



Innovation made real

Innovation to Impact

Ploughshare Review 2022

ploughshare



It is vital we support and encourage the innovation of our leading scientists and engineers in the UK. Ploughshare's commercialisation capabilities enable us to continue to harness the use of new technologies which have real and beneficial impact in our society.

Sir Patrick Vallance
Chief Scientific Adviser



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In the past year, we have doubled the number of venture agreements and increased our balance sheet value by over a third.

Foreword by Hetti Barkworth-Nanton

Game-changing government innovations

I am delighted to introduce our very first Ploughshare Review. The 2022 review focuses on the organisational transformation we have taken Ploughshare through to become the responsive and people-first business we want for the future.

The changes we've implemented enable us to deliver on our mission for defence and government innovations to benefit humanity, support economic growth and raise financial returns for government. We're not just delivering on our mission but accelerating the pace at which we transfer these game-changing, impact-driven, government-funded innovations into the hands of the user.

And these changes are showing in our performance. In the past year, we have doubled the number of venture agreements and increased our balance sheet value by over a third.

How have we done it? Firstly, we've made it easier for innovators across the Ministry of Defence to do business with us by increasing our core funding as well as establishing an accelerator fund; secondly, by being more adaptable in licensing and spin-out creation; and thirdly, perhaps most importantly, by focusing on our people. We've created a team with world-leading expertise in every single step of the innovation journey.

Positive change in our cultural health has seen the doubling of our diversity index and employee engagement rising to 20 points above the UK national average. We've put diversity and inclusion at the centre of our strategy, recruiting people from across the ecosystem, recruiting for growth, agility

and collaboration. Great technology goes nowhere without the right people, and we now have an amazing team in place. Go to pages 14-17 to judge for yourself.

I'm incredibly proud of what the team has achieved, but we couldn't do it without the support of our partners. We engage daily with innovators, corporates, investors, entrepreneurs and the public sector. And it is in building these communities that our success has been realised.

Ploughshare has already delivered over £117m gross value added and £152m of exports since inception, and by the end of next year we should have generated c. £175m GVA cumulative. But this is just the beginning. We will continue to deliver innovations that help to solve some of the world's most pressing problems in support of the Defence and Security Industrial Strategy. Read on to find out how we intend to do it.

Hetti Barkworth-Nanton
CEO, Ploughshare



Foreword by the Ministry of Defence's Chief Scientific Adviser,
Professor Dame Angela McLean

Delivering real prosperity

Ploughshare's purpose is to ensure that UK Defence science and technology delivers capability back to the MOD whilst providing real benefits to the economy, our society, people's lives and the environment. This purpose is very much being realised.

Since Ploughshare's inception, its spinouts and licensing agreements have created hundreds of new jobs and generated millions of pounds for the UK in exports and investments.

The social value from the commercialisation of home-grown science and technology directly contributes to the UK's ambitions to be a science and technology superpower and will have a real and beneficial long-term impact for UK and global society.

Government technologies can be lifesaving, and Ploughshare provides an important pathway to get these technologies into the hands of users.

The sepsis diagnostic tool, (see page 8-9) for example, is not just capable of saving lives, but will contribute to revolutionising the management of hospitals. It will relieve pressure on the National Health Service and guarantee a better outcome for the patient.

It is this sort of game-changing technology that the UK government wants to see in the public domain. Recent government reviews, such as the Knowledge Asset Review and the Mackintosh Report, recognise the need for a step change in commercialisation across government, and the Defence and Security Industrial Strategy acknowledges and enables Ploughshare's contribution.

UK Defence scientists are some of the most talented and capable in the world. Every day, they are creating disruptive technology, but their full benefit can only be realised if we support organisations like Ploughshare. Ploughshare has an exciting strategy which will deliver real impact, and I look forward to witnessing the acceleration of government science and technology and its contribution to our society.



To use my experience in the risky world of start-ups for the good of humankind is a privilege. I've built up many years of knowledge in adding commercial value to innovation and I'm now using this experience to pursue success for the sepsis diagnostic tool.

Iain Miller
CEO at Presymptom Health

Case Study

Presymptom Health

A spin-out delivering sepsis prediction before symptom onset.

Diagnosed cases of sepsis exceed 49 million a year globally, with 1,400 patients dying daily in the developed world alone. Rapid treatment is critical to a patient's recovery. Therefore, identifying individuals who are more susceptible to the onset of sepsis would be a huge advantage to patients and to hospitals.

Iain says, "And that is exactly what our technology does – it analyses a patient's genomes to rapidly predict patients with infections who are more susceptible to sepsis. So, imagine the management of a hospital in another wave of Covid or any other pandemic. These patients can be more susceptible to sepsis because the virus affects the body's immune system, but this technology will potentially recognise those patients at a higher risk of developing sepsis, as well as those patients that have a low risk."

"This means that those higher-risk patients could be monitored immediately and receive intensive care as soon as they need it. And those who are lower risk could be discharged and monitored from their own homes. This really is a diagnostic tool that could relieve significant pressure on the NHS, especially in times of crisis."

Iain Miller, an entrepreneur with more than 30 years of start-up experience in the US and UK, was appointed to the helm of Presymptom Health in 2019. The spin-out was initially set up using a lean operating model, which meant that Iain was initially brought in on a part-time basis and additional technical skills were attained through outsourcing.

Mark Gostock, Ploughshare VP Commercialisation, explains: "At Ploughshare, we work with the spin-outs to find the most appropriate operating model possible, including flexibility in licensing agreements and funding routes. We're looking for the option that will create the maximum long-term impact, and not letting 'the

norm' become a barrier to success. We also look for this ability in the people running the company and we have certainly found this in Iain."

Early-stage funding was crucial for Presymptom Health for the development of a prototype to use in hospitals so that the process of validation via a clinical trial could commence. Mark continues, "Iain, who is adept at looking for creative funding and grant opportunities, together with our help, was able to secure this early-stage government funding."

As a result, Presymptom is now trialling the diagnostic tool in five hospitals, which will expand to eight in the autumn. By late 2023, the spin-out aims to have its first operational diagnostic tool in hospitals.

Iain says, "In this risk-averse investors' climate, it's all about making the technology 'investor ready' and with the clinical trials under our belt, we are on track to attract investor interest."

Commenting on the transformational change at Ploughshare, Iain says, "Ploughshare has evolved and is in a more understanding and flexible position to help accelerate a start-up's technology.

New routes to innovation success, best-practice sharing and a virtuous circle of innovation knowledge, where spin-outs feed back their experience and offer advice to Ploughshare, are enabling government technology to benefit society more rapidly.

About Ploughshare

New Ploughshare New direction

Gordon Scott, Commercial Director

Ploughshare is accelerating at pace, and we will take hundreds of technologies to market over the next 10 years. This will boost the UK economy, through the generation of exports and UK jobs up and down the country.

To achieve this, we are embracing change. We've made changes to how we operate our commercial services, what we offer to the market and the way we recruit and retain our people. We are already seeing the benefits and as we accelerate our efforts and consolidate our processes, we will build on these successes.

"We have made it simpler and faster for our innovation ecosystem to work with us. We've streamlined our processes, increased the variety and market accessibility of our licencing agreements and improved the way we create spin-outs. We prioritise our investment in commercialisation for the technologies most likely to have the highest impact and

we are increasing our visibility in the markets we serve. What's more, we now take a view on the impact that innovation will have over the whole of its life, rather than just the immediate income generated.

"Alongside an emphasis on employing the right people and collaborating across our ecosystem, it is these changes that have enabled us to present a broader range of government IP, increase the investment in our ventures and grow our government client base."

Ploughshare changes

The changes we have implemented are delivering more value to more stakeholders, for example:

More routes to venture success

We have shifted the ownership structure of our ventures, making it more advantageous for founders to share in their success.

Increasing visibility and accessibility

As a champion of UK innovation, we need to reach new markets and technology scouts.

Awareness of Ploughshare has doubled in the past two years. Not only are we more engaging in our communications, but we are more transparent and can now be found in more markets.

The Ploughshare Playbook, for example, is a simple step-by-step guide that traces the journey of a spin-out from initial idea whilst always looking for ways to deliver enhanced capability to our defence partners.

We have also launched ourselves on the world's largest marketplace for new technologies, Ploughshare Discovery (powered by Flintbox). See page 7. Ploughshare Discovery makes it easier for innovation scouts to purchase our government IP. With Ploughshare Discovery, it is possible to evaluate and sometimes purchase government IP safely and securely from wherever you are in the world.

Shift to impact

We are focused on seeking the value of innovation throughout its life, shifting our emphasis away from generating immediate income to actively finding and supporting innovations that could create long-term impact. We can do this because we have unique access to hundreds of government inventions that are truly game-changing. We want to get disruptive innovations to the marketplace, especially those that are capable of helping with humanity's most pressing problems, like protecting our environment and saving lives.

Prosperous innovation across the MOD landscape

As the MOD's go-to for taking innovations to market, we have a new transformational strategy that is approved and supported by them. It forms part of our overarching aim to create a wider portfolio of innovations being developed across the whole of government.

We now offer our proven processes (Ploughshare as a Service) to all innovation hubs and agencies across the entire MOD, making it easier for them to harness their home-grown IP. The MOD's innovation hubs

and agencies, such as the front-line commands (FLCs), will now have access to our services for spin-outs and licencing.

The strategy forms part of the wider UK government agenda to maximise impact from in-house knowledge assets and IP. We are working closely with the Department for Business, Energy and Industrial Strategy (BEIS), including the Government Office for Technology Transfer (GOTT), which is conducting a similar exercise across wider government. And we are contributing to the ambition of the UK to maintain and enhance its position as a global science and technology superpower."

About the Ploughshare Accelerator Fund

Our new Ploughshare Accelerator Fund (PAF) invests in the IP we are commercialising. It helps bridge the valley of death between less mature technologies to make them more obviously capable of delivering a competitive advantage and market penetration. The PAF can also be used to help form a spin-out, for example, to cover initial set-up costs and help develop prototypes.



Ploughshare Discovery

Discover the MOD's latest innovations

As part of our growth plans to reach new sectors and audiences with our breadth of new innovations, we have launched Ploughshare Discovery – a digital licensing channel powered by Flintbox.

Discovery enables the 10,000 technology scouts currently accessing Flintbox to browse our catalogue of technologies and allows them to swiftly move into the licensing process. It will provide all the information needed to invest in our exciting new IP and it will be a hub for express IP contracting in the near future. We've already started to add innovations to the platform and we are ready to start commercial discussions with interested parties.

Over the past two years we have delivered:

30% | Increase in our balance sheet

50% | Bolster of our resources

25% | Increase stakeholder awareness

82% | Employee engagement score (20 points above the national average)

500% | Increase in our investment fund for accelerating innovation – now standing at £5m



A Diverse Team

Best brains in the business

Ploughshare has a diverse team which includes astute business minds, as well as talented scientists and engineers.

Our team works collaboratively to pool knowledge and together we are well qualified to identify wider uses for the technology we license and seek out the right investment partners. We innovate, not just in what we do, but also in how we do it, leaving no opportunity unexplored to maximise the potential of government-owned technology.

Supporting secondees

Transparency and greater engagement are key to the success of Ploughshare's transformation strategy. This is supported by our secondee programme with AWE and Dstl. Currently, we are pleased to have Laura Harris and Stewart McManus embedded within our commercial team. Whilst offering their technical expertise to Ploughshare, both Laura and Stewart are strengthening their commercial skills and will return to their organisations to share their experiences, as ambassadors for further technology transfer among the MOD community.



Lily Chan Commercialisation Manager

Lily is passionate about delivering impact and facilitating the benefits of research to society. She understands the innovation journey and shares her knowledge across the team and with our stakeholders. She uses her experience in commercialisation strategy, diversifying licensing models and fostering new business relationships with stakeholders to ensure technology is transferred to the relevant users. This experience is invaluable to Ploughshare

as we begin our own diversification journey, finding better ways of working to increase the benefit for our clients, customers, investors and the end user. Lily challenges decisions to avoid 'dead ends' and seeks to find the right way forward to ensure that exciting innovations find a pathway to the market. If the technology readiness level needs to be advanced, she works with all parties to find the funding necessary to make this happen.

"It satisfying to find viable commercial avenues for government innovations that have the potential to positively impact people's lives. My previous training and experience in technology transfer

enable me to identify innovations with high potential for success and the vehicle to get them to market whether licensing to existing companies or through formation of a new spin-out."



Mark Gostock VP Commercialisation

Mark's focus at Ploughshare is on overseeing the growth of our life sciences portfolio and evolving early-stage healthcare and medical technologies into successful commercial ventures. Mark's rich background in technology transfer has gained him an understanding of start-up governance, such as legal frameworks, environment social governance (ESG) and barriers to innovation success.

Additionally, his insight, particularly at pre-seed and seed stage, enables him to assist spin-outs to identify funding options at each stage of their growth, allowing the teams to take risk and opportunity in their stride.

"For me, it's all about the spin-out. At Ploughshare, we enter into an advisory role with our spin-outs, offering strategic guidance at every step of the commercialisation journey. We want the spin-out to achieve success and create maximum societal impact."

"I'm a networker and I relish the opportunity to connect individuals with complementary skills, so they can energise each other as one team. Each spin-out is unique and requires a different path, but I enjoy working closely with each one to help map out and carve a successful journey."

Megan Hatton

Commercialisation Manager

Megan liaises with scientists, entrepreneurs, investors and industry to seek opportunities for commercialisation. She negotiates licensing and spin-out arrangements that work for all parties and, crucially, exploit the innovation to achieve the greatest social impact. Previously, Megan has worked in commercial roles focused on innovation, across numerous technical sectors. She has managed projects from R&D to product launch and is well-versed in the nuances of taking new products to market. This experience places Megan in an enviable position to seek innovation opportunities in government and allows her to think holistically and realistically when pursuing a route to commercialisation.

“At Ploughshare, we are a diverse team bringing together a wealth of skills and experience. We cover a breadth of technical specialisms between us and share a passion for innovation. FY23 is a pivotal year for Ploughshare and it’s such an exciting time to be part of the team. Many of the technologies we commercialise are genuinely improving and saving lives, realising environmental benefits, or advancing the security of the nation, so delivering at pace is essential and incredibly rewarding. Our transformation journey is ambitious and exciting, and I am energised to be part of that change.”



Andy Portlock

Chief Operating Officer

As a seasoned senior leader, Andy brings extensive experience to Ploughshare. He has led other organisations through major transformative times and managed global teams to deliver international new product and business development. “At Ploughshare, we are a diverse team bringing together a wealth of skills and experience. We cover a breadth of technical specialisms between us and share a passion for innovation. FY23 is a pivotal year for Ploughshare and it’s such an exciting time to be part of the team. Many of the technologies we commercialise genuinely improve and save lives, realise environmental benefits, or advance the security of our nation, so delivering at pace is essential and incredibly rewarding. Our transformation journey is ambitious and I am energised to be part of that change.” Used to working at pace and with agility, Andy is delivering our ambitious plans for growth and communicating across our network the benefits of using Ploughshare as an end-to-end service. Andy has run his own business and he regularly shares this experience and provides advice to our licensees and spin-outs. He encourages the commercial team to use their own backgrounds to unravel and identify the value proposition for each IP offer.

“Much of my working life has been spent close to the world of intellectual property (IP). From my time working in highly innovative digital corporations, I learnt quickly to look for the market opportunity and seize the moment. I joined Ploughshare as I see it as my chance to do something for the UK – to give something back. It’s not just about the bottom line here but about having an impact on the UK – creating new jobs and adding benefit to the whole country. The inventors I meet and the IP I witness within government are truly extraordinary and to be part of their innovation journey is exciting.”



Case Study

Air Monitor



Transferring government technology for the benefit of the public's health is the pinnacle of what Ploughshare is about – so it is very exciting to see the DustCanary rapidly progressing towards the market place. We wish Will and his team every success.

Hetti Barkworth-Nanton
CEO, Ploughshare



William Averdieck
Managing Director, DustCanary



Dust is a common occurrence in factories and warehouses and it can rapidly become airborne, posing health risks for factory employees. Regular exposure to dust particles, for instance, can irritate the skin, eyes, respiratory system, ears and more. Whilst some of the most serious respiratory diseases and skin conditions contracted from the workplace can also be attributed to dust.

To date, the monitoring of dust particles has intruded on manufacturing time and measurement is only for a specific point in time. However, the DustCanary, a Ploughshare licensee, is addressing this challenge with a wearable dust monitor. Invented in a government laboratory, the DustCanary will be fully operational as an occupational safety device later this year.

William Averdieck, Managing Director at DustCanary, says, "Our technology is compact and convenient to wear – fitting easily onto an employee's clothing. The device samples inhalable dust and can also continuously monitor respirable dust in real time, warning when workers should fit Respirable Protective Equipment (RPE) or to remove themselves from an area, thus protecting them from increased dust exposure."

"Our technology will enable factories and warehouses to continuously monitor their teams' exposure to dust levels, giving peace of mind to employees and employers alike. Whilst current policy means that monitoring need only be done on an annual basis, the DustCanary allows employers to take control of their own employees' safety, protecting them daily and providing the level of assurance expected of the modern-day workplace."

"We are at an exciting point, with the product development stage very nearly complete. We are on track for production by the end of 2022."

Commenting on Ploughshare's role, William says, "Ploughshare has been a helpful supporter and we've had a strong relationship throughout the growth of DustCanary. It has taken us longer than expected in the product development stage, but Ploughshare has been flexible with licensing and provided us with continual advice. We have had weekly liaison meetings with the inventor, for example, which has been hugely advantageous to generating new ideas and ironing out any issues."

"I was approached to head up the development of DustCanary whilst partnering with the University of Hertfordshire on a project and I jumped at the chance to be involved in a pioneering innovation. The Ploughshare model offers a fair licensing and partnership agreement, allowing us to develop at pace and define the market."



Case Study

Protecting our borders, protecting our soldiers

From warships and tanks, to planes and boats – the ability to identify vehicles and their intent is important in protecting our borders and personnel.

Using Electronic Support Measures (ESM) these platforms can be tracked and identified and thanks to our spin-out company ESROE, this surveillance capability is now more readily available to both defence and civilian operators.

While working on a Dstl programme in the early 1990s, Jon Roe developed a piece of software that would come to revolutionise the way that Electronic Support Measures (ESM) were deployed. His work has improved the safety of our armed forces and also opened up this method of surveillance for civil use.

Jon had previously spent 25 years researching ESM for the UK Ministry of Defence. This new innovation came about due to a problem noticed by the Royal Navy as some of their ESM systems

were producing ambiguous answers. Jon formed a team to solve the problem which resulted in a novel piece of software they called Palantir.

Interest in Palantir was expressed by defence giant Thales which resulted in an initial license deal negotiated by Ploughshare. However, both Jon and Ploughshare recognised that there was an opportunity to spin-out the technology into a new company. In addition to the Palantir software, the new company ESROE, saw its future in the development of an innovative miniature ESM system using another piece of software licensed out of Dstl, now known as Glamdring, and so the Micro ESM product was conceived.

“This was the beginnings of Micro ESM. Whilst the commercial version of Palantir, called Thorondir, remains successful in generating revenue, I see the future of ESROE being with Micro ESM.”

The biggest market Jon sees for ESROE is in defence. However, given the small size of Micro ESM, this has opened up other markets such as drone-enabled ESM and civilian maritime surveillance. Jon says: “We are maintaining a key area of capability for the MOD and I believe that ESROE can grow to become a significantly sized company.”

The technology

ESM allow users to detect, track and identify vehicles by using radar signals and has to date been limited to large high value platforms, such as warships or fighter aircraft. Micro ESM, however, is so small that it can be carried in the hand or mounted on lightweight unmanned aerial vehicles and is sufficiently low cost to be deployed in high volume.

For the military, this means ESM capability can now be scaled from individuals and small teams, through to networking with other electronic warfare systems.

Benefits

- » ESM capability in a small and lightweight unit
- » Automatic processing of known signals using programmed radar database
- » Requires no supervision to operate in the presence of interference and noisy data
- » Automatically creates database entries for tracking of unknown signals.



Ploughshare’s expertise was invaluable in helping us access potential investors.

Jon Roe
Director, ESROE



Innovation made real

Ploughshare is the hub that makes government innovations prosper

Established in 2005 as the technology transfer partner for the Defence Science and Technology Laboratory (Dstl), our purpose is to ensure UK government innovations deliver real prosperity to the economy, our society, people's lives, and the environment.

For more than 15 years we have worked with an array of scientists, innovators, investors, entrepreneurs, SMEs and public sector organisations to bring about the commercialisation of

many great innovations developed at world-class organisations such as Dstl, Ministry of Defence, and the Atomic Weapons Establishment.



An independent assessment of Ploughshare Innovations Ltd, who act as the technology transfer office for the MOD's Defence Science and Technology Laboratory (Dstl), calculated that its activities generated **£117 million in net additional gross value added (GVA)** and **£152 million in new additional exports** since it was established in 2005.

Mackintosh Report

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Innovation made real

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