

2009 Report on Florida's Photonics Cluster



2009



INNOVATION INSIGHT
www.innovationinsight.com



TABLE OF CONTENTS

Executive Snapshot of the Cluster	1	Florida Photonics Directory	24
The Florida Photonics Cluster.	2	Universities and Research Centers.	24
What is an Economic Cluster?.	2	Industry Organizations	24
Photonics - A Definition	2	Economic Development and Technology Transfer Organizations	25
History of Florida’s Photonics Cluster	2	Private Companies	25
Where are Cluster Organizations Located?	5	Consultants	41
Major Photonics Markets	5	Specialty Publishers	41
Photonics Product and Service Categories	9	Specialty Services Providers	42
Industry Makeup: Markets Versus Products and Services	11	Hospitals and Medical Institutions	42
The ‘Typical’ Florida Photonics Company	14		
Annual Research Activity.	14		
Economic Impacts	14		
Federal Procurement Activity	14		
Annual Patent Activity	17		
Specialized Degrees and Certificates.	17		
The Future.	19		
Technologies That Will Change Photonics.	19		
How the Cluster Will Change	21		
About the Research.	23		



Executive Snapshot of the Cluster

Research and Innovation

- 77+ photonics faculty researchers at Florida universities and research centers
- 154 photonics patents in 2007 alone
- \$20+ million in annual federal, industrial and state-funded research at UCF CREOL alone
- \$19.4 million in annual federal photonics research awards to Florida academic and private organizations
- Many Fellows of international photonics societies including OSA, SPIE, LIA and IEEE

Economic Impact

- 271+ photonics companies
- \$130 million annually in photonics-specific procurement
- \$3.6 billion impact on Florida's Gross State Product
- \$7.2 billion impact on Florida's annual sales activity (economic output)
- Over 27,000 jobs impact on Florida's employment

Specialized Research Laboratories and Centers

- UCF CREOL, the College of Optics and Photonics
- UF Laser-Based Diagnostics Laboratory
- UF Semiconductor Laser Research Laboratory
- USF Laboratory for Laser Remote Sensing
- USF Bio-MEMS and Microsystems Laboratory

Global Corporate Leaders in Photonics

- Lockheed Martin
- Harris Corporation
- Northrop Grumman
- L-3 Communications Advanced Laser Systems Technology Inc.
- VLOC
- Ocean Optics

Specialized Workforce

- 5,700+ photonics employees
- Over 100 specialized photonics graduates per year

Specialized Education and Training

- 4 photonics degree programs including A.S., B.S., M.S. and Ph.D. levels
- 4 photonics certificate training programs
- photonics training/experience programs for high school / middle school educators

Major Conferences and Trade Shows

- SPIE Defense, Security, and Sensing Conference
- Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)
- Regular academic conferences hosted by CREOL, the College of Optics and Photonics

Major Florida Support Industries

- Global microelectronics cluster
- Global medical manufacturing /instrumentation cluster
- Global aerospace, defense, military manufacturing cluster



The Florida Photonics Cluster

What is an Economic Cluster?

“Industry cluster analysis” has become an increasingly prevalent framework for measuring and understanding regional economies. Popularized by Dr. Michael Porter of the Harvard Business School, it is a useful tool for guiding regional economic development. It can be distinguished from other economic research methods by an emphasis on competitiveness, productivity, relationships among mutually dependent industries and resources, and conceptualization of business sectors that best matches how private sector leaders actually think about their industries.

Simply put, an economic cluster is a regionally bounded collection of interdependent companies, organizations, and resources that are specialized toward shared markets and technologies.

Photonics - A Definition

Wikipedia describes “photonics” as

The science of photonics includes investigation of the emission, transmission, amplification, detection, and modulation of light. Photonic devices include optoelectronic devices such as lasers and photodetectors, as well as optical fiber and planar waveguides, and waveguide-based passive devices. The most advanced area of photonic research is fabrication and investigation of special structures and “materials” with engineered optical properties. These include photonic crystals, photonic crystal fibers and metamaterials. (wikipedia.com, 12/17/08).

For the purposes of this report, we use ‘photonics’ to refer to both optics-related and photonics-related academic and industrial research, technologies and commercial products that incorporate optics and photonics elements for their most critical functions,

and the companies and organizations that are specialized toward the development and production of such technologies.

History of Florida’s Photonics Cluster

Photonics as an industry goes back to the late 1960s and the development of the laser. Florida companies were some of the earliest commercial manufacturers of laser technologies, so Florida’s photonics industry had an early start.

Florida’s photonics cluster is largely the result of the state’s strong relationship with the defense / aerospace industry. By the late 1940s, a few key US Air Force bases were established in Florida to support of the growing national need for aerospace control, guidance and tracking systems, particularly in the development of weapons systems. The presence of these Air Force bases contributed to the formation of leading international aerospace installations such as the NASA Cape Kennedy Space Center.

These installations were also pivotal in attracting and supporting core group of specialized, high-tech companies relating to aerospace, optics, microelectronics, communications and simulation. In particular, three companies were established in the 1960s around this early aerospace cluster that served as the “seed” for much of Florida’s high-tech optics manufacturing presence. The largest of these has been Martin Marietta Corporation, which was established in 1957 and developed into the current Lockheed Martin Missiles and Fire Control and its sister companies. Martin Marietta developed some of the earliest laser guidance and tracking systems, and has “parented” a considerable portion of Central Florida’s core optics companies, especially for military and aerospace

FLORIDA PHOTONICS CLUSTER MILESTONES

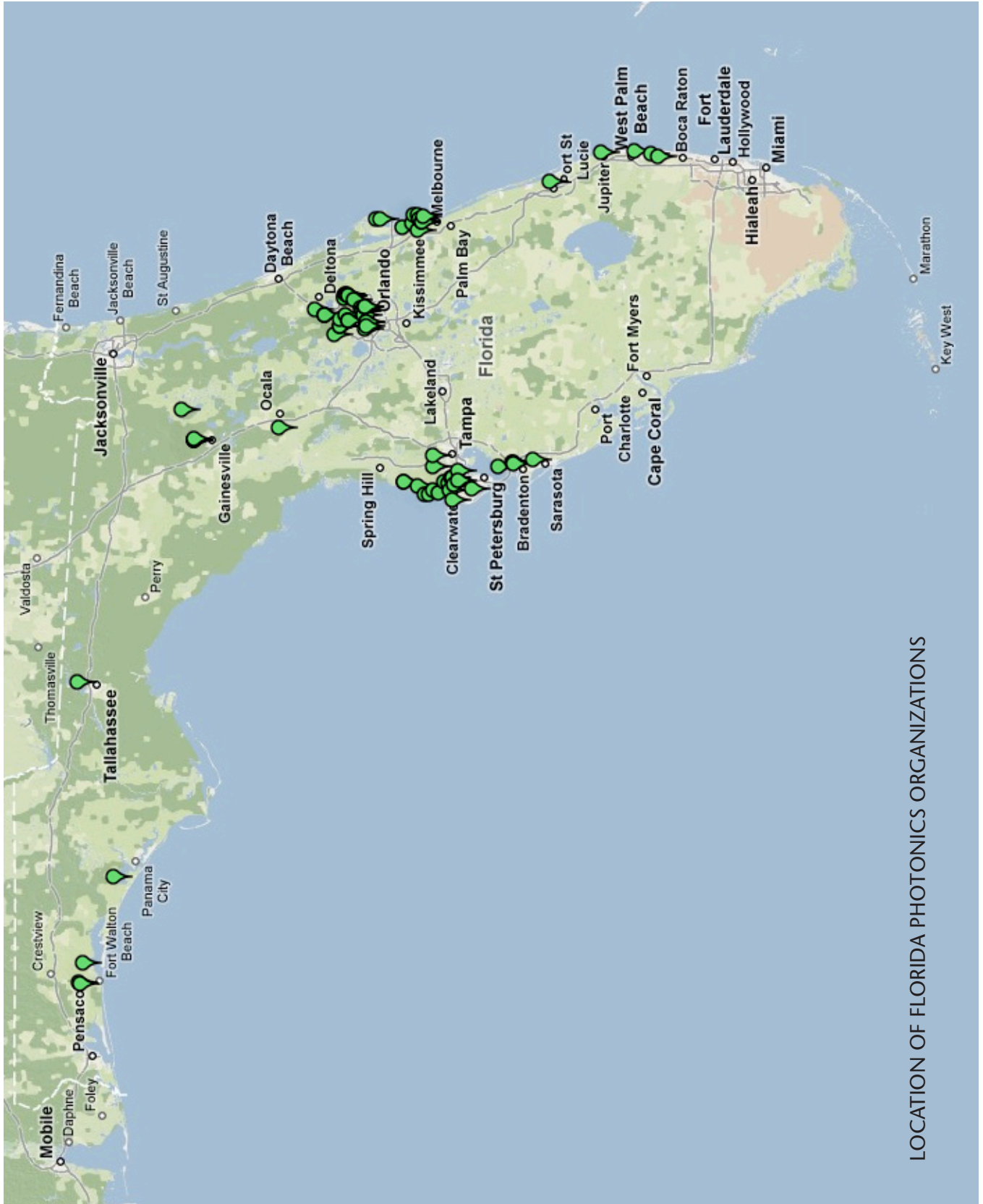
1957	Martin Marietta (Florida) established
1962	Laser Ionics (Martin Marietta "spin out")
1965	Control Laser (Martin Marietta "spin out")
1968	Litton Laser Systems (Martin Marietta "spin out")
1971	McMahan Electro-Optics (Martin Marietta "spin out")
1978	Laser Applications (Martin Marietta "spin out")
1979	Analog Modules (Martin Marietta "spin out")
1980	Coleman Research (Martin Marietta "spin out")
1984	Lee Laser (Martin Marietta "spin out") Schwartz Electro-Optics (Orlando)
1985	Autonomous Technologies (Martin Marietta "spin out")
1987	UCF Center for Research in Electro-Optics and Lasers (CREOL) established
1987	Photon Dynamics (Martin Marietta "spin out")
1989	Ocean Optics (USF startup)
1990	Laser Photonics (Martin Marietta "spin out") Constellation Technologies (USF "spin out")
1991	LaserSight (UCF startup) Laser Energetics (UCF startup)
1993	Semiconductor Diagnostics Inc. (USF startup)
1995	Micro Materials Inc. (USF startup)
1995	Crystal Photonics (UCF startup)
1997	Beam Inc. (UCF startup)
1999	UCF School of Optics established
2003	Florida Photonics Center of Excellence (UCF) established
2004	UCF College of Optics and Photonics established

applications. Lockheed Martin Missiles and Fire Control *continues to be one of the most central and important drivers for Florida's photonics industry as one of the largest purchasers of optics systems and services in the Southeast.*

The Florida optics cluster was recognized and considerably strengthened in 1987, when the Florida Board of Regents established the Center for Research in Electro-Optics and Lasers (CREOL) at the University of Central Florida (now named the "Center for Research and Education in Optics and Lasers"). Today, CREOL is part of "CREOL, The College of Optics and Photonics" at UCF, and is one of the most prominent research institutions in the world that focus on research and education in optics and photonics. Many companies have established a Florida presence to take advantage of proximity to the College and the students that it graduates. UCF expanded its programs in February, 1999 when it formally inaugurated a separate School of Optics, expanding CREOL's programs for providing education and degrees in optics fields and providing tenure-track support for specialized photonics faculty. The School of Optics became CREOL, The College of Optics and Photonics in 2004, the first college of photonics in the US. CREOL remains the single most significant and visible resource for the Florida optics cluster, with 51 research faculty members generating over \$20 million in annual research. Its curriculum goals include the full range of research from fundamental physics to applied photonics engineering and design.

With a \$10 million grant from the State of Florida, the Florida Photonics Center of Excellence (FPCE) was established within the UCF School of Optics in July 2003, with a special emphasis on nanophotonics, biophotonics, advanced imaging and 3D displays, and ultra-high bandwidth communications. A second grant from the State of Florida in 2007 established the Townes Laser Institute to conduct research focused on new laser technologies for applications in medicine, manufacturing, and defense. Today, CREOL, the College of Optics and Photonics, has grown to over 104,000 square feet of research facilities, 29 faculty, 22 joint and courtesy appointment faculty, 35 research staff, 18 staff, and 145 MS and PhD students.

Academic photonics, lasers, and optical research expertise is not limited to UCF, however. According to membership lists for one of the nation's primary optics and photonics organization SPIE, at least 26 university professors at other Florida universities specialize in photonics (see table, next page).



LOCATION OF FLORIDA PHOTONICS ORGANIZATIONS

Faculty	University
51	University of Central Florida, College of Optics (29 faculty, 22 associate faculty, not including 35 research staff)
13	University of Florida, various departments
5	University of South Florida, Departments of Physics and Mechanical Engineering
3	University of Miami, Department of Biomedical Engineering
2	Florida Institute of Technology (FIT), Department of Electrical and Computer Engineering
2	Florida International University (FIU), Biomedical Engineering
1	University of North Florida, School of Engineering

- Scientific, instrumentation, spectroscopy, analytic, chemical detection
- Tracking, ranging, vehicle sensor
- Microelectronics, photolithography, semiconductors
- Photography, imaging, image capture, VR
- Displays, lighting
- Holography
- Computing and optical storage
- Weapons systems
- Manufacturing systems, etching, engraving, marking, cutting
- Photonics industry - components, subsystems, subcomponents

Where are Cluster Organizations Located?

The map on the preceding page was generated using Google Maps and a vetted list of Florida photonics contacts in industry, government and academia. The majority of organizations are clustered heavily in the Metro Orlando and Tampa Bay (primarily Pinellas County) regions, with a third group in the Melbourne/Brevard County region.

Major Photonics Markets

Most Florida photonics companies are focused on one or more of the following 16 industrial markets. In Florida, the majority focus on Defense, Military, Aviation and Aerospace, and Weapons markets (combined), followed next by the photonics market (selling to other photonics, lasers, and optics manufacturers – see chart, next page). Of course, these categories are **not** mutually exclusive, as a given company can, and usually does, serve more than one market; organizations responding to a survey for this report supported more than four distinct markets each on average (4.3)

- Biomedical, health, pharmaceutical, ophthalmology
- Communications, telecom
- Aerospace, aviation
- Defense, military
- Homeland security, police, fire, emergency

Biomedical Markets

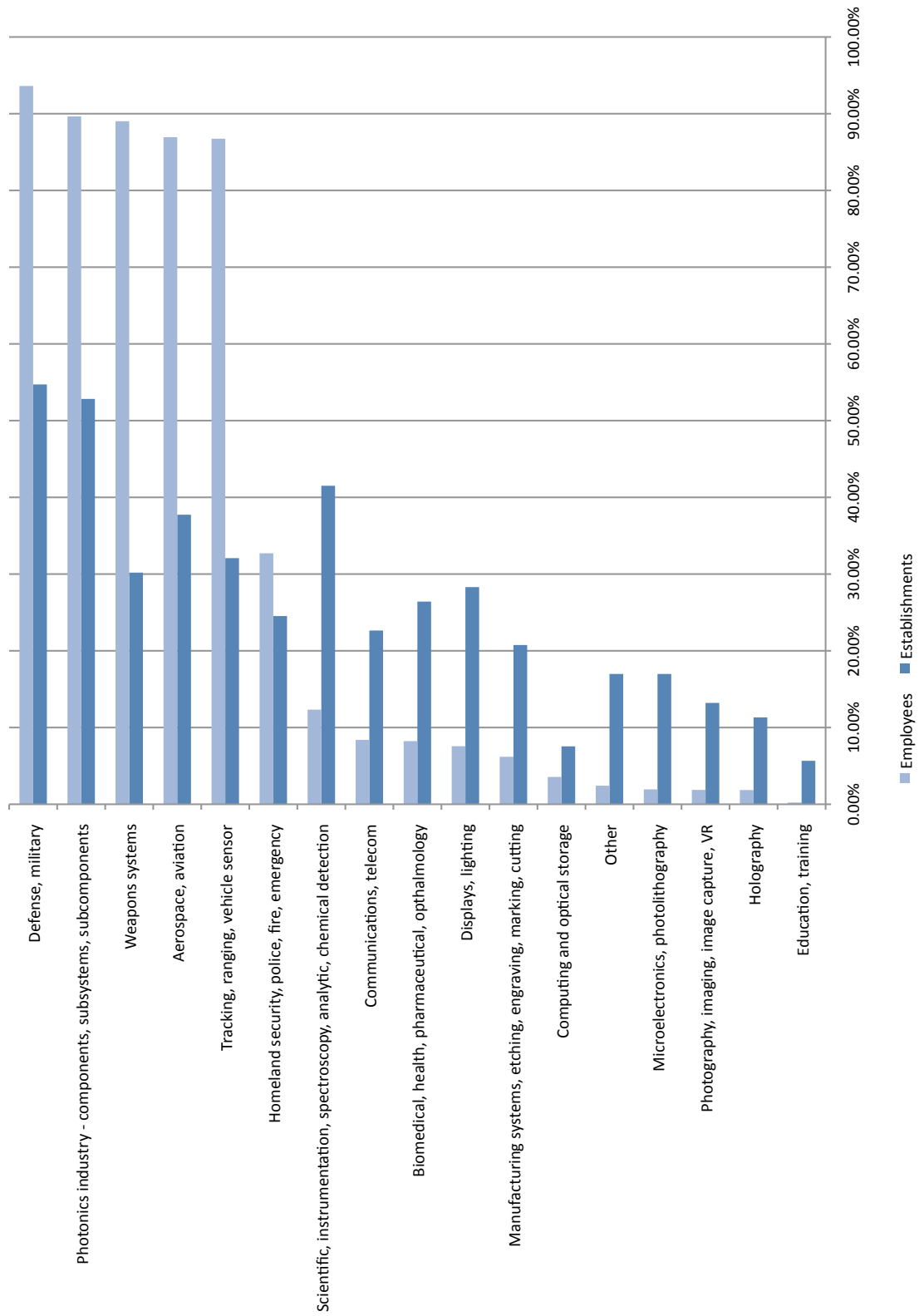
This market includes photonics devices used for medical and health applications such as surgery (cutting and cauterization), diagnostics and therapeutics, dentistry (drills), ophthalmology (LASIK), and even cosmetic therapies (vein, wrinkle, and hair treatments). Complex optical systems are increasingly being used for minimally invasive diagnosis (endoscopy and radiography) and detection (fluorescence and spectroscopy). Photonics devices also serve an increasing role in the development of pharmaceuticals and biotechnology. Applications that are seeing tremendous growth include noninvasive optical diagnostic devices for monitoring human physiometric data such as diabetic blood glucose monitoring or monitoring of patient vitals during surgery. Some Florida photonics companies that serve this market include PDR-Chiral, VLOC, Tower Optical, Schott Advanced Optics, Jabil, National Aperture, Laser Optical, Harris, General Ruby and Sapphire, and others. Most of the companies serving this market have relatively few employees.

Biomedical Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	26.4%
Cluster Employees Serving This Market:	8.2%

Communications Markets

Photonics technologies underlie most of the world's telecommunications systems for high-bandwidth data, video, and voice transmission. Optical solutions are often even used for wireless networked communications where bandwidth and security are major considerations. In general, telecommunications optics markets include the production of fiber-optic cabling and all the components necessary to connect

Florida Photonics Organizations by Primary Market



such cabling to other systems, such as optical routers, switches, lasers and multiplexers. Companies that serve this market include Harris, Tower Optical, VLOC, MF Lightwave, MZA Associates, Jabil, General Ruby and Sapphire, and Atlantic Positioning Systems.

Communications Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	22.6%
Cluster Employees Serving This Market:	8.4%

Aerospace and Aviation Markets

Much of Florida's high tech manufacturing sector is based upon defense contractors that overlap aerospace, military, and weapons sectors. Aerospace applications include sensor, detection and ranging systems such as LIDAR, optical tracking, targeting and guidance systems, and even motion tracking and countermeasure systems. Flight communications technology, propulsion systems, and of course traffic control and lighting technologies also serve this market. Some aerospace photonics companies include Lockheed Martin Missiles and Fire Control, Harris, Infrared Systems Development, Northrop Grumman, Aspheric Technologies, VLOC and many others.

Aerospace and Aviation Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	37.7%
Cluster Employees Serving This Market:	86.9%

Defense, Military, and Weapons Markets

Military markets share many of the same needs and applications as aerospace for communications, sensing, visioning, tracking, targeting, detection, and countermeasures. Military markets also include advanced detection systems for chemicals and explosives, as well as actual weapons and weapons components. Individually and together, these markets make up the largest markets supported by the Florida photonics cluster. The weapons market is generally considered a subsector of the general military/defense market. Companies that serve these market tend to be some of the largest companies in the Florida photonics cluster. Some Florida photonics companies that claim to serve this sector include Lockheed Martin Missiles and Fire Control, L-3 Advanced Laser Systems, Harris, Infrared Systems Development, Northrop Grumman, Alphalaunch and many others.

Defense and Military Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	54.7%
Cluster Employees Serving This Market:	93.6%

Tracking, Ranging, and Sensor Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	32.8%
Cluster Employees Serving This Market:	86.7%

Homeland Security and Emergency Markets

Since the September 11, 2001 terrorism tragedy, an increased emphasis has been placed on supporting and improving national emergency services such as police, fire, law enforcement and domestic intelligence. The needs and applications of this sector mirror those of the defense and military sectors including communications, detection systems, visioning and sensing, and targeting and weapons systems, though with greater emphasis on urban environments and civil populations. Many companies that serve military/defense markets also serve this market as well. Florida companies that claim to support this market include Northrop Grumman, Ocean Optics, Laser Optical Corporation, L-3 Advanced Laser Systems, Harris, Lockheed Martin Missiles and Fire Control, DRS Technologies, Pyramid Imaging and many others.

Homeland Security and Emergency Services Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	24.5%
Cluster Employees Serving This Market:	32.7%

Scientific and Instrumentation Markets

This market is oriented toward the production of specialty analytical, detection and diagnostic equipment for scientific, instrumentation, laboratory, spectroscopy and other applications. Many university photonics start-ups focus on this market as a natural outgrowth of novel inventions developed during the process of academic research. Analytical photonics devices can be required for all industry sectors, but especially so for those with high research and development needs such as academia. Florida photonics companies serving this market include Ocean Optics, AC Materials, A&N Corporation, Analog Modules, General Ruby & Sapphire, Pyramid Imaging, Infrared Systems Development and many others.

Scientific and Instrumentation Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	41.5%
Cluster Employees Serving This Market:	12.3%

Microelectronics and Semiconductor Markets

Companies in this market focus on the manufacturing of semiconductors, integrated circuits, and micro-electromechanical systems (MEMS). This market is driven by the continued need to pack more, and smaller, features onto semiconductor materials to meet ever-increasing demand for faster computers and more memory. Not only are photonics fundamental to the manufacture of semiconductor-based technologies through the application of various forms of photolithography, but increasingly the computing industry is looking to incorporate optical components to bypass physics-based limitations of purely electronic logic systems. Photonics systems are also used for diagnostics and quality control in the semiconductor manufacturing industry, as well as for other related applications. Florida's photonics cluster is not heavily focused on this market. Some Florida companies that serve this sector include Semiconductor Diagnostics Inc., Unaxis, and Intelligent Micro Patterning.

Scientific and Instrumentation Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	17.0%
Cluster Employees Serving This Market:	1.9%

Display and Lighting Markets

Lighting is one of the most widespread applications of photonics technology, and consequently one of the largest global markets. Lighting products are heavily commoditized, but there are many markets for the production of specialized lighting systems for transportation (landing systems, automobile lighting), computing (flat panel displays), entertainment (digital theater and television), advertising (digital billboards), and many other applications. While incandescent – and even fluorescent – light bulbs have become ubiquitous for home, commercial and environmental lighting, there is tremendous investment toward the development of a true “white light” emitting semiconductor diode, which would be many times more efficient and durable than other forms of light generation. Some Florida companies that support display and lighting markets include Cuneiform

Concepts, Neoteric Concepts, Ocean Optics, AC Materials, Goodrich Lighting Systems and others.

Display and Lighting Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	28.3%
Cluster Employees Serving This Market:	7.6%

Photography and Imaging Markets

Photonics is also a basic component of camera systems, whether they are digital or optical in nature. Image capture, image recognition and other imaging systems are also components of many other technologies including mapping systems, training and entertainment software, military and security systems for object and target recognition, and many other applications. Some Florida companies working in this market include Laser Optical Corporation, Schott Advanced Optics, Pyramid Imaging, and Harris.

Photography and Imaging Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	13.2%
Cluster Employees Serving This Market:	1.9%

Computing, Optical Storage and Holography Markets

In order to overcome some of the physical limitations of semiconductor-based electronic computing components, researchers are increasingly looking to optical-based components for computing. Optical computing elements have many superior performance characteristics compared to electronics, particularly regarding communications speeds. Completely optical binary digital computing systems have even been proposed, and may be the most realistic alternative for continued growth of computing technologies over the next ten or twenty years. Optical technologies are of course already the basis for most modern computer storage systems (CD, DVD, hard drives).

Holography is the process of using a medium to store, alter, and process light for the purpose of recording and retrieving information, and most of its applications relate to the computing and optical storage industries.

Some of the Florida companies serving these markets include Harris, Schott Advanced Optics, National Aperature, and others.

Computing and Optical Storage Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	7.5%
Cluster Employees Serving This Market:	3.6%

Holography Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	11.3%
Cluster Employees Serving This Market:	1.9%

Manufacturing and Industrial Markets

Solid state laser devices are becoming fundamental tools for industrial manufacturing and fabrication industries, particularly for marking and engraving, cutting (torching), soldering and welding. Some notable Florida companies that specialize on these markets include Lee Laser, Control Micro Systems, CCIUSA Inc. of Florida, and Focused Light Engraving.

Manufacturing and Industrial Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	20.8%
Cluster Employees Serving This Market:	6.2%

Photonics Markets

One of the largest markets served by Florida photonics companies – are other photonics companies. These products are integrated into increasingly sophisticated and specialized systems and products toward an eventual end-market outside of the photonics industry. Most photonics companies that are not themselves systems and end-product integrators also sell products to other photonics companies, but this sector is especially represented by companies that produce specialized optical components, subsystems, assemblies, materials, coatings, and lenses. Some Florida companies in this category include LightPath Technologies, AC Materials, VLOC, Quality Thin Films, Analog Modules, Aspheric Technologies, American Photonics, Optigrate, and many others.

Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	52.8%
Cluster Employees Serving This Market:	90.0%

“Other” Markets

Of course, photonics companies may serve other markets and applications than the major ones that have been listed thus far. Some of these other markets (as indicated by photonics survey respondents) include solar energy and power markets, test equipment, and specialized photonics-related services and publications

Homeland Security and Emergency Services Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	5.7%
Cluster Employees Serving This Market:	0.1%

Other Photonics Markets (Cluster Share)	
Cluster Companies Serving This Market:	17.0%
Cluster Employees Serving This Market:	2.4%

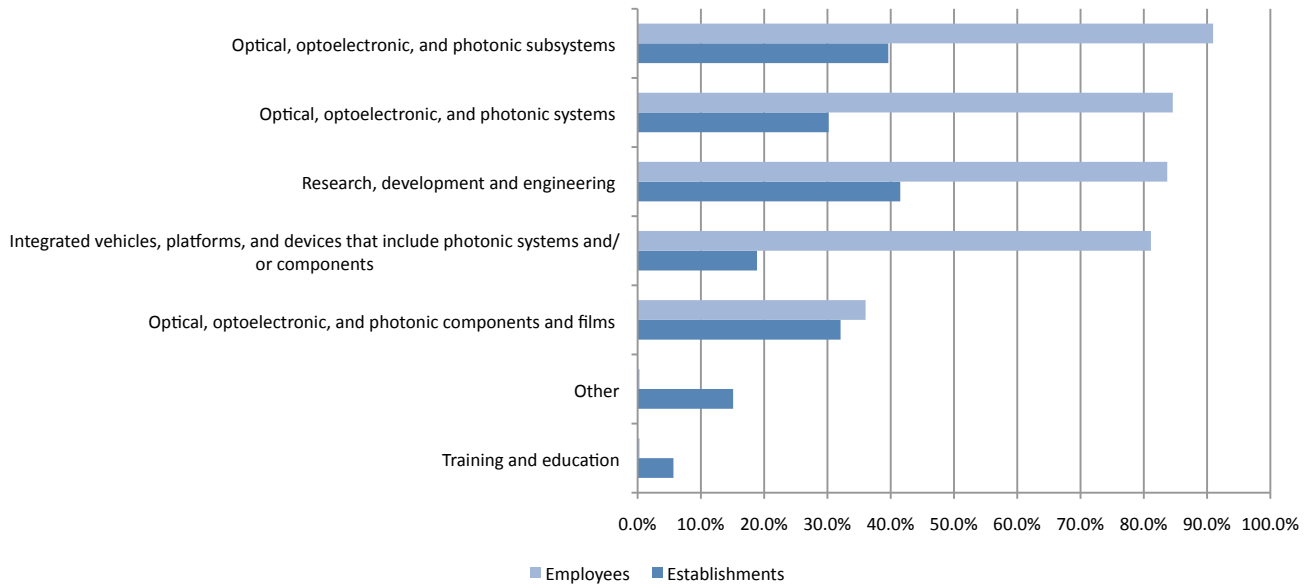
Photonics Product and Service Categories

Apart from the markets photonics products are sold to, we can examine the photonics cluster by the types of products and services that are provided. Manufactured photonics products can begin with specialized materials and components, which can be combined into increasingly sophisticated subassemblies and subsystems, and eventually integrated into complete specialized products, vehicles, systems, and applications. Similarly, cluster organizations can provide services in the form of research and development, training and education, funding and administration. A healthy industrial cluster will serve a wide variety of global markets – but also have the capabilities to generate the full range of products and services necessary to support all aspects of manufacturing and production. Of course, production and service categories are not mutually exclusive, as companies may be “vertically integrated” to produce a variety of subsystems, systems, and products inside and outside of the photonics sector. On average, Florida photonics organizations reported that they support more than one (mean 1.8) product or service category.

The major product and service categories include:

- Optical, optoelectronic, and photonic components and films
- Optical, optoelectronic, and photonic subsystems
- Optical, optoelectronic, and photonic systems

Florida Photonics Organizations by Product and Service Category



- Integrated vehicles, platforms, and devices that include photonic systems and/or components
- Research, development and engineering
- Training and education

The largest category of Florida photonics organizations by count provide research, development and engineering services – although nearly as many also classify themselves as focused on subsystems (see chart above). Subsystems manufacturers are also the largest category in terms of combined employment.

Components and Films Production

This category includes specialized materials and coatings, mirrors, lenses and optical elements, connectors and fibers, cabling, and other components. Generally, products in this category cannot be sold directly to end-markets and require integration and assembly with other components and subsystems. Companies in this category include LightPath Technologies, Quality Thin Films, VLOC, and many others.

Optical Components and Films (Cluster Share)	
Cluster Companies In This Category:	32.1%
Cluster Employees In This Category:	36.0%

Subsystems Production

This category includes single-purpose devices and subsystems intended for integration. Examples include power supplies, beam generators and collimators, lens assemblies, multiplexors, couple charged devices (CCDs, essentially image capture boards), and special purpose circuit boards. Some Florida companies that produce subsystems include CCIUSA Inc., MF Lightwave, Analog Modules, Neoteric Concepts, Aspheric Technologies, Pyramid Imaging, and others.

Photonics Subsystems (Cluster Share)	
Cluster Companies In This Category:	39.6%
Cluster Employees In This Category:	91.0%

Standalone Systems Production

This category includes manufacturing of products that have many subcomponents but are more or less standalone devices designed to produce a specific optic or photonic effect (such as lasing). Examples include laser systems, motion detector systems, general-purpose and special-purpose detectors and analytical systems. Florida companies manufacturing photonics systems include Field Metrics, Infrared Systems Development, Intelligent Micro Patterning, Ocean Optics, PDR-Chiral, Triple Play Communications, Jabil, General Ruby & Sapphire, and many others.

Photonics Systems (Cluster Share)	
Cluster Companies In This Category:	30.2%
Cluster Employees In This Category:	84.6%

Integrators

Integrators generally produce a large, complex standalone product that incorporates photonics elements. In Florida, this often refers to military vehicle platforms such as fighter aircraft, which while themselves not photonic in nature may incorporate a very significant amount of critical photonics. Some major companies in this category include Lockheed Martin, Northrop Grumman, and Harris.

Integrators (Cluster Share)	
Cluster Companies In This Category:	18.9%
Cluster Employees In This Category:	81.1%

Research and Development

This category includes government and academic research organizations that provide fundamental and applied research services, as well as testing and product/process improvement and design services. It also includes private sector organizations, consultants and companies that conduct research and engineering for new product development. Prominent examples include UCF's CREOL, the College of Optics and Photonics, the USF Laser Atmospheric Research Center, University of Florida Laser-Based Diagnostics Laboratory, the USF Florida Laboratory for Laser Remote Sensing, the USF Bio-MEMS and Microsystems Laboratory, the FSU National High Magnetic Field Laboratory and others.

Research and Development (Cluster Share)	
Cluster Companies In This Category:	41.5%
Cluster Employees In This Category:	83.7%

Other Products and Services

Although most cluster organizations fit into one of the major product and service categories already listed, there are exceptions. Some organizations that specialize on the photonics sector focus entirely on providing education and training, consulting services, administration and funding, publications, networking, and other products and services that support the industry. Examples include industry associations such as the Florida Photonics Cluster, the Laser Institute of

America, state and regional economic development organizations, Vand technician training programs at Valencia Community College and Indian River State College, and others.

Uncategorized Products and Services (Cluster Share)	
Cluster Companies In This Category:	15.1%
Cluster Employees In This Category:	0.2%

Training and Education (Cluster Share)	
Cluster Companies In This Category:	5.7%
Cluster Employees In This Category:	0.1%

Industry Makeup: Markets Versus Products and Services

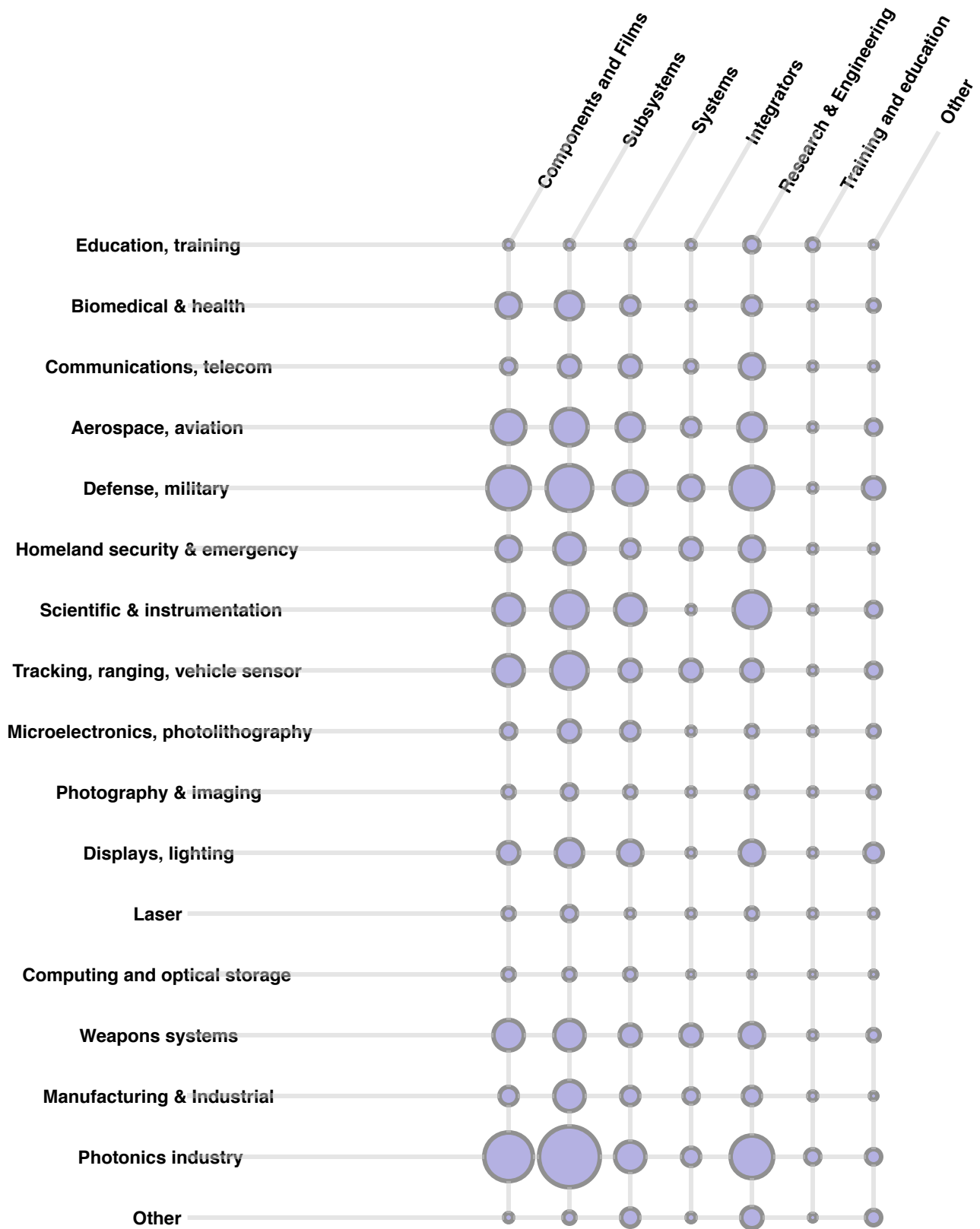
The following two charts show a matrix representation of the size and scale of Florida photonics industry simultaneously by number of establishments and by employment. These charts are useful for providing a quick understanding of where the relative strengths of the cluster are, without necessarily valuing one market or product/service category over another. They are also a good indicator of specialization versus diversification; a completely diversified matrix would have equally-sized bubbles in all categories.

The first chart shows establishments, and reveals the same emphasis on military, aerospace, defense and especially photonics markets as shown in the previous bar charts. Along the product/service categories, companies are partially distributed with a specialization in manufacturing subsystems for photonics markets.

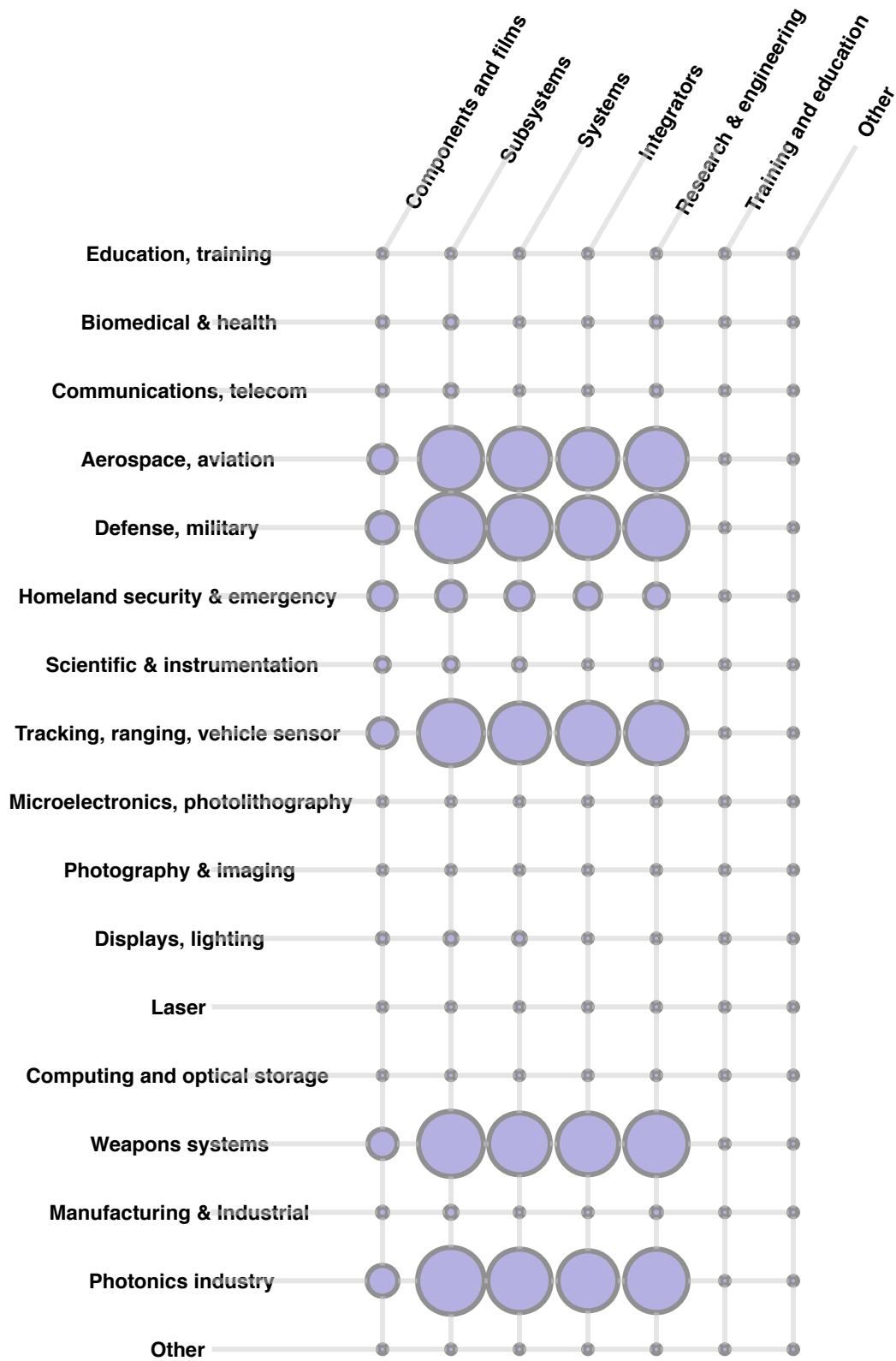
The second chart illustrates distribution by employment, and reveals a very different picture. This chart shows that the Florida photonics cluster is very specialized toward military and defense industries, and implies that a few very large integrators report broad capability across their defense/aerospace/military markets and for subsystems manufacturing, systems manufacturing, integration, and research /engineering.

Taken together, these charts indicate that (a) there is considerable specialization in the cluster, and a sort of core/satellite industry structure; (b) smaller companies fill a niche for providing components, films, and subsystems for the larger integrators; (c) growth

FLORIDA PHOTONICS CLUSTER ESTABLISHMENTS:
MARKETS VERSUS PRODUCT AND SERVICE CATEGORIES



FLORIDA PHOTONICS CLUSTER EMPLOYMENT:
MARKETS VERSUS PRODUCT AND SERVICE CATEGORIES



in photonics lighting and displays, semiconductors / nano-optics, new scientific / instrumentation, and probably other new technology areas technologies will come from small companies; (d) much of the growth and culture in the cluster will be driven by the demands and activities of the large defense employers and the markets they serve.

The ‘Typical’ Florida Photonics Company

Based on survey responses, the most typical company in the Florida photonics cluster can be described as a private, for-profit corporation with less than ten employees. Most (79%) are headquarters, were first incorporated in Florida (62.2%), and were established by individuals who worked in other Florida photonics companies (which we refer to as “spin-outs” – 60.7%). The charts on the next page demonstrate these statistics, but show that in contrast most actual photonics *employment* in Florida exists at branch manufacturing facilities of large corporations with out-of-state headquarters.

Why are these companies here? Responding photonics companies stated that the primary reasons for locating in Florida include:

- Climate and lifestyle. The preferable climate is attractive to corporate founders and executives, and can be a positive for recruiting new talent and for inviting potential clients to visit local facilities.
- Specialized workers. Florida has a strong existing base, and ability to produce, workers with photonics degrees and experience.
- Favorable taxation and business climate. Florida is generally described by photonics company executives as having a business-friendly environment, and the lack of personal income tax reduces labor costs.
- Low costs. While having many of the same resources and advantages of top US photonics centers such as Rochester and Silicon Valley, Florida does not share the housing, operational, or transportation costs.
- Strategic photonics resources including CREOL and other educational and research institutions, and the presence of supporting industry and government organizations.
- International access supported by strong international airports, deepwater ports, and a compromise time zone for access to Europe and Latin America.

- A business community of large and small photonics-related companies.
- Key large, global photonics customers and military bases.

Annual Research Activity

CREOL, the College of Optics & Photonics reports an annual research budget of over \$20 million, with over 20% of the funding originating from industrial sponsors. In 2007, the Federal Assistance Award Data System (FAADS) reported over \$19.4 million in federal awards to Florida academic and private organizations for grants explicitly for photonics subjects (81% of which was awarded to 9 Florida universities and research centers). The FAADS database reports all non-confidential federal grants, loans, insurance and direct payments, which we searched using photonics-related keywords against grant titles and descriptions (other award and payment types were not considered).

Economic Impacts

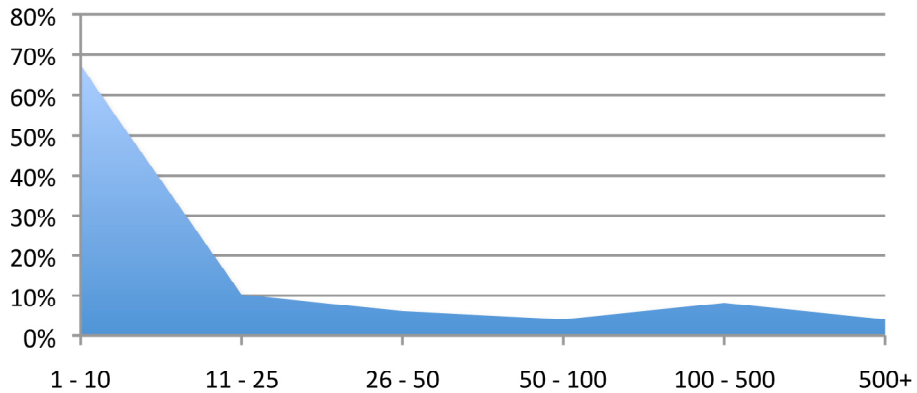
The photonics cluster has a very significant impact on Florida’s overall economy. It supports over 5,700 direct photonics-related jobs (based upon survey responses), and impacts over 27,000 jobs annually across the state. Annually, the cluster generates over \$7.2 billion in economic output (sales activity), and contributes over \$3.6 billion to Florida’s gross state product.

Economic Impacts of the Florida Photonics Cluster	
Florida Employment, Direct	5,757 reported
Florida Employment, Direct+Indirect	27.1 Thousand
Florida Gross State Product	3.6 Billion (fixed 2008\$)
Output (Sales)	7.2 billion (fixed 2008\$)

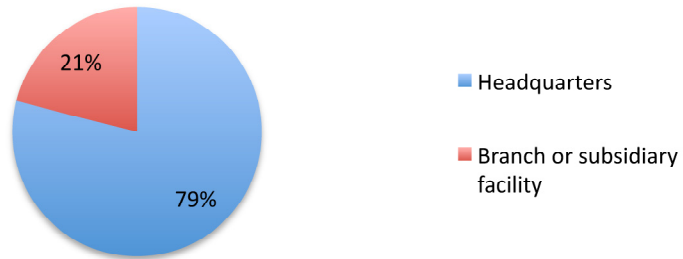
Federal Procurement Activity

In 2007, we identified 1,346 federal procurement awards to Florida photonics organizations totalling \$130,410,112 in funds (base funding and all options). This was extracted from the Federal Procurement Data System (FPDS) using a photonics-based keyword search similar to that used for federal grant awards, and categorized by state of performance (rather than the state where the vendor is headquartered). The FPDS is the federal repository for all non-confidential federal procurement awards. This probably under-represents photonics procurement activity by a large

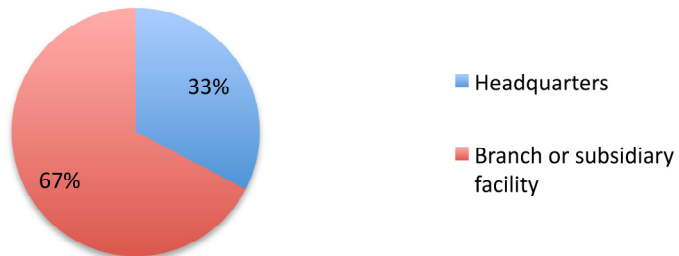
Florida Photonics Companies by Number of Employees



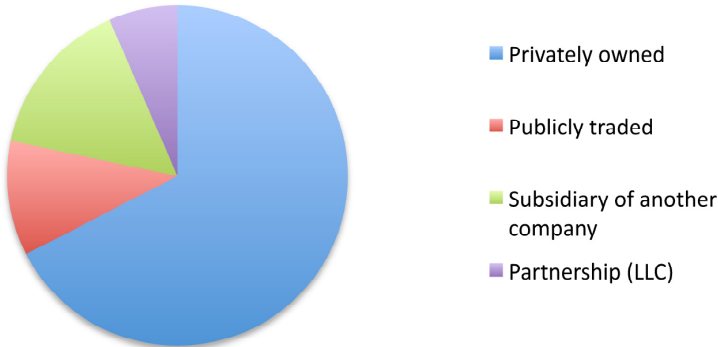
Headquarters by Number of Establishments



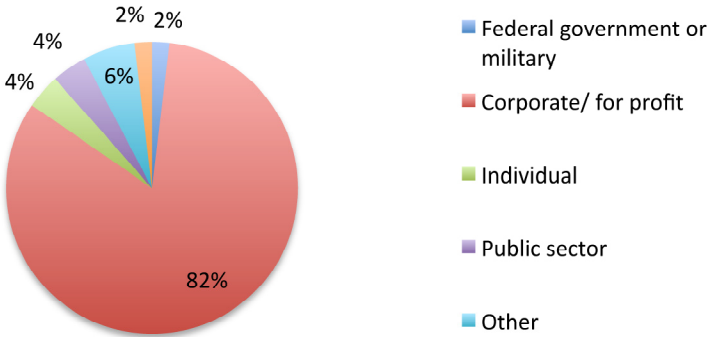
Florida Photonics Branches and Headquarters by Number of Employees



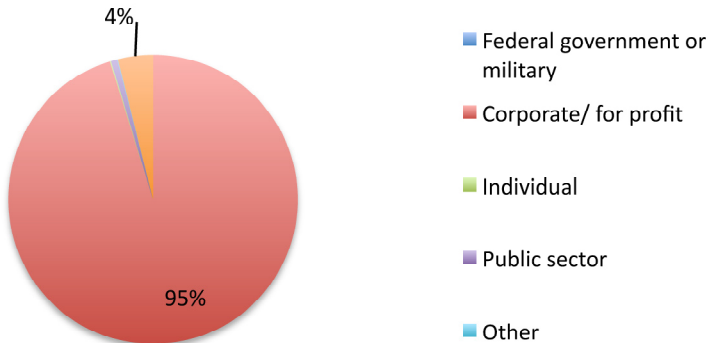
Florida Photonics Companies by Ownership Type



Types of Florida Photonics Organizations by Number of Establishments



Types of Florida Photonics Organizations by Number of Employees



margin, as it may not capture awards for technologies that include photonics as a component (for example, fighter aircraft).

Annual Patent Activity

In 2007, 154 US patents were awarded to Florida recipients with photonics-related keywords in their titles. This is 40% growth since 2002, and places Florida as #8 in the US for annual photonics-related patent awards (California is first with 1,697), and has grown 28% faster than the US as a whole. This accounts for roughly 2.8% of all Florida patents for that

2007 FLORIDA PHOTONICS PATENTS ACTIVITY BY PATENT CLASS

Class	Patent Class Title	#
385	Optical waveguides	20
356	Optics: measuring and testing	18
359	Optical: systems and elements	15
382	Image analysis	10
351	Optics: eye examining, vision testing and correcting	9
324	Electricity: measuring and testing	9
398	Optical communications	7
349	Liquid crystal cells, elements and systems	6
372	Coherent light generators	6
362	Illumination	5
348	Television	5
250	Radiant energy	3
606	Surgery	3
425	Plastic article or earthenware shaping or treating: apparatus	3
430	Radiation imagery chemistry: process, composition, or product thereof	2
713	Electrical computers and digital processing systems: support	2
343	Communications: radio wave antennas	2
514	Drug, bio-affecting and body treating compositions	2
D16	Photography and optical equipment	2
600	Surgery	2
427	Coating processes	2
370	Multiplex communications	2
	All Others	19

year; the state shows a strong relative specialization for photonics patents (LQ=133%). The largest single assignee organization for Florida photonics patents was Harris corporation (17) and the University of Central Florida (17), followed by Johnson & Johnson Vision Care (10).

Specialized Degrees and Certificates

Photonics is at its nature highly driven by technology and advances in science. Most photonics related industry positions require some form of specialized training or degree. To serve this need, Florida academic institutions offer at least eight specialized degree and certificate education programs, from certificate level to graduate (see following table).

This demand for specialized, degreed workers is reflected by current industry employment levels. As shown on the following charts (next page), responding companies reported that of their positions that are specialized (dedicated to) photonics related products

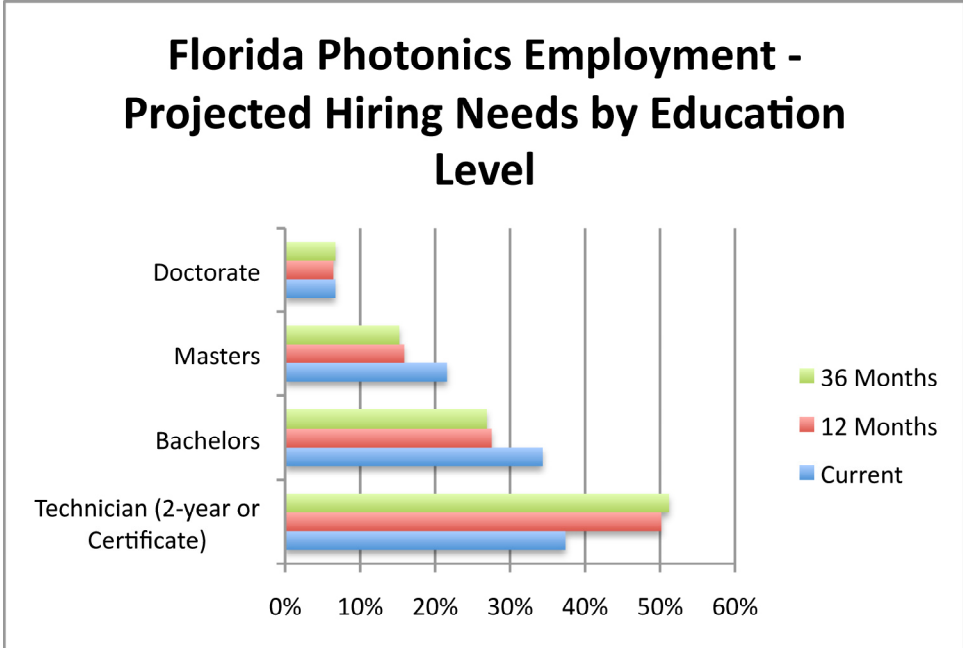
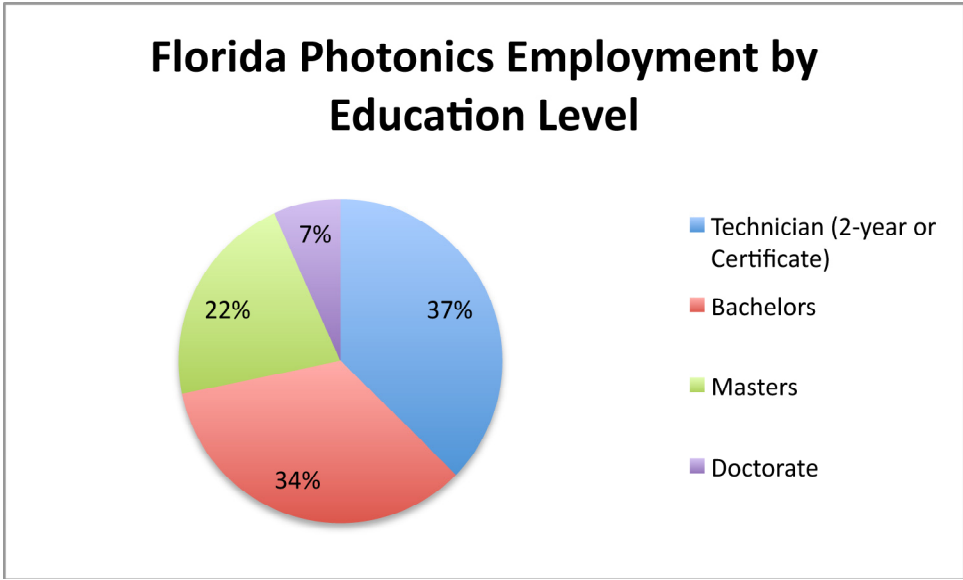
Level	Program	Institution
Ph.D.	Optics	University of Central Florida
M.S.	Optics	Univeristy of Central Florida
B.S.	Electrical Engineering Technology with a concentration in Photonics	Univeristy of Central Florida
A.S.	Electronics Engineering Technology with specializaiton in Lasers and Photonics	Valencia Community College
Certificate	5 Day fiberoptics training program	Univeristy of Central Florida
Certificate	Certified Fiber Optics Technician Course	Univeristy of Central Florida
Certificate	Certified Fiber Optics Splicing Specialist Course	Univeristy of Central Florida
Certificate	Technical Certificate Program in Lasers and Photonics Technology	Valencia Community College
Certificate	Certificate in Lasers and Photonics	Indian River State College
na	Photonics techCAMP	techPath

and services, 63% require a bachelors degree or higher. 29% require a graduate degree, and 7% require a full Ph.D. in a relevant field. This is a dramatically higher percentage than Florida's general population, in which only 27% of the state's population age 25 to 64 has a bachelor's degree.

degrees. This trend was projected to continue over the next 36 months, with the photonics workforce expected to grow by roughly 9% per year and the greatest need demand being shown for technicians. Generally, new hires in the photonics industry were expected to have the following attributes:

Although Florida photonics companies were surveyed during the onset of the 2008 economic recession, there is a continued strong demand projected for trained and educated photonics workers within the state. Overall, responding companies expected to increase their existing photonics workforce roughly 10% in 2009, with a slightly greater demand for certificate and technician-level workers over workers with higher

- Experience working within the photonics industry
- Knowledge of relevant software
- Basic knowledge of optical alignment, fabrication (shaping, polishing, metrology) and inspection
- Basic understanding of the manufacturing process and "good business" manufacturing concepts
- Common sense and good hand-eye coordination





The Future

The industry and science of photonics is changing rapidly – perhaps following the same exponential growth curve as Moore’s Law. Moore’s Law describes the explosive growth in the semiconductors industry, in which processing speed and memory capacity has doubled every two years since approximately 1958. Photonics technologies such as quantum lasers are in widespread production today that forty years ago would have been considered scientifically impossible. New scientific and engineering breakthroughs are promising to create unprecedented opportunities and possibilities for photonics-enabled technologies, and consequently, this may also signify opportunity and change for the Florida photonics cluster.

Technologies That Will Change Photonics

Nobody can accurately predict the future – but experts and researchers from the photonics industry consistently discuss and remark upon the potential of a few key promising technologies to overturn current industry and scientific standards in photonics and optics. All of the topics summarized in the following paragraphs, as well as many others, are active areas of research at CREOL, the College of Optics and Photonics. A summary of the current research at CREOL is available at <http://www.optics.ucf.edu/Research/FacultyResearchBooklet.pdf>

Quantum optics

Quantum optics describes the application of quantum theory to optics and photonics. Quantum laser technologies (quantum dot lasers, quantum well lasers, quantum cascade lasers) demonstrate many of the performance advantages of gas lasers without many of their shortcomings. Lasers based on quantum structures have created entirely new commercial

applications such as optical coherence tomography, but also have begun to replace many applications traditionally supported by gas laser technologies. The scientific and engineering implications of this field have only begun to be explored.

Further, laser researchers are beginning to apply quantum principles of entanglement and superposition for applications in secure communications and cryptography.

Nanophotonics and Optical Computing

From Wikipedia, nanophotonics is

...the study of the behavior of light on the nanometre scale. The ability to fabricate devices in nanoscale that has been developed recently provided the catalyst for this area of study. The study of nanophotonics involves two broad themes 1) studying the novel properties of light at the nanometer scale 2) enabling highly power efficient devices for engineering applications. The study has the potential to revolutionize the telecommunications industry by providing low power, high speed, interference-free devices such as electrooptic and all-optical switches on a chip.

Optical computing is one of the most promising areas of research to continue Moore’s Law for the development of computers through the next few decades, and has tremendous implications for telecommunications and all other applications of optics and photonics.

Nanophotonics also includes applications of optical properties of nano-scale materials and structures, such as the use of metal nanoparticles to manipulate color without the degradation or other shortcomings of dyes.

Tunable Fiber Lasers

Fiber lasers and fiber disk lasers have already begun to replace gas lasers for many high-power applications in industry and manufacturing, particularly for cutting and welding. They have the advantage of supporting previously unattainable output power (greater than one kilowatt), high beam quality, small size and high reliability. Technologies such as phase locking arrays and amplifiers may multiply upper output power ranges many times further. Currently, fiber lasers (like gas lasers) are primarily limited in frequency, but other advances such as optical frequency combs show promise for “tunable” laser systems which may create unexpected applications. Overall, fiber laser technology represents a major shift in high-power applications to solid-state technologies, representing tremendous improvements in cost and efficiency and enabling new innovations in manufacturing and industry.

Solid State Lighting

Solid state lighting utilizes light-emitting diodes as the light source rather than filaments, plasma or gas. Commercial and consumer lighting is still mostly supported by incandescent and fluorescent light bulbs, which have a fraction of the energy efficiency and durability of proposed solid state light sources. This represents a significant commercial opportunity, as well as an important energy conservation target as the US spends approximately \$12 billion each year on lighting.

However, there are some cost, technical and manufacturability hurdles still remaining before solid state lighting sources can surpass fluorescent bulbs for efficiency. LED light sources are already used for some applications in which durability, temperature and longevity is more important than cost, but true saturation of this technology will not begin until costs can surpass existing commercial alternatives. Another technical barrier that remains is the production of a manufacturable, true solid state “white light” source; most current solutions involve combining LEDs of different colors (red, green blue) or combining LEDs with phosphors and other materials simulate white light to limited success.

The impact of these technologies is not limited to lighting however; display manufacturers are also looking to solid-state lighting sources (particularly organic light-emitting diodes) for improving the power consumption, color, durability, size limitation and brightness characteristics of television, computer, and

laptop monitors. Market researchers expect that the annual global sales of flat panel TVs alone may top \$45 billion by 2010.

Solar Power and Photovoltaics

The market research firm Clean Edge tracks the growth of “clean energy” markets, and currently projects the global solar photovoltaic market to grow fourfold into a \$74 billion market by 2017. Annual solar generator installations have grown nearly 500% since only 2004. Last year, US investment firms invested \$2.7 billion into the solar technology sector (more than 9% of all venture capital activity), so this market is being recognized for its tremendous growth potential. This growth is being driven by the recent surge in oil prices, the drive to reduce US dependence upon foreign energy sources, and the push toward “clean” and “green” technologies.

Solar power is simply the science of using light from the sun to generate light, heat, or chemical activity. Most frequently, solar technologies are used for heating (particularly water) or for power generation by conversion into electricity. Solar power can also be used to generate chemical power, such as through the production of hydrogen.

New efficiency breakthroughs are being reached with photovoltaic technologies. Production costs and efficiency levels are approaching the critical cost-value threshold for widespread use not only in large power generation installations but for residential applications as well.

New solar cells utilizing dye-coated nanocrystals (Grätzel cells), inexpensive solar coatings and polymer films, dye-based organic solar concentrators and other innovations are paving the way for low-cost photovoltaic applications for homes, devices, vehicles, and other products, and are indication that a true “solar revolution” may be on the horizon.

Biomedical Photonics

The demand for photonics technologies in medical applications – diagnostic, therapeutic, detection – is growing rapidly with the aging population of the US and the needs of the US military for in-field medicine. This market may quickly surpass aerospace and telecommunications as the largest consumer of photonics technologies within the next decade or so. Currently, Laser Focus World projects the global

market for medical lasers alone to top \$3 billion annually, and the US medical imaging industry also demonstrates about \$3 billion in revenue annually; yet together, these two sectors represent only a fraction of the potential applications and markets for medical photonics for sensors, monitoring, detection, and therapeutics.

How the Cluster Will Change

Any one of the revolutionary technologies listed in the previous section has the potential to radically change the status quo in US photonics markets. Innovative companies may surpass current leaders, new university researchers and research centers may rise to prominence, and relative strength of geographic photonics clusters in California, New York, Florida, Colorado and Arizona may wax or wane depending upon where the next generations of technology can take root first. Where Florida's photonics cluster will rank over the next ten to twenty years will depend on a combination of factors:

- Current research strengths and research priorities at Florida universities
- The degree to which Florida's largest consumers of photonics technology (primarily large aerospace/defense contractors) create demand for, and embrace critical new technologies
- Continued funding and facility support for academic research and development
- Increased support for small company growth and development
- Public funding support for new product and process innovation
- Growth of the Florida Photonics Cluster industry association

Florida is well positioned to take a leading role in some of these new technology fields, with biomedical photonics perhaps promising the greatest opportunity. The University of Central Florida has recently established a new medical school, and the College of Optics has dedicated considerable resources and part of its faculty toward collaborating directly with medical school researchers and focusing on medical applications of photonics and optics. Both the University of South Florida and the University of Florida have medical schools of their own. Florida is home to world-class cancer research centers such as the H. Lee Moffitt Cancer Center and Research Institute (Tampa) and the UF Shands Cancer Center (Gainesville). The University of Florida also hosts a Center for Nano-Bio

Sensors to focus on medical diagnostics. Biomedical research has been recognized as a priority research area for the state; a state Center of Research Excellence in Biomolecular Identification and Targeted Therapeutics was established at the University of Florida and the Center of Excellence in Biomedical and Marine Biotechnology was established as a collaboration between Florida International University, Florida Atlantic University, and several other academic, research and industrial partners. Further, medical manufacturing and instrumentation is one of the most significant industrial clusters in the state, providing a good industrial base for cross-fertilization.

Similarly, Florida provides a natural environment for capitalizing on solar technologies. As a test environment and consumer market, it offers one of the most ideal combinations of latitude and sunny weather in the US. Florida Governor Charlie Christ has declared "Green Technologies" to be a focus area for his administration, and the state is home a considerable amount of academic research expertise in solar technologies including the Florida Institute for Sustainable Energy (University of Florida) and the Florida Solar Energy Center (University of Central Florida). This is augmented by decades of academic infrastructure built in the areas of thin films, semiconductors, fuel cells and batteries, and advanced power distribution research.

Finally, the state may have the resources to become a major innovator in nanophotonics as well. The previously stated academic expertise includes university research centers such as the Bio-MEMS (micro-electro-mechanical systems) and Microsystems Research Group at the University of South Florida, and the Advanced Materials Processing and Analysis Center (AMPAC) at the University of Central Florida (UCF). UCF has also established a strong foundation in nano-optic research at CREOL, the College of Optics and Photonics. The University of Florida also has an Interdisciplinary Microsystems Group, and microelectronics / semiconductor industry has been recognized as one of the strongest clusters in the state having been home to two semiconductor wafer fabrication facilities and research laboratories belonging to AT&T / Bell Labs, Harris, and others.

Florida has a more than sufficient academic / industrial foundation and ecosystem to build prominence in these new technology areas. The Florida photonics cluster has shown forty years of growth and leadership, and both industry and academic experts believe that this growth will continue unabated. The cluster has

built a tremendous reputation across the globe for research and academic prominence. However, the future of the cluster is not guaranteed; the pressure of competition from other states and regions is high, and the field of photonics is prime for a revolution that will present both opportunity – with proper nurturing – and danger.

Note: this chapter draws upon structured interviews with experts from Florida photonics industry and academia, a survey of Florida photonics companies, and substantial contributions for technology descriptions drawn from Wikipedia.com.



About the Research

The research for this report was coordinated and performed by Innovation Insight Inc. for the Florida Photonics Cluster, under grant support from Enterprise Florida and the Florida High Tech Corridor Council Inc. Special research contributors included Avera Wynne and Patrick O'Neil of the Tampa Bay Research Planning Commission (<http://tbrpc.org>) for economic impact analysis. Considerable additional support was provided by the Florida Photonics Cluster association, the staff of the UCF College of Optics, and Stefanie Delguidice of the UCF University Economic Development Department.

The primary data sources contributing to this report included:

- A direct survey of over 500 Florida photonics contacts and organizations
- Structured interviews with over two dozen executives and researchers
- The US Patent and Trademark Organization (USPTO): <http://www.uspto.gov/>
- The Federal Procurement Data System (FPDS): <https://www.fpds.gov/>
- The Federal Assistance Award Data System (FAADS): <http://www.census.gov/govs/www/faads.html>
- REMI Policy Insight (under license to the Tampa Bay Regional Planning Council)
- Contact list assistance provided by SPIE (<http://spie.org/>), Photonics Spectra magazine (<http://photonics.com/>), the Laser Institute of America (<http://www.laserinstitute.org/>), the Optical Society of America (<http://osa.org/>), the Florida Photonics Cluster (<http://floridaphotonicscluster.com>), and Florida's economic development organizations.

Content from this report may also reference or include information from the following references:

- "1999 Florida High Tech Corridor Report on Florida's Laser and Optics Cluster" (University of South Florida)
- Wikipedia.org (December 2008)
- "CREOL: The First 20 Years (1986-2006)" (University of Central Florida College of Optics)
- "Evolution of the Optics Industry in Central Florida: ILS and Offspring" by Dr. William Schwartz (1989)
- The ARGIS Florida Research Grant Archive: <http://floridaresearch.argis.ucf.edu/index.cfm>
- The UCF CREOL / College of Optics and Photonics web site: <http://creol.ucf.edu/>
- "The Promise and Challenge of Solid-State Lighting," A. Bergh, G. Craford, A. Duggal and R. Haitz (Physicstoday, December 2001).
- "Strategy Analytics Projects 66 Percent Flat Panel Tv Revenue Increase in 2005; 17.5 Million Unit Sales Generates \$25 Billion" Strategy Analytics (Business Wire, April 13 2005)
- "Clean-Energy Trends 2008," Clean Edge (2008).
- "Medical Market: Consumers Still Rule," (Laser Focus World, January 1 2006)
- "Medical & Imaging Laboratories (Industry Profile Excerpt)," (First Research Inc., December 15, 2008).



Florida Photonics Directory

Universities and Research Centers

University of Central Florida CREOL, College of Optics and Photonics

4000 Central Florida Blvd / PO Box 162700
Orlando, FL 32816
407-823-6800
<http://www.creol.ucf.edu>

University of Central Florida CECS, Department of Engineering Technology

4 000 Central Florida Blvd.
Orlando, FL 32816-2450
Tel (407) 823-4740
<http://www.ent.ucf.edu>

University of Florida Laser-Based Diagnostics Laboratory

PO Box 116300
gainesville, FL 32611-6300
352-392-0807
<http://plaza.ufl.edu/dwhahn/>

University of Florida Semiconductor Laser Research Laboratory

PO Box 116200
gainesville, FL 32611-6300
<http://www.ece.ufl.edu/research/labs/semilaser.html>

University of South Florida Laboratory for Laser Remote Sensing

4202 E. Fowler Avenue, PHY114
Tampa, FL 33620
813-974-3995
<http://www.cas.usf.edu/lidarlab/>

University of South Florida Bio-MEMS and Microsystems Laboratory

4202 E. Fowler Avenue, ENB370
Tampa, FL 33620
813-974-3593
<http://mems.eng.usf.edu>

National High Magnetic Field Laboratory

1800 E. Paul Dirac Drive
Tallahassee, FL 32310-3706
850-644--0311
<http://www.magnet.fsu.edu>

Georgia Tech Research Institute

3361 Rouse Rd Ste 210
Orlando, FL 32817-2137
407-482-1423
<http://www.gtri.gatech.edu>

Industry Organizations

Florida Photonics Cluster

407-422-3171
<http://floridaphotonicscluster.com>

Laser Institute Of America

13501 Ingenuity Dr., Ste. 128
Orlando, FL 32826
407-380-1553
<http://www.laserinstitute.org>

American Welding Society

550 NW Le Jeune Rd.
Miami, FL 33126
305-443-9353
<http://www.aws.org>

Economic Development and Technology Transfer Organizations

Central Florida Development Council of Polk County, Florida

600 N. Broadway Avenue, Suite 300
Bartow, Florida 33830
863-534-4370
<http://www.cfdc.org>

Enterprise Florida Inc

800 N Magnolia Ave., Ste. 1100
Orlando, FL 32803
407-956-5600
<http://www.eflorida.com>

Florida High Tech Corridor Council, Inc.

1055 AAA Drive
Heathrow, FL 32746
407-708-4630
<http://floridahightech.com>

Metro Orlando Economic Development Commission

301 E. Pine Street, Suite 900
Orlando, FL 32801
407-422-7159
<http://www.orlandoedc.com>

Tampa Bay Partnership

4300 West Cypress St
Tampa, FL 33607
813-872-2806
<http://www.tampabay.org>

University of Central Florida Economic Development Department

12424 Research Parkway, Suite 100
Orlando, Florida 32826-3257
407-882-2103
<http://universityrelations.ucf.edu/economic-development/>

University of Central Florida Office Of Research & Commercialization

12201 Research Parkway, Suite 501
Orlando, FL 32826
407-823.3778
<http://www.research.ucf.edu>

University of Florida Office of Technology Licensing

Gainesville, FL 32611
352.392.8929
<http://www.research.ufl.edu/otl>

University of South Florida Office of Research, Division of Economic Development

3802 Spectrum Blvd, Suite 155
Tampa, FL 33612-9220
813-974-0994
www.research.usf.edu/ed

Government Organizations and Laboratories

Federal Aviation Administration

Faa Surveillance Radar Engineering
1189 Fountainhead Drive
Largo, FL 33770-0000

Naval Surface Warfare Center - Panama City

CODE HS15
110 Vernon Avenue
Panama City, FL 32407-0000

Us Air Force Research Labs

4661 Browning Court
Crestview, FL 32539

Private Companies

21st Century Innovations, Inc.

PO Box 826
Indian Rocks Beach, FL 33785-0826
727-595-4880
<http://www.21stci.com>

A & N Corporation

707 SW 19th Ave.
Williston, FL 32696
352-528-7826
<http://www.ancorp.com>

Academy Of Laser Dentistry

PO Box 8667
Coral Springs, FL 33075-8667

Advanced Fiberoptic Technologies

1650 12th St E
Palmetto, FL 34221-6437
941-722-4099

Advanced Laser Design

5618 Regis Avenue
Port Richey, FL 34668-6516
727-843-8011

Advanced Optics

3824 Emerald Estates Cir
Apopka, FL 32703-6710
407-296-4061

Aesculight, Llc

21504 NE 115th Ave.
Po Box 458
Earleton, FL 32631-0458

Air Dimensions Inc.

1371 W Newport Ctr. Dr., #101
Deerfield Beach, FL 33442
954-428-7333
<http://www.airdimensions.com>

AIS Automated Imaging Systems, Llc

PO Box 691179
Orlando, FL 32869-1179
321-228-2701
<http://www.aissemi.com>

Alaka'i Consulting & Engineering Inc

7887 Bryan Dairy Rd Ste 220
Largo, FL 33777

Align Optics Inc.

4700 Hiatus Rd., Ste. 144-A
Sunrise, FL 33351
954-748-1715
<http://www.alignoptics.com>

Alphalaunch

410 E. Concord St.
Orlando, FL 32803
407-701-5577

American Laserware, Inc.

1103 Bobwhite Trail
Chuluota, FL 32766
407-673-5993

American Photonics Corporation

6216 28th St. E
Bradenton, FL 34203
941-752-5811
<http://www.americanphotonics.com>

American Torch Tip Co.

6212 29th St. E
Bradenton, FL 34203
941-753-7557
<http://www.americantorchtip.com>

Amglo Kemplite Laboratories, Inc.

8787 Enterprise Blvd.
Largo, FL 33773
727-812-2035
<http://www.amglo.com>

Analog Modules Inc

126 Baywood Avenue
Longwood, FL 32750
407-339-4355

Applicote Associates Llc

894 Silverado Court
Lake Mary, FL 32746
407-322-4460

Applied Films, Inc.

643 Timber Ridge Rd.
Pensacola, FL 32534
713-667-2561

Arges-Usa Llc

8368 SW 109th Lane Rd.
Ocala, FL 34481
413-330-2723
<http://www.arges-usa.com>

Ashwin Systems International, Inc.

PO Box 483
Dunedin, FL 34697-0483
813-785-5844
<http://homel.gte.net/infrared>

Aspheric Technologies Inc

2060b Whitfield Park Ave
Sarasota, FL 34243-4072
941-739-0844

Astro-Pure, Inc.

1441 SW 1st Way
Deerfield Beach, FL 33441
954-422-8966

AT & T Services, Inc.

14008 Saint Leo Ct
Orlando, FL 32826-3559

ATK Mission Research Corp.

13133 34th Street N.
Clearwater, FL 33762-0000

Atlantic Positioning Systems

6950 112th Circle
Largo, FL 33773-5209
727-299-0150x272
<http://www.atlanticpositioners.com>

Atlas Specialty Lighting

7304 N Florida Ave.
Tampa, FL 33604
813-238-6481
<http://www.asltg.com>

Audio Visual Imagineering

8440 Tradeport Dr., Ste. 109
Orlando, FL 32827
407-859-8166
<http://www.av-imagineering.com>

Aurora Design & Technology, Inc.

4116 Grandchamp Cir
Palm Harbor, FL 34685-1095

BAE Systems Technical Services

557 Mary Esther Cut-Off
Fort Walton Beach, FL 32548
850-244-7752
<http://www.ts-technicalservices.com>

Bascom Palmer Eye Institute

1638 Nw 10 Ave.
Miami, FL 33136-0000

Baublys Control Laser Corporation

2419 Lake Orange Dr.
Orlando, FL 32837-7804
407-926-3500
<http://www.controllaser.com>

Bausch & Lomb, Inc

21 Park Place Blvd.
Clearwater, FL 33759-0000

Beam Corp.

686 Formosa Ave.
Winter Park, FL 32789
407-629-1282

Beam Dynamics, Inc.

13749 Shelter Cove Dr.
Jacksonville, FL 32225
904-221-5832
<http://www.beamdynamicsinc.com>

Beam Engineering For Advanced Measurements Co.

809 S Orlando Ave., Ste. I
Winter Park, FL 32789
407-629-1282
<http://www.beamco.com>

Beckman Coulter

11800 SW 147th Ave.
Miami, FL 33196-2500
305-380-3907
<http://www.beckmancoulter.com>

Bolton Associates, Inc.

P.O. Box 10697
St. Petersburg, FL 33733-0697

Boston Scientific

6400 NW 114 Ave
Unit 1134
Miami, FL 33178

Boston Scientific

8600 Nw 41 Street
Miami, FL 33166-0000

Brain Power Inc.

4470 SW 74th Ave.
Miami, FL 33155
800-327-2250
<http://www.brainpowerinc.com>

Brijot Imaging Systems, Inc.

1064 Greenwood Blvd., Ste. 124
Lake Mary, FL 32746
407-641-4370
<http://www.brijot.com>

BSA Optics, Inc.

3911 SW 47TH AVE., SUITE 914
Ft. Lauderdale, FL 33314-0000

C E R Industries

1520 Lake Way
Clearwater, FL 33756

CF Motion Inc

2049 Larchmont Way
Clearwater, FL 33764

Chemplex Industries, Inc.

2820 SW 42nd Ave.
Palm City, FL 34990-5573
772-283-2700
<http://www.chemplex.com>

Chip Supply, Inc.

7725 North Orange Blossom Trail
Orlando, FL 32810
407-296-5645

Chromalux

1311 N. Highway US 1
Suite 129
Titusville, FL 32769-

Citel Inc.

1515 NW 167th St., #6-303
Miami, FL 33169
305-621-0022
<http://www.citelprotection.com>

Coastal Optical Systems, Inc.; Subsidiary Of Jenoptik

16490 Innovation Dr.
Jupiter, FL 33478-6428
561-881-7400
<http://www.coastalopt.com>

Commercial Crystal Laboratories, Inc.

4406 Arnold Ave.
Naples, FL 34104
239-643-5959
<http://www.crystalguru.com>

Complete Inspection Systems, Inc.

334 Fourth Ave.
Indialantic, FL 32903
321-952-2490
<http://www.completeinspectionssystems.com>

Compulink Cable Assemblies, Inc.

1205 Gandy Blvd. N
St. Petersburg, FL 33702
727-579-1500
<http://www.compulink-usa.com>

Computer Dynamics Inc

88 Coleman St
Lakeland, FL 33815-3311

Computer Sciences Corporation

5155 WILDWOOD AVE.
Merritt Island, FL 32953-0000

Constellation Technology Corp.

7887 Bryan Dairy Rd.
Largo, FL 33777-1444
727-547-0060

Control Laser Corporation

2419 Lake Orange Drive
Orlando, FL 32837
407-926-3500

Control Micro Systems, Inc.

4420A Metric Dr.
Winter Park, FL 32792
407-679-9716
<http://www.cmslaser.com>

Control Systemation Inc.

2419 Lake Orange Dr.
Orlando, FL 32837
407-926-0800
<http://www.controlssystemation.com>

Control Systems Research, Inc.

368 Adams Ave.
Valparaiso, FL 32580-1282
850-689-3284

COSCI Technologies Inc.

4409 Hoffner Ave
Suite 401
Orlando, FL 32812
321-297-1984

Crystal Complete Interface Usa, Inc.

PO Box 07442
Fort Myers, FL 33919
239-481-1046
<http://www.cyberstreet.com/cci>

Crystal Photonics, Inc.

2729 North Financial Court
Sanford, FL 32773-8117
407-328-9111

Crystal Photonics, Inc.

5525 Benchmark Lane
Sanford, FL 32773
407-328-9111

Crytur Usa

1720 Natchez Trace Blvd
Orlando, FL 32818
407-578-6468

CTE

234 SW 12th Ave.
Deerfield Beach, FL 33442
305-428-8259

Cuneiform Concepts, Llc

2275 LADNER RD. NE
Palm Bay, FL 32907-2648
321-258-5156

Custom Manufacturing & Engineering (CME)

2904 44th Ave. N
Saint Petersburg, FL 33714
727-548-9799
<http://www.custom-mfg-eng.com>

Davis Marketing International Llc

3412 Brian Rd. S
Palm Harbor, FL 34685
727-786-6157
<http://www.davis-marketing.com>

Dearborn Electronics, Inc.

1221 N Highway 17/92
Longwood, FL 32750
407-695-6562
<http://www.dearbornelectronics.com>

Dermacare

17900 NW 5th St
Suite 202
Pembroke Pines, FL 33029

Digimed Analytical Instruments Inc.

6861 SW 196th Ave., Ste. 116
Pembroke Pines, FL 33332
954-689-0939
<http://www.digimed.ind.br>

Digital Infrared Imaging, Inc.

515 Cooper Commerce Dr. Ste. 150
Apopka, FL 32703
407-884-0202
<http://www.thermalsecurity.com>

Digital Lightwave, Inc.

15550 Lightwave Dr.
Clearwater, FL 33760-3533
727-578-5565

Digital Lightwave, Inc.

5775 Rio Vista Dr.
Clearwater, FL 33760
727-442-6677
<http://www.lightwave.com>

DILAS Diode Laser Inc.

Boca Raton, FL 33400
520-282-6001
<http://www.dilas.com/>

Diomed

252 41st Avenue
St Pete Beach, FL 33706

Direct Optical Research Company

8725 115th Ave. N
Largo, FL 33773
727-319-9000
<http://www.dorc.com>

Discovery Technology International Lllp

6578 Palmer Park Circle
Sarasota, FL 34238
941-921-1511
<http://www.discovtech.com>

DRS Optronics Inc

100 N Babcock St
Melbourne, FL 32935-6715

DRS Optronics Inc

2330 Commerce Park Drive, NE
Palm Bay, FL 32905
321-984-9030

DRS Optronics Inc

3520 US Highway 1
Palm Bay, FL 32905
321-693-1245
<http://www.drs.com>

DTI Nanotech

6578 Palmer Park Circle
Sarasota, FL 34238
941-371-1777
<http://www.dti-nanotech.com>

Dyna Technologies, Inc.

1670 Tropic Park Dr.
Sanford, FL 32773
407-330-6423
<http://www.dti-fla.com>

E.R. Precision Optical Corp.

505 W Robinson St.
Orlando, FL 32801
407-292-5395
<http://www.eroptics.com>

ECI Telecom

1201 West Cypress Creek Rd.
Ste. 100
Ft. Lauderdale, FL 33309
954-351-4437

Eclipse Energy Systems Inc

2345 Anvil St N
St Petersburg, FL 33710-3905

Egret Systems Inc.

3130 Southern Oaks Dr.
Merritt Island, FL 32952
321-459-9459

Electro-Optical Imaging Inc

4300 Fortune Place, Ste. C
West Melbourne, FL 32904
321-435-8722
<http://www.eoimaging.com>

Electronics Source

2361 Vista Parkway, Ste. 14
West Palm Bch, FL 33411
561-687-7737
<http://www.electronics-source.com>

Elk Industries

2117 S Babcock St., #106
Melbourne, FL 32901
321-259-8114
<http://www.elkindustries.com>

Eltec Instruments, Inc.

355 Fentress Blvd
Po Box 9610
Daytona Beach, FL 32120
386-253-5328
<http://www.eltecinstruments.com>

EMW Laser

6840 114th Avenue
Largo, FL 33773-5305
727-548-8783

EMX, Inc.

4200 Dow Rd., Ste. C
Melbourne, FL 32934
321-751-0111
<http://www.emx-inc.com>

EWM General Corp.

PO Box 610-PH
New Port Richey, FL 34656
727-849-0638

Faro Technologies, Inc.

125 Technology Park
Lake Mary, FL 32746
407-333-9911
<http://www.faro.com>

Femtoptics

12565 Research Parkway Suite 300
Orlando, FL 32826
407-658-1001

Fiber Optic Engineering

38 Parkview Lane
Ormond Beach, FL 32174-9013
904-677-2497

Fiberoptic Engineering Corp.

6541 Bay Line Dr.
Panama City, FL 32404

Fieldmetrics

13352-82ND AVENUE
Seminole, FL 33776-0000
727-319-0299

FLIR Systems Inc

701 John Sims Pkwy E Ste 202
Niceville, FL 32578-2031

FLIR Systems Inc

8210 Presidents Dr
Orlando, FL 32809

Flomet/Tekna Seal LLC's

810 Flightline Blvd.
Deland, FL 32724
386-736-4890

Florida High-Tech Optics, Inc.

606A 17th St., Court East
Palmetto, FL 34221
941-729-5380

FMS Secure Solutions

5316 Championship Cup Ln
Brooksville, FL 34609

Focused Light Engraving, Inc.

1987 Corporate Square Dr., #147
Longwood, FL 32750
407-830-8885
<http://www.lasermen.com>

Fonon Technology International, Inc.

3217 Yattika Place
Longwood, FL 32779
407-804-1000
<http://www.fonon.com>

Full Spectrum Concepts

933 N. Alexander Street
Mount Dora, FL 32757-0000

Gam Laser Inc.

6901 TPC Dr., #300
Orlando, FL 32822
407-851-8999
<http://www.gamlaser.com>

Gam Laser Inc.

6901 TPC Drive, Suite 450
Orlando, FL 32822-5127
407-568-5555

Gamma High Voltage Research Inc.

1096 N US Highway 1
Ormond Beach, FL 32174
386-677-7070
<http://www.gammahighvoltage.com>

General Ruby & Sapphire Co.

PO Box 610
New Port Richey, FL 34656-0610
727-849-0638

Geo Systems Inc

210 S Washington Ave.
Titusville, FL 32796
321-383-9585
<http://www.geosystemsinc.com>

Global Systems International

1273 Central Florida Pkwy, Suite 4
Orlando, FL 32837
407-251-4163
<http://www.globalsystemsint.com>

Graflex Inc

15855 Assembly Loop
Jupiter, FL 33478
561-691-5959
<http://www.graflex.com>

Grapevine Laser, Inc.

105 N 15th St.
Fernandina Beach, FL 32034-3124
214-364-8669
<http://www.grapevinelaser.com>

Gripping Power, Inc.

11930 44th St. N, Ste. B
Clearwater, FL 33762
727-572-4100
<http://www.grippingpower.com>

Gulf Fiberoptics, Inc.

148 Dunbar Ave., Unit B
Oldsmar, FL 34677
813-855-6618
<http://www.gulffiberoptics.com>

Handren Associates, Inc.

5818 Princess Caroline Place
Leesburg, FL 34748-7980
352-314-8829

Harris Corporation

1025 W NASA Blvd.
Melbourne, FL 32919-0001
321.727.4185
<http://www.harris.com>

Hatch Transformers, Inc.

5403 W Gray St.
Tampa, FL 33609
813-288-8006
<http://www.hatchtransformers.com>

Hernon Manufacturing, Inc.

121 Tech Dr.
Sanford, FL 32771
407-322-4000
<http://www.hernonmfg.com>

High Tech Photonics

23 Alafaya Woods Blvd.
Oviedo, FL 32765
800-335-5582
<http://www.ht-photonics.com>

High Tech Photonics

316 Harlequin Court
Oviedo, FL 32765
800-335-5582
<http://www.ht-photonics.com>

High'born Technology USA Inc

5970 Sw 18th St Ste 227
Boca Raton, FL 33433

HN Burns Engineering Corp

3275 Progress Dr Ste A
Orlando, FL 32826-3230

Honeyhill Technical Co

11550 Ballylee Ter
Boynton Beach, FL 33437-6429

IB Laser Consulting, Inc.

P.O. Box 950661
Po Box 950661
Lake Mary, FL 32795-0661
407-929-5574
<http://www.ib-laser.com>

ICS Inex Inspection Systems

13075 US 19 N
Clearwater, FL 33764
727-669-9999
<http://www.icsinex.com>

ICX Imaging Systems

515 Cooper Commerce Dr.
Suite 150
Apopka, FL 32703
407-884-0202
<http://www.icximagingsystems.com>

Imaging Diagnostics Systems, Inc.

6531 N.W. 18th Court
Plantation, FL 33323
954-581-9800

Imperx

6421 Congress Ave., Ste. 204
Boca Raton, FL 33487
561-989-0006
<http://www.imperx.com>

IN/US Systems, Inc.

5809 North 50th St.
Tampa, FL 33610-4809
813-626-6848

Inex Vision Systems

13327 US Highway 19 North
Clearwater, FL 33764-7225
727-535-5502

Infrared Associates Inc

2851 SE Monroe St.
Stuart, FL 34997
772-223-6670
<http://www.irassociates.com>

Infrared Systems Development

7319 Sandscope Ct., Ste. 4
Winter Park, FL 32792
407-679-5101
<http://www.infraredsystems.com>

Insulator Seal

6460 Parkland Dr.
Sarasota, FL 34243
941-751-2880
<http://www.insulatorseal.com>

Integrated Design Tools, Inc.

1804 Miccosukee Commons
Suite 208
Tallahassee, FL 32308
850-222-5939
<http://www.idtvision.com>

Intelligent Micro Patterning

1922 Illinois Avenue NE
St. Petersburg, FL 33703
727-522-0334
<http://www.intelligentmp.com>

IR Industries, Inc.

512 18th Street
Orlando, FL 32805-4708
407/425-7882

Jabil Circuit

1401 Eden Isle Blvd Ne
Saint Petersburg, FL 33704-2418
727-458-5274

Johnson & Johnson Vision Care

7500 Centurion Parkway
Suite 100, W-2-A
Jacksonville, FL 32256-0000

JT Ingram

316 Harlequin Court
Oviedo, FL 32765
561-276-9055
<http://www.jtingram.com>

K-O Concepts, Inc.

21 N Texas Ave., Ste. A
Orlando, FL 32805-2162
407-296-7788
<http://www.k-oconcepts.com>

Kandu Software Corp.

933 Beville Rd., Ste. 103-C
South Daytona, FL 32119
800-979-2244

Kinetec Systems, Inc.

1241 SW Marmore Ave.
Port St. Lucie, FL 34953
772-879-9627
<http://www.kientec.com>

L-3 Communications Advanced Laser Systems Technology Inc

2500 N Orange Blossom Trail
Orlando, FL 32804
407-295-5878
<http://www.l-3com.com/alst>

Laser Depot

41 Skyline Dr., Ste. 1009
Lake Mary, FL 32746
407-804-1000
<http://www.laserdepot.net>

Laser Labs Inc.

6001 Johns Rd.
Suite 211
Tampa, FL 33634

Laser Optical Corp.

4855 Big Oaks Lane
Orlando, FL 32806-7826
407-760-7200

Laser Photonics, LLC

41 Skyline Dr., Ste. 1009
Lake Mary, FL 32746
407-829-2613
<http://www.laserphotonics.com>

Laser Production Network

20209 NE 15th Court
Miami, FL 33179-2710
305-690-6885
<http://www.lasernet.com>

Laserliance Technologies

1075 Florida Central Pkwy. #2500
Longwood, FL 32750-6319
407-339-0737
<http://www.laserliance.com>

Laserlight

2633 Windsorgate Lane
Orlando, FL 32828

Laserpath Technologies, LLC

2789 Wrights Rd., Ste. 1021
Oviedo, FL 32765
407-673-9000
<http://www.laserpathtech.com>

Lasers For Surgery, Inc.

6811 Flanders Streetstation Dr.
Polk City, FL 33868-8948
863-984-4545

Lasersight Technologies, Inc.

6848 Stapoint Court
Winter Park, FL 32792
407-678-9900
<http://www.lase.com>

Lasertripsy Techniques, Ltd.

2188 Sprint Blvd.
Apopka, FL 32703

Lasertron Inc.

14251 N.W. 4th Street
Sunrise, FL 33325

Lee Laser Inc

7605 Presidents Dr.
Orlando, FL 32809
407-812-4611
<http://www.leelaser.com>

Light Processing And Technologies, Inc.

4028 Laurel Branch Lane
Orlando, FL 32817
407-823-6978

Lightpath Technologies Inc

2603 Challenger Tech Court, #100
Orlando, FL 32826
407-382-4003
<http://www.lightpath.com>

Linearchip

4247 Se Happy Lane
Stuart, FL 34997-0000

Lockheed Martin

12506 Lake Underhill Road
Mp-610
Orlando, FL 32825
407-306-1000

Lockheed Martin

5600 Sand Lake Road
Mp-455
Orlando, FL 32819-8907
407-356-2000

Lockheed Martin Enterprise Information

12506 Lake Underhill Rd.
Mp-610
Orlando, FL 32825
407-306-1789

Lockheed Martin Missiles & Fire Control

5600 W Sand Lake Rd
Orlando, FL 32819-8907
407-356-7068

Ludeca Inc.

1425 NW 88th Ave.
Doral, FL 33172
305-591-8935
<http://www.ludeca.com>

Lumiron

20725 NE, 16 Ave., A-33
Miami, FL 33179
305-652-2599
<http://www.lumiron.com>

Mace Security International, Inc.

3233 SW 2nd Ave.
Fort Lauderdale, FL 33315
954-585-6223
<http://www.mace.com>

Magna-Tech Electronic Co., Inc.

5600 NW 32nd Ave.
Miami, FL 33142
305-573-7339
<http://www.magna-tech.com>

Malema Flow Sensors

1060 S Rogers Cir.
Boca Raton, FL 33487
561-995-0595
<http://www.gate.net/^malema>

Manasota Optics, Inc.

1743 Northgate Blvd.
Sarasota, FL 34234
941-359-1748
<http://www.manasotaoptics.com>

Mcmahan Electro-Optics, Inc.

2160 North Park Ave.
Winter Park, FL 32789-2310
407-645-1000

McMillan Optical Co.

PO Box 380130
Murdoch, FL 33938-0130
941-627-0100
<http://www.mcmillanopticalcompany.thomasregister.com>

MCR Group, Inc.; A PPGI Company

793 Shotgun Rd.
Sunrise, FL 33326
954-577-2600
<http://www.mcrgroup.com>

Medical Energy, Inc.

8806 Paul Starr Dr.
Pensacola, FL 32514
850-476-8113
<http://www.medicalenergy.com>

Medicolaser

2633 E Commercial Blvd
Fort Lauderdale, FL 33308-4110

Metrotek

6880 46th Ave. N, Ste. 100
St. Petersburg, FL 33709-4751
727-547-8307
<http://www.metrotek.com>

MF Lightwave Inc

2711 Airport Road
Suite 7
Plant City, FL 33564
813-764-8800

Micromaterials, Inc.

6223 Chauncy St.
Tampa, FL 33647
813-627-0474
<http://www.micromaterialsinc.com>

Micromo Electronics, Inc.

14881 Evergreen Ave.
Clearwater, FL 33762-3008
727-572-0131
<http://www.micromo.com>

MRC Precision Metal Optics

6455 Parkland Dr.
Sarasota, FL 34243
941-753-8707
<http://www.mrcoptics.com>

Murnaghan Instruments Corp.

1781 Primrose Lane
West Palm Beach, FL 33414
561-795-2201
http://www.e-scopes.cc/Murnaghan_Instruments_Corp56469.html

Mustang Vacuum Systems

1675 Independence Blvd.
Sarasota, FL 34234
941-377-1440
<http://www.mustangvac.com>

MVM Electronics, Inc.

3410 N Harbor City Blvd.
Melbourne, FL 32935
321-752-8010

MZA Associates Corp

140 Intracoastal Pointe Dr Ste 310
Jupiter, FL 33477-5064
561-747-6881

Naked Optics Corp.

1090 Delacroix Circle
Nokomis, FL 34275
908-685-0352
<http://www.nakedoptics.com>

Nanoptics, Inc.

3014 NE 21 Way
Gainesville, FL 32609-3307
352-378-6620
<http://www.nanoptics.com>

National Aperture, Inc.

5530 W. 1st Sq SW
Vero Beach, FL 32968-2254
772-564-9390

NEOS Technologies Inc

4005 Opportunity Dr.
Melbourne, FL 32934
321-242-7818
<http://www.neostech.com>

Neoteric Concepts

1612 Eastlake Way
Weston, FL 33326
954-529-7273
<http://www.neotericconcepts.com>

New Technology Precision Machining, Inc.

15915 Assembly Loop
Jupiter, FL 33478
561-624-3830
<http://www.newtechprecision.com>

Noah Industries, Inc.

751 North Dr., Ste. 1
Melbourne, FL 32934
321-255-2775
<http://www.noahcorp.com>

Nokia Siemens Networks

900 Broken Sound Parkway
Boca Raton, FL 33487
561-923-8515

Nonosphere

12085 Research Dr.
Alachua, FL

Northrop Grumman Electronic Systems

2000 W NASA Blvd
Melbourne, FL 32904
<http://www.dsd.es.northropgrumman.com/laser/index.html>

Northrop Grumman Laser Systems

2787 S Orange Blossom Trail
Apopka, FL 32703
407-295-4010
<http://www.dsd.es.northropgrumman.com/laser/>

Northrup Grumman

1235 Evans Rd.
Melbourne, FL 32904
321-837-7020
<http://essexcorp.com>

Nova Laserlight LLC

7600 Dr Phillips Blvd
Suite 74
Orlando, FL 32819-7231

Ocean Optics Inc

380 Main Street
Dunedin, FL 34698-5314
727-733-2447

Ocean Optics Inc

4202 Metric Drive
Winter Park, FL 32792-6819
407-673-0041

Ocean Optics Thin Films

8060A Bryan Dairy Rd.
Largo, FL 33777
727-545-0741
<http://www.oceanthinfilms.com>

ODI - Ocean Design, Inc.

1026 N Williamson Blvd.
Daytona Beach, FL 32114
386-236-0780
<http://www.odi.com>

Olin Aegis

103 Fontaine St.
Melbourne Beach, FL 32950
321-674-0443

Optek

PO Box 1170
Pinellas Park, FL 33780-1170
727-525-2153

Opnext Inc.

Orange City, FL 32763
386-774-2404
<http://www.opnext.com/>

Optical Imaging, Inc.

6339 Memorial Highway
Tampa, FL 33615-4537
813-888-8024

Optical Integrity

8317 Front Beach Road
Suite 21
Panama City Beach, FL 32407-0000

Optical Polymer Research

5921 NE 38th St.
Gainesville, FL 32609
352-378-1027
<http://www.opri.net>

Optical Process Automation

1110 W Hibiscus Blvd.
Melbourne, FL 32901-2704
321-751-2777

Optical Systems Engineering

1853 Timarron Way
Naples, FL 34109-3319

Opticalliance, Inc.

4736 Jetty St.
Orlando, FL 32917
407-617-7493
<http://www.opticalliance.com>

Optics Professionals LLC

P.O. Box 133
Penfield, NY 14526
800-506-9819
<http://www.opticsprofessionals.com>

Optigrate

3267 Progress Dr.
Orlando, FL 32826
407-381-4115
<http://www.optigrate.com>

Optonetic LLC

6901 TPC Dr., Ste. 420
Orlando, FL 32822
407-857-4410
<http://www.optonetic.com>

Optronic Laboratories

4632 36th St.
Orlando, FL 32811
407-422-3171
<http://www.olinet.com>

OSA Inc.

2519 N. McMullen Booth Rd.
Suite 510
Clearwater, FL 33761-0000

Pall Aeropower Corp.

10540 Ridge Rd
New Port Richey, FL 34654-5129

Pangolin Laser Systems, Inc.

9501 Satellite Blvd., #109
Orlando, FL 32837
407-299-2088
<http://www.pangolin.com>

Panoptic Associates, Inc.

10151 University Blvd.
Suite 230
Orlando, FL 32817-
407-658-2517

Parallax Research, Inc.

PO Box 12212
Tallahassee, FL 32317
850-580-5481
<http://www.parallax-x-ray.com>

PDR-Chiral Inc.

1331A S Killian Dr.
Lake Park, FL 33403
561-841-4195x8
<http://www.pdr-chiral.com>

Pegasus Imaging Corp.

4001 N Riverside Dr.
Tampa, FL 33603
813-875-7575
<http://www.pegasusimaging.com>

Photon Kinetic Systems

719 Casey Key Road
Nokomis, FL 34275
813-485-4743

Piezo Technology

2525 Shader Rd.
Orlando, FL 32854-7859
407-298-2000

Plasma-Therm, Inc.

10060 16th Street North
St. Petersburg, FL 33716-4219
727-577-4999
<http://www.plasmatherm.com/>

Polara, LLC

1070 Schaffer Trail
Oviedo, FL 32765-
407-359-1460

Posong Inc.

318 74th Ave. NE
St. Petersburg, FL 33716
727-527-6282
<http://www.posonginc.com>

Precision Optical Plating

743 Northgate Blvd
Sarasota, FL 34234
941-355-5784

Precision Resistor Co., Inc.

10601 75th St. N
Largo, FL 33777-1427
727-541-5771
<http://www.precisionresistor.com>

Product Design Solutions

3220 Oak Brook Lane
Eustis, FL 32736
352-483-1244
www.productdesigns.com

Pukoa Scientific LLC

257 Plaza Dr Ste B
Oviedo, FL 32765

Pyramid Imaging LLC

615 Bannockburn Ave. N
Tampa, FL 33617
813-984-0125
<http://www.pyramidimaging.com>

Quality Thin Films Inc

141 Burbank Rd.
Oldsmar, FL 34677
813-855-1900
<http://www.qtf.com>

Quantum Technology Inc

108 Commerce St., Unit 102
Lake Mary, FL 32746-6212
407-333-9348
<http://www.quantumtech.com>

Rave Llc

430 S Congress Ave Ste 7
Delray Beach, FL 33445-4678

Raydiance Inc

12565 Research Parkway
Suite 300
Orlando, FL 32826
321-231-8475

Raydiance Inc

2602 Challenger Tech Court
Suite 240
Orlando, FL 32826
407-515-3180
<http://www.raydiance-inc.com>

Ray Williams Consulting

4984 Wellbrook Drive
New Port Richey, FL 34653-5611
727-372-0346
<http://www.ray-optics.com/>

RCI Media Group

550 Heritage Dr., Suite 200
Jupiter, FL 33458
561-686-6800

Redlake

1202 E Park Ave.
Tallahassee, FL 32301
542-547-2772
<http://www.redlake.com>

Reliant Technologies, Inc.

3484 Torremolinos Avenue
Doral, FL 33178

Riegl Usa Inc

7035 Grand National Dr., #100
Orlando, FL 32819
407-248-9927
<http://www.rieglusa.com>

Rini Technologies, Inc.

3267 Progress Drive
Orlando, FL 32826
407-384-7840
<http://www.rinitech.com/>

Robertson Optical Laboratories

2506 Taylor Avenue
Orlando, FL 32806-4428
407-649-2149

Satellite Electronics Engineering, Inc.

4892 Outlook Dr
Melbourne, FL 32940-2334
813.855.8687

Schott Glass Technologies, Inc.

816 Tomlinson Terrace
Lake Mary, FL 32746
407-324-0047

Science Applications International Corp

13432 156th St. N
Jupiter, FL 33478-8521

Scientific Glass Of Florida

201 Northstar Court
Sanford, FL 32771-6674
407-323-5002

Scionix Usa

1720 Natchez Trace Blvd.
Orlando, FL 32818
407-578-6469
<http://www.scionixusa.com>

Semiconductor Diagnostics Inc

3650 Spectrum Blvd Ste 130
Tampa, FL 33612
<http://semiconductordiagnositics.com/>

Sensidyne, Inc.

16333 Bay Vista Drive
Clearwater, FL 33760-3130
727-530-3602
<http://www.sensidyne.com/>

Siemens Power Generation

4400 Alafaya Trail
Orlando, FL 32826

Sinmat, Inc.

2153 Hawthorne Rd., Ste. 129
Gainesville, FL 32641-7553
352-334-7237
<http://www.sinmat.com>

Skyline Broadcast

30 Skyline Dr.
Lake Mary, FL 32746
866-804-1184

Smart Material Corp

Po Box 1115
Osprey, FL 34229-1115

South Coast Fiber Optics

5875 NE 349 Hwy.
Old Town, FL 32680
352-542-8884
<http://www.southcoastfiberoptics.com>

Space Coast Laser, Inc.

191 Greenacre Drive SE
Melbourne, FL 32909-3702

Space Coast Quartz, Inc.

223 Fentress Blvd.
Daytona Beach, FL 32114-1203
904-238-1515

Specs Scientific Instruments

3318 Plantation Dr.
Sarasota, FL 34231
941-362-4877
<http://www.specs.com>

Spectrecology, LLC

551 Baywood Dr. S
Dunedin, FL 34698
727-230-1697
<http://www.spectrecology.com>

Springwood Electronics

3685 Woodridge Pl
Palm Harbor, FL 34684-2472

Stellarnet Inc

14390 Carlson Circle
Tampa, FL 33626
813-855-8687
<http://www.stellarnet-inc.com>

Stratos Lightwave, Inc.

1450 Treeland Blvd. SE
Palm Bay, FL 32909

Suncoast Technologies, Inc.

1625 Timocuan Way, Bldg. 113
Longwood, FL 32750
407-830-8644
<http://www.suncoastnet.net>

Sunoptic Technologies, LLC

6018 Bowdendale Ave.
Jacksonville, FL 32216-6042
904-737-7611
<http://www.sunoptictech.com>

Sunrise Optical LLC

5352 NW 93rd Terrace
Sunrise, FL 33351
954-654-1734
<http://www.zebraoptical.com>

Surgilight Inc.

2100 N. Alafaya Trail, Suite 600
Orlando, FL 32826
407-482-4555
<http://www.surgilight.com>

Swiss Tec, LLC

2212 Belle Chase
Tampa, FL 33634
813-871-0582
<http://www.swisstecag.com>

Switch And Data

1715 N Westshore Boulevard
Suite 650
Tampa, FL 33607
8132077722

Sycoleman

Po Box 190
Shalimar, FL 32579-0190

Sypris Test & Measurement

6120 Hanging Moss Rd.
Orlando, FL 32807
407-678-6900
<http://www.calibrationandrepair.com>

Teamwise Limited

12898 Hyland Circle
Boca Raton, FL 33428-4858
561-909-0250

Technical Systems Integrators

500 Winderley Pl., Ste. 108
Maitland, FL 32751
407-339-4874
<http://www.tsieda.com>

Tecport Optics Inc

6901 TPC Blvd., Ste. 450
Orlando, FL 32822
407-855-1212
<http://www.tecportoptics.com>

Tensolite Company

100 Tensolite Dr.
Saint Augustine, FL 32092
904-829-5600
<http://www.tensolite.com>

Thermocarbon, Inc.

391 Melody Lane
Po Box 181220
Casselberry, FL 32718-1220
407-834-7800
<http://www.dicing.com>

Tower Optical Corp

3600 S Congress Ave., Unit J
Boynton Beach, FL 33426
561-740-2525x17
<http://www.toweroptical.com>

Transitions Optical

9251 Belcher Rd
Pinellas Park, FL 33782

Tri-Tronics Co., Inc.

7705 Cheri Court
Po Box 25135
Tampa, FL 33622-5135
813-886-4000
<http://www.ttco.com>

Trion Technology

2131 Sunnydale Blvd.
Clearwater, FL 33765
727-461-1888
<http://www.triontech.com>

Triple Play Communications

321-243-2671
www.3playcomm.com

Triquint Optoelectronics

1818 South Highway 441
Apopka, FL 32703
407-884-3404

TTL Automation

6398 Danner Dr., Bldg. E
Sarasota, FL 34240
941-379-8262
<http://home.earthlink.net/~ttl1/>

Turbocombustor Technology, Inc.

3651 SE Commerce Ave.
Stuart, FL 34997

Twinstar Optics

6741 Commerce Ave.
Port Richey, FL 34668
727-847-2300
<http://www.starstar.com>

Ultrafast Systems

1748 Independence Blvd.
Suite G-6
Sarasota, FL 34234
941-360-2161
<http://www.ultrafastsystems.com>

Unaxis Usa, Inc.

10050 16th St. N
St. Petersburg, FL 33716
727-577-4999
<http://www.semiconductors.unaxis.com>

Vectronix Inc

2789 Wrights Rd Ste 1021
Oviedo, FL 32765-8528

Video Display Corp.

7177 N Atlantic Ave.
Cape Canaveral, FL 32920
321-784-4427
<http://www.vdcdisplayssystem.com>

Vision Contol, Inc.
6327 S. Orange Avenue
Orlando, FL 32809-5109
407-851-2780

Vision Engineering Labs
8787 Enterprise Blvd.
Largo, FL 33773-2702
727-812-2035

Vision Engineering, Inc.
108 Surf Drive
Cocoa Beach, FL 32931-3310

Vistakon Inc
7500 Centurion Pkwy
Jacksonville, FL 32256
904-443-3093

VLOC
7826 Photonics Dr.
New Port Richey, FL 34655
727-375-8562
<http://www.vloc.com>

Wafer World, Inc.
1100 Technology Place, #104
West Palm Beach, FL 33407
561-842-4441
<http://www.waferworld.com>

World Precision Instruments, Inc.
175 Sarasota Center Blvd.
Sarasota, FL 34240
941-371-1003
<http://www.wpiinc.com>

Zaubertek, Inc.
1809 E Broadway St., #313
Oviedo, FL 32765
407-977-5583
<http://www.zaubertek.com>

Consultants

David G. Stites
8401 Ninth St. N, Ste. 250
St. Petersburg, FL 33702
727-735-1022
<http://www.totalopticsolutions.com>

James Carter Optical Consulting
141 Lee St.
Indialantic, FL 32903-2307

Perioperative Education Consultant
6301 Heritage Ln
Bradenton, FL 34209-7053

Ray Williamson Consulting
4984 Wellbrook Dr.
New Port Richey, FL 34653-5611
727-534-7964
<http://www.ray-optics.com>

Williams Consulting
3675 Big Pine Road
Melbourne, FL 32934-0000

Stephen Hornell Md
333 E Sheridan Rd
Melbourne, FL 32901-3152

Specialty Publishers

CRC Press
6000 Broken Sound Pkwy Nw Ste 300
Boca Raton, FL 33487-2713
561-998-2525

Taylor & Francis, Llc
6000 Broken Sound Pkwy.
Suite 300
Boca Raton, FL 33487
800-272-7737
<http://www.crcpress.com>

ICD Publishing
2932 Cove Trail
Winter Park, FL 32789-1159
407-629-5370
<http://www.jcdpublishing.com>

Specialty Services Providers

Opticus IP Law PLLC

7791 Alister Mackenzie Dr
Sarasota, FL 34240-8708
941-378-2744

Tampa General Hospital

12521 River Birch Drive
Riverview, FL 33569

Waterman Med. Center

1290 Waterman Way
Tavares, FL 32778-5229

Hospitals and Medical Institutions

Apple Medical Incubator Inc

1448 Pelican Bay Trl
Winter Park, FL 32792

Bellissimo Medical Cosmetic Enhancement, Inc.

4800 Lupo Lane
Sw Ranches, FL 33330

Brevard Surgery Center

665 Apollo Blve
Melbourne, FL 32901

Comprehensive Health Services, Inc.

1724 Harbor Drive
Merritt Island, FL 32952

Dermatology Associates Of Tallahassee

1707 Riggins Rd.
Tallahassee, FL 32309

Helen Ellis Memorial Hospital

3624 Galway Dr
New Port Richey, FL 34652

Laser Hair & Scalp Clinic

13555 Automobile Blvd
Suite 110
Clearwater, FL 33762-3826

Sarasota Memorial Hospital

1700 S Tamiami Trl
Sarasota, FL 34239-3509

Shands Hospital / University Of Florida

1600 SW Archer Rd.
Box 100366, Rm G015
Gainesville, FL 32610-0366

Shands Hospital / Jacksonville, Cc- Or

655 W 8th Street
Jacksonville, FL 32209-6511