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## 20 Years of Innovation

Optics Manufacturing and the 21<sup>st</sup> Century

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# 20 Years of Innovation

## Optics Manufacturing and the 21<sup>st</sup> Century

by Rick Plympton



*Optimax Systems, Inc. is a prototype optics manufacturer located in Ontario, NY. Founded August, 21, 1991, Optimax was one of the first optics manufacturers to use the computer-controlled machining of brittle materials to create superior optical component manufacturing. In the basement of a pig barn, our team created innovative processes that reduced fabrication time from 10 weeks to five days. Optimax has continued with 20 years of growth by recognizing opportunities in the market and developing innovative solutions.*

### High Quality, Quick Delivery

A need for quick delivery of custom optics has been recognized by Optimax from the beginning. In 1995, we began to market "Prototype Optics in 1 Week". This created the opportunity for us to support important projects, such as NASA programs. In 1998, we provided NASA with a set of imaging lenses for a shuttle launch in just five days. Since then, Optimax has proudly supplied NASA with lenses for the Mars Rovers, Mercury Messenger and Jupiter Fly By, to name a few.

At Optimax, providing the highest quality optics possible is a requirement. We have successfully

developed manufacturing processes for optics required for specialized applications, such as; deep ultraviolet (DUV) applications, high energy lasers (HEL) and multispectral systems. With the help of the Internet, the optics industry has been given a global marketplace and Optimax discovered a new opportunity. Advancements in computing technology and new optical design software empowered independent optical engineers, creating a demand for an independent optics manufacturer such as Optimax.



### Prototype Optics

Optimax developed a Manufacturing Tolerance Chart as a tool for engineers when tolerancing lenses. This chart provides reasonable tolerance options and specifications that are both cost-effective and within the bounds of our quick-delivery capabilities. The tolerances listed on the chart apply to aspheres, cylinders, prisms and spheres, and with this tool, engineers

can quickly tolerance prototype optics for manufacturability.

To further advance our capabilities and improve our processes, Optimax began to experiment with unconventional surface-processing ideas such as spirograph motion, ultra-sonic and belt lapping. In 2005, Optimax patented VIBE polishing for high-speed removal of optical material and fine finishing of high-precision optical surfaces. With this process, we were able to produce non-spherical optics from hard-ceramic optical materials in one tenth the time of conventional processes.

### Lean Manufacturing

By this time, Optimax had grown into a 40,000 square foot facility. A shift from departmentalized manufacturing to lean manufacturing became necessary and the workforce underwent a cultural shift from "I'm a grinder" to "I'm an optician." In older factories, each manufacturing step is departmentalized and a technician is taught a single step in the complex process.

In lean manufacturing, a technician is taught the entire process and is expected to capably perform at each step.

For opticians to reliably produce a high-quality optical form that cannot be measured conventionally, Optimax collaborated with university researchers to create instruments that could do the job. With the addition

of sophisticated metrology and fabrication equipment, Optimax has developed the capability to manufacture and measure optical components to a fraction of a wave.

## R&D on the Shop Floor

As Optimax grows, our focus remains on optical component manufacturing. To diversify our capabilities, we have developed the technology to process new optical materials, including glasses, hard ceramics and crystals. Hard ceramics are challenging to process so our R&D and Manufacturing Engineering teams have developed manufacturing technologies that fit the need. Optimax has successfully processed hard ceramics, such as ALON, Spinel, CeraLumina™ and Ceramic YAG into precision optical components.

Through Small Business Innovative Research (SBIR) Grants, we have stayed on the cutting edge of technology. We have received several grants since 1994 and have three projects currently under way for an aerodynamic infrared dome, conformal optics and an optically precise conformal sensor window. The new manufacturing capabilities that develop from this are applied within and outside the defense sector.

With our R&D and manufacturing teams working together to create solutions for real time manufacturing issues, processes are routinely improved and our capabilities continue to advance. As optical engineers' preference for specifications continue to tighten, Optimax has been able to respond. In January 2010, we updated the Manufacturing Tolerance Chart to reflect the tolerances – commercial, precision and high precision - that are currently achievable in our one week delivery timeframe.

## Workforce Development

Optimax's success is widely attributed to our workforce; our growth is a



direct result of hiring employees with strong technical skills and analytical and problem-solving abilities. In general, the average worker does not possess the skills required for superior performance. The lack of qualified technicians posed a real dilemma so Optimax created a training program to teach our workers the required skills.

Our training program consists of three levels: mentoring, on-the-job training and external development. Our mentoring program teaches personal accountability. Our on-the-job training program teaches the skills necessary to perform every operation in the manufacturing process and external courses provide employees with leadership and professional skills for career development.

It is because of the mutual need among advanced manufacturers to fill the pipeline with qualified technicians that Mike Mandina, President of Optimax, co-founded the Finger Lakes Advanced Manufacturers' Enterprise (FAME). FAME focuses on collaborating with workforce educators and local colleges to train advanced manufacturing technicians and create awareness of employment opportunities.

An empowered workforce is the company's greatest asset. At its best, this means having clearly defined roles, openly sharing information,

being accountable, recognizing and appreciating team member strengths, and focusing on a team effort to satisfy the customer. Optimax has long practiced an open business policy and has built up the morale of the workforce by helping them take ownership of their responsibilities. Optimax reinforces this system by rewarding every employee with a monthly profit-sharing check.

Optimax has worked hard at establishing a culture that encourages employee prosperity and has been successful. Earlier this year, Optimax entered *Inc.* Magazine's 2010 Top Small Company Workplaces competition and was recognized among the top 20. We were presented with an award from *Inc.* for "recognizing innovation and leadership in establishing a great workplace". As a result of this placement, the Hitachi Foundation contacted us and put together a case study on our workplace. This document has been published and is available for download at [www.optimaxsi.com](http://www.optimaxsi.com).

Today, Optimax has nearly 150 employees, including more than 100 opticians. Continuous improvement is at the heart of everything we do. Optimax is constantly seeking to reduce cost and improve quality while actively developing manufacturing solutions for emerging market needs. With the continuous improvement of current processes, we are equipped to provide high-tech optics manufacturing solutions to the 21<sup>st</sup> Century marketplace. □



*Plympton is the CEO of Optimax, Systems, Inc.*