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The magazine for Defence Engineering and Science

Ministry of Defence

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Codex is the Latin word for the first Roman books that replaced scrolls and were collections of the key learning of the day. In the modern age, Codec is a shortened version of compression/decompression, the algorithms used to efficiently store and transmit large quantities of digital information.

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Times have changed

Seventy years ago during the D-Day landings in Normandy, around 4,500 allied troops died during the first day of the invasion. Most from machine gun fire, but many victims of the turbulent sea and the weight of their equipment.

Today, the Armed Forces remain ready and better prepared for today's challenges, supported by science and technology. In this issue, we discover how the UK is working with other government agencies to develop defences at sea and in space, lighten the load of personal equipment and working with industry and academia to make the world a safer place.

Behind these advances are the people who make things happen. We talk to: Surgeon General Paul Evans who explains why it is so important to continue to invest in research; Dstl scientist Dan Pope who gives a personal account of what it is like working on secondment in Germany; and Brigadier Timothy Hodgetts who puts forward a plan for innovation in trauma care.

And it is now time for Defence Codex to change too. Technology provides an opportunity to communicate news faster by providing regular updates online. We will be inviting subscribers and anyone interested in defence science and technology to sign up for regular updates at www.defencescience.blog.gov.uk

We look forward to continuing to bring you news of the latest developments in defence science and welcome your views and suggestions.

Find the latest and back issues of Defence Codex at:-
www.gov.uk/government/groups/defence-science-and-technology

MOD Chief Scientific Adviser celebrates advances in defence S&T

Outstanding contributions to defence science and technology were recognised at this year's presentation at MOD, Whitehall.

Nine individuals and 29 teams received their awards from MOD Chief Scientific Adviser Professor Vernon Gibson, who spoke of the challenge of making the final selection from the inspiring nominations: "Reading through the nominations, it was easy for me to see just how important the work being done by the Defence Science and Technology community is and how the MOD's outstanding community of highly talented and motivated scientists and engineers successfully addresses an incredible diversity of scientific and technical challenges."

Professor Vernon Gibson

The awards recognise the contribution of the scientists, engineers and others who develop advances that support the work of the Armed Forces and the civilian sector: "It is for new scientific breakthroughs and for discovering new ways of exploiting both military and civilian technologies that I know that I can rely on the scientists and engineers across MOD and our partners in industry and academia. It makes me confident that I can report back to Ministers and the government on the great work that's being done and how this makes a real difference to the Defence and Security of the UK.

"We have worked on delivering the commitments in the National Security through Technology and we are making good use of the budget that MOD has committed to spend on S&T.

It is important that S&T continues to be recognised for the importance of the role it plays in supporting and enabling both the Armed Forces of today and the role it will play in enabling our Armed Forces of the future."

Diversity of awards

This year's awards covered a wide range and areas of defence science and technology and also recognised the importance of international collaboration, particularly with the US.

The Atomic Weapons Establishment (AWE) received a number of awards for their contribution to science and there was recognition of the ground-breaking work in the area of Chemical, Biological and Radiological detection and protection.

Industry recognition

The contribution of the wider defence industry was recognised with an individual award to Chemring Technology Solutions Client Manager MOD Research Peter Mallinson who said "Receiving this award was the highlight of my career to date, and the feeling was up there with getting both of my degrees!

Defence Medical Educational Local Area Network Implementation Team

My role is to take low TRL ideas from the whiteboard to the hands of the user as quickly and efficiently as possible by maturing them and matching them to exploitation pathways. This involves working very closely with the CDE, Dstl's Research teams, wider MOD and my own Company for PV funding in order to make this happen. This can be a tricky process and only works if the focus remains tightly on the customer and their challenges at all times and under all, sometimes conflicting conditions.

The award is positive confirmation for me that I am doing the right thing and that it is recognised by my customer for the value it provides to them."

> "The CSA award recognizes excellence in MOD research activities, and the joint industry-government military driving study exemplified effective team working and partnership."

Peter Mallinson receiving award from CSA

XPI Simulation Managing Director Simon Skinner, the industry lead of the Military Driver Training Simulation Research Team said: "The CSA award recognises excellence in MOD research activities, and the joint industry-government military driving study exemplified effective team working and partnership. As the industry lead, XPI Simulation worked closely with our partners – QinetiQ, CAE UK and NSC, as well as many smaller suppliers – to construct an experimental simulator for the research programme in just seven months. This would not have been possible without the cooperation and partnership with Dstl and other parts of the MOD. The ground-breaking results have proved that a good proportion of military driver training can be performed with simulators instead of using the actual vehicle. Not only is this better for the environment, but it will also save the MOD and the taxpayer a large amount of money in terms of reduced fuel use and vehicle attrition."

Recipients from the Atomic Weapons Establishment

Richmond trousers in style

Rackety's, a small Staffordshire business, has designed innovative new clothing for wounded soldiers.

The family-run firm specialises in clothing for disabled adults and children. Personnel with leg injuries may require specialist external supporting leg frames to aid their recovery. This means that they have to cut their existing trousers to fit over the frame, or wear shorts. Rackety's has developed a specialist pair of trousers that can be worn over the top of frames, helping to reduce infection, provide better comfort and be more practicable.

The original idea was submitted to MOD's Centre for Defence Enterprise (CDE) who provided initial funding. Ongoing support was provided by Dstl. Rackety's visited Headley Court to spend time with troops undergoing rehabilitation and worked with researchers at Coventry University.

Rackety's owner Annabel McMahon said: "During our visits to Headley Court we realised our existing products were not suitable and discovered there was a need for something completely different. CDE guided us through the daunting process of dealing with the defence market and provided support with every aspect of the project. This led to the development of the trousers and a whole new potential market in specialised rehabilitation garments."

The new product is named 'Richmond trousers' after Colonel David Richmond, an officer who underwent rehabilitation at Headley Court, after suffering a gunshot wound to the leg on operations.

Colonel David Richmond

Richmond trousers

University designs new prosthetic sleeve

Nottingham Trent University has been contracted by MOD's Defence Science and Technology Laboratory, through the Centre for Defence Enterprise to develop a seamless knitted sleeve for the management of perspiration at the interface between prosthetic limbs and an amputee's residual stump.

The first phase of work demonstrated the potential for knitted sleeves with a grip, longitudinal stiffness and transverse flexibility, which can be customised for individual amputees.

Current prosthetic sleeves are constructed from textile fabrics coated with an impermeable sheet of silicone rubber. Consequently, sweat is not transported away from the skin and accumulates within the sleeve and needs to be emptied.

The breathable prosthetic sleeves will aid the recovery of injured military personnel by reducing complications, such as ulcers. The lack of seams will help improve comfort and protect against pressure necrosis.

Potentially, the sleeves will improve quality of life for amputees and personnel from the Defence Medical Rehabilitation Centre (DMRC) who have been closely involved in the project, ensuring that military amputees' requirements are understood. Further research will include feedback from Headley Court.

The technology will also be of benefit to amputees in the general population.

SEA to deliver £4m research programme

MOD's Defence Science and Technology Laboratory (Dstl) has appointed SEA, a subsidiary of the independent technology group Cohort plc, to deliver a £4 million research programme as part of the Synthetic Environments Tower of Excellence (SE Tower).

The research programme will focus on future training and experimentation environments, with the aim of developing, evaluating and enabling the exploitation of advanced Live, Virtual and Constructive simulation architectures, interoperability and management techniques. This will aid integration between land, sea and air operations, and support greater interoperability between NATO nations and other coalition partners.

The SEA-led team will investigate innovative ways to integrate and deliver live and virtual simulations for training and experimentation environments more effectively and efficiently, exploiting increasingly-realistic lower-cost synthetic environments where appropriate. The research will focus on the development and evaluation of advanced open, agile and standards-based approaches, achieving more flexible through-life solutions and facilitating collaboration in integrated operations.

Porton Man robot ready for duty

MOD's newest recruit – Porton Man – is ready for action. With robotic ability to walk, run, kneel and sight a weapon, he will join the Armed Forces and contribute to their commitment to make the world a safer place.

MOD has invested £1.1 million in the robotic mannequin that has been designed to test protective suits and equipment. Built using advanced lightweight materials developed for Formula One racing cars, the robot features over 100 sensors that record data, enabling scientists to carry out real-time analysis on equipment such as chemical and biological suits in a realistic, but secure environment.

The robot was designed and built by i-bodi Technology in Buckinghamshire. Briefed to build a lightweight robot that is easy to handle, company CEO Jez Gibson-Harris explains the challenges. "There were a number of challenges associated with this and one way we looked to tackle these challenges was through the use of Formula One technology," he says."Using the same concepts as those used in racing cars, we were able to produce very light, but highly durable, carbon composite body parts for the mannequin."

Although mannequins have been used by Dstl before, Porton Man is unique to the UK. Dstl is the only laboratory in the world that can use chemical warfare agents to assess the effectiveness of complete clothing systems, such as the chemical, biological and radiological suits used by UK armed forces.

Porton Man

Defence Growth Partnership implementation plan to be announced at Farnborough International Airshow

Progress on the Defence Growth Partnership (DGP) will be announced at this year's Farnborough International Airshow.

Launched at Defence Systems & Equipment International (DSEI), the DGP focuses on Government and Industry working together, bringing a fresh and ambitious approach to building a strong future for the UK Defence Sector.

The launch document – Securing Prosperity: A strategic vision for the UK Defence Sector – set out the challenge of delivering a long-term strategic vision, which will maximise the opportunities for British business and enable them to offer innovative and competitive solutions for the Armed Forces and customers around the globe.

Government and industry will set out a joint action plan to ensure a thriving national Defence Sector, delivering security, growth and prosperity for the UK, into the future.

The UK's Defence Sector is renowned around the globe for developing world-class capabilities across the full range of defence equipment and services, which are vital to assuring the UK's national security and relationships with key Allies.

The Industry directly employs 155,0001 people in the UK generating £22.1 billion turnover for the economy and is the number one exporter of defence equipment and services in Europe and number worldwide. In addition, the Industry indirectly employs a further 145,0001 in the supply chain.

The Global Challenge

The global defence environment is highly dynamic: customers' needs are changing in an uncertain world; competition is fiercer and technology is driving new solutions. Nations around the world are faced with constrained investment at home and are becoming more active in the international market place.

Working together, Government and Industry have concluded that there is an opportunity to modernise and reshape to improve the conditions for the future success of the UK Defence Sector. By working in partnership, the objective is to have a truly competitive, sustainable, and globally successful UK Defence Sector that provides affordable leading edge capability and through life support for the Armed Forces and international customers.

Key UK strengths that the Defence Growth Partnership will maximise include:

- air capabilities – which have yielded 82% of UK defence export success over the last ten years and which have significant potential for growth
- Intelligent systems – development of the electronics, software and systems integration that are found at the heart of many military capabilities
- Growing international business – developing more coordinated UK solutions, tailored to the needs of customers around the world
- Technology and enterprise – establishing more effective ways of creating and exploiting the intellectual property of the future, such as autonomous systems
- Skills – developing the next generation of apprentices, technicians, engineers and other professionals
- Value chain competitiveness – improving the competitiveness of the UK's defence value chain, providing differentiation in terms of capability, cost and market access

Defence growth partnership

Vision

The Defence Growth Partnership will secure a thriving UK Defence Sector

Delivering security, growth and prosperity for our nation.

Strategy

Taking a fresh and ambitious approach through a Joint commitment from Government and Defence Industry to work together to develop new opportunities by

Building on our nation's strengths in air capabilities and intelligent systems and deliver growth through Innovative and tailored solutions for Customers around the globe.

POST SORTIE DATABASE

EFFICIENCY UP THERE RESULTS FROM EFFICIENCY DOWN HERE.

With any complex aircraft, capturing pilots' post-sortie observations in a timely, effective and valuable manner can be a challenge. However, by not capturing and using this data, Project Teams could be losing the opportunity for **better decision making, risk avoidance and improved fleet efficiency**. This was an issue **Typhoon Project Team** were familiar with.

With tlmNEXUS' senior staff having served in the RAF, their first-hand experience of this challenge made them a natural choice for a partnership with Typhoon to design a realistic, workable software solution to help make this **complex problem a little simpler**.

The Project Team needed a solution which recorded the minor system and equipment anomalies pilots noticed when they were flying which potentially compromised **performance, efficiency** and the **effectiveness** of the training mission.

Designed by pilots, for pilots, the Post Sortie Database (PSD) is simple to use and intuitive to the nature of the industry. The web-based tool allows for optimised sharing between teams, enabling greater **transparency and collaboration**, regardless of location. The software can then aggregate and present this data in an intelligent way, supporting decisions made by **engineering teams, acquisition, finance and operational management**.

The utilisation of an electronic framework in place of old style spreadsheets and documents means that performance, reliability and mission effectiveness can be measured and **analysed over time** with minimal effort.

Squadron Leader Millikin, Typhoon Requirements Capture from **Typhoon Mission Support Centre** stated;

"PSD's appeal is its **ease of use**, **ubiquity** and **flexibility**. tlmNEXUS' focus on the customer's needs coupled with their rapid software updates ensure that the customer, in this instance the **Typhoon frontline pilots**, get what they need both **quickly and efficiently**"

Six years on from its creation, PSD is an integral part of the way Typhoon Project Team work, and there is ambition for further roll out within MoD.

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How to win business abroad

Representatives from over 60 UK defence and security companies recently attended a seminar on how to win business overseas.

Organised by UK Trade and Investment Defence and Security Organisation (UKTI DSO) their regional 'How to win Business' seminar for UK small and medium enterprises (SMEs) was held at Caterpillar Defence Products, Shrewsbury, in early May. Over 80 UK SME representatives from over 60 companies attended this event – the biggest and most successful seminar to date.

Delegates received a number of presentations from government and industry covering a wide range of advice, information and support.

The event was organised by UKTI DSO's Small Business Unit, with support from the UKTI West Midlands International Trade Team.

Speakers included Minister for Defence Equipment, Support and Technology Philip Dunne who spoke about the Government's continuing commitment to support UK SMEs in the defence and security markets.

UKTI DSO briefed delegates on the variety of defence/security export services available including:

- UKTI DSO global marketing support package;
- specialist military advice and assistance;
- latest developments on support within the security sector.

These were followed by advisory presentations on localised UKTI support, export licensing and media engagement.

TEQ Solutions, a successful communication company, shared their experience of working with UKTI DSO and hosts Caterpillar Defence Products gave insight into their supply chain policies and introduced two of their main first tier SME suppliers.

Supply chain opportunities

UKTI DSO also recently hosted an event on behalf of Raytheon UK, one of the UK's biggest defence contractors, offering unique potential sales opportunities to UK SMEs.

Raytheon invited the SMEs to submit capability tenders against a series of mid and longer-term technological requirements. The requirements included innovations and related services.

Over 100 SMEs applied. This list was reduced by Raytheon to 63 companies. Each was offered two 20 minute one-to-one appointments with Raytheon's UK and US technology teams.

Raytheon are now evaluating all the discussions and will be contacting the SMEs to develop the most promising innovations and capabilities presented to them. UKTI DSO will be working closely with all parties to ensure that this process moves forward as quickly and positively as possible.

Thirty years on – looking to the future

The MOD Development, Concepts and Doctrine Centre (DCDC) has set out what the world might look like 30 years from now.

Global Strategic Trends (GST) looks at a broad range of regional and thematic trends including the environment, health, education, automation, information, identity and transport.

Researchers from the DCDC consulted with experts, academics and other government departments as well as countries and institutions from around the world to develop a comprehensive analysis of the future.

Minister for International Security Strategy, Dr Andrew Murrison, said: Global Strategic Trends is a key element in setting the MOD's context for long-term decision-making. Past editions of GST have been used to inform our national security strategy, and this fifth edition highlights further key themes that will shape our thinking.

Our world will significantly change over the next 30 years and all of us will feel it. It will be a time of continuing transition, characterised by uncertainty, challenge and complexity. GST maps this and is well worth studying closely.

Global Strategic Trends forms part of the DCDC's strategic trends programme, which began in 2001. The latest edition considers the strategic context out to 2045, highlighting a number of global defence and security implications for use by policy and decision makers not just in defence, but across government.

Minister praises export success

Crib Gogh, based in Stoke-On-Trent, design and test equipment to withstand extreme environments. With MOD support and funding, they are now set for export success to the Malaysian Army.

The vest and rucksack of the Soldier System work together to provide unique energy dissipation and ergonomic weight distribution, allowing dismounted personnel to be effective on the ground for longer. Designed in conjunction with the Royal College of Physicians, the vest and rucksack finished first against leading market manufacturers in like-for-like tests.

The Soldier System is now being exported overseas and recently the company signed a memorandum of understanding with the Malaysian Army to support its future equipment requirements.

Crib Gogh founder – Steve Heaword, worked closely with Dstl to develop the Soldier System. "I believe the UK is still a driving force behind innovation within the defence industry," says Steve. "And the type of support that Dstl can offer SMEs will help maintain the quality and direction of that innovation."

Minister for Defence Equipment, Support and Technology Philip Dunne gave his support to the company's success saying; "The global success of Crib Gogh is a fitting testament to the strength of our small and medium size enterprises and what they can achieve overseas, particularly with the support of the Ministry of Defence. It demonstrates that our SMEs can and do trade successfully overseas, which encourages innovation and helps build a more sustainable business at home."

> "I believe the UK is still a driving force behind innovation within the defence industry. And the type of support that Dstl can offer SMEs will help maintain the quality and direction of that innovation."

Partnership on combined space operations announced

The UK, Australia, Canada and the United States have furthered their defence cooperation by establishing a partnership on combined space operations.

The combined space operations partnership will enable sharing of space-related information and resources to synchronize space operations among the partners and to provide enhanced awareness of the space environment, allowing more effective and coordinated use of capabilities.

The partners will cooperate on identifying and understanding what objects are in space, ensuring uninterrupted satellite operations and avoiding satellite collisions. This will contribute towards a safer and more secure space environment and enhance mutual security.

Countries around the world now depend upon satellites for weather information, navigation, banking transactions, mapping, disaster relief, internet access, and many other functions necessary to a modern economy and lifestyle. Space is also crucial to national security, with space-based capabilities providing the Armed Forces with the ability to operate and communicate around the globe, and unparalleled understanding of the space environment.

UK Armed Forces have an increasing reliance on space, making the partnership vital to the way the Ministry of Defence does business. Minister for Defence Equipment, Support and Technology, Philip Dunne, referred to the UK's history of space operations when announcing the partnership saying; "I am delighted to announce this vital partnership on combined space operations with some of our key allies.

"We already work closely with the US on space and are already making a significant contribution to this partnership through the Space Operations Co-ordination Centre at RAF High Wycombe, and the radar and analysts at RAF Fylingdales in North Yorkshire.

"By sharing the burden of space operations amongst the partner nations we will all reap the benefits of more effective space operations."

Catching up with Taranis following first flight trials

The most advanced aircraft ever built by British engineers has already made its maiden flight at an undisclosed test range, under the command of BAE Systems test pilot Bob Fraser.

MOD recently revealed that the demonstrator aircraft made a perfect take-off, rotation, 'climb-out' and landing on its 15-minute first flight. A number of flights took place last year, of up to one hour in duration and at a variety of altitudes and speeds.

The Taranis demonstrator is the result of 1.5 million man-hours of work by the UK's leading scientists, aerodynamicists and systems engineers from 250 UK companies.

The aircraft has been designed to demonstrate the UK's ability to create an unmanned air system which, under the control of a human operator, is capable of undertaking sustained surveillance, marking targets, gathering intelligence, deterring adversaries and carrying out strikes in hostile territory.

The findings from the aircraft's flights prove that the UK has developed a significant lead in understanding unmanned aircraft, which can strike with precision over a long range whilst remaining undetected.

The technological advances made through Taranis will also help MOD and the RAF make decisions on the future mix of manned and unmanned fast jet aircraft, and how they will operate together in a safe and effective manner for the UK's defences. Costing £185 million and funded jointly by MOD and UK industry, the Taranis demonstrator aircraft was formally unveiled in July 2010, but only a very limited number of scientists and engineers have ever been given full access to the top secret aircraft.

Initial 'power-up' or ground testing commenced later in 2010 at BAE Systems' military aircraft factory in Warton, Lancashire, followed by a comprehensive and highly detailed programme of pre-first-flight milestones. These included unmanned pilot training, radar cross-section measurements, ground station system integration and, in April 2013, taxi trials on the runway at Warton.

The aircraft and its ground station were then shipped from Warton to the test-range before being reassembled and undergoing systems and diagnostics checks. Taranis then made a number of high speed taxi tests in July before its maiden flight in August 2013.

Minister for Defence Equipment, Support and Technology, Philip Dunne, said: "Taranis is providing vital insights that will help shape future capabilities for our Armed Forces in coming decades. Its advanced technology is testament to the UK's world-leading engineering skills that keep Britain at the cutting-edge of defence."

Commenting on behalf of the industry team, Nigel Whitehead, Group Managing Director of BAE Systems, added: "The first flight of Taranis represents a major landmark for UK aviation. The demonstrator is the most advanced air system ever conceived, designed and built in the UK.

It truly represents an evolution of everything that has come before it. This milestone confirms the UK's leading position as a centre for engineering excellence and innovation."

About the size of a BAE Systems Hawk aircraft, Taranis has been designed and built by BAE Systems, Rolls-Royce, the systems division of GE Aviation (formerly Smiths Aerospace) and QinetiQ, working alongside MOD military staff and scientists. In addition to prime contracting the project, BAE Systems led on many elements of the Taranis technology demonstrator, including the low observability, systems integration, control infrastructure and full autonomy elements (in partnership with QinetiQ).

Linking the battle-space

Surrey based small business 2iC has developed an innovative way of linking different systems in the battle-space, which will enable troops to reduce their kit burden, while also increasing the tempo of operation and overall battlefield effectiveness.

Designed to coordinate distributed systems supplied by multiple vendors in challenging technical environments, 2iC's solutions provide comprehensive, rapid and low-risk systems interoperability.

MOD have now contracted 2iC to work on the new Lean Services Architecture, part of the Land Open Systems Architecture (LOSA) programme.

In the past it has been difficult to link and control the large number of different systems needed in the battle-space and share information intelligently between them. The LOSA programme aims to tackle this by enabling systems integration and interoperability.

The interface specification of the Lean Services Architecture is now published as an open standard using the Open Government Licence, allowing free use of the technology – a further step towards achieving the Government's open standards objectives.

2iC CEO, Graham Booth, says: "2iC has been able to connect and then coordinate previously standalone systems anywhere; whether on soldiers, vehicles and bases or distributed systems in the civil world. We believe that this, along with the availability of the open standard, could have significant benefits on future interoperability for both UK forces and allies."

The company worked with MOD's Centre for Defence Enterprise (CDE) which they believe has helped them grow their business. "Working with CDE has not only allowed us to achieve this, but given us credibility amongst investors and the wider defence industry," says Booth.

CDE Head of Operations, Jim Pennycook, says: "The creation of a new government-licenced open standard, that MOD will use as the backbone of the Lean Services Architecture, is a very significant step. It is a fundamental change in the way MOD will integrate technology into capability and we are proud that, by supporting 2iC, CDE has been instrumental in helping to achieve this."

Royal Navy test remote-controlled boat

A motorboat, called Hazard, is currently being put through its paces by a specialist team of sailors in Portsmouth naval base. The boat can also act as the 'mother ship' to an assortment of hi-tech remote-controlled and robot submersibles.

Collectively, they can search for, hunt and finally destroy mines faster than the Royal Navy's (RN's) Sandown and Hunt-class ships and they also have the added benefit of keeping the sailors required to operate them out of harm's way.

Modified versions of the same systems are also being looked at to carry out survey operations such as those performed by HMS Echo (which recently looked for the missing Malaysian airliner), as part of the future mine-countermeasures and hydrographic capability programme.

The Maritime Autonomous System Trials Team (MASTT) is the small Portsmouth-based RN unit testing the new unmanned systems.

Hazard is a small, fast motor launch, capable of speeds up to 30 knots and able to be transported by an RAF Hercules. The boat carries either the bright yellow, torpedo-sized Remus 600 or the much smaller Remus 100, which are sent off to scan the seabed at depths of up to 600 or 100 metres respectively.

After several hours in the water scanning the ocean floor, the submersibles return to their mother ships and the data is then collected, downloaded and analysed by the RN's mine warfare experts.

They can then send in another small submersible, steered onto a suspect object and identified by a mine specialist using its onboard camera. On the front line it would carry an explosive charge to destroy any mines; like the Seafox system used by RN minehunters off Libya and in the Gulf.

The immediate goal for the team is to fit this technology and unmanned sweep systems to a Hunt-class ship, but in the future the system could easily be run from any reasonable-sized warship, and sent anywhere in the world in just 48 hours.

The remote controlled system will be tested more widely by the RN before the end of the year.

Innovation key to maritime security

The National Strategy for Maritime Security (NSMS) was launched recently, outlining the UK's approach to delivering maritime security at home and abroad. It explains how the UK will organise and use its national capabilities to identify, assess and address maritime security challenges.

The UK's maritime industry directly contributes up to £13.8 billion to the UK economy and indirectly contributes a further £17.9 billion. The sector accounts for over 2% of the entire economy, supports one in every 50 jobs and creates nearly £8.5 billion in revenue for the UK Exchequer each year.

Recent trends such as globalisation, resource competition, population growth and climate change have changed the maritime domain to one that is simultaneously more connected – providing substantial growth opportunities for UK business; and more contested – in which developments in distant maritime regions can have an immediate and direct impact on UK prosperity and security.

The NSMS has five objectives:

- to promote a secure international maritime domain and uphold international maritime norms;
- to develop the maritime governance capacity and capabilities of states in areas of strategic maritime importance;
- to protect the UK and the Overseas Territories, their citizens and economies by supporting the safety and security of ports and offshore installations, and Red Ensign Group (REG) flagged passenger and cargo ships;
- to assure the security of vital maritime trade and energy transportation routes within the UK Marine Area, regionally and internationally; and
- to protect the resources and population of the UK and the Overseas Territories from illegal and dangerous activity, including serious organised crime and terrorism.

Innovation

The strategy includes a commitment to continue to monitor the latest innovative technological developments in security screening and detection equipment, with a view to sponsoring joint trials with UK industry and European and international partners. This will encourage exploitation of the latest research and development activity and deliver effective and low cost solutions to future maritime threats.

Research and development

Where maritime security interests clearly overlap, cooperative research and development across government and where possible internationally, will become the norm.

Common acquisition

The UK will build the evidence base for greater flexibility, interoperability, cost-effectiveness and coherence in relation to maritime security. This will include the identification of new or shared capability requirements and investigation of the feasibility and benefit of delivering common systems, equipment and platforms.

Defence Secretary highlights piracy threat

The NATO Summit in September will be the largest gathering of international leaders ever to take place in Britain. As well as discussing Europe's role in NATO's maritime work, the Summit will address issues which threaten NATO countries' national security and also the withdrawal of troops from Afghanistan at the end of this year.

In the run up to the Summit, Defence Secretary Philip Hammond recently delivered a speech at a meeting of the Chiefs of European Navies in Portsmouth where he discussed the importance of nations coming together, emphasising the benefits of working together to tackle shared threats, such as international piracy and blockades of economic choke points. "Since the threats we face are global in scale, we must be ready to deploy, willing to project force around the globe, whenever and wherever the need arises."

Scout prototype on display at DVD

This year's Defence Vehicle Dynamics (DVD) exhibition gave visitors the opportunity to see the Scout specialist prototype – the UK's first fully-digitised tracked armoured vehicle.

Demonstrating how technology and capability requirements are evolving to meet the needs of Future Force 2020, the displays provided an insight into the vast array of equipment used by the British Army.

DVD brings together MOD's equipment and support organisation (DE&S), the Army and industry to showcase the vehicles used by the military such as the heavily armoured Mastiff and the agile Foxhound. The event also looked ahead to future equipment requirements with some of the next-generation of army vehicles on display.

Minister for Defence Equipment, Support and Technology Philip Dunne commented on the need to adapt to changing demands: "Operations over the last decade have demanded that our vehicles were created or adapted to suit the challenges our armed forces faced in two very different campaigns. As we move to an age of contingency, DVD provides a glimpse as to how we are preparing to meet the needs of Future Force 2020.

"It highlights the innovative technology that industry has developed to enable the Armed Forces to deliver the capability required on operations. World-class technology that is made in Britain and that I want to support British industry to export worldwide."

Dunne also announced that logistical support company KBR (which already provides 100 sponsored UK reserves in Afghanistan), had signed the corporate covenant: "The corporate covenant provides large or small businesses with the opportunity formally to support the Armed Forces community. Our personnel and their families play an invaluable role in our society and it is only right that they get the recognition they deserve."

Philip Dunne at DVD

www.science.mod.uk has moved to www.gov.uk

Find the latest and back issues of Defence Codex at:- www.gov.uk/government/groups/defence-science-and-technology

Keep up to date with news updates on defence science and technology at defencescience.blog.gov.uk

A CONVERSATION WITH

PETER STOCKEL

What is your current role?

I am Air Account Manager at the Defence Science and Technology Laboratory (Dstl). My primary responsibilities cover Air Command, Joint Helicopter Command and the relevant Air elements of Defence Equipment and Support (DE&S). The Air Account covers customers' interests in over one-sixth of Dstl's entire business, so it's pretty busy!

Why did you choose a career in Defence Science and Technology (S&T)?

I graduated from Manchester University with a degree in Aeronautical Engineering, in 1986 and spent the first seven years of my career working in the defence industry, before joining Dstl's ancestor organisation, The Defence Research Agency (DRA) at Farnborough in 1994. I had been looking for a role that offered the opportunity to do more systems and operationally-related work and would provide more opportunities to engage with the military user. As a plane geek, I also couldn't resist the opportunity to work at Farnborough, at the original home of military aerospace technology in the UK.

What is the purpose of your work?

The purpose of the Dstl Accounts Directorate is to provide clear points of engagement and focus for our senior customers' and stakeholders. Through developing close working relationships with our customers, we ensure that Dstl's role as MOD's Science and technology (S&T) agent is focused on our customer's highest priorities and that we have a strategically targeted and shared forward view about the contribution and impact that S&T should be making to defence.

We support our customers across MOD Head Office, the Front Line Commands, DE&S and other government departments (OGDs) in strategically planning their requirements for S&T, understanding their needs and priorities, and helping with their exploitation of the S&T programmes.

We are also responsible for managing the consequent demand on Dstl and our supplier base and for establishing the mandates for our S&T programmes. Our prime driver is about S&T impact and the directorate also includes our Senior Science Gateway staff and our Senior Military Advisors.

Can you provide details of some current projects?

All Dstl's programmes incorporate appropriate parts of the Chief Scientific Adviser's (CSA's) S&T budget alongside relevant elements of project support tasking from DE&S or other customers. This structure is aimed at improving our focus and exploitation for research investment against user challenges and at stimulating innovation opportunities for nearer-term projects.

Although there are five Dstl programmes with 'Air' somewhere in the title, my customers' interests also lie across many of the nearly 40 Dstl programmes, so I interact across most of these as appropriate (as do my fellow Account Managers).

Two of the largest Dstl 'Air' programmes are those concerned with Air Survivability and Combat Air & platform technologies. These two programmes are combinations of on-going research to understand and address the challenges of future air operations in contested air space and deliver the pull-through of technology and technical advice for air systems in service, or in acquisition.

The Air Survivability programme, led by John Liddicoat, leads and delivers S&T for all aspects of the survivability chain for fixed and rotary wing air systems across the threat spectrum, from threat systems analysis to threat mitigation through technology and operational approaches.

These include defensive aids and countermeasures development, system-level survivability analysis and assessment, and support to trials working with the Air Warfare Centre.

The Combat Air and Platform Enabling Technologies Programme, led by Steve Simm, leads and delivers all our air platform level S&T for manned and unmanned fixed wing air systems, encompassing air vehicle design and performance (including fixed wing low observable technologies), propulsion system technologies and some aspects of mission systems. This programme is also the lead for our pan-Dstl project support for the Combat Air Operating Centre (OC) in DE&S, including our support to Typhoon, Lightning II and for Future Combat Air systems (FCAS).

What progress is being made to speed up delivery of new programmes to the customer?

Having initiated some significant organisational change last year in line with the wider Defence Transformation, we are starting to make good progress in driving the new Dstl programme structures forward to focus on genuine S&T benefits for the operational customer, and getting their engagement through the S&T Customer Board and relevant Dstl Research and Development (R&D) programme boards.

As examples, we have people both in Dstl and industry working hard on systems and technologies to enable the delivery of flexible and affordable through-life air platform protection, others working to enhance the front line capability of our current operational platforms and those soon to enter service and others looking to create options for potential international collaborations for future systems.

We have had major recent outputs supporting Air Command in the development of the future air platform protection strategy, technology demonstrations for new defensive aids and countermeasures systems and the delivery of major milestones in our support for the route to introducing Lightning II into the UK inventory, amongst others.

Tell us about how industry contributes to this work?

The Defence Industry is a fundamental and vital part of our overall programme. Our overall target for research programme delivery through industry is 60% and the example programmes mentioned earlier are well in excess of this. We have long-standing and developed relationships with both the key industry primes and with small and medium sized enterprises (SMEs).

And SMEs?

We continue to work on expanding our direct engagement across the SME base, exploiting channels for interaction such as the Centre for Defence Enterprise (CDE) and the Knowledge Transfer Networks (KTNs). We also actively encourage the established Primes to seek innovation through SME engagement; our view is that we want to bring through 'best of breed' appropriately for the UK.

What excites you about future technologies in the air domain?

We have recently seen some significant achievements by the UK Defence aerospace sector, including the significant milestones that the flight trials of Taranis and the Common Defensive Aids System (CDAS) represent. Both of these are the culmination of several years of sustained effort between MOD and industry, with Dstl playing a core role throughout. There is a lot happening – emerging maturation of autonomous systems technologies, exciting developments in new propulsion technologies and directed energy weapon systems, interesting work in bio-inspired air vehicle technologies, increasing advances in computer power and network technologies and the potential advent of more commercial access to space. This is an exciting period for aerospace technology, despite the economic climate.

The challenge remains to exploit these emerging technologies in an affordable way. This may come through innovative approaches to design, manufacture and support for future air systems, exploiting new materials, 3-D printing and new business models.

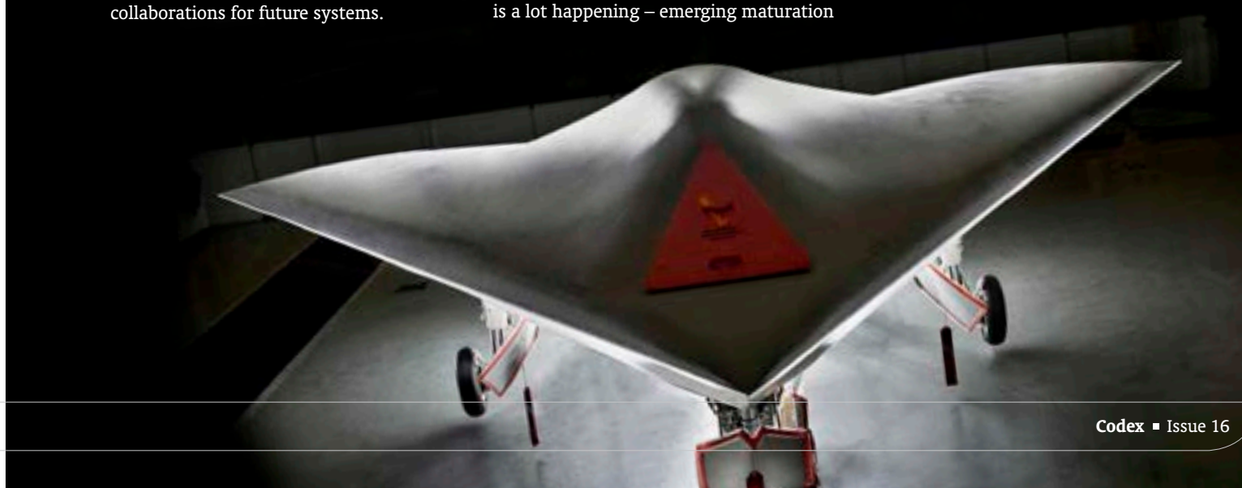
Personally, what is the best thing about your work?

At the risk of sounding trite, it's being able to work closely with military and civilian colleagues to shape and focus S&T on real problems and find solutions that deliver to the front line of today and tomorrow.

In a variety of different jobs within Dstl and central MOD, I have had the privilege the privilege of working with many great colleagues, both in the UK and internationally, in government and in industry, who are at the cutting edge of technological thinking and innovation. That has come hand in hand with working alongside some inspirational military personnel.

For me, it's about finding affordable solutions to defence challenges, by bringing together the best of operational, technical and policy thinking.

I guess I'm still really an engineer at heart – I like seeing problems fixed. It's even better if there's a flying machine involved!



Defence Growth Partnership – turning the vision into reality

ADS Chief Executive Paul Everitt is a communicator – a valuable skill for a man in the hot seat of the trade organisation representing all companies operating in the UK Aerospace, Defence, Security and Space industries.

Communication across the sectors, international liaison and high-level meetings with government departments means Everitt is constantly on the move. But, he stays connected (even finding time for the occasional Tweet) and today he is in his office, just behind London's South Bank, ready to talk to Defence Codex about the Defence Growth Partnership (DGP) and the launch last year of Securing Prosperity: a strategic vision for the UK Defence sector.

With a background in media and political communications, predominantly in the manufacturing and transport sectors, Paul Everitt is in his second year at ADS. "This job is not just about the aerospace side; it is also about the core sectors. And for me, the exciting part is the linkages between public policy, manufacturing and advanced technology," he says.

ADS have offices in England, Scotland, Northern Ireland, France and India, with new offices planned in China and the Middle East. Formed from the merger of the Association of Police and Public Security Suppliers (APPSS), the Defence Manufacturers Association (DMA) and the Society of British Aerospace Companies (SBAC) in 2009, ADS also encompasses the British Aviation Group (BAG). Together with its regional partners, ADS represents over 2,600 companies.

Everitt is relishing his role, saying that he is particularly interested in the prospect of helping to promote a strong manufacturing sector in the UK. "The emergence of industrial strategies and high-level cross-party buy-in to the idea that we need a set of active governmental policies to support a better balanced economy, is promising. It is important that the City and the South East drive our economy forward, but we also need balance – to see growth in all parts of the UK."

New opportunities

"We are seeing very significant growth in terms of the level of demand for new aircraft. In 2013, we saw a 12% increase in the number of large aircraft deliveries. That feeds through directly to increased levels of demand in the UK for a whole variety of advanced equipment. Success for our sectors means businesses are able to generate new employment and new investment opportunities in all parts of the country."

"One of our objectives is to encourage all of our members to be open and proactive in telling people what they're doing. This includes the smaller businesses which are also benefiting from growth or activities in a number of sectors and have a story to share."

Defence Growth Partnership

The DGP is jointly led by the Department of Business Innovation and Skills (BIS), as the lead department for economic growth, and the defence industry, with the support of MOD as the UK customer.

The aim of the DGP is to create opportunities for the development and exploitation of UK skills in innovation, particularly in small and medium-sized enterprises (SMEs) and academia. The Government's vision is to secure a thriving defence sector and develop a strategy that builds on the UK's strengths in air capabilities and intelligent systems, and encourages competitiveness in a global market. The DGP has government and industry backing, plus the support of trade associations. The full implementation plan will be announced at the Farnborough International Air Show this summer.

Everitt explains that the DGP is an opportunity to secure a thriving UK defence sector, with last year's vision document outlining the challenges and the key areas that need to be addressed to develop a coherent strategy for a successful future.

"The current work is around turning that high-level vision into a set of practical measures that can be implemented through the next three to five years. One of the areas that the DGP is looking at is future air capabilities. Eighty per cent of our defence exports are in the air domain, so clearly that's an area where we have expertise and future opportunities.

"We are also looking at intelligence systems; recognising that much of defence capability is not specifically platform oriented, but at the systems level. There are big opportunities in the regular upgrading of existing platforms with new technology – as well as new systems – both in the UK and other markets around the world."

Keeping up to date with the future technology requirements of customers means investing in research and development. "It is also important to share with customers what is currently going on and how business models can be developed for new technology."

Research and development

In a time of financial constraint it is imperative that the defence industry deliver value for money throughout the development process and Everitt believes this should start at the very beginning. "There needs to be a joint or collaborative approach to the development of technology," he stresses.

Photo 1 – Paul Everitt
Photo 2 – An 11 Squadron Typhoon

“We need to look at the supply chain and ensure that we always deliver the best, both in terms of quality, cost and delivery. We also need to focus on developing and retaining skills if we are going to be competitive in the long term.”

Success means delivering the battle winning capability that the Armed Forces require, as well as delivering products and services that are affordable and attractive to export customers. “It is about moving from understanding the environment into how we can change for the better,” he explains.

Industry resilience

The Defence Reform Bill focuses on procurement – contracts and competitiveness, enabling MOD to make changes by reforming procurement and support of defence equipment through DE&S. The implications are awaited by an industry which has undergone considerable reform and change over recent years, and Everitt remains confident in the industry’s ability, resilience and commitment to respond to future changes.

“Clearly we’ve seen the implementation of some significant expenditure cuts in order to bring the major equipment programme into balance, but I think there is a general sense that things are more stable. There has been some significant constraint and restraint in public expenditure and sometimes it takes a bit of time for everybody to become aligned to the new priorities,” he admits.

The UK has been extremely successful in exporting defence equipment in this constrained market. Through their Market Development Board, ADS provide guidance and support to members to help them win business overseas. Everitt acknowledges that other major economies are also looking at exports and the market is highly competitive. “In the United States and France domestic constraint means they also need to be more outward looking. The UK needs to focus on what we can do to win more export markets. We need to work harder to ensure that we continue to be competitive and that we can hold our own against that intensified level of competition and this is a big theme for ADS.

Support for SMEs

“One of the big challenges that we face, if we want to be a long-term economic success, is that we need to be developing products and services that have potential global audiences. You can only do that if you are continually investing in technology and innovation. Inevitably, much of this will be based in smaller companies and we must help and support these companies. ADS provides the information on which they can then base their business decisions, helping them to discover potential opportunities for their applications.”

“We need to look at the supply chain and ensure that we always deliver the best, both in terms of quality, cost and delivery. We also need to focus on developing and retaining skills if we are going to be competitive in the long term.”

The global market for security services and technology is also large and growing, and Everitt believes that there are opportunities to be exploited. “The experience that we have gained, particularly through the Olympics, gives us a reputation to build on. Airport security is one highly important, but specialist area and we have successfully developed operations that work well from a UK perspective. There are opportunities to transfer that technology to other markets. This is an exciting prospect, especially in growing markets such as China, India, Brazil and Southeast Asia, where they are building new airports and have an interest in security systems.”

Skills and thrills

Last year, the Government announced plans to grow the UK’s Reserve Forces. ADS support the initiative and says there are already many reservists employed across the industry and in ADS offices. “We see the value that they add to our businesses through their reserve activities, particularly in terms of the management experience and the responsibilities they undertake. We have highly technical people who are involved in specific areas of engineering, or looking after particular bits of kit, where their role as a reservist gives them better, stronger knowledge, information and experience that they can bring back into their company position.”

Everitt recently announced that the first quarter of 2014 set a new record for aircraft and engine deliveries – up more than seven per cent on last year. “This is a strong foundation for the year ahead, confirming significant UK growth for this global industry. Aerospace manufacturers are working hard to respond to the current and projected future increase in demand.”

With this recent announcement and this year’s Farnborough International Air Show to look forward to, Everitt can anticipate using his communication skills to announce more good news. ▪

Together with its regional partners, ADS represents over 2,600 companies

ADS supports:
- SC21
- Sustainable Aviation
- Defence Industries Council
- RISC

ADS also hosts the Aerospace & Defence Knowledge Transfer Network.

New record for commercial aircraft deliveries

Compared to the same period last year, there has been a 7.5% uplift in QI aircraft deliveries

Aircraft and engine order backlog continues to grow, strengthening order books

The latest commercial aircraft order and delivery data, released by ADS Group, revealed a record first quarter for aircraft deliveries in 2014, revealing that 302 single-aisle and wide-body aircraft were delivered in the first three months of the year – a 35% increase on Q1 in 2011 and 7.5% more than the same period last year.

The figures put the global industry in a strong position as it looks to the rest of the year, with experts predicting the order backlog – currently standing at 11,318 aircraft and 20,202 engines – will continue to grow as orders come in throughout the course of the year. The order backlog is thought to equate to around nine years’ work in hand for companies in the UK, offering much-needed security to many thousands of aerospace companies and workers, as well as the broader UK economy.

Key findings from the data:

- Industry sets first quarter record for both single-aisle and wide-body deliveries, increasing by 7.5% compared to 2013
- Aircraft backlog increases by 13% in a year, and over a quarter (27%) in the last two years
- Engine orders increase by 60% in Q1 2014 and deliveries are up 7% compared to a year ago
- Engine backlog jumps to 20,202, a seventh consecutive monthly record.

By 2032 it is estimated that more than 29,000 new large civil airliners, 24,000 business jets, 5,800 regional aircraft and 40,000 helicopters will be required. The UK specialises in the development and manufacture of some of the most complicated and high tech parts of modern aircraft, so this requirement means a potential market share of around $600bn for the UK.

Farnborough International Air Show 2014

Farnborough International Air Show
14–20 July 2014

It was raining hard during our visit – too hard for the photographer to capture the site preparation and building works that transform a regional runway into an organised showground for visitors to this world famous event. Defence Codex talks to Farnborough International Limited (FIL) Commercial Director, Amanda Stainer, about the run up to this year's show and returns later to photograph progress.

This is a big event and expectations are running high for 2014. Amanda Stainer has the experience (ten years at Farnborough and a background in the conference and events industry) and is now a Director of the FIL board, responsible for new business, marketing and sales strategy.

She appears undaunted by the figures, which in 2012 included 107,000 trade visitors and US $72 billion of confirmed orders or commitments. The success, she says, is based on the brand and their established reputation. "Industry respect and recognise the brand and the strength of the FIA, which delivers a strong military and civil delegations programme, and a history of business orders."

Our clients want to be associated with us," she explains.

There is lots happening this year and the company has already received a record number of requests to exhibit aircraft, in both the static aircraft park and the flying display – including more large bodied aircraft than in recent years. To date, over 70 aircraft are confirmed as part of the static line-up and a further 23 for the flying display.

The show will also feature a number of Farnborough firsts; including the F-35 Lightning and Textron Airland Scorpion, through to classics such as the Douglas Dakota DC3 and Spanish Navy's Sea Harrier, which will be flying there for the first time.

Stainer is particularly pleased that MOD and the US DOD have chosen the event to showcase the F35 aircraft. "The F-35 Programme has seen participation from nine partner countries, including the UK. FIA will provide the perfect venue for many of the global supply chain companies involved in the programme to showcase their expertise".

Another first this year will be the opening of their new Row A Chalet development, the first phase of the company's strategic vision for the air show site, replacing the familiar temporary structures and improving facilities for exhibitors.

The theme for the public air show this year is 100 years of aviation and will feature aircraft from every decade of the past century. The public weekend will also commemorate the 100th anniversary of the start of the First World War with a display by the Great War Display Team.

And with 2014 ready to take off, Stainer and her team are already talking about 2016 – no doubt planning for even more ambitious targets! ■

Farnborough International Ltd (FIL)

Farnborough International Ltd (FIL) is a subsidiary company of ADS. FIL has a three-strand business: as the organiser of the biennial Farnborough International Air Show (FIA); operator of Farnborough International Venue and Events (FIVE); and as international consultants for civil, defence and business aviation events, including Bahrain International Air Show (BIAS) and India Aviation. FIL is made up of a team of industry experts focused on delivering innovative, cost-effective events and maintaining the standing of its shows and venue as world-class in a competitive global industry. FIL has its permanent headquarters at TAG Farnborough Airport in the United Kingdom.

Small and Medium-Sized Enterprises (SME) Meet the Buyer opportunities

The UKTI DSO Small Business Unit are financing Meet the Buyer opportunities at Farnborough International where UK SMEs can meet influential people in the overseas defence and security supply chain and promote their products and services.

Direct and from the heart

Defence Medical Services (DMS) is headed by the Surgeon General Paul Evans. Based at Lichfield, outside Birmingham (the geographical 'heart' of England), this is where the welfare and healthcare of around 170,000 servicemen and women, and care of injured personnel is organised. Wendy Jacob visits the Headquarters of the Surgeon General and talks to Paul Evans about his role, priorities and commitment to medical research.

Photo 1 – Surgeon General Paul Evans
Photo 2 – Medical Emergency Response Team (MERT) recovering a casualty from operations in Helmand Province, Afghanistan

Surgeon General Paul Evans is in the centre seat – his corner office with views across the campus giving him access to the personnel across two open plan floors of the busy office. He describes the role of the Surgeon General as 'quite complex' (perhaps an underestimation of a job that includes being the professional Head of the Defence Medical Services and in charge of a high-level budget, which is part of Joint Force Command). And of course, with the accompanying executive responsibility comes the requirement to communicate and this, he says, is important. "We increasingly collaborate with the NHS, other government departments, devolved administrations, the Royal Colleges, medical academia and nationally. International collaboration, with NATO, the United States and other alliances also remains of crucial importance as the main effort is still Afghanistan."

> "Most patients now reach Birmingham 24 to 36 hours after injury, which is quite staggering given the distances involved. Survival rates are better than we ever expected and we continue to strive for maximising patient improvement. As far as I am concerned, that still remains the main effort, until we ultimately withdraw from Afghanistan."

For Evans, Afghanistan remains his priority and the requirement to continue to provide support for those injured during the conflict. "Most patients now reach Birmingham 24 to 36 hours after injury, which is quite staggering given the distances involved. Survival rates are better than we ever expected and we continue to strive for maximising patient improvement. As far as I am concerned, that still remains the main effort, until we ultimately withdraw from Afghanistan."

"The return to contingency then becomes more relevant. It is important that we maintain the skills and capabilities that we've learnt from managing medical casualties in Afghanistan. It is easy to say that we must not let these skills fade, but that can easily happen. We must be positive and make certain that we avoid that happening."

Turning to the more administrative side of his role – Evans has been involved during a time when medical services have been undergoing major changes. "One of the achievements in my first year has been the establishment of the Defence Primary Healthcare Headquarters (DPHC) and that has brought the three elements of single service primary care here under one umbrella."

DPHC is now fully operational and Evans says the transition has been faster than could have been expected and they are moving forward, taking on budgetary responsibility for British Forces, Germany as personnel rebase in the UK. "The formation and establishment of Defence Primary Healthcare is probably one of the most important things that we've done recently," adds Evans.

Civilian doctors will have an important part to play in the future of defence primary care and more permanent jobs will be created as an integrated primary healthcare, rehabilitation, mental health and occupational health service are established. Skills learnt in Afghanistan, particularly in trauma care, are of considerable value to the Department of Health in the development of major trauma centres across the UK.

Queen Elizabeth Hospital Birmingham (QEHB) is the home of the Royal Centre for Defence Medicine (RCDM) and the main receiving unit for military patients injured overseas, providing the very best in medical care. In 2012, the NHS announced that trauma care would be centred in major trauma centres around the UK. Fortunately the QE and the hospitals at Derriford, Plymouth, and University Hospital in Middleborough are all designated as major trauma centres and these hospitals are used for military clinical placements to maintain the skills required for operational deployments.

Evans sees these developments as an opportunity for greater collaboration, exchange of skills and for military doctors and nurses to gain experience in times when there is no conflict. “The development of a trauma network across England is part of Department of Health policy and they will manage the bulk of the major trauma cases. It makes sense that the military have placements within those facilities. We need to make certain that our medical services personnel are given the opportunities to retain and practice the skills that will be required when they are next deployed,” explains Evans.

Working with the NHS is increasingly important and in the future this may depend not just on placements, but on organising real-time exercises within the UK. Evans says the principle has been well-received by both the trusts and NHS England. “We may also look for opportunities abroad as we get less busy from Afghanistan, which has been the main effort up to now.”

“We also have to consider the exposure and experience that DMS personnel gain in the primary care setting. We provide primary care for our service men and women, and in certain bases will provide family dependent care as well. It’s important that we make certain that those who are working within primary care – defence medics as well as doctors and nurses – are given an opportunity to see first responder type injury and illness, as well as the more traditional primary care.”

Referring back to Afghanistan, Evans highlights local support to civilians as important, with the added benefit of encouraging bonding with the local community. “This is another reason why our primary care personnel benefit from exposure and practice to a spectrum of primary care on a regular basis,” he adds. Asked to comment on the benefits and advances in synthetic training, he stresses the need to be able to practice in realistic military environments. “This includes training in additional skills such as learning how to construct and work out of tents and respond to military leadership,” he explains.

Simulation is an important part of training, offering opportunities to replicate realistic scenarios away from the battlefield. Based near York, 2 Medical Brigade delivered HOSPEX that has, to date, provided clinical teams with an opportunity to work together honing the basic technical skills of individual clinicians whilst training them to work more effectively and efficiently as part of a clinical team in the realistic simulation of the Camp Bastion hospital. “Everyone who deployed to Bastion, including our coalition partners, attended HOSPEX and found it a real bonus to be able to become familiar with the symmetry of the building, know where things were and as a team, work within the simulated environment.” The concept will carry on, although Evans says the shape and format has been developed.

> “Simulation, who knows where it will end? What is important is that we remain on the forefront of this technology and continue to look to the future.”

Photo 3 – Defence Medical Services near Lichfield, Staffordshire
Photo 4 – Defence Medical Rehabilitation Centre at Headley Court

> “We have some outstanding individuals who do research as part of the process of gaining full accreditation as consultants and we must give them the option to continue that. I think that is an area, particularly in a period of non-operational, limited operations, that will give them the impetus and the enthusiasm to maintain themselves at the cutting edge of surgery, medicine or other skills. Research is absolutely crucial to our longevity.”

“What we must do is learn from its success and now set ourselves different parameters.”

The development of the Military Operational Surgical Training (MOST) course in collaboration with the Royal College of Surgeons gives individuals and teams the opportunity to practice trauma surgery and prepare for future conflicts. As Evans says, “Simulation; who knows where it will end? What is important is that we remain on the forefront of this technology and continue to look to the future.”

For Evans, the future is dependent on current research and his passion and commitment become evident when asked to comment on the work of the multi- disciplinary teams collaborating in this area. “The research that has gone on in the frontline and translated back into true effect, has been quite remarkable. Working with Dstl and academia, we have been able to translate specific injuries back into a laboratory setting. This allows us to carry out research into how we can reduce injuries – whether through individual protection or collective protection. To me, the ability to continue this, to look for improved ways of improving our patient care, is essential.

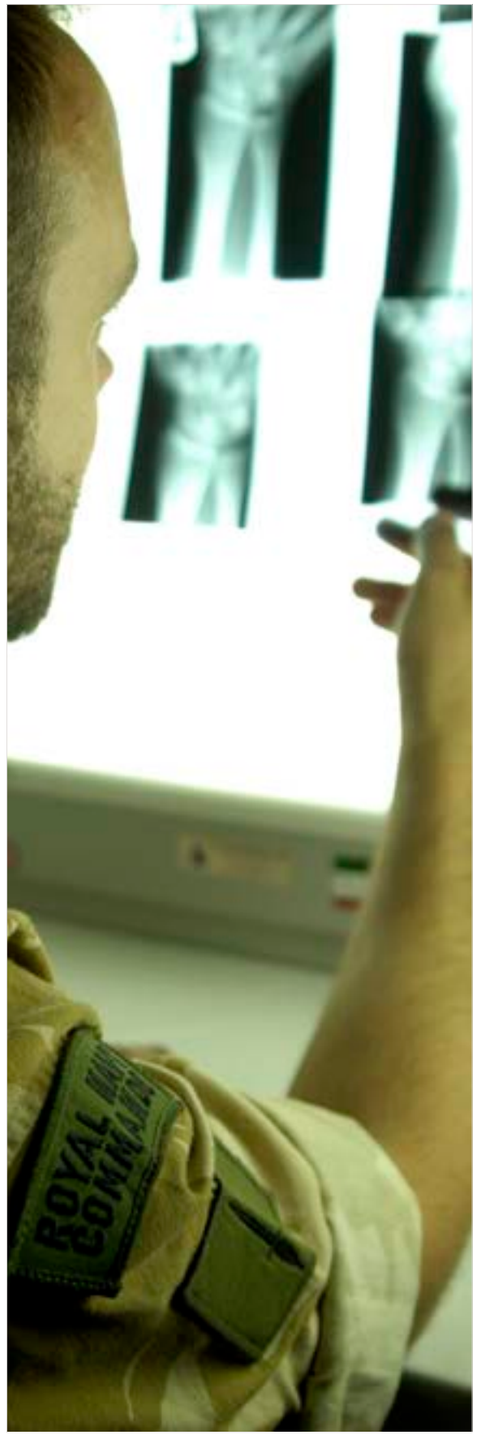
“We have some outstanding individuals who do research as part of the process of gaining full accreditation as consultants and we must give them the option to continue that. I think that is an area, particularly in a period of non-operational, limited operations, that will give them the impetus and the enthusiasm to maintain themselves at the cutting edge of surgery, medicine or other skills. Research is absolutely crucial to our longevity.”

It is the Government’s aim to increase the number of reservists and that applies to the medical arena as well.” I think that anybody would say that medics have been a success and are a good template for others to follow in terms of the utilisation of reserves. During the last three to four years if you visited Bastion, or other elements of the medical support area within Helmand, you would have found members of the reserves. In terms of day-to-day operation, the defence medical services have been an exemplar for the MOD in terms of integrating regulars and reserves on operations,”

But, now that the UK is drawing down from Afghanistan, the incentive of being able to experience the challenges of working on the front line are removed. How will this affect recruitment? Evans agrees that up to now, when people have joined the reserves, they would be likely to be deployed to Afghanistan and therefore experience operations first hand. “Now, come the end of this year we can’t promise that. Part of the attraction of becoming a reservist is to have operational exposure and we’ve got to facilitate that in the best way we can. The recruitment of reserves is a single service responsibility to individually recruit the size of reserve force they need. It is important that they target effectively the sort of groups that are needed to make up reserve numbers. For MOD and the Department of Health the major source of reservists is inevitably going to be the NHS and it is important that we work collaboratively to consider the best ways to produce the numbers that we need in the most effective way,” he responds.

Evans is committed to supporting medical personnel and promoting the need for ongoing medical research. Asked to expand a little on his own career, he admits that the scope of his role is challenging. “The breadth and spectrum of the job is enormous and it is a challenge to meet all the various parameters that are placed in front of you. But, bottom line is always healthcare – improving the patient experience and patient outcomes. If you base that around the philosophy of what you try to achieve, that helps with the hard judgements and decisions that you have to take as Surgeon General, who is ultimately responsible for the health and healthcare delivered within the Armed Forces.” ■

Hospital in a box pops up at Strensall



The simulated military hospital in Afghanistan will close later this year and be replaced with a new facility to train medics for future conflicts.

For 11 years, a vast ward-for-ward replica of Camp Bastion's hospital has been based at Strensall, North Yorkshire training thousands of medical staff. Between the partitions, which mimic the walls of operating theatres, wards, store rooms and corridors of the real Bastion Role 3 Hospital 3,500 miles away, surgeons, anaesthetists, nurses and support staff have been tested against the scenarios they might face in Afghanistan.

Bastion's hospital is a world leader in trauma treatment, but the bulk of its work is disease and non-battle injuries; the kind of work carried out at any NHS hospital. Patients suffering anything from stomach bugs to appendicitis could find themselves on the Intermediate Care Ward.

Clinical director at Strensall Lieutenant Colonel Andy Griffiths, oversaw the 21 medical teams which have passed through between August 2011 and January this year. "This facility has delivered continuity between Bastion hospital staff, it has ensured that a patient is as safe on the first day of the new hospital team as he or she is on the last day of the old one. The people we have and the processes they employ are what make our outcomes the envy of the world, but this facility has kept us there."

The Bastion replica will be replaced by a new mock-up, this time a 'hospital in a box' which can deploy anywhere in the world and provide first class care, most of it within 24 hours of unpacking. Part of that care package is a portable CT scanner which can be loaded on to a truck or delivered by Chinook.

The DMS:

- has over 7,000 regular DMS personnel
- has 15 Regional Rehabilitation Units (RRUs) across the UK and Germany
- has 4 Ministry of Defence Hospital Units (MDHU) embedded into NHS acute trusts
- has the Royal Centre for Defence Medicine (RCDM) in Birmingham
- has 16 military run Departments of Community Mental Health (DCMH) in the UK with 5 DCMHs at the major permanent overseas bases
- provides healthcare to about 258,000 people

Behind the battle games

The final drawdown of combat troops from Afghanistan later this year will bring to an end a significant chapter in the histories of both the Army and specialist training, and simulation consultancy specialist NSC. While the Surrey-based company has not experienced first-hand the threats of the front line, its simulation systems, computer modelling and software have helped preserve the lives of many of those fighting on it. Andy Simms visits NSC's headquarters in Camberley to discover how the firm plans to keep stride with the march towards Future Force 2020.

NSC's co-founder and Managing Director, Jeremy Spurr, is conscious that a return to a peacetime training cycle will also signal a period of transition for his own operation.

However, the engineer-turned-operational analyst (he started his working life on a MOD graduate scheme and previously led Honeywell's UK operational analysis and systems engineering capability) explains that the prospect of evolving to meet new training requirements is familiar territory. "Throughout our history we've had to adapt to change and stay ahead of the trend – it is something we've always done," he says.

"NSC began life in 1991 when fellow director and co-founder Mike Newman and I identified there was going to be a requirement in the UK for computer-based wargaming to help exercise senior officers; we were very early into the technology. Conventional table-top wargaming had limitations and the need for commanders to interact with a range of assets and joint systems was beyond the capability of traditional exercises.

"Looking back now, the early computer modelling we introduced to the Army Staff College was relatively simplistic. There were two sides – a large blue alliance and a large red alliance – but, militarily, the real-world problems were also really quite simple in those days. The main British focus was the protection of NATO from the Warsaw Pact," he explains.

"In contrast, the kind of work we do now is very much in support of training for complex operating environments; three or four block wars. Training needs to encompass all levers of power such as influence operations and the use of intelligence assets and forces in a peace support or enforcement role. Today's forces need to train across the whole spectrum of conflict. Small units are now much more to the fore rather than large formations fighting in set piece engagements."

The nature of conflict is not the only thing to have changed since NSC spearheaded the use of virtual wargaming, and Spurr acknowledges his company's growth has been allied to the huge technological advancements seen over the past two decades.

Whilst faster, more powerful computers have enabled the company to deliver increasingly immersive virtual training environments, the use of hi-tech hardware has not become NSC's default solution.

"Although we were among the first to see the value of using a computer to support training we have always been acutely aware that technology must not become the driver," he says.

"The artificial effects of a war game have to disappear as much as possible and the bits of simulation the exercise players can see has to be as near to reality as possible. There is no point in giving them capabilities or knowledge that they wouldn't have in the real battlespace. One would always like bigger, more complex models, but those are not always appropriate in terms of delivering the right information at the right time.

"If NSC has a prime skill it is in deciding what is helpful for the customer in meeting the training need and advising on the best use of technology and supporting tools.

Photo 1 – Jeremy Spurr at NSC's Head office in Surrey

Sometimes that might be a model or virtual environment, but sometimes it might be some other construct – a spreadsheet, media injects or having the appropriate humans in the loop.

"Effective training is about finding the best ways of stimulating commanders in a decision cycle, not using a computer-based sledgehammer to crack a nut. There is no point in producing more detail than people need or can assimilate.

"At the lower levels of command we do tend to use more detailed modelling and virtual environments and where we have been able to adopt commercial off-the-shelf gaming technologies we have done so.

"These game engines give us access to large visual environments and provide the players with a higher degree of immersion.

NSC's Joint Combat Operations Virtual Environment (JCOVE) was introduced in 2007 to help train soldiers to evade, counter and detect ambushes and minimise the threat of improvised explosive devices with around 14,000 trained using the system to date.

"As the JCOVE programme has shown, we have become adept at taking these commercial commodities and mixing them successfully with military reality."

NSC's skill in the field of serious gaming is further demonstrated by the synthetic environment it has provided to Dstl as a means of exploring methods of improving maritime marksmanship.

Employing next-generation game-based technology, the company developed a ship-mounted general-purpose machine gun (GPMG) simulator for use in trials to establish the effectiveness of virtual tools in the training of Royal Navy and Royal Fleet Auxiliary personnel.

The cutting-edge system – the first in the UK to utilise the latest version of Bohemia Interactive Simulations Virtual Battlespace – puts users' fingers on the trigger of a deactivated general-purpose machine gun (GPMG) as action unfolds on a three-metre radius curved screen.

With compressed air providing realistic haptic feedback and hidden electronics tracking the weapon's every move, operators are exposed to engagements in an immersive, high-definition audio-visual environment.

The portable simulator is capable of replicating scenarios ranging from defending against attacks from small, fast-moving vessels and supporting anti-piracy missions to port-based security taskings and can be adapted to assist land and air assets and myriad weapon systems.

Environmental factors are also accounted for with weather conditions, solar glare, surface reflections and spray all affecting visibility and weapon performance.

Making sailors sharper shooters is just one way in which Spurr believes computer-based training and simulators can assist the Armed Forces and reserves in the post-Afghanistan era.

"You will never replace the feeling of getting out on the ground and firing live rounds, but the opportunities and space to do so and associated costs mean live training is not always an option," he says. "Simulation provides a unique offering in that its use is unlimited and it can ensure that trainees are fully prepared to make best use of their live training opportunities.

"It makes it possible to exercise senior commanders without placing restrictions on the size or make up of formations; to train with assets and experience the effects of those assets in a manner that would be impossible to do in a conventional way in the middle of Wiltshire.

"The Armed Forces' training areas are constrained and it is not feasible to practise high-intensity warfare within a small estate."

Headquarters staff at NATO's Allied Rapid Reaction Corps (ARRC) are among those able to testify as to the simulation's ability to overcome barriers to training.

By replicating the vital intelligence feeds provided by air and remotely-piloted air system platforms on military operations, NSC enabled exercising Allied Rapid Corps (ARRC) personnel to conduct detailed ground reconnaissance and track time-sensitive targets without the significant expense of scrambling real aircraft or reconnaissance platforms.

Aside from offering value-for-money training in the use of in-service assets, technology has a part to play in informing how best to equip the Forces of 2020 and beyond.

"It is an interesting time for the British military; a time of transition. The operation in Afghanistan allowed the Armed Forces to explore new capabilities – some of which will be highly relevant in future roles and some of it not so. The decisions as to how these capabilities are introduced back into a peacetime cycle of training and use are difficult.

"Modelling at the front end can help make the right choices and we are very heavily involved with the research that is going on into what the future forces will look like, how they will be integrated and what their capabilities will be."

NSC's contribution to the restructuring of the Armed Forces hit the headlines last year when it provided the British Army with the technical weaponry and support to conduct its largest virtual simulation – a cyber battle involving more than 200 soldiers.

The company's training experts designed, tested and delivered the simulation architecture for Exercise Urban Warrior 5c, which integrated an arsenal of off-the-shelf simulation, communication and analysis tools. Carried out at the Land Warfare Centre in Warminster, Wiltshire, the state-of-the-art experiment allowed military directing staff to alter variables – such as the number of troops on the ground and the amount of surveillance and communication available.

Data captured by NSC's analysts during the exercise is being used by Dstl to assess how best to equip and command the Army in future conflicts.

Photo 2 – NSC's IMPACT system was developed for use in Dstl trials
Photo 3 – Simulation can be used to replicate feeds from ISTAR assets

The company is also currently lending its expertise to Dstl's Operational Analysis Strategy and Capability programme, which has brought together 18 external organisations to evaluate the range of analysis tools, techniques and technologies available to MOD.

Proficiency in the fields of modelling and simulation, coupled with decades of working in and around the UK military, has been key to the company's successful integration into the study, according to head of consultancy at NSC Chris Smith. "We have supported Dstl's work in this area for many years having been involved in the development and support of campaign-level simulation models – including DIAMOND, CLARION and COMMAND," he says.

"More recently, NSC has, and continues to play, a major role in the development and support of PSOM [Peace Support Operation Model], which has evolved from a relatively simple model to a highly regarded and sought after system for examining stabilisation operations in complex environments.

"Under the current programme, we are developing and using tools that employ a wide range of operational analysis techniques. This familiarity with how Dstl operates and our experience of close collaboration with the Armed Forces through the delivery of training – be it at operational or sub-unit level – has given us a comprehensive understanding of defence issues and training lifecycle methodologies. At NSC we have an enviable mix of modelling specialists and former Service personnel, which allows us to deal with the intricacies of software development and ask the intelligent questions."

This is a sentiment shared by Spurr."There is no 'geek/soldier' divide at NSC," he says. "One of our great strengths is our knowledge of how headquarters really work. It allows us to provide the right amount of stimulus and deliver the tempo needed to support a rapidly evolving scenario.

"We are proud of our close ties with Britain's Armed Forces and its training establishments. Their excellence is recognised internationally and this reputation, coupled with our core expertise, has provided us with a springboard to build relationships overseas. Over the years, NSC has supported training in Europe, America, Australia and the Middle East. In Kuwait, we have assisted the training of officers at the Mubarak Al Abdullah Joint Command and Staff College since it was set up in 1996 and continue to do so.

"For a fairly small company we have an expansive customer footprint," concludes Spurr. ■

2d3 Sensing share their vision with SMEs

As a frequent supplier to MOD, 2D3 Sensing are benefiting from opportunities and support from MOD's Centre for Defence Enterprise (CDE). 2d3 Sensing General Manager Pete Hughes is keen to contribute to the success of the UK defence industry and share his experience with other small and medium-sized enterprises (SMEs). He talks to Defence Codex about his experiences of working with MOD.

2d3 Sensing is an agile commercial-off-the-shelf (COTS) technology provider, specialising in the processing, exploitation, and dissemination of motion imagery and metadata. Using innovative vision science techniques and standards-based media management capabilities, 2d3 Sensing improves and extracts the information contained in motion imagery for better situational awareness and intelligence, surveillance and reconnaissance mission results. They offer stand-alone software products and customized software solutions.

Company support

The company recently completed five projects for Dstl with a total value approaching £350,000. These included short-term proofs of concept projects for CDE and Framework Agreement for Technical Support (FATS4), through to involvement in a long-term research program managed for Dstl by an industrial consortium.

Their parent company – OMG plc (Oxford Metrics Group) – operate a group of four technology companies providing computer vision and image understanding products and services for the entertainment, defence, life science and engineering industries.

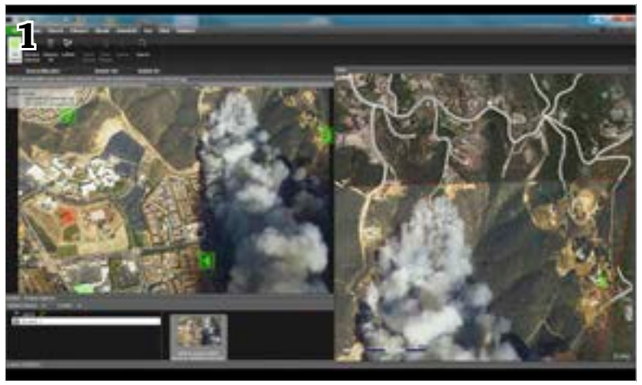
The Group's motion capture technology is used to capture the movements of actors (for the movie industry), by sportsmen (for improving team performance), by orthopaedic surgeons for planning surgery, and to aide in the rehab of patients with limb injuries (including at the Headley Court military rehabilitation centre)

OMG technology is also used for the management of infrastructure assets, and through 2d3 Sensing for providing image intelligence and situational awareness from manned and unmanned aircraft. Founded in 1984, OMG has its headquarters in Oxford, and has offices in the US and in the UK. It has customers in over 50 countries and is a quoted company listed on AIM, the London Stock Exchange international market for smaller, growing companies.

Early success

2d3 Sensing's relationship with CDE was consolidated in early 2012 when they were awarded a £63,000 contract for weapon sighting. The initial project was completed later in 2012. In partnership with Qioptiq, an international company which designs and manufactures photonic products including weapon sights, they were then awarded a short additional development contract by Dstl. This demonstrated that the concept could be integrated into a small arms weapons sight and significantly reduced the size, weight, power and cost of the associated processing unit.

> "Components of our software are widely used by many of the large US based Defence primes in their own motion imagery capabilities and our most advanced TacitView and Catalina products are in operational service with the RAF and will enter service with the USAF in 2014."



This resulted in a successful demonstration in 2013 and the 2d3/Qioptic team are now continuing this work under a longer research programme for Dstl.

The CDE project demonstrated that computer vision techniques can be used to 'hand over' targets using images, providing a more reliable method than using verbal handover.

The system extracts features from a scene and matches them with a second image to pinpoint a target.

CDE support

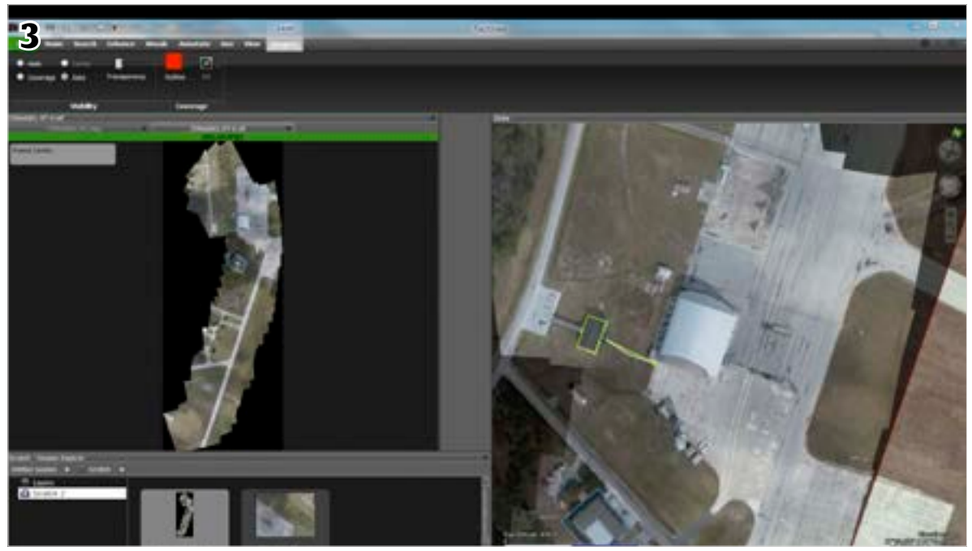
Ongoing development is now focused on wider integration into the soldier system, with further algorithm improvements and additional Size, Weight, Power and Cost (SWAPC) reduction.

> "We are based in the US and UK, with the UK team tasked with defence-related R&D plus supporting the sale of our software outside the US."

2d3 Sensing's Pete Hughes can be often be found at CDE events, supporting their relationship and last year presented to the Defence Suppliers Forum, chaired by Minister for Defence, Equipment and Support, Philip Dunne, at CDE's base near Oxford.

He explains that 2d3 Sensing is focused on the defence and security sectors and in addition to their research activities, builds a suite of commercial off the shelf (COTS) software designed for the management, processing, exploitation and dissemination of motion imagery.

Photo 1 – 2d3 Sensing TacitView Software
Photo 2 – Tactical Remote Video Viewing Terminal
Photo 3 – 2d3 Sensing Live Video Mosaicking Capability



"We are based in the US and UK, with the UK team tasked with defence related research and development (R&D) plus supporting the sale of our software outside the US," he says. "Components of our software are widely used by many of the large US-based Defence primes in their own motion imagery capabilities and our most advanced TacitView and Catalina products are in operational service with the RAF and will enter service with the USAF in 2014. They are being actively considered by a number of NATO Nations."

Evolution

2d3 Sensing are in the fortunate position that OMG are able to invest in the company. "This has enabled us to bring our groundbreaking COTS software capabilities to market. We are, however, aware of the challenges facing many SMEs, who find it difficult to find a way through a technology development period without parental financial support."

Hughes says that schemes such as CDE work, but is concerned that the initial short-term finance and the competitive element can be unpredictable. "There are, however, many positives, such as the close connection that develops through a project with the Dstl technical lead and allowing the technology provider to maintain ownership of the resulting IP which is crucial," he says.

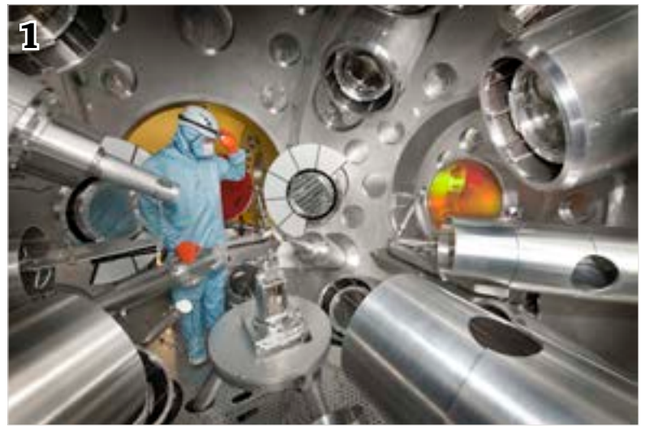
Hughes believes that it is important to use the outcomes of successful research projects to build a mature, competitive and exportable product line. "SMEs are generally well supported by MOD at the proof of concept phase through schemes such as CDE, but some struggle to ensure that emerging technology, whose concept has been proven, is then developed to maturity and they need support and finance at this stage." ■

MOD projects

- Proof of concept project to demonstrate the use of computer vision technology to enable a collaborative weapons sighting capability. This was then followed by a joint project with Qioptiq to develop a practical demonstrator leading to inclusion(in partnership with Qioptiq), into the three-year DCCS program.
- Sensing for Asset Protection using Integrated Networked Technology (SAPIENT): The SAPIENT project is part of a joint Dstl/TSB program and will demonstrate automatic classification of human activities from video, a capability especially relevant to building and perimeter security and law enforcement.
- Automated Image Understanding: 2d3 Sensing has recently completed two FATS4 contracts which used the novel application of computer vision techniques to develop automated image understanding capabilities. These capabilities can be used to automatically tag or classify imagery as it is recorded from live sensors, dramatically reducing the operator's need to review hours of footage.
- Centre for Defense Enterprise: 2d3 Sensing celebrated the award of its 11th CDE project in July 2013. This focused on examining improved methods of handling streaming intelligence data (such as Video and GMTI data) and delivered startling results of great significance to the MOD Equipment Program.
- 2d3 Sensing is currently working toward a second phase of work for MOD to develop and validate an international data exchange standard for future use, which will improve the collaboration and data sharing among NATO and other coalition partner countries.

Orion stars in academic research

Academics are increasing mankind's understanding of the universe through groundbreaking research at the Atomic Weapons Establishment (AWE). Scientists from the University of Oxford are using AWE's world leading Orion laser facility to study conditions on stars and inside planets. The experiments are part of AWE's outreach work with academic institutions.



The Orion laser is designed to meet the requirements of AWE's technical programme and to support the UK's commitment to a science-based approach to stockpile stewardship.

A programme of high-energy density physics experiments concentrates on basic physics and material properties, with the direction coming from the core science mission at AWE. Orion is a national facility and external users may bid for time on the laser.

Although Orion's main purpose is to support the UK deterrent programme, MOD has committed up to 15% of Orion system time each year to cutting-edge collaborative academic research. Following the first two calls for proposals, four academic experiments were scheduled on Orion; two for the University of Oxford, one for the University of York and the fourth for Imperial College London.

Experiments with the University of Oxford are already helping the scientific community get a better understanding of, among other things, the conditions found at the cores of giant planets such as Jupiter or Saturn.

The phenomenon of diffraction can be illustrated by looking through a fine-weave net curtain at a distant, bright-yellow lamp – the lamp then appears as a regular arrangement of several spots. The same phenomenon – but using x-rays – is routinely used to study crystals. At Orion, researchers from the University of Oxford have been using these techniques to study matter at extreme pressures. Results show a regular pattern of rings (rather than spots) of x-rays that reveal otherwise hidden details of crystal type and atomic spacing.

The first international experimental team, led by Oxford University academic, Professor Gianluca Gregori, consisted of researchers from the University of York, University of Michigan (USA), LULI Observatoire de Paris (France) and CEA (France), coordinated by AWE Scientist, Professor John Foster.

The experiment studied supersonic plasma interactions such as those found between binary stars. In total, the team had 18 good data shots and found the 'Orion' experience – from experimental support, target diagnostics, off-line facilities, quality of the targets, reliability of the laser, security arrangements and hospitality – a great success.

"Given that this was the first academic experiment, it was normal to expect that things would not always go as expected. Instead, all went as planned and we got fantastic results on the first day of the experiment. This is something that rarely happens, even on laser facilities that have had a strong academic programme for many years," commented Gregori.

"In my opinion, the Orion laser is definitely the best laser facility in the UK (and in the EU) – highly versatile, with a large amount of energy delivered on target and an exceptional support for laser and plasma diagnostics. I would be delighted to see the Orion laser grow as a point of reference for laboratory astrophysics experiments in the UK academic community. We would definitely hope to use the Orion laser again in the future to recreate cosmic events into the laboratory."

Academic access

AWE is committed to provide access to the laser facility to external users. It has been agreed that up to 15% (up to 6 weeks) of system time each year will be available to UK academics. ■

www.awe.co.uk

Photo 1 – Inside view of Orion short-pulse compressor
Photo 2 – Inside view of target interaction chamber

“Let’s work together!” –“Arbeiten wir zusammen!”

There are many reasons for the UK to work cooperatively with other nations including; exchanging information, making best use of resources and establishing a coordinated approach to defence requirements. Contributing to this work and creating greater understanding are the people who cross the borders and spend time developing their skills and sharing their knowledge on secondment abroad. In 2011 Dstl Structural Dynamics Capability Leader, Dan Pope, embarked on a 23-month secondment at WTD (Wehrtechnische Dienststelle) 52, a Government research agency of the Bundeswehr in Germany, based in the Bavarian Alps. Defence Codex talks to Dan Pope about his experiences working in Germany.

For Pope and his family, this was a life changing experience bringing with it a number of personal benefits, including enabling him and his family to learn the language and fully submerge themselves in life in a different country.

Pope’s exchange was the first time for 30 years that a foreign national had taken up a posting at the Dienststelle. The opportunity arose as the reciprocation of the placement of a WTD 52 engineer, Frank Landmann, within Dstl’s Physical Sciences Department some years ago. The primary purpose of Landmann’s exchange was to enable him to improve his English and gain a better understanding of the culture and ways of working within a foreign, government research institute.

Pope explains that within his area of research (numerical simulation of protection systems against blast and ballistic threats) there is recognition of a commonality between Dstl and WTD 52. “In a climate of reduced defence spending, it made sense for me to base myself in Germany for a time to intensify this promising collaboration with emphasis on joint capability enhancement and cost-saving,” says Pope.

> “Before I took up the role, I was aware that in order to get the most out of this experience, both technically and culturally, I would need to improve my German language skills as work at the Dienststelle would be exclusively in German.”

Language skills

“Before I took up the role, I was aware that in order to get the most out of this experience, both technically and culturally, I would need to improve my German language skills as work at the Dienststelle would be exclusively in German.

“My supervisor was Frank Landmann and he and others in the organisation speak excellent English. But less than 10% of the technical material is produced in the English language. There are also many highly educated technical and administrative personnel, for whom conversations in English are still a rarity. Plus, on a personal level, the thought of sitting in internal technical meetings for two years requiring translation would be difficult, if not humiliating!”

Already equipped with a GCSE in German, he soon became competent, although he says the technical language can be challenging.

Working with Landmann and in keeping with the cost-saving element of the initiative, they set about exploiting the commonality between the organisations, to produce a work programme of mutual technical interest. “This allowed the secondment to be substantively funded on a project rather than an overhead basis, “he explains. “But inevitably resulted in a slightly ‘uncultural’ emphasis on British research requirements.”

“The first couple of months were pretty difficult – intense verbal communication gave me headaches and I would sometimes find conversations confusing. Email-writing, arrangement of meetings and development of work proposals seemed to take at least four times as long as when working in English.”

The hard work, Pope’s persistence and, he believes, sympathy from co-workers who deliberately avoided the temptation to use English, eventually paid off. “My first technical report was generously ‘red-penned’, but subsequent efforts required less and less attention, until I was able to plan, lead and deliver the technical elements of my German work programmes as I would in the UK.”

Pope, with his new found proficiency, went on to make a number of technical presentations, including a nerve-racking 50-minute demonstration to a panel of medical experts on the numerical simulation of human injury.

Family life

When the secondment started, Pope’s son was two and daughter four-years-old respectively. The family set up home in a small alpine village, Grabenstätt, where the nearest international school was around 30 miles away in Austria. Initially, the children went to the local kindergarten (in Germany children generally start school at seven). “My daughter, who could already speak Danish,” (Popes wife is Danish). “became fluent in German after two months and German rapidly became my son’s mother tongue”, he says proudly.

“The local people were extremely friendly and on the whole welcoming, if sometimes a little difficult to understand when speaking their ‘Bayerish’ dialect. My wife became politically active as a Parent Governor at the kindergarten and we instantly made a lot of, what would become, longstanding friendships.”

“The weather in Bavaria was far more extreme than in Camberley where we live in the UK. The 45-minute drive to work could be a nightmare in winter and I spent three months of the year shovelling snow from our driveway.”

As the typical Englishman abroad, Pope say he once made the mistake of going for a jog around the village in temperatures of minus 20 degrees Celsius and just managed to get back to the house before collapsing. “I always checked the thermometer before embarking on any outdoor exercise after that,” he jokes. “The plus point was that there was a ski slope in the neighbouring village and we spent every spare moment trying to match the prowess of the locals – I also nearly killed myself by

Photo 1 – Dan Pope and his family at home in Camberley

entering the Dienststelle's "Luge" competition! I stuck to simple sledging with the kids after that."

Another plus for Pope is that the south eastern part of Germany is within close reach of many other European countries and they were able to spend time in Austria and Italy." Unlike the UK you can just jump in the car and within a few hours of driving, be in a country with a strongly different linguistic and cultural heritage. We were able to live like real Germans and gain genuine experience of the German way of life."

Joint benefits

In addition to swapping valuable numerical techniques, diagnostic methods and validation data, the scheme has enabled the participants to undertake joint testing and develop highly interactive common work-programmes, involving MOD and other faculties within government – such as the Home Office and Centre for the Protection of National Infrastructure.

Pope is still involved, retaining an account on the project's high performance computer and regularly travelling to the Dienststelle. This summer, a Dstl colleague will also spend four weeks at the site, demonstrating cutting edge transient diagnostic techniques in exchange for valuable test data using WTD 52's range which has world-leading blast testing facilities, built into the mountain behind the site.

He says he would recommend a foreign language secondment to anyone. "I have been able to develop personally and professionally, as well as improve my communication skills." concludes Pope.

Frank Landmann is equally enthusiastic and supportive of the scheme, explaining that WTD 52 have had close collaborative relationships with UK research institutes for many years. "As part of a bilateral agreement, these collaborative initiatives have been recently intensified with the secondment of Dan Pope, who was the first British exchange engineer at WTD 52.

"Coming from Dstl and expert in the area of numerical simulation, he has made a considerable contribution to the strengthening of German-UK cooperation. Thanks to his initiative, new measurement technologies have been implemented at WTD 52 for capturing the deformations of protective structures, such as Digital Image Correlation. He continues to be a pioneer for the further enhancement of the collaboration between the two nations," says Landmann.

Government support

First Secretary Defence Technology, Equipment and Procurement, Michael Schubert, based at the German Embassy in London is an enthusiastic supporter of the scheme. He believes that there are commonalities between the two parties and each benefit from a longer working experience. "The people who come here are related to military procurement or science and they are keen to experience and understand the differences between the two nations. They develop ideas that can help adapt processes in Germany when they return."

> "When I worked in DE&S, I experienced a very open minded team. Although a stranger from abroad, I immediately became part of the team and tasked with a lot of responsibility. There was never any question about this – it was always – let's work together!

Schubert points to his own experience of working with DE&S. "One of the purposes of the scheme is to gain more information about how military procurement and science works in this country. Although we have lots in common, we can learn a lot from understanding how people work here."

This understanding, he believes, cannot be learnt in a short time, as the history and culture of the host country influences the attitude and behaviour of the people. "When I worked in DE&S, I experienced a very open minded team. Although a stranger from abroad, I immediately became part of the team and tasked with a lot of responsibility. There was never any question about this – it was always – let's work together!"

Schubert says the German Government see the scheme as a way of enhancing their participant's capabilities and widening their experiences. "The UK is highly respected and advanced in military procurement and defence science. By working together we save money, double our experience and work collaboratively in military science – benefiting both nations as well as those who participate in the scheme."

Organisation and support

At DE&S in Bristol, Ruth Challand from DES International Relations Group explains that as soon as they are informed of a German officer seeking a placement within DE&S, they start by looking for a suitable area of work. Once this has been done, they continue with support helping to resolve any administrative issues arising after the officer's arrival.

Challand describes some of the benefits of the scheme. "DE&S gets a highly qualified, highly motivated additional staff member for very little cost, as the officer involved is paid for by the Germans. They invariably bring different knowledge to the team and the opportunity for a different approach. The sharing of knowledge can be a tremendous asset.

"We have a great deal in common with the Germans yet we also have different approaches and experiences. The opportunity to learn from each other is enormous, and the more we work together, the more we are able to exploit the benefits that can be delivered through co-operation.

"On an individual level, the officers involved learn about a different culture, language, ways of working and living, in two of the major defence players in Europe," explains Challand. ■

A roadmap for innovation

Medicine has historically advanced during conflict, but military medical services have consistently regressed during peace. As over a decade of campaigning in Iraq and Afghanistan draws to a close, securing the legacy of hard won clinical lessons and retaining flexibility to adapt to new patterns of illness and injury during contingency is critical. Brigadier Timothy Hodgetts from the Royal Centre for Defence Medicine looks to the future.

Central to sustaining exceptional outcomes for future operations and to maintaining the current position of the Defence Medical Services as providers of clinical excellence is retaining the capability to innovate. This capability must extend across the spectrum of clinical innovation – concepts, guidelines, equipment (invention and adoption), curricula (design, assessment and refinement), research and Defence diplomacy. To achieve this requires a strategy, a 'roadmap', with a clear vision, end state and centres of gravity (core strengths that must be protected).

The direction for innovation will be guided by emergent analysis of the future character of military medicine. Success will be determined by ensuring the conditions are met to protect and enhance the existing 'winning culture'.

Medicine historically advances in conflict, with the casualty imperative, driving innovations that have subsequently been adopted in civilian practice. Part of this innovation is the initiatives in research that provide the evidence-base for changes in practice and improvements in clinical outcome. This special research edition of the Journal celebrates the answers to an eclectic range of contemporary clinical questions, specifically in relation to the challenges faced from conflict in Afghanistan.

Military medical capability also historically regresses in peace. In the years following World War 1 the historian FA Crew commented that "The establishment of the Army Medical Services was to be determined entirely by the requirements of peacetime" and that "The Royal Army Medical Corps was all but emasculated". Further, analysis of capability immediately prior to World War 2 identified that "The state of the medical services was so parlous that they were unable to meet their peacetime commitments, let alone those of a small expeditionary force." While in the centenary year of the start of the Great War this may be dismissed as an antique concern, the Defence Select Committee's assessment of military medical capability immediately prior to the Kosovo campaign in 1999 was that "The Defence Medical Services are not sufficient to provide proper support to the front line in all realistic planning scenarios and show little prospect of being able to do so in the future."

As an extended period of campaigning draws to a predictable close it will be critical to defend against this historical regression through securing our winning culture and sustaining our innovation in order to ensure our continuing ability to rapidly adapt to new clinical challenges in a phase of contingency operations.

This requires a strategy for innovation, or an innovation 'roadmap', which must be shaped by an analysis of the future character of military medicine.

The meaning of 'innovation'

The traditional meaning of innovation as simply something 'new' introduced – a clinical policy, practice or piece of equipment – is an insufficient definition for our roadmap. It must also be 'better', either because it performs the same function more efficiently (and specifically is cheaper, with greater value for money), or it improves outcome (at the same or an acceptable incremental cost), or it is an unforeseen step change in capability. The latter is exemplified by the introduction of topical haemostatics at point of injury in UK military practice from 2004.

While Defence has sustained a medical research strategy, research is only one component of innovation: a comprehensive roadmap must incorporate novel concepts, technology, curriculum design, clinical guidelines development and organisational process changes. This is the comprehensive innovation strategy. These components of innovation may arise from primary invention or secondary adoption (Figure 1).

Primary invention may be de novo, an out-of-the-blue idea, or developed from structured research, audit of clinical data, or critical analysis of published work.

As examples, competing products for topical haemostasis have been the subject of comparative large animal model studies; and groin protection from blast was developed in 2009 because of clinical audit data demonstrating an increase in perineal injuries.

Critical analysis plays a greater part in secondary adoption, where an effective medical intelligence framework detects emerging evidence early and a flexible system enables early adoption to sustain sector-leading advantage (Figure 2). An important example has been the adoption of a shortened ratio of packed red cells to plasma in actively treating the coagulopathy of trauma, following early evidence of US improvements in outcome.

Figure 1

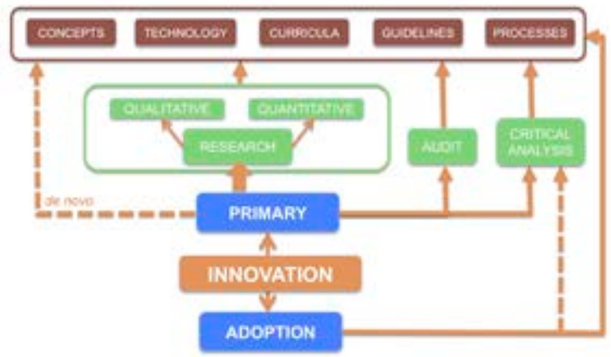


Figure 2

Innovation can also be defined by the underpinning rationale:

- Was the innovation principally to advance scientific understanding, such as the coding of DNA?
- Was the innovation principally to solve a practical problem, such as the development of a ventilator?
- Was the innovation an opportunity to lever scientific understanding to enhance medicine, such as the development of vaccines?

In this model (Figure 3, also referred to as "Pasteur's Quadrants"), three principal agencies engaged in military medical research in the UK are plotted to demonstrate where their centre of gravity may lie.

Figure 3: Defence academic institutions and relationships with research

Dstl, Defence Science and Technical Laboratories; CBIS, The Royal British Legion Centre for Blast Injury Studies; RCDM, Royal Centre for Defence Medicine.

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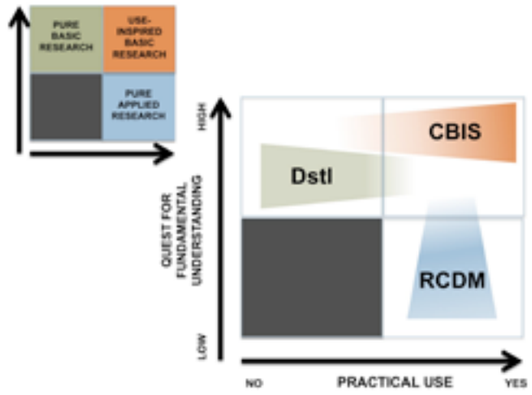
Figure 3



The contemporary revolution

Almost every major conflict in the last 200 years has yielded substantial advances in medicine from the ambulances volantes of the Napoleonic wars ('flying ambulances', the first evidence of formed field ambulance units), through environmental health measures and the femoral (Thomas) traction splint in WW1, to the birth of our national blood transfusion service and the introduction of antibiotics in WW2, and the use of helicopters for casualty evacuation in the Korean War.

The contemporary conflicts in Iraq and Afghanistan have proven to be no less important. Indeed, when comparing the Defence Select Committee's criticism in 1997 to the Healthcare Commission's unprecedented description of 'exemplary' combat casualty care in 2009 something extraordinary and transformational has occurred in this era. To cite a revolution, and specifically a 'Revolution in Military Affairs' (RMA), demands that certain criteria are met:

- Lambeth has characterised an RMA as 'Innovation in military concepts and doctrine, organisational processes, and application of technology'.
- Toffler has added that for a 'true revolution' there must be more than efficiency changes – there must be changes in the 'rules of the game', which can be interpreted as a change in the ways and means that clinical care is delivered.
- Cohen in a three part test principally adds to these definitions by identifying the need to demonstrate an improvement in outcomes: without this as the foundation of all advances in medicine, innovation is nugatory.

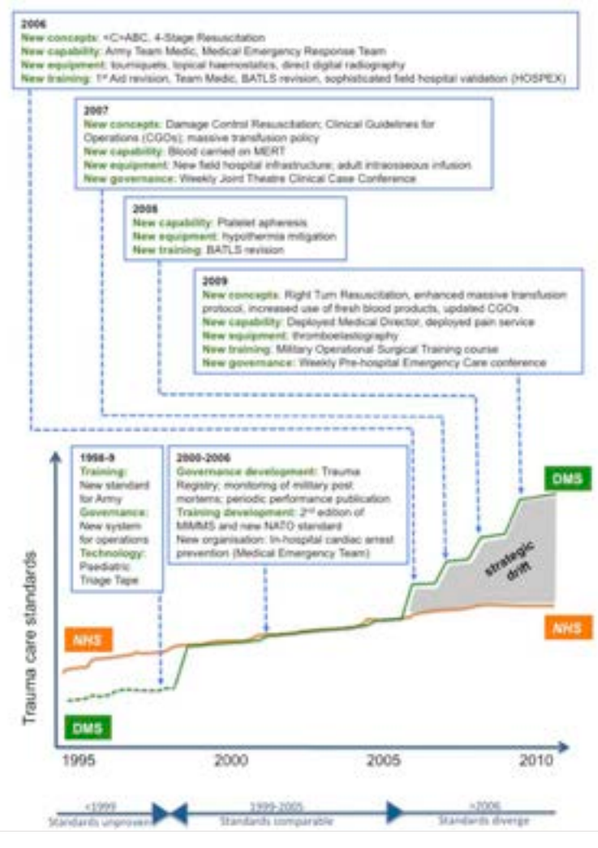
A structured analysis of the serial innovations within UK Defence Medical Services from 1999 – 2009 strongly satisfies all these criteria (Figure 4).

A radical change in the character and practice of military medicine has been proven, exceptional outcomes have been demonstrated and a 'Revolution in Military Medical Affairs' (RM2A) can be confidently claimed.

A winning culture

As we now concentrate on codifying this legacy and ensuring the advances endure, the key question is "What were the conditions that enabled sustained, serial innovation

Figure 4



and that tolerated a 'strategic drift' from civilian practice norms?" The second question is "How can these conditions be replicated to secure effective future innovation?" The answer to both is the same: it is a combination of a 'winning culture' and determined clinical leadership.

The business literature is rich with descriptions of what constitutes a 'winning culture'. For our purposes it can be defined as:

A culture of continuous improvement, underpinned by a collective desire to improve, a belief that the organisation has the ability to enact improvements, and an understanding that multiple small changes add up to a substantial overall change.

Mankins describes seven characteristics derived from wide research that an organisation should demonstrate (with strength in 3–4 domains) in order to encourage the desirable behaviours within its employees for a 'winning culture' (Box 1).

Seven characteristics for a winning culture

1. Integrity in all interactions (internal and external)
2. Performance focus (with aligned mechanisms for professional development and reward)
3. Collaboration
4. Accountability
5. Agility
6. Innovation
7. Orientation towards winning

The governance mechanisms for major trauma that have developed within the Defence Medical Services in the last ten years have unequivocally demonstrated willingness and ability of the organisation to continually improve, timely adaptability to emerging injury patterns, cross-boundary collaboration (particularly in relation to personal and vehicle protective system developments), an acute focus on clinical performance, and – as already proven – innovation across its full spectrum.

Conversely, the inadequate expression of a winning culture has been at the heart of the three strategic shocks to the National Health Service in 2013:

- The Francis Report – an exposé of failed leadership and a toxic culture within the Mid-Staffordshire NHS Trust;
- The Keogh Report – a review identifying common failures within 14 poorly performing NHS Trusts;
- The Berwick Report – a strategy to improve patient safety across England.

In his introduction to the Francis Report, the Secretary of State for Health stated that 'a toxic culture was allowed to develop unchecked'. While it would be convenient to regard this as representative of one hospital in isolation, Professor Sir Bruce Keogh analysed poor performance in 14 additional NHS Trusts, which equally had demonstrated poor leadership. Professor Don Berwick (a health advisor to President Obama) identified culture's central role in NHS performance, stating "Time and again in our Group's deliberations, every member used the word 'culture' to diagnose both the faults of and the possibilities for the NHS." Further, a culture of fear was present that was 'toxic to both safety and improvement'.

The Defence Medical Services has been a high performing organisation in this period of expeditionary campaigning: it must, therefore, be very cautious of adopting remedial measures targeted at the NHS that have been catalysed by these independent assessments of poor performance and an undesirable culture. More importantly, the proposed national measures to improve 'quality' through increased frequency and depth of inspection, new punitive legislation against clinicians, and counting the number of nurses on duty every day are unlikely to influence cultural change in the positive way that is intended.

A 'campaign' framework

The military campaign planning language and tools provide a relevant framework for articulating an innovation strategy to guide continuing military clinical development. To begin, this requires a vision that is consistent with the wider organisational strategic aims which, in personal terms, is considered to be an internationally renowned organisation for military medical innovation in research, education, clinical practice and concept development that encompasses health promotion, injury and illness prevention and care from insult to rehabilitation in all environments.

Knowing the direction of travel, the destination or 'end state' must then be clear. This is taken to be a winning culture protected and enhanced, ensuring excellence in all aspects of military medical innovation. While culture cannot be dictated, it can be strongly influenced by attention to the six components of the cultural paradigm (Box 2).

Six components of the cultural paradigm

1. Stories and symbols
2. Rituals and routines
3. Power structures
4. Control systems
5. Processes
6. Infrastructure

The centre of gravity is the organisation's strength that must be protected and/or the problem's critical vulnerability that must be targeted. For innovation to be sustained within the Defence Medical Services during contingency there are two specific strengths that need to be protected. These are sustaining an environment for innovation (the physical and

intellectual environment for creativity and innovation) and maintaining effective medical intelligence, which is systematic, integrated, comprehensive and multilateral.

The world's most creative companies such as Google and Pixar have developed flexible working environments that stimulate employees: these include design features that encourage accidental interaction, a high number of common areas, and generic thinking areas within open plan spaces to encourage collaboration. The recognition that how people work can affect creative outputs and therefore organisational success is equally relevant to the Defence academic environment.

Figure 2 highlighted the prominence of medical intelligence in driving change: the challenge rests with ensuring effective systems for the synthesis, analysis and applied judgment to profligate sources of internal and external information that turn this information into intelligence.

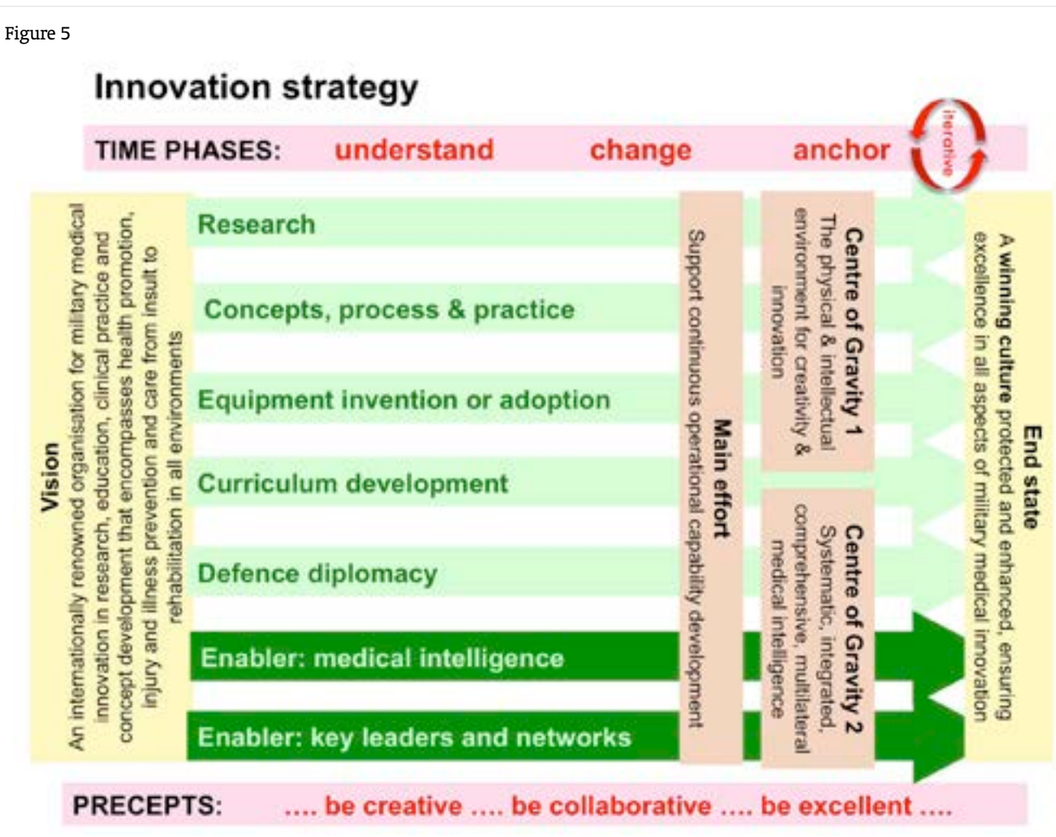
Guiding precepts

There are three themes, or guiding precepts, that must shape our future innovation, and have already been alluded to: they are creativity, collaboration and excellence.

Our future Armed Forces will require people who 'can think flexibly and with imagination', and we will need a 'brains-based approach to operations.' The creativity in clinical concepts, guidelines, governance processes and curriculum development throughout the contemporary RM2A has arisen largely from the Defence clinical-academics. Academia is not, however, just one step in a generalist military career. It is an enduring state of mind. To build our future creativity in military medicine requires academic careers to be managed and for there to be opportunities for development between and beyond tenured appointments: such talent management is critical to encouraging and retaining this 'battle winning' capability.

A renewed culture of collaboration post-Afghanistan is encapsulated in NATO's Smart Defence and Connected Forces initiatives, aimed at optimising multilateral capability in an age of austerity. Yet medical interoperability may never have been so great as in operations in Afghanistan, with the UK's experience since 2009 being management of an integrated multinational hospital within a framework nation's equipment, guidelines and governance.

Figure 5



The realistic risk is losing this level of practical integration, although it may be mitigated by sustaining simulated training within the sophisticated field environment of HOSPEX. Reassuringly, the mutual bilateral strong commitment to collaboration in science between UK and US was reaffirmed in 2012 and the intent to maintain the capability advantage and interoperability was stated in a joint Defence Science and Technology communiqué in 2013.

If academia is a state of mind, then so is excellence. In distilling 24 leadership principles from General Colin Powell in 2003, Oren Harari quotes that "If you are going to develop excellence in big things you must develop the habit in little things. Excellence is not the exception; it is a prevailing attitude."

The innovation roadmap

Drawing on the vision and end state for the innovation strategy, the centres of gravity and the lines of activity that represent the components of innovation, then the logic of the innovation roadmap for continuing military medical development emerges (Figure 5).

The 'Main Effort', to where any limitation of resources will be focused, is providing the academic evidence to support continuous operational capability development.

Figure 5: A strategy for continued military medical innovation

The lines of activity within this strategy are largely self-explanatory:

a. Research. Basic science, quantitative and qualitative research can all contribute, depending on whether the focus is on fundamental understanding or on solving an existing problem.

b. Concepts. The Development Concepts and Doctrine Centre exists to advance Defence thinking, but concepts, processes and guidelines that relate to direct clinical care will continue to be generated independently by the clinical-academic community.

c. Equipment:

i. Technology adoption (using new technology developed externally) has been an organisational strength within the contemporary RM2A, with examples including topical haemostatics and adult intraosseous infusion.

ii. Technology invention (technology developed internally) has been prominent in the cross-boundary domain of force protection, where analysis of clinical data from deaths and survivors has underpinned both personal and vehicle protective systems development.

iii. Technology adaptation (existing technology used in a new way) has supported a new use of thromboelastography to dynamically monitor coagulation at point of care for critically injured, and has encouraged the field use of platelet apheresis.

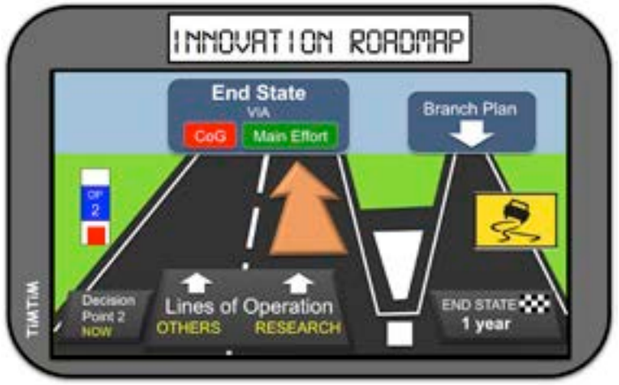
Where clinical innovation has not been effectively exploited is in translating internal invention into a fielded product: this requires analysis to understand how the processes to protect intellectual property, secure seed corn funding for prototype development and collaborate with industry can be enabling rather than constraining.

d. Curricula. Considerable organisational success has been enjoyed from the development, assessment and refinement of curricula by the Defence clinical-academics, evidenced by the international propagation of the restructured Battlefield Advanced Trauma Life Support course[30] and the adoption of the military version of the Major Incident Medical Management & Support (MIMMS) course[31,32] as the NATO standard.

Since its inception in 1992, MIMMS has used military principles to teach civilians, with courses run for civilians in over 20 countries within four continents. The current requirement for curriculum development rests with clinical leadership. Internally this is needed to ensure practicing clinicians are not disadvantaged in their later career through no opportunity to attain educational milestones accessible to those on conventional management career pathways. Externally there is opportunity to influence leadership development in the civilian sector with military principles, evident from the criticisms of failed leadership within the Francis, Keogh and Berwick reports. This overlaps with Defence diplomacy.

e. Defence Diplomacy. Medicine is a relatively non-contentious, apolitical, soft power tool for influence and Defence diplomacy, whether this is in support of allied military medical development (through sharing of guidelines, propagation of courses, or an invited external validation/capability review); UK civilian health system development (through education and capability development; analysis and enhancement to international civilian healthcare; or supporting a public legacy (through the media, popular publication, and national museum exhibitions).

The contribution of medicine to Defence in demonstrating wider public utility is significant, particularly as the military's prominent current purpose to conduct enduring campaigning diminishes.



The Sat-Nav approach

For those unfamiliar with using military campaign language and structure to provide a framework for achieving a goal in a complex environment, this is analogous to the roadmap provided by satellite navigation. There is a start point (the Vision) and a destination (the End State). Equally, analogies can be drawn to all key components of the campaign structure. Without labouring the metaphor, traffic lanes are the 'Lines of Operation'; milestones are the 'Decisive Points' at which a key decision has to be made or an activity is achieved; feedback on passing a milestone is a 'Measure of Effectiveness'; diversions around obstacles are a 'Branch Plan'; and lane restrictions demand the 'Main Effort' is followed (Figure 6).

The influence of FCOMM

The Future Character of Conflict (FCOC)[29] describes the future battlespace as 'congested, cluttered, contested, connected and constrained', which has aided Defence strategic thinking. But this is an inadequate fit for the Future Character of Military Medicine (FCOMM), which is additionally 'confused, collaborative and complex'. As the concept of FCOMM has been previously described, only how it impacts on future innovation will be briefly considered here.

The future brings both creative freedoms, together with constraints. The freedom relates to unanticipated uses of established or emerging technology to aid diagnosis or treatment (where this uncertainty constitutes a degree of future clinical 'confusion', together with the uncertainty of new illness and injury patterns) – for example, exploitable ideas may include far forward, robust, rapid, point of care diagnosis of trauma coagulopathy (analogous to the card test for malaria); the use of nanotechnology or new drugs to address internal, non-compressible haemorrhage prior to access to surgery; or the application of synthetic diamond to monitor temperature at a cellular level.

Constraints relate to social, technological, economic, environmental, political, legal and ethical factors (STEEPLE). Foremost amongst these is the impact of austerity on the availability of research funding and the requirement for more rigorous prioritisation. If our combat casualty care is currently 'exemplary' and has differentiated from civilian care standards to generate exceptional outcomes, is this good enough? Is there a requirement, therefore, to continue to research and develop combat casualty care standards during austerity, where other domains of deployed healthcare may have a greater requirement for development? Analysis of US combat casualty care data has argued that 25% of combat casualty care deaths still remain potentially avoidable, particularly in relation to acute haemorrhage, and this is justification for further active research. While this appears to maintain the moral imperative to continue development, it must be recognised that UK analysis substantially corrects for those deaths that are 'tactically unpreventable'.

Conclusion

Despite transitioning from a decade of campaigning, with the requirement for clinical development driven by a sustained casualty imperative, we must not accept an operational pause in Defence medical innovation: to do so will be to repeat the actions of history that tolerated a regression of medical capability in the period between major conflicts.

Rather, the challenge exists as to how we can continue to innovate in the widest sense – through research, new concepts, clinical guidelines, curricula design, equipment and Defence diplomacy – in order to maintain the advantage of world-leading clinical capability in support of deployed operations. This will be enabled by an innovation strategy, a 'roadmap', with a clear vision, end state and supporting campaign structure. ■

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