Defence Innovation External Advisory Panel Report – April 2018

Background

"Innovation is fundamental to Defence. With the international situation darkening, effectively harnessing new technologies and approaches will be critical to keeping the UK ahead of the curve and ultimately help our serving men and women protect the nation." Vice-Chief of Defence Staff (VCDS) - 31 January 2018.

The 2015 National Security Strategy and Strategic Defence and Security Review (SDSR 15) identified the key strategic challenges of our time: international terrorism; state-based threats; the impact of technology, including cyber; and the erosion of the rules-based international system. That the sum of these challenges would create a darker and more dangerous world is not surprising: we [the UK] have entered a period of increased complexity and risk; the threats we face are intensifying and diversifying; and the boundaries between competition, confrontation and conflict are blurred with our adversaries becoming more adept at exploiting this. What we [Defence, in the view of the Panel] underestimated, however, was how quickly these issues would evolve and impact upon our national security and that of our allies.

UK Defence needs to step up its response to this accelerating context and innovate quickly to confront two major, concurrent challenges; pace of modernisation and affordability. Increasing the pace of Defence modernisation will 'strengthen the force' against the intensifying and more complex threats that we, and our allies, face while tackling the strategic affordability of UK Defence in the longer term.

To succeed means building on the strong foundations laid down in the SDSR 15 and the recent National Security Capability Review. Quickly modernising Defence and the Armed Forces will restore the balance between policy, plans, commitments and resources and deliver better military capability and value for money. We [Defence, in the view of the Panel] must make the necessary changes to deliver a robust, credible, modernised and affordable force, able to use 21st Century technology and thinking to address 21st Century problems.

Technology offers leverage as never before where friend or foe are unconstrained in terms of reach, messaging and speed of scaling. This trend is set to accelerate in the digital world with the development of useable quantum computing but also in the physical domain with technologies such as 3D printing, computer vision and robotics.

The UK Defence Innovation Initiative, titled 'Advantage through Innovation', was launched in September 2016 with the aim of maintaining the military edge of the Armed Forces in a rapidly changing, global strategic landscape. Given the challenges faced, the Innovation Initiative aims to realise innovative solutions more rapidly, and ultimately seeks to impact the culture of Defence so that it becomes 'innovative by instinct'.

As a key part of the Initiative, the Defence Innovation External Advisory Panel ('the Panel') was established, and met for the first time in July 2017. The Panel provides independent challenge as the members seek to interrogate MOD's current innovation ecosystem[1] and help ensure that the Department is driving the right change at the necessary pace to meet its future goals. To support this challenge function, the Panel were asked to provide an annual report to Secretary of State for Defence on their findings. This is the first of these reports.

---

[1] After initial Head Office briefings, including a visit to Dstl, each Panel member was partnered with a Defence Innovation Hub to gain an understanding of how innovation is currently working across the Department and to be briefed on current projects.

The report identifies four themes, each of which forms a section of this report. Each section includes a summary of main points, a set of observations reflecting the Panel's engagement with Defence and their experience elsewhere, and several key recommendations.

Context – the Need for Defence Innovation

Defence has an abundance of talented people who are great at generating ideas and solving problems. Throughout history the Department has used this skill base to drive technological advances such as radar, tanks and jump jets. However, against 10-20 years of technological advances, a lack of focussed effort on innovation and digital work practices has meant that Defence is now not only behind much of Whitehall but is slipping behind our adversaries.

Increased automation, miniaturisation and artificial intelligence are transforming the technological landscape. Cognisant of the installed base of rapidly improving technology, reach of social networks and scalable and affordable cloud infrastructure, this radically different context requires novel approaches. The speed of this technological revolution is phenomenal. Smartphones offer global distribution at the press of a button – whereas it took 75 years for the telephone to reach 50 million users, it took Facebook less than 2 years, YouTube less than a year and we now see online gaming reaching this number in less than a month. Defence must rapidly update its work practices if it is to master and exploit this changing environment.

Conclusion

Overall, the Panel felt that Defence is making some progress towards becoming more innovative and responsive. However, its *modus operandi* is still hugely structured and bureaucratic, albeit thorough and safe. A fundamental change is needed if MOD wishes to become truly equipped for an information warfare age. The Panel thought that the Department would need to be significantly **more flexible, fast moving and agile** if its overarching aim was to be innovative.

In the last 12 months, Defence has put in place some good, basic structures for innovation but innovation is still considered a fringe activity. While there is a drive to move fast, realistically it's going to take 5 to 10 years to achieve the required level of change to make MOD a truly innovative organisation. Practically this means that MOD needs to secure short term wins whilst seeking to understand the scale of change needed in the longer term.

There is currently a real dissonance between the Department's innovation rhetoric and its resources. While the leadership undoubtedly see the need for change and innovation, they are generally not embracing the level of resources needed to begin to deliver against this need. Until innovation is fully embraced and resourced at the very highest levels in Defence, business as usual will continue to keep the Department conducting warfare of the 20th, not the 21st, Century.

Emerging Themes and Recommendations

The Panel's observations and associated recommendations have been categorised into four themes as follows:

1.   Defence Priorities & Exploitation

The UK could benefit hugely by making some tough choices about where it can truly win technologically. We [Defence, in the view of the Panel] do not have the funding, skill base or resources to step change technology across the board so we should define a short list of where Defence can make significant gains from a military, wider economic and prosperity perspective.

While there are many useful forums for discussion and collaboration between Defence and Industry, the most common request by suppliers is for Defence to send a more coherent demand signal. In this rapidly changing environment and where cash will inevitably be constrained, where does the UK and Defence specifically want to focus its attention?

It is well recognised that Defence suffers from a "valley of death" between great research and procurement to the Front Line User. It is essential that these two worlds work hand in hand if the Department is to drive forward successful innovation. All innovation must start with an end user in mind if Defence is to increase its exploitation of ideas and place innovative capability in to the hands of the user.

Observations

- Defence and Government spending reviews provide a successful way of articulating both the threats and options Britain's defences are facing. What they are less clear on are the specific technical and opportunity areas which industry should be focussing on.
- The UK needs to pick the areas it wants to lead the world on and disproportionately invest in these. This could have huge prosperity benefits. At the moment Defence is spreading itself too thin and trying to tackle everything.
- When a demand signal is sent from MOD, it is always from only one silo of the organisation or around a single longer-term requirement e.g. Defence Science and Technology (S&T) publish their strategy.
- To date, there has been no consistent, Defence-wide demand signal to Industry about where they should focus their innovation and funding efforts. There is a real need for far greater coherence across MOD and between the needs of the Front Line Commands.
- MOD tends to focus too heavily on longer-term strategic needs and misses shorter-term, tactical opportunities. Currently, the Defence acquisition system is set up to disproportionally support and fund the former. A public focus on short term wins could yield useful results.
- It was perceived that there is too little meaningful dialogue and understanding between the S&T community and their end users. Often projects are pursued for which no exploitation route has been identified.
- Outside of the big Defence prime contractors (and sometimes even there) opportunity for industry to directly engage with front line users is far too limited. The standard processes around articulating customer needs, seen in commercial organisations, are simply not present in MOD.
- Having committed to a path, MOD tends to stop very few projects. MOD needs to engender an environment of failing fast and learning from its mistakes. A system of "up or out" should be ruthlessly applied to our S&T and innovation work flows.

- Defence must realise that its key competitive advantage will come from finding, adapting and assimilating new technology from other industries rather than from developing new technologies in-house. This would be a major cultural departure from the past.
- Defence could gain benefit from accessing wider Government funding, use of alternative acquisition models and use of Venture Capital funded initiatives like those seen in the US. International allies appear to be significantly ahead in accessing and leveraging venture capital to fast track scaling up and exploiting new technology SMEs.

Recommendation 1: Drive Innovation Through User Need

- Publish a Defence Innovation Index. This must be a Defence-wide demand signal with linked consistent but complimentary needs from across the individual Front Line Commands. This will provide a clear and consistent demand signal to industry and academia on Defence priorities for innovation.
- Insist that all innovation projects have a clear customer engagement plan and an articulated exploitation route. Do not spend any funding unless there is a Front Line Command and / or end user willing to procure a successful project.

Recommendation 2: Engender an Environment of Failing Fast and Learning to Achieve Greater Acceptance and Mitigation of Risk

- Demonstrate more agile risk taking through structures such as the Defence and Security Accelerator (DASA) and the Innovation Hubs. Increase their resources, in terms of personnel and funding, to support this.
- Defence should seek to take advantage of external funding opportunities and alternative acquisition models to help mitigate risk in innovation projects, e.g. exercise USA models such as In Q Tel.
- Introduce a new research and innovation board with the power to:
  - Review all projects on an annual basis. Insist that the weakest projects (~10%) are culled and the freed-up resources given to the most promising projects.
  - Analyse S&T funding and its value against output and benefit once delivered to emulate the same level of rigour as would be applied in an external commercial environment.

2.   Defence Acquisition & Processes

To meet the Defence innovation and procurement goals of the future, the current Defence acquisition model and processes has been identified as the key area for change. The Panel noted a clear opportunity for simplification, education and consistency.

Observations

- There is a clear need for far greater alignment of architectures within Defence systems and capabilities. At the moment individual systems are being procured in isolation of a Defence wide perspective.
- Defence can feel impermeable to non-Defence industry, small and medium-sized enterprises (SMEs) and other Government Departments. Defence is missing out on emerging technologies from non-traditional suppliers as a result.
- Systems and processes are geared towards long-term platforms with fully defined requirements up front. This long-term, large platform mentality results in contracts with no formal stopping structures in place and platform systems being obsolete at the point of commissioning.
- Major programmes are inflexible and prime contractors are not incentivised to accommodate innovation. Innovative solutions, once piloted successfully, cannot be integrated and are therefore unsupported. If innovation is to get beyond small, occasional projects, programmes will need to have flexibility and support change. Innovation needs to be built into large programmatic delivery, not seen as an irritant.
- Excessive money and time is being spent on risk averse engineering assurance, inhibiting innovation. Taking greater, more calculated, risk in the trials and development phase would facilitate innovation. Spaces for experimentation such as the Marine Intelligence Systems unit set up by Defence Growth Partnership should be used more. A mentality of "build a little, test a little" needs to be adopted.
- The ownership of the product lifecycle is disjointed with no-one owning the whole cost of development and failure.
- The laborious commercial process has a negative impact on project delivery, time and cost. Approval costs potentially exceed the value of the contracts in some low value innovation projects.
- There is a need for Defence commercial officers to understand the key controls where risks cannot be taken but allow freedom to manoeuvre in the areas where flexibility is possible. There appears to be a general lack of professional and expert commercial skills in Defence, which would be expected externally.
- There is no incentive built into the commercial/procurement processes to take innovation risks. The same Defence commercial officers are applying standardised judgements to business cases, whether for small, theoretically agile, innovation projects, or major programmes. Though well-intentioned, this is slow, bureaucratic and risk-averse. How do you incentivise "over delivery"?
- There appears to be an overly complex and long winded oversight and approvals process for delivery, which does not take account of scale, limiting agility to deliver innovation projects.
- The procurement process of development and prototyping with one supplier followed by full open competition is not fit for modern purposes in areas such as software. The organisation is trying to work around the process.
- Consideration should be given to how MOD engages in the acquisition of software and key algorithms which may reside in small start-ups and may have short but key useful lives. In this space getting comfortable with rapid obsolescence is essential.
- Current Intellectual Property models are more suited to equipment than data or software.

Recommendation 3: *Define, Drive and Demonstrate Innovative Procurement Best Practice*

- Identify an opportunity for an early-stage, technology development area, such as the creation of a cyber specialist group, to drive and demonstrate contemporary procurement.
- Defence should establish an acquisition and procurement "Tiger team" to identify and overcome commercial, legal and regulatory barriers and develop new processes to enable radical innovation and new ways of working.
  - Develop a proportionate "light touch" commercial procurement process for Innovation projects below a certain funding level (perhaps £100k).
  - Establish a limited cadre of demonstrator procurement projects where frameworks are pushed to the absolute legal and regulatory limit, i.e. change behaviours by demonstrating specific examples of how rules can be followed, but lightly.
  - Define an Intellectual Property model suitable for SME engagement on software and data systems and services.

Recommendation 4: *Fundamentally Refine and Simplify Contract and Approvals Processes*

- Future contracts should contain a level of flexibility that allows for the specification of systems to take place during the contract period. I.e. separate platform from system procurement and specifically stipulate and mandate the use of open and common architectures to facilitate the avoidance of built-in obsolescence.
- Use innovation projects to develop and showcase streamlined oversight and approvals processes within the Department.

Recommendation 5: *Review Existing Structures in Light of New Ways of Working*

- It is not clear whether the size, scope and organisation of the separate ISS, DE&S and central commercial / approvals teams is necessary or indeed optimal. A full independent review should be commissioned to investigate and propose a modern, fit for purpose structure.

3. Defence Data & Information Systems

Defence needs to up its game in the collection, analysis and exploitation of data. MOD does not need to be an expert in all new and emerging technologies, it never could be, but it needs to know enough to procure smartly and to know where to seek expert advice. The department needs to get its basic IT systems fit for purpose in short order and additionally drive an entirely new approach to Cyber. To do both MOD needs to be prepared to spend more to recruit and retain data scientists in a competitive market.

Observations

- Defence is confused when it talks about data. It needs to clearly separate everyday back office (utility) data and other data (such as Cyber data).
- The procurement process and relevant systems have evolved over time and through evolution have become heavily layered. A consequence of which is inefficiency of time, leading to significant additional cost. This is clearly apparent regarding IT systems, where patching of the software to facilitate communication between different platforms and architecture is extensive.
- The speed and reliability of the IT systems is significantly compromised and very costly, resulting in the amplification of project inefficiencies and reduced staff motivation.
- Whilst the benefits of interoperability through open architectures and 'plug and play' communications and information systems are understood; these are far from being the default position and getting them right is central to success.
- There is a chronic shortage of computer science, data science and digital engineering skills at every level. At the advanced level, MOD needs to be prepared to spend more to recruit and retain data scientists in a competitive market.
- The MOD must at a minimum be an expert procurer of advanced data systems. To do this it will need to establish a wide expert advisory network and build up category expertise in - Artificial Intelligence, Machine Learning, Audio-Visual, Augmented Reality/Virtual Reality, Blockchain, Cyber.
- Exploiting the changing shape of people and skills in the MOD is key. Greater IT capabilities, flexibility, agility and device familiarity are all opportunities. New developments such as the Army Experimental Brigade and the Centre for Intelligence Innovation are a chance to explore the evolving human capacity alongside technologies.

Recommendation 6: Put Data Collection, Sharing, Analysis and Use at the Top of the Departments Must Do List

- Create a new architecture to collect, share, analyse and use both legacy and future data and enable resilience in the system.
- Mandate the use of Open and Common Architectures on all future platform contracts and create a Defence Data Strategy to set out the strategic requirements for data capture and use.
- Review Information Systems and Services procedures to ensure that they meet the needs of modern software development practices, such as agile sprint development.
- Expand the use of novel techniques to rapidly develop software such as hackathons, sandpits, data science challenge, and exploit the Defence Intelligence Innovation and Collaboration Centre.
- Learn from the new US Defense Digital Service to ascertain if a similar construct would be a useful addition to UK MOD.

Recommendation 7: Create a New Standalone Cyber Force.

- Given the fundamental need in the cyber space and the level at which we need to prioritise increased performance, a new standalone Cyber Command should be created.

- The Cyber Force should have no responsibility for basic utility IT requirements or systems and should be the new test bed for faster more agile procurement and hiring practices.
- Fast track the piloting of a secure and "above official" cloud provision, addressing governance, policy and procurement challenges.
- Mandate the joining up of Defence data in order to link data sources together, to leverage the benefits of the "Big Data" drive.

Recommendation 8: *Embed Computer Science and Digital Engineering as Core Technical Competencies for the Department*

- Expand MOD recruitment further into Science, Technology, Engineering and Mathematics (STEM) areas (and, in particular, software developers).
- Create internal digital engineering, computer and data science career paths.
- Make more use of two way secondments between Industry and Defence, both in technical and cultural change roles.
- Teach computer and data science skills as part of basic training as well as during in-career development to build the expertise, trust and confidence in the human-information relationship.

4.   Defence People & Culture

It was noted by all the Panel members that Defence People are highly motivated, creative and good at solving problems. There is a strong sense of the common objective, a strong desire to "win" and a desire to modernise. However, there is a high level of frustration within the system and morale has been impacted following long periods of change and budgetary reductions.

For innovation to thrive, a delicate balance between control and freedom is required. Too much open ended activity can lead to inefficiencies and duplication. Too much control and creativity dies. The new Defence innovation ecosystem has emerged over the last year and is broadly working well. However, attention will need to be given to establishing how much the drive for innovation should come from the centre and how much should be left to the Commands. In either case a broad push to train, motivate and reward staff to be more innovative is now needed. The scale of the cultural change needed should not be under estimated.

Observations

- There is a severe lack of training and support for innovation across the organisation.
- Innovation is not considered as core business and staff, both civilian and military, are not encouraged or adequately rewarded to innovate in their day-to-day roles.
- The nature of military and civilian rotations every 2-3 years does not provide the required level of continuity.
- There is too much "fear of project failure" across the department, limiting ability and opportunity to take innovation risks.
- Innovation hubs in the Commands and Delivery organisations have been developing independently at their own pace with their own unique emphasis, structure and goals. This has been most successful when the problem space owners have been brought together with industry and experts to identify and develop solutions to the User's needs. Coordination and coherence could be stronger across both the hubs own organisation and across the Defence Enterprise.
- Ownership, knowledge and cohesion of the innovation process throughout Defence is poor. Innovation is not represented at the MOD Executive Committee, the Armed Forces Committee or the Defence Board. Innovation needs to have a permanent seat at these tables if it is to be taken seriously by both industry and staff.
- The delegated model (as implemented) is not ideally optimised for innovation. Clear strategy and direction from the centre is required to achieve balance. The 'islands of innovation' across the Commands are having positive effect but are also leading to duplication, less than optimal prioritisation, and some unnecessary competition.
- Authority for the management of the Innovation Fund is helping the Defence Innovation Unit to influence direction, but it lacks direct authority to cohere and coordinate the hubs.
- The Defence S&T model is structured and set up to research and solve problems that have a sole or predominantly Defence aim, potentially missing out on multi-sector use technology and funding opportunities.
- The Department is diverse in the way it operates with differing reliance on large platforms between the services. A one size fits all approach is unlikely to be successful. Some areas will need a greater focus on people and process innovation to achieve meaningful change.

Recommendation 9: Appoint a Chief Innovation Officer to Provide Board Level Representation

- The Chief Innovation Officer will champion innovation across Defence
- The Chief Innovation Officer should sit on MOD's high-level board meetings to send a clear message that innovation is part of core Defence business and not a fringe activity.
- The Chief Innovation Officer should be appropriately empowered to ensure innovation coherence across the Department and to stipulate minimum dedicated innovation resource

in the devolved organisations. They should drive greater coordination and coherence of innovation activity across the department, through the Defence Innovation Unit.

Recommendation 10: *Engender a Culture of Innovation, Recognising and Rewarding Excellence*

- Encourage small pockets of innovation wherever they are established but measure their performance and reward the most successful with profile and additional resources.
- Identify and implement innovation training for 25% of the Department over the next 2-3 years as the enabling process and structural changes are realised.
- Recognition should be given for individual and team efforts on innovation through existing or new reward structures.
- Create a career path which enables key innovation personnel on the military side to stay in post for greater than 2-3 years without harming their career.
- Review Incentives and signals around the value of innovation, to 'permit failure' and to encourage a focus on portfolios rather than projects.
- The Defence Secretary should personally hold annual awards to recognise and showcase those truly driving innovation across Defence.