

## Appendix E

### **Extracts of the United Kingdom's 'Defence Industrial Strategy: Defence White Paper' (December 2005)**

This appendix supplements the Committee's comments in paragraph 2.220 in chapter two. The most relevant pages of the White Paper have been extracted:

- The White Paper's Executive Summary (pages 6 to 11), which provides an overview of the UK's approach to the defence industry established in 2005; and
- A section of the White Paper relating to the maritime sector (pages 68 to 77), which discusses measures specific to ships, submarines and related systems.





# Defence Industrial Strategy

## Defence White Paper

Presented to Parliament by  
The Secretary of State for Defence  
By Command of Her Majesty

December 2005

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**C**

Implementing the  
Defence Industrial Strategy

# Executive Summary

i. The Defence Industrial Strategy (DIS) is structured in three parts: Part A, providing the strategic context; Part B, reviewing different industrial sectors and cross-cutting industrial capabilities; and Part C, outlining the implications for MOD and industry as a whole, and how the DIS will be implemented.

## Part A – Strategic Overview

ii. The global security environment in which the Armed Forces operate has changed substantially over the past fifteen years. Facing new and complex challenges, the roles, size and shape of Armed Forces have also changed. In parallel, the defence industry has evolved; defence companies are now often transnational, needing to attract and retain investors in international markets – forcing increased efficiency, restructuring and rationalisation. We are now reaching a crossroads.

iii. Although we are in the middle of a substantial transformation, involving a series of major new platforms (including the future aircraft carriers, Type 45 Destroyers, new medium-weight armoured fighting vehicles, and the A400M, Typhoon and Joint Combat Aircraft), we expect these platforms to have very long service lives. This means the future business for the defence industry in many sectors will be in supporting and upgrading these platforms, rapidly inserting technology to meet emerging threats, fulfil new requirements and respond to innovative opportunities, not immediately moving to design the next generation.

iv. In parallel, industrial rationalisation continues, and sustaining competition to meet domestic requirements is increasingly difficult. In several sectors, following the entry into service of major projects, there will be substantial overcapacity in production facilities in the UK defence industry in a few years' time.

v. As we look to non-British sources of supply, whether at the prime or subsystems level, we need to continue to recognise the extent to which this may constrain the choices we can make about how we use our Armed Forces – in other words, how we maintain our sovereignty and national security.

vi. Companies now have more choice than ever before about which markets to enter, which secure the best return for shareholders, and where to base their operations. If we do not make clear which industrial capabilities we need to have onshore (and this includes those maintained by foreign-owned defence companies), industry will make independent decisions and indigenous capability which is required to maintain our national security may disappear.

vii. Equally, we do not seek to restrict the scope for international cooperation and competition where this is appropriate, and we cannot afford to maintain a complete cradle-to-grave industrial base in all areas. As industry has told us, greater clarity is therefore needed urgently on which capabilities must be retained onshore, and which by implication can be met from a wider market. The DIS does not seek to set out a preferred route to international restructuring; that is very much industry's business. But it does seek to create a clear UK context to inform these decisions.

## Our aim in the DIS

viii. For these reasons, we need to consider how best the MOD should seek to engage with the industrial base in order to meet our requirements. The DIS flows from the wider Defence Industrial Policy (2002), and is 'driven by the need to provide the Armed Forces with the equipment which they require, on time, and at best value for money for the taxpayer.' The DIS is thus one of many contributions to the wider aim of ensuring that the capability requirements of the Armed Forces can be met, now and in the future.

ix. The DIS will promote a sustainable industrial base, that retains in the UK those industrial capabilities needed to ensure national security. Our interaction with this industrial base must provide good value to the taxpayer and good returns to shareholders based on delivery of good performance, consistent with broader security and economic policy.

x. To deliver this, the DIS:

- gives a strategic view of defence capability requirements going forward (including new projects, but also the support and upgrade of equipment already in service), by sector. Part of the strategic view is specifying, in order to meet these, which industrial capabilities we would wish to see retained in the UK for Defence reasons. We aim to communicate the overall view to industry as clearly as possible, recognising that plans change as the strategic or financial environment evolves (and the DIS explains our current internal planning process, to allow industry to make informed judgements about how to interpret this information);
- gives further detail on the principles and processes that underpin procurement and industrial decisions;
- where there is a mismatch between the level of activity our own plans (and export/civil opportunities) would support and that required to sustain desired industrial capabilities onshore, investigates how we might with industry address that gap.

## The evolving market and the UK business environment

xi. We recognise that in the UK we have a successful and sophisticated industrial base with a broad range of capabilities and which delivers a large proportion of our defence equipment and services. We welcome overseas investment where this creates value, employment, technology or intellectual assets in the UK.

xii. We also recognise the attractions of the US market, given its scale and high levels of investment in research and technology, and that the level of influence and attractiveness of MOD business varies by sector and by type of company. But the UK provides a unique environment for the defence industry:

- a greater proportion of our overall business is available to industry than in any other major defence nation, and growing expertise in the combination of systems engineering skills, agility and supply chain management required to deliver through-life capability management gives the UK defence industry a comparative advantage;

- we have a sophisticated demand for high-value products which have to stand up to active service, and consequently, are easier to market to export customers;
- we have an open market and diversity of suppliers which encourages innovation, new entrants and inward investment;
- and profit potential and a trading environment which is open to new procurement models, including long-term partnering arrangements, which incentivise industry to drive down costs but allow increased profits where these are earned by improved performance;
- in addition, the Government helps sustain an attractive overall business environment, including:
  - a stable macro-economic and political environment;
  - leadership in science & technology, including by targeted MOD investment;
  - low costs;
  - Strong support industries in finance, business services, design and marketing;
  - a highly skilled and flexible labour force;
  - a transparent business environment that encourages fair competition;
  - specific support to the Defence industry, including the Defence Export Services Organisation.

xiii. We also recognise that the bedrock of our procurement policy has to be long-term value for money. Competition is often a useful mechanism to establish this, but is not always appropriate, and needs to be used intelligently, alongside other models, considering the nature of the marketplace. The UK has increasing experience of new approaches which may apply in different circumstances, and by setting out how we approach different situations, and the various tools available, we hope in future to speed the decision-making process significantly, and pick the right tool from the toolbox first time. We also recognise the need to improve the earned profit margins available to industry based on good performance if we are to attract global investment capital into the UK defence industry.

xiv. The priority for the DIS is in ensuring that UK industry can meet the requirements of the Armed Forces, both now and in the future. Wider factors, as set out in Chapter A9, will continue to be considered in acquisition decisions. The key to ensuring that a chosen procurement strategy is most suited to the circumstances of a particular project is to expose the wider factors which impinge upon that project at the earliest opportunity, engaging relevant Government stakeholders from the outset in order to do so.

### Identifying and sustaining Key Industrial Capabilities

xiv. Every nation ideally wants to keep under its control critical defence technologies, but no country outside the US can afford to have a full cradle to grave industry in every sector, and our Armed Forces continue to benefit from the extensive range of foreign-sourced equipment currently in service. And it is readily recognised that much of the equipment procured from UK prime contractors contains non UK sourced content. We welcome the progress made in establishing understandings on security of supply and the decision to introduce an EU Code of Conduct on Defence Procurement which aims to create an effective European Defence Equipment Market. We continue to welcome overseas products, and indeed in many significant areas rely on overseas supply, with appropriate guarantees (which may include technology access to ensure we can adapt equipment to meet national requirements over time) and/or judgement that any increased risk to maintaining our operational independence is acceptable.

xv. The UK also retains a sizeable, open and broadly-based defence industry which delivers a large proportion of MOD's needs, and we welcome overseas investment, especially from companies that create value, employment,

technology or intellectual assets in the UK and thus become part of the UK defence industry. Within this strategy, we aim to tell industry very clearly where, to maintain our national security and keep the sovereign ability to use our Armed Forces in the way we choose, we need particular industrial capabilities in the UK (which does not preclude them being owned or established by foreign-owned companies). We have therefore assessed industrial capabilities against national security priorities, broken down into:

- strategic assurance (capabilities which are to be retained onshore as they provide technologies or equipment important to safeguard the state, e.g. nuclear deterrent);
- defence capability (where we require particular assurance of continued and consistent equipment performance);
- and strategic influence (in military, diplomatic or industrial terms), as well as recognising potential technology benefits attached to these which have wider value. But as the DIS makes clear, even where we wish an industrial capability to be sustained in the UK for strategic reasons, that does not necessarily preclude global competition in that sector for some projects.

## PART B – Review by Industrial Sector and Cross-cutting Capabilities

### B1. System Engineering

xvi. Given that the new platforms being brought into service are likely to remain in our inventory for many years, and are increasingly complex, it is little use investing in cutting-edge science unless systems engineering capability and vital long-term knowledge is maintained. New technologies will have less benefit if the knowledge of how they might best be exploited and inserted into existing equipment has been lost. This demands a high level of systems engineering skills, at all levels of the supply chain (recognising that much of a platform's capability is delivered through its subsystems, which will often be the route to upgrading capability), sustained through the life of the equipment. The significance of this capability varies by sector, but it is generally very important for maintaining our control of how we operate our Armed Forces.

### B2. Maritime

xvii. We require versatile maritime expeditionary forces, able to project power across the globe in support of British interests and delivering effect on to land at a time and place of our choosing. To sustain this capability:

- it is a high priority for the UK to retain the suite of capabilities required to design complex ships and submarines, from concept to point of build; and the complementary skills to manage the build, integration, assurance, test, acceptance, support and upgrade of maritime platforms through-life;
- For the foreseeable future the UK will retain all of those capabilities unique to submarines and their Nuclear Steam Raising Plant, to enable their design, development, build, support, operation and decommissioning. MOD and industry must demonstrate an ability to drive down and control the costs of nuclear submarine programmes;
- We also need to retain the ability to maintain and support the Navy.
- There are a number of specific key maritime system capabilities and technologies which we should retain onshore, and the ability to develop and integrate into platforms complex maritime combat systems is also a high priority.

xviii. In the past, we have specified that all warship hulls should be built onshore. However, the national security requirement surrounds the ability to upgrade rapidly, integrate highly complex and sensitive subsystems, and launch operations from the UK base. To sustain this requires a minimum ability to build as well as integrate complex ships in the UK, not least to develop the workforce, and to adjust first-of-class designs as they develop. At issue is the capacity required. The Future Aircraft Carrier, Type 45 Destroyer and Astute projects will keep the UK shipbuilding industry fully employed for some years (and it may not have the fabrication capacity to absorb the full programme at its peak), but from around 2016, the steady-state demand will be significantly lower. The business must be streamlined for greater efficiency and profitability. The clear trend is for fewer more capable platforms, able to incorporate upgrades as necessary to respond to new technologies and threats. The ability to do so will depend upon us working together with industry to address the fundamental issues of affordability and productivity. The industry, which is currently fragmented, needs to consolidate and refocus around a core workload which sustains key capabilities and represents a viable business. Provided our key capabilities are maintained, not all of them must be exercised onshore for every project, and the strategic need for onshore execution will be judged on a case by case basis.

xix. We will immediately start negotiations with the key submarine companies with the aim of achieving a programme-level partnering agreement with a single industrial entity for the full life cycle of the submarine flotilla, addressing key affordability issues. The aim is to achieve this agreement in time for award of the fourth and subsequent Astute Class submarines. For Surface Ship Design & Build, within the next six months, we aim to have reached a common understanding of the core load required to sustain the high-end design, systems engineering and combat systems integration skills that we have identified as being important. We expect industry to begin restructuring itself around the emerging analysis to improve its performance, and shall build on the momentum generated by the industrial arrangements being put together on the CVF programme to drive restructuring to meet both the CVF peak and the reduced post-CVF demand. For surface ship support, we will start immediate negotiations with the industry with the aim of exploring alternative contracting arrangements and the way ahead for the next upkeep periods, which start in the autumn of 2006. Key Maritime Equipment industrial capabilities will be supported by the production of a sustainability strategy by June 2006.

### **B3. Armoured Fighting Vehicles (AFVs)**

xx. The AFV fleet is key to the Land Forces' military effectiveness. There are compelling advantages to retaining a UK industrial AFV capability to maintain and upgrade the capability of current and future equipment. We seek to maintain in the UK AFV Systems Engineering, Domain and Design Knowledge for though life capability management, including the ability to act as an intelligent customer for the design, development and manufacture of new AFVs and their integration into networks. We also need the intellectual ability to design, validate and interpret the results of AFV testing, though most test and evaluation facilities do not necessarily have to be on-shore. We also wish the UK defence industry to be able to design, build and integrate onto the platform AFVs' critical subsystems, including electronic architecture, sensors and integrated survivability solutions. We also need to be able to repair and overhaul AFVs onshore, and we need the industry to be able to respond quickly, including through deployed support on operations. For future projects, we need industry to deliver the complex system of systems that will make up the Future Rapid Effects System (FRES) fleet.

xxi. It is questionable whether any single company has the ability or expertise to provide all elements of the FRES capability cost-effectively. The most likely solution will be a team, led by a systems integrator with the highest levels of systems engineering, skills, resources and capabilities based in the UK, in which national and international companies cooperate to deliver the FRES platforms, including the required subsystems.

xxii. The UK AFV industry has consolidated so that BAE Systems Land Systems (LS) is the supplier of 95% of our current inventory. We need to manage this in-service fleet through life whilst still retaining access to best of market products at subsystem level. Building on discussions already set in train, we will work hard with the company to give effect to the long-term partnering arrangement required to improve the reliability, availability and effectiveness through-life of our existing AFV fleets. We intend to establish a joint team early in 2006 to establish a business transformation plan underpinned by a robust milestone and performance regime. We expect to see a significant evolution of BAE Systems Land Systems both to deliver AFV availability and upgrades through life, and to bring advanced land systems' technologies, skills and processes into the UK. If successful in their evolution, BAE Systems will be well placed for the forthcoming FRES programme.

### **B4. Fixed wing**

xxiii. Air power continues to offer the ability to transform the battlespace, utilising its inherent attributes of reach and speed to enable strategic operational and tactical agility. We are introducing two new, highly sophisticated manned combat fast jets, Typhoon and the Joint Combat Aircraft, which are intended to last for more than 30 years. Current plans do not envisage the UK needing to design and build a future generation of manned fast jet aircraft beyond these types. However, precisely because the current fleet and the new types we are introducing are likely to have such long operational lives, we need to retain the ability to maintain and upgrade these types for a considerable period.

xxiii. The focus must shift to through-life support and upgrade and what is required to sustain this critical capability in the absence of large-scale manufacture. MOD has been working closely with BAE Systems, as the UK's only supplier of fast jets, for some time to understand these mutual challenges, which are likely to impact on the UK industrial footprint, in particular around BAE Air Systems' four main production sites. We intend to continue to work together to explore how a long term partnering arrangement for the through-life availability of a significant proportion of the fixed-wing fleet might be delivered to sustain these capabilities and deliver improved value for money. We aim on working during 2006 to develop the solution – which will be challenging given the scale of the transformation that is required – and to implement it from 2007.

xxiv. We and industry share a close alignment of interest in UAV and UCAV technology. Although at present we have no funded UCAV programme, targeted investment in UCAV technology demonstrator programmes would help sustain the very aerospace engineering and design capabilities we will need to operate and support our future aircraft fleet. Such investment would also ensure that we can make better informed decisions which will need to be taken around 2010-2015 on the future mix of manned and unmanned aircraft. Additionally, UK industry will have the opportunity to develop a competitive edge in a potentially lucrative military and civil market. We intend to move forward with a substantial joint Technology Demonstrator Programme in this area. We hope that appropriate arrangements will be in place to allow this to proceed in 2006.

xxv. Our plans to retain onshore the industrial capabilities required to ensure effective through-life support to the existing and planned fast jet fleet – and to invest in developing UCAV technology – will also provide us with the core industrial skills required to contribute to any future international manned fast jet programme, should the requirement for one emerge. This recognises both the uncertainty of our very long term requirements – with the possibility that we shall want to replace elements of the Typhoon and Joint Strike Fight fleets with manned aircraft – and that we should avoid continuing to fund industrial capabilities for which we have no identified requirement.

xxvi. Critical mission systems, including electro-optical (EO) sensors, radar, Electronic Support Measures (ESM) and Defensive Aids Systems (DAS) are also significant areas where we wish to retain onshore capability and where suppliers must be able to work with the prime contractor and be rewarded for developing new solutions.

xxvii. Our need to retain a minimum level of onshore capability does not necessarily mean that we will need to support all aspects of our aircraft in the UK. For Typhoon, we will work with our partners to create a better and more efficient business model for the aircraft's support and upgrades, ensuring that we retain onshore our ability to satisfy our sovereign requirements over its lifetime. Clearly, BAE Systems, and, for the engines and mission systems respectively, Rolls-Royce, Smiths Aerospace and Selex Sensors and Airborne Systems will have a significant role to play in this..

xxviii. For the Joint Strike Fighter, the through-life support of the UK aircraft will be provided from the Lockheed Martin Global Support System which is being established on a co-operative basis amongst the nine JSF partner nations. As part of this performance based arrangement, the UK also intends to establish sovereign support capabilities which would provide, in country facilities to maintain, repair and upgrade the UK fleet and an Integrated Pilot and Maintainer Training Centre. Our aim is that BAE Systems as a key JSF Industry partner to Lockheed Martin will provide these support services in the UK under a Team JSF badge. There is no fundamental defence requirement for a JSF Final Assembly and Check Out (FACO) facility, although an ongoing joint study between MOD, DTI and BAE Systems, due to conclude in early 2006, is seeking to assess whether a UK FACO is necessary to preserve essential engineering skills within BAE Systems and would be a cost effective and affordable solution.

xxix. There is no sovereign requirement to sustain an indigenous capability in large and training aircraft. We will continue to need, however, the systems engineering and design skills and Intellectual Property Rights for the integration of new mission systems, avionics and defensive aids into these platforms.

## B5. Helicopters

xxx. Helicopters are inherently responsive, adaptable and flexible, and contribute to a variety of military tasks. They can operate in a very wide range of combat and environmental conditions, and will often be an essential part of a balanced expeditionary force.

xxxi. The helicopter sector has similar characteristics to the AFV sector – a high concentration of knowledge relating to the existing fleet, but a healthy international competitive environment. AgustaWestland's systems engineering capability needs sustainment to maintain our ability to support and upgrade the current fleet.

xxxii. Our preferred solution is to invest in the Future Lynx product, currently undergoing detailed capability and value for money assessment, to meet our Battlefield Reconnaissance and Surface Combatant Maritime Helicopter requirements and sustain the necessary Design Authority capability at the company in the short to medium-term. We intend to promote a more open, predictable but demanding partnered relationship with the company, to provide better value for money and reduce their reliance on our investment to sustain the design engineering skill-base, and accordingly intend to finalise a Strategic Partnering Agreement with AgustaWestland by Spring 2006. We will continue to look to the vibrant and competitive global marketplace to satisfy our future helicopter requirements (including for support). We also wish to keep different levels of capability onshore in rotorblades, mission systems, survivability, vibration management and electronic architecture.

## B6. General munitions

xxxiii. Recent operations have clearly demonstrated that despite the increases in technology, modern warfare, particularly on the ground, requires highly trained and motivated service personnel to engage in combat at a very personal level. It is in such engagements that quality general munitions are essential to provide the volumes of fire and the 24 hour, all weather capability required to suppress, neutralise and demoralise enemy forces. It is essential that we retain onshore the Design Authority (DA) role and its underpinning capability for munitions manufactured. We also require the ability to develop munitions for specific purposes to match our doctrine, and maintain an intelligent customer capability for non-UK designed munitions. A robust through-life management capability onshore is vital. It is also essential that we retain a proof and surveillance capability onshore for UK designed munitions as well as at least a minimum munitions disposals capability. We should also retain onshore the UK's insensitive munitions and related energetic materials capability, which are world-class. But we do not consider it necessary to retain all aspects of bulk explosives manufacture in UK and would be prepared to source small arms ammunition offshore if security of supply could be guaranteed; it is presently questionable given potential undercapacity in global supply.

xxxiv. In this sector, BAE Systems has the majority of the existing business, but there remain niche capabilities abroad and elsewhere in the UK which may meet future needs. We have therefore adopted a partnership with BAE Systems and are considering ways in which we can rationalise the through-life management of munitions, without ruling out the prospect of global competition for future projects at this stage. We also have partnering agreements with other suppliers (Rheinmetall and Wallop Defence Systems) in niche areas. We will reach further conclusions on how best to sustain our required access to general munitions in summer 2006.

## B7. Complex weapons

xxxv. Complex Weapons provide our Armed Forces with battle winning precision effects. The UK is making a significant investment in the upgrade and development of complex weapons, which peaks at just over £1BN next year and will reduce by some 40% over the next five years following the delivery of Storm Shadow and Brimstone. There is, apart from the Meteor programme, little significant planned design and development work beyond the next two years. This will present a substantial challenge to the industry.

xxxvi. There are some types of complex weapon that we have bought from overseas in the past, and we would be prepared to source future torpedoes from abroad provided we retain the capability to support the current inventory, write tactical software, and design and integrate homing heads. However, we would wish to maintain the ability to design, develop, assemble, support and upgrade other complex weapons, which is a complex task requiring a number of critical and sensitive underpinning capabilities. We also see the potential of Directed Energy Weapons.

xxxvii. The fragility of the wider UK industrial base is such that open international competition could put the sustainment of key industrial capabilities at risk. We intend to work with all elements of the onshore industry over the next six to twelve months to establish whether – and if so how – we can achieve a sustainable industry that meets our requirements in a value for money fashion. There is potential for industrial rationalisation and consolidation and we will need to work with other European governments to identify whether a coordinated approach to sustain a viable industrial base is possible. But this will not be to the exclusion of US-owned companies, in particular those who have established a firm foothold in the UK.

## **B8. Command, Control, Communication and Computers, Intelligence, Surveillance, Target Acquisition and Reconnaissance (C4ISTAR)**

xxxviii. This is a very significant area where we assume sustained expenditure. It will be the C4ISTAR related capabilities that will help underpin the overarching Network Enabled Capability essential to the continued transformation of our capability, by providing the technology to deliver agile, networked and informed Armed Forces.

xxxix. Much of the innovation is driven by the civil sector and we are in general a relatively minor customer in a market where the pace of technological change creates its own set of unique pressures. To maintain national security, we need to maintain in the UK specific industrial capabilities, including:

- High grade cryptography and associated information assurance capabilities;
- A continued ability to understand, integrate, assure and modify mission critical systems.

as well as intelligent customer status and a research and development base supported by a manufacturing capability in specific areas.

xxxx. There are a number of healthy companies with the requisite skills in the UK, and given civil opportunities in this sector and a large number of planned projects, competition by project seems sustainable for the foreseeable future. However, maintaining a cryptographic capability currently requires a specific strategy to sustain an end-to-end design, development and manufacturing capability. We are working with other government departments to generate better coherence across Government, and increase industry's visibility of the total opportunities.

## **B9. Chemical, Biological, Radiological, and Nuclear Force Protection**

xxxxi. We are committed to maintaining the UK's political and military freedom of action despite the presence, threat or use of CBRN weapons, and this is an area in which significant increases in investment are currently planned. We need the UK industrial base, which is a world leader in this field, to deliver intelligent supplier capabilities, systems engineering, specific technology research, as well as the supply of certain raw materials and the manufacture of medical countermeasures.

xxxvii. CBRN protection requirements have for some time been met through a healthy competitive industrial market place. We will explore however the potential costs and benefits of partnering, however, particularly with the four main industrial players in the UK (Smiths Detection, General Dynamics UK, Serco Assurance and EDS), to see whether other acquisition models could allow us to achieve rapid and innovative acquisition and achieve better value for money.

## **B.10 Counter terrorism (CT)**

xxxviii. Given the nature of the international terrorist threat, capabilities previously needed in specialist areas and in Northern Ireland are increasingly becoming required across the Armed Forces. This reinforces the importance of the counter-terrorism sector, and provides greater opportunities for both industry and MOD to become more cost-effective in the CT field.

xxxix. Although there are aspects of the technology base within the development, manufacture and sustainment of a CT system that need to

be retained within UK industry, it is primarily within the areas of systems engineering (including design and development), testing and evaluation, and system packaging that the MOD needs to be able to maintain critical elements of its CT capability onshore. We believe there is no urgent remedial action required to sustain these industrial capabilities.

## **B.11 Technology priorities to enable defence capability**

xxxxv. To support the industrial capabilities identified across the sectoral analysis there are a number of areas in which the UK must sustain existing technological strengths or where we should, resources permitting, consider developing our expertise. There are other technologies showing promise across a range of defence applications that may have either a large impact on specific defence capabilities or a more widespread impact across many aspects of defence. These are provisionally identified in the DIS, but we recognise we will need further work in 2006 to inform our research and technology priorities.

## **B.12 Test & evaluation (T&E)**

xxxxvi. T&E is vital to the development, introduction into service and through-life support of the equipment used by our Armed Forces. It contributes to a variety of activities which reduce risk to our Armed Forces. We use a mixture of in-house, Government Owned Contractor Operated (GoCo) and commercial T&E facilities in the UK to support the acquisition and sustainment of military capability. The majority of MOD T&E sites operated on our behalf by QinetiQ under the Long Term Partnering Agreement (LTPA). All these capabilities are kept under constant review to ensure that they continue to meet our T&E requirements and to identify potential rationalisation or efficiency opportunities.

xxxxvii. In some cases a UK based T&E capability is essential for, amongst other things, certain quality assurance, safety or operational security needs and sovereignty of access. In other cases the important element is to retain the ability to direct, understand, analyse and verify T&E results rather than actually conduct testing on-shore, subject to certain safeguards including security of supply. We will work with industry to identify where such distinctions can be safely made. Our current strategic intent in the medium term is to retain T&E capability within the UK, but to look for overseas cooperation where appropriate. Work in the European Defence Agency may lead, in due course, to a longer-term strategy to consolidate T&E capabilities across Europe.

## **PART C: Implementing the Defence Industrial Strategy**

xxxxviii. The DIS also presents real and fundamental challenges to the Ministry of Defence. The strategy will not deliver unless the whole of the defence acquisition community, including industry, are able to make the necessary shifts in behaviours, organisations and business processes.

il. The basic principles of Smart Acquisition still hold true and are a strong foundation from which to take forward the DIS. But our future approach to acquisition must be built around achieving primacy of through life considerations; coherence of defence spend across research and development, procurement and support; and successful management of acquisition at the departmental level. Our detailed implementation plan has specific initiatives to address the objectives of achieving:

- primacy of through-life considerations;
- coherence of defence spend across research, development, procurement and support;
- successful management of acquisition at the Departmental level.

i. The measures identified under these headings are necessary to improve our acquisition performance. But they may not be sufficient. We will appoint a senior official to review our current acquisition construct and recommend changes across the MOD's business with final recommendations by May 2006 for early implementation.

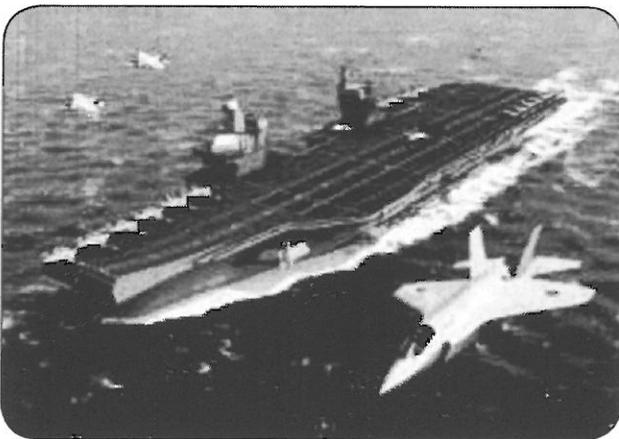
ii. We will be looking for parallel commitment from industry in the following areas:

- planning more effectively and jointly for the long term, embracing the vision of through-life capability management to meet our requirements cost-effectively;
- investing in growing and maintaining a high-quality systems engineering capability within the UK;
- promoting greater interaction and collaboration between MOD, prime contractors, SMEs and the universities to stimulate innovation in science, technology and engineering;
- encouraging trust, openness, transparency and communication with MOD at all levels;
- embracing open systems architecture principles and incremental acquisition approaches throughout the supply chain;
- working jointly to foster better understanding of each others' objectives and business processes, including a greater commitment to joint education, staff development and interchange opportunities.

iii. We will keep the progress of this work, and the extent to which real change is being demonstrated on the ground, under review within the MOD, through the Acquisition Policy Board reporting to the Minister for Defence Procurement. We will want formally to review progress with the National Defence Industries Council regularly. We will also review this Strategy as a whole once every Comprehensive Spending Review period.

### Definition

B2.1 The Maritime Sector is that element of the Industrial Base which designs, builds, supports and disposes of all naval platforms and systems. It encompasses ships, submarines, and their integral systems; including propulsion, services, combat systems and combat system elements. It draws extensively on other sectors, such as Guided Weapons, Aerospace and C4ISTAR (Command, Control, Communication and Computers, Intelligence, Surveillance, Target Acquisition and Reconnaissance). Maritime capability is delivered by the effective integration of platforms and systems, and their through-life support.



Future CVF & JCA (Computer generated image).

### Strategic overview

B2.2 The 2004 Defence White Paper, *'Delivering Security in a Changing World – Future Capabilities'*, emphasised the importance of versatile maritime expeditionary forces to project power across the globe in support of British interests and delivering effect on to land at a time and place of our choosing. Future maritime operations are likely to follow a similar, expeditionary pattern to those conducted recently. The sea offers an opportunity for UK Forces to operate with a degree of security and persistence, without reliance on the territory of others for basing. These factors, in particular the need for freedom to operate in an uncertain world, make the sea a very attractive location from which to project power. To take advantage of this the Royal Navy will in future need to be an agile, network enabled expeditionary force able to switch between missions and tasks and to interoperate with chosen allies. The force will have the ability to deliver and sustain a full range of missions: from small highly focussed interventions with Special Forces, to large, high intensity coalition operations, securing key influence in the process. This versatile maritime force will be capable of winning safe theatre entry for the deployment of joint forces. Through amphibious operations and a full range of medium scale offensive air effort, the versatile maritime force will deliver Maritime Strike and Littoral Manoeuvre to achieve decisive effect on the land.

### Equipment Programme

B2.3 We are currently in the middle of a substantial modernisation programme that will enhance the capabilities of the RN. It has particular emphasis on fewer but more capable platforms, focusing on the capability to conduct expeditionary operations.

B2.4 The two planned **Future Carriers (CVF)** will be the biggest surface ships ever to be built in the UK - and will carry a strike package of Joint Combat Aircraft (JCA). The CVF programme is subject to an incremental approvals process: Target In-service Dates (ISD) for the two vessels will be agreed when the manufacture phase is approved. Given that both France and the UK are embarking on major, complex carrier procurement projects, we are examining areas of mutual benefit and opportunities to deliver economies. It is for industry to put forward proposals which will be judged on their merits and in light of national policies. It has been agreed with France that for co-operation to work, it must deliver cost savings and must do so without delaying UK or French programmes.

In 8 days the RN assembled off the coast of Africa a Joint Force of over 3000 RN, Royal Marines, Royal Fleet Auxiliary and RAF personnel, in support of the UN in Sierra Leone

B2.5 The **Type 45 Destroyer** will provide the RN's primary Anti Air Warfare capability for over thirty years. It is a versatile warship that will provide exceptional detection and air defence capability when the first of class, HMS DARING, enters service. This capability is centred on the Principal Anti Air Missile System (PAAMS), delivered through a collaborative consortium in EUROPAAMS; and SAMPSON, a UK Multi Function Radar under development with BAE Systems. Up to eight Type 45 Destroyers are planned to enter service in the next decade.

B2.6 A **Future Surface Combatant (FSC)** study is looking at how the capability currently provided by the Type 22 and Type 23 frigates might be met in the future. No decisions have been taken, but our current assumption for planning purposes is a two class platform solution. The **Future Mine Counter-Measures Capability** is also being examined.

B2.7 The **Astute Class** will be the most advanced and powerful attack submarines the Royal Navy has ever operated and will play a key part in our defences for decades to come. With improved communications, a greater capacity for joint operations and the ability to carry more weaponry, the Astute-class submarines will deliver a marked increase in the flexibility of our attack submarines. Three Astute Class nuclear powered submarines are on contract with BAE Systems and due in-service in 2009, 2010 and 2012, with potential for a further 5, subject to affordability.

B2.8 The future **Amphibious Capability** will be built around specialist shipping consisting of two **Landing Platform Docks (LPD)**, one **Landing Platform Helicopter (LPH)**, an Invincible Class aircraft carrier in the LPH role, and four **Landing Ship Dock(Auxiliary) (LSD(A))**. The LSD(A) class is expected to remain in-service for around 25 years. Additionally, CVF will be deployable in a secondary role as a Helicopter Carrier.



**A Landing Craft, Air Cushion (LCAC) from 539 Squadron Royal Marines approaches the well dock of HMS ALBION.**

B2.9 The **Military Afloat Reach and Sustainability (MARS)** programme is a significant planned investment in a new integrated approach to Afloat Support, combined with investment in life extensions for retained platforms. The MARS system-of-systems may include Fleet Tankers, Joint Sea Based Logistics and Fleet Solid Support vessels.

B2.10 **Type 23 Frigate Capability Upgrade Programme** is complementary to the FSC concept and potentially extends the life of the Type 23 Frigate. Capability upgrades are planned for the combat system, with updates to address structural strength and platform systems to follow.

B2.11 The **Trafalgar Class SSNs** (nuclear powered submarines) are nearing completion of a world-leading sonar and combat system improvement programme. This will ensure the submarines remain effective for the remaining life of the class.

B2.12 The **Vanguard Class SSBN** (nuclear powered ballistic missile submarine) main sonar inboard electronics are about to be delivered by a technically and commercially open systems solution, marking a pioneering and significant change in our approach to through-life capability sustainment.



**Vanguard submarine.**

B2.13 Capability investigations are underway, exploring the utility of **Minor War Vessels** for Maritime Interdiction Operations and an Anti-Fast Inshore Attack Craft capability.

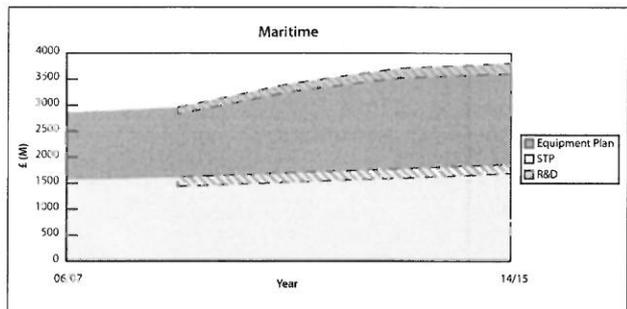
B2.14 The **Offshore Patrol Vessel** replacement for the Falkland Islands Patrol role will be through a leasing arrangement with VT; its expected ISD is 2007.

B2.15 **Support** to warships, submarines and Royal Fleet Auxiliaries, including their update and upgrade, represents a significant element of a platform's whole-life cost; for example, for CVF the initial procurement will account for around one third of total through life costs. In recent years the total amount of support

work has diminished as a result of force level rationalisation, but the planned life extension of Surface Combatants moderates the reduction out to 2030. The level of future support still represents significant opportunities for UK industry.

### Indicative planning assumptions

B2.16 The assumed spend profile in the maritime sector is expected to grow over the next ten years, providing a very strong programme of work for UK shipbuilding as T45, Astute, CVF and MARS work comes on line. This is followed by a longer term downturn as these major programmes come to an end. As a customer, we cannot afford and do not need to maintain the current pace of successive new platforms once the new ships are in service. This has implications for both new procurement and the volume of support business required. As the graph demonstrates, a very significant amount of resources - around half the amount the Department spends annually on the maritime sector - are consumed in supporting naval equipment.

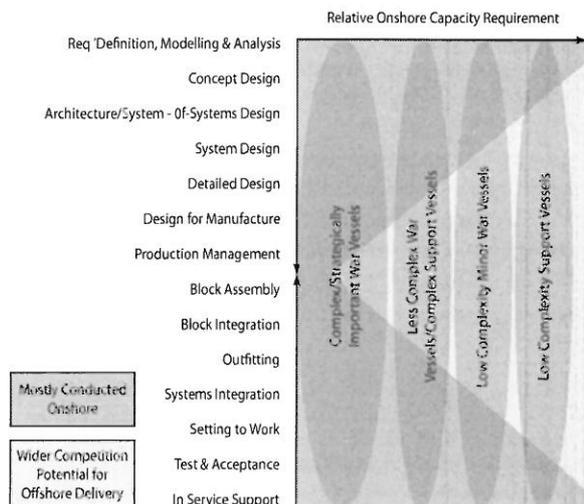


**Figure B2(i) Illustrative spend profile.**

The above graph shows indicative spending in this sector over the next ten years. The figures from 08/09 are illustrative and include a range in order to emphasise the potential for shifts in investment priorities after the end of the current Spending Review period. This is prudent planning which does not distort the overall illustrative picture of general trends.

### What is required for retention in the UK industrial base?

B2.17 Retention of onshore capability is driven by two fundamental strategic requirements: the need to develop and support military capability throughout its life; and the ability to mount operations from the UK base. To meet these two requirements we have identified six strategic themes supported by a breakdown of specific capabilities. Where these are at a high level the maintenance of each capability is critically dependent upon retaining access to associated skills, facilities, processes and underlying technologies.



**Figure B2(ii).**

B2.18 Not all key capabilities must be exercised onshore for every project. The strategic need for onshore execution will be judged on a case by case basis (Figure B2(ii) illustrates this point); with the proviso that offshore delivery should not challenge the viability of key capabilities in the Maritime Sector as a whole. Using this model we can distinguish between that which must be executed onshore; and that which may be competed more widely, but might need to be executed onshore for reasons of sustainability or commercial viability.

### Strategic capabilities for retention onshore:

**Maritime systems engineering resource:** it is a high priority for the UK to retain the suite of capabilities required to design complex ships and submarines, from concept to point of build; and the complementary skills to manage the build, integration, assurance, test, acceptance, support and upgrade of maritime platforms through life.

**Shipbuilding and integration:** there is no absolute requirement to build all warships and Royal Fleet Auxiliary vessels onshore, but a minimum ability to build and integrate complex ships in the UK must be retained.

**Submarines:** for the foreseeable future the UK will retain all of those capabilities unique to submarines and their Nuclear Steam Raising Plant (NSRP), to enable their design, development, build, support, operation and decommissioning.

**Maritime Combat Systems:** the ability to develop complex maritime combat systems is a high priority for the UK, and their integration into warships and submarines is an essential onshore capability.

**Maritime support:** the UK shall retain the ability to maintain and support the effectiveness of the Fleet, including incremental acquisition, generating force elements at readiness, and meeting urgent operational requirements.

**Maritime systems and technologies:** it is a high priority to retain onshore research, development and integration of specific key maritime systems and technologies.

### Maritime systems engineering resource

B2.19 The systems engineering resource includes: design expertise from early concept through to design for manufacture; all elements of maritime project management and the ability to specify and manage complex warship integration, test & acceptance at the platform and system-of-systems levels. These skills are as relevant to the through-life management of military vessels as they are to the front end procurement process.

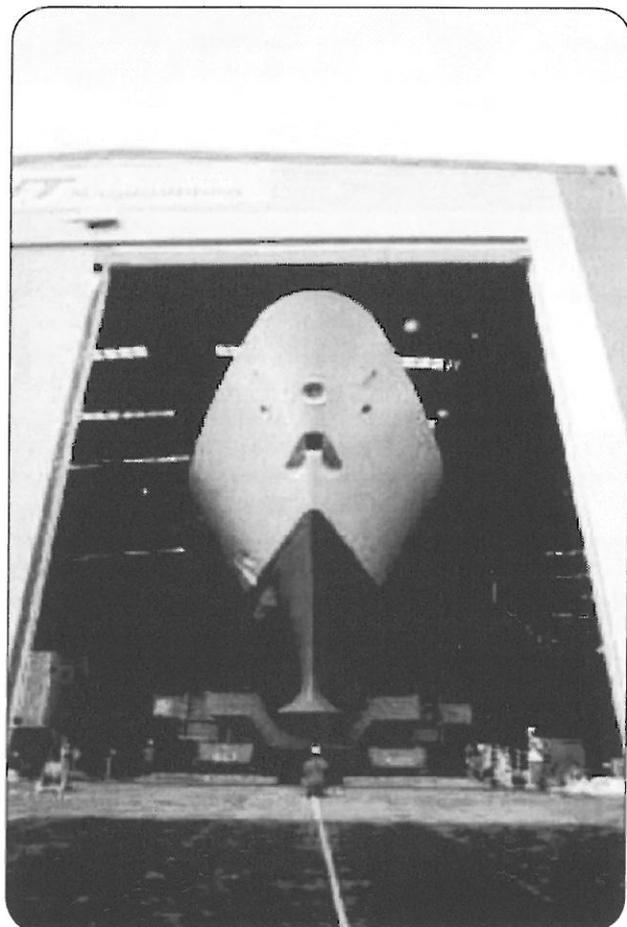
B2.20 Maintaining control of the procurement and support processes as an intelligent customer is essential, regardless of where they occur. During initial procurement and throughout service, we must be able to manage the product risk associated with complex maritime platforms, particularly for the first of a new class of vessel. We are also required to fulfil our duty as a safe and competent owner and operator of our assets; and we will regularly use industry to provide supporting advice. Therefore, retention of the Maritime Systems Engineering Resource must encompass the expertise necessary to generate and support military capability throughout the acquisition lifecycle.

**Through-life capability management.** A good example of this in practise is the refit of HMS ILLUSTRIOUS to prepare it for a new dedicated strike carrier role. It is also a good example of how the UK shipbuilding industry can rise to such challenges. HMS ILLUSTRIOUS was a 30 month, £120M refit, to deliver an extensive upgrade package within an ambitious timescale. It came in under budget, enabling the savings to be re-invested in additional upgrades to the ship during the refit. Central to this success was a triangular partnership between the contractors, the MOD and the ship's company. The NAO cites this as a good practice example in its recent report - Driving the Successful Delivery of Major Defence Projects.

### Shipbuilding and physical integration

B2.21 In a change to the previously stated Defence Industrial Policy (DIP), there is no absolute sovereign requirement to construct all our warship hulls onshore. We have revised our approach which concentrated solely on hull construction, now to consider sovereignty of the high-value capabilities needed for our operational independence.

B2.22 We need to build onshore to the extent that it sustains the ability to design and physically integrate complex warships. Furthermore, since warships are rarely prototyped, we need to ensure that we retain the ability to learn and adjust designs whilst the first of class is being built. Steel may be cut when the design is relatively incomplete compared to other military platforms; feedback during the production process is critical to ensuring that the platform meets the requirement as intended.



Type 45 Destroyer.

B2.23 The build of warships extends beyond the simplistic view of steelwork and its assembly, incorporating an amalgamation of skills, facilities, technologies and knowledge. In particular, it is the high complexity, value added aspects of ship build and platform integration that must be maintained under UK sovereignty: this includes specialist hull construction involving signature amelioration, Nuclear Biological Chemical Damage Control requirements, and complex fabrication and assembly technologies. These capabilities can be maintained in the long term only by their continued employment in suitably representative programmes of work.

B2.24 There is no requirement for fabrication of basic structures in the UK per se; however, mounting military operations from the UK base (including the fit of specific equipment for the operation in question), requires the relevant facilities and skills to be available onshore. Additionally, it is not effective to develop from scratch the most advanced, high-value skills needed for specialist hull construction or complex assembly tasks. There must be sufficient fabrication onshore to sustain a skills development path for workers to learn their trade and progress towards the most challenging tasks.

B2.25 When determining where aspects of a programme should be executed, straightforward cost considerations cannot be taken in isolation. We must also consider the strategic requirement for an industrial programme, sufficient in volume and complexity to deliver higher-end capabilities. Programmes that will tend towards total onshore delivery are those where the complexity (typically 'packing density' or outfit to steel work ratio) is high: the management and overhead of an offshore fabrication effort becomes less attractive when the high value aspects of a programme significantly outweigh the low order fabrication costs. This is especially true when a high level of outfitting is conducted at the same time as block construction.

The ratio of Combat System to platform costs is typically 2:1 for complex vessels; for Type 45 it is in the region of 60% for the Combat System against 20% hull costs.

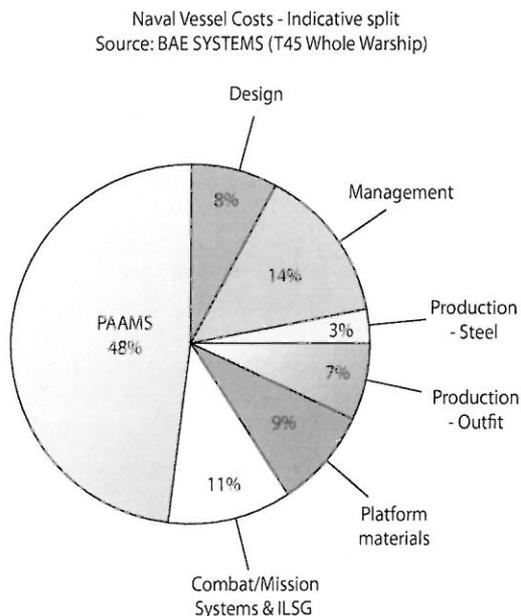


Figure B2(iii).

## Submarines

B2.26 The UK's fleet of nuclear powered submarines requires a specialist subset of skills within the maritime industry. We have duties of nuclear ownership and commitments to the USA which can only be fulfilled by close control of an onshore submarine business. Therefore, it is essential that the UK retains the capability safely to deliver, operate and maintain these platforms, without significant reliance on unpredictable offshore expertise. This delivery spans from conceptual design through to disposal, and includes the management of submarine and nuclear safety; all underpinned by appropriate science and technology. Some submarine sub-system elements may be sourced from abroad, but only under appropriate arrangements that guarantee supply, or from a sufficiently broad supplier base to assure access and availability.

B2.27 Deep scientific and technical advice on hydrodynamics, manoeuvring & control, propulsor technology and atmosphere control are specific capabilities essential to submarine performance. Structural acoustic engineering design is not readily available from the broader marketplace and has to be maintained within the specialist submarine industry. Submarine hull and infrastructure design and construction require the use of specialist techniques, for example particular welding and fabrication processes. These specialist underpinning key capabilities must be sustained in the UK.

B2.28 The ability to manage Nuclear Steam Raising Plant throughout its life-cycle, including the fuel elements, is a strategic capability that must be retained onshore. This includes design and development, manufacture, test and evaluation and decommissioning. An irreducible minimum level of associated facilities, intellectual resource and supporting technologies must be provided within the UK or under arrangements that guarantee UK control and safe ownership.



Astute (Computer Generated Image).

## Maritime Combat Systems

B2.29 A Combat System is a sophisticated and complex system, ongoing development is essential if interoperability and military advantage are to be maintained. Combat System engineering consists of two complementary endeavours: the logical development of sub-systems into a single Combat System; and the physical integration of the Combat System into the platform, to deliver the platform's military capability. These two aspects of Combat System engineering apply equally for both surface ships and submarines.

B2.30 Not all elements of a Combat System must be developed and provisioned onshore; but it is strategically important to be capable of developing a single integrated Combat System. Maintaining control of specification, design, integration and acceptance is fundamental to initial

procurement and through-life management of the Combat System, including spiral development and incremental acquisition. This dictates absolute involvement at the front edge of procurement and an ongoing relationship with a sovereign Combat System Design Authority.

The Type 42 Class of Destroyers has undergone a major architectural redesign and five further capability upgrades in the last 12 years.

B2.31 Physical integration of a Combat System into a maritime platform requires co-operation between the systems engineering organisation that maintains the design architecture of the platform and the Combat System design authority; given the likelihood of ongoing change through-life, this needs to be an enduring relationship. This high value-added aspect of shipbuilding must be retained within the UK maritime industrial base, if through-life development is to be pursued for complex or strategically important platforms.

### Maritime support

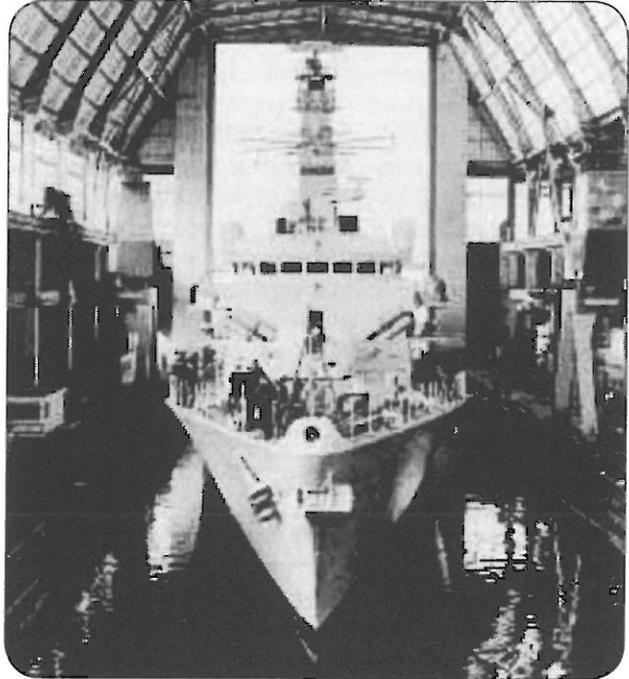
B2.32 Support of the UK Fleet has traditionally been divided between Operational Support and Refitting, each with very different requirements and characteristics. However, the division is becoming increasingly blurred by an approach to routine upgrade known as 'Fleet Time Fitting', which is undertaken during periods in harbour for vessels at higher states of readiness. Onshore ability to conduct both Operational Support and Refit is strategically essential, but largely for different reasons and at differing scales.

B2.33 The need for Operational Support is equally applicable to warships, submarines and RFAs. Implicit in Operational Support is the ability to mount operations from the UK base through rapid force generation; it involves bringing units to increased levels of readiness, including the installation of mission specific equipment, and the provision and integration of equipment to meet urgent operational requirements. These tasks frequently require a high speed cycle through the acquisition process, and involve classified military capabilities and the handling of highly sensitive material. Therefore, key discriminators for provision of Operational Support include maintenance of national security and assured access to meet operational planning assumptions. Conduct of system upgrades by 'Fleet Time Fitting' increases the overall operational availability of the Fleet, but introduces similar demands to those of rapid force generation, albeit in slightly less demanding timescales.

In preparation for Operation TELIC, more than 30 warships, submarines and RFAs were fitted with over 120 operational enhancements in less than one month.

B2.34 The infrastructure required to conduct refits is extensive and not readily regenerated once lost. A level of surface ship refit capability must be retained in the UK to ensure guaranteed access when required, including for urgent operational support. An onshore refit capability becomes essential when security needs safeguarding, force protection is

a significant issue, or control of the programme is strategically necessary. Contingent docking and recovery from operations will require a UK dockyard, especially as embarked ammunition is often involved. For the less complex platforms, refits may be conducted offshore (e.g. RFAs and some minor war vessels) once sensitive equipment has been removed or security concerns, including force protection, otherwise safeguarded. The requirement to refit the submarine flotilla onshore is absolute.



T23 Frigate.

### Maritime systems and technologies

B2.35 Running through each of the strategic themes is the need to sustain sufficient research and technology investigation to develop and maintain maritime domain expertise. This supports the UK in remaining an intelligent customer, even when buying elements from offshore, and is particularly pertinent to matching capability to threat. In the past, we have held sufficient research capability in-house, but it is increasingly developed and sustained by industry.

UK Mine Countermeasures and Uninhabited Underwater Vehicles expertise enabled evaluation and adaptation of a US commercial reconnaissance vehicle, which is now in service with the RN.

B2.36 The UK has a strategic advantage in many key platform and Combat System technologies and systems. These military capabilities are often in sensitive areas and have high security classifications. For the purposes of operational and strategic security, or assured access at times of tension or conflict, onshore retention of key research and development is a high priority. Onshore expertise also enables the exploitation of wider research to deliver systems that meet UK capability requirements. Retention of these key capabilities is fundamental to maintaining the battle winning edge.

## Global overview

B2.37 Worldwide **commercial** shipbuilding is mainly in Asia (Korea, Japan and China), which has around 70% of world production. With about 20% of world ship production, Europe is competitive for the more complex platforms such as passenger carriers and specialist vessels.

B2.38 Global **military** shipbuilding is dominated by the USA and Europe. In the US, ownership has consolidated into two main shipbuilding companies and two companies providing major sub-systems. Europe has twelve major military shipbuilding companies, with the bulk of these in UK, France, Germany, Spain, Italy, and the Netherlands: having consolidated from a larger industrial base further rationalisation seems likely. Similarly, there are extensive military ship repair facilities throughout Europe and within the US, many still controlled by national governments; consolidation and rationalisation is also evident in this area. To date, rationalisation has not extended across borders, although some cooperative programmes have been pursued by European governments. Retaining national military support facilities is widely seen as an essential requirement for mounting and supporting operations of a first class Navy.

## The UK sector

B2.39 The contraction of the UK shipbuilding industry has been driven by fierce competition for commercial shipbuilding work, primarily from within Europe and the Far East. The UK industry is no longer sufficiently competitive to win substantial amounts of traditional merchant shipbuilding, especially where extensive conventional steelwork is involved. However, the industry remains internationally competitive on high-value conversion and refit work, and on specialist builds such as luxury yachts.

B2.40 A reduction in UK warship building has mirrored the parallel reduction in the number of platforms required by the Royal Navy. Nevertheless, the UK remains a major provider of warships, ranked in the world's top four alongside USA, Germany and France. MOD is the UK shipbuilding industry's biggest customer, and naval ships comprise around 85% of those being constructed in UK shipyards. We will spend several billion pounds in the next decade to procure new ships and submarines. The potential for exports to help sustain the UK industrial capability should not be underestimated. The RN is a valuable asset to industry in promoting export business. However, UK new builds for export are a small fraction of the domestic output, whereas European states export a significant proportion of their total build. This reflects the global demand for modestly priced frigates, rather than the high-end complexity currently represented by the majority of UK shipbuilders' portfolios.

France and Germany together have more than 60% of the military export market; Germany producing twice as much for export as for domestic use.<sup>1</sup>

<sup>1</sup> 'Military and Commercial Shipbuilding' RAND (2005)

B2.41 The maritime support workload has also reduced in recent years, both as a result of force level reductions and new rationalized maintenance techniques. Whilst some increase in demand for updates and upgrades will moderate this trend, the UK exhibits over-capacity in support facilities. Existing suppliers have not been incentivised to rationalise, as keenly competitive bidding has driven down prices, limiting funds available for the short-term investment required. The repair yards have therefore experienced fluctuating work loads.

B2.42 Ownership of UK warship yards has consolidated to two main companies with the skills necessary to design, manufacture and integrate complex warships: BAE Systems (Naval Ships and Submarines) and VT Shipbuilding; with further capacity at Swan Hunter. DML and Babcock Engineering Services have design capability and fabrication skills but, together with FSL, essentially deliver surface ship and submarine support (including upkeep).

B2.43 Areas of critical expertise such as design and systems integration skills exist throughout the industrial base, not simply within the manufacturing sector. For example, BMT, QinetiQ and Three Quays have expertise in naval design and systems engineering; QinetiQ having the additional capacity to undertake research. Other large companies without shipyard infrastructure contribute significant capabilities. For example, Rolls-Royce Marine design and manufacture submarine nuclear propulsion and marine gas turbines; Thales Naval is a leading Combat System design, engineering and integration company, whilst supplying specific systems such as sonar; Ultra is proficient in underwater systems and naval Command and Control. More than half the unit cost of a naval vessel lies with firms other than the shipbuilder, and we recognise the importance of small and medium enterprises as part of this mix, whether within the supply chain of primes or those that work directly with the MOD. Many of the higher order capabilities are dependent on the specialist skills and expertise of SMEs. SMEs' ability to meet our requirements is an important consideration.

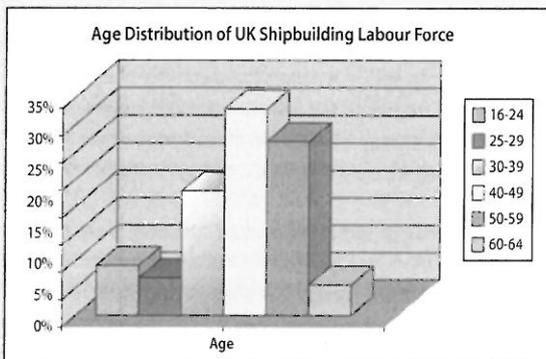
## Application of commercial capacity to defence

B2.44 There are clear differences between warship and commercial shipbuilding: the cost of a warship is typically 70% systems, 30% hull construction and outfitting; by contrast, for a commercial ship the figures are typically 20% systems, 80% hull construction. The underlying skill sets and processes for warship work are not available in yards focussed on the commercial sector. In general terms, the more war-like the vessel, the more complex the ship: this does not necessarily apply to hull fabrication, but does apply to many aspects of design, outfitting, military system integration, test and commissioning. Naval shipbuilding is specialist work and demands significant assurance regimes, engineering and professional support, whose underlying skills take time to build and effort to sustain.

B2.45 The differences between military and commercial shipbuilding need not necessarily exclude commercial shipyards from military shipbuilding. Their expertise potentially is relevant to less complex auxiliary and support vessels, where commercial design and production techniques offer considerable efficiencies over warship construction practices. The wider commercial sector also offers a benchmark against which military yards can set performance improvement targets, taking into account the increased complexity of military shipbuilding. Non-warship facilities also undertake a valuable supporting role in fabrication and other work, particularly during periods of peak demand for facilities and resources. The wider industrial base has system integration experience, but this is not directly comparable to the complexity of warship integration. Nevertheless, there are some useful lessons to be learned from the Alliance/partnering approach the wider industry adopts, the potential of which will be exploited by the CVF programme.

## UK Military Shipbuilding Skills Base

- UK military shipbuilding requires a highly skilled work force that can be confident in an enduring and stable career path. This is particularly true of the high value skills, knowledge and expertise demanded for the delivery of complex warships.
- The ratio of white to blue-collar workers in commercial yards is 1:6, in military yards it is about 1:1-7.
- In some areas, industry is confident of its ability to generate capability rapidly should the need arise, steelwork fabrication being a key example. However, many military standards (such as for welding and surface flatness) are higher than for commercial work.
- Research suggests that when shipyards lay-off workers, 70% of them leave the industry and are unavailable for re-hire by their former employer<sup>2</sup>.
- There is a perceived skills shortage in specific capability areas. For example, industry agrees that design engineers are in short supply; and the intellectual support of underpinning science and technology is also fragile in some areas.
- Demographics are likely to feature as an increasing challenge in the sustainability of this workforce and the delivery of the Maritime Sector's key capabilities.



Source: 'Outsourcing and Outfitting Practices', RAND 2005

## Sustainment strategy

**To maintain the key capabilities, a vibrant onshore forward programme is required, focusing on high value activities.**

B2.46 The planned maritime forward programme represents a healthy customer order book for the industry and is likely to sustain UK employment in the maritime sector well into the next decade. The UK Maritime Industrial Base currently possesses the key capabilities required to support this programme. Furthermore, the UK has the industrial capability to design, manufacture and support all UK Fleet surface ships, submarines and auxiliaries, but may not have the fabrication capacity to absorb the full programme at its peak. However, the high volume of programmed shipbuilding activity cannot be sustained indefinitely. Beyond the peak of activity for CVF the potential work available to UK industry reduces to a steadier state by around 2016. The future for UK shipbuilders lies in high value design, systems and sub-system assembly and integration; plus specialist and novel hull construction capability, particularly where there is a high outfit to steel ratio, as exhibited in complex warships.

<sup>2</sup> 'Reducing the strains in the labour force available for warship building in the UK', Furness Enterprises Ltd. July 2003.

## The UK's Maritime Industrial Base must deliver improvements in its performance.

B2.47 To deliver an affordable forward programme the maritime sector faces considerable challenges, including industry's ability to control costs. The UK maritime business is characterised by high and increasing overheads, and has a skills base spread across too many entities. Procurement strategies and commercial arrangements have not adequately incentivised or enabled rationalisation and efficiency improvements. The sector has failed consistently to deliver satisfactory performance, with several high-profile maritime projects encountering delays and cost increases. The business must be streamlined for greater efficiency and profitability, whilst mirroring UK demand and maximizing the opportunity for export. The UK will need to buy warships and submarines for the foreseeable future, but the clear trend is for fewer, more capable platforms, with longer operational lives and increased opportunity for regular upgrades in response to new technologies and threats. The ability to do so will depend upon us working together with industry to address the fundamental issues of affordability and productivity.

## Challenges for UK Shipbuilding

Independent study has shown:

- Major UK Defence Acquisitions are typically behind schedule.
- Commercial ships are typically produced on time.
- Ship builders employ no consistent forecasting methodology.
- We must work with industry to better manage late changes.
- Late delivery of commercial ships attracts more punitive financial penalties than for military vessels.
- The commercial and military markets differ significantly in ship size & complexity, acquisition process, design and construction, and the work force skill sets and make-up.
- Industry restructuring and changed industry/ MOD processes could benefit the UK military programme and increase export opportunities.

Source: 'Monitoring the progress of shipbuilding programmes', RAND 2005

**Without improvements in performance, delivery of the forward equipment programme is threatened. Industry restructuring is a priority.**

B2.48 The current situation is unsustainable and places huge pressure on the future programme. Whilst applicable to surface ships it is compounded many times over in the submarine domain, due to the high cost of entry for these specialist capabilities and the very high overheads for their continued delivery. Industry restructuring and consolidation is likely to be a key feature of any improvement programme, and fundamental to creating a viable and sustainable business to meet anticipated steady-state demand.

B2.49 In addition to horizontal consolidation the potential for integration of procurement and support delivery must be realised if efficiencies are to be generated. This offers the prospect of better management of through-life military capability, from delivery to disposal. It would also entail rationalisation of facilities and the skill base, delivering a more enduring and stable career path.

B2.50 In light of the serious financial challenges facing the industry, it is our view that consolidation should occur as a matter of urgency. This is particularly pertinent to the Submarine domain, but applies across the board.

**The nature of restructuring is for industry to consider, but must be customer focused**

B2.51 We will not micromanage industry's restructuring but it must be customer focused and we are likely to express preferences as different approaches emerge. We must be confident that consolidation will be beneficial to MOD and industry. We are considering potential models as they arise and these might involve some form of Government stake in how the industry develops. We also recognise that as the predominant client we are critical to improving the efficiency of the supply demand relationship.

**We will pursue procurement strategies and commercial arrangements that are optimised for the sector to deliver three key objectives: a sustainable enterprise, better performance for MOD, and opportunities for attractive rates of return for industry.**

B2.52 We will seek to employ more sophisticated strategies and arrangements that will be optimised for the sector. Competition will continue to be used when appropriate, especially for embedded electronics and marine equipment, but alternative approaches will be developed where they are necessary to deliver greater value for money and long term sustainability. As an example of an optimised approach the Future Carrier (CVF) project is being pursued through the CVF Alliance. This type of arrangement is well established in the oil and gas industries, but innovative for UK defence acquisition. It draws on the strengths, resources and expertise of all parties with rewards geared to the overall project outcome rather than maximising benefits to one participant.



Type 23 HMS SUTHERLAND.

**There will be a minimum level of activity, or Core Work Load, necessary to sustain the key capabilities.**

B2.53 We recognise that simply maintaining a minimum sovereign industrial base is not likely to be attractive to industry or to represent good value for money. To make the industry viable will require a through-life capability approach based on cost of ownership. Working with industry we will define a Core Work Load that not only would sustain the key capabilities, but also offer value for money and be commercially viable, allowing industry to scale its core capacity accordingly.

B2.54 The Core Work Load will contain all activity unique to submarines. For surface ships it is possible that only a proportion of the total programme in any given period may be required to sustain key capabilities. This core is likely to be centred on, though not necessarily restricted to, an onshore build capability for large complex warships. This activity will provide the necessary experience for the management of build, integration and testing across the wider maritime programme. The Core Work Load will include support activities required to prepare and deploy UK forces.

**We will provide industry with visibility of a sustained demand to deliver this Core Work Load.**

B2.55 We will seek to sustain this workload to ensure the retention of key capabilities and the viability of the business that delivers them. This will be achieved by viewing the forward programme as a set of projects that may be phased to balance required military capability, affordability and industrial sustainability. Clearly, flexibility will continue to be required as circumstances can change; but given the importance of sustaining a critical mass of onshore expertise, for both maintaining sovereignty and delivering value for money, sustainability impacts will be given serious attention when adjustments to the programme are being considered.

B2.56 The concept of project frequency, or 'drumbeat', is a response to this theme. For submarines we have endorsed, but not yet committed funding for a 24 month SSN build drumbeat. This scales the build capacity to be satisfied by the industry supply chain after the third Astute Class submarine (HMS ARTFUL); and sets the rhythm for the rest of the programme, notably support. The longer term surface ship production drumbeat is of the order of one new platform every one to two years, given anticipated force levels and platform life cycles. The concept of drumbeat is not restricted to major platform delivery, but includes discrete key capabilities, such as Combat System development.

B2.57 The Support work-rate is set by the size of the Fleet and the maintenance cycle, which is dominated by overhaul periods, and defueling for submarines. The new vessels (Astute Class, Type 45) will require less maintenance than legacy platforms. This combines with the reduced size of the Fleet to result in a lower and fluctuating maintenance demand. To counter this we are assessing alternative maintenance cycles with more frequent, less intrusive interventions, which will both smooth demand and improve readiness.

**We will not pay a premium for capacity in excess of that required to deliver the Core Work Load.**

B2.58 Projects within the maritime programme that exceed the Core Work Load requirement may be widely competed and potentially undertaken offshore if it does not prejudice the key capabilities. UK industry will be able to bid for this, capacity allowing. However, we will not expect industrial capacity over that required to meet the Core Work Load to have an adverse impact on the MOD's overall exposure to industry's overheads. When considering work outside the Core Work Load envelope, we will not make a simplistic distinction between entire platforms: the concept applies equally to discrete project elements.

B2.59 The CVF and Type 45 programmes represent a significant deviation from normal steady-state demand. It would be unwise to expand onshore capacity above current levels, only for it to contract rapidly after CVF delivery. Low complexity elements of CVF build are strong candidates for offshore provision, if UK steady-state capacity is exceeded and better value for money is offered elsewhere. After the Type 45 and CVF surge we will seek to ensure a managed transition to a more typical, less intensive build/integration activity. This will involve smoothing the work rate to sustain the Core Work Load.



*Type 45 (Computer Generated Image).*

**We recognise the fragility of the design base and we will implement measures to exercise the capability when this is strategically necessary and can be shown to offer long-term value for money.**

B2.60 Major design is a relatively infrequent activity naturally occurring just once per class. However, maintaining the platform design is a through-life activity, with updates and upgrades requiring significant design effort up until a platform's last refit (often with further application on disposal). By combining the new build and support design activities in a rationalised manner, a more sustainable capability is possible. This also offers the potential for whole-life cost reduction and capability enhancements, as well as long-term career paths for the associated engineers.

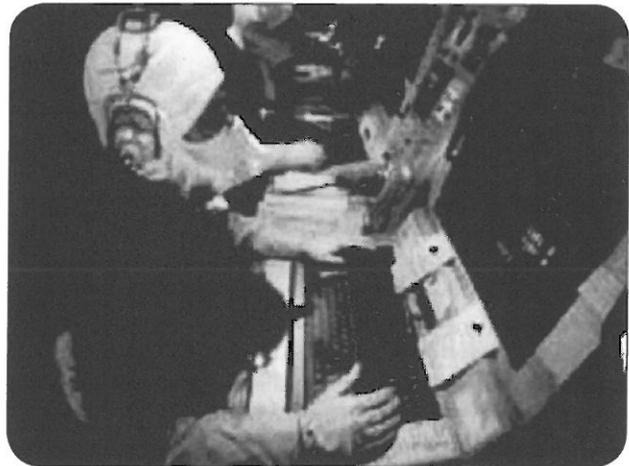
B2.61 CVF detailed design work will employ much of the nation's maritime engineering workforce to the end of the decade. However, early concept and architectural design requires a subset of this skilled workforce, which will need managed short term sustainment as their employment by CVF diminishes.

B2.62 Submarine design capability is at risk if long gaps emerge between first-of-class design efforts. The eleven year break between the design of Vanguard and Astute undoubtedly led to a loss of capability and impacted on the Astute programme. We now aspire to an eight year drumbeat to sustain the design capability through incremental improvements, both to drive down build costs and reduce subsequent support costs. In the short term key design effort will be focussed on improving these whole-life costs in the existing Astute design, particularly in areas that have direct benefit to subsequent classes.

B2.63 The submarine design programme will ensure options for a successor to the current Vanguard class deterrent are kept open in advance of eventual decisions, likely to be necessary in this Parliament. Cost-effectiveness will clearly be a key factor in any consideration of potential options, both submarine based and non-submarine based. For submarine-based options it will be very important that MOD and industry are able to demonstrate an ability to drive down and control the costs of nuclear submarine programmes. Industry will be fully engaged in ensuring that design efforts achieve the maximum impact in control of submarine build and support costs, so sustaining the potential for this significant future business and military capability.

**Combat Systems sustainability and ongoing development will be promoted by the use of modern design and integration techniques, whilst facilitating integration of products from both large scale traditional suppliers and smaller enterprises.**

B2.64 Combat System design and integration capabilities are a clear strategic imperative to deliver the required installed performance in maritime combatants. The adoption of planned and future upgrades will help to maintain the necessary suite of capabilities. In parallel, submarine and warship initiatives to converge towards a reduced set of core Combat System solutions will support the incremental approach. These common core Combat Systems will seek to exploit Modular Open System Architecture design philosophies, to enable continuous obsolescence management and affordable capability insertion across the Fleet.



*Type 23 Frigate's Operations Room.*

B2.65 The Surface Ship Combat Management System Convergence and submarine Common Core Combat System initiatives are both seeking to promote these strategies in the medium term. These initiatives have the potential to consolidate and retain the strategic capabilities necessary to form Combat System Architecture Authorities and support the specialist capabilities necessary to integrate modern high-technology sub-systems. A key objective is to exploit Open Architectures to allow SMEs, many from within UK industry and academia, to contribute niche capabilities in areas such as sensor algorithms, data fusion, security, and knowledge based systems.

B2.66 In the longer term we will investigate innovative methods of sustaining the UK's Combat System design, integration and acceptance expertise and associated facilities. We will welcome novel proposals from industry.

**We will take specific measures to ensure sustainability of significant capabilities in 2nd and 3rd tier suppliers where these are at risk.**

B2.67 We need further work to better understand the risks to 2nd and 3rd tier suppliers. Certain key capabilities have very limited sources of supply, which become fragile if they are not loaded or managed appropriately. Several levers exist to reduce exposure to this risk, ranging from increasing volume by amalgamating orders, to removing the critical component by redesign. We will work with primes to prevent the loss of key capabilities through failure of the supply chain. We are already moving in this direction with recent examples including procurement action to sustain the Astute Boat supply chain, and proposals to restructure aspects of the NSRP supply chain.

B2.68 Frequently a significant proportion of the escalation in project costs occurs through bought-in equipment. It is imperative for the MOD and industry 1st tier suppliers to ensure that they manage exposure to cost escalations throughout the supply chain.

**We will seek to work together with industry to develop and sustain our own capabilities.**

B2.69 It is essential that we sustain the qualities necessary for the MOD to fulfil its obligations as a safe and competent owner and operator of its vessels. In some specialist areas our capability is fragile. Action is now in hand to redevelop these areas and to actively career manage associated disciplines. We anticipate this will include working with industry, using secondment and joint working to develop knowledge for the benefit of both the MOD and the private sector.

B2.70 A range of measures are being applied to improve our performance and coherence. For instance, Director General (Nuclear), based in the DLO, has been appointed as the single focal point for delivery of nuclear submarine programmes across the MOD. We are committed to change that enables industry to perform effectively and address overall long-term sustainability. In particular, we are developing a stream of work known as the Maritime Industrial Strategy (MIS).

**MIS will be at the heart of developing a sustainable relationship between the MOD and industry.**

B2.71 We have been working with industry on the MIS for some time, looking at how we can best tackle these difficult sustainability issues. This work is concentrating on more clearly identifying the likely volume and timing of future business, and defining in greater detail how we plan to maintain the sovereign capabilities we require. This includes defining the Core Work Load in discussion with industry. In parallel, we expect industry to begin restructuring itself around the emerging Core Work Load. The success of the MIS is ultimately dependent on companies' willingness to work together and draw their own conclusions. However, we need improvements in quality and efficiency if our programme is to be affordable. The MIS needs to define the routemap to delivering this whilst sustaining our sovereign capabilities.

B2.72 MIS now embraces the Submarine Acquisition Modernisation (SAM) and Surface Ship Support (SSS) projects. These initiatives were launched to address growing concern at the performance of elements of the sector. By combining these projects, examining both procurement and long-term support improvements, we recognize that a viable and sustainable Maritime Sector is dependent on a more coherent approach across both domains.

**We will move ahead quickly to begin making the most of immediate opportunities.**

B2.73 Under the MIS, we will immediately start negotiations with the key companies that make up the submarine supply chain to achieve a programme level partnering agreement with a single industrial entity for the full life cycle of the submarine flotilla, while addressing key affordability issues. The objective is to achieve this agreement in time for the award of the contract for the fourth and subsequent Astute class submarines in early 2007. This will be matched by the implementation of a unified submarine programme management organisation within the MOD.

B2.74 For surface ship design and build, we aim within the next six months to arrive at a common understanding of the Core Work Load required to sustain the high-end design, systems engineering and combat systems integration skills that we have identified as being important. We expect industry to begin restructuring itself around the emerging analysis as set out above to improve its performance. We will build on the momentum generated by the

industrial arrangements being put together on the CVF programme to drive restructuring to meet both the CVF peak and the reduced post-CVF demand. For surface ship support, we will start immediate negotiations with industry with the aim of exploring alternative contracting arrangements and the way head for the next upkeep periods, which start in the autumn of 2006. Key maritime equipment industrial capabilities will be supported by the production of a sustainability strategy for these equipments by June 2006.

**The high work load in the immediate Maritime Equipment Programme opens a window of opportunity for industry to do things differently.**

B2.75 The increased demand of the next few years will diminish after the middle of the next decade. Although over-capacity offers the theoretical prospect of competition, this is unlikely to be sustainable in a shrinking market. Value for money may soon be delivered better through alternative strategies. For example, one fully loaded allocated stream of surface ship build might offer better value for money than several partially loaded streams in competition. We have been working to smooth out the long term cyclical demand for naval warships and provide a more predictable future for ourselves, and industry. But this more stable future can only be achieved if the design, manufacturing, support and integration capacity within the industry is matched to that pattern of demand. There is a clear need to streamline the businesses, making them more efficient and profitable, removing duplication and establishing clear centres of excellence, to meet our requirements and maximise the military export potential. This is good for the Royal Navy, the taxpayer and for the long term sustainability of the industry.

B2.76 Our shipbuilding industry needs to renew itself and there is a window of opportunity to do so, now. By taking this opportunity head on and tackling the challenges it presents, there can be a fundamental shift from seeking profit through volume, to profit derived from excellent delivery, long-term support, and the continual improvement of the military capability available to the front line.



HMS ARGYLL.