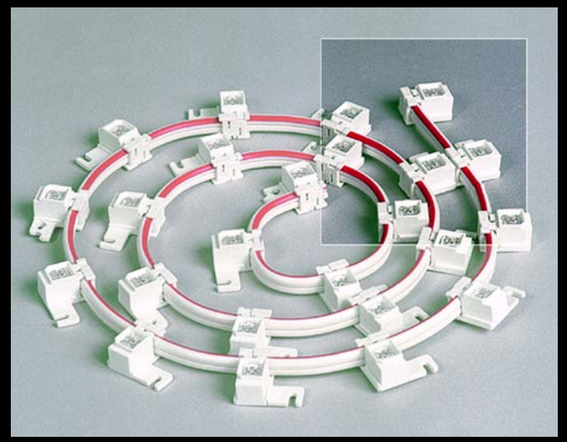
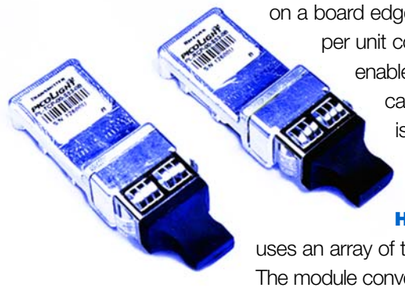


Don't let what you cannot do interfere with what you can do.

—John Wooden

Parallel arrays of diode lasers, called vertical-cavity surface-emitting lasers (VCSELs), enable communications system designers to break slower copper-interconnect bottlenecks. These devices significantly boost backplane speed in short-distance applications. However, early implementations had difficulty ramping up to the needed volume. Here is a product that reliably and cost-effectively improves backplane speed.

Magnus™



How It Helps: The Magnus Parallel Optical Interconnect allows communications system designers to cost-effectively and reliably improve backplane speed in short-distance applications. The device delivers huge improvements in the most critical of today's datacom metrics: more gigabits per linear inch on a board edge; more gigabits per Watt of power consumed; more gigabits per unit cost. In addition, its pluggable, connector-based design enables manufacturers to provide bandwidth on demand, upgrading cards in the field with the snap-on optics. The device's footprint is only twice the size of the industry-standard 1 Gb/s small form factor transceiver.

How It Works: The Magnus Parallel Optical Interconnect uses an array of twelve 850-nm VCSELs capable of 40 Gb/s transmission. The module converts 12 electronic signals of up to 3.125 Gb/s each into optical signals, and launches them into a fiber ribbon cable 1 cm wide. Since the transceiver is based on multimode fiber, it is intended for transmission lengths of up to 1,000 feet. In the transmitter module, digital electrical signals flow through the electrical connector, through a circuit board, and into a laser driver integrated circuit. The circuit translates the digital data into small current pulses to drive the VCSEL array. The light beams from the VCSEL array are aligned into the fiber ribbon, which guides them to the receiver module. At the receiver, the functions of the transmitter take place in reverse order.

How Much It Will Cost: Prices for the interconnect modules start at $1,000 per transmitter/receiver pair in low manufacturing volumes. The product ultimately will sell for much less than that in high volume.

When It Will Be Ready: The product is available now. It works well for very short distance data transfer as well as for metropolitan area access applications. Vendors of routers and telecommunications switches have purchased it.

Who Is Working On It: The innovator is Picolight Corporation. Founded in 1995 by technical officer Jack Jewell and chief executive Stan Swirhun, the company makes VCSEL-based fiber-optic transceiver components and subsystems for telecommunications switches, storage area networks, and enterprise networks. In mid-2002, it completed its fourth round of funding, raising $27 million from institutional investors. Investment in Picolight now totals $80 million. The company employs 100 people and occupies space in Boulder and Louisville, Colorado. The Boulder facility, which serves as the company's headquarters, totals 37,000 square feet. The Louisville facility is 30,000 square feet and can be expanded. For more information, contact Jack Jewell of Picolight at (303) 530-3189 or jack.jewell@picolight.com. The company Web site is www.picolight.com.

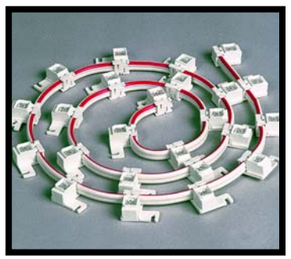
MDA Origins

BMDO played a major role in helping Picolight develop the base technology used in this product and others. From 1996 to 1998, Picolight won seven SBIR Phase I and four Phase II contracts to research VCSEL-based laser technology, the same technology used in the parallel optical interconnect module. BMDO was interested in advancing the development and manufacturing of this technology because it could significantly improve the quality and speed of fiber communications systems used in missile defense.

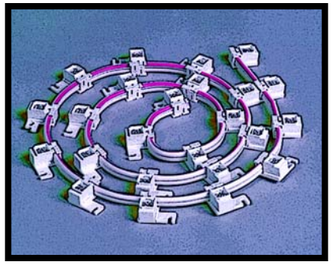
Big neon letters create eye-popping displays that attract customers to strip malls, restaurants, grocery stores, and retail establishments. But the neon bulbs are not energy efficient and are difficult to maintain—excessive vibrations cause them to break frequently. Here is a product that provides a better solution for outdoor displays.

Tetra™

How It Helps: The GE Tetra LED System is more durable and up to 80 percent more energy efficient than standard neon tubes used in outdoor displays. It can also last up to 100,000 hours while delivering maximum efficiency and the same high light output as clear red neon. Longer life means fewer system changes, lower maintenance costs, and fewer disruptions due to burned out tubes. The forward-facing light-emitting diodes (LEDs) are placed in flexible packaging for easy installation in new or retrofit applications. These devices also are more resistant to vibrations than neon tubes.



How It Works: The GE Tetra LED System uses ultrabright LEDs made from aluminum-indium-gallium-phosphide (AlInGaP) and indium-gallium-nitride (InGaN) materials. A metal-organic chemical vapor deposition system called TurboDisc™ is used to fabricate AlInGaP and InGaN wafers. The TurboDisc system is vacuum-loadlocked and uses a high-speed, rotating substrate holder. To produce an epitaxial layer, feed gases are introduced into the reaction chamber, where high temperatures dissociate the gases into constituent elements. These newly liberated reactants combine at the substrate wafer surface, where the proprietary TurboDisc geometry ensures uniform temperature and reactant gradients to form the compound layers.



How Much It Will Cost: The price of the GE Tetra LED System varies, depending on the size and length of the channel letter signage.

When It Will Be Ready: This product is available now. It is being sold for outdoor use only. LED colors include red, blue, cyan, green, red-orange, and yellow-amber. It is shipped in reels that can be cut to size on location. In one notable application, numerous strands of GE Tetra LED Systems were placed on the National Christmas Tree, displayed in Washington, D.C.

Who Is Working On It: GELcore, LLC, a joint venture between GE Lighting and EMCORE Corporation, developed this product. Founded in 1999, the company develops, manufactures, and markets LED-based lighting solutions. In addition to the GE Tetra LED System, its product line includes LEDs for traffic signals, indoor signage, automotive displays, and specialty lighting applications. GELcore has more than 200 employees and occupies more than 100,000 square feet of office space and development/manufacturing facilities. For more information, contact Alex Franco of GELcore at (216) 606-6612 or alex.franco@gelcore.com. The company Web site is www.gelcore.com.

MDA Origins

Through several SBIR contracts, BMDO funded early work at EMCORE to optimize the TurboDisc system for gallium arsenide film growth, and later funded EMCORE's initial research on group III-V compound semiconductors, most notably GaN. BMDO was interested in these components for many uses, including high-temperature electronics, display technologies, ultraviolet laser diodes, devices for the detection and recognition of spacecraft, and space communications.

A university has campus facilities spread all over a major metropolitan area. Digging up streets or purchasing rights-of-way and laying fiber-optic lines from one building to the next would be prohibitively expensive and could take years. Here is a product that quickly establishes an affordable, robust, high-speed, and high-bandwidth telecommunications network.

FlightSpectrum™

How It Helps: The FlightSpectrum free space optics system is fiber-optics without the fiber. Free space optical communication is both a substitute for and a supplement to fiber-optic cable links. In either case, deployment of free space optical equipment is a cost- and time-effective approach that has the additional advantage of redeployment flexibility (or no permanent fixed infrastructure). Because free space optical equipment operates at frequencies above 300 GHz, it requires no licensing in the United States. Some of its applications would be impossible to duplicate with fiber optics, such as ship-to-port, dirigible-to-station, or terrestrial point-to-point communications, where laying cable is prohibited for regulatory or political reasons.

How It Works: The FlightSpectrum free space optics system incorporates three high-powered lasers, separated from each other by approximately 200 mm and individually operating at 1,550 nm wavelength. These lasers safely transmit signals through air to multiple, spatially separated, large-aperture receiving lenses. Transmitting and receiving equipment is combined in a "transceiver," which can be stationed at any convenient space, such as on a rooftop or even in an office behind a window. The technique of separating the laser beams is called "spatial diversity" and it solves problems of atmospheric turbulence and dense fog. FlightSpectrum is protocol-independent equipment and provides carrier-grade reliability at a data transfer rate of OC-48 (2.5 Gb/s) through dry air at distances of up to one kilometer.

How Much It Will Cost: Costs per pair of FlightSpectrum transceiver units varies, depending on desired reliability, transfer data rate, and management software: $15,000 to $20,000 for 20 Mb/s; $20,000 to $25,000 for 155 Mb/s; and $100,000 for 2.5 Gb/s.

When It Will Be Ready: The product is available now. The manufacturer meets customer demands for communications equipment directly and also indirectly through service providers. Company products accommodate any protocol, connect to existing network equipment, and require no licensing.

Who Is Working On It: LightPointe Communications, Inc., developed this product. In 2000, LightPointe moved its San Diego headquarters to a new location in the city, a 27,000-square-foot building that also will serve as a manufacturing facility for North American customers. Currently, however, a majority of the manufacturing is done at a subsidiary (LightPointe Europe, GmbH) in Dresden, Germany, at a 30,000-square-foot facility. The company also maintains a development laboratory called the Advanced Networking Lab in Boulder, Colorado. LightPointe employs 90 to 100 full-time-equivalent people. For more information, contact Jeff Bean of LightPointe at (858) 643-5200 or jbean@lightpointe.com. The company Web site is www.lightpointe.com.

MDA Origins

LightPointe traces FlightSpectrum's origins back directly to research funded by BMDO in 1998 to 2000. In 1999, BMDO awarded an SBIR Phase I contract to LightPointe for a digital radio backup system for multi-Gb/s terrestrial laser communications links. In 2000, BMDO awarded a follow-on Phase II contract to design a transceiver that combined both terrestrial laser and radio backup functions. Today, the radio frequency backup is used as an out-of-band management device.

PI-200

A petroleum company blends a variety of chemicals to produce different grades of gasoline. But to measure the makeup of each final product, samples must be taken and then transported from the field to the lab for detailed analysis—a process that can take up to eight hours, slowing gasoline production. Here is a product that performs real-time monitoring of chemicals.

How It Helps: The PI-200 Raman Analyzer allows real-time analysis of chemical concentrations in sample streams, which can significantly improve quality control and process monitoring for industrial users. Compared with conventional equipment, the PI-200 is more rugged and can be used in many different industrial environments. Its compact design makes it suitable for field use, and the elimination of moving parts makes it low maintenance. Moreover, the analyzer's design can be used with any existing high-power diode laser, giving the system a large wavelength selection and, therefore, greater flexibility in detecting materials.

How It Works: The key to the PI-200 Raman Analyzer is an external-cavity-stabilized, narrow linewidth, near-infrared diode laser that offers high power and long life. In the analyzer, laser light is focused into an excitation fiber connected to a remote Raman sample cell. Inside the cell, the light interacts with the sample to be characterized. Raman scattered light emanating from the sample is guided down one or more collection fibers to the Raman spectrometer. The spectrometer passes the optical signal through a filter, an optical slit, and a diffraction grating. The signal is then transmitted to a charge-coupled device, which converts the optical signal into an electronic one. A computer analyzes the electronic signal and converts it into a graphical representation of the chemical analysis of the sample stream.

How Much It Will Cost: A laboratory version of the PI-200 costs about $80,000, while a process control system using the device will cost more than $120,000. A less sophisticated model for educational and quality control applications, called the PI-20, costs around $33,000.

When Will It Be Ready: The analyzer is available now and can be purchased through six U.S. sales representatives as well as dealers in Europe and Japan.

Who Is Working On It: Process Instruments, Inc., developed the analyzer. Founded in 1994, the privately held company develops Raman spectroscopy instrumentation specifically for industrial process monitoring. Process Instruments currently employs eight people and occupies about 5,000 square feet of development and manufacturing space in Salt Lake City, Utah. For more information, contact Dr. Lee Smith of Process Instruments at (801) 322-1235 or lsmith@process-instruments-inc.com. The company Web site is www.process-instruments-inc.com.

MDA Origins

Process Instruments developed the PI-200 through BMDO SBIR Phase I and II contracts in 1998 and 1999. Raman spectroscopy instruments could prove valuable for quality control and process monitoring during the manufacture of key components for terrestrial and space-based ballistic missile systems. In 2001, BMDO awarded Process Instruments an SBIR Phase I contract to further develop its Raman spectroscopy system for testing the chemical state of new and aging rocket motors. Rapid, in situ determination of solid rocket propellant chemistry could greatly reduce the need for destructive testing.