

TOWARDS A NATIONAL STRATEGY FOR LASER-BASED MANUFACTURING



The EPSRC Centre for Innovative Manufacturing in Laser-based Production Processes and ALLU are working together with the UK industrial laser community to develop a National Strategy for Laser-based Manufacturing. The Centre and ALLU have recently published "*Laser-based Manufacturing Applications: UK Roadmap 2014*" developed through a consultation process with UK industry.



Context

UK Government policy aims to develop a better economic balance between the service sector and manufacturing, as a route to high quality employment and increased sustainability. A key element of government policy and Innovate UK strategy is a particular focus on the need for improved UK performance in the manufacture and marketing of high added value products. To achieve this, cutting-edge research and timely innovation are vital, but so is industry's willingness and capacity to invest-in and exploit emerging IP and advanced production processes.

One of the key areas that is not currently exploited to its full potential is laser-based manufacturing. There are many examples where laser tools have replaced more conventional processing techniques (often with disruptive impact as in automotive, aerospace and electronics production) to enable major increases in manufacturing productivity, quality and functionality. There has also been a stream of new laser-unique production processes capable of producing transformational impact, such as additive manufacture of metal components, high speed shaped laser-cutting of smart-phone 'gorilla' glass and laser direct-write fabrication of high performance, multifunctional freeform micro-optics. The inherent flexibility of laser tools coupled with the high level of compatibility with sensors and automation provides an effective choice to match the growing importance of industrial design and the trend towards product customisation. Furthermore, the advantages of wear-free laser tooling and integrated monitoring and intelligent control systems offer routes to zero-fault production, leading to higher product quality and reduced wastage.

However, there are growing strands of evidence that the UK has fallen behind its global competition (e.g. Germany, Japan, USA) in terms of both the degree of laser-tool benefit recognition, and also investment in the adoption of laser-based production processes, right across the spectrum of UK manufacturing.

UK Roadmap

Early in 2014, ALLU and the EPSRC Centre for Innovative Manufacturing in Laser-based Production Processes (the Centre) partnered to develop a UK Roadmap for Laser-based Manufacturing Applications and Markets. The primary objective of the Roadmap was to identify new and evolving manufacturing applications and associated market opportunities, where laser processing can enable the development of new production techniques, opening the door to globally-competitive high value-added components and products across multiple sectors of UK industry. A secondary and closely related objective was to identify those areas where focussed R&D is required to support new laser-based production technology, including both the development of new process science/technology to facilitate emerging laser-based manufacturing solutions, and in the UK laser-machine hardware supply chain.

Through a process of questionnaires, workshops, discussion and consultation, involving a total of 140 people from 100 organisations, including 73 companies, it was judged that industrial laser systems can and should play an important role in meeting current and future market requirements across multiple UK manufacturing industry sectors. Advantages identified included high quality processing of advanced, dissimilar and brittle materials, reduced manufacturing costs, increased manufacturing speeds and reduced environmental impact from industrial activity, and the potential for disruptive 'game-changing' high value-added manufacturing impact.

Through the roadmap process four market/application areas were identified as key areas for future concentration and investment. The Report went on to specify five underpinning areas (4 technical and 1 socio-economic) for particular R&D focus.

Application Areas

- Laser-based Additive Manufacturing, including component repair;
- Laser joining materials including both thin and thick, similar and dissimilar materials;
- Laser surface processing, structuring and modification of both dielectric materials and metals;
- Laser micro-manufacturing of both dielectric and metal materials.

R&D Priorities

- Increased understanding of the laser material interaction science underpinning predictable and transferable laser-based manufacturing processes, particularly across applications of advanced, dissimilar and brittle materials;
- Development of improved laser-process monitoring techniques with reliable associated hardware that can be integrated into automated machines;
- Fundamental laser device technology and improved techniques and components for laser beam manipulation including high-speed, real-time (adaptive) control;
- Increased levels of automation in laser tools and machines, while reducing cost of ownership through increased productivity and reduced environmental impact.
- Understanding the demand-pull for laser-based manufacturing in the UK and how it differs from that in our competitor economies. In particular, there is a need to determine the scale of possible missed commercial opportunities through failure to invest in and adopt more technologically advanced (laser-based) manufacturing solutions.

Future Plans

The Roadmap is viewed as a significant step along the path to developing a UK National Strategy for Laser based Manufacturing. The overall aim is to generate a strategy document for the UK that will be used to influence UK policymakers, researchers, product and process developers, trainers and educators, including the hardware supply chain. The key strategic goals are to stimulate the implementation of laser-based manufacturing processes across a much broader range of UK manufacturing industry, and to develop suitable support mechanisms to support and further develop a small but very successful laser manufacturing and machine integration manufacturing industry in the UK.

The National Strategy will be developed by a group of key stakeholders, including trade bodies, industry (laser manufacturers, machine integrators and laser users), government bodies, independent research organisations, funding agencies, and universities. This working group will draw both on their own wide range of experience and knowledge, and on a broad evidence-base including Photonics21, the UK Farnham report and foresight Roadmaps and reports prepared to support UK Government and Horizon 2020 priorities.

It is intended that the National Strategy will be developed over winter 2014 and spring 2015 and be circulated for consultation in the summer of 2015, to be published by late 2015.

To see the full UK Roadmap-2014 Report please contact LbPP@hw.ac.uk or go to the Centre website at www.cim-laser.ac.uk

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