MINISTRY OF DEFENCE

Ministry of Defence

Innovation Strategy

Creating a new environment for innovation within the defence supply chain

Foreword

By Baroness Taylor, Minister for Defence Equipment and Support

'Innovation in military equipments contributes to achieving a battle-winning edge'
Defence Technology Strategy 2006

Innovation has played an important part in underpinning the UK's productivity and economic success over the past few decades. For defence, innovation is central in providing improved equipment, processes and services to our Armed Forces. The UK's front line and battle winning edge depends on us improving the pace in delivery of defence capability, improving the quality of that capability and reducing our whole life costs. Above all innovation is about achieving greater value for money from the UK's defence investment.

As part of commitments set out in the Defence Industrial Strategy in 2005, we undertook to achieve a better understanding of the innovation process within the defence supply chain. This Innovation Strategy takes the initial work by the National Defence Industries Council Research and Technology sub-group and sets out our approach to increase, nurture and sustain innovation in the defence supply network.

The strategy identifies the main challenges to innovation in delivery of our defence capability. It expresses actions to address these challenges in terms of five distinct pillars. These pillars show our intent to articulate our capability needs better, provide transparency in how we translate these needs and aspirations through to delivery of capability, highlights our commitment to open architectures which will in turn foster insertion of new or improved technology, demonstrates our commitment to new business models, that provide incentives for both customers and suppliers to achieve greater innovation and communicates our desire to maintain the pace of MOD's acquisition processes.

The Innovation Strategy should not be viewed in isolation from other major reforms the Government has set in train in defence acquisition. Our commitment to taking forward the Defence Industrial Strategy and ensuring it remains current, relevant and challenging to deliver the needs of our Armed Forces is as strong as ever. As part of my commitment to DIS and in taking the Innovation Strategy forward, I have announced the development of a Defence Technology Plan. This plan will provide a clear direction to the research and development (R&D) community about our capability aspirations and visions and set out a clearly defined roadmap of capability and technology options on how we will achieve these capability visions.

It is now vital that we work together to deliver the other aspects of the five pillars of innovation, to stimulate innovation in the defence supply network and to ensure we get the best outcomes from our defence investment.

Chapter One

Importance of Innovation in Defence

1. Defence is underpinned by increasingly sophisticated technology and innovation. As such the UK's battle winning military capability remains heavily dependent on both development and exploitation of world-class technology as well as innovation[1] within defence processes and services.

2. Innovation is a key driver for change in the modern world, creating new opportunities but more importantly creating wealth in the economy. Technology innovation and associated research and development, underpins much of the UK's productivity and success in the past few decades. In response the UK Government set out a ten-year Science & Innovation Strategy[2] in 2004. The UK Government remains committed both to the strategy and to raising public and private sector investment in Research and Development. A commitment which is reaffirmed in the recent review of innovation[3] by Lord Sainsbury.

3. UK Government, industry and university research and development (R&D) effort remains critical at a time of uncertain threats, as demonstrated by the diverse tasks demanded of our Armed Forces since the end of the Cold War. The UK needs to stay ahead in applying technology innovation against both conventional and novel threats. It needs to respond quickly as new threats emerge and evolve, especially now that global communication and the world-wide web allow potentially unrestricted proliferation of these threats. A strong and innovative science and engineering base in UK Government research agencies, industry and universities is essential to meet this need.

Lightweight modular bar-armour made from aluminium alloy is an innovative solution to protect against Rocket Propelled Grenades without compromising operational effectiveness.

1 Delivering Security in a Changing World - Defence White Paper 2003

2 Science and innovation investment framework July 2004

3 Lord Sainsbury of Turville, The Race to the Top, a review of Government's Science and Innovation Policies, HM Treasury October 2007

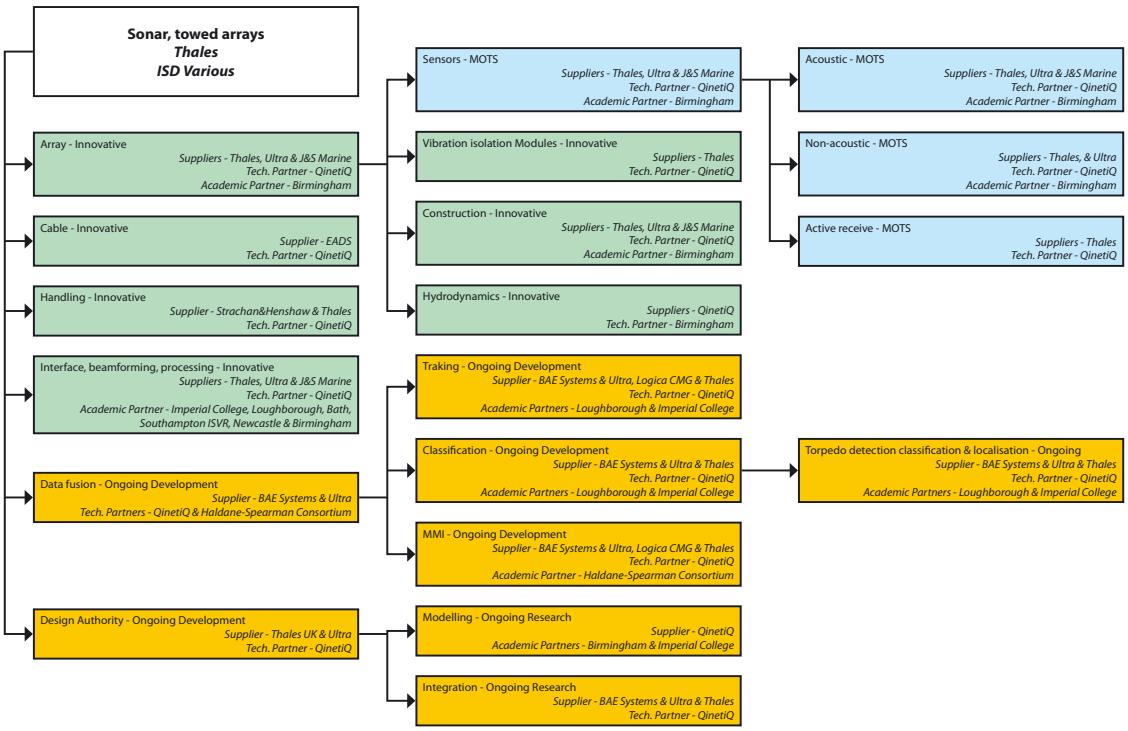
4. Within defence, innovation is essentially "the successful generation and exploitation of new or where appropriate novel application of existing technology, processes or services to produce a more cost-effective military capability for our Armed Forces". Technological innovation is, for example, crucial for network-enabled, adaptable and rapidly deployable forces. But as important is innovation within the acquisition cycle that reduces procurement times, improves equipment quality and makes capability more cost effective and reliable. Moreover, such improved quality and reliability will lead to better competitiveness in the UK defence industry and improved export performance. We must not forget, however, that innovation also comes from using new scientific approaches to problems and the generation of new ideas which are pertinent to the development of capability. For example, the development of Liquid Crystal Display technology, now ubiquitous in commercial and military displays, saving weight and increasing reliability over Cathode Ray Tube systems, came from work funded by MOD[4] in the 1980s. Although innovation within the defence supply chain primarily tends to focus on equipment and its support, innovation within other Defence Lines of Development is also important.

Barriers to Innovation in defence

5. We recognise however, that there are barriers to innovation in terms of both culture and process, particularly within the defence environment. On the whole, MOD needs to improve the way it articulates its requirements and visions across a wider supply network, so that it does not miss innovation opportunities, especially from non-traditional suppliers. The recently published Defence Technology Strategy was an important step in defining the priority of MOD's needs, but we can do more. When MOD does commission research, much of the research output is captured in paper reports, which can be difficult to visualise within the customer community and hence demonstrate innovation potential. When innovation is successful, its effect is often diminished by the limited insertion opportunities arising from the closed architectures and designs within current defence systems, and our culture of aversion to risk. Furthermore, unlike others such as the biomedical fields, there is a notable lack of entrepreneurship within the defence sector as demonstrated by a low level of venture capital funding. A further barrier is that MOD's commercial approaches are not always applied in a flexible, transparent or fast enough way to engage with many of the highly innovative suppliers, including Small and Medium size Enterprises (SMEs). There is a tendency for both MOD and Industry to apply terms of business through historical precedent, irrespective of the type of R&D being procured. Finally, there are often perceived risks of the long-term sustainability of supply from smaller and often more dynamic innovative companies that need to be overcome.

The Thales Quantum Well Infrared Photo-detector (QWIP) camera is an innovative integration of components to produce a cost-effective and affordable Thermal Imaging system; shown during trials in Iraq.

4 The key elements for Liquid Crystal Display technology, now found in televisions and computer displays, originated from MOD funded work at the Royal Signals and Radar Establishment, Malvern in the 1970s and 80s.



An example of a technology tree for towed array sonar
Key: dark yellow - current development /research, green - innovation, blue - MOTS

6. Initial work undertaken by the National Defence Industries Council Research and Technology Sub-group, together with publication of the Defence Technology Strategy[5] highlighted the importance of identifying where innovation occurs. Technology trees developed for the Defence Technology Strategy show the value of innovation generated within all parts of the supply chain. In particular the role of SMEs as niche suppliers of materials, products and services which lie outside the span of major prime contractors together with the role of universities in providing novel ideas and problem solving. MOD must encourage innovation from within its existing supplier base as well as broaden this base to include other innovative suppliers not traditionally associated with defence.

7. Our vision for successful innovation in defence is:

- To create a culture where our processes stimulate and reward innovation and increase the numbers of new organisations entering the defence technology supply chain
- To encourage an open approach to our capability requirements leading to the development of radically new systems approaches to solve capability needs, coupled with a clearer definition and vision of MOD's needs for the future taking a flexible approach as new concepts, techniques and threats emerge
- An environment of incremental innovation that allows the rapid exploitation and technology insertion of novel technologies which enhance capability, reduce cost or both.

A strategy for innovation in defence - Defence Pillars of Innovation

8. To increase innovation within defence acquisition and more widely in defence business, our strategy focuses on five main elements or pillars for innovation. We consider these pillars as a whole represent the key enabling components for achieving greater innovation within the defence supply chain.

I. Sharing the Vision for Defence Capability

9. We need to stimulate innovation in order to generate fresh approaches to achieve future capability. We need to articulate our challenges

5 Defence Technology Strategy October 2006, p175

and visions for future military capability in a way that leads to innovation, taking note that this is a constantly evolving vision.

10. For innovation to flourish, we must identify our needs early and articulate our future capability aspirations in a form all potential suppliers can understand. We need to foster an environment where promising innovative ideas are taken forward rapidly to their earliest exploitation. Sharing our capability visions with industry and academia, subject to security constraints, will encourage wider participation and generate fresh approaches in the formulation of new equipment capability concepts. The Defence Industrial Strategy and Defence Technology Strategy go a long way towards this, but there is more we can do.

The Future Carrier uses a technology insertion plan for the development of a wide range of systems, so that decisions on insertion are informed and timely.

11. The Office of Government Commerce identified that organisations gain advantage through their ability to innovate and improve, driven by pressure and challenge from demanding customers[6]. We therefore must challenge suppliers in new ways. We need to ensure that our customers, the military, are well educated in science and technology opportunities to address the threats they face. Following on from the success of engaging suppliers in the Grand Challenge and Competition of Ideas, a package of new communication measures is needed in order to 'spread the word'.

12. Through better sharing of our visions we aim to:

- Encourage fresh, innovative thinking to the early stages of capability formulation
- Provide a practicable visualisation of output and value of the research programme both within MOD and industry
- Provide a competitive advantage to specific technology providers, where sovereignty is required, through promoting early-to-market solutions.

6 Capturing Innovation, Office of Government Commerce 2004

II. Capability & Technology Road Mapping

13. Even if our capability visions are clear, innovation will only flourish if suppliers can identify where effort should be focused and innovation best applied. By depicting the various steps and options towards our equipment[7] performance and price aspirations, we aim to engage a wider number of suppliers within the equipment programme and bring greater innovation into our military capability. Suppliers will be better able to judge where effort should be focused and innovation best applied, where technology can be inserted and to allow an early effective balance between technology push and capability pull, within the Equipment Programme Plan.

14. Through better sharing of our capability and technology plans with suppliers we aim to:

- Increase the understanding in the supply network of MOD's technology and capability requirements and the steps to achieve these in terms of performance and cost
- Focus industry, including sub-prime and SMEs on innovation for defence technology needs
- Provide a clear map for where innovation can be inserted into MOD's research, equipment and support programmes.

7 Within equipment, we include capability and system related performance, for example Information Systems and Network Enabled Capability.

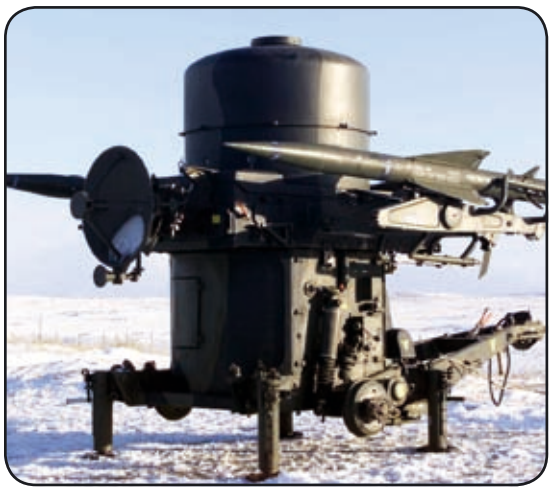
III. Smarter Systems Engineering

15. Any road map showing capability and technology options must be accompanied by an appropriate framework to allow technology insertion and innovation to take place. The Defence Industrial Strategy recognises the importance of Systems Engineering, which ensures that our equipment is procured effectively and that our equipment is able to be developed through-life.

16. Our response to this challenge has been to develop a more integrated approach to the acquisition and in-service management of military capability. This involves each member of MOD's customer community acting with unity of purpose to ensure that a coherent approach is taken to planning and managing every aspect of new and existing military capability. Through Life Capability Management emphasises the importance of considering all components of military capability, of sustaining capability through life, and of identifying opportunities to deliver capability through innovative programmes.

17. Getting better at Systems Engineering and the integration of technologies and systems to form new solutions or upgrade existing capability will increase innovation in Defence Platforms. Systems should be designed with upgrade and flexibility in mind to allow the insertion of innovative technology, particularly where there is rapid evolution of technology. Innovation can be encouraged by managing complexity through the use of open architectures and in particular modular structures with clearly defined, freely usable interfaces. Open architectures will allow the insertion of innovative technologies as they become available and lead to an incremental acquisition approach. We must also investigate the business models which are required to realise open architectures that encourage innovation.

18. Through Life Capability Management (TLCM) means that we must challenge the assumptions that new requirements inevitably lead to entirely new platforms or systems. Rather, TLCM highlights the fact that capability enhancement can often be achieved more effectively though innovation across other Defence Lines of Development, or applying innovation to specific sub-systems of existing capability.



The Rapier air defence system allows innovation to be introduced incrementally, through modular systems architecture.

19. An open innovation approach is increasingly common in the civil sector. It is an approach characterised by a modular and open technical architecture, in which companies compete on the basis of their enhanced functionality or their lower cost. Because market entry tends to be easier, new innovative companies emerge often holding intellectual property originating from universities and supported by venture capital. In an open innovation model, much of the basic or background intellectual property is shared or cross-licensed, while individual supplier differentiations are achieved by building on this background IPR.

20. The UK defence industry, however, currently exhibits many of the characteristics of 'closed' innovation, where ownership and exclusivity of intellectual property dominates the business model. Even if there is little intellectual property, ownership by the 'design authority' and a limited number of top-tier suppliers, can lock out competitors and allow only the business which is first to market to prosper[8]. This tends to prevent insertion of innovative technologies from other suppliers. We need to transition to 'open' innovation models, in which technology is shared, and where system architectures allow for technology insertion by different suppliers.

---

8 H W Chesbrough, 'Open Innovation: The New Imperative for Creating and Profiting from Technology' 2003 Harvard Business School Publishing Corporation

What is Systems Engineering?

Modern defence equipment and services delivered using equipment generally rely on discrete elements, often complex in their own right, relating to each other in a planned and well understood way. This combination of different elements, delivering an overall result which is greater than the sum of its parts, is a system, and military capability is delivered through systems.

Systems engineering is the general term for the methods used to provide optimally engineered, operationally effective, integrated systems that work. Systems engineering balances capability, risk, complexity, cost and technology choices to provide a solution which best meets the customer's needs.

21. The challenge for both MOD and Industry is to encourage and create an environment in which an open innovation approach can develop, despite small production volumes and a limited opportunity for profit.

The Typhoon has significant technology innovation over its predecessor, Tornado. But revolutionary rather than incremental approaches can carry high-levels of technical risk and lead to project delays.

22. Through smarter approaches to systems engineering we aim to:

- Provide a clear framework for beneficial technology insertion and the supply network to deliver this
- Maximise the use and re-use of investment and development across multiple defence applications, as well as through-life capability enhancements
- Firmly embed the use and benefits of systems engineering throughout the capability life cycle
- Identify technologies that are likely to evolve rapidly in order to target the areas where we need to design for modularity and insertion.

IV. Improved Business Models

23. A constant theme in innovation literature is the "valley of death"[9] and the difficulty in stimulating appropriate risk and reward between Government and Industry. The valley of death reflects a funding transition from R&D to the prototype and manufacturing phases, resulting in a gap where many innovations starve of funds and often or not die.

24. We need to encourage greater financial contribution to R&D from other sources of funding and from within the technological supplier network, for example by allowing investors to see benefits from developing wider markets and providing more cost effective products and services. We need to ensure appropriate safe-guards for Intellectual Property but recognise the advantages other financial contributions bring to market size and sustainability. As the Office of Government Commerce report on 'Small supplier… better value' points out, 'SMEs can bring innovation through, for example: the early exploitation of new technology, providing products or services in new or underdeveloped markets, or by using innovation to differentiate themselves from

9 Managing Defence Research – NAO Report 2004

established market players'[10]. We need to ensure organisations, including SMEs, which provide technology innovation to Prime Contractors will be fairly rewarded for their contribution. We need to develop an environment which creates trust and encourages entrepreneurs within the defence industry. Additionally, recognising that a significant proportion of SME contribution to defence acquisition will be acting as sub-contractor, we need to encourage larger suppliers to form alliances with smaller creative partners.

25. The Office of Government Commerce suggested that public sector procurement has not always exploited innovations from suppliers, partly due to public sector procurement practices and partly due to supplier issues in marketing to the public sector. 'There is a tendency to opt for low-risk solutions, low-margin players and mature technology – innovation is not routinely welcomed or rewarded'[11]. Sensitivity to failure and the very risk averse and conservative acquisition culture adopted over the years has led to a lack of innovative solutions. We need a more balanced view of risk taking and to recognise that innovation can actually reduce risk. This includes using technology insertion as a way of managing technological risk through the use of incremental acquisition.

26. We have a wide range of available business models but there is a tendency for both MOD and industry to apply terms of business through precedent, irrespective of the type of research and development being procured. This leads to processes that appear not to be flexible, transparent or fast enough to engage with many of the highly innovative suppliers.

27. Our strategy will be to ensure that the right business models are used to encourage and reward innovation in meeting MOD's needs. We also need greater transparency in our models, e.g. clearly communicating tender evaluation processes. In addition, we will investigate new business models to address the 'valley of death' and ensure a smoother pull through of R&D. MOD must provide leadership in exploring new contractual mechanisms and business models. We must learn from civil sectors, for example contracting for service availability rather than equipment and its support. We need contractual incentives where supplier and client can share the benefits of developing innovative solutions to meet changing needs.

28. Through the development of new business models we aim to:

- Ensure organisations (including SMEs), who provide innovative technologies to Prime Contractors, are fairly rewarded for their contribution
- Develop Partner and Consortium based approaches to technology (with shared incentives) to encourage innovation, including the ability to integrate emerging participants
- Facilitate the transition of promising technology from research funding into the acquisition programme (overcoming the 'valley of death')
- Develop a stronger defence industrial base, encouraging the contribution of suppliers (both traditional and non-traditional) to complex solutions.

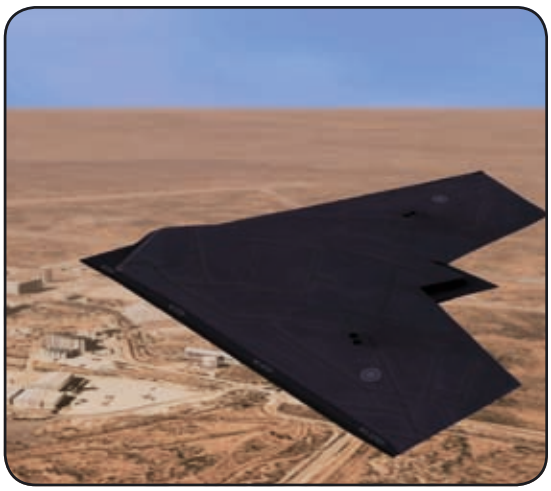
V. Need for Speed

29. Rapid exploitation of innovation in military equipment is crucial to achieving a battle-winning edge as it provides a technological advantage over our opponents. This is particularly important when these opponents are becoming better at evolving the threat and exploiting new technology more rapidly against the UK's Armed Forces. The need for speed is covered more generally in the Defence Industrial Strategy, which addresses overall agility in the wider context of capability management and acquisition. However, not only do we need to increase the pace that technology is taken up but we need to improve the flexibility of MOD's processes and commercial models, to ensure they align with our most innovative suppliers. Recognising that 'SMEs can find the cost of long tendering processes to be prohibitive'[12], we must change our tendering and contracting procedures to ensure SMEs can become part of MOD's acquisition team. By this means, we will

10 'Small supplier… better value', CP0083/12/05 Office of Government Commerce 2005.

11 Office of Government and Commerce, Capturing Innovation, 2004.

12 'Small supplier… better value', CP0083/12/05 Office of Government Commerce 2005.



The TARANIS industry led consortium to develop an unmanned aerial vehicle, involving MOD and industry funding. (Image courtesy BAE Systems©)

encourage involvement by other companies not usually associated with defence business.

30. Unsolicited innovative proposals can be difficult to handle as MOD may not recognise a requirement, there may be no funding stream or the cost of implementing the idea may be prohibitive. However, we recognise that a number of ideas can lead to improved equipment and reduced costs. We therefore need to respond swiftly to innovative ideas and emerging trends.

31. By increasing the pace of MOD's processes and models we aim to:

- Attract innovators who have novel, cost effective, high impact technologies
- Provide a quick response to innovative technology proposals
- Increase entrepreneurship and the number of 'start-up' companies within the Defence supply network.

Innovation culture

32. The optimum environment for innovation in MOD and the defence supply chain requires both a motive to innovate (a challenge and financial reward) and the freedom to innovate (skills and entry points into programmes). However, equally important is a culture which embraces innovation within the defence acquisition environment and this is a key enabler across all five pillars of innovation.

33. An innovative culture is one that focuses on problem-solving and allows individuals to challenge and apply independent thinking. We need to set clear corporate goals that reflect innovation. Such goals must create a culture where personal development objectives include innovation and individuals are fairly rewarded in meeting these objectives. We will only succeed in increasing innovation within the defence supply chain, if we develop a culture where conventions can be challenged, information is shared and valued as much as our tangible assets, and where a value is placed on the speed of decision making over any delays stemming from a fear of making the wrong decision.

34. There is a perception that MOD is not receptive to innovation as it leads to increased risk. We must balance the risk, recognising that innovation can lead to reduced risk in terms of better processes or reduced costs. Given that the start of a tender is sometimes the first a supplier hears about a new requirement, the time scales can be too short for innovative solutions to be developed. Additionally, our tendering activities rarely evaluate innovation and we do not encourage variants to the core or standard specification. We need to develop a culture in which we engage suppliers and the end user in forming requirements, with a greater emphasis on experimentation to refine these requirements. We must encourage innovation in tendering activities, selecting the appropriate defence conditions and making our processes transparent to our suppliers. We will use standard terms of business to streamline the contracting process but ensure that when a business model and terms and conditions are chosen, selection is done to achieve the most effective and innovative output and outcomes.

35. The Defence Acquisition Change Programme has work underway designed to enable and encourage the adoption of alternative acquisition approaches, where appropriate. One of the objectives for this change programme is to increase the agility of the MOD's current acquisition approach.

36. The Defence sector must also learn from other, apparently unrelated, business sectors to identify best practice in processes and supply chain management. Today, we can see an open innovation approach in high technology industries such as information technologies

and communications. There are also signs that many industries are in transition to an open innovation culture, including the automotive, pharmaceutical, biotechnology and US defence industries.

Science and engineering skills to support the research and innovation base

37. The UK Government recognises the need for a stronger supply of skilled R&D staff and the defence sector is no exception. UK industry has suffered from a shortage of skilled scientists and engineers (41% shortfall), skilled technicians (32%) and managerial and professional skills (28%)[13]. According to the Organisation for Economic Cooperation and Development (OECD), the UK has 5.5 researchers per 1,000 people employed (below the OECD average of 6.5) compared to 7.1 in France, 8.6 in the US and 15.8 in Finland[14].

38. The Roberts review[15] found that fewer students were choosing to study science and engineering disciplines (there has been a decrease in A-level entries in mathematics, physics, chemistry, computer science and biology of 7.5% from 1997 to 2004) and it concluded that attractive alternative careers for science graduates would constrain their supply to R&D employers and reduce innovation. And even though the Government Chief Scientific Adviser recently pointed out that the proportion of students studying for degrees in science has increased from 38% to 41% between 1997/98 and 2003/04, the increases were mainly in biological and computer sciences and there are still relatively few students entering mathematics, physical science and engineering degrees[16]. Whilst the recent Sainsbury review[17] of science and innovation indicates a recovery, particularly in the numbers of students taking mathematics, biology and chemistry A-levels, there is still a decline in numbers taking A-level physics. Overall, the review highlights a concern that the number of students entering the pipeline for science and engineering disciplines will not meet the future needs of the UK.

39. In MOD, our Engineering and Science Head of Profession, the Science and Technology Director is charged with meeting MOD's needs for R&D staff. In order to make use of both national and international R&D, MOD (including Dstl) and industry need in-house R&D staff with knowledge and systems integrations skills that can pull technologies together to develop capability solutions. This also includes a need for MOD staff to have a stronger awareness of industrial capabilities. In addition we will also want teams which have true technical depth and world class research expertise in those priority areas we wish to lead as a nation. Increasingly interdisciplinary teams make the greatest contribution to knowledge advances. We need to ensure MOD and the defence industry remain attractive as employers of engineering and science graduates, offering rewards both in interest and variety as well as financial.

40. Both the Minister (Defence Equipment & Support) and our Head of Profession are committed personally to increased outreach to schools and colleges in the promotion of science and engineering as an exciting and challenging career.

13 EEF South Employer Survey 2003

14 Strategic Science provision in English Universities. HOC Select Committee on Science and technology inquiry 2005.

15 Sir Gareth Roberts. SET for success – the supply of people with science, technology and mathematics skills, April 2002.

16 Science and innovation framework 2004-2014, July 2004.

17 Lord Sainsbury of Turville, The Race to the Top, a review of Government's Science and Innovation Policies, HM Treasury October 2007

Chapter 2

Taking Forward the Innovation Strategy

41. In chapter one we presented a strategy for innovation in UK defence by identifying five enabling pillars. In this chapter, we set out the actions we will take forward against each pillar in the first steps to create a new environment for innovation within defence. The challenge to MOD (including Dstl), industry and academia is to take up these actions.

42. We will generate fresh approaches to achieve future capability by **sharing the vision for defence capability,** in particular we will:

- Set out our high level visions and strategic research challenges for future military capability (where security constraints allow) in the newly created Defence Technology Plan (see below), in terms that suppliers and potential suppliers can readily understand. This includes learning the lessons from and a continued commitment to the on-going Grand Challenge
- Publish a forward looking plan for future equipment needs and encourage wider participation in the formulation of new equipment capability concepts.

43. To develop **Capability & Technology Road Mapping**, we will produce a new, dynamic Defence Technology Plan that will set out how MOD will deliver its research needs which, like the Acquisition Operating Framework (AOF), will be published on the internet. The Defence Technology Plan will clearly express MOD's R&D in terms of Defence benefit, policy aims, capability target, R&D output, Defence Lines of Development, delivery route, timeframe and priority. **The Defence Technology Plan will be published in late 2008**. We will take best practice from industry, together with existing guidance already set out for Through-Life Management Plans and technology mapping in the AOF, to develop roadmaps for MOD technology and capability research, which will provide an effective means of communicating visions of the future to technology suppliers.

44. The Defence Technology Plan will enable MOD and industry to make strategic decisions on the content and priorities of MOD's R&D, and hence allow balance of investment decisions where resources are limited. It will form the basis of our national and international partnerships with academia, industry and allies. It will identify strategic technical challenges for the future, ensuring that the R&D community takes appropriate steps in the correct timeframe to develop capabilities to maintain the competitive edge of our Armed Forces. This will involve identifying capability visions, evolving technology and considering the defence impacts of disruptive technologies.

45. The technology road maps within the Defence Technology Plan will set out detailed performance, cost and time parameters for elements of sub-systems research, together with the milestones required for integration into the

broader capability themes and the Equipment Programme Plan. The Defence Technology Plan will allow suppliers to understand the priorities and value the various technology elements have within the broader capability and Equipment Programme Plan.

46. To achieve **smarter systems engineering** and the effective integration of technologies and sub-systems to form new capability or upgrade existing capability, we will:

- Develop our capability formulation and procurement processes, including IPR guidance, to encourage adaptable systems and where appropriate, use modular architectures, with open and standard interfaces. Increasingly, such open architectures and standards will be mandated and rigorously enforced
- Work with the National Defence Industrial Council Research & Development Group to identify the scope and framework for 'open architectures in Defence' and identify Systems Engineering tools and processes to be adopted across the supply chain **by summer 2008**
- Embed the principles and use of systems engineering and architecting at all levels from initial capability formulation through to equipment and support delivery
- Increase the use of research concept demonstrators to take forward development of selective sub-systems which encourage innovation and provide a visualisation of particular elements of military capability.

COMPETITION OF IDEAS

The Competition of Ideas (COI), launched in October 2006, was developed by the Science Innovation Technology Top Level Budget (TLB) to stimulate scientific, innovative and technological capabilities of academia and industry, and to support the implementation of the Defence Technology Strategy.

COI is open to all ideas which could benefit Defence, however as a stimulus the broad subject areas of real interest are:
Prediction of Intent – Improving the accuracy of prediction and maximising the time between the forecasting of an event and its occurrence in the real world
Protection – Safeguarding assets by such means as restricting access to weapons, keeping assets from view, reducing the recognition of assets once in view, provision of barriers to deny access to visible assets and reducing the impact of weapons on assets
Automatic Object Recognition – Methods of sensing and classification of objects based on physical attributes and behavioural traits
Ad Hoc Networking – Spontaneous formation of people, equipment, media and information networks with self forming command and control hierarchies in support of rapid and robust decision making

The Competition of Ideas is an online service for the UK science and engineering base to offer their research ideas and gain funding from the MOD. The proposals are input online and assessed by subjects matter experts within MOD.

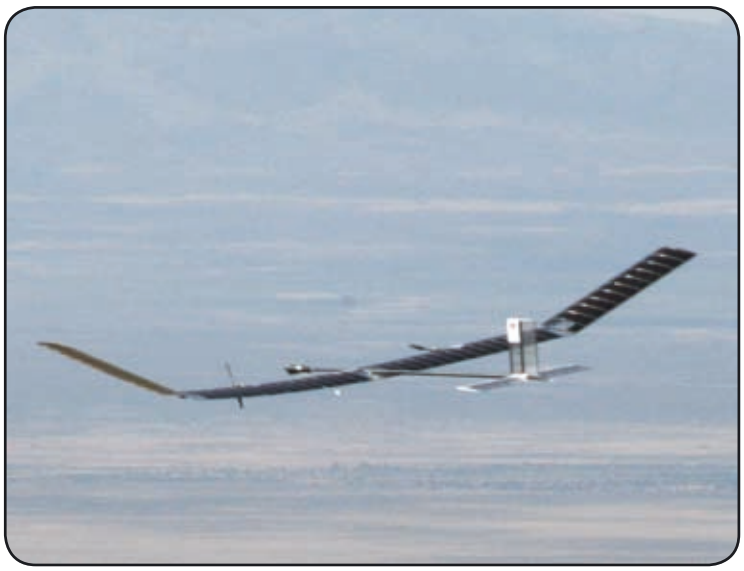
After assessing all submissions, MOD has offered 66 contracts. Of these 22 contracts are being awarded to Universities, 19 to small and medium sized businesses (SMEs) and the rest to larger businesses. These projects represent an investment of about £11 million into new ideas.

COI is web based with a simplified bidding and contracting process specifically designed to make it easier for small businesses and academia in particular to obtain support for ideas.

The contracts awarded range from short term projects that we hope to exploit as soon as possible, to projects over the next three years looking at more fundamental developments.

47. To achieve **improved business models** we will:

- Explore ways in which to bring innovators, Government, defence industry and entrepreneurs together early in the process of understanding our capability needs
- Work with the National Defence Industries Council Research & Development Group to investigate a number of new business models and work with other commercial model development being led by the Defence Commercial Director
- Investigate a rebalancing of the UK's public and private funded Science and Technology investment to achieve a more even coverage over the defence value creation chain, to bridge the "valley of death"
- Develop consortium-based approaches which ensure SMEs and other non-defence suppliers can effectively feed innovation into defence equipment and services
- Select the right business models, where appropriate, to encourage and reward innovation in meeting MOD's needs. We will clearly communicate our chosen business models and evaluation processes early in the procurement cycle.



Zephyr is a High Altitude Long Endurance (HALE) UAV, which uses a combination of innovative light weight airframe material, solar cell and battery technologies to provide sustained performance at high altitude. (Image courtesy of QinetiQ©)

Working more effectively with a broader supplier base:

- the Defence Technology Plan identifies those technologies we believe are critical to defence;
- through 'Suppliers Days' we present the R&D challenges we face and the effects we seek;
- increasing the amount of the research programme open to competition should broaden and deepen the supplier base;
- partnering with industry and universities in our 6 Towers of Excellence to share benefits and costs and increase the pull through of technology;
- Defence Technology Centres (DTCs) foster collaboration with industry and universities;
  - jointly funded by MOD and industry;
  - MOD has earmarked £90 million to the DTCs over a 5 year period;
  - they are diverse and cover; Data and Information Fusion; Human Factors Integration; Electromagnetic Remote Sensing and; Systems Engineering for Autonomous and Systems;
- Competition of Ideas provides a new mechanism to engage a wider supplier base for inovative ideas.
- The Grand Challenge poses a difficult urban situational awareness problem to a new group of innovators.

48. Rapid exploitation of innovation in military equipment is crucial to achieving a battle winning edge. To underpin the **need for speed** we will:

- Develop standard terms of business for R&D, which will allow a more agile and streamlined contracting process
- Use the Supplier Engagement Team to improve awareness of SME innovation to MOD and its primes through greater use of 'show-case' events
- Move to a more agile acquisition process, which includes providing a quicker response to innovate technology proposals
- Investigate the role of specific review or ginger groups to challenge the use of innovation within the acquisition and capability management communities. Such teams will need to be independent of Military customer or Sponsor and DE&S but must involve the Front line in the Armed Forces or User
- Transform our research organisation structure to allow better communication channels with industry, including SMEs and academia.

THE GRAND CHALLENGE

The Grand Challenge, launched in November 2006 at the Science Museum, is a major technology activity as part of the Defence Technology Strategy to find new ideas and encourage innovation, opening up UK Defence to new suppliers and investors. The Grand Challenge welcomed proposals from the whole UK science and technology base; large and small companies, research laboratories and academic science faculties. The challenge is to design a system with a high degree of autonomy that can detect, identify, monitor and report a comprehensive range of military threats in an urban environment.

The Grand Challenge is a competition for teams to solve the problems faced in performing a specific task: using technology to reconnoitre a specific urban area. Teams have 1 year to devise a system which will have one hour to investigate an urban area approximately 100m by 100m.

In total the competition MOD received 23 proposals from industry and research institutions. Since the deadline for proposals in May 2007, MOD has chosen to fund 6 teams, these teams include 17 SMEs, 7 universities and 2 schools. A further 8 teams have entered the Challenge with private funding. The proposed systems include ground and aerial unmanned vehicles. At an inauguration day on 30 July 2007 at Copehill Down Village, the Minister for Defence Equipment & Support, announced the chosen teams to compete in the Finale in August 2008. The inauguration allowed the teams a valuable opportunity to familiarise themselves with the challenges faced by UK armed forces in an urban environment. Such threats include marksmen and improvised explosive devices (IEDs).

The Grand Challenge is a specific project to introduce the needs of UK Defence to the whole of the UK science and engineering base. Working through Regional Development Agencies, SMEs and universities have been encouraged to participate. The best ideas generated could receive development contract.

The teams have until summer 2008 to develop their systems. There will be site visits in January 2008 and a Pre-Qualification event in early summer to ensure that the competitors' systems are safe and suitable for the Finale in August 2008. More information at www.challenge.mod.uk

Produced by DGMC DefPR Graphics on behalf of the Ministry of Defence