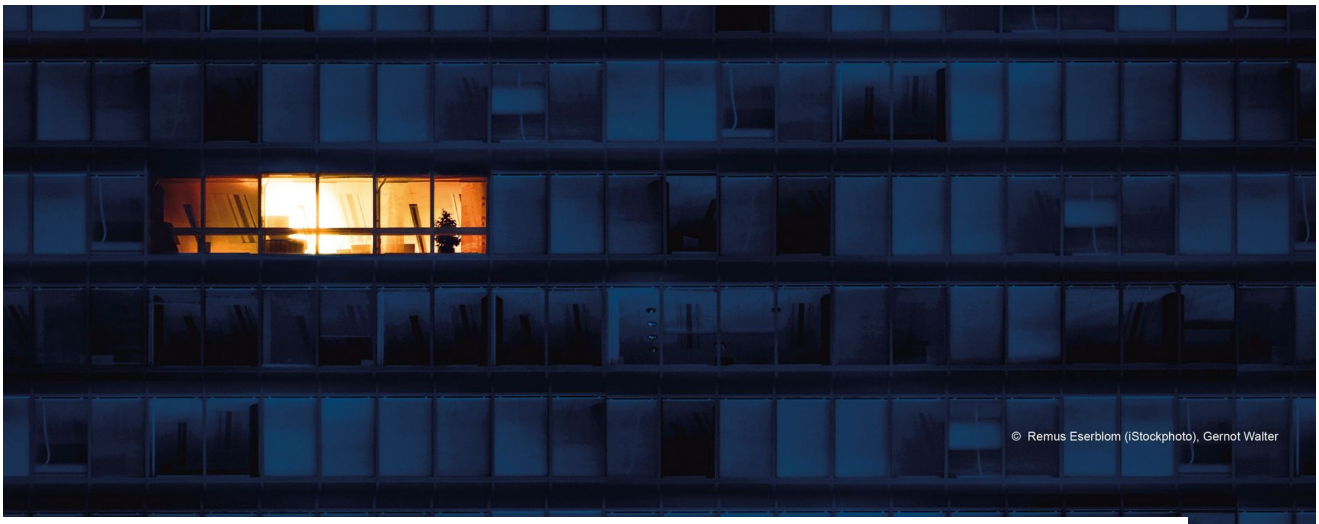


CHRISTOF SIEBERT

The entrepreneurial era is back

Light-based technologies are currently transforming every industrial sector, including aviation, medicine, automotive, research, biology, electronics, and many more. This process of up-heaval presents entrepreneurs with the perfect opportunity to make their mark with a single, brilliant idea.

Disruptive technology" Is a popular term in today's tech world. Industry experts and economic analysts apply it to photonics in general and to laser systems in particular, perceiving these as disruptive technologies that will have far-reaching effects on every aspect of our lives. This radical transformation has received solid political support for a number of years. Back in 2005 the European Union created the Photonics21 association of industrial representatives and research organizations. In 2012 U.S. President Barack Obama followed suit, founding the National Photonics Initiative to bring all the key institutes and industry associations under one roof. The stated goal of both alliances is to play a pioneering role in this highly promising field. Light-based technologies are currently transforming every industrial sector, including aviation, medicine, automotive, research, biology, electronics, and many more. This process of up-heaval presents entrepreneurs with the perfect opportunity to make their mark with a single, brilliant idea. Right now, young men and women on every continent are founding companies based around laser light. Laser technology may be a fairly recent development, but this marks the second era of entrepreneurs over the course of just 60 years.

The first gold rush

The history of the industry really began with a legendary figure in the laser world, Eugene Watson. In 1961, he founded his first company, Quanta-Ray, in California – the oldest laser manufacturer still up and running today. Just five years later he took another bold step, setting up a number of other photonics companies. He built one of his first lasers in a laundry room. With the help of his lifelong friend Earl Bell, Watson was one of the first people to see that lasers with sufficient average power could be used to machine materials. When the first CO2 laser was invented with the power they needed, the two scientists realized that their hour had come. Boeing pioneered the use of CO2 lasers for titanium cutting and welding. Eugene Watson was part of the first generation of entrepreneurs in the laser industry. The production of laser beam sources for research purposes was already underway when various entrepreneurial inventors and developers began to realize just how profitable laser material processing could be. In 1974, Jürgen Held decided to take the plunge and launched a start-up called Held Systems based on lasertechnology in West Germany. Just one year later, his company sold its first industrial laser, a 200-

watt system for manufacturing glass fibers. Later on, when the first industrial-scale, high-power lasers became commercially available, Held Systems focused on building special-purpose laser machines, a segment they are still flourishing in today.

Photonic is going through a gold rush phase

But it was in the 1980s and 1990s that the first laser technology gold rush really picked up pace. New laser machine tools revolutionized various sectors, particularly the manufacturing industry. In 1992, Bernhard Lang founded the company Lang-Laser-System in Germany to build his own laser machines for processing packaging materials. In 1995, Thomas Kimme set up a contract manufacturing business offering laser metal deposition. Today, Laservorm also produces its own laser processing machines. In 1999, Erhard Hujer set up a job shop for 2D and 3D laser material processing and has been opening a new location every few years ever since. For the most part, these entrepreneurs are practical people, typically engineers and technicians from the manufacturing industry. Not always experts in laser technology, they understand how much laser cutting and welding are transforming sheet metal processing. This new era of entrepreneurs also encompasses integrators who delve deep into the realm of laser technology to develop methods and machines for material processing. In the USA, Mark Plasse opened the job shop and integrator Litron in 1997. Today, Litron is the leading U.S. provider of laser cutting and fully enclosed laser welding systems for the medical and aerospace industries. In the Netherlands, Martin Langkamp set up the company IMS in 1999 as an offshoot of Texas Instruments. Since then he has been building laser manufacturing systems designed for micro-processing in the medical device and electronics industries. So laser technology is once again prompting people to establish new companies.

Here comes the second wave

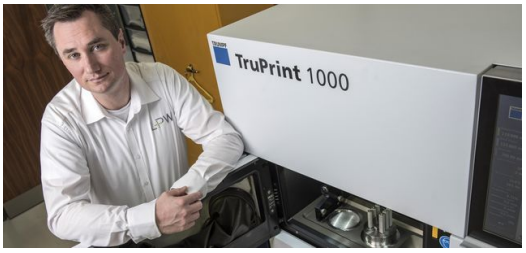
In 2012, Balthasar Fischer from Austria had an idea he couldn't get out of his head. The qualified physicist and sound engineer was determined to build a functional microphone without any moving parts – in other words, without a membrane. He was tired of trying to measure sound and having to deal with interference such as wind noise, the noise of water flowing, vibration, and membrane reverberation. His ground-breaking solution was to detect sound waves directly by measuring the changes in light intensity in a laser beam. Fischer founded the start-up company Xarion while he was still studying at the university. That makes him a good example of today's second era of entrepreneurs, many of whom started out in research institutes.



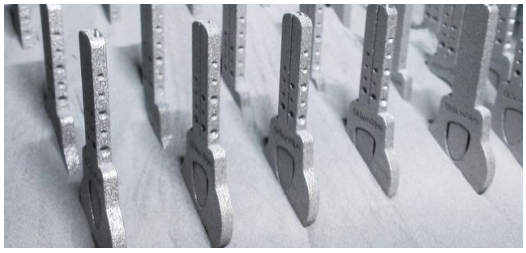
Balthasar Fischer's invention paved the way to founding a company. Picture: Michael Mazohl



Prof. Cather Simpson on a meadow near Auckland. Picture: Alex Wallace



In 2007, Phil Carroll began working as a freelance engineer. In 2012, he decided to hire other people, and entered the powder business. Today his company employs over 75 people at five locations. Picture: Paul Cooper



The 3D printing process enabled the young engineers to completely redesign the traditional key. Picture: UrbanAlps

The more researchers discover about laser light and how it works, the more these findings give rise to ideas for applications and business concepts. Similar to the famous "Stanford boys" of Silicon Valley, many of this latest batch of start-up founders are post-grads and post-docs who spin off a market-able idea from their research work and then team up with venture capitalists who have their eye on a profitable investment. The fact that these ideas stem from general research rather than a narrowly-framed user problem makes them more diverse than ever before. Cather Simpson is a university professor of physical chemistry in New Zealand and an expert in laser technology in her area of expertise. In 2015, she heard about the problems involved in selecting the gender of dairy cattle and immediately realized that a laser might offer the perfect solution. Now her start-up company Engender is on the verge of launching a viable sperm sorting machine.

Digital Photonics

Two key technological trends that reinforce each other – and arguably even depend on each other – are photonics and digitalization. Many observers in the media and business world consider the digitalization of production in the form of Industry 4.0 and smart manufacturing to be the defining disruptive technology of our time. That may well be true, but it's only part of the story. The fact is that fully digitalized factories still need a tool that can actually perform the required steps on the workpiece in a fast, automated, direct and versatile fashion. Light is the perfect choice. It is physically unconstrained and can be formed in real time using lines of code. Laser light can be modified and adapted from one set of data to the next, and that makes it an excellent tool for bridging the digital and physical worlds. Its benefits are particularly striking in the field of additive manufacturing.

» Laser technology often inspires people to start up their own companies

In 2016, the Swiss start-up UrbanAlps redefined the concept of a key, adding additional security features within the key's hollow interior that make it impossible to forge. Producing a key in this way would be impossible without laser-based 3D printing. People say data in the future will be like gold, but perhaps it will actually be more like the gold pan. Because in many cases it will ultimately come down to using streams of data to create, move or modify real things that you can touch. A further trend in digitalized photonics is automation, another area where entrepreneurs are making major strides. Take Walter Sticht in Germany, for example. In 2011, he decided that even at 64, there was still plenty more to discover. He sold his old company and started afresh with the idea of creating ultra-fast automation for flexible small-batch production – using lasers of course!

Everyone's on board

Jörg Jetter from Germany took a very different approach. In 2006, with an MBA under his belt, he decided to start his own company. He began searching for a worthwhile technology that could form the basis of a business. He analyzed markets and potential demand and eventually founded the company Firma 4Jet. The idea he settled on was to build mass-market laser machines to ablate surfaces. The applications soon snowballed, and 4Jet machines are now used to vaporize rubber residues in tire molds and remove photoactive layers around the edges of solar cells. This willingness to see the laser as a problem-solving tool enriches laser technology enormously and broadens the scope of what we regard as feasible. With a surge of entrepreneurial momentum also emerging in a plethora of other sectors, the new era of laser start-ups is steadily gaining even more impetus. Laser technology has become a familiar and confident part of the industrial landscape. Any product developer worth their salt knows that laser light is an integral part of their toolkit, because whatever product they have in mind, lasers can almost always form a fruitful part of the production process.

» Photonics is clearly destined to play a key role in the future of technology

New opportunities are also constantly emerging based on novel laser-based technologies, and astute engineers know how to spot these and turn them into successful businesses. For example, one of the side-effects of the recent surge in 3D printing is the huge demand for high-quality metal powder. UK-based LPW Technology is a one-man company that decided to tackle this challenge head on. In 2012, Phil Carroll hired a team of specialists to help him investigate every aspect of metal powder manufacturing, all before he sold a single particle. Today his company supplies powder to demanding customers in the aviation and medical sectors.

Lasers are cool

There's one more reason behind the recent surge in laser start-ups, a hard-to-pin-down factor that exerts a powerful influence: lasers are cool! They fuel the imaginations of hundreds of thousands of highly intelligent people. You would probably struggle to find any engineer or scientist who didn't lap up science fiction books or TV shows as a kid. Laser beams were a staple of that genre before they became a reality, and that's one of the reasons why they have now come to epitomize the idea of future technologies. And this isn't just a subjective feeling – more and more of today's biggest visions feature light and lasers, including star probes, space elevators, weather modification, e-mobility, factories of the future, and cancer therapy. Photonics is clearly destined to play a key role in the future of technology. Ultimately there's one key thing that any potential entrepreneur needs to remember: if you're looking for an idea that amounts to more than just lines of code, you would be wise to take a careful look at what lasers can do. Or think carefully about what people who work with lasers need. Or at least mull over what lasers can do to help people who are planning something new – or who are simply looking to save the world.



Optics for laseramplifier in science. Picture: TRUMPF

A time for entrepreneurs – just a few of the many

1961: Eugene Watson founded his first company, Quanta-Ray, in California – the oldest laser manufacturer still up and running today. 1975: Jürgen Helds company Held Systems sells its first industrial laser, a 200-watt system for manufacturing glass fibers.1992: Bernhard Lang founded the company Lang-Laser-System in Germany to build his own laser machines for processing packaging materials. 1995: Thomas Kimmes Thomas Kimme set up a contract manufacturing business offering laser metal deposition. 1997: Mark Plasse opened the job shop and integrator Litron. Today, Litron is the leading U.S. provider of laser cutting and fully enclosed laser welding systems. 1999: Erhard Hujer set up a job shop for 2D and 3D laser material processing and Martin Langkamp set up the company IMS that builds laser manufacturing systems designed for micro-processing in the medical device and electronics industries. 2006: Jörg Jetter founded the company Firma 4Jet. The company builds mass-market laser machines to ablate surfaces. 2012: Balthasar Fischer founded the start-up company XARION Laser Acoustics GmbH and Phil Caroll LPW Technology. 2015: With her start-up company Engender Cather Simpson develops a viable sperm sorting machine. 2016: UrbanAlps produces keys with 3D-printing.



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