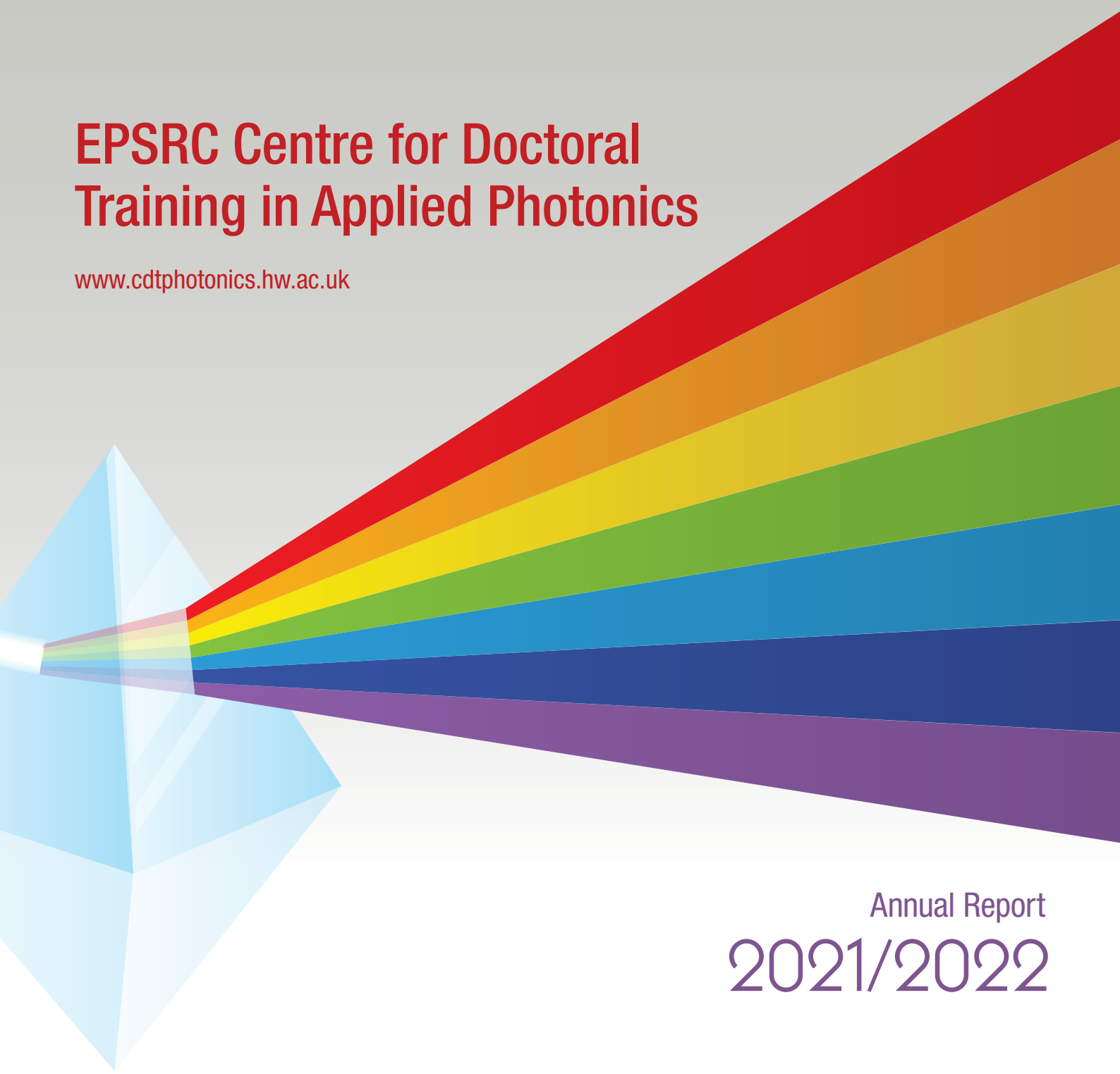
UKRI Engineering and Physical Sciences Research Council

CENTRE FOR DOCTORAL TRAINING IN APPLIED PHOTONICS
industry inspired: imaging | sensing | analysis

EPSRC Centre for Doctoral Training in Applied Photonics

www.cdtphotonics.hw.ac.uk



Annual Report 2021/2022

University of Glasgow

University of Strathclyde Glasgow

THE UNIVERSITY of EDINBURGH

University of St Andrews

University of Dundee

HERIOT WATT UNIVERSITY

Contents

Welcome

Professor Derryck T. Reid
Director, EPSRC Centre for Doctoral Training
in Applied Photonics

Last year, we celebrated twenty-one years of photonics doctoral training in what has become the EPSRC Centre for Doctoral Training in Applied Photonics.

During this time, the publication rate in photonics has grown rapidly, with nearly ten times more papers published in 2022 than in 2001, when our Centre began.

Celebrating its 21st birthday, our Centre came of age last year, and indeed the 21st Century promises to be the golden age of photonics, just as the 20th Century was for electronics. Our birthday celebrations and events are featured later in the report.

In April 2022 we were delighted to join with Heriot-Watt's CDT in Robotics and Autonomous Systems to host a special workshop attended by scientific staff from Sellafield Ltd. As key enabling technologies, Photonics and Robotics are both able to contribute to Sellafield's mission. This was our first CDT in-person event following lifting of the pandemic restrictions.

The return to face-to-face teaching and learning gave us the opportunity in the last academic year to resume in-person training and events.

Opportunities to reconnect our cohorts are always important, and we were pleased to run Intellectual Property at Heriot-Watt University and Public Engagement at Glasgow Science Centre in person during the last academic year. We are particularly grateful to all of our training providers who made the transition back to this format such a success.

As usual, our report features some fascinating case studies and profiles from several of our students and alumni. We wish we had enough space for every single student in this report, but with over 100 alumni and over 50 current students this was simply impossible!

I also want to thank our industrial partners, who over the last year have continued to support our students in exceptional ways, and to work with them to conduct some outstanding research.

Finally, I am indebted to colleagues in the wider CDT team at Heriot-Watt and across our consortium, whose work often goes unseen but enables us to deliver the highest quality doctoral training experience for our students.

Principal Contacts

Executive

Prof. Derryck Reid
Director
D.T.Reid@hw.ac.uk
+44 (0)131 451 3652

Prof. Steve Marshall
Deputy Director
Stephen.Marshall@strath.ac.uk
+44 (0)141 548 2199

Dr. Bill MacPherson
Deputy Director
W.N.MacPherson@hw.ac.uk
+44 (0)131 451 3733

Alison Low
Centre Manager
A.H.Low@hw.ac.uk
+44 (0)131 451 8245

Colette Bush
Training Programme Manager
C.Bush@hw.ac.uk
+44 (0)131 451 3792

Louise Exton
Centre Administrator
L.Exton@hw.ac.uk
+44 (0)131 451 8229

Coordinators

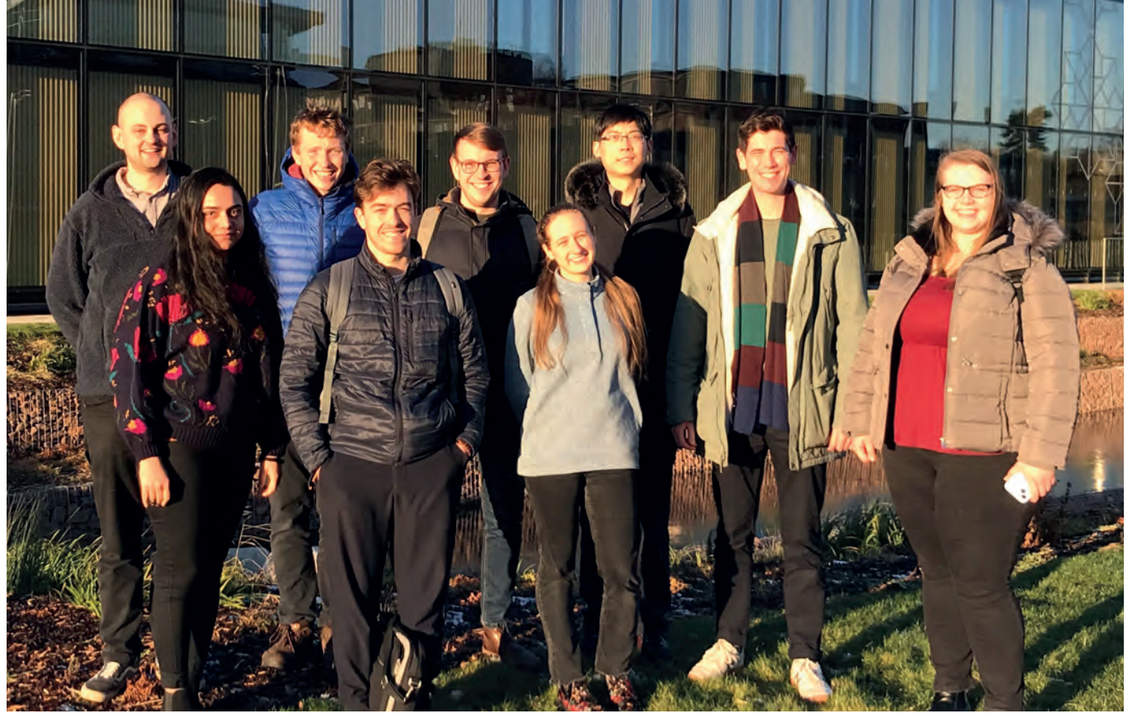
Dr. Keith Wilcox
University of Dundee
K.G.Wilcox@dundee.ac.uk

Dr. Phillip Hands
University of Edinburgh
Philip.Hands@ed.ac.uk

Prof. Martin Lavery
University of Glasgow
Martin.Lavery@glasgow.ac.uk

Prof. Graham Turnbull
University of St Andrews
gat@st-andrews.ac.uk

Dr. Gordon Flockhart
University of Strathclyde
Gordon.Flockhart@strath.ac.uk



Contact Us

CDT in Applied Photonics, Heriot-Watt University, School of Engineering and Physical Sciences, Edinburgh, EH14 4AS

E: CDTphotonics@hw.ac.uk

www.cdtphotonics.hw.ac.uk

@CDTAP

www.linkedin.com/groups/2497044/

Committees

Programme Committee

The Programme Committee, which includes representatives of the academic partners, has oversight of the implementation and development of the accredited and professional-development training programme, and the operational aspects of student admission and progression.

Management Committee

The Committee's remit is to provide oversight and strategic input to the CDT Executive and to maintain a strong connection between the CDT and its industrial partners. CDT students and the EPSRC have representation on this committee.

Independent Advisory Committee

The purpose of the Independent Advisory Committee is to provide an external perspective to the CDT by drawing on expertise from the international photonics community and other nationally funded CDTs.

21st Anniversary Celebration and Conference

The EPSRC Centre for Doctoral Training held a 21st Anniversary Celebration and Conference on 28 June 2022. The Centre is the longest running Centre for Doctoral Training in Photonics in the UK and is jointly funded by EPSRC and Industry, being awarded five consecutive rounds of competitive funding.

The Centre presently has 51 current students and over 100 alumni. Our alumni are Chief Scientists and Engineers, founders of start up businesses, CEOs and COOs, as well as being in many other leadership roles including academic teaching and research roles.

The Anniversary Celebration featured a discussion with joint founder Prof. Julian Jones, a distinguished panel discussion chaired by Dr. Tom Vettenburg with CDT Alumni Dr. Mariastefania De Vido, Dr. Agata Pawlikowska, Prof. Daniel Esser, Dr. Tiina Delmonte and also Dr. Henry White who is a former industrial supervisor and long term supporter of the Centre. A newly created video, which can be viewed on our website **here** traced the origin and evolution of the Centre, and featured our alumni and research by our current students.

The current Centre Director Professor Derryck Reid said "I am delighted that so many were able to attend our 21st anniversary celebration. Like all birthday parties, it was a real 'family event' in respect of the community of students, alumni, academics and industrial partners that our CDT brings together to pursue state-of-the-art research with the potential for near-term economic and societal benefit."

Congratulation to our Prize Winners as follows:

1st Year Group Prize- Christopher Boland, Will Gash, Aoife Keane

2nd Year - Ultan Daly

3rd Year - Ellis Kelly

4th Year - Eilidh Johnston

Research Videos - Ellis Kelly, Angel Victor Juanco Muller, Danielle Clarke & Gary Quinn

21st Anniversary Celebration and Conference

The Centre is a partnership between Heriot-Watt University (lead) and the universities of Dundee, Edinburgh, Glasgow, St Andrews and Strathclyde. Every student in the Centre is sponsored by Industry with 61 different Industrial Sponsors being involved with the Centre over the 21 years.

"Our current projects show that photonics is just as relevant to the world today as it was when our Centre began"

The Centre was founded in 2001 by Professor Julian Jones and Professor Duncan Hand. Professor Jones attended the anniversary celebration and said "When our Centre was born at the turn of the millennium, we knew that photonics had a great deal to offer to society, and our 21st birthday was a splendid opportunity to celebrate what we have achieved, through our research and enterprise and the careers that our graduates have built. Our current projects show that photonics is just as relevant to the world today as it was when our Centre began, whether in rebuilding the post-pandemic economy, tackling global environmental change, or contributing to international security. I look forward to many celebratory anniversaries to come!"

Keynote speakers at the Conference were Professor Kishan Dholakia, School of Physics and Astronomy, University of St Andrews and Faculty of Sciences, Engineering and Technology, University of Adelaide, and Professor Laura Waller, Computational Imaging Lab, University of California, Berkeley.

The research of our current students was showcased with lively one minute poster pitches and conventional poster sessions.

Our Students

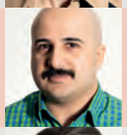
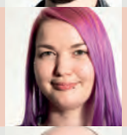
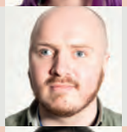
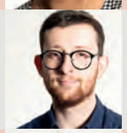
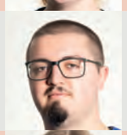
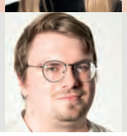
New Students

We were delighted to welcome our new students in September 2021 at our induction event held at Heriot-Watt University on Monday 5th September. The new students are hosted by all six of our academic institutions and ten different Industry Partners. At the Welcome Event, new students were able to get to know each other, receive advice from a senior CDT student about what to expect and hear from a seasoned supervisor about how to get the most out of their supervisory support.

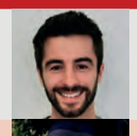
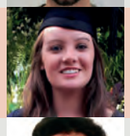
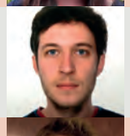
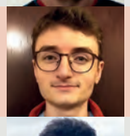
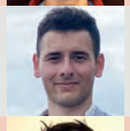
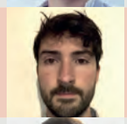
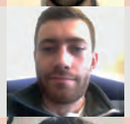
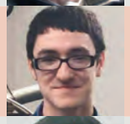
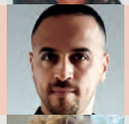
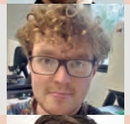
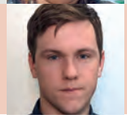
The cohort of students spend their first year completing technical courses before moving to their companies for the research component in June 2022. The companies supporting our 2021/22 cohort are:

- AWE
- Canon Medical
- Edinburgh Transplant Centre
- Huawei
- Leonardo
- NPL
- Optos
- Sellafield/NNL
- STMicroelectronics
- VividQ Ltd

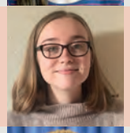
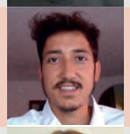
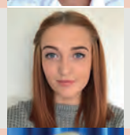
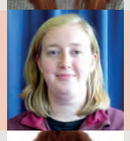
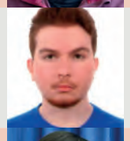
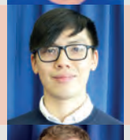
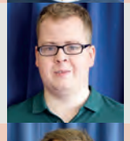
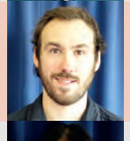
Year 1

Name		Company	University	Project Title
Iman Alhamdan		VividQ Ltd	University of St Andrews	Metasurfaces for augmented reality applications
Mohanad Al-Rubaiee		Huawei	University of Glasgow	Laser sources and semiconductor optical amplifiers for free-space orbital angular momentum communication systems
Christopher Boland		Canon Medical Research Europe Ltd	University of Edinburgh	More efficient deep learning for medical image analysis
Jemma Callaghan		ST Microelectronics	Heriot-Watt University	Active 2-dimensional optical meta-surfaces
Patrick Foley		Leonardo	Heriot-Watt University	Development of multi-kW coherently combined fibre master oscillator power amplifiers
Femy Francis		AWE	University of St Andrews	Development of planar waveguide based gas sensors for challenging environments
William Gash		AWE	Heriot-Watt University	Development of remote optoelectronic sensor systems for long-term component monitoring
Aoife Keane		NNL	University of Strathclyde	New optical imaging and analysis techniques for the early detection and quantification of corrosion on special nuclear materials packages
Cosmin Suciu		NPL	University of Glasgow	Ultra-high-Q integrated optical microresonators for frequency comb generation
Shannon Thompson		NHS Lothian	University of Edinburgh	Optical spectroscopy to enable screening in the liver transplant theatre
Dorian Urban		Optos	University of Dundee	Hybrid optical-digital coherence tomography

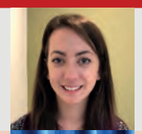
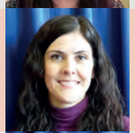
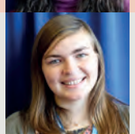
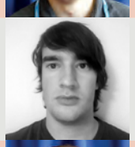
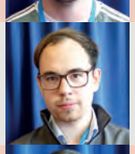
Year 2

Name		Company	University	Project Title
Samuel Buck		STFC	Heriot-Watt University	Development of technologies for high-repetition rate PW level laser systems
Danielle Clarke		STFC	Heriot-Watt University	Development of a DPSSL pump for a 10 Hz petawatt laser system
Francesco Dalla Serra		Canon Medical Research Europe Ltd	University of Glasgow	Answering questions about medical images
Ultan Daly		BT	University of Glasgow	Atmospheric monitoring for next generation cable free optical communication technologies
Aubin Donnot		Gooch & Housego	University of Strathclyde	Fiber optic components and sub-systems for communication and sensing in harsh environments
Matthew Gil		NHS Glasgow and Greater Clyde	University of Strathclyde	Multi-modality image registration
Harry Hall		Fraunhofer	Heriot-Watt University	Ultrafast laser inscription of components for quantum technologies
Paul Hawthorne		MBDA	Heriot-Watt University	Electro-optic devices for extreme LIDAR in highly dynamic environments
Tehmoor Hussain		Luxinar	Heriot-Watt University	Short pulse lasers for machining composite materials
Nick Kabawa		STAR Dundee	University of Dundee	Data handling in spacecraft optical systems
Nathaniel Marsh		MTC	Heriot-Watt University	Optical sensors for monitoring and control of ultra-short pulsed laser manufacturing processes
Marek Michalowski		Fraunhofer	University of Strathclyde	Intelligent and directed laser-based spectroscopy

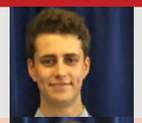
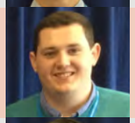
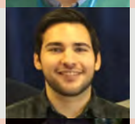
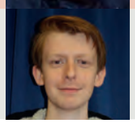
Year 3

Name		Company	University	Project Title
Rachel Cannon		Optocap	University of Strathclyde	Miniaturised high-reliability lasers for quantum technologies
Louise Finlayson		NHS	University of St Andrews	Fluorescence imaging, diagnosis, and photodynamic therapy for brain tumours
James Jackson		Fraunhofer	Heriot-Watt University	Optical fibre sensing for offshore renewable energy
Angel Victor Juanco Muller		Canon Medical Research Europe Ltd	Heriot-Watt University	Graph convolutional neural networks for medical image analysis
Ellis Kelly		Fraunhofer	University of Strathclyde	Stand-off, SPAD-enhanced ultra-violet Raman spectroscopy
Alexandra Lee		Wideblue	Heriot-Watt University	Development of a novel single photon quantum key detection (QKD) optical ground station for secure satellite based communications
Stavros Misopoulos		Edinburgh Instruments	Heriot-Watt University	Design and build of a high specification extended FTIR spectrometer
Calvin Wan		AMETEK	Heriot-Watt University	Miniature phase grating interferometer contact gauge/ high speed phase shifting interferometric gauge
David Webster		KP Technology	University of St Andrews	Kelvin probe and ambient photoemission measurements of organic and hybrid semiconductors
Paul White		Fraunhofer	University of Strathclyde	Ultrashort-pulse optical frequency combs for quantum technologies and sensing
Suki Yau		Lightpoint Medical	Heriot-Watt University	Biomedical imaging and signal processing for the intra-operative detection of cancerous tissue

Year 4

Name		Company	University	Project Title
Natalie Bruce		Fraunhofer	University of Strathclyde	Hybrid UV LED/elastomeric bio-instrumentation
Natalie Flaherty		Thales	Heriot-Watt University	Image processing for situational awareness in urban environments
Eilidh Johnston		Fraunhofer	University of Strathclyde	Photonics in life and health
Antanas Kascenas		Canon Medical Research Europe Ltd	University of Glasgow	Learning from diverse data for clinical decision support
Jack Marston		EDF	University of Strathclyde	Photonic sensing within civil nuclear infrastructure for lifetime extension and long-term structural health monitoring of decommissioned plant
Gary Quinn		STFC	Heriot-Watt University	Development of a diode-pumped solid-state laser system operating at 10 J, 100 Hz
Bence Szutor		UniKLasers	Heriot-Watt University	Single-frequency laser engineering at exotic wavelengths for quantum technologies
Bethany Thompson		Canon Medical Research Europe	University of Strathclyde	Multitask deep learning from images for clinical decision support

Writing Up

Name		Company	University	Project Title
Owen Anderson		Canon Medical Research Europe Ltd	University of Glasgow	An investigation into the analysis of computed tomography images using deep learning methods
Kyle Brown		Thales	University of Glasgow	Novel concepts for high performance opto-mechanical line of sight pointing applications
Paolo Ercolino		Thales	University of Strathclyde	New concepts for compact LIDAR systems
Paul Harrison		Powerphotonic	Heriot-Watt University	Development, production and characterisation of laser-machined micro-optics
Nicholas-Alexander Smith		Fraunhofer UK	Heriot-Watt University	Compact wind LIDAR: towards hand held remote sensing of wind

Graduations and Vivas

The following graduated from the Centre betweeen September 2021 and August 2022.

Dr. Munadi Ahmad	Heriot-Watt University
Dr. Jamie Coyle	University of Strathclyde
Dr. Juan Pedro Godoy Vilar	Heriot-Watt University
Dr. Ben Gore	Heriot-Watt University
Dr. Daniel Marwick	University of St Andrews
Dr. Paul Mitchell	Heriot-Watt University
Dr. Rowan Pocock	Heriot-Watt University
Dr. Hollie Wright	Heriot-Watt University

Recent Vivas

The following have successfully defended their theses and will be graduating in Autumn/Winter 2022.

Tamer Cosgun	Heriot-Watt University
Vladimirs Horjkovs	Heriot-Watt University
Ben Michie	Heriot-Watt University

Research Outputs

We are delighted that our students have managed to disseminate their research widely in 2021/22.

Journal Publications

M. De Vido, P. D. Mason, M. Fitton, R. W. Eardley, **G. Quinn, D. L. Clarke**, K. Ertel, T. J. Butcher, P. J. Phillips, S. Banerjee, J. Smith, J. Spear, C. Edwards, J. L. Collier, “Modelling and measurement of thermal stress-induced depolarisation in high energy, high repetition rate diode-pumped Yb:YAG lasers,” Opt. Express **29** (4), 5607-5623 (2021).

P. J. Phillips, S. Banerjee, P. Mason, J. Smith, J. Spear, M. De Vido, K. Ertel, T. Butcher, **G. Quinn, D. L. Clarke**, C. Edwards, C. Hernandez-Gomez, J. Collier, “Second and third harmonic conversion of a kilowatt average power, 100-J-level diode pumped Yb:YAG laser in large aperture LBO,” Opt. Lett. **46** (8), 1808-1811 (2021).

Nicholas A. Smith, Mark D. Mackenzie, James M. Morris, Ajoy K. Kar, and Henry T. Bookey, “Nd:YAG laser rod manufactured by femtosecond laser-induced chemical etching,” Opt. Mater. Express 11, 3946-3953 (2021).

E. Eadie, P. O’Mahoney, **L. Finlayson**, I. Barnard, S. H. Ibbotson, K. Wood, ‘Computer Modeling Indicates Dramatically Less DNA Damage from Far-UVC Krypton Chloride Lamps (222 nm) than from Sunlight Exposure’, Photochem Photobiol, 97(5), 1150-1154, (2021).

L. Finlayson, I. Barnard, L. McMillan, E. Eadie, S. H. Ibbotson, C. T. A. Brown, K. Wood, ‘Depth Penetration of Light into Skin as a Function of Wavelength from 200 to 1000 nm’, Photochem Photobiol, online ahead of print, doi: 10.1111/php.13550, (2021).

Jones, C., Biner, D., **Misopoulos, S.**, Krämer, K.W. and Marques-Hueso, J., 2021. Optimized photoluminescence quantum yield in upconversion composites considering the scattering, inner-filter effects, thickness, self-absorption, and temperature. Scientific reports, 11(1), pp.1-10.

Conference Proceedings

J. Jackson, H.T. Bookey, W.N. MacPherson, B. Sellar, J. Macarthur “Investigating the Response of Distributed Fibre Optic Acoustic Sensing for Subsea Cable Motion Monitoring”, presented at ISOPE, June 20-25th, 2021.

M. Warden, R. Spesyvtsev, **E. Kelly** et al., “Long-range, range-resolved detection of H2 using single-photon ‘quantum’ Raman: a condition monitoring tool for long-term storage of nuclear materials”, paper PC12116-27, in SPIE Defence + Commercial Sensing, Florida, 2022.

Aubin Donnot, James Edmunds, Niall Hammond, Matthew Welch, Peter Kean, Efstratios Kehayas, Ronald Hagen, Shobhit Yadav, Henk Medenblik, Lun Cheng, Gabriele Bulgarini, Martijn Dresscher, “Development, assembly, and characterisation of a breadboard CCSDS compliant 4W average power high photon efficiency (HPE) pulsed laser source,” Proc. SPIE 11993, Free-Space Laser Communications XXXIV, 1199308 (4 March 2022); https://doi.org/10.1117/12.2607602.

Matthew Welch, **Aubin Donnot**, James Edmunds, Marios Kechagias, Elliott Prowse, Karen Hall, Peter Kean, Stratos Kehayas, “High power WDM sources for laser communication,” Proc. SPIE 11993, Free-Space Laser Communications XXXIV, 119930B (4 March 2022); https://doi.org/10.1117/12.2608506 .

S. Buck, et al, “Development Update of an Ultra-broadband, all-OPCPA Petawatt Beamline”, CLEO US 2022.

S. Buck, M. Galimberti, “Pulsefront-tilt Correction of Laser Pulses by Angular Dispersion Management”, CLEO US 2022.

B. Thompson et al. “Pseudo-label refinement using superpixels for semi-supervised brain tumour segmentation”, (2022), International Symposium for Biomedical Imaging 2022 (ISBI 2022).

Oral Conference Papers

A. Kascenas, R. Young, B. S. Jensen, N. Pugeault, A. Q. O'Neil, "Anomaly Detection via Context and Local Feature Matching", International Symposium in Biomedical Imaging 2022.

R. Cannon, S. Dyer, et. al., "Miniaturized High Reliability Lasers for Quantum Technologies", EFTF-IFCS conference, Paris, April 2022.

L. Finlayson, I. Barnard, L. McMillan, E. Eadie, S. H. Ibbotson, C. T. A. Brown, K. Wood, 'Simulated Penetration Depth of Ultraviolet Radiation in Skin with Varying Stratum Corneum Thicknesses as an Aid for Phototherapy', Presented at 19th Congress of the European Society for Photobiology, Virtual, 30th Aug - 3rd Sep 2021.

L. Finlayson, I. Barnard, L. McMillan, E. Eadie, S. H. Ibbotson, C. T. A. Brown, K. Wood, 'Production of a Dataset Containing Penetration Depth of Light into Skin from 200–1000 nm', Presented at 2022 Annual Conference of the British Medical Laser Association, Edinburgh, 25th-27th May 2022.

D. L. Clarke, "Development of an automated null ellipsometer for the characterisation of the phase delay introduced by high-reflectance optical coatings for high-energy, high-repetition rate lasers," Workshop on Birefringence Measurement and Control (01/12/21).

D. L. Clarke, M. De Vido, K. Ertel, P. D. Mason, P. J. Phillips, S. Banerjee, J. M. Smith, J. L. Spear, **G. Quinn**, A. Wojtusiak, T. J. Butcher, C. Edwards, "Recent DiPOLE technology developments," HPL Conference (15/12/21).

Poster Conference Papers

Flaherty, N.A.D. "Information Fusion System for Threat Awareness", Thales PhD Day, Thales Greenpark, Reading. 24th May 2022.

Flaherty, N.A.D . "Information Fusion", Centre for Doctoral Training in Applied Photonics Summer School, 14th - 18th June 2021. Online.

Flaherty, N.A.D. "Information Fusion System for Threat Awareness", Centre for Doctoral Training in Photonics Annual Conference, Edinburgh, June 2022.

D. L. Clarke, CDT in Applied Photonics Summer School in Imaging, Sensing and Analysis, 14th–18thJune 2021, Online.

A. Kascenas, N. Pugeault, A. Q. O'Neil, "Denoising Autoencoders for Unsupervised Anomaly Detection in Brain MRI", Medical Imaging with Deep Learning 2022.

A. Kascenas, SUSSP 76 Summer School in Photonic Imaging, Sensing & Analysis 2021, Virtual Poster.

F. Dalla Serra, SUSSP 76 Summer School In Imaging, Sensing & Analysis, 14 – 18 June, Edinburgh, UK, SUSSP 76, Virtual Poster.

T. Hussain, SUSSP 76 Summer School In Imaging, Sensing & Analysis, 14 – 18 June, Edinburgh, UK, SUSSP 76, Virtual Poster

P. J. Foley, S. P. Thompson and D. R. Urban, "Monitoring Heart Rate and Blood Oxygen Saturation with Photoplethysmography", Systems Engineering Lab Group Project, CDT in Applied Photonics Conference (2022).

W. Gash, A. Keane, and C. Boland, "Optical Theremin" Systems Engineering poster, CDT in Applied Photonics Conference (2022) .

M. Al-Rubaiee, J. E. Callaghan, and C. Suciu, "myRIO Optical Ranging System" Systems Engineering Project, presented at EPSRC CDT in Applied Photonics Conference, Edinburgh, UK, 28 June 2022.

R. Cannon, S. Dyer, et. al., "Miniaturized High Reliability Lasers for Quantum Technologies", EFTF-IFCS conference, Paris, April 2022.

R. Cannon, S. Dyer, et. al., "Miniaturized High Reliability Lasers for Quantum Technologies", SPIE Photonics for Quantum conference, Rochester, NY, June 2022.

L. Finlayson, I. Barnard, L. McMillan, E. Eadie, S. H. Ibbotson, C. T. A. Brown, K. Wood, 'Light penetration into a 6-layer skin model', Presented at British Association of Dermatologists 101st Annual Meeting, Virtual, 6th-8th July 2021.

L. Finlayson, I. Barnard, L. McMillan, E. Eadie, S. H. Ibbotson, C. T. A. Brown, K. Wood, 'Penetration of Light into a 6-Layer Skin Model for 200-1000nm', Presented at SUSSP 76 Photonic Imaging, Sensing & Analysis, 14th – 18th June 2021.

Kelly, E., Stothard, D. and Li, D., 2021. Stand-Off Hydrogen Detection Using Quantum Raman Spectroscopy. SUSSP 76 Photonic Imaging, Sensing & Analysis (Online).

E. Eadie, P. O'Mahoney, **L. Finlayson**, S. H. Ibbotson, K. Wood, Characterising 'Far-UVC' KrCl excimer lamps for safety and inactivation of viruses', Presented at 19th Congress of the European Society for Photobiology, Virtual, 30th Aug - 3rd Sep 2021.

J. Marston, P. Niewczas J. Guo, "Structural Health Monitoring in NPPs." CDT Conference, Heriot Watt University, UK.

H. Hall, SUSSP 76 Photonic Imaging, Sensing & Analysis, 14-18 June 2021, Virtual Poster.

D.E.J. Webster, "Kelvin probe and ambient photoemission of organic and perovskite semiconductors", CDT Summer School in Imaging, Sensing and Analysis, 2021.

Aubin Donnot, Peter Kean, Craig Michie, Gordon Flockhart," Optical Amplifiers for Space-Based Optical Communication", CDTAP Annual Conference 2022, (June 2022).

S. Misopoulos, J. Marques-Hueso and D. Nather, "Design and build of a high specification FTIR spectrometer," presented at EPSRC CDT in Applied Photonics Conference & 21st Anniversary Celebration, Edinburgh, UK, 28 June 2022.

Nicholas A. Smith, "Ultrafast Laser Inscription in Crystalline Materials", SSUSP76.

S. Yau, "Application of a CMOS sensor for in-situ detection of radiopharmaceuticals", SSUP 76, June 2021.

Patents

S. Misopoulos, A. Kechagias, T. Aretos, J. Marques-Hueso and D. Nather, ''Optical system and method" (GB2210919.3 · Filed Jul 26, 2022).

Other

S. Buck, M. Galimberti, "Wavefront-tilt Correction of Laser Pulses by Dispersion Management", CLF Annual Report submission 2020-2021.

Juanco-Müller, Ángel Víctor, et al. "Deep supervoxel segmentation for survival analysis in head and neck cancer patients." 3D Head and Neck Tumor Segmentation in PET/CT Challenge. Springer, Cham, 2021. (BOOK CHAPTER).

Müller, Ángel Víctor Juanco, Joao FC Mota, and Corné Hoogendoorn. "Segmentation of Skin Lesions by Superpixel Classification with Graph-Context CNN." 25th UK Conference on Medical Image Understanding and Analysis. 2021. (CONFERENCE ABSTRACT).

Flaherty, N.A.D, IET "Maximising the Value of your PhD - How I do my PhD", IET Colloquium on Antennas Wireless Electromagnetics (CAWE). Online, 15th September 2021.

J. Callaghan, "I've graduated – What now?" Panellist, Conference for Undergraduate Women and Non-Binary Physicists (CUWiP), 7-10 April 2022, Glasgow, UK.

Project Supervisors

Name	Academic/industrial	Affiliation
Dr. David Anderson	Academic	University of Glasgow
Prof. Colin Campbell	Academic	University of Edinburgh
Dr. Richard Carter	Academic	Heriot-Watt University
Dr. Xianzhong Chen	Academic	Heriot-Watt University
Dr. Fani Deligianni	Academic	University of Glasgow
Dr. Andrea Di Falco	Academic	University of St Andrews
Dr. Ross Donaldson	Academic	Heriot-Watt University
Prof. Daniel Esser	Academic	Heriot-Watt University
Prof. Duncan Hand	Academic	Heriot-Watt University
Dr. Lianping Hou	Academic	Univeristy of Glasgow
Prof. Walter Johnstone	Academic	University of Strathclyde
Prof. Alan Kemp	Academic	University of Strathclyde
Dr. Nicolas Laurand	Academic	University of Strathclyde
Prof. Martin Lavery	Academic	University of Glasgow
Dr. David Li	Academic	University of Strathclyde
Dr. Bill MacPherson	Academic	Heriot-Watt University
Dr. Jose Marques-Hueso	Academic	Heriot-Watt University
Prof. John Marsh	Academic	Univeristy of Glasgow
Prof. Stephen Marshall	Academic	University of Strathclyde
Dr. Craig Michie	Academic	University of Strathclyde
Dr. Joao Mota	Academic	Heriot-Watt University
Dr. Paul Murray	Academic	University of Strathclyde
Dr. Pawel Niewczas	Academic	University of Strathclyde
Dr. Nicolas Pugeault	Academic	University of Glasgow
Prof. Derryck Reid	Academic	Heriot-Watt University
Dr. Jinchang Ren	Academic	University of Strathclyde
Prof. Erling Riis	Academic	University of Strathclyde
Dr. Sebastian Schulz	Academic	University of St Andrews
Dr. Paul Siebert	Academic	University of Glasgow
Dr. Marc Sorel	Academic	University of Glasgow
Prof. Robert Thomson	Academic	Heriot-Watt University
Prof. John Travers	Academic	Heriot-Watt University
Prof. Sotirios Tsaftaris	Academic	University of Edinburgh
Prof. Graham Turnbull	Academic	University of St Andrews
Dr. Tom Vettenburg	Academic	University of Dundee
Prof. Andrew Wallace	Academic	Heriot-Watt University
Dr. Keith Wilcox	Academic	University of Dundee
Dr. Kenneth Wood	Academic	University of St Andrews

Name	Academic/industrial	Affiliation
Prof. Iain Baikie	Industrial	KP Technology Ltd
Dr. Bob Bennett	Industrial	Taylor Hobson
Dr. Henry Bookey	Industrial	Fraunhofer
Dr. Simon Brooks	Industrial	AWE
Dr. Barry Connor	Industrial	Thales
Dr. Mariastefania de Vido	Industrial	STFC
Dr. Antonio Di Buono	Industrial	National Nuclear Laboratory
Dr. James Downing	Industrial	STMicroelectronics
Dr. Ewan Eadie	Industrial	NHS
Dr. Marco Galimberti	Industrial	STFC
Dr. Keith Goatman	Industrial	Canon Medical Research Europe
Dr. Jiansong Guo	Industrial	EDF
Dr. Stephen Harrow	Industrial	NHS
Dr. Anne-Marie Haughey	Industrial	Fraunhofer
Dr. Mark Holm	Industrial	Huawei
Dr. Corne Hoogendoorn	Industrial	Canon Medical Research Europe
Dr. John-Mark Hopkins	Industrial	Fraunhofer
Dr. Andrzej Kaczorowski	Industrial	VividQ Ltd
Dr. Peter Kean	Industrial	Gooch & Housego
Dr. Phil Keenan	Industrial	AWE
Dr. Nils Krichel	Industrial	PowerPhotonic
Dr. Jason Lee	Industrial	Luxinar
Dr. Andrew Lord	Industrial	BT
Dr. Dirk Nather	Industrial	Edinburgh Instruments
Dr. Alison O'Neil	Industrial	Canon Medical Research Europe
Dr. Gabriel Oniscu	Industrial	NHS Lothian
Dr. Maciej Pajak	Industrial	Canon Medical Research Europe
Dr. Ian Park	Industrial	MBDA
Dr. Steve Parkes	Industrial	STAR Dundee
Mr. Andrew Parmley	Industrial	Thales
Dr. Adam Polak	Industrial	Fraunhofer
Dr. Miguel Preciado	Industrial	Optos
Mr. Stephen Robertson	Industrial	Optocap
Dr. Tian Long See	Industrial	MTC
Dr. Mark Silver	Industrial	Thales
Dr. Jonathan Silver	Industrial	NPL
Dr. David Stothard	Industrial	Fraunhofer
Dr. Ian Thomson	Industrial	Leonardo
Dr. Jeremy Voisey	Industrial	Canon Medical Research Europe
Dr. Kunal Vyas	Industrial	Light Point Medical
Dr. Chris Watts	Industrial	Thales
Dr. Craig Whitehill	Industrial	Wideblue

History of the Centre

Engineering and Physical Sciences Research Council

CENTRE FOR DOCTORAL TRAINING IN APPLIED PHOTONICS
industry inspired: imaging | sensing | analysis

2001

Professor Julian Jones and Professor Duncan Hand successfully bid for funding for the EPSRC Engineering Doctorate Centre in Photonics.

First students join the Centre.

2002

HERIOT WATT UNIVERSITY

University of St Andrews

University of Strathclyde Glasgow

The first Centre is a partnership between Heriot Watt University and the Universities of St Andrews and Strathclyde.

2003

Recruitment of students for the Centre continues. The 2003 EngD stipend rate was £12,000, in 2022/23 the EngD stipend rate is £22,000.

2004

Professor Duncan Hand leads the successful bid for the SECOND tranche of funding.

2005

The first student to graduate - Dr. Ian Armstrong from the University of Strathclyde.

2006

Students spend the first semester in their First year taking taught courses as the University of St Andrews.

2007

First Photonics EngD Centre Conference takes place in 2007.

2008

Professor Andy Harvey takes over as Director of the Centre.

Andy advised in 2022 “I regularly see our CDT alumni as established researchers in the photonics community - which is very rewarding!”

2009

University of Glasgow

Optics & Photonics Technologies
Industrial Doctorate Centre

THIRD tranche of funding awarded and Centre re-branded the EPSRC Industrial Doctorate Centre in Optics and Photonics Technologies. University of Glasgow joins the Partnership

2010

Conference Organisers 2010 - Over the years the Centre has had many wonderful and dedicated Support Team members- Alex Campbell, Linda Bruce, Alison Low, Dr. Dawn Beddard, Colette Bush, Kasia Sulima, Audrey McCrorie and Louise Exton.

2011

Students and staff attend outdoor activities at the Firbush Centre located on the shores of Loch Tay.

2012

Professor Derryck Reid takes over as Director of the Centre and implements new initiatives such as Annual Reports and Quarterly Progress Reviews.

HERIOT WATT UNIVERSITY · University of St Andrews · University of Strathclyde Glasgow · University of Dundee · THE UNIVERSITY of EDINBURGH · University of Glasgow

History of the Centre

Engineering and Physical Sciences Research Council

CENTRE FOR DOCTORAL TRAINING IN APPLIED PHOTONICS
industry inspired: imaging | sensing | analysis

2013

First Centre Annual Report produced, featuring the Industrial connections of the Centre.

2014

University of Dundee

Centre for Doctoral Training in Applied Photonics

FOURTH tranche of funding awarded and becomes the EPSRC Centre for Doctoral Training in Applied Photonics.

University of Dundee joins the partnership.

2015

First Cohort of the refunded Centre for Doctoral Training in Applied Photonics.

2016

SUSSP 72 Photonic Systems for Sensing and Metrology', the first international Summer School organised by the CDT, takes place at University of St. Andrews.

2017

Over 100 students have graduated from the Centre becoming Chief Scientists and Engineers, Founders of Start Up Businesses, CEO, COO, Professors and many other Leadership Roles as well as Academic Teaching and Research roles.

2018

THE UNIVERSITY of EDINBURGH

Centre awarded a FIFTH tranche of competitive funding. Launch event to celebrate the refunding of the Centre and to showcase the refocus of the Centre to Photonics, Imaging, Sensing and Analysis. University of Edinburgh joins the partnership.

2019

First cohort of refunded and refocused Centre start in September 2019.

2020

Covid-19 pandemic effects much of 2020 and 2021. CDT students, supervisors and staff learn to work at home due to lockdowns.

The MacFarlane Prize for the best thesis at Heriot-Watt University in 2020 was awarded to CDT alumna Dr. Mariastefania Da Vido.

2021

The in-person summer school planned for 2020 was cancelled due to the Covid-19 pandemic, this took place as a successful on-line event in 2021 instead.

2022

First year students Systems Engineering demonstrations at the University of Strathclyde.

HERIOT WATT UNIVERSITY · University of St Andrews · University of Strathclyde Glasgow · University of Dundee · THE UNIVERSITY of EDINBURGH · University of Glasgow

Our Alumni

The following have graduated from the Centre for Doctoral Training in Applied Photonics and its predecessors, the Industrial Doctorate Centre.

Name	Institution	Graduated	Job Title
Dr. Ben Gore	Heriot-Watt University	2022	Optical Development Engineer, Alter Technology TUV Nord UK Ltd
Dr. Daniel Marwick	University of St Andrews	2022	Development Scientist, Malvern Panalytical
Dr. Munadi Ahmad	Heriot-Watt University	2021	Instrument Systems Engineer, University of Oxford
Dr. Andreas Aßmann	Heriot-Watt University	2021	Senior System Architect, STMicroelectronics
Dr. Christopher Blackwell	Heriot-Watt University	2021	Optical Engineer, Ceres Holographics
Dr. Jamie Coyle	University of Strathclyde	2021	Senior Laser Engineer, Leonardo
Dr. Tamrha Cummings	University of Glasgow	2021	Lead Hardware Engineer, Leonardo
Dr. Riccardo Geremia	Heriot-Watt University	2021	System Engineer, Oxford Lasers
Dr. Juan Pedro Godoy Vilar	Heriot-Watt University	2021	Research Engineer, MTC
Dr. Calum Hill	Heriot-Watt University	2021	Principal Development Engineer, Vector Photonics
Dr. Anna Michalska	Heriot-Watt University	2021	Design Engineer, Renishaw
Dr. Paul Mitchell	Heriot-Watt University	2021	Principal Engineer, Optoscribe
Dr. Rowan Pocock	Heriot-Watt University	2021	Development Engineer, Avicena Tech
Dr. Michael Reilly	Heriot-Watt University	2021	Senior System Engineer, Leonardo
Dr. Jack Thomas	University of St Andrews	2021	Researcher, Fraunhofer
Dr. Peter Wakeford	University of Glasgow	2021	Research Engineer, Optos
Dr. Michael Woodley	Heriot-Watt University	2021	Research Fellow, University of Sussex
Dr. Hollie Wright	Heriot-Watt University	2021	Research Associate, Heriot-Watt University
Dr. Jonathan Crabb	University of Strathclyde	2020	Applications Engineer, European Space Agency
Dr. Matthew Daykin	Heriot-Watt University	2020	Senior Software Analytics Engineer, Csignum Ltd
Dr. Mariastefania de Vido	Heriot-Watt University	2020	Senior Laser Scientist, STFC
Dr. Leonardo Del Bino	Heriot-Watt University	2020	Co-founder, Akhetonics
Dr. Tom Dyer	Heriot-Watt University	2020	Senior Engineer, Defence Contractor
Dr. Jamie Foubister	University of Glasgow	2020	Research Engineer, Optos
Dr. Yili Guo	Heriot-Watt University	2020	Optical Engineer, Baraja
Dr. Matthew Knights	Heriot-Watt University	2020	Product Manager, Electric Portfolio, Groupe Atlantic
Dr. Gabriel Reines March	University of Strathclyde	2020	Digital Pathology R&D Project Manager, OracleBio
Dr. Neil Stevenson	University of St Andrews	2020	Senior Laser Engineer, Leonardo
Dr. James Brooks	University of Strathclyde	2019	Research Assistant, Universitätsklinikum Düsseldorf
Dr. Michele Guastamacchia	Heriot-Watt University	2019	Optical Modelling Engineer, ASML
Dr. Giovanni Giuliano	University of Glasgow	2019	Postdoctoral Researcher, Istituto di Scienze Marine, Consiglio Nazionale delle Ricerche (ISMAR - CNR)
Dr. Dominic Hunter	University of Strathclyde	2019	Research Associate, University of Strathclyde
Dr. Aneta Lisowska	Heriot-Watt University	2019	Senior Postdoctoral Researcher, Sano Centre for Computational Medicine
Dr. Iain Mckeeman	University of Strathclyde	2019	Senior R&D Engineer, Synaptec Ltd
Dr. Adam Polak	University of Strathclyde	2019	Researcher, Fraunhofer
Dr. Adam Sroka	University of Strathclyde	2019	Director, Hypercube Consulting
Dr. David Barr	Heriot-Watt University	2018	Software Engineer, Durham University
Dr. Ioannis Bitharas	Heriot-Watt University	2018	Research Associate, Heriot-Watt University
Dr. Luke Maidment	Heriot-Watt University	2018	Project Leader, Class 5 Photonics
Dr. James Morris	Heriot-Watt University	2018	Programme Engineering Manager, Raytheon UK
Dr. Iain Rodger	Heriot-Watt University	2018	Head of Data Science, Arachnys
Dr. Paul Ross	Heriot-Watt University	2018	Principal Software Engineer, hyperTunnel Ltd
Dr. James Sloan	University of Glasgow	2018	Data Scientist, Baillie Gifford
Dr. Marc Smillie	University of Strathclyde	2018	Senior Sales Manager, NKT Photonics
Dr. Gediminas Sumskis	Heriot-Watt University	2018	Research Engineer, Luxinar
Dr. Stefano Valle	University of Glasgow	2018	Senior MEMS Metrologist Engineer, SiTime
Dr. Ross Aitken	Heriot-Watt University	2017	Senior Antenna Engineer, Leonardo
Dr. Ian Baker	Heriot-Watt University	2017	Product Manager, NKT Photonics
Dr. Robert Campbell	University of Strathclyde	2017	Research Engineer/Physicist, Self Employed
Dr. John Molloy	Heriot-Watt University	2017	Research Fellow, University of York
Dr. Howard Moshtael-Oskui	Heriot-Watt University	2017	Science (Physics) & Maths Teacher, North Cambridge Academy
Dr. Alison O'Neil	Heriot-Watt University	2017	Principal Scientist, AI Team, Canon Medical Research Europe Ltd
Dr. Alexander Weir	Heriot-Watt University	2017	Senior Technical Manager, Canon Medical Research Europe Ltd
Dr. Anthony Corcoran	University of Glasgow	2016	Principal Optical Engineer, Leonardo

Name	Institution	Graduated	Job Title
Dr. Maurice Lessing	University of St Andrews	2016	Group Leader, Menlo Systems
Dr. David Myles	Heriot-Watt University	2016	Head of Systems Engineering, Opsydia
Dr. Agata Pawlikowska	Heriot-Watt University	2016	Project Engineering Lead, Leonardo
Dr. Savino Piccolomo	University of Strathclyde	2016	Postdoctoral Researcher, Universite Pierre & Marie Curie
Dr. Gary Stevens	University of Glasgow	2016	Principal Scientist, Electro Optic Concepts, DSTL
Dr. Mel Strachan	Heriot-Watt University	2016	Project Manager, UKATC
Dr. Joseph Thom	University of Strathclyde	2016	Quantum Technology Scientist, M Squared Lasers
Dr. Marcus Ardron	Heriot-Watt University	2015	Senior Design Engineer, Renishaw
Dr. Will Cochrane	Heriot-Watt University	2015	Mechanical Design Engineer, UKATC
Dr. Michael Crozier	Heriot-Watt University	2015	Technical Specialist (Laser Processing), MTC
Dr. Matthew Currie	Heriot-Watt University	2015	Sales Director, Skylark Lasers
Dr. Oliver Daniell	Heriot-Watt University	2015	Senior Software Engineer, Veracity
Dr. Christopher Dickson	Heriot-Watt University	2015	Algorithms Engineer, Thales
Dr. Daniel Drysdale	Heriot-Watt University	2015	Senior Process Engineer, Huawei Technologies Research & Development Ltd
Dr. Benjamin Fulford	Heriot-Watt University	2015	Solid-State Laser Technical Stream Manager, Luxinar
Dr. Michael Leach	Heriot-Watt University	2015	Co-founder & CEO, GenomeKey
Dr. Eoin Murphy	University of Strathclyde	2015	Research Engineer, BAE Systems, Inc
Dr. Mathieu Rayer	Heriot-Watt University	2015	Product Owner, Mynaric
Dr. Ryan (John) Anderson	Heriot-Watt University	2014	CTO, Vault Laboratories, Inc
Dr. Roger Fenske	Heriot-Watt University	2014	CEO, Edinburgh Instruments
Dr. Brian Flemming	Heriot-Watt University	2014	Principal Systems Engineer, Leonardo
Dr. Viktor Granson	Heriot-Watt University	2014	R&D Scientist, Trumpf
Dr. Javid Khan	Heriot-Watt University	2014	Artificial Intelligence, Neuromorphic Processing, GPU & Data Visualisation Engineering Lead, Leonardo
Dr. Mhairi Martin	Heriot-Watt University	2014	Primary School Teacher, Highland Council
Dr. Andrew White	Heriot-Watt University	2014	Laser Engineer, Leonardo
Dr. Lucy Williamson-Hodge	Heriot-Watt University	2014	R&D Scientist, Abbott Diabetes Care
Dr. Margaret Anyaegbu	Heriot-Watt University	2013	Senior Software Design Engineer, TES Electronic Solutions
Dr. James Beedell	Heriot-Watt University	2013	Laser Engineer, Leonardo

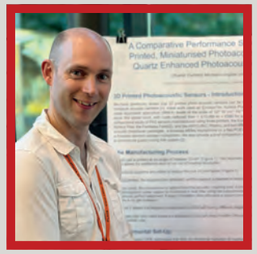
Name	Institution	Graduated	Job Title
Dr. Jochen Deile	Heriot-Watt University	2013	Product Line Manager, Coherent Kaiserslautern GmbH
Dr. James Downing	University of Glasgow	2013	Senior Staff Engineer, Optical Metasurface R&D Manager, STMicroelectronics
Dr. Catherine Fitzpatrick	Heriot-Watt University	2013	Research & Technology Translation Manager, University of Cambridge
Dr. Yves Lacrotte	Heriot-Watt University	2013	Microelectronic Engineer, Renishaw
Dr. Marcus Perry	University of Strathclyde	2013	Senior Lecturer, University of Strathclyde
Dr. Veronika Tsatourian	Heriot-Watt University	2013	Postdoctoral Researcher, University of Aston
Dr. James Bain	University of Strathclyde	2012	Director of Innovation, M Squared Lasers
Dr. Patrick Harding	Heriot-Watt University	2012	Postdoctoral Researcher, University of Frankfurt
Dr. Paul Harrison	Heriot-Watt University	2012	Chief Engineer, Product Applications, Trumpf
Dr. Thomas Legg	University of Strathclyde	2012	Team Leader, EFFECT Photonics
Dr. Gordon McKenzie	Heriot-Watt University	2012	Senior Electronic Engineer, University of St Andrews
Dr. Gerald Wong	Heriot-Watt University	2012	Data Strategy and Governance Lead, UK Hydrographic Office
Dr. Suzanne Costello	Heriot-Watt University	2011	CEO, MCS Ltd
Dr. Michael Poulter	University of Strathclyde	2011	Global Product Manager, Trumpf
Dr. Charles Ward	Heriot-Watt University	2011	Portfolio Management Consultant, Fiji Roads Authority
Dr. Paul Black	University of Strathclyde	2010	Engineering Manager, Emerson Automation Solutions
Dr. Richard Dunn	Heriot-Watt University	2010	Business Partnerships, University of Bradford
Prof. Daniel Esser	Heriot-Watt University	2010	Professor, Heriot-Watt University
Dr. Yvonne Huddart	Heriot-Watt University	2010	Design & Development Engineer, Renishaw
Dr. David Mitchell	Heriot-Watt University	2010	Senior Integration Engineer, Coherent
Dr. Peter Thomas	University of St Andrews	2010	Chief Scientist, NORCE Norwegian Research Centre
Dr. Clare Dillon	Heriot-Watt University	2009	Senior Optical Engineer, Leonardo
Dr. Tiina Delmonte	Heriot-Watt University	2008	Product Line Manager, Optoscribe Ltd
Dr. Trefor Sloanes	University of St Andrews	2008	Scientist, DSTL
Dr. David Faichnie	Heriot-Watt University	2007	International Manager, TechnipFMC
Dr. John Wooler	Heriot-Watt University	2007	Applications Engineer, Fibercore Ltd
Dr. Daniel Purchase	Heriot-Watt University	2006	Head of Optics, Rayner
Dr. Ian Armstrong	University of Strathclyde	2005	Research Associate, University of Strathclyde

Student and Alumni Profiles

Over the 21 years of the Centre we celebrate the contribution of the following.

- 51 Current Students
- 107 Alumni
- 84 Academic Supervisors
- 107 Industrial Supervisors
- 61 Industrial Sponsors

Each of our Students/Alumni has made an invaluable contribution to the Centre, here we highlight 21 of them showing the breadth of research of the Centre over the years.



Dr. Ian Armstrong

Enrolled 2001

Kamelian/University of Strathclyde

To me, as an Electronic and Electrical Engineering graduate from Strathclyde University, the main appeal of the EngD in Photonics programme, from the CDT in Applied Photonics as it has come to be known, was that it provided a balance between academic and industrial experience. It allowed me to build on my knowledge of laser systems in an academic environment and provided a direct route to continue my undergraduate work through a collaboration with Kamelian Ltd: enabling me to directly transfer technical knowledge of Erbium Doped Fibre Amplifiers (EDFAs) to Semiconductor Optical Amplifiers (SOAs) in an industrial setting.

As the majority of the academic contribution towards the EngD award, six months of Heriot-Watt University's laser physics MSc was used as the basis for the technical coursework. This coursework would go on to cover laser devices in much greater scope and detail than my undergraduate degree had, resulting in me accruing a much better breadth of knowledge of photonics systems and their applications.

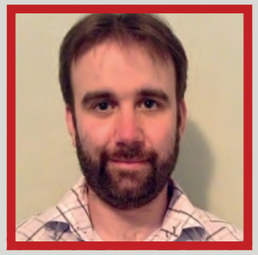
The technical academic portion of the degree served as an excellent foundation to build upon my understanding of laser systems, carrier dynamics, nonlinear wave mixing and several other design considerations central to designing and producing commercially viable SOA products. And, although I was completely unaware of it at the time, I would later come to use significant portions of the taught coursework in research projects long after my industrial placement had ended.

During my industrial placement at Kamelian I had direct input into the test, measurement and design of the SOA waveguiding structures being used to couple between active and passive waveguiding components. This research & development produced a hybrid integration technique that enabled the production of All-Optical Wavelength Converter (AOWC) devices. Prototype devices could transfer data signals up to 40Gbit/s from one incoming optical carrier wavelength onto a different outgoing wavelength without the need to return the data-stream to the electrical domain to be re-launched on the new optical carrier: removing a significant bottleneck from telecoms transmission systems.

However, as the "Dot-Com bubble burst" of the early 2000s made itself felt, Kamelian closed its doors three quarters of the way through my EngD placement. I relocated back into Strathclyde University and spent the remaining industrial placement time writing my thesis and working with researchers at Glasgow University, further characterising the carrier dynamics of SOA devices.

Although not part of the intended EngD learning outcomes, the experience of being involved with the demise of a start-up company, such as Kamelian, and the rapid scramble to find an appropriate resolution to my Doctorate, has also embedded an ability to be flexible and resilient in the face of changing circumstances.

As the first person to graduate with the title of Doctor of Engineering in Photonics, I can happily say that the four years of my EngD degree has had a profoundly positive effect on my professional working life. It has provided me with valuable experience in an industrial setting, and a wealth of specialist technical knowledge which I still apply and add to on a regular basis, some 20-odd years later. It has kept me involved with laser research in several areas, in both academia and industry. And over that time, I have used the EngD as a foundation to build a varied, application-focused research career, developing active optical devices for telecoms systems, designing systems to enable non-destructive laser-excited ultra-sound testing techniques, and building laser-based gas sensing technologies for applications as diverse as cattle emission monitoring, gas pipeline leak identification, turbine engine exhaust gas species quantification and in-combustor gas visualization.



Dr. David Faichnie

Enrolled 2002

Scalar Technologies / Heriot-Watt University

Having graduated from the University of Strathclyde with a BEng (Hons) in Electronic and Electrical Engineering I moved into industry and was employed as a product engineer for Nortel Networks who manufactured communications systems and components. I was responsible for manufacturing introduction of new products from the design centre to the manufacturing plant and responsible for test times, test yields and maintenance of automatic test equipment. During my undergraduate degree I had developed an interest in optical technologies and while looking for new employment opportunities in that area I realised I lacked some of the fundamental knowledge needed for most of the jobs on the market.

The EngD programme was an attractive route for me to gain new skills to move into another industry and it didn't feel like a step back into academic studies since project work could be done with the industry sponsor. With inclusion of taught coursework modules to gain fundamental knowledge in optics, and training of business modules the program suited my needs very well.

Since graduating from the programme in 2007 I joined FMC Technologies who were establishing an optoelectronics research centre in Glasgow in late 2008. I joined the team as a research engineer responsible for planning and conducting research projects in the application of optoelectronics to oil and gas equipment. Such technologies are used to conduct downhole monitoring of well conditions, monitoring process flow and separation efficiencies, asset integrity monitoring and a whole host of other interesting and varied applications. The skills learned during the EngD research project allowed me to define, test, document and evaluate product development projects while business skills were also used to help develop business plans and evaluate new market opportunities.

In 2011 I was selected to provide support for use of optical sensors to a Houston project team for implementing a control system on a subsea multiphase booster pump. This involved working as part of a large multidisciplinary team to consider how to perform mechanical integration of such technologies in harsh environments. Again, experience during the EngD program enabled me to cope with the rigours of such projects, research new technical areas of interest and allowed me to provide the necessary technical input to the various members of the team.

In 2012 I was then relocated to work in the North American Technology Center in Houston on a 2 year assignment. After the first year in Houston I was made Program Manager for a technical program developing innovative wireless technologies for both surface and subsea applications. This involved providing technical guidance as well as setting up project frameworks and a set of processes to allow project teams to execute their specific applications. Project management skills learned during the EngD proved to be invaluable for such a challenge.

I returned to work in Dunfermline in Scotland in late 2014 as Lead Engineer, this time moving into the Enabling Technologies Group for surface applications (Oilfield equipment you might find in the desert in the Middle East to the new Fracking equipment typically used in North America). My main focus remained on new product development and providing the technical capability to allow FMC Technologies to grow their product portfolio and service businesses. This then evolved into a Principal Engineer role with the Surface Controls Technologies group helping lead various R&D efforts within the equipment automation realm.

In 2017 FMC Technologies merged with a French company called Technip to become TechnipFMC, a global leader in energy projects, technologies, systems and services to provide clients with deep expertise across subsea and surface projects. During the last 5 years I have been working in our Surface Product Management organisation as the International Manager for Digital, Controls & Automation. I help to manage our portfolio of products designed to improve operations, increase safety and reduce costs by leveraging new digital capabilities like AI and machine learning, coupled with field proven automation technology suitable for long term operation in harsh environments. My role is to liaise between our customers in APAC, Middle East, Europe & Africa and ensure our R&D plans and investments are aligned to address the challenges they face and support development efforts to close identified gaps in our product portfolio. This is a varied role, requiring skills in engineering as well as marketing, project planning and budgeting, project management and also relies heavily on customer interaction to be successful. Digital remains a focus area for the industries where we operate to allow operations to be become more efficient and reduce environmental impacts of projects while improving overall economic viability of our clients investments.

The EngD program provided a fantastic foundation that helped enable a successful and varied career so far, allowing many different opportunities and challenges to be faced over the years. My step back from full time employment into the EngD program back in 2002 remains the pivotal moment in my career journey so far, and one of the most rewarding to date.

Dr. Yvonne Huddart

Enrolled 2005

Renishaw/Heriot-Watt University

I had been working for Renishaw as a software engineer for around two years when I was asked if I'd be interested in applying for an EngD, with the remit of investigating non-contact measurement techniques for industry with a focus on photogrammetry and structured light. I originally studied Mathematical Physics, and when I completed my degree, I decided the kinds of PhDs that would be the natural next step were not for me, so instead I did an MSc in Computer Science and since then had been working as a software engineer for about four years, including the two years at Renishaw.

The EngD seemed like an interesting new challenge, and before long I found myself in St Andrews for a semester, studying physics courses with some MSc students, filling in gaps in my knowledge of optics-related subjects that I hadn't studied the first time around. I spent the rest of the four years of the EngD splitting my time between a lab in Heriot-Watt University, and the Renishaw office.

The EngD offered me the chance to really research in depth about the subject in a way that I would have been unlikely to do had I continued as a normal employee. It offered Renishaw the chance to research a subject of interest and draw on the expertise available within a university setting. Renishaw invests heavily in R&D to maintain competitive advantage and this kind of arrangement has repeatedly been found to be very beneficial to the development of new areas of interest for the company. The result by the end of my EngD was the development of algorithms and proof of concept prototypes for a fringe projection probe for CMMs (coordinate measuring machines), along with four patents and two published papers.

When the 4-year funded period for the EngD ended, I returned to work at Renishaw and the project slowed for some time, as I worked as a project manager on development of a related product, whilst also completing the write-up of my thesis, which, happily, I submitted less than a year later.

A year or two after that, the product development based on my EngD thesis really kicked off in earnest, and Renishaw has since started selling the RFP (Revo Fringe Probe) to key customers, primarily in the automotive and aerospace industries. I have been involved at every stage of the product development, initially as technical lead of the project, but then as the project team grew and I switched to working part time due to family commitments I handed over overall responsibility to my line manager, and became responsible for the metrology of the product, with other colleagues responsible for other aspects.

Many people who have studied for PhDs have mentioned to me how they have slogged away for years on their PhD but then never had the chance to continue the work once they'd submitted their thesis. I am delighted that the EngD gave me the chance to study to such depth but then continue with the work in a very different capacity, and I'm very proud that Renishaw has built on the research to develop a real product that is in demand with our customers.

Dr. Suzanne Costello

Enrolled 2007

MCS/Heriot-Watt University

After graduating in 2004 with a MPhys degree in Physics, I was still unsure what I wanted to do with my life. I chose to spend some time away considering options whilst enjoying the freedom of travelling life. I felt that although I was ready to start working, I didn't have the specific skills I wanted to make an impact in the workplace. I returned home and went to visit one of my lecturers who introduced me to the Engineering Doctorate scheme.

I was interested in a project that involved testing of microsystems/ MEMS devices and went to meet with the Managing Director of the company involved, Materials Consultancy Services, MCS Ltd.

MCS offer failure analysis and problem solving services based on materials science to a wide range of industry sectors. The service is analogous to forensic science but instead of investigating dead bodies MCS diagnose the root-cause of product failures. MCS work closely with large multinational companies across the world to improve design, manufacturing and reliability of products ranging from semiconductor die to hold down bolts for wind turbines.

I was immediately curious about the company's work and motivated to learn how I could be involved. Upon completion of my EngD, I went to work with MCS as soon as a role became available.

I began as a junior scientist bringing my knowledge of MEMS packaging and testing to the company. I continued to learn about materials science when applied to a range of electronic devices and quickly realised that this position offered me the perfect blend of applied science and business.

The EngD programme helped me to communicate cutting edge scientific results using everyday language and this has been a skill I use daily to ensure results of investigations are clearly understood.

Throughout my EngD studies, I also volunteered on the committee of the UK Chapter of the International Microelectronics Assembly and Packaging Society (IMAPS-UK). The power of networking was clear, and I continued to work with IMAPS-UK when I joined MCS. I became the first female chair of the society in 2015. The taught courses and research undertaken during my EngD gave me a broad technical knowledge of microelectronics and the specific skills in packaging that were required to lead the technical committee.

At MCS, a new process to prepare micro-sections without mechanical deformation using inert gas plasma was being developed. This new technique, Perfect Edge™, was ideal for preparing large micro- sections through full devices in package and the commercial case for this was apparent. My role developed alongside this new offering as the company continued to grow and I moved into a new position as Senior Responsible Officer in 2016.

This role gave me responsibility for ensuring completion of critical investigations in short time scales, sometimes delivering results within 24 hours of beginning a project. Although the EngD was a far longer process, the principle of project planning and identifying clear deliverables that address specific questions has been invaluable. In January 2019, I was promoted to Chief Operating Officer at MCS. This next step in my career is challenging and exciting in equal measures and marks a clear evolution of MCS as a business.

I am now able to use the business knowledge that I learned during my EngD on daily basis as I work with other members of the leadership team on strategic planning and the future of the business. For me, the advantage of working at MCS and the reason the EngD was so perfectly suited is that even as my role develops, I remain fully technically involved and ensure I keep my practical skills.

The EngD programme gave me with the optimum balance of technical and business skills to make an impact on my sponsoring company. It provided a solid foundation for the development of my own career and growth of the company that I am still proudly working in.

Profile written in 2018

Dr. Javid Khan

Enrolled 2008

Holoxica/Heriot-Watt University

Dr. Javid Khan was working as a Scientific Officer at the European Commission and foresaw the re-emergence of the 3D market in cinema and TV, back in 2007. Although 3D cinema is still around, 3DTV did not last because consumers did not want to wear glasses in their living rooms. The 3D market has since been dominated by Virtual Reality (VR) and more recently, Augmented Reality (AR). Both of these still require wearing a headset, which has a number of inherent drawbacks including headaches, nausea and motion sickness. Since this affects a significant number of people, the ultimate adoption of these technologies is always going to be limited.

Every science-fiction fan knows that the best way to make 3D images is using holography. The scientific literature also says that the best way to make 3D displays is via holographic or similar technologies. Frustrated by the poor quality and bad user experience of head-mounted displays, Javid saw an opportunity to make 3D displays based on a novel bottom-up approach. He started a series of experiments in his basement, which had some good results.

However, he soon reached the limits of his understanding and indeed of human knowledge at that time. Javid's experience at that time was in electronics and computing. Although he had some knowledge of LCDs, he realised that he needed to expand his knowledge of optics and photonics. The EngD centre for Applied Photonics came to the rescue and provided a solid foundation for gaining the required knowledge in photonics to pursue his vision. He pitched his idea to the centre director who thought it was an exciting, if unorthodox proposition. Javid also started up Holoxica Limited, which was set up to commercialise the results of the research and act as the industrial sponsor. He is grateful to the centre for taking a risk on a start-up, which was highly unusual given that most companies participating in the scheme are relatively mature.

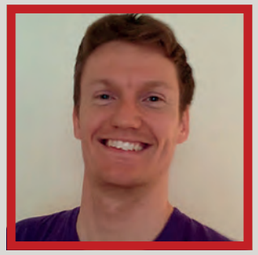
The company started up at the Scottish Microelectronic Centre at the University of Edinburgh. Prof. Ian Underwood was the industrial supervisor. The EngD delivered a patent and some publications as well as two generations of 3D display prototypes (a symbolic display and a HUD, shown in the photo) demonstrating the potential of the technical approach.

The work was also presented on national TV and in various news or trade articles. Javid won a series of awards including an SPIE scholarship, AEngD writer of the year in 2013 and Best Holographic Optical Element (HOE) Application by the IHMA (International Hologram Manufacturers Association) in 2014. In 2015, the company won a substantial EU grant to develop the technology further. This enabled the business to fund another EngD with the Applied Photonics Centre, with Dr. Christopher Blackwell who graduated in 2021. This included two more generations of displays including volumetric and light field displays, together with more patents and publications. In the meantime, Javid continued the MBA that he had started as part of his EngD, which he completed in 2018. The MBA includes entrepreneurialism which is valuable for writing business plans, planning, budgeting, marketing etc. The company had to raise investment from private shareholders and grants in order to perform or support much of the project work.

Unfortunately, despite the technical successes, the business struggled to find a substantial investor to take the products into the markets. Notwithstanding significant interest from the USA and the far East, where most display panels are manufactured, they were unable to close an investment deal. They were also losing competitive advantage since a number of US-based start-ups received substantial funding to develop such technology. So, in 2020, the company decided to pivot away from display hardware and into systems and 3D graphics software development. They partnered with a well-funded US company to provide the hardware. Since then, Holoxica has been working on next generation solutions like 3D video conferencing and 3D telexistence with the MOD/DSTL.

Dr. Khan continues to serve on the steering board for Mathematics and Computer Science at Heriot Watt University. He is a honorary Research fellow at University of Edinburgh in 3D computational imaging, from 2020. In 2021, became a fellow of the Institute of Engineering Technology (FIET). He is also an external examiner for PhDs in 3D visualisation and displays. He is a member of the SPIE and SID professional organisations. He is active in STEM outreach and is a mentor for graduates starting in the workplace.

Dr. Khan decided to step down from Holoxica in 2020, as a result of the pivot and he still advises the company on strategy. Since then, he has been working at Leonardo, a leading military aerospace defence company. He is the engineering lead for Innovation, Artificial Intelligence, GPU, Neuromorphic computing and data visualisation. He is setting up a new team on AI and runs two labs including an Innovation Hub. He continues to support academic activities including sponsoring university chairs and PhD/EngD research as well as organising talks and seminars on topics of interest. He works on Model-base System Engineering methods promoting rapid prototyping and continuous delivery to accelerate development of advanced embedded avionics systems. His activities are multi-disciplinary across electronics, software, RF, mechanical and systems engineering. He is currently working on the Global Combat Air Programme, GCAP: an international venture between the UK, Italy and Japan to build the next 6th generation fighter jet by 2035.



Dr. Ryan Anderson

Enrolled 2009

BAE/Heriot-Watt University

I undertook an EngD project rather than a more traditional PhD because I felt it was time to leave a purely academic setting and start getting experience in a commercial environment. The other thing that attracted me to the programme was the ability to take MBA modules from the Edinburgh Business School. I took full advantage of this and took the maximum available, 5 modules, as I was sure I wanted my career to break out of pure research and I wanted to be able to understand and influence the wider business context of any technical work I was a part of.

My project was with BAE Systems Advanced Technology Centre developing fibre-optic sensor systems for structural health monitoring applications focusing on detecting impacts such as birdstrikes to aircraft wings. As the project progressed I found myself being drawn to any parts of the project which involved programming such as writing code to analyse large amounts of data. I also implemented a neural network in Matlab to determine where an impact had occurred given time-of-flight information from several sensors.

In addition, I developed an algorithm which took in an acoustic signal from a carbon fibre panel during an impact, performed some signal processing and then looked for specific characteristic features to determine if it was likely that the impact had damaged the panel.

Coupled with the realisation that I wanted to do more programming came a desire to be involved in a faster moving industry which is always changing. So, in my spare time, I started learning to code in earnest, learning object-oriented programming and Java in particular so that I could make mobile apps for my Android smartphone. Being able to come up with an idea, create it in code and then see the results in front of you is immensely rewarding.

When I came to the end of my project I was lucky enough to find a great company that helped me make the transition from someone who could code to an actual software engineer. Kotikan was an app development agency which made apps used by millions of people for companies such as Skyscanner, Standard Life and Fanduel. Eventually, I became involved in an internal project at the company which had Scottish Enterprise funding to develop a technique for taking a picture of a rota and then extracting and interpreting the data so that the shift information could be understood. This IP lead to a spin-out called Yavi which I joined as a founding engineer.

Yavi aims to become the digital home for shift workers allowing them to communicate more effectively with both their employers and their co-workers. Taking inspiration from the huge success of consumer messaging apps we can deliver a similar experience but with the added context of knowing when the user is working and with whom. This makes it easy for a worker to organise their lives and find someone to swap or cover their shift if they need to.

Although my job is very different to what I was doing during my EngD it still prepared me well. Analytical thinking and problem solving are the most crucial skills in my job and the business knowledge I acquired through the MBA has given me tools to see the wider picture as I carry out my work. Building a high-growth consumer facing startup is really tough, there are so many aspects to consider at once and lots of competing priorities along with scarce resources. The EngD showed me that I could throw myself into a subject I knew little about and, through time and effort, learn to be an expert in at least a narrow field. It's never too late to take a passion for learning new skills and dive into a different career!

Profile written in 2016

Dr. Alison O'Neil

Enrolled 2011

Canon Medical Research Europe/Heriot-Watt University

I undertook an EngD at Canon Medical Research Europe in collaboration with Heriot-Watt University, focussing on image analysis for the detection and labelling of anatomical structures in 3D medical images, in particular CT and MRI scans. I used statistics and machine learning to design algorithms which leveraged anatomical domain knowledge via atlas techniques. During my EngD I had the opportunity to present my work at conferences in San Diego, Vienna, and Athens. I was an author of a patent on vessel tracking from anatomical landmarks, and it has been rewarding to see one of my doctoral programme algorithms make it into Canon Medical scanners.

I was hired by Canon at the end of my EngD and I am now a Principal AI scientist and Team Lead in Canon Medical's AI Centre of Excellence. I work on machine learning for healthcare applications, working with imaging, text, and structured clinical data. The research skills that I gained during my EngD have been invaluable, in particular the understanding of rigorous scientific practices, the ability to analyse and debug new ideas, and the tenacity to bring research through ups and downs to a successful conclusion. I now supervise EngD and PhD students myself and hold an Honorary Research Fellow position at the University of Edinburgh – so I am happily continuing the theme of staying at the confluence of industry and academia!

Dr. Alexander J Weir

Enrolled 2011

Medical Devices Unit at NHS Greater Glasgow and Clyde/ Heriot-Watt University

Having spent 14 years in industry before I joined the EngD CDT, I guess I have a slightly unusual profile in comparison to most doctoral students. I hope that by sharing a little of my story it might encourage others at a similar stage to have the confidence to take on doctoral studies if they still harbour the ambition.

After completing my BEng in Electrical and Electronic Engineering back in 1997 (first class honours), I joined a graduate training programme in the defence industry with British Aerospace in New Malden, Surrey, where I worked as a Software Engineer on Submarine and Surface Ship Command and Control Systems. After 3-years, I worked my way back north, taking the opportunity to join Cadence Design Systems in Livingston, where I became a Senior, then Principle Software Engineer, working on telecommunications and short range wireless protocol stack development in their Wireless and Multi-media design services group.

Following a brief spell in the same role at Tality, a spin out from Cadence Design Systems, I joined Thales and then TES Electronic Solutions. Once again I worked in a design services capacity on telecommunications and short range wireless systems, delivering solutions for a variety of products and a wide range of companies.

After the best part of 15 years in industry I was looking for a change and a new challenge. I found it with a move into healthcare, when I got the chance to bring my industry and commercial experience to the assistance of Prof David Keating and Dr. Stuart Parks to help establish the Medical Devices Unit at NHS Greater Glasgow and Clyde. This was a transformative experience. I found a new interest and a zeal for medical technology. I found a place where I could combine my established skills with new learning in the medical domain, and I was thrilled by the challenge of helping to establish a health technology innovation capability within the NHS. It was a role I thoroughly enjoyed and it was here that I got the opportunity to develop an idea and then a proposal that became an opportunity to join the Engineering Doctorate programme at the CDT.

My thesis was titled, *'Channel Characterisation and Modelling for Transcranial Doppler Ultrasound*'. I was interested in the use of Doppler ultrasound as a method for the detection of micro-embolic signals in arterial waveforms and its application to diagnose and predict stroke. My thesis explored Transcranial Doppler (TCD) propagation channels in three related research areas. Firstly, as a method of characterising TCD ultrasound propagation channels. Secondly, through development of a blood flow phantom. And finally, through the verification of my modelling with results from my phantom and patient recordings.

It was a challenge on many levels. Mathematically complex, practically challenging, and limited by the volume of actual patient recordings I had access to. Meanwhile, I also juggled my 'day job' as Technical Operations Manager at the Medical Devices Unit, where we'd grown rapidly from a team of 3 to over 20 engineers and scientists. I don't think I had a free weekend or an uninterrupted vacation for the duration of my doctoral studies, but it was an enormously fulfilling experience.

I learned a huge amount from my academic supervisor, Professor Chen-Xiang Wang, and I developed a deep respect for academic rigour, and an acute sense of what to prioritise against what was unimportant. It also reinforced in me aspects of my character; resilience, determination to succeed, and the desire to understand and learn more. I thoroughly recommend this journey to others that are tempted to follow!

Since completing my studies, I've also moved on from my role at the Medical Devices Unit, back to my roots in industry. In June 2017 I joined Toshiba Medical Visualisation Systems Europe as a Technical Manager, now Canon Medical Research Europe. More recently, I became a Senior Technical Manager with responsibility for the AI Research group and the AI Centre of Excellence at our design centre in Edinburgh.

As part of this role, I also Programme Manage Canon led work packages and deliverables for a small portfolio of grant funded collaborative research projects, including iCAIRD (Industrial Centre for AI Research in Digital Diagnostics) and INCISE (Integrated Technologies for Improved Polyp Surveillance).

My interests include health informatics in general, but more specifically the application of AI and machine learning in a broad range of applications in healthcare, signal and image processing, mHealth/eHealth, cloud-based services, and I'm developing a growing interest in bio informatics and it's applications to clinical decision support.

In everything I've done since my time at the CDT, I can honestly say the experience has shaped me deeply and the lessons continue to influence my approach to work and new learning. I strongly recommend it.

Dr. Agata Pawlikowska

Enrolled 2011

Leonardo/Heriot-Watt University

After a degree in Physics and an MSc in Photonics, I briefly worked in industry as an optical engineer. I liked my job, but as a young engineer, I was looking for an exciting and rewarding research opportunity. Initially, I thought that a standard PhD placed in a University was my only option to pursue research, but at the same time, I wanted to remain in industry where the focus was on applications. The Engineering Doctorate (EngD) scheme turned out to be the perfect alternative to the traditional PhD, as it is for people who ultimately want a career in industry. It combines academic research in an industrial context by placing the student with an industrial sponsor. I was accepted onto the EngD programme as part of the Centre for Doctoral Training in Optics and Photonics. As a result, I was given a fantastic opportunity to conduct PhD-equivalent research whilst working closely with the industrial sponsor, Leonardo. Leonardo are one of the UK's leading aerospace companies and one of the biggest suppliers of defence and security equipment to the UK MoD. They invest around £200m in UK-based Research and Development each year.

The investment and innovation enables Leonardo to deliver the UK's most advanced technology programmes, such as new-generation radar for the RAF's Typhoon combat aircraft, Infra-Red cameras and advanced helicopter capabilities. Through the EngD scheme, Leonardo defined my project and provided me with the tools and facilities necessary to conduct my research. I was placed at the company's premises in Edinburgh, which gave me an excellent grounding for a career in industrial research and development.

My research project focused on the delivery of a single-photon counting lidar demonstrator for long-range 3D imaging. The project provided Leonardo with a valuable understanding of the system performance and problems that need to be addressed in developing new technology for next-generation electro-optics sensors.

The EngD gave me fantastic experience in industrial research, providing an excellent grounding for a career in industry. The successful outcome of the project led to full-time employment at Leonardo. I began my career as a Senior Systems Engineer working on electro-optics advanced research projects for airborne applications. The industrial experience gained during my EngD allowed me to progress to the Principal Engineer within less than three years. In my current role, I work as an Engineering Lead and a Design Authority, leading a multi-disciplinary team of engineers on a technology development programme.

Dr. Yili Guo

Enrolled 2012

Powerlase/Heriot-Watt University

Having graduated almost two years now, when thinking back on my 6-year EngD journey, everything is still like yesterday. What a memory!

I embarked on the EngD journey a little bit late in my career compared to most other EngD students. As a professional who has already worked in the optics and laser industries for more than 10 years, the unique CDT EngD program is attractive to me in many aspects.

Not only does it allow me to continue working as a full-time company employee, but also it provides the knowledge, tools, mindset, and support that I need to prepare myself for the next level in my career. Although the taught courses were carried out by distance learning, they were well structured, and I fully enjoyed the experience. The very highlight of all the courses that I've taken is Prof. Derryck Reid's nonlinear optics course. Derryck explains everything so clearly, with well-selected work examples, that it helps to build a solid foundation for my research project. The MBA course in the EngD program is the cherry on the cake. The flexibility of selecting two more business modules of your own choice, in addition to the three compulsory ones, offers a great opportunity for students like me who wants to tap into the business world in the high-tech sector to gain versatile business skills and knowledge for future career progress.

Having said that, I must admit, doing an EngD with a full-time job with excessive workloads is a true challenge to me. At the time, I lived in a place 50 miles away from work. To complete the required 180 taught course credits for the EngD program, studying is my only evening entertainment for three years. Even when I back home visiting my parents, I would normally spend the day either studying one of the business modules or preparing for an upcoming technical exam. Halfway through the journey, I was promoted from a senior technical role to a managerial role responsible for the global technical service activities of the company on four different continents. This makes the whole experience even more intense. Juggling competing priorities is my daily life. Not only did I need to stand by and prepare to answer phone calls from customers or service engineers in different time zones at late night, but also, I need to travel to different customer sites frequently either to build and maintain customer relationships or to solve tricky technical issues that need my attention. Regardless of how effectively I managed my time, I found myself struggling to keep up with the EngD schedule and was always late on the required deliverables. Thanks to the understanding and the full support from my supervisors and the EngD office, I was able to extend my study for a further two years to fulfil all the stringent EngD requirements to graduate.

I still remember the whole long list of people to thank for in the acknowledgement section of my thesis. Without the understanding and support from the family, the loved ones, the supervisors, the university, and the company, without perseverance and a strong mind, I don't think I'll ever be able to get to the end. As my industrial supervisor, Dr. Nick Hay, always told me, doing an EngD is not a light-hearted decision. Think it carefully, make up your mind, do it and never look back. It takes time, it might also take a lot of sweat and tears, but you will get there in the end.

After graduation, I decided to move to Australia to start a new page of my life. I worked as a Business Development Manager for Powerlase for a year, responsible for growing the Australasian and EU client base and expanding the sales and distributor network. Now I work for an Australian Lidar company, deeply involved in the development of advanced Lidar for future autonomous driving.

I am thankful for my EngD journey, not only because it enhanced my technical and business knowledge and empowered my career progress, but more importantly, it continuously inspired me to go deeper, try harder and progress further in this volatile, uncertain, and complex ever-changing world.

Dr. Adam Polak

Enrolled 2013

Fraunhofer CAP/University of Strathclyde

After a successful engineering career at Phillips Lighting, Dr. Adam Polak undertook an EngD programme in EPSRC Industrial Doctorate Centre in Optics and Photonics Technologies, currently known as Centre for Doctoral Training in Applied Photonics, at Heriot-Watt University. His research was focussed on nonlinear optics, hyperspectral imaging and signal processing. This programme spanned across two disparate fields – the world of signal and image processing, under his academic supervisor Professor S. Marshall at the University of Strathclyde, and solid-state lasers and nonlinear optics under the industrial supervision of Dr. D. Stothard at the Fraunhofer Centre for Applied Photonics. This marriage allowed him to recognise the enormous potency of data which the optical instrumentation can produce, and how this allows the technology to be applied to a wide range of different areas.

For most of the time Dr. Polak was placed in the Fraunhofer labs and from day one, he was involved in a range of competitively won projects, focusing on spectroscopy and sensing applications, demonstrating the strong interlink between the hardware and software development. Beyond the scientific know-how, Dr. Polak's doctoral training laid foundations to other aspects of the work at R&D environment – generating ideas, seeking and obtaining the funding for the research activities and collaboratively working with academic and commercial partners – all invaluable for his future career.

During the second year of his studies, Dr. Polak secured an additional support to his programme in the form of a Fellowship from the Royal Commission of 1851 with funding up to £80,000. The aim of the Industrial Fellowship is to encourage profitable innovation and creativity in British Industry – to the mutual benefit of the Fellow and his or her sponsoring company. These prestigious Fellowships are awarded to selected, exceptional graduates with the potential to make an outstanding contribution to Industry for a programme of doctoral level research.

When the funded period of the EngD programme finished in December 2017, Dr. Polak remained in Fraunhofer, being employed on the Researched position. By that time he was still in the process of writing up his thesis yet the full-time involvement in running projects extended this effort even further. It was not until the end of 2018, when Dr. Polak passed his Viva, successfully completing the doctoral programme.

Thanks to the involvement in a portfolio of projects throughout the EngD and continued work directly after the programme, by the time Dr. Polak formally graduated, his research career was already well underway. Since then, he has been leading and was largely responsible for delivering multiple projects scoped around remote detection and sensing, with a main focus on the infrared spectroscopy. His extensive portfolio of national and international research projects and the overall leadership shown over the years brought Dr. Polak to a position of Senior Researcher in 2020 and Principal Researcher in 2021. Currently Dr. Polak oversees the mid infrared sensing theme at Fraunhofer Centre for Applied Photonics including a broad range of funding sources with activities ranging from components to complete systems for the mid infrared.

Dr. Aneta Lisowska

Enrolled 2014

Canon Medical Research Europe/ Heriot-Watt University

The 4-year journey through EngD programme now seems like it happened in the blink of an eye! The programme was packed with technical and business courses, various workshops, summer schools, conferences and most importantly in Canon I was never short of exciting research projects, which kept me motivated throughout the years.

The most challenging part was the first semester at the University of St Andrews. I came completely unprepared from a Cognitive Science background to this interesting new world of laser physics. But it was also a time when the seed of future friendships was planted. Nothing binds more than a joint struggle and I was lucky to be surrounded by very bright people who were eager to help with both physics assignments and autumn melancholia. I think this shared experience was important for strengthening the connections between the research engineers in our cohort.

The most inspiring moment was the first time that I flew for an international conference (International Conference on Computer Vision 2015). I was overwhelmed with the amount of fascinating machine learning approaches for a rainbow of imaging applications. My mind exploded with ideas. If you are stuck in your research searching for inspiration, I recommend attending top conferences in your field - these are the most stimulating and give you a vision to aim for.

As preparation for the next stages of my career, the most useful was interaction with my supervisors and EngD students from the cohorts preceding me. I have looked up to them and tried to learn as much as possible. Currently I am an AI scientist at Canon, and I feel privileged to be surrounded by brilliant people from whom I still have a lot to learn. Recently, the most joyful moment was when I spoke to my MSc student and realised that she is now at the point where I was previously, and I can now share with her what I have learned.

Update December 2022

I currently live in Berlin working remotely and affiliated with the Sano Center for Computational Medicine (a research institute in Cracow) and Poznan University of Technology (PUT). In Cracow I have a small team of six wonderful students with whom we are doing research on mobile health (mhealth) applications for disease prevention. In Poznan I am working on a European project in which we aim to support cancer patients with treatment adherence with use of digital technology (mobile and wearables). I work closely with very inspirational researchers from Israel (Haifa University) and Poland (PUT). My recent research can be found on my website:https://sites.google.com/view/anetalisowska/research

I have kept my connection with Heriot-Watt and have just recently finished the MBA with the Edinburgh Business School which I started as an EngD student.

Dr. James Morris

Enrolled 2014

Fraunhofer/Heriot-Watt University

My EngD focused on the development of advanced laser micro-fabrication techniques to produce photonic devices in mid-infrared transmitting substrates. This included laser micro-machining, refractive index modification using short pulses, and different etching techniques to enable micro-optical component machining, micro-scale channel formation, and waveguide formation.

My studies were supported by Fraunhofer Research UK and the Nonlinear Optics (NLO) Group at Heriot-Watt University, which allowed me to spend time in both academic and industrial settings. This variety, combined with the comprehensive technical and business training offered by the CDT, were the main differentiators that initially attracted me towards the CDT.

The work undertaken over the course of my EngD has been presented at national and international conferences, along with publications in peer-reviewed journals. I also led a successful technology transfer of laser micro-fabrication techniques pioneered by the NLO group to Fraunhofer, who now operate their own laser micro-fabrication facility based at the Fraunhofer Centre for Applied Photonics (FCAP) in Glasgow.

After completing my EngD, I took up a Researcher post at FCAP working on R&D projects in the area of lasers and laser applications. I then moved to Leonardo as a Principal Laser Engineer focused on High Power Fibre Amplifier development. I am now with Raytheon UK as a Programme Engineering Manager and recently completed my MBA.

Dr. Gabriel Reines March

Enrolled 2015

NHS Greater Glasgow and Clyde/ University of Strathclyde

Back in 2015, when I started my EngD, little did I know that the programme would be such a pivotal point in my professional career. My initial idea of an Engineering Doctorate was that the research activities would be developed in a company, but aside from this fact, it would not differ much from a standard PhD.

My project, which was co-sponsored by NHS Greater Glasgow and Clyde, consisted of developing novel imaging tools for aligning lung cancer PET/CT scans -taken before surgery- with microscopy slides of the resected cancerous tissue, enabling clinicians to compare the tumour microenvironment, as seen on the scans, with its actual cellular composition. Why is this important? Because the more we learn about the information contained in PET/CT, the better cancer treatment can be tailored to a specific patient.

Due to the broad scope of the project, I had to interact with a diverse range of people from different departments to get the study up and running, including oncologists, pathologists, radiologists and clinical engineers. It was daunting in the beginning, not least because my knowledge about lung cancer was next to nothing! What I didn't realise at the time is that, by collaborating with all these new colleagues, I had started to build a heterogeneous professional network, reaching far beyond the purely academic setting and into multiple different fields.

After my graduation in 2020, I spent a year as a postdoctoral researcher at the University of Glasgow, working on developing an AI tool to detect cardiac small vessel disease using retinal fundus images. After that, I joined OracleBio, a Scottish contract research organisation specialised in digital pathology image analysis. My current role in the company is R&D project manager, which involves overseeing and managing a varied portfolio of innovative projects, from testing novel commercial image analysis solutions and technologies to programming our own image processing tools.

In hindsight, the multidisciplinary, industrial nature of the EngD was the real asset of the programme, regardless of the research subject. Being exposed to a real working environment taught me how to adapt to new circumstances and challenges, how to manage a project with multiple stakeholders, how to find optimal trade-offs between engineering solutions and real-world constraints... And these unique translational skills make you highly employable.

Dr. Mariastefania De Vido

Enrolled 2016

STFC/Heriot Watt University

Dr. Mariastefania De Vido joined the CDT in 2016 after being employed at the STFC Rutherford Appleton Laboratory for 3 years. Dr. De Vido is developing a new type of high-energy laser with an average power output which far exceeds that of traditional lasers has applications which will benefit industries such as aviation, and efficient generation of particles and X-rays for the development of novel medical and imaging techniques.

Dr. De Vido advised “I was looking for opportunities to further my education while retaining my job position. I chose to apply for a position at the CDT in Applied Photonics because it offers me not only the possibility to develop a doctoral thesis around my current job, but also to expand my technical and management skills through taught modules, courses and conferences. The friendly and welcoming atmosphere of the EngD enables me to widen my network through the interaction with fellow students and with academics and has already helped me to establish fruitful collaborations. I believe that the EngD is an excellent opportunity to develop not only academically, but also as a well rounded professional”

In 2018 Dr. De Vido was awarded a prestigious 1851 Royal Commission Industrial Fellowship with funding up to £80,000. The aim of the Industrial Fellowship is to encourage profitable innovation and creativity in British Industry – to the mutual benefit of the Fellow and his or her sponsoring company.

These prestigious Fellowships are awarded to selected, exceptional graduates with the potential to make an outstanding contribution to Industry for a programme of doctoral level research. Professor Derryck Reid, Director of the EPSRC CDT in Applied Photonics said: “I’m delighted that the Royal Commission has selected Mariastefania for this highly competitive fellowship -- a testament to the ability, commitment and ambition she has demonstrated in her EngD research. Her project is a perfect example of the balance between academic excellence and industrial relevance which is embodied in our Applied Photonics EngD programme.”

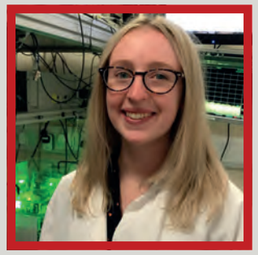
The Association of Industrial Lasers Users (AILU) awarded Dr. De Vido - Young UK Laser Engineer’s Prize 2019. Professor Daniel Esser, Dr. De Vido’s academic supervisor during her time at Heriot-Watt University, said: “It is a great pleasure to work with such an outstanding researcher as Mariastefania. Her work will result in significant advancements in laser technology, as well as more broadly for the international optics community”

Dr. De Vido was awarded the Heriot-Watt University MacFarlane Prize in 2020. The MacFarlane Prize commemorates the contribution to the University made by Professor A G J MacFarlane during his tenure as Principal and Vice-Chancellor. The Prize is presented annually to the PhD/Engineering Doctorate graduate who, in the opinion of the Awards Committee, has made the most outstanding contribution to the research of the University.

The Awards Committee noted that during her Engineering Doctorate study Dr. De Vido authored and co-authored 12 high-impact journal papers and 20 international conference papers. Of these she was first author on 4 journal papers leading 15 different collaborators, and first/presenting author on 7 international conference presentations, in addition she has two patents filed. She scooped several prizes at national and international conferences during her doctorate.

Dr. De Vido said “I am very honoured to receive this recognition from Heriot-Watt University. I would like to thank my supervisors for their valuable advice and encouragement and the STFC Rutherford Appleton Laboratory and the Royal Commission for the Exhibition of 1851 for supporting my research and my studies. This Prize is a great motivation for me to continue to give my best to the field of high energy solid state lasers.”

Since graduating Dr. De Vido has continued her involvement with the Centre becoming an Industrial Supervisor to two CDT in Applied Photonics Students and has also becoming a member of the CDT Management Committee. The remit of the Management Committee is to provide oversight and strategic input to the CDT Executive and to maintain a strong connection between the CDT and its Industrial Partners.



Dr. Hollie Wright

Enrolled 2016

Renishaw/Heriot-Watt University

Enrolling with the Centre for Doctoral Training in Applied Photonics was the best career decision I could have made. At the time, I had recently completed my undergraduate degree in physics, and I dreamt of using my new skills to make my own contribution to physics. I didn’t know it at the time, but the CDT programme would give me the opportunity to do that.

For my EngD research, I was tasked with developing Dual-Comb Metrology for industrial applications. Publications had shown Dual-Comb Metrology was a powerful optical metrology technique with the potential to fill the existing gap in the optical metrology market. Unfortunately, the technique was quite intricate and required complex laser sources, so it was yet to make the transition from the lab to an industry tool. We developed a variation on the technique which was simpler and reduced the requirements placed on the laser sources. With these reduced requirements on the laser sources, we were able to develop compact and robust lasers which were ideal for use in industrial environments. With the simplifications we made to the metrology technique, we could forgo the conventional data collection – which required digitization at >100 MSa/s – instead, opting to collect the data with a cheap Arduino microcontroller.

This ultra-efficient data collection offered the same levels of measurement precision but significantly reduced the data burden. Further, the efficiency of the technique enabled real-time measurements which is rarely possible in dual-comb techniques.

The technology is protected by a shared patent between Heriot-Watt University and Renishaw. Although I’ve now finished my EngD, Renishaw has provided further funding so that I can continue my work. I’m currently developing new capabilities, such as multi-target ranging and pose measurements. Meanwhile, a team at Renishaw are working on reproducing my EngD results in an industrial prototype. I’m really excited Renishaw has chosen to continue investing in this research. In physics it is common to wait years (even decades) before research receives industrial interest; but the CDT system of partnering students with industry sponsors means my research already has a route to commercialisation. The unique partnership enabled by the CDT system has allowed me to gain experience in both academia and industry. I have contributed to Renishaw’s knowledge base and benefitted from their know-how; but I have also been able to share my work with the optics community through publications and conference presentations. I’m proud of the work I have done, and I feel satisfied that I achieved my goal of making an original contribution to the photonics field.

There have been many other advantages to training through the CDT. As well as conducting PhD-level research, we completed taught courses in a variety of subjects including electronics, marketing, project management, science communication and intellectual property management. These are subjects I was unlikely to have pursued on my own, yet I now see how much I have benefitted from this broad training. Furthermore, by being involved with the CDT I have benefitted from opportunities which otherwise would not have been available to me. For example, I was able to join the Women in Science and Engineering Campaign as a member of their Young Professional’s Board. This position gave me an opportunity to contribute to gender parity in STEM, while also giving me valuable experience of sitting on a professional board.

Overall, I am very grateful for the CDT and the opportunities for success it opened to me. I think the training and experience I received has been excellent preparation for my future career. I would recommend the programme to anyone interested in a career in photonics.

Dr. Ben Szutor

Enrolled 2017

Skylark Lasers/Heriot-Watt University

The past four years have been full of challenges and excitement and ultimately provided me with the opportunity to become familiar with the field of photonics, specifically the design and manufacturing of single-frequency lasers and their applications. As an industrial degree, the EngD allowed me to work in a team of experts focusing on the commercialisation of a pioneering technology, pushing what's technically feasible on a daily basis.

I originally graduated with a degree in Mechanical Engineering, and I was keen to work in the automotive industry. However, this idea quickly changed after my interview with Prof Derryck Reid, four years ago. Knowing very little about lasers, I was up for the challenge to learn something new and interesting, guided and supported by academic and industry experts.

My EngD was sponsored by Skylark Lasers (formerly UniKLasers), an R&D house based in Edinburgh. Working for an SME, I was involved in all aspects of laser design from day one. My first project focused on the development of a single-frequency laser tuned to the magic lattice frequency of a strontium optical clock. Optical clocks can provide higher frequency resolutions than current microwave standards. This can enable better space-time measurements, pushing the boundaries of many scientific fields. These applications require multiple precisely tuned laser sources.

The stability of these lasers can be maintained by minimising noise sources in the mechanical, optical and electronics design, all of which have their own challenges.

Working in a team with diverse backgrounds allowed me to learn about multiple engineering disciplines and apply these learnings first hand, making sure no two days are the same. Lasers for quantum technology applications are still in their early years with huge potential. Applications such as precise sub-sea navigation and better timestamping capabilities for the finance sector are just a few examples of the potential ramifications of this new technology.

Unlike a PhD, my EngD was based around a variety of small projects under two main themes: scientific research and product development. Scientific research, such as building quantum lasers, required me to keep up-to-date with the state-of-the-art, working with a wide network of academics around the country. Product development projects supported the commercial efforts of the company to release new laser products into existing and emerging markets. I worked on multiple lasers in the visible and ultraviolet regions. This work has been supported by millions of pounds worth of private investment in order for the company to become a supplier of high-end laser products.

A lot was happening outside the lab during my EngD. Skylark is in constant look-out for new opportunities both on the supply and customer side. I was fortunate to travel globally to visit tradeshows, present at conferences and meet our business partners. Customers and end-users are still searching for the best ways to integrate these instruments into their applications, which is the case with many pioneering technologies.

Working with early adopters is the most rewarding partnership one can hope for. In these cases, the manufacturer can learn about the application, while the rapid development cycle enables a multitude of customisation options for the integrator. This was the case with holographic applications, where I presented our products in front of world-leading holography companies, pitched our industrial products to some of the largest biomedical companies, and I presented on our quantum lasers for space applications.

My responsibilities have evolved tremendously over the years and currently I lead the interdisciplinary engineering team at Skylark. I am very grateful to be working with industry experts such as Bill Miller and Stephen Webster and a team of engineers dedicated to manufacturing truly unique products. This year we have quadrupled the number of units sold and shipped to customers and we hope to keep growing to convert many years of our R&D heritage into core photonics products.

Being successful in such a rapidly evolving field requires constant development and quick adaptation. Laser components improve year-to-year and with the current global supply shortages, securing a reliable supply-chain is critical. Meanwhile, the photonics market is one of the fastest growing sectors in engineering, providing pioneering laser manufacturers with myriads of applications to consider. The Applied Photonics EngD gave me the opportunity to learn about new perspectives, techniques and the persistence that is required to push these frontiers even further.

Louise Finlayson

Enrolled 2019

NHS/University of St Andrews

Glioblastoma (GBM) is a rare but deadly form of brain cancer with a median survival rate of only 14.6 months. A clinical trial, currently taking place at Lille University Hospital in France, hopes to extend this survival time by intraoperatively treating GBM with light via a process called photodynamic therapy (PDT). Published preliminary phase I trial results already show an increased survival of 23.1 months, an improvement of over 8 months. The main aim of my current research is to help increase understanding of intraoperative PDT for glioblastoma by computationally simulating the trials protocol treatment within a realistic brain model using Monte Carlo Radiative Transport (MCRT) techniques. The idea is to then be able to change various factors in my code such as treatment time and light power and predict how these changes will affect the treatment outcome.

As one of the first PhD students funded by the CDTAP, I work collaboratively between the School of Physics and Astronomy at the University of St Andrews and the Photobiology Unit at Ninewells Hospital in Dundee. Being a PhD student has allowed me to focus on developing academic skills such as writing papers and presenting at conferences but the connection with Ninewells has provided the opportunity to massively enrich my research with the clinical expertise of my supervisors there.

Up until the end of 2021, my research focused on simulating light penetration depth into skin for wide range of wavelengths. This project helped solidify my understanding of the MCRT code and culminated in the publication of a journal paper and the development of a web app to allow clinicians to easily access the data from the paper. This experience helped me move into the GBM work with more confidence and, with the clinical guidance of my supervisor Kismet, a neurosurgeon at Ninewells, we have now developed a realistic simulation of the Lille clinical trials protocol.

I recently had the opportunity to present this GBM work at a PDT conference in Nancy, France, also attended by a leading scientist involved in the Lille clinical trial. This has led to a closer collaboration with their research group, further increasing the opportunity for our research to have a real clinical impact. At the end of my talk, I received a question about what being part of the CDTAP involved. They were impressed by the range of skills developed and liked the idea of having research students directly involved in industry, stating that a program like this should also be developed in France.

I fully agree with them, the CDTAP builds much needed bridges between academia and industry, creating many valuable connections. In my research specifically, collaboration with clinicians has allowed me to direct my research to answer questions that I as a physicist would not have thought to ask.

It has also allowed me to present the results and data in a way that is most valuable and accessible to them, increasing the likelihood of the research having an impact on clinical practice. Working at Ninewells has also given me the opportunity to observe while patients are treated using PDT and it is certainly a rewarding and eye-opening experience to be able to see this happening outside the realms of my laptop and to see first-hand the real-life applications of this research field.

I have thoroughly enjoyed the past few years as part of the CDTAP and I do believe that my research experience, along with the skills development and business classes, has left me well equipped to face the real-world next year!

Danielle Clarke

Enrolled 2020

Central Laser Facility STFC/ Heriot-Watt University

I work for a group at the Central Laser Facility who are responsible for developing world-leading, high energy, high repetition rate lasers. This new generation of lasers represents a paradigm shift in the high energy laser field. Traditional high energy laser technology is limited in terms of how often pulses are generated (pulse repetition rate) due to the efficiency of the flash lamp pump sources. Our technology, instead, allows for more efficient, multi-Hz operation, paving the way to more widespread use of these systems also in commercial settings.

We have developed lasers able to produce 150 J nanosecond pulses at a 10 Hz repetition rate. We are also currently developing two lasers operating at 10 J, 100 Hz. Direct applications of these systems range from industrial materials processing to fundamental science experiments for investigating the extreme states of matter found, for example, at the centre of extra-solar planets.

Existing petawatt class lasers can produce few pulses per minute to few pulses per day in the worst cases.

These systems are sufficient for proof-of-concept demonstrations of compact, high brightness, laser driven radiation sources for high resolution imaging, for example, but cannot be used in “real world” settings. DiPOLE technology is enabling a major step-change in terms of how often petawatt amplifiers can be pumped at. All of a sudden, in this regime, petawatt lasers, operating at 10 Hz repetition rates, would be much closer to moving from proof-of-concept demonstrations in research laboratories to real world applications, such as real time, high resolution imaging for medical applications.

The main aim of my project is to optimise high energy, high repetition rate lasers to enable successful pumping of petawatt amplifiers. My research includes conducting experiments on existing lasers to characterise laser operation, using fundamental physical modelling to further understand our lasers and to devise new solutions and performing proof-of-concept experiments to validate new concepts.

One of my colleges, Gary Quinn (a fourth year CDTAP student), is also completing his EngD on a closely related project. This has been really useful for both of us as we have been able to collaborate on various aspects of our work to further our progress. For example, we are currently working on a collaborative project to develop new methods for manufacturing ceramic gain materials for use in our lasers.

We have also collaborated on the development of numerical models for the prediction of thermo-optical effects in laser amplifiers.

The opportunity to complete a doctorate with the CDTAP alongside my job at the Central Laser Facility was brought to my attention by my line manager, Mariastefania De Vido (a previous CDTAP student), after a year in the role. She found the course enjoyable and very useful and encouraged me to follow in her footsteps. Being part of the CDT has allowed me to network with lots of other scientists working in the field of photonics throughout the UK, many of whom are now also good friends.

The course offered by the CDTAP is unique as there is a large focus on the development of business and professional skills alongside conducting research for my doctoral thesis. The wide skill set I have been able to develop has boosted my employability and put me in a good position to fulfil my future career aspirations. I would definitely encourage others looking for further study opportunities in industry to consider this course and would be happy to supervise other students through the process in the future.

Mohanad Al-Rubaiee

Enrolled 2021

Huawei/University of Glasgow

My research project objective is to build robust and reliable semiconductor mode-locked laser diodes (SMLLDs) for producing a frequency comb for terabytes per second (Tb/s) free space optical communications that is capable to meet the increasing demands for higher data and communication capacity. SMLLDs are ideal sources for generating such optical combs because they are compact, mechanically stable, robust, and can be designed to have a broad gain spectrum. In addition, they can reduce costs and simplify the packaging issues by replacing the individual lasers for every wavelength-division multiplexing (WDM) channel with a single laser diode.

So far, we have made some designs for these lasers and started the fabrication process at James Watt Nanofabrication Centre (JWNC) at Glasgow University. JWNC has many state-of-the-art fabrication equipment which facilitate our fabrication and we are progressing steadily towards our goals, especially with the great support of my group, supervisors, and the CDT.

In our fabrication, we use asymmetric multiple quantum well (AMQW) structure with quantum wells (QWs) of different thicknesses and (or) compositions which can emit at different wavelengths and hence increase the optical bandwidth.

Our research is expected to impact the communication industry by providing these cutting-edge laser sources which will provide a great improvement to the communication capacity and data transfer rate. This, in turn, will have a wider impact on society as a whole by facilitating and accelerating digital transformation in many public and private sectors.

Doing my PhD as part of CDT in applied photonics programme has been a great opportunity and positive experience. What I admire the most about the programme that its structure which is able to bridge the gap between university research and industry, providing valuable experience at both academic and industrial levels. Of course, not to mention the other precious development opportunities through CDT structured academic and professional courses, workshops, and summer schools. I’ve been able to make friends and expand my scientific network due to the diversified nature of the programme which includes multi cohorts, universities, and industrial involvement.

I believe the CDT in Applied Photonics programme not only helps you to be a good researcher, but also gives you the tools that enables you to make a business out of the research through the professional and business courses included in the programme.

Even though I’m only at the second year of the programme and still have much more to experience, I’m proud to be part of this programme and looking forward for the rest of the journey.

Euan Martin

Enrolled 2022

Emerson Automation Solutions/ University of Strathclyde

Whilst I haven't been a student with the CDT for very long, the courses, training and opportunities presented so far have confirmed that this was an excellent choice for my doctoral level study. Whilst the first semester in St Andrews is intense, the broad basis of skills and content covered has really strengthened my understanding of optics and photonic systems. Coming from an undergrad severely disrupted by Covid-19, the lab sessions have presented me with an opportunity to develop a wide range of skills which I hope to put to good use when starting the research phase soon.

My first interaction with the CDT after receiving my offer was an invite to the 2022 conference and 21st Anniversary Celebrations. The opportunity to meet with centre staff, current students and other academic and industrial partners gave me a fantastic taste of what studying on the programme would be like, and I'm excited for Summer School in July to hear more about the exciting work happening across the CDT.

My EngD project will focus on developing and advancing new techniques for detecting impurities in hydrogen gas, building on pre-existing technologies from Emerson (formerly Cascade Technologies). This will be supported by research at Strathclyde, with several projects occurring in the last few years related to tuneable diode absorption spectroscopy for applications such as engine combustion analysis.

Hydrogen will become an increasingly valuable asset over the coming decade as we work towards decarbonisation goals, with Scotland and my hometown of Teesside both set to be major locations for development in the field. Monitoring purity at stages throughout production, transportation and end user applications will be of critical importance for successful implementation of hydrogen technologies. I hope that my participation in this project will allow me to explore this exciting field for both its scientific interest and increasingly important environmental, geopolitical and economic contexts.

Industry Partners

The EPSRC Centre for Doctoral Training in Applied Photonics gratefully acknowledges the support of the following companies in the delivery of the EngD programme.

Laser Research and Therapy Fund

Contact Us

EPSRC CDT in Applied Photonics, Heriot-Watt University,
School of Engineering and Physical Sciences, Edinburgh,
EH14 4AS

T: +44 (0)131 451 8245

E: CDTphotonics@hw.ac.uk

www.cdtphotonics.hw.ac.uk

@CDTAP

www.linkedin.com/groups/2497044/