

THE

# LASER USER

ISSUE 101  
SUMMER 2021

AILU

IN THIS ISSUE:

*Magnetic effects on powder feed*

*Beam shaping for laser welding*

*Pulse shaping improves welding*

*Laser sawing faster than cutting*

*Tailored USP laser vector fields*

*LIPSS laser texturing machine*

**ADVANCED LASER  
WELDING TECHNOLOGY:  
IMPROVING CAPABILITY,  
PRODUCTIVITY & QUALITY**

## THE LASER USER

**Editor:** Dave MacLellan  
**Sub-Editor:** Catherine Rose

**ISSN 1755-5140**

© 2021 – Association of Industrial Laser Users

The Laser User is the house magazine of the Association of Industrial Laser Users. Its primary aim is to disseminate technical information and to present the views of its members. The views and opinions expressed in this magazine belong to the authors and do not necessarily reflect those of AILU.

The Editor reserves the right to edit any submissions for space and other considerations.

Authors retain the right to extract, in part or in whole, their material for future use. The Laser User is published quarterly in February, May, August and November by AILU for its members and is available in print or online.

#### Editorial Board for this issue:

Ric Allott	STFC
Jan Brajer	HILASE Centre
Armando Caballero	Cranfield University
Richard Carter	Heriot-Watt University
Adam Clare	University of Nottingham
Clive Grafton-Reed	Rolls-Royce
Mark Millar	Essex Laser
Neil Main	Micrometric
Walter Perrie	University of Liverpool
Mike Poulter	TRUMPF
David Waugh	Coventry University
Mark Wilkinson	LBP Optics



#### ADVERTISING ENQUIRIES

+44 (0) 1235 539595  
 cath@ailu.org.uk

Advertising rates at:  
<http://bit.ly/AILU2020Media>

Association of Industrial Laser Users  
 Oxford House  
 100 Ock Street  
 Abingdon  
 Oxfordshire  
 OX14 5DH

Tel: +44 (0) 1235 539595  
 E-mail: [info@ailu.org.uk](mailto:info@ailu.org.uk)  
 Web: [www.ailu.org.uk](http://www.ailu.org.uk)

#### WELCOME TO NEW AILU MEMBER

**Graham Engineering Ltd**  
 Ian Fraser  
[ifraser@graham-eng.co.uk](mailto:ifraser@graham-eng.co.uk)



The cover image shows an extreme high-speed laser application (EHLA), where protective metal layers can be applied at extremely high speeds.

Photo credit: © Fraunhofer Institut für Lasertechnik, Aachen / Volker Lannert.

#### AILU STEERING COMMITTEE 2021-22

President: Adam Clare (University of Nottingham)  
 Vice President: Mike Poulter (TRUMPF)  
 Exec. Director: Dave MacLellan (Anode Marketing)

#### Elected until 2024

Cliff Jolliffe (PI)  
 Tara Murphy (NKT Photonics)  
 Danijela Rostohar (HiLASE)  
 Tian Long See (MTC)

#### Elected until 2023

Paola De Bono (TWI)  
 Tom Chaffer (TRUMPF)  
 Clive Grafton-Reed (Rolls-Royce)

#### Elected until 2022

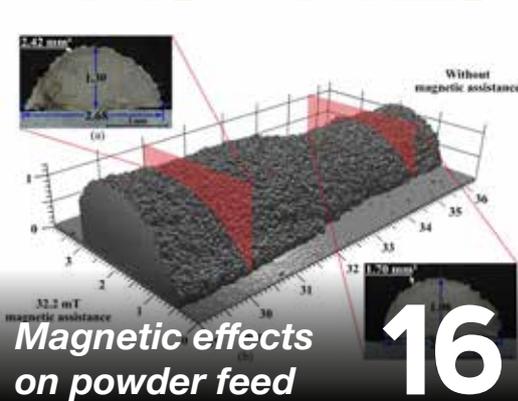
Prveen Bidare (University of Birmingham)  
 Richard Carter (Heriot-Watt University)  
 Hollie Denney (II-VI)  
 Matthew Wasley (Knowledge Transfer Network)

#### Co-opted

Sinan Bilgin (SS Laser Solutions)  
 Derrick Jepson (Aerotech)  
 Tony Jones (Cyan Tec Systems)  
 Jonathan Lawrence (Coventry University)  
 Mark Millar (Essex Laser)  
 Arina Mohammed (University of Hull)

Past presidents and founder members are also able to attend committee meetings. Anyone wishing to join the AILU Steering Committee please contact the Executive Director.

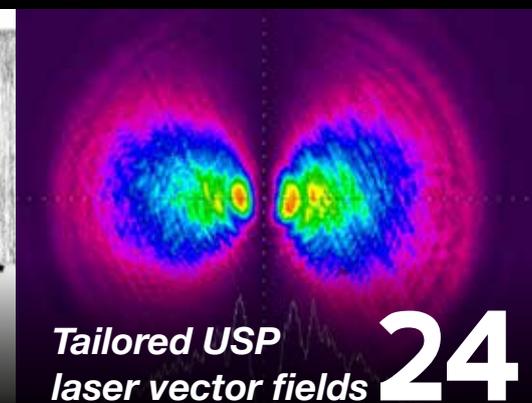
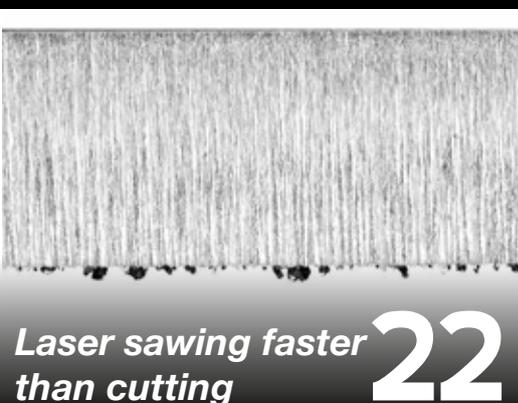
# HIGHLIGHTS...



**Magnetic effects on powder feed** **16**

**Beam shaping for laser welding** **18**

**Pulse shaping improves welding** **20**



**Laser sawing faster than cutting** **22**

**Tailored USP laser vector fields** **24**

**LIPSS laser texturing machine** **26**

**ASSOCIATION NEWS**

- First Word 4
- President's Message 4
- Ric's Ramblings 4

**BUSINESS NEWS**

- Business 5
- Case Studies 6

**SHORT FEATURE**

- Choosing laser cutting gas supply 8

**RESEARCH & DEVELOPMENT**

11

**EDITORIAL**

- Interview: Paola De Bono (TWI) 12
- Job Shop Corner 14
- Chair's Message 15
- A Funny Thing... 34

**SHORT FEATURE**

- 3D inline weld inspection 30
- Stone engraving application 30

**PRODUCT NEWS**

- Systems & Sources 31
- Ancillaries 33

**EVENTS** 35, 36

**MAIN FEATURES**

- Magnetic powder redistribution in DED Additive Manufacturing**  
**Peter Smith et al.** 16
- Improving laser beam welding with beam shaping**  
**Julien Bayol** 18
- Effect of temporal pulse shaping on minimising welding defects**  
**Mohammed Naeem** 20
- Laser sawing with piezo-driven adaptive mirrors**  
**Patrick Herwig et al.** 22
- Ultrashort-pulse processing with tailored laser vector fields**  
**Olivier Allegre et al.** 24
- Surface functionalisation for industrial applications**  
**Jérôme Patars & David Bruneel** 26
- Observations** 28

**CONTENT BY SUBJECT**

- Business**
  - Members' News 5
  - Case Studies 6
- AILU Interview** 12
- Product News** 31-33
- Job Shop**
  - Choosing laser cutting gas supply
  - Short Feature 8
  - News 14
  - Chair's Report 15
- Magnetic effects on powder feed**
  - Main Feature 16
- Beam shaping for laser welding**
  - Main Feature 18
- Pulse shaping improves welding**
  - Main Feature 20
- Laser sawing faster than cutting**
  - Main Feature 22
- Tailored USP laser vector fields**
  - Main Feature 24
- LIPSS laser texturing machine**
  - Main Feature 26
- 3D inline weld inspection Stone engraving application**
  - Short Features 30

## ASSOCIATION NEWS

## FIRST WORD

The nature of lockdowns is that they are imposed suddenly and relaxed gradually, and rightly so. We are all thrilled about the prospect of being able to meet up again face-to-face and attend more live events and meetings.

AILU is planning its first live event since October 2019 - we are focusing on the future (everything is changing rapidly) and gathering at Cranfield University on 6 October with the topic of Digital Manufacturing. This theme is one that is gathering much interest with remote working, automation, error reduction and smart manufacturing (AI, machine learning, IoT and Industry 4.0 included).

We look forward to seeing you in person at this event, but since we imagine there will be some international travel restrictions we are making it a "hybrid" event where we can allow international presenters to present via Zoom to the live and online audiences – and we will also open up the event to delegates joining online, who can't be there in person due to restrictions on travel, time or requirements to self-isolate or shield.

Spaces are available for exhibitors and presenters – get in touch if you want to book. Hope to see many of you in person at this event. Real networking, real coffee (and tea), and real lunch are coming back!

**Dave MacLellan**  
dave@ailu.org.uk



## PRESIDENT'S MESSAGE

It is our pleasure to write this message as incoming President and Vice President of AILU. Mike Poulter and myself picked up the mantle from Dr Jon Blackburn (TWI) who has done a tremendous job of steering AILU over the last couple of years. No small feat when we consider the challenges the last 18 months has brought us. We would be remiss indeed not to thank Jon for his excellent service to AILU – thank you Jon!

Dr Mike Poulter is well known to AILU members and the international lasers community through his role as Global Product Manager with TRUMPF. I got to know Mike through formative discussion relating to AILU's identity and strategy. This is something we are keen to develop, and we have written to all members to seek input on just this matter.

Mike and myself share a passion for all things laser and the industrial application of lasers. In my capacity as Professor of Manufacturing Engineering at the University of Nottingham I am perhaps more academic-facing but as a business owner I am fully aware of the pressures our community faces in communication, networking, technology demonstration and research for the lasers business. However, this operating environment does bring opportunities and in order to realise these, the power of our community and our people will be at the heart of everything we do. With this in mind, we are delighted to have the opportunity to represent our membership over

the next couple of years and help to shape the strategy that will ensure our success for the next 25 years of our history. This will not however be achieved by a Geordie and Scouser alone – we need your support.

The AILU Steering Committee recently met to consider our purpose, mission and vision. While we have an excellent Terms of Association dating back to our foundation, the forthcoming launch of our new website provides us with the opportunity to refresh and update for the future. Input from colleagues in this regard has been tremendous and while we are finessing wording, AILU will continue to "connect, empower and guide industrial laser users."

I would like to sign off this message by reminding you that your voice is important. We are listening and with your help we can make gains at an exciting time for lasers technology and for AILU.

**Adam Clare**  
adam.clare@nottingham.ac.uk

**Mike Poulter**  
mike.poulter@trumpf.com



Adam Clare



Mike Poulter

## RIC'S RAMBLINGS

Welcome to summer! I feel this time around we need to talk about celebrating success. If I had written this before the final of Euro 2020 – then I would have been even more up-beat in the expectation that perhaps, just perhaps, it was coming home. However the dreaded penalties struck again and – well yes England lost and it didn't come home, rather it went to Rome. But that doesn't mean we shouldn't celebrate the success of all our UK teams who took part and achieving something really special – bringing the country together after the stresses and strains of the past 16 months.

Actually if I'm totally honest I prefer the game played with the non-spherical ball, where you can pick it up and run with it – come on the British Lions!

Sport aside – what I think we should be really celebrating is in fact the amazing UK photonics sector, in which we in the laser industry play a critical role. The Photonics Leadership Group have just published the latest facts and figures on the size and impact of photonics in the UK.

In summary UK Photonics is now a £14.5bn industry. This is an increase of over £1bn over the last 2 years. There are more than 76,000 people

employed with a gross value add (GVA) of £6.5bn to the UK economy. This equates to £85,000 GVA per employee, far higher than the average GVA per employee across all sectors. Coupled to this is a like-for-like growth of 12% over 2 years. So we are in good shape and I believe we should all take a moment to pat ourselves on the back and celebrate a remarkable set of figures.

Of course there is lots of hard work ahead and we want to see photonics (and especially lasers) continue to grow and build on this success. Being part of AILU and contributing by attending events, writing articles, sharing knowledge and building our networks will all help us to achieve even greater success in future.



**Ric Allott**  
ric.allott@stfc.ac.uk