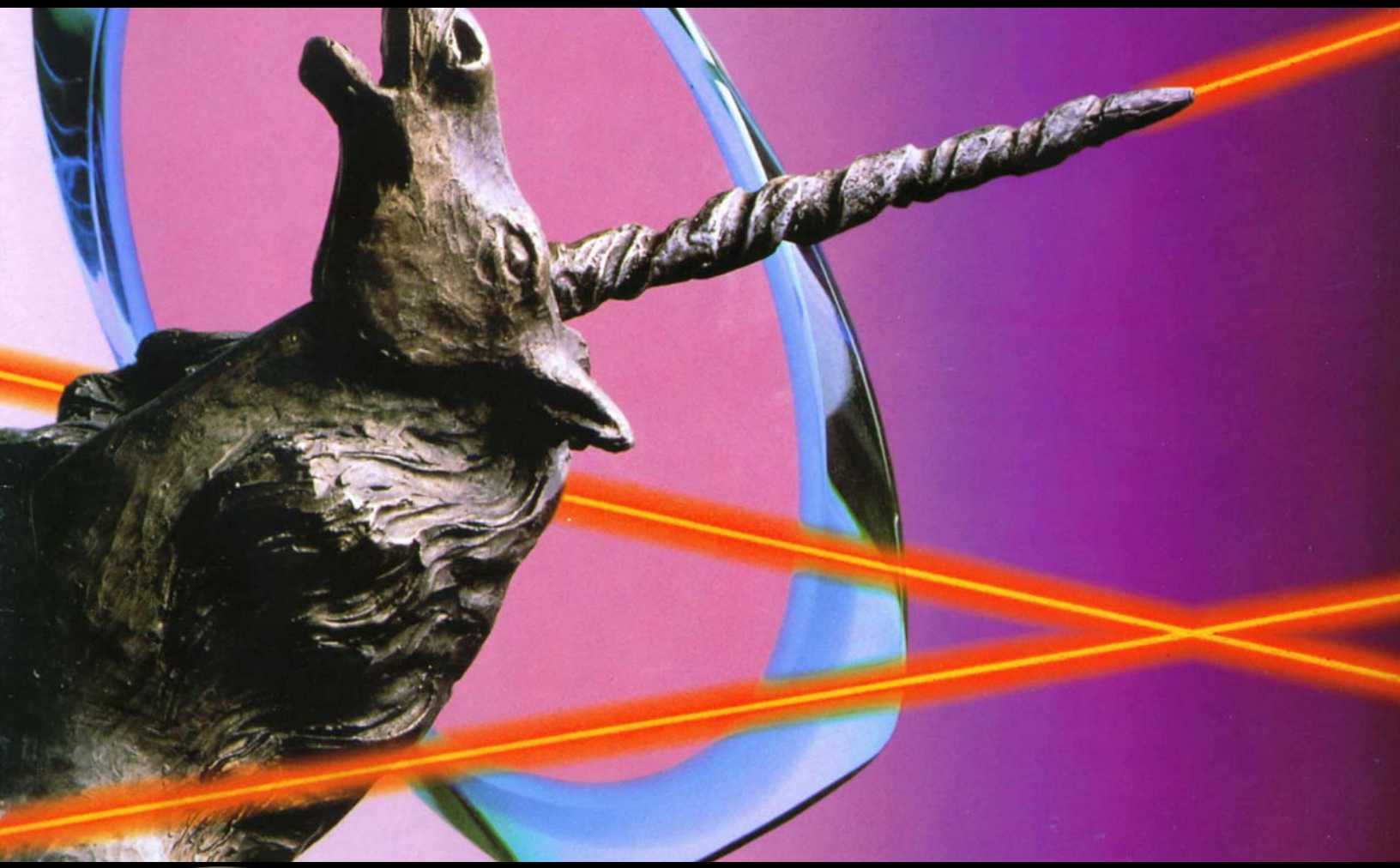
KIGRE, INC.

Laser Transmitters & Components



KIGRE, INC. DPSS GLASS LASERS

KIGRE, INC.

KIGRE, INC.

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KIGRE, INC.

Laser Transmitters & Components

Leading The Way

In the world of high technology, where new companies suddenly appear and disappear with alarming frequency, Kigre, Inc. has thrived and grown until today is one of the better established and robust organizations of its kind in America.

The business of Kigre, Inc. is developing and manufacturing laser-related components of the very highest quality for original equipment manufacturers worldwide. Consequently, Kigre-made components can be found in most laser-based equipment and apparatus thought the world – from simple rangefinders to sophisticated medical devices to leading-edge high energy fusion research apparatus.

Founder John D. Myers & Kigre, Inc. 30,000 sq. ft Hilton Head Island Manufacturing Facility

The fact that Kigre conducts its business well is reflected by Kigre's steady growth. It has achieved success without compromising the spirit of invention and innovation that propelled it from the start – a fact manifested by the breakthrough technology which continues to flow from is research facilities year after year.

Partners in Progress

But Kigre's innovation is not merely confined to technology. The company is also leading the way in the manner in which it services its customers. In an age where lasers are becoming commonplace, Kigre has recognized the need to provide non-laser oriented manufacturers with the ability to pre-test and prove potential laser applications before bringing them to market.

Thus, Kigre engages in development partnerships with its customers – opening its laboratories and work-shops to firms without appropriate research and testing capabilities of their own – allowing them to explore new product opportunities that might otherwise elude them. These development activities can include everything from on-site formulation and casting of esoteric laser glass to the brass-boarding of unique or down-sized laser system configurations, or even the bread-boarding of specialized electronic control circuitry.

KIGRE, INC.
Laser Transmitters & Components

Kigre's technological credentials are not only reflected in its impressive product line, but also in the wealth of original inventions and technological enhancements which has marked its growth over the years. Proof of Kigre's impact on the solid-state laser industry is the list of early accomplishments by founder John D. Myers and both American and foreign patents which the company has been awarded.

Date	Name	Achievement
1959	John D. Myers	First stroboscopic X-Ray system at Pennsylvania State University. Precursor to X-ray LASER.
1961	John D. Myers	First Q-switched Ruby LASER at Cornell Aeronautical Laboratory
1964	John D. Myers	First field demonstration of a Ruby LASER rangefinder at Cornell Aeronautical Laboratory
1964	John D. Myers	First demonstration of LASER propulsion.
1965	John D. Myers	First Gigawatt (world record) Ruby Laser at Lear Siegler Laser System Center.
1965	John D. Myers	First dual frequency LASER ceilometer at Lear Siegler Laser System Center.
1965	John D. Myers	First frequency-doubled LASER rangefinder at Lear Siegler Laser System Center.
1966	John D. Myers	First plane position indicating LASER radar at Lear Siegler Laser System Center.
1967	John D. Myers	First commercial Nd:Glass LASER rod at Owens-Illinois.
1967	John D. Myers	First Gigawatt Nd:Glass LASER oscillator/amplifier system at Owens-Illinois.
1969	John D. Myers* Carl Sulter** Tom Crow***	Invention of samarium filters for Nd:YAG lasers at *Owens-Illinois, **Hughes Aircraft & ***Martin Marietta.
1974	John D. Myers	US Patent No.3,842,368 Hybrid Laser Structures at Owens-Illinois
1978	John D. Myers Charles Vollers	US Patent No.4,075,120 Laser Phosphate Glass Compositions (Q-88) at Kigre.
1981	John D. Myers Charles Vollers	US Patent No.4,248,732 Laser Phosphate Glass Compositions (Q-88*) at Kigre

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1982	John D. Myers Charles Vollers	US Patent No.4,248,732 Laser Phosphate Glass Compositions (QE-7) at Kigre
1982	John D. Myers Charles Vollers	US Patent No.4,333,848 Athermal Laser Glass Compositions (Q98/100) at Kigre, Inc.
1985	John D. Myers	Canada Patent No.1,229,135 Laser Device and Method (Eye Surgery) at Kigre, Inc.
1985	John D. Myers	US Patent No.4,525,842 Laser Device and Method (MK Lasers) at Kigre, Inc.
1985	John D. Myers	First commercial LASER eye surgery device and method, US patent No. 4,525,942 and UK patent No. GB 2 157 483 A at Kigre, Inc.
1986	John D. Myers	US Patent No.4,601,288 Laser Device and Method (Eye Surgery) at Kigre, Inc..
1987	John D. Myers	UK Patent No.2,191,629 Q-switched Laser Device and Method at Kigre, Inc.
1988	John D. Myers	US Patent No.4,770,811 Sensitized Laser Glass (QE-7S) at Kigre, Inc.
1988	John D. Myers	UK Patent No.2,157,483 Laser Devices (MK Lasers) at Kigre, Inc.
1989	John D. Myers Charles Rapp	US Patent No.4,849,002 Ion-Exchange Germanate Glass at Kigre, Inc.
1989	John D. Myers	US Patent No.4,875,920 Ion-Exchange Phosphate Glass at Kigre, Inc.
1991	John D. Myers William Zhong	US Patent No.5,053,360 Ion-Exchangeable Phosphate Glass at Kigre, Inc.
1991	John D. Myers	US Patent No.5,164,343 Ion-Exchange Phosphate Glass at Kigre, Inc.
1993	John Harwick	US Patent No.5,202,892 Pulse Forming and Delivery System at Kigre, Inc.
1994	John Myers	US Patent No.5,322,820 Athermal Laser Glass Composition at Kigre, Inc.
1994	Ruikun Wu He Huiuan He Jianrong	US Patent No.5,278,852 Intra-Cavity High Order Harmonic Laser at Kigre, Inc.

1995	John D. Myers	US Patent No.Des.351,911 Medical Control Console for a Laser at Kigre, Inc.
1995	Michael J. Myers Ken Kowalyk	US Patent No. 5,456,603 Dental Laser Apparatus and Method for Treating Tooth at Kigre, Inc.
1996	David Myers Gerald Rickel	US Patent No.5,523,883 Field Adjustable Beam Splitter at Kigre, Inc.
1996	Michael J. Myers Ken Kowalyk	US Patent No. 5,554,029 Dental Laser Apparatus and Method for Ablating Dental at Kigre, Inc.
2004	John D. Myers Michael J. Myers	US Patent No. 6,693,924 B2 Optical Fiber Laser Structure and Systems at Kigre, Inc.
2005	John D. Myers Michael J. Myers	US Patent No. 6,911,160 Phosphate Glass for use in the manufacture at Kigre, Inc.
2005	John D. Myers Michael J. Myers	US Patent No. 6,931,032 B2 Method of transferring energy at Kigre, Inc.
2006	John D. Myers Michael J. Myers	US Patent N0. 7,042,915 Fiber Laser with Clad-Core Energy at Kigre, Inc.

The Anatomy Of Kigre

The continuing growth and expansion of Kigre, Inc. has resulted in a number of organizational changes over the years. Presently, the company is composed of three primary working groups all supported by a central administrative, marketing and sales staff. The groups are:

- **The Specialty Glass Group**
- **The Laser Components Group**
- **The Laser Transmitter Group**

As their name suggest, the focus of each group is highly specialized. However, because all of the groups also participate in Kigre's ongoing research and development activities, they are interactive in terms of day-to-day operations.

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Laser Transmitters & Components

The Specialty Glass Group

It is in the field of laser glass where Kigre first established its reputation as an innovative leader in solid-state laser technology. In the early 1970's, Kigre acquired the basic patents and won industry attention by developing high-gain, platinum –free, phosphate laser glasses with optical and damage resistant properties not thought possible only a few years earlier. Today, that tradition of pace-setting technological leadership remains alive and well in the Specialty Glass Group.

The Group's list of technological breakthroughs is long and impressive. Among the most commercially successful is the development of sensitize Erbium-doped, phosphate glass (QE-7S) capable of lasing at a wavelength of 1.535 microns – the "eye-safe" region in the infrared portion of the spectrum. The patented material was enthusiastically adopted by OEMs for field-safe laser range finder applications.

To sustain its leadership in the manufacture and development of platinum-free, high-gain laser glass, Kigre maintains one of the most unique and best equipped specialty glass melting facilities in the world.

The entire complex of pre-heaters, optical melters, casing equipment, fiber draw towers and annealers is installed in a sealed "dry" area which can be maintained at humidity levels as low as 10 percent. The chemical batching area also shares this carefully controlled environment. Consequently, both the harmful presence of water in rare earth-doped glasses and collateral contamination are significantly reduced. To further guard against contamination, Kigre also utilizes proprietary chemical purification techniques to purify and prepare the starting chemicals which ultimately are converted into laser and filter glasses.

KIGRE, INC.
Laser Transmitters & Components

The Laser Components Group

It is the task of the Laser Components Group to develop, test and manufacture nearly all of the wide variety of laser parts and subassemblies which Kigre manufactures. These include everything from laser gain elements, pump cavity filter flow tubes, pump cavity reflector assemblies, Q-switch cells and other laser resonator subassemblies.

Within the Laser Components Group are the laser glass fabrication, machining and polishing departments as well as Kigre's expanded machine shop, applications laboratory and prototype modeling facility.

Because the Laser Components Group's laser glass machining and polishing section is immediately adjacent to Kigre's Specialty Glass Group, over the years the two Groups have been able to work in tandem to develop not only advanced glass formulations, but also significantly improve glass fabrication techniques. The result is glass fabricated components of unmatched quality and precision.

Kigre's glass fabrication capabilities are significantly enhanced because of the improved strength Kigre chemists have imbued into many of Kigre's laser glass materials. Not only does this added strength significantly extend the operational life of finished glass components, but it also makes possible more precise glass boring and milling operations. Consequently, Kigre is able to maintain exceptionally close tolerances not easily obtained by other manufacturers.

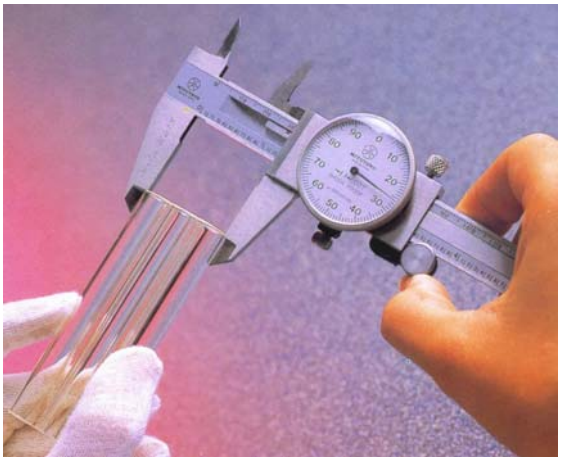
KIGRE, INC.
Laser Transmitters & Components

Kigre Solid-State Laser Subassemblies

Kigre offers a variety of solid-state laser subassemblies for use in leading-edge laser-powers applications. And because of its ongoing research into improved laser glass materials, Kigre is able to quickly incorporate many of these material advances into its products. This willingness to reconfigure an available component for a specific customer application (or to prototype a completely new subassembly) is what makes Kigre the primary solid-state laser component supplier of choice to OEMs around the world.

Optimum Quality Control

One-hundred percent quality assurance at Kigre begins as soon as raw materials arrive at the door, continues through the fabrication and assembly process, and ends only when the Kigre-built component leaves the shipping department. Such step-by-step inspection is critical in such a close tolerance, high tech business. Consequently, Kigre's quality assurance program is ISO-9000 format traceable and easily meets nearly every military specification including:



- **MIL-I-45208A Inspection System Requirements**
- **MIL-STD-45662 Calibration**
- **MIL-Q-985A Quality Program Requirements**
- **MIL-O-13830 Optical Components for Fire Control**
- **MIL-STD 810C Environmental Testing**
- **MIL-G-174B Glass, Optical Elements**
- **MEL 73-001227 Inspection Procedures for Glass & Crystal Lasers**

While all Kigre's products are tested in accordance with the above provisions, additional measures are taken into account when needed to conform to the US Food and Drug Administration, Good Manufacturing Practices (FDA GMP) requirements under CDRH 1040.10 and the Compliance Guide for Laser Products, HHS Publication FDA 86-8260. With this multi-level system for quality assurance, Kigre can insure a high level of quality to all customers as a fair price. This allows Kigre to provide additional documentation within the same framework, for a reasonable additional cost, to those customers who require it.

KIGRE, INC.
Laser Transmitters & Components

The Laser Transmitter Group

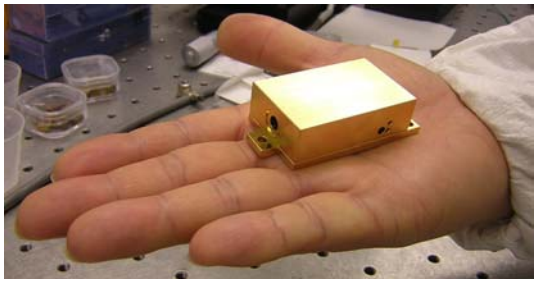
The Laser Transmitter Group at Kigre maintains a 1,200 sq. ft. Class 10,000 clean room to assure a contamination-free environment for assembly and testing of sensitive laser components and subassemblies. The specially designed facility includes eight Class 100 workstations and plus hooded areas for specialized electronic, chemical and materials fabrication and processing.

Kigre's complete state-of-the-art laser and electronics laboratories serve a double function. On the one hand, they are part of the ongoing research and development program. Simultaneously, the labs also function as a production facility for laser transmitter-oriented optical and electronic components.

Kigre's fully equipped machine shop is primarily utilized to both service the great variety of machines and equipment throughout the plant as well as to custom manufacture prototype mechanical devices to support the companies research and development activities. The shop is also capable of providing secondary manufacturing operations when necessary.

Kigre has recently developed a family of next generation micro-lasers for use in enhanced laser surveillance and detection systems. The first products in this family are new innovative eye-safe laser devices that utilize a unique diode pumping architecture. The diode pumping design provides a foundation for compact reliable high power/high gain laser devices an order of magnitude lighter, smaller, more efficient and less expensive than the existing state-of-the-art. New and retrofit applications for these devices abound.

The significant performance improvement in these **H**igh **E**fficiency **S**ide **P**umped (**HESP**) **D**iode **P**umped **S**olid **S**tate (**DPSS**) lasers is due in large part to the invention of a new generation of athermal high-gain laser glass materials and innovative conduction cooled packages that portends long diode lifetime at high power levels with minimal thermal conditioning requirements.



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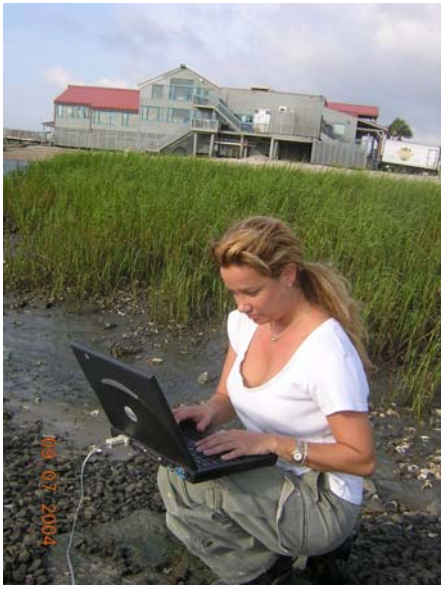
Laser Transmitters & Components

HESP laser technology will enhance both old and new commercial products and government programs. Numerous defense contractors have already initiated the integration of the small high power diode pumped solid-state lasers into various laser programs. Examples of some of these applications are summarized below.

BAE is building the NLOS-C is a 23-ton, 155mm, high-caliber, self-propelled cannon system developed for the U.S. Army under the Future Combat System (FCS). The system includes a Breach Mount Laser Ignition System (BMLIS) fire control that provides for the automated high repetition rate firing of munitions from remote locations.

Field portable remote chemical detection/analysis systems may now employ eye-safe HESP lasers. Portable LIBS (Laser Induced Breakdown Spectroscopy) systems use lasers, laptop computers and fiber spectrometers for real-time material analysis without sample preparation.



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Laser Transmitters & Components

The Future Combat System (FCS) Unmanned Air Vehicle (UAV) Organic Air Vehicle (OAV). is designed to operate from the battlefield, by the field troops. The reconnaissance, surveillance and target acquisition (RSTA) payload may include a HESP eye-safe laser range-gated imaging system. Potential contractors include FLIR, Northrop Grumman, General Dynamics, BAE, and Honeywell.

Northrop Grumman's Mini Eye-safe Laser Infrared Observation Set (MELIOS) is a lightweight hand held laser rangefinder.

Raytheon's Long Range Advanced Scout Surveillance System (LRAS3) multi-sensor system is used on the U.S. Army's scout vehicles.

The M1 Abrams Main Battle Eye-safe Laser Rangefinder (ELRF) is supplied by Northrop Grumman.

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