry through an Industrial Affiliates program with 30%-40% of its annual external research funding provided by industry.

In 2003, Florida Governor Jeb Bush and the Florida Board of Education allocated \$10 million to establish the Florida Photonics Center of Excellence (FPCE) at UCF's College of Optics and Photonics. In 2007, a third research center was added to the College in addition to CREOL and FPCE - the Townes Laser Institute, in honor of Nobel laureate Charles Hard Townes, the inventor of the maser/laser. The mission of the Townes Laser Institute, funded in part by a recent \$4.5 million grant from the state of Florida to UCF's Florida Photonics Center of Excellence, is to make UCF the premier institution in advanced laser technology in the United States. The center also provides needed faculty and facilities in laser science and the next generation of laser technologies for medicine, advanced manufacturing tools and defense.

The Photonics Center adds an important new dimension to UCF's internationally renowned College of Optics and Photonics and provides resources needed to expand photonics efforts in the growing areas of:

- Nanophotonics
- Biophotonics
- Advanced imaging and 3D displays
- Ultra-high bandwidth communications

The College of Optics and Photonics/CREOL is one of the world's top graduate institutions in optics and photonics education and research. The school offers a comprehensive interdisciplinary graduate program covering all aspects of optics, photonics and lasers leading to master's and doctoral degrees in Optics. The College of Optics and Photonics /CREOL provides unparalleled opportunities for not only continuing education, but research partnerships with photonics companies as well. The facility is currently engaged in more than a dozen areas of research including:

- Diffractive and holographic optics
- Liquid crystal
- Remote sensing, laser radar and atmospheric propagation
- Theory of light matter interaction
- Virtual reality and medical imaging

Many faculty members at other colleges and centers within UCF have affiliate appointments at CREOL, and research collaboration with UCF's new [College of Medicine](#) is increasing. The CREOL faculty are recipients of numerous awards and honors and are world-renowned for their contributions to fundamental and applied optics and photonics, and optical engineering. Recently, a College of Optics and Photonics professor invented a lens using liquid crystal technology. Used in eyeglasses, the lens electronically allows wearers to adjust their focus, eliminating the need to have new lenses made or to wear bifocals. The professor holds one of only a few U.S. patents on liquid crystal technologies.

As well, strong programs at local community colleges train students to enter the optics and photonics field in various capacities and help to create a complete workforce pool that includes engineers, laser technicians, optics technicians, opto-mechanical technicians, and systems analysts, among many others. The Florida Photonics Cluster (FPC) worked closely with the University of Central Florida's Engineering Technology Department and the College of Optics and Photonics/CREOL to develop a photonics-specific "Two plus Two" program, which is designed to expand technical and engineering education related to photonics.

This program is now an approved degree called the BSEET-Photonics and has seen steady growth in the first year. Students enrolling in the program begin their post-secondary education at one of the many outstanding community colleges in Metro Orlando, and may elect to attend UCF upon completion of their Associate of Science degree. Upon completion, graduates enter the optics and photonics workforce with a more marketable four-year technology degree. This is the first degree of its kind offered anywhere in the country.

In addition to supporting community college programs, the FPC has also implemented the Photonics Tech Camp, which is a series of seminars that bring middle and high school teachers from around the state to Orlando for a two-day industry orientation. The intent of the program is to help educators understand photonics so that they are better able to incorporate the topic into their curriculums. By introducing students to photonics at an early age, there is a greater chance they will pursue the field in their secondary education.

Recently, Northrop Grumman Laser Systems, along with several local optics companies and the Metro Orlando Economic Development Commission (EDC) began working with Valencia Community College (VCC) and Orange County Public Schools (OCPS) to create the Photonics Academy at Wekiva High School. The Photonics Academy began at the beginning of the 2009-2010 school year and offers high school students interested in careers as laser/photonics technicians to be dual enrolled at their high school and VCC. Upon graduation from high school, students will also receive nearly enough credits to also obtain their A.S. degree in photonics from VCC. This will allow the graduates to immediately enter the workforce, with high-tech, high-wage jobs, instead of spending two more years earning the degree. Many optics and photonics companies in Metro Orlando also offer tuition assistance programs, allowing the technicians to earn higher degrees with little or no out-of-pocket expense. The newly created Photonics Academy is just another great example of Metro Orlando's dedication to our established cluster of photonics companies.

Industry Organizations & Involvement

The Metro Orlando business community is closely knit and works together to foster an environment that encourages information exchange and breeds success. Research, community and business organizations unite to enhance the optics and photonics industry within the region. Industry leaders meet frequently to discuss the business climate, as well as to develop strategies to accelerate the growth of the optics and photonics sector in Metro Orlando.

The Florida Photonics Cluster (FPC)

The FPC's mission is to support the growth and profitability of the optics and photonics industry throughout Florida by providing a unified voice for the field and a network for communication and collaboration. The cluster utilizes a unified synergistic approach to build partnerships between companies and support organizations. FPC is dedicated to growing the industry by bringing together the knowledge, expertise and service that each company or organization has to offer.

The FPC regularly hosts a CEO Networking forum to facilitate communication and information exchange among business leaders in the optics and photonics industry. In addition, the FPC meets biannually to conduct seminars and other informative presentations. Speakers discuss the impact of optics and photonics on the region, and ways in which local companies can spread awareness of the industry and gain legislative representation. The Metro Orlando Economic Development Commission is a strong supporter of the Florida photonics industry and an active member of the FPC.

The Laser Institute of America (LIA)

LIA is a professional membership society dedicated to fostering lasers, laser applications and safety worldwide. Headquartered in Orlando and serving the industrial, medical, research and military communities, LIA offers technical information and networking opportunities to laser users from around the globe.

In addition to the numerous professional events attended and hosted by the Metro Orlando EDC, other trade organizations hold various local and nationally attended events such as:

- **SPIE Defense, Security, and Sensing Conference**

This conference is one of the industry's leading meetings for scientists and engineers from industry, military, government agencies, and academia throughout the world. The conference attracts over 6,000 attendees from the military, government, industry, and academia from all over the world., with more than 500 company product exhibition where you can find the most current hardware and software, meet with suppliers, and learn about product developments across the broad spectrum of infrared, sensing, and imaging technologies. In addition, there is an education program designed to bring you up to date on the hottest technologies and get you up to speed with the background basics you need within the industry.

- **Pittcon**

Pittcon is the world's annual premier Conference and Exposition on laboratory science, especially as it relates to Analytical Chemistry and Applied Spectroscopy. The conference attracts nearly 20,000 attendees from industry, academia and government from 90 countries worldwide who are striving to solve scientific problems related to energy and the environment, agriculture and foods, health and pharmaceuticals, and other concepts and products to improve the quality of life accessible by societies around the world.

Incentives

The state of Florida recognizes that semiconductor, defense and space technology facilities make significant annual investments in high-tech replacement equipment to keep pace with rapid advances in technology and heavy usage. As a result, qualifying businesses in these sectors are exempt from sales and use taxes that would otherwise be paid on machinery and equipment used in production, research and development.

A business certified to receive this exemption may elect to designate one or more state universities or community colleges as recipients of up to 100 percent of the amount of the exemption for which they may qualify. If the university or college agrees to receive the funds, it must further agree to match them equally and use the proceeds in pursuit of research and development projects as requested by the certified business.

Additionally, Metro Orlando offers attractive incentives to qualified relocating and expanding companies. This assistance is provided based on each organization's particular needs, including, but not limited to:

- Job creation
- Wage levels
- Capital investments

For more information, please visit the "Relocate & Expand/Incentives" section of the Metro Orlando EDC's website at OrlandoEDC.com, which provides a general overview of incentives offered to companies within Metro Orlando.

Company Profiles

Central Florida has been named one of the top four regions in the United States for optics and photonics clusters and is one of the nation's fastest growing high tech locations. The optics and photonics cluster in Metro Orlando benefits from an outstanding workforce, dedicated educational institutions, and organizations founded to ensure strong awareness of the industry through marketing and legislative initiatives. Following are brief overviews of a sampling of optics and photonics companies based in Metro Orlando:

[Analog Modules, Inc \(AMI\)](#)

AMI designs and manufactures a wide range of analog electronic products primarily for the laser and electro-optics industries. These products serve applications in medical, military, scientific, and industrial markets. Founded in 1979, AMI's key employees have over 100 years of combined experience in the laser and electronics industries. AMI takes pride that it is certified to ISO 9001:2000 and gives quality its highest commitment from top management down in order to deliver consistent, high quality products to its customers. AMI is located in Longwood, (Orlando) FL. Over 65 full-time employees are involved in design, development and manufacturing. In April 2001, AMI was acquired by HEICO Corporation as part of their Electronic Technologies Group.

Crystal Photonics (does not have a website)

Founded by two University of Central Florida professors, Crystal Photonics, Inc. is a highly successful spinout of CREOL. Crystal Photonics manufactures crystals for microelectronic and photonic industry applications. The company develops ultraviolet resonant cavity light-emitting diodes grown by molecular beam epitaxy on non-polar gallium nitride substrates. The company is based in Sanford, Florida.

[ER Precision Optical](#)

ER Precision Optical is a diverse manufacturing company located in downtown Orlando specializing in optical fabrication and optical assemblies as well as advanced inspection and testing processes. ER Precision Optical has specialized in fabrication of Infrared materials for the past 17 years and will now aim to be a main supplier of U.S. Made Infrared crystal blanks, as well as finished parts starting in 2010 (possible due to their new expansion and growth in Orlando). ER Precision Optical is committed to producing high quality optics at competitive prices and in a timely manner. Their components are built to customer's specifications and requirements. ER Precision Optical's ever growing scope for high precision and high energy optics extends from defense and aerospace to science, medical, and technology industries.

[L-3 Communications](#)

L-3 Communications Advanced Laser Systems Technology (L-3 ALST) designs, develops, and manufactures lasers and laser rangefinding systems. As an active center of laser and electro-optical system development, Central Florida provided the ideal environment for the creation of L-3 ALST. The founders, drawing on their extensive previous experience with companies such as Martin Marietta, International Laser systems, and Laser Photonics, established the company in July 1987. After its incorporation, L-3 ALST developed a new laser product for medical applications, and eventually sold its entire medical laser business to Surgical Laser Technologies in 1990. For the last fourteen years, L-3 ALST has focused on the production of laser rangefinders for various specialized applications, including military surveillance, fire-control, navigation, laser altimetry, and interplanetary space probes. The diversity of contracts in which L-3 ALST has participated distinguishes it from other companies in the laser industry.

[Laser Photonics, LLC](#)

Laser Photonics is an industry leader in developing high-tech fiber and CO2 laser systems for marking, cutting and engraving applications. Laser Photonics' systems are used by the automotive, aerospace, industrial, defense, electronic and medical industries around the world. Their mass-produced, environmentally friendly systems help lower the amount of manual labor and the number of steps involved in completing a job, making facilities more cost effective. Laser Photonics also assists in continuing manufacturing in America.

[Lee Laser, Inc.](#)

Lee Laser Incorporated was formed in 1984 as an OEM source for continuously-pumped and Q-switched Nd: YAG lasers for industry and science. Using the most reliable electronic and solid state laser technology, the Company designed the uniquely new Series 700 lasers to fill a market void created by existing products that had changed little over the previous 15 years. Today, Lee Laser's management and engineering staff averages more than 25 years experience in the design and manufacture of Nd:YAG lasers. To date, Lee Laser has delivered more than 12,000 Nd:YAG lasers to OEM system integrators worldwide. With a highly regarded laser product line that has exhibited consistent growth and strength each year since its inception, Lee Laser has become the largest OEM supplier of CW Nd:YAG lasers in the U.S. The Series 800 and Series LDP lasers have attracted considerable international attention; more than 50% of their lasers are ultimately shipped to end users outside of the U.S.

[LightPath Technologies](#)

LightPath Technologies is a recognized leader in optical solutions for industrial, defense, communications, test and measurement, and medical applications. For over 20 years, LightPath has built a strong portfolio of optical components and technologies that serve these industries. These products include molded glass aspheric lenses, optical isolators, fused fiber collimators, and gradient index GRADIUM® lenses.

[Lockheed Martin](#)

One of the largest single employers in Metro Orlando, Lockheed Martin is a customer focused, global enterprise principally engaged in the research, design, development, manufacture, and integration of advanced technology systems, products, and services for government and commercial customers. It employs over 7,000 people in Central Florida and maintains contracts with many local photonics and other high technology companies.

[Northrop Grumman](#)

Northrop Grumman Laser Systems, a sector of Northrop Grumman Electric Systems based in Baltimore, Md., is involved in the design, development, manufacture and support of airborne, ground vehicle and man-portable laser and electro-optical systems.

[Ocean Optics, Inc.](#)

Ocean Optics is a diversified photonics technology firm and a global leader in optical sensing, optical networking, display optics and biophotonics. The company is a leading supplier of optical sensing systems used to determine the chemical, color, radiant and metrological properties of samples by measuring their interaction with light. With full-service locations in the United States, Europe and Asia, the company serves a wide range of markets, including process control, consumer electronics and medical diagnostics. Ocean Optics' facility in Winter Park, FL, houses their R&D and assembly operations.

[OptiGrate Corporation](#)

OptiGrate Corporation designs and manufactures a full range of volume Bragg gratings (VBG), a type of unique narrowband optical filter for industrial, scientific, and defense applications. OptiGrate has developed a method for embedding microscopic holograms into optic glass that can direct light to perform a vast number of functions – which holds promise for the military, semi-conductor, automotive and shipping industries, as well as applications ranging from medical imaging to high resolution big screen TVs.

[Tecport Optics, Inc.](#)

Tecport Optics, Inc. works vigorously and continuously with its customers as well as world class instrument manufacturers to provide state-of-the-art coating systems with cutting-edge technology. Tecport manufactures one of the most reliable, efficient, flexible, and cost effective thin film deposition systems on the market.