The Ascent of Lithuanian Lasers

High-tech industry provides a model of manufacturing development in a growing economy

Mikas Vengris

Lasers in Lithuania are a source of considerable pride and are often presented as a success story. How did it happen that a small country without obvious reasons to succeed in a knowledge-intense field of lasers and laser applications has become a player equal with the laser industry giants from the USA, Germany, France and other developed countries (Fig. 1)? Here is an insider look into the circumstances and factors that have determined the success of Lithuanian laser industry.

Fig.1 Lithuanian laser industry pavilion between Chinese and US booths in the World of Photonics exhibition in Munich, 2011. (Source: Lithuanian Laser Association)

The recipe for success usually includes a timely start. Back in 1962, three smart youngsters were sent from Vilnius University (VU) to the Moscow State University to study laser physics. After getting their degrees, they came back with ambitions of starting up the laser research in Vilnius. The results came quickly: first laser light was produced in the labs of VU in 1966, followed by the laser in the Lithuanian Academy of Sciences in 1970. In the next couple of decades, the scientific research on laser technology and laser applications flourished in both institutions, precipitating in tens of defended PhD theses and several new laser laboratories established. State-owned laser factory Eksma was founded in 1983, followed by Standa in 1987. The latter was "a cooperative", a Gorbachev era euphemism for a private business, and therefore marks the start of the privately owned laser industry.

With the restitution of independence in the early 1990s and the severe economic turmoil that followed, laser industry was up for a harsh awakening. The funding of the state-run labs at VU and the institutes of the Lithuanian academy of sciences dwindled to the levels where quantum effects become important. Young scientists had to look for new ways of survival. Essentially, they had two choices: going abroad to pursue science (either temporarily or emigrating altogether), or trying their hand in business. The people who favoured the first choice gave rise to the diaspora of Lithuanian laser scientists spread out all over the globe, whereas those, who went for the second option, founded the major laser businesses. Eksma was privatized and concentrated its laser business in a daughter company, Ekspla (1992), Standa continued as a joined-stock company, and Light Conversion was founded in 1994.

From the garage to the Wembley Stadium

The start of the Lithuanian laser business is almost anecdotal. The story goes that in the days when a glass of beer in Sweden cost more than a monthly salary of a teacher in Lithuania, the engineers of Light Conversion used to put a newly assembled parametric amplifier in a travel bag and embark on a bus going to the other side of Europe to perform the installation. Next to the laser, they would pack a hearty peace of smoked bacon and some bread, enough to survive in the "capitalist jungle". When something went amiss during the installation, they would find some scrap metal in the customer`s lab, and go to the machine shop of the university. Using whatever tools where available (and some strong language), they would repair whatever was broken and bring the instrument back to life. The rumour also goes that the first Lithuanian honeycomb optical tabletops used the arrays of coffee tins as spacers between the steel plates.

Gradually, the Western scientific community started to be impressed with the results obtained using the equipment that came at an affordable price from behind the iron curtain and was brought to them by the people who got offended easily when referred to as Russians. The instruments were also actively promoted by the diaspora of

Fig. 2 The distribution of Lithuanian laser equipment in the world. (Source: Lithuanian Laser Association)

Lithuanian laser scientists, who knew the products for what they were because of their old contacts at VU and the Institute of Physics.

In the late 1990s and early 2000s, things started to look up. The customers who bought the first equipment, returned for more; the PhDs who used it for their graduate work, became professors and wanted the tried-and-tested solutions for their own labs. With the admission of Lithuania to the EU, the country secured a position on the global map and in people's minds, and stopped being so mysterious as to put off potential overseas customers. Not only the major players, Eksma, Ekspla, Light Conversion and Standa grew in their number of employees, they were also joined by a number of smaller companies producing custom laser and optical components, coatings and specific laser applications. The beginnings of a versatile, self-sustaining laser cluster started to show.

In the meantime, the researchers who endured the years of hardships and financial strangling in academia, managed to secure several substantial grants from Lithuanian government, NATO and EU partnership programmes. These, in turn, helped to attract students to laser physics programmes and supply the vital element for the growth of the laser business.

Too good to be true

In the past ten years, the laser industry in Lithuania has been exhibiting results that are virtually too good to be true. The revenues grew from 13 M€ in 2004 to 60 M€ in 2012. Even in 2009, a disastrous year for Lithuanian economy, which plummeted by 15 %, the laser sector saw a healthy growth of 4 %. The number of employees which was 200 in 2003, climbed to ca. 600 in 2013. Of those 600, roughly 10% hold PhD degrees.

Lithuania is a small country with open economy and has virtually no tradable natural resources worth mentioning. The common sad joke goes that the only useful things in Lithuania that one can dig from the ground are potatoes, but even those are scarce. For such a country, it is vital to produce exportable goods to balance the foreign trade. Laser industry shows exemplary behaviour in this regard, with more than 90 % of production sold abroad. The major markets for Lithuanian laser products are developed countries as shown in Fig. 2.

Uncanny success

The reasons for such a success are hard to fathom. It is perhaps easier to explain why Lithuania can retain its positions once they are achieved. Mostly, it seems to be due to the size of the market. Market volume of lasers for fundamental research is too small to be especially attractive to the industry giants. At the same time, the initial investment threshold required to succeed in this marked is rather high both in terms of knowledge and equipment. Lithuania with its long tradition in laser research and limited appetite for the market volume seems to be a natural candidate to fill this niche.

On the other hand, many factors came together just right to help the country's laser industry to catch the wave. Continuous efforts of laser researchers to keep up the studies at the VU at a proper level, helped along by successful lobbying with the Government ensured a steady influx of young people, whose work was the main ingredient of the growth. The diaspora of Lithuanian laser researchers abroad helped promoting the products. Finally, all the companies together formed something very close to an industrial cluster: an intertwined network of companies with almost no internal competition, all working in different aspects of laser physics. In fact, the head hunting at neighbouring companies is still something not done in Lithuanian laser industry. They are still a sort of family, with a yearly reunion taking place at the end of summer in a lakeside bungalow park about 60 km away from Vilnius, where a significant fraction of the people working in the industry gather to talk about science and business.

Light Conversion: the flagship

Lithuanian laser companies cover a number of aspects in laser technology. The flagship, Light Conversion, has earned its reputation as a producer of femtosecond and picosecond optical parametric amplifiers (Fig. 3). In fact, it seems that the entire market of femtosecond OPAs now belongs to Light Conversion, with all major producers of femtosecond Ti:Sapphire laser systems offering OPAs manufactured in Lithuania.

From 2006, Light Conversion has also entered the market of femtosec-

Fig. 3 Femtosecond and picosecond OPAs from Light Conversion have practically monopolized the global market. (Source: Light Conversion)

ond solid-state lasers with their 'Pharos' product line (Fig. 4). Currently, a standard amplified Ti:Sapphire laser system occupies several square meters on the optical table. It needs the lab temperature to be stabilized to a couple of degrees Celsius. The total power output is of the order of 5 W. In comparison, Yb:KGW based Pharos laser is a box with a footprint of just 64 × 36 cm and can reach average output powers in excess of 15 W. The operation is completely hands-free and does not require a climate-controlled or even particularly clean lab. These outstanding properties were caught on not only by scientific customers, but also by the high-tech industry, where Pharos is widely used as a light source for femtosecond laser material processing. In addition to lasers, OPAs and harmonic generators to satisfy a variety of tastes, Light Conversion offers autocorrelators and complete femtosecond spectroscopy systems to boot.

In 2011, Light Conversion, a company with just under 100 employees was the 27th largest tax-paying industrial company in the country. To put this in perspective, the total number of companies evaluated was 6650.

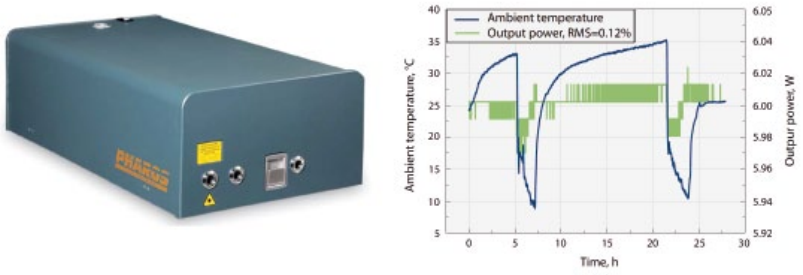

Fig. 4 Yb:KGW laser Pharos spits out up to 18 W of average power and is virtually insensitive to ambient temperature. (Source: Light Conversion)

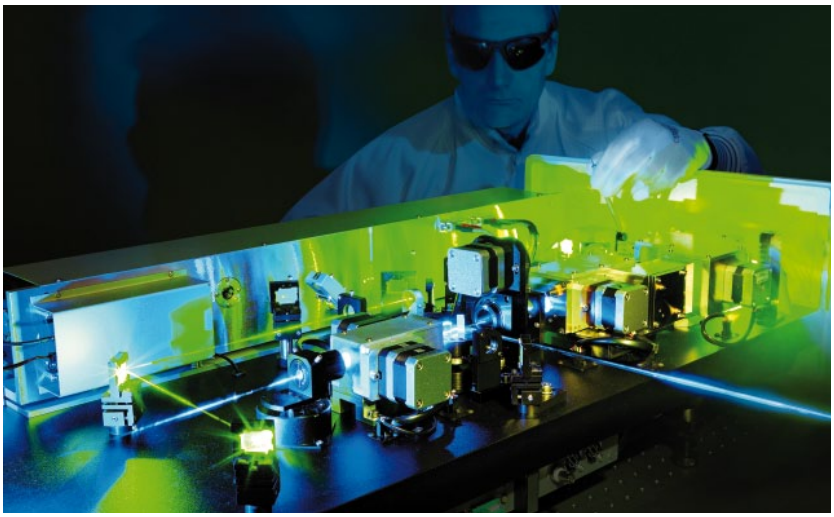

Fig. 5 Since the foundation of EKSPLA, in-house design and development has been one of their core competences. (Source: EKSPLA)

EKSPLA: the pioneer

EKSPLA took over the laser system business from its mother company Eksma, a pioneer of laser industry in Lithuania. Currently it is a solid ISO9001 certified manufacturer of solid state lasers, systems and optoelectronics for basic research and industrial applications (Fig. 5). Its first laser was sold more than 20 years ago like a hot cake. The customer snatched it during the launch event, at an international exhibition in Germany. Inspired by the success, the company continues to provide high performance advanced laser solutions.

High peak power laser systems, short pulse generation and amplification, tunable nonlinear OPO/OPG/OPA and nonlinear spectroscopy are among EKSPLA's core competencies. The company is one of the major global producers of scientific picosecond lasers and is one of the very few suppliers of complete SFG spectrometers for surface and interface research.

In the last couple of years EKSPLA saw several breakthroughs. Engineers finally mastered exciting products that cost them many years to perfect. The most prominent of those are fiber lasers featuring maintenance-free operation, all-in-fiber design and low energy consumption. It is another major step towards that dream of laser engineers that never quite comes true: the lasers that just work by themselves, without scientists running in circles around them to tweak knobs. EKSPLA's lasers enable the customers concentrate on their direct tasks – scientific research or industrial processes.

EKSPLA exports 90 % of its production to more than 40 countries worldwide. In the last four years, the sales volume has doubled. You will find EKSPLA lasers in the most famous universities across the globe: CERN, Cambridge University, Lawrence Livermore National Laboratory, NASA, RIKEN Nishina Center in Japan and the Chinese Academy of Sciences.

EKSPLA's efforts and results did not go unnoticed by the international laser community. The entire EKSPLA team was happy (and quite a few champagne bottles were cracked), when they became the first company in central and Eastern Europe to be awarded a Prism Award for Photonics Innovation in 2011. EKSPLA received the prize for the world's most advanced product in the scientific laser category.

Besides their usual laser business, Ekspla is a keen supporter of scholarly research associations and student events. Every year young people studying natural sciences or engineering come to the company for their internships: here they obtain their first work experience required by the university curriculum.

Contact for Germany

In Germany, the Lithuanian laser companies are represented by the German company TOPAG.
Contact: TOPAG Lasertechnik GmbH
CEO: Dr. Erwin Jäger
E-Mail: jaeger@topag.de

www.topag.de

All bases covered

It is not just lasers though. Standa manufactures all the things you will find in a laser research lab besides a laser: optical tables, precision mounts, motorized and manual positioning components, motion controllers. Additionally, the company produces microlasers, light test and measurement instrumentation, etc. Represented by 25 different companies throughout the world, Standa will make all the mechanical components necessary to actually use the light coming from the laser.

EKSMA Optics and Altechna are suppliers of laser optical components, starting from general optics, such as mirrors, lenses, polarizers, etc., all the way to common and exotic, state-of-the-art laser and nonlinear crystals. Additionally they offer complete optical systems, such as f-theta lenses or beam expanders. EKSMA Optics also specializes in the production of Pockels cells used for short pulse generation and control. Workshop of Photonics is a system integrator and produces complete femtosecond material processing systems, Teravil is a supplier of generators and detectors for terahertz radiation, Optida produces customized coatings for optical laser components, Geola makes holograms and holographic equipment, Brolis Semiconductors is a manufacturer of single-mode mid-infrared semiconductor lasers ... and it does not stop here.

What's next?

Making predictions is tricky at the best of times, and times are far from the best for the global economy with the crises erupting all over the world. Currently, Lithuanian laser industry is a cluster of companies with different product ranges and is dominated by small and medium-sized privately owned companies. From inside, all of them are similar: in each company you will find R&D engineers in their "sandboxes" cluttered with instruments and half-finished projects, production engineers in lab coats with serious attitude to work, service guys with jeans, three day stubble and jet lagged faces and friendly administration staff helping to keep it all ticking. Everyone is happy in this environment, a mixture of chaos (R&D) and order (production). As long as a healthy balance between the two is obtained and the ambitions to be in the lead of the pack remain, all should be well. However, the management of growth and fierce competition will not make it an easy walk in the park for Lithuanian laser industry. There may come a time when the entire sector is bought out by a large investor and reorganized to their taste. The future will show.

Author

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