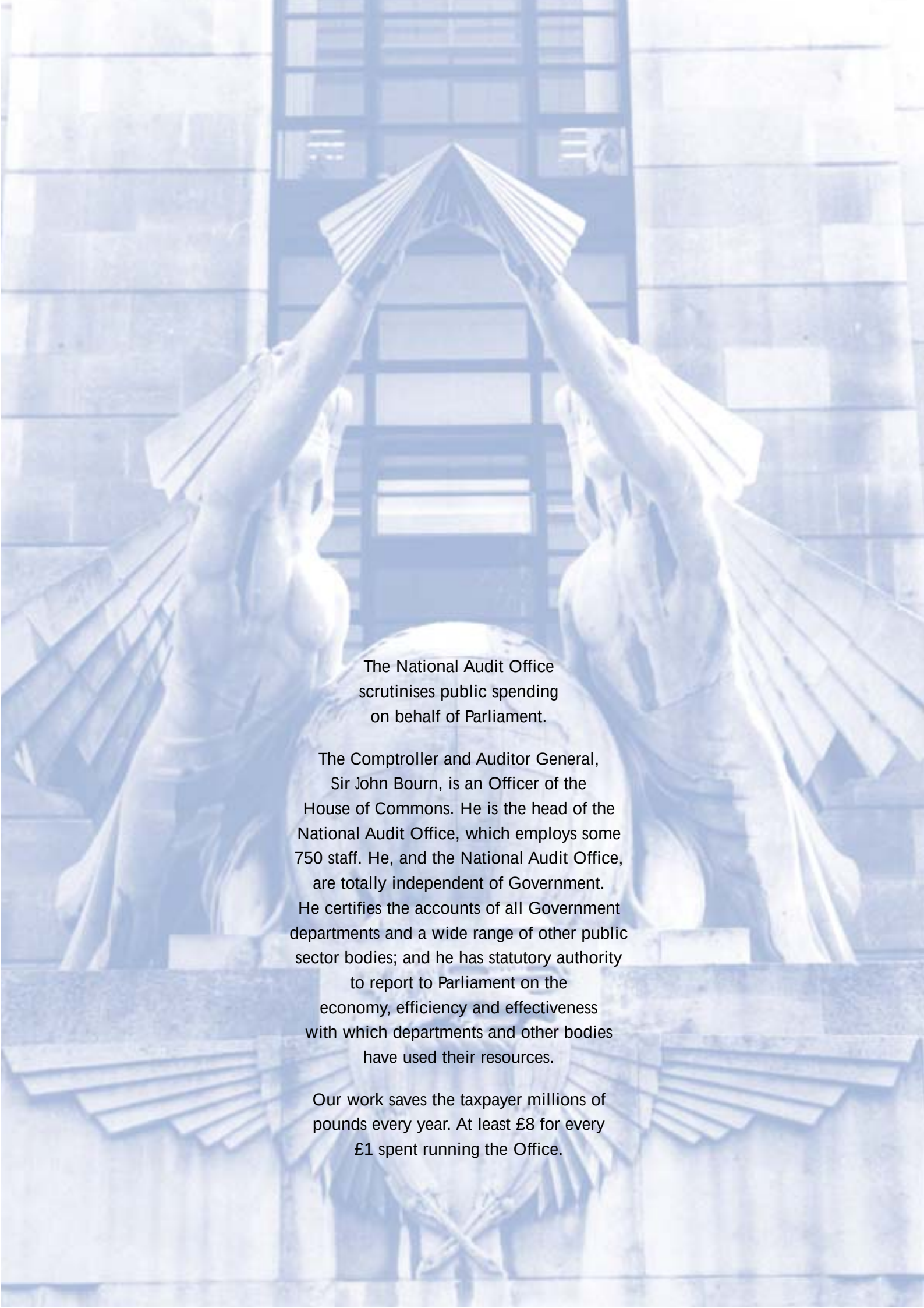
NATIONAL AUDIT OFFICE

Ministry of Defence

Major Repair and Overhaul of Land Equipment

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 757 Session 2001-2002: 26 April 2002



The National Audit Office scrutinises public spending on behalf of Parliament.

The Comptroller and Auditor General, Sir John Bourn, is an Officer of the House of Commons. He is the head of the National Audit Office, which employs some 750 staff. He, and the National Audit Office, are totally independent of Government. He certifies the accounts of all Government departments and a wide range of other public sector bodies; and he has statutory authority to report to Parliament on the economy, efficiency and effectiveness with which departments and other bodies have used their resources.

Our work saves the taxpayer millions of pounds every year. At least £8 for every £1 spent running the Office.

Ministry of Defence

Major Repair and Overhaul of Land Equipment

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 757 Session 2001-2002: 26 April 2002

LONDON: The Stationery Office
£9.25

Ordered by the
House of Commons
to be printed on 23 April 2002

This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn **National Audit Office**
Comptroller and Auditor General **26 March 2002**

The National Audit Office study team consisted of:

Ben Alexander, Mark Andrews, Jason Beeley, Toby Evans and Steve Merrifield, under the direction of David Clarke.

This report can be found on the National Audit Office web site at www.nao.gov.uk

For further information about the National Audit Office please contact:

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 020 7798 7400

Email: enquiries@nao.gsi.gov.uk

Contents


DR 25 AA

executive summary

In this section

1 The major repair and overhaul of the Ministry of Defence's (the Department's) land equipment is a complex business. The Department owns a large and diverse range of land equipment worth around £5.6 billion and there are over 15,000 different repairable items in the inventory. Each year, the Department spends some £290 million on a wide range of repair and overhaul work. A mixture of private sector providers and in-house agencies, principally the Army Base Repair Organisation (ABRO), conduct the repairs on the Department's behalf.

2 The Department's 1998 Strategic Defence Review outlined the need for major savings in order to fund force restructuring and future equipment programmes. The Department therefore is seeking to reduce the cost of major repair and overhaul. In doing so, the Department is keeping in view the need to retain repair capacity for strategically vital equipment, to "surge" repair provision prior to hostilities, and to ensure value for money in a highly monopolistic sector. At present, the Department allocates rather than competes much of its repair work.

3 This Report examines the effectiveness of the Department's management of the major repair and overhaul of land equipment. In addition to documentary review and interviews with Departmental staff, our methodology (detailed in Appendix 1) centred on a survey of land Integrated Project Teams (IPTs) within the Defence Logistics Organisation and detailed examination of a sample of 14 equipments and sub-assemblies. We also visited a number of industrial repair providers.

4 We found that the Department has done much to improve the management of major repair and overhaul and recognises that there is more to do, including the need to address the future role and shape of ABRO. It has reorganised its supply organisation and is introducing many business improvements, including new information technology to support better logistics management. Industry is taking a wider role in the support of equipment and there are a number of innovative projects underway as part of this. The Department has incomplete information on equipment usage, repair activities and costs, and some management practices could be improved. The Department also needs to address the future role and shape of its in-house provider, ABRO. Without resolving key issues - relating to the unclear military case for retaining ABRO, questions over the extent to which truly competitive procurement of repair and overhaul can be achieved, and uncertainty over the longer-term ownership of ABRO - there are wider risks, for example, that IPTs may not act in a fully co-ordinated way and that the Department's major repair and overhaul business will not be cost-effective.

The major repair and overhaul of land equipment is large and complex but there is scope for it to be more cost-effective

5 The major repair and overhaul of land equipment is a large and complex business. Using the existing performance measures, it appears that the Department's performance is good on the whole. But these performance measures are not comprehensive and the Department needs to continue to improve its performance measures - for example, demand fulfilment is not yet measured and there is only limited measurement of equipment reliability. And there appears to be scope for major repair and overhaul to be more cost-effective. For example, repair loop times are very long and compare unfavourably with some sectors of industry. Consequently, for some repair lines, the Department holds excessive stocks of repairables - the Department recently identified stock worth over £300 million for disposal.

The Department has made important changes to its supply organisation and to the way it conducts business

6 The Defence Logistics Organisation was launched in April 2000, creating a new unified logistics provider for the Armed Forces. It has a clear high level mission and vision for the Department's logistics activities, including for land equipment support. The Defence Logistics Organisation also has a key strategic goal to reduce output costs by 20 per cent by 2005 while maintaining or improving the quality of its outputs. The introduction of IPTs has created a single supplier within the Department for the support of each equipment in a cost-effective way.

7 The introduction of resource based accounting and whole life costing is focusing managers' attention on the costs of unserviceable equipments, spares and other assets and of the equipment support process generally. More specifically, the Beacon Initiative is designed to provide selected IPTs with consultancy support to help them to pursue innovative changes and to apply best practices while, for a number of equipments including AS90 and the Warrior Fighting Vehicle, the Department is reducing the amount of base overhaul work carried out in favour of more cost-effective approaches to scheduled repair.

8 Within the land environment, the Department has difficulty in predicting equipment usage. There are problems translating equipment usage into required repair activity and stock levels. In addition: IPTs do not yet have full visibility of repair costs; automatically generated demand figures in the Army's stores system can be inaccurate; there is no visibility of spares consumption at the point of delivery; failure reporting by users is inaccurate and incomplete; and repair providers cannot plan with any precision their repair and production schedules as the Department is not able fully to asset track equipments. Management practices could also be improved since repair turnaround times are not always monitored and repair providers' performance is rarely queried. Limitations in IT systems mean that many management processes are paper-based and are resource intensive.

9 The Department is using and developing new tools and major IT solutions to enhance its current information. For example, the Department is now developing a software tool to help to identify the resources required for peacetime training. And it expects that many of the above deficiencies should be rectified by the likely introduction of the Defence Stores Management Solution (DSMS), which is intended to replace the Army's current stores system, and of the Delivering the Requirement for Unit Materiel Management (DRUMM) project which will provide visibility of holdings of spares and repairables.

Industry is set to get a wider role in major repair and overhaul

10 The through life approach to equipment support, called Integrated Logistics Support, is driving the further involvement of industry for future equipments. The support solutions currently being developed for future land projects involve a high degree of contractor provision. For example, Public Private Partnership and Private Finance Initiative deals are proposed for the Heavy Equipment Transporter project and Field Electrical Power Supplies programme respectively. And other future land projects, such as those for fuel and water tankers and the Multi-Role Armoured Vehicle, are likely to involve at least some long-term contractor logistics support. Despite potential increases in operational risk, there are clear benefits to contracting with industry in such ways that may not be achievable through the use of in-house providers. These include:

a reduced whole life costs through design improvements incorporated from the outset;

b the introduction of gainsharing arrangements relating to benefits from improved equipment reliability and capability due to subsequent design modifications proposed by industry; and

c the retention of industrial capabilities during gaps between main production contracts.

11 The Department lags behind best industrial practice in such areas as supply chain performance, inventory management and asset tracking. The Department is seeking to take advantage of industry's capabilities in such fields by operating direct exchange schemes for repairable spares in the support of the Rapier Field Standard B short range air defence system and the Phoenix target acquisition and surveillance system. And a cost saving modification proposed by industry is to be introduced into the repair programme to enhance the reliability of the TN-54 gearboxes used by the Challenger 2 main battle tank.

12 Despite trends towards contractor logistics support, however, parts of industry acknowledge that they do not have well developed repair and overhaul capabilities. Some manufacturers are therefore looking to ABRO to provide this expertise and capability. In addition, Alvis Vehicles Limited and Vickers Defence Systems both entered into partnering arrangements with ABRO in 2001. And ABRO intends to work more closely with other potential industrial partners on future equipment programmes.

ABRO is moving to Trading Fund status but important issues are unresolved

13 The Department is establishing ABRO as a Trading Fund on 1 April 2002. The Department's case for retaining ABRO in-house is not that it has a strategic role in a military sense, but that it is beneficial to the defence mission and to the effective management of logistics support. It is unclear, however, how the lack of a strong military strategic case for retaining ABRO in-house reconciles with the existing policy of retaining in-house repair and overhaul facilities for key operational equipments. The Department has not fully defined the need for either surge and flexibility or for dual sourcing and so it cannot be certain what level of ABRO capacity is needed. And we found that IPTs' views on the strategic importance of ABRO varied. The Department has still to determine what minimum in-house logistics capability is required to support military operations, including in-house repair and overhaul. And, while it has decided to keep ABRO in-house for the present time, it has still not decided the longer-term future ownership of ABRO.

14 To date, the Department has achieved very little competition in the major repair and overhaul of land equipment - around 20 per cent of repair lines included in our sample cases. And in cases of dual sourcing, the Department had not conducted full competitions but had allocated work on the basis of repairers' costings for a single item. The Department has now set a target for competing 30 per cent of ABRO's workload, by value, within three years of moving to Trading Fund. This is a significant reduction from the 80 per cent target that the Department initially intended to set because of constraints on IPTs to compete many of the repair programmes quickly. To be effective, competition must be on a level playing field, in terms of the competitive process, and equivalent pricing conditions and risks placed on bidders. It has not always been easy to demonstrate that these conditions applied in the past but this is now improving.

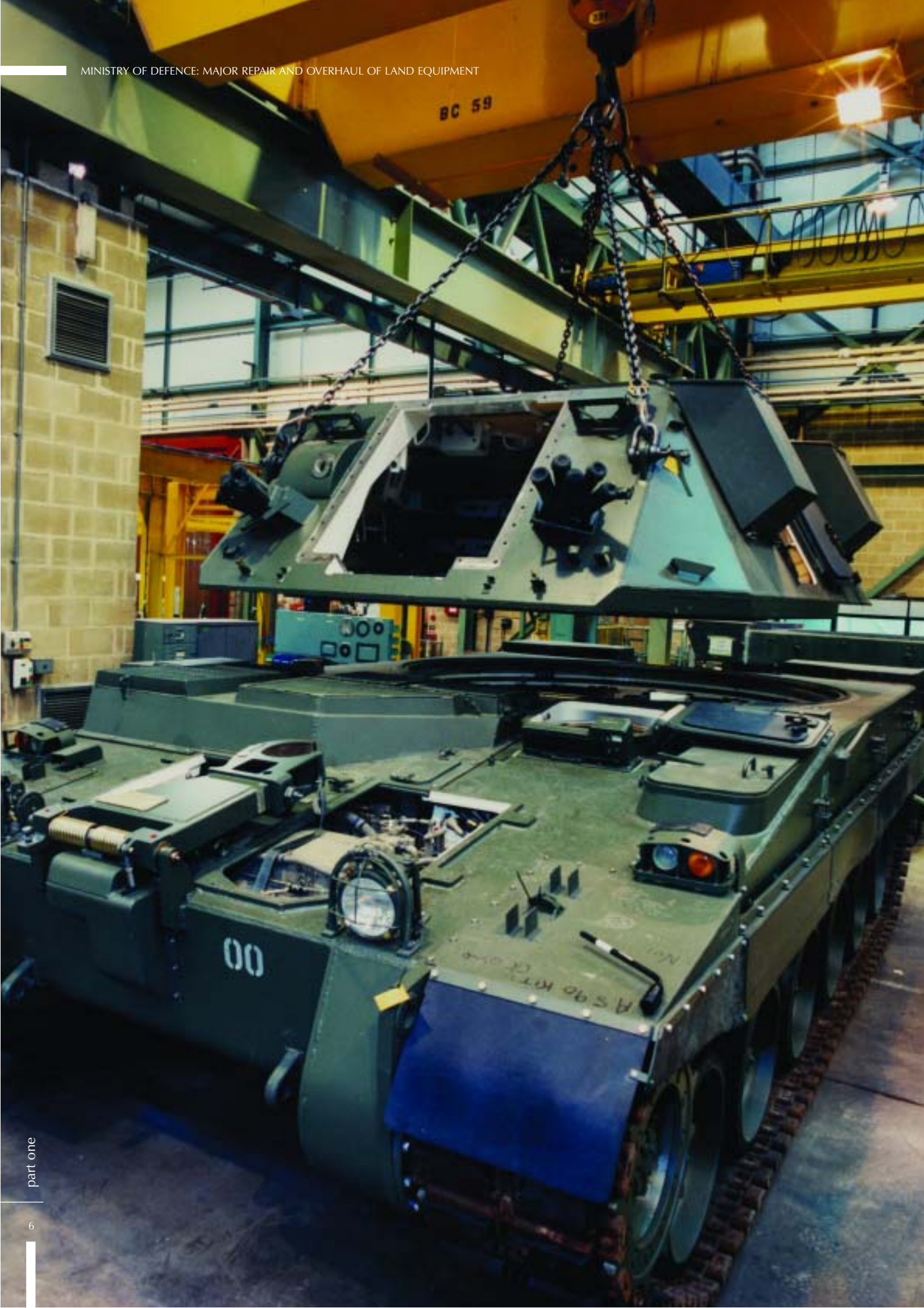
15 One significant constraint on increased competition is the ownership of intellectual property rights. Most intellectual property is owned by the original equipment manufacturer. A large proportion of repair work requires the use of intellectual property and is allocated non-competitively for this reason. This constraint could be overcome by negotiating additional rights for the Department, but it is likely to be costly.

16 While there are a number of clear benefits from ABRO's move to Trading Fund status, including efficiency gains and better information on the costs of repair by ABRO, there are also risks. The lack of clarity about strategic military requirements for ABRO, and the extent of dual sourcing and surge required from it, is a barrier to reaching a clear and optimal balance between industry and in-house repair and overhaul. Although IPTs have to pursue objectives that are consistent with the wider corporate frameworks within which they are located and although there is planned guidance, there is a risk that they may make individual decisions on repair sourcing that will erode ABRO's capabilities or capacity to provide effective competition - a situation that may not satisfy IPTs' ultimate customer, the Army. ABRO may also take decisions that constrain the Department's future options, although the Department has put in place arrangements to mitigate this risk. Finally, industry may continue to have concerns about the conduct of future competitions.

Recommendations

17 The Department should:

- move ahead with innovative repair arrangements involving industry, ensuring that any successes are identified and promoted widely;
- ensure that lessons learned, particularly those relating to supply chain improvements and management practices, are captured consistently and disseminated;
- press ahead with initiatives to improve the management information and IT support available to IPTs;
- take stock of how sensible competition for repair and overhaul work can be enhanced, particularly as regards ensuring that project teams have suitable specifications on which to base competition, have the resources to conduct the competitions and that there is a level playing field between industry and the in-house provider - ABRO;
- more clearly define how much flexibility (the ability to switch resources between different repair programmes), surge capacity and dual sourcing it needs because this would better inform the allocation of repair and overhaul work;
- think through the implications of such definition for the size, shape and ownership arrangements of its in-house repairer (ABRO) and establish clear policy guidelines for informing decisions on whether repairs should be conducted in-house or be outsourced; and
- review whether it needs to negotiate additional intellectual property rights in order to enable greater competition and to allow greater flexibility when determining the future role and ownership of ABRO.


BC 59
00

Part 1

The major repair and overhaul of land equipment is large and complex but there is scope for it to be more cost-effective

1.1 The Ministry of Defence (the Department) commissions major repair and overhaul work on a wide range of land equipment each year. It employs a mixture of private sector providers and in-house agencies, principally the Army Base Repair Organisation (ABRO), to conduct the repairs on its behalf[1]. This Part of the Report examines the nature and scale of the work undertaken and the Department's performance against its existing performance measures. We found that the major repair and overhaul of land equipment is a complex business. And while performance, as measured currently, is good on the whole, there is scope for the Department to continue to improve its performance measures and the cost-effectiveness of repair.

The major repair and overhaul business is large and complex

1.2 In this section of the Report, we examine the nature, range and cost of major repair and overhaul work undertaken on the land equipment fleet. We also consider the main sources of such work and how the Department has allocated tasks to each provider.

1.3 The Department's fleet of land equipment is valued at some £5.6 billion, of which about £4 billion is owned and operated by the Army. There is a diverse range of equipment and this is illustrated by the examples in Appendix 2.

The Department has to undertake a wide range of repair and overhaul activity

1.4 The Department conducts a wide range of repairs, including those carried out in operational theatres by the field Army, but the scope of this Report is limited to major repair and overhaul carried out by ABRO and industry.

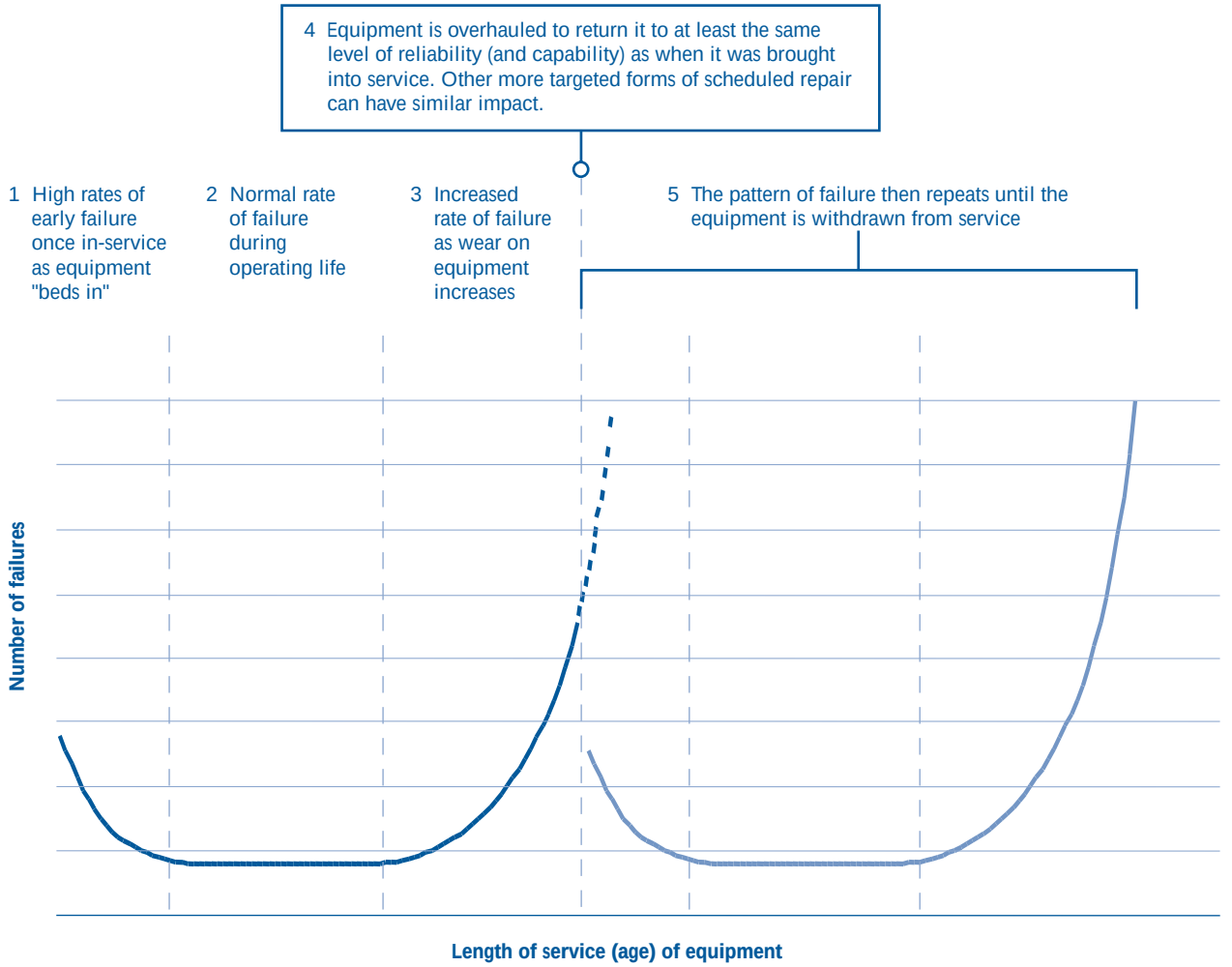
1.5 The Department carries out repairs on sub-assemblies and other repairable items (known as line replaceable units) that fail in use, when this is more cost-effective than replacing them with new parts, or where replacement parts can no longer be purchased because they are obsolete, as, for example, with the Clansman Combat Net Radio system. The Department calls this activity "planned repair" because, even though it is not possible to predict exactly when individual items will fail, the Department can plan for a certain level of repair activity on the basis of a forecast number of failures during the year. There are over 15,000 different repairable items in the Department's land inventory - examples of repairable items are given in Appendix 2. Planned repair accounts for over 55 per cent of the Department's major repair and overhaul activity overall.

1.6 The Department also carries out "scheduled" repair and reconditioning of whole equipments for some fleets. One reason for doing this is to return equipments to a level of reliability and capability that at least matches the original specifications. This is particularly important in the case of armoured vehicles where, over time, the hulls of these vehicles can be thinned through wear or can be cracked as a result of stress and metal fatigue. Such damage can reduce the ability of the hull to withstand attack - a quality known as "ballistic integrity". **Figure 1** illustrates the type of reliability profile of an equipment over its life, and shows that carrying out scheduled work can extend the period in which it is more reliable. Traditionally, scheduled work has consisted of full "base overhauls" in which the equipment is stripped and re-built with a high proportion of new or reconditioned sub-assemblies and repairable items. Scheduled repair also provides an opportunity to incorporate modifications to raise equipment to the latest build standards. Overall, scheduled work accounts for less than 45 per cent of the cost of major repair and overhaul activity.

1 *One of the Department's other repair agencies, the Defence Aviation and Repair Agency, undertakes a small amount of repair and overhaul of land equipment.*

1 The impact of scheduled repair on equipment reliability

Carrying out scheduled repair on an equipment during its service life can delay a significant increase in rates of failure



Source: National Audit Office

Repair work is conducted by many providers, including one in-house (Army Base Repair Organisation)

1.7 Integrated Project Teams (IPTs) within the Defence Logistics Organisation manage major repair and overhaul work arising on all military equipment **(Figure 2)**. Ten teams, working within the Equipment Support (Land) business unit, are specifically responsible for the major repair and overhaul of land equipment.

1.8 The Department owns an in-house repair provider called ABRO, with eight workshops around the country. In the past, the Department has not worked out the value of work conducted by ABRO, only the hours of work completed. And the Department does not collate data on the total value of the major repair and overhaul work contracted with industry. Our analysis in **Figure 3 (page 10)** shows that, in 1999-2000, the Department spent over £290 million on this activity in total. ABRO has a much larger share of the value of work (60 per cent) than industry (40 per cent). Figure 3 shows also that in terms of the range of work, the position is reversed, with industry repairing a greater number of different items (55 per cent) than ABRO (45 per cent).

There is relatively little competition in the sector, instead work is allocated to repair providers by the Department

1.9 The Department does not collect information on how much repair work is competed overall. **Figure 4 (page 10)** shows that, for our sample, only 17 per cent of repair lines overall were subject to formal competition. For sub-assemblies and other repairable items, for which most of the work is the planned repair of items that fail, 19 per cent of repair lines were competed. But for the scheduled repair and overhaul of whole equipments, only five per cent of repair lines were competed.

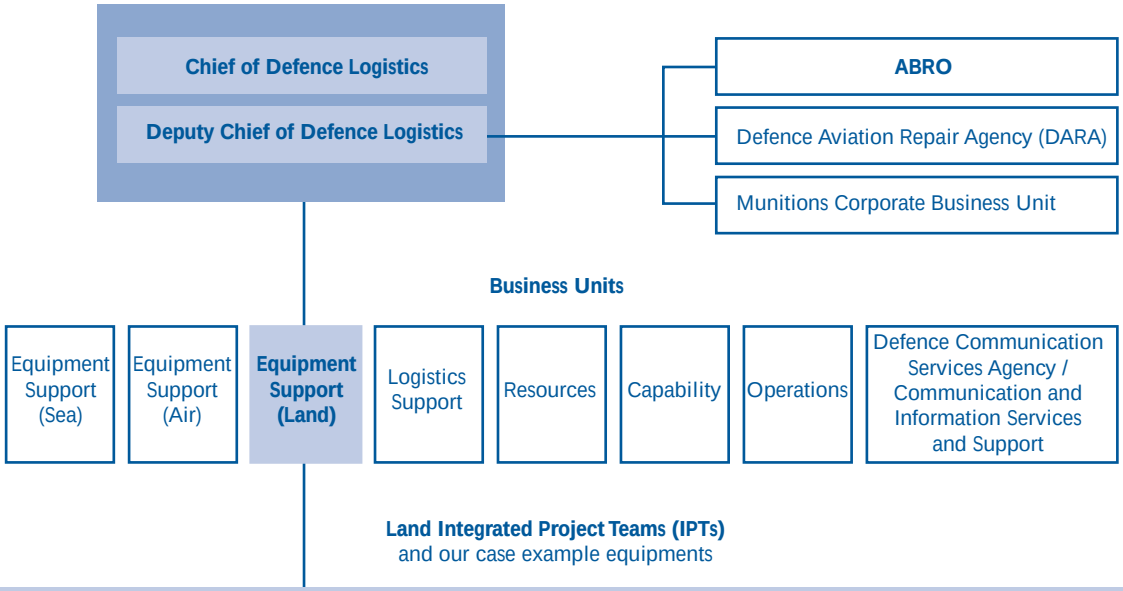
2 The structure of the Defence Logistics Organisation

The major repair and overhaul of land equipment is managed by Integrated Project Teams within a business unit of the Defence Logistics Organisation, one of the Department's Top Level Budget Holders. Key stakeholders in the repair of land equipment are shown in bold.

The Department's Top level budget holders

Armed Forces - Operational	Commander in Chief Fleet (Royal Navy) **Land Command (Army)** General Officer Commanding Northern Ireland (Army) Strike Command (Royal Air Force)
Armed Forces - Personnel and Training	Second Sea Lord (Royal Navy) Adjutant General (Army) Personnel and Training Command (Royal Air Force)
Headquarters and Equipment Support:	Vice Chief of the Defence Staff Second Permanent Under-Secretary **Chief of Defence Procurement/Defence Procurement Agency** **Chief of Defence Logistics/Defence Logistics Organisation**

Defence Logistics Organisation



Land Integrated Project Teams (IPTs)
and our case example equipments

Integrated Project Teams

- **Combat Support Equipment IPT**
- **Combat Support Vehicles (Support) IPT**
- Defence Clothing and Textiles IPT
- Defence General Munitions IPT
- **Engineer Systems Support IPT**
- **Field Artillery Systems Support IPT**
- **Guided Weapons Systems Support IPT**
- **Information and Communications Systems Support IPT** [2]
- **Light Armoured Systems Support IPT**
- **Surveillance, Target Acquisitions and Special Projects Systems Support IPT**
- **Tank Systems Support IPT**
- **Workshop Support Services IPT**

Case example equipments [1]

- DROPs cargo handling; Foden Recovery Vehicle; Land Rover engines and gearboxes
- Generators
- AS90 and MLRS self propelled artillery systems
- Rapier and Stormer SP HVM air defence systems
- Clansman radio
- Warrior and CVR (T) armoured vehicles; K60 engine
- Phoenix aerial reconnaissance system
- Challenger 2 main battle tank

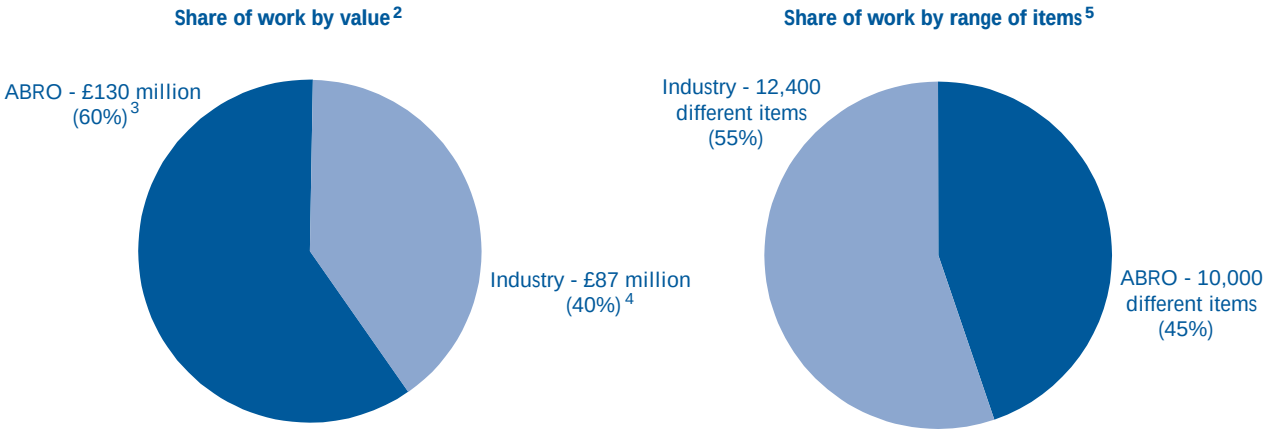
NOTES

1. Further information on our case example equipments is provided at Appendix 2
2. Responsibility for the Information and Communications System Support IPT transferred from the Equipment Support (Land) business unit to the Defence Communication Services Agency in April 2001. However, in general, information in our Report for this IPT refers to the period before transfer

Source: National Audit Office

3 The share of overhaul and repair work between ABRO and industry

ABRO has the larger share of the total value of major repair and overhaul work, but industry repair a greater range of items[1]



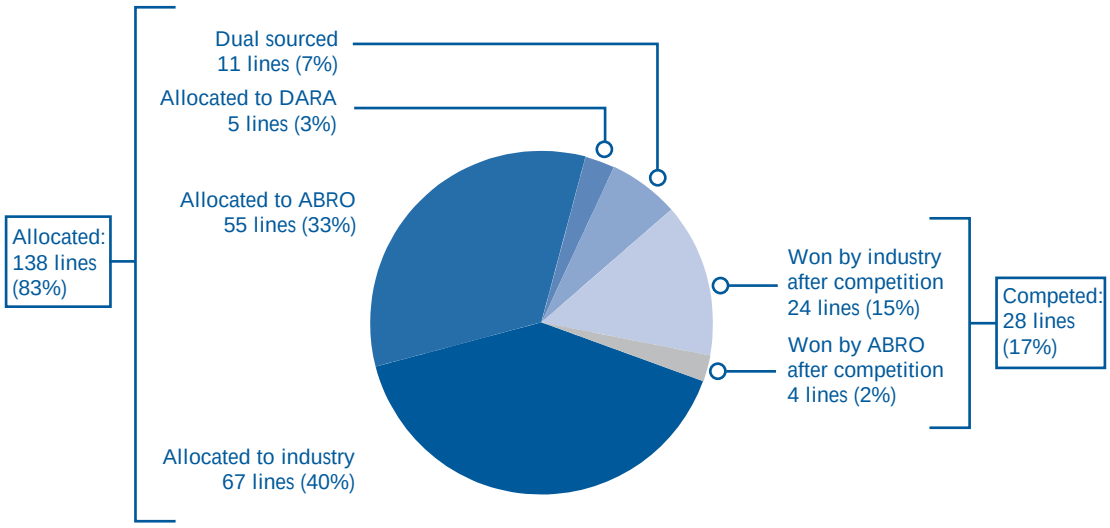
NOTES

1. IPTs were surveyed to provide data on the entire land fleet, but were not able to provide complete responses without disproportionate effort. The Defence Aviation and Repair Agency (DARA) undertakes some repair and overhaul work on land equipment, but it is a small amount compared with ABRO and industry, and has been excluded from this analysis
2. The value of work includes labour and spares but excludes the provision of large repairables (i.e. sub-assemblies such as engines). To some extent, industry uses such "Government Furnished Equipment", and ABRO uses a substantial amount in the base repair programmes - some £76 million. Including this figure brings the total value of work to more than £290 million
3. The value of work conducted by ABRO comprises £73 million in labour (constructed from the survey of IPTs) and £57 million in spares (from the Department's analysis of data on the Army Stores System)
4. Data on the value of work conducted by industry were provided by the Department
5. Data on the range of work conducted by ABRO and industry were obtained from the survey of IPTs

Source: National Audit Office survey of IPTs and analysis of the Department's data

4 The amount of overhaul and repair work which is competed

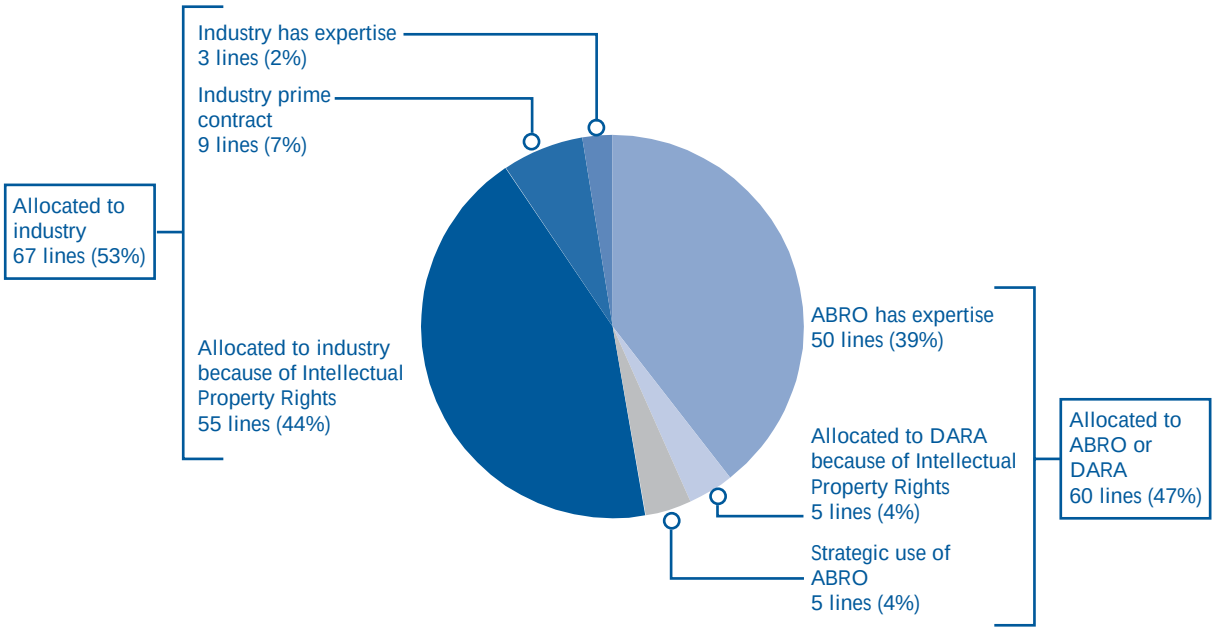
The majority of repair lines in our sample were allocated to repair providers by the Department without competition



Source: National Audit Office analysis of case example equipments

5 Overhaul and repair work allocated without competition

Around half of the repair lines in our sample that were allocated without competition went to ABRO (or DARA) and half to industry. Almost half of the work that is allocated without competition is allocated in this way because of Intellectual Property Rights.



Source: National Audit Office analysis of case example equipments

1.10 In the past, in line with their business process instructions, the Department has automatically allocated a substantial amount of repair work to ABRO without consideration of whether the work could have been done by other repairers. There are good reasons why ABRO may have been selected:

- ABRO has strong remanufacturing skills and substantial expertise and knowledge built up from repairing and overhauling the Department's equipment over the years. **Figure 5** shows that 39 per cent of the work which was allocated without competition went to ABRO for this reason;
- The diversity of its work means that ABRO is very flexible and can quickly shift resources from one repair line to another to accommodate changes in the Department's requirements;
- For some equipments that have been in service for a long time, ABRO is the only repair source, because either the original manufacturer no longer exists, or is no longer interested in repairing such equipment;
- ABRO provides an alternative source of repair to the original equipment manufacturer where, as is often the case, the Department does not own the full intellectual property rights for the equipment it purchases. In these circumstances, the Department has the right to repair the equipment itself, but is not entitled to award work to other industry repairers; and
- IPTs and their predecessors often regarded ABRO as a "free" resource since, under the Department's previous accounting system, a set amount of repair capacity at ABRO was funded at the start of the year and the cost of ABRO repair was not passed on to its customers.

1.11 Much of the work awarded to industry is also allocated without competition, often because the intellectual property rights held by original equipment manufacturers make it difficult for other repairers to carry out the work. Figure 5 shows that, for our sample, 44 per cent of the work that was allocated without competition was allocated to industry repairers for this reason. Work was also allocated to industry where there was a prime contract already in place or where the company had the unique skills and equipment needed to undertake the work. The scope for competition within industry may diminish further given the rate of consolidation of companies in the defence sector.

The Department has varied and often competing requirements

1.12 In carrying out major repair and overhaul work, the Department needs to balance the competing demands of several factors that could impact on the operational capability of the Armed Forces:

a A joint-Service approach is required

The Department seeks to take a joint-Service approach to support. The 1998 Strategic Defence Review recognised that many future operations would be expeditionary in nature and would be conducted by joint forces composed of fighting units from the individual Services. As a result, logistics support activity would, increasingly, need to be joint and the Review established the intent to create a unified Defence Logistics Organisation.

b The Department has a strategic need for major repair and overhaul

The Department needs to be sure that it can retain the repair capabilities and capacity it needs, especially for strategically vital equipments. In June 2000, the Department specified that an in-house repair capability should be retained for over 35 key operational equipments. Of our 14 case example equipments (Appendix 2), 11 are defined as being key operational equipments or associated sub-assemblies. For some of these, the Department has adopted a policy of 'dual-sourcing' the repair by awarding some of the work to ABRO and some to industry. Typically, 30 per cent of the work would be allocated each to ABRO workshops and to industry. The remaining 40 per cent would be "competed" - either formally competed or awarded on the basis of the prices agreed for the initial allocations.

c The Department has a need for surge capability

The Department needs to be able to "surge" the amount of repair provided in the run up to hostile operations or war. And, given the uncertainty inherent in military operations, the Department values flexibility in its repair arrangements where these allow the switching of resources between repair programmes.

d The Department has to manage a monopolistic sector

The Department needs to ensure that it is getting a fair price in a sector which is highly monopolistic, often due to the constraints imposed by restrictive intellectual property rights (paragraph 1.11). To do this, the Department uses non-competitive procedures including a government-wide profit formula, open-book accounting and audit of contractors pricing arrangements - we reported earlier this year on the procedures used for contracts above £1 million[2]. For some repair programmes, the Department has also used ABRO to maintain competitive tension with the industry repairer through dual-sourcing (paragraph 1.10). Only 11 repair lines (seven per cent) in our sample were dual-sourced (Figure 4). And all of the "competed" element (paragraph 1.9) was awarded on the basis of prices for allocated work, rather than formally competed.

e Cost savings are needed

The Department needs to improve the cost-effectiveness with which it conducts major repair and overhaul. The Strategic Defence Review set out the need for major savings in order to fund force restructuring and future equipment programmes. It anticipated that savings would come from, for example, a smarter approach to procurement, the proceeds of increased property disposals and improvements in logistics. As part of this, the Department set a target to reduce non-munitions stocks, including repairable items, by 20 per cent overall - we will be reporting separately on progress.

There is scope for major repair and overhaul to be more cost-effective

1.13 This section of the Report looks at the output measures used by the Department to gauge the performance of their repair and overhaul activity. We also highlight the lengthy repair loops that exist within the business and their impact on the volume of stocks held.

The Department's output measures are not comprehensive, but those in place show that performance is good

Many IPTs were unable to provide information on equipment availability

1.14 A key measure of equipment performance is availability, but this does not reflect solely the effectiveness of the major repair and overhaul managed by IPTs because availability also depends on front line repairs conducted by, for example, the Royal Electrical and Mechanical Engineers. Nonetheless, equipment availability is included as a target for major repair and overhaul activity. However, only four IPTs hold availability information for their equipments, and these data are incomplete.

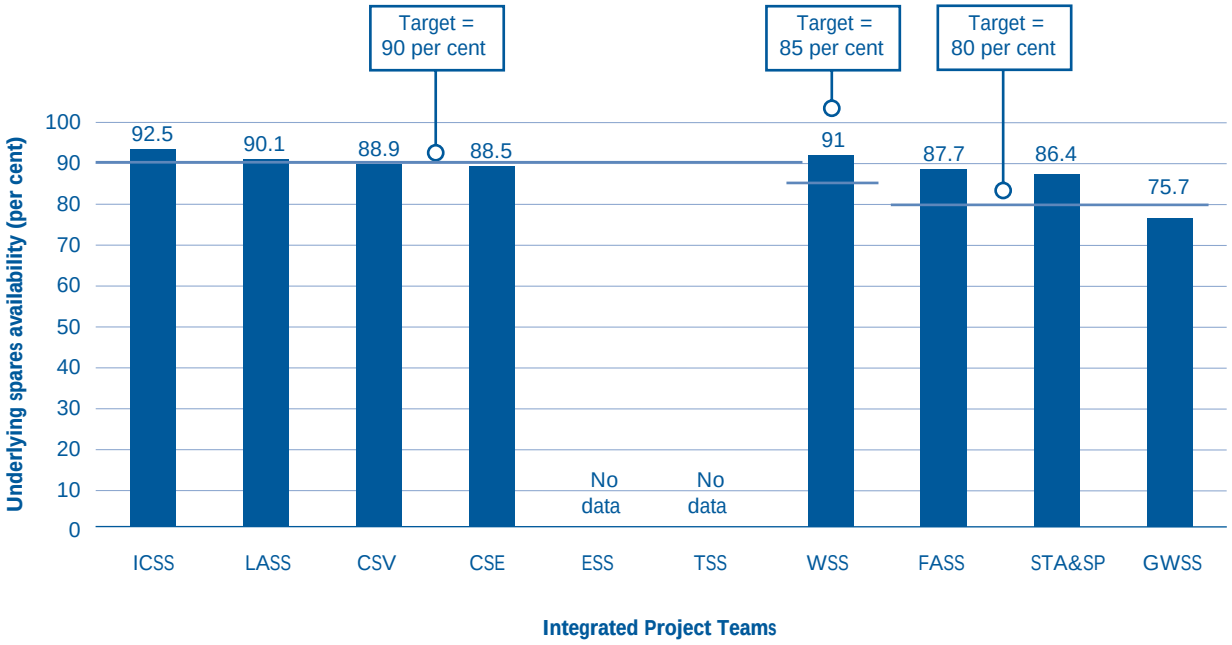
Equipment reliability is not measured

1.15 Another important measure would be equipment reliability, but the Department does not measure reliability for all whole equipments. We found that the reliability of specific sub-assemblies and other repairable items was not collated across the Department, but that IPTs knew how reliable important items were. Without this information, it is impossible for the Department to make accurate comparisons of whole life costs to:

2 *"Non-Competitive Procurement in the Ministry of Defence" (HC 290, Session 2001-2002)*

6 Spares availability

Most IPTs were meeting or were close to meeting their targets for underlying spares availability



Source: National Audit Office survey of IPTs

a support procurement decisions;

b measure the performance of defence manufacturers in providing reliable equipment; and

c assess the military and civilian manpower required to support particular equipments.

For example, industry maintains that, while its repairs may be more expensive, their life to subsequent failure is significantly greater. This claim cannot be substantiated without accurate reliability data.

Spares availability is generally good

1.16 In the absence of more comprehensive measures, the key measure used by IPTs for the performance of the major repair and overhaul activity they manage is underlying spares availability - the proportion of occasions that spares (including repairable items) are issued to units when required. The Department recognises that a more desirable measure is demand fulfilment - the number of orders received by units on time, in full, with no errors, but it is currently working to agree standards and definitions for this. **Figure 6** shows that IPTs were meeting, or were close to meeting, their spares availability targets where these were set and where data on performance were available.

There is scope for improvement in the efficiency of repair

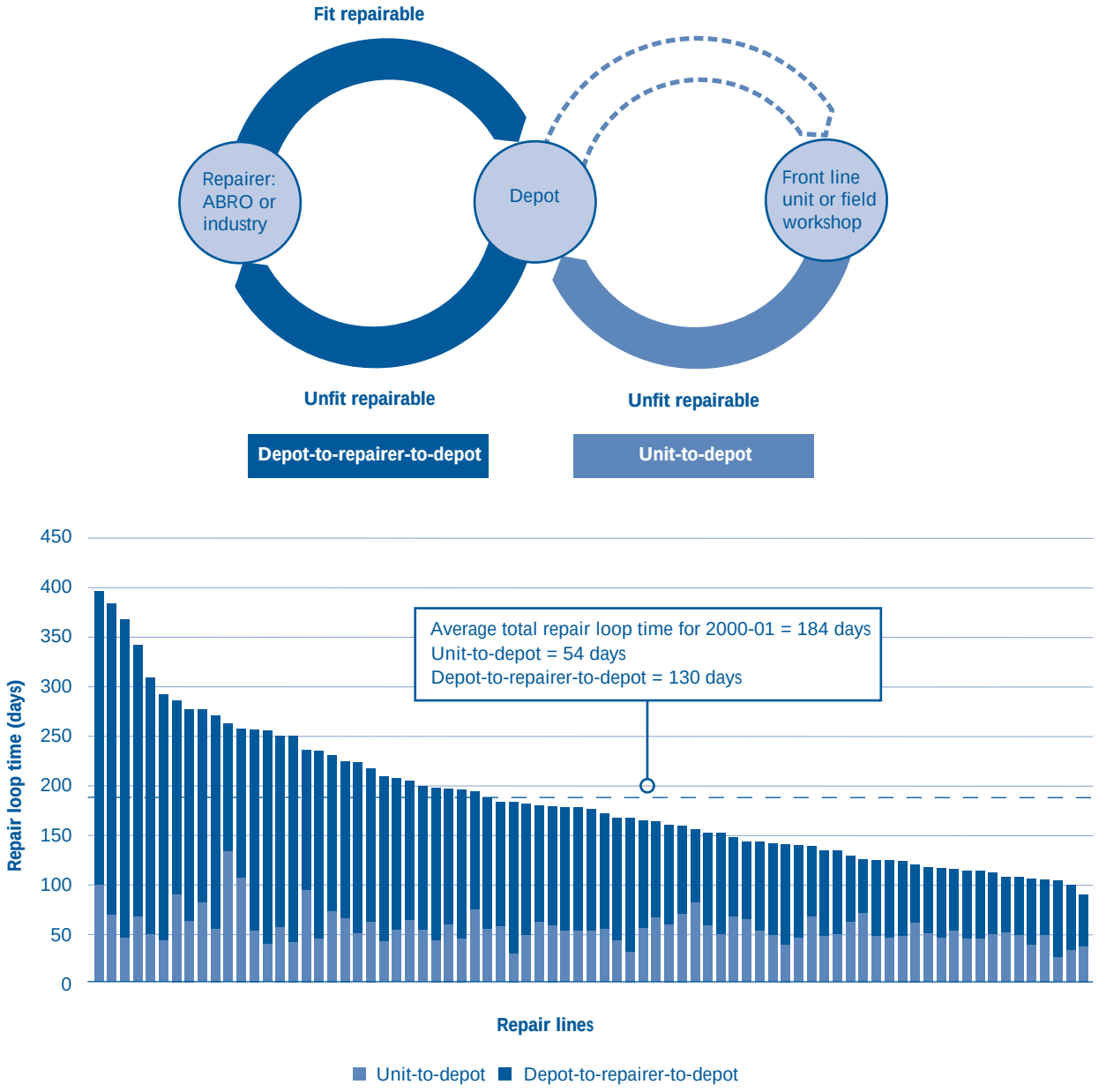
Repair loops are very long and could be substantially reduced

1.17 **Figure 7 (overleaf)** shows a simplified map of the repair loop. The Department used a new software tool to interrogate their stores systems and our analysis of the resulting data shows that, for our sample of sub-assemblies and repairable items, it took an average of 184 days in 2000-01 to move items around the repair loop - 54 days for items to be returned from units to depots, and a further 130 days for them to be repaired and arrive back at the depot ready for supply to the users. This was, however, an improvement over previous years - in 1999-00 it took a total of 249 days, and in 1998-99 it took an average of 304 days. In 1999, before the new software tool was available, the Department had estimated that the average repair cycle across the whole Army inventory was 138 days.

1.18 One possible consequence of long repair loop times is high levels of stock. The Department has calculated that, overall, a one day reduction in the segment of the repair loop from the unit to the depot to the repairer would enable a £3 million reduction in stock. And examples from other operational environments illustrate what improvements may be feasible. The Department has found that turnaround times for Royal Air Force engines were typically four times longer than those in industry. It

7 Repair loop times for sub-assemblies and repairable items

It takes a long time to move sub-assemblies and repairable items around the repair loop. For our sample, it took in 2000-01 an average of 54 days for unfit items to be returned from units to depots, plus 130 days for items to be loaded to a repairer, repaired and returned to depot



Source: National Audit Office analysis of the Department's data

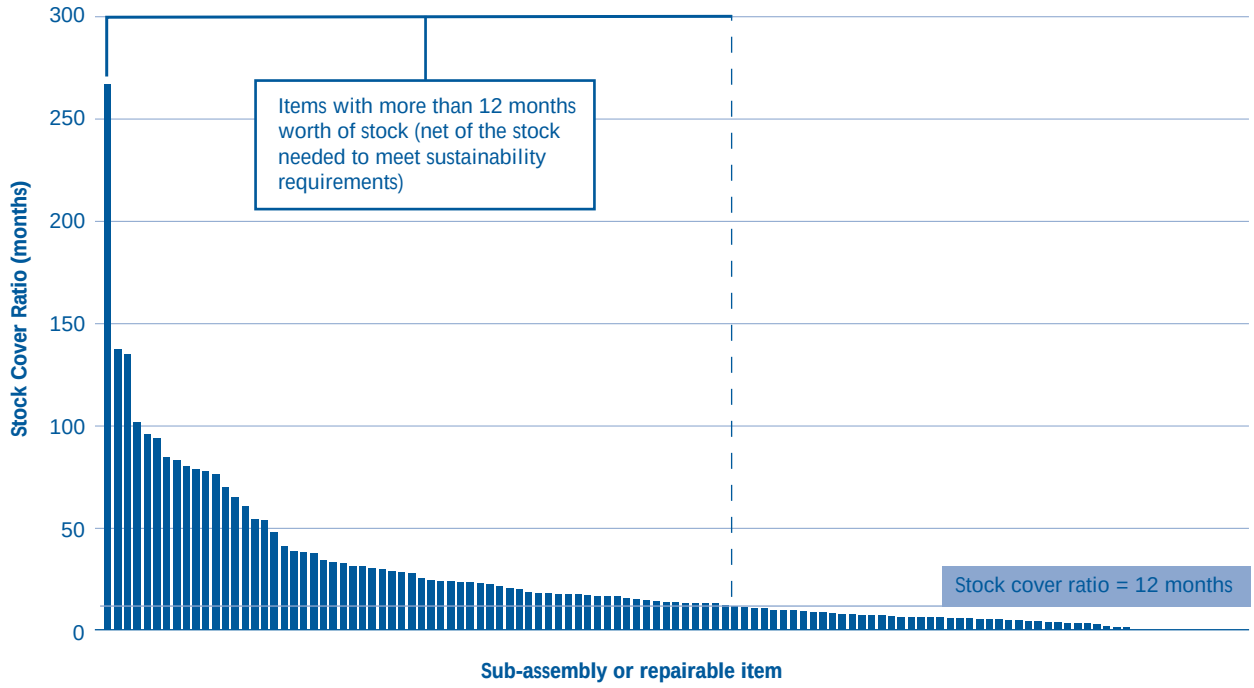
has been able to reduce the repair loop time for a marine generator from over 200 days to 49 days, with further reductions expected. However, for some repair lines, reducing loop times may not always be the optimum solution. For example, where the Department requires a high level of "sustainability stock" - which the Department earmarks for deployment on operations in order to keep the required quantity of equipment fit for the duration of an operation - or where reductions can only be achieved at high cost with little impact on availability.

There are large stocks of repairables

1.19 There are large stocks of sub-assemblies and other repairable items, even after taking account of sustainability requirements. We used data from the Department's land stores system to calculate how much repairable stock is held. We found that there were over 15,000 lines of repairable stock, worth over £1.3 billion. Furthermore, the levels of stock of some of the repairable items that we examined were very high. For 64 different repairable items (50 per cent of the sample), there was sufficient stock to cover more than 12 months of demand, even after we had subtracted the amount of

8 Stocks of sub-assemblies and other repairable items

There are large stocks of repairables, even after taking account of sustainability requirements



Source: National Audit Office analysis of the Department's data

sustainability stock **(Figure 8)**. One reason for high levels of stock is the length of the repair loop (paragraph 1.18). Another factor is the practice of buying large initial stocks of spares for some new equipments. This has been done either to guarantee supply of potentially obsolescent items over the equipment's life, or to achieve economies of scale in the purchase price - although these economies may be offset by stock management and storage costs.

1.20 If the Department was able to reduce the stock levels of these items to a 12 month supply, this would lead to a reduction in value of stock held of some £45 million (and the associated annual interest on capital charge by £2.7 million). More widely, the Department has recently identified for disposal total land stock (both consumables and repairables) worth over £300 million and further reductions are planned.

Programme completion is mixed

1.21 Our case examples show that performance in meeting annual programmes of repair and overhaul is mixed. This is not surprising for the planned repair of sub-assemblies and repairable items, as the planned programme depends on forecasts of the number of failures that will occur. For some lines, there may also be high numbers of items that are found to be beyond economic repair and must therefore be replaced. We found that for 46 repair lines (32 per cent) the Department repaired as many items as it expected to, and for 55 repair lines (38 per cent), the number of repairs fell short of those expected. For the remaining repair lines, data were not available.

1.22 We would, however, expect scheduled overhaul and repair programmes for whole equipments to be completed in year. But we found that whilst nine repair lines (41 per cent) in our sample were completed in year, 11 repair lines (50 per cent) were not. The remaining two programmes of scheduled repair - for Challenger 2 and AS90 - were just beginning and data were not available.


87KJ94

Part 2

The Department has made important changes to its supply organisation and the way it conducts business

2.1 To deliver cost-effective repair, the Department needs to have sound organisational structures and procedures and relevant information on which to base its decisions. This Part of the Report considers the initiatives that have taken place, or are in hand, in each of these areas. The Department has introduced a new unified organisation for the delivery of its logistics support function and is pursuing more cost-effective approaches to equipment support. Some problems remain, however, in the information available to the Department, and some management practices could be improved.

The Department has made some important high level changes

2.2 This section of the Report identifies the high level changes that the Department has introduced to its management of equipment support in recent years and how this is translated into the land environment.

2.3 The Defence Logistics Organisation was launched in April 2000 creating a new unified logistics provider for the Armed Forces (Figure 2). The Defence Logistics Organisation replaces the single Service logistics organisations - the Chief of Fleet Support, Army Quartermaster General and RAF Logistics Command - and is headed by a single Chief of Defence Logistics.

2.4 The Defence Logistics Organisation has corporate and business plans that clearly set out the high level mission and vision for the Department's logistics activities - "to provide joint logistics support to our Armed Forces" and "to excel as an integrated and responsive logistics team". The Defence Logistics Organisation also has a key strategic goal to reduce output costs by 20 per cent by 2005 whilst ensuring that the quality of outputs is maintained or improved. There are other important targets for reducing the amount of stock held (paragraph 1.12e), annual spares provision, and storage and distribution costs.

2.5 This vision is cascaded into a vision for Land equipment support, as set out in Director General Equipment Support (Land)'s corporate strategy and short term business plan.

The Department has improved its approach to supporting equipment

2.6 This section examines how the introduction of IPTs has improved the organisational focus for equipment support. It also considers the business improvement programmes introduced by the Department to introduce best practices into equipment support, including steps taken to reduce the amount of base overhaul undertaken.

The introduction of IPTs has improved the organisational focus for equipment support

2.7 The introduction of IPTs has created a single supplier within the Department for each equipment. We have reported separately on whether the transition to IPTs is being managed effectively[3]. IPTs are empowered to manage equipment support in a cost-effective way. As part of the "breakthrough" process when an IPT is set up, it is asked to identify targets, including for financial savings. IPTs identify both "hard" targets which are considered to be testing but achievable, and "stretch" targets which will be significantly harder to meet and will require the team to consider all constraints and find innovative solutions. IPTs are empowered to make decisions to enable them to meet these targets.

Resource based and whole life approaches focus more clearly on costs

2.8 The introduction of Resource Accounting has focused attention on the cost of holding assets. Under the previous cash accounting regime, the Department did not have to record and value its holdings of assets. Now, assets such as vehicles and spares attract a six per cent interest on capital charge and this is focusing managers'

3 *"Ministry of Defence: Implementation of Integrated Project Teams" (HC 671, Session 2001-02)*

attention on the cost of unserviceable equipments and the cost of owning spares and other assets needed for repair. In addition, a through life approach is focusing more attention on the cost of equipment support. The IPT for a major equipment stays with it throughout its life, transferring from the Defence Procurement Agency to the Defence Logistics Organisation once the equipment is in service with the Armed Forces. All IPTs have through life management plans and consider the downstream support of equipments whilst they are being procured. And the Department is developing "whole life costing" systems which draw together all of the costs of procuring, supporting and operating an equipment throughout its lifecycle - which can be some 20 to 30 years from initial concept to disposal.

There are specific business improvement programmes for repair and other equipment support activities

2.9 The Department has introduced two main programmes in this area. The Beacon Initiative is designed to provide selected IPTs with short but sustained application of consultancy support in order to pursue innovative changes and apply best practices in order to help the IPT achieve not only its hard targets but also its stretch targets (paragraph 2.7). The Department intends also that the lessons from Beacon IPTs will provide a model for other IPTs facing similar challenges. Tank Systems Support is the only IPT in the Land environment to be selected as a Beacon IPT. In addition, the Department has a Support Chain Integrated Business Team which is running an Accelerated Lean Delivery Programme aimed also at introducing best practices in support IPTs. To date, the Department has concentrated its efforts under this programme on the Air and Sea environments, where it judges improvements and savings to be more readily obtainable - support in the Land environment is more diverse and lower value. Nonetheless, the Department intends to apply the Programme to the Land environment because it is seeking to generate a lean support culture across the Defence Logistics Organisation.

The Department is reducing the amount of base overhaul work carried out and pursuing more cost-effective approaches to scheduled repair

2.10 The Field Artillery IPT is now using a "condition monitoring programme" where three vehicles a year are inspected in order to inform the preventative maintenance required in the field. This hybrid approach - between reliability centred maintenance by the field Army and base overhaul - is being trialled currently across the AS90 fleet.

2.11 For other equipments, such as the Warrior Fighting Vehicle, the Department has reduced the frequency of base overhaul and reduced the amount of work carried out during the process. The IPT is pursuing a similar Economic Base Repair scheme for CVR(T), although the Team has not been able to undertake engineering studies in the same depth as were done for Warrior. Similarly, the Tank Systems Support IPT has introduced Base Inspection and Repair for Challenger 2. Previously the Challenger I main battle tank was base overhauled by ABRO at set intervals, based on the usage of each vehicle. Each vehicle was stripped down and the hull repaired (paragraph 1.6). The majority of repairable items was also replaced or repaired, irrespective of condition, to bring the vehicle to the same standard as when it had first rolled off the production line. For Challenger 2, the IPT is proposing a regime of "Base Inspection and Repair", under which vehicles will be stripped and inspected and hull repairs will be carried out. With some exceptions, only those items found to be unserviceable after testing will be repaired or replaced.

2.12 In-depth repair, rather than full overhaul, is being pursued for other equipments. For example, on HVM Stormer and 'B' vehicles (wheeled support vehicles) such as DROPs and the Foden Recovery Vehicle (Appendix 2), following inspection and testing only unserviceable parts will be repaired or replaced. And for MLRS, the Department intends that ABRO will carry out regular "value engineering exercises", a form of targeted in-depth repair, on long serving vehicles. The vast majority of repair work for MLRS is planned repair and is carried out by, or contracted by, the NATO Maintenance and Supply Agency.

Information needed for the management of repair activity is patchy and some management practices are weak, but the Department is working on this

2.13 This section looks at the problems faced by the Department in collecting meaningful data on which to forecast repair workloads and the initiatives in place to overcome them. We also note shortcomings in the management practices of some IPTs.

The Department acknowledges that there are data problems

2.14 The Lean Support Chain Tiger Team found that, across the Department, information on repair demand and workload forecasting is poor. Staff we spoke to, including

IPTs and the Land Command customer, agreed that this was the case for the Land environment. Problems exist both in predicting customer demand for equipment usage and in translating this into repair activity.

There are problems with forecasting equipment usage but the customer is working on these

2.15 Forecasting usage is difficult. Land Command, the principal customer for major repair and overhaul of land equipment, predicts likely repair demand from an overall annual level of training activity (for example, in track kilometres) for each fleet but, in the past, this has been constructed from minor adjustments to the previous year's bid. And the unpredictable nature of defence means that changes in demand have often arisen in-year as a result of relatively short notice operations - for example, in Kosovo. Land Command is, however, now developing a software tool to assist in the development of a complete costed picture of the resources required for peacetime training activity. In future therefore, the customer will be able to see the impact of changes in the training programme on the overall level of training activity and on fleet usage.

There are problems in translating equipment usage into required repair activity and stock levels, but the Department has adopted new tools

The process relies on experience as much as hard data and there are problems with data quality

2.16 The process of translating routine activity levels into repair requirements requires IPTs to consider historical demand, equipment reliability, and anticipated types (as well as levels) of future activity. It relies on the experience of IPT members and the assumptions made are not usually documented. Moreover there are important problems with the data that are used.

2.17 Automatically generated demand figures in the Army's Stores System 3 can be inaccurate. And there is no central information on spares usage at the point of consumption, so IPTs do not know when spares and repairables demanded by units are in reserve or when they are fitted to equipments. Nor are the Department's data on equipment reliability as good as they could be. For example, for major sub-assemblies, IPTs have fleet-wide data on the "mean distance before failure" but they do not necessarily know the way in which equipments are used at the time of failure. Both IPTs and industry complained of incomplete and inaccurate equipment failure reporting by users.

2.18 In addition, the Department is not able fully to asset track equipments, sub-assemblies and major repairables. It does not know which specific sub-assembly (by serial number), such as an engine, is in which equipment. The Department, therefore, has problems in maintaining configuration control records of the modification state of equipments and in monitoring the reliability of specific sub-assemblies and the quality of repair by different repairers. The exact location of assets in transit is also hard to determine. Repairers often do not know exactly when an item that requires repair will arrive, or what condition it will be in. This means that they find it hard to plan their repair or production schedules, and often leads to longer turn around times. Some companies have cited this lack of information as a key contributory factor to their poor performance on some repair lines.

The Department is using and developing new tools and major IT solutions

2.19 The Department is already using new tools to enhance its current information. For example, IPTs have adopted a software tool, "SABRE", developed by the Department's consultants to assist in the optimisation of stocks of repairables during peacetime. The Equipment Support Sustainability Analysis Model (ESSAM), is also in widespread usage. This tool is used for planning optimised levels of stocks of repairables for military operations and to model the stock levels and repair performance required to meet "sustainability" requirements (paragraph 1.18). The tool uses forecast information on repair loop times, repair performance (including the speed with which, and extent to which, repair providers can surge), and demand rates to model over time the size of the operational stockpile in-theatre. The Department can therefore use it to analyse different support scenarios and set the levels of stock that are required to sustain an operation, as well as exploring alternative ways of providing sustainability with smaller stock levels.

2.20 The Department also has in train substantial projects that should rectify many of the above deficiencies in management information. The Army's Stores System 3 is likely to be replaced as part of the project to provide a single inventory system for the land, sea and air environments - the Defence Stores Management Solution (DSMS). DSMS should provide a fully visible, on-line integrated demand and issues system, reducing much of the need for paper-based manual processes. As part of this, DSMS is expected to provide a modern provisioning package, and identification of unique assets by serial number. In conjunction with the Army's Delivering the Requirement for Unit Materiel Management (DRUMM) project, this should provide visibility of holdings and consumption of spares and repairables at units, and engineering and configuration management. And the In-Transit Visibility (ITV) system

should enable better tracking of individual assets in transit between locations, including around the repair loop, for all three environments. Eventually, other significant projects could give repair providers visibility of the repair process and stock levels.

2.21 The Department needs to be sure that it can deliver these projects in a way that will meet its future business needs. The procurement of any large IT system carries substantial risks, and there are many examples where government departments have found successful implementation difficult[4]. The Department's selection of commercially available products, and its incremental approach should reduce some risks. Nonetheless, the Department still has to tailor the solutions to the defence logistics business and integrate them with many existing and planned systems. The criticality of the systems means that the Department needs to ensure that they are delivered on time and meet not only current requirements, but the requirements of a leaner logistics organisation.

IPTs do not yet know repair costs

2.22 Resource Accounting and Budgeting is highlighting the cost of holding assets, but IPTs do not yet know the full costs associated with their repair management - for example, distribution, storage, and spares provisioning.

Some management practices are weak

2.23 The Department's Lean Support Chain Tiger Team highlighted poor monitoring of repair turn around times and repairer performance. We found specified repair turn around times for only 73 repair lines (44 per cent) in our sample, and repair performers' performance against them is not queried unless it is exceptionally poor. Instead IPTs concentrated on in-year completion of repair programmes (see paragraph 1.21). IPTs did not collate information on the number of warranty returns incurred by different contractors, although they considered the number to be low for most contractors. And we did not find widespread use of vendor rating systems, although IPT staff generally had an appreciation of the quality of repair carried out by different contractors, as well as the overall quality of the service provided.

2.24 Limitations in the Department's current IT systems mean that many processes in the management of major repair and overhaul are paper-based. Moreover, as a result of the data deficiencies described above (paragraphs 2.16 to 2.18), a considerable amount of staff time in the customer, IPTs, and supporting Defence Logistics Organisation branches, is devoted to micromanagement - especially locating items and managing their progress around the repair loop. There is substantial scope therefore to reduce this workload through improved IT and through outsourcing these functions.

4 *PAC 1st Report, Session 1999-2000, "Improving the Delivery of Government IT Projects"*

Part 3

Industry is set to get a wider role in major repair and overhaul

3.1 Part 1 of this Report has shown that industry is a key provider of major repair and overhaul work for the Department. This Part shows how, largely as a result the Department's whole life approach to the support of future equipments, industry is set to get a wider role. We also examine how the Department is benefiting from wider industrial capabilities in innovative projects for some in-service equipments.

The through life approach drives further industry involvement

3.2 This section of the Report explains how, despite their empowerment to manage equipment support, IPTs must balance their choice of repair provider between industry and the in-house Agency. It also discusses how support solutions currently being developed by IPTs involve a high degree of contractor provision and the benefits associated with this action.

IPTs may use industry, subject to a number of constraints

3.3 IPTs in the Defence Procurement Agency are empowered, in collaboration with stakeholders, to select the best support solution for any given equipment as part of an approach called Integrated Logistics Support. Since the cost of in-service support is comparable to the cost of initial procurement, Integrated Logistics Support is aimed at achieving the optimum whole life cost as well as ensuring that the necessary support infrastructure is put in place. IPTs tailor their approach for each equipment, and so there is a wide range of possible support solutions. The team responsible for these matters in the Defence Logistics Organisation, the Support Chain Integrated Business Team has, with consultants, mapped a support options matrix with 11 options - ranging from totally in-house to totally outsourced - but with the potential for equipments to be supported through a hybrid of two or more options.

3.4 IPTs are, nevertheless, subject to some constraints. The Defence Logistics Organisation's business units provide IPTs, including those in the Defence Procurement Agency, with policy direction on, and funding for, Integrated Logistics Support. And the Director General Equipment Support (Land) must endorse support solutions identified by them for land equipment. For key operational equipments and their sub-assemblies, Director General Equipment Support (Land) mandates that a core in-house repair capability must be retained if one or more of the following criteria are substantially met:

a the Department would otherwise be dependent on a monopoly source contractor;

b dedicated "war reserve" stockpiles are less than 75 per cent of either NATO and National "Stockpile Planning Guidelines" for complete equipments or calculated sustainability requirements (paragraph 1.18) for sub-assemblies and repairables; and/or

c repair capabilities are not available in other Government owned facilities.

These criteria imply that some Government owned repair capacity is required for all key operational equipments and their sub-assemblies. The Equipment Capability Customer provides guidance to Integrated Logistics Support Managers on which equipments are key operationally.

Future support solutions involve a high degree of contractor provision

Public Private Partnerships and Private Finance Initiative deals

3.5 The Heavy Equipment Transporter project will provide a fleet of around 90 specialised trucks designed to move heavy and medium armoured vehicles. These are due to replace Scammell tank transporters, with an in-service date of 2003. The project is a Public Private Partnership and is an innovative support arrangement in that the Department will be contracting for, and paying on the basis of, an available capability. During peacetime, the contractor will be entirely responsible for the in-depth

repair of sub-assemblies and any vehicle overhaul required, and will deliver spare parts to military units. Within the units, the contractor's employees will work alongside military personnel both to drive the vehicles and to maintain and repair them. Some of the contractor's drivers and mechanics will also deploy on operations as uniformed Territorial Army soldiers (under the "Sponsored Reserves" scheme[5]). And, depending on how benign the operational environment is, the contractor will deliver spares packs either into the military supply chain or direct to front line units.

3.6 The Department intends that the future Field Electrical Power Supplies programme will be provided under Private Finance Initiative arrangements and has selected Vickers Specialist Engines, teamed with a number of partners, as the Private Finance Initiative provider. The programme involves the design, development, supply, maintenance and finance of a fleet of over 1,300 trailer-mounted generator sets in the 8kW to 40kW power range. The contractor will own the equipment and the Department will pay a fee for its use. The programme is estimated to be worth over £100 million over a 15 to 20 year contract. The Department is considering similar approaches for fleets of generator sets in the lower power ranges.

Other future land projects

3.7 The Department is likely to pursue full contractor logistics support for two major combat support vehicle projects. The Wheeled Tankers project is for the provision of over 400 fuel and water tankers, with a whole life cost of around £500 million. The Support Vehicles project is to replace the existing four, eight, and 16 tonne cargo trucks and associated recovery vehicles, and could result in a new fleet of over 10,000 vehicles at a cost of over £1 billion. The Department intends that the contractors will provide all in-depth repair of sub-assemblies and repairables, overhaul of vehicles where required, and stock on a just-in-time basis into the military supply chain. And the Department intends that the future armoured engineering vehicles Titan, Trojan and Terrier will all involve substantial contractor logistics support, with at least 10 to 15 year contracts let with industry.

3.8 The programme to provide a Multi-Role Armoured Vehicle fleet of more than 1,000 armoured utility vehicles is an important land project and is due in-service in 2008, with early vehicle deliveries in 2006. It is a collaborative project involving the United Kingdom, Germany and the Netherlands. The logistics support policy for the fleet is still under development but current proposals suggest that the repair strategy will be fairly traditional. Nonetheless, the contractor may well carry out much of the planned repair of sub-assemblies and repairables and there may be some use of novel solutions such as direct exchange (paragraph 3.12 below). The vehicles are likely to require base overhaul, and it is currently intended that this will be competed between ABRO and industry.

Involving industry brings benefits

3.9 While contracting with industry for support needs to be carefully considered in the light of potential increases in operational risk, there are, nonetheless, clear benefits to such arrangements which are difficult or impossible to achieve through the use of in-house providers:

a Contractor Logistics Support can lead to reduced whole life costs through design improvements from the outset

By contracting with industry for through life support, original equipment manufacturers can be incentivised to design equipment from the outset in a way which will reduce future support costs. The Department should be able to contract in a way which transfers some of the risk about the performance of an equipment, in particular its reliability, to the contractor.

b The involvement of manufacturers in repair more readily allows reliability and capability improvements to be made throughout the life of an equipment

It is possible to agree gainsharing arrangements under contractor logistics support that will allow both the Department and the industrial partner to benefit from improvements in reliability later in life, as the result of design improvements and modifications proposed by industry. An original equipment manufacturer is well placed to propose modifications as it has the design expertise and test data for the equipment in question, and frequently can draw on technological advances adopted for similar future equipments sold to other military or commercial customers. This is particularly important in areas where the technology advances considerably during the service life of an equipment, such as electronics and software. In contrast, under traditional repair and overhaul arrangements, there is little incentive for industrial repairers, even when they are the original manufacturer, to propose modifications. And in-house repairers, such as ABRO, have limited or no design and manufacturing capabilities and are unable to design or implement modifications without the assistance of industry who often hold the intellectual property rights.

5 *Sponsored reserves are contractors' staff who have agreed to be mobilised when required, to continue their work in operations alongside Service personnel who depend upon them.*

c Support work can provide one way of maintaining industrial capabilities during gaps between production contracts

Defence procurement is characterised by peaks and troughs in demand, with long gaps between large production contracts. In such circumstances, especially if the prospects for exports are weak, manufacturers look to support activities such as repair. Support work rarely provides levels of turnover or profits comparable with manufacture, but it does provide a way of maintaining skills and capacity. Several industrial players told us that repair work helped to maintain a reasonable level of turnover during the lean years. They were concerned that without such support work, they would have to exit the defence business, particularly in the face of international competitors in Europe and the United States who have substantial repair work.

Wider logistics and manufacturing expertise in industry is being drawn on

3.10 In this section, we examine how the Department is seeking to take advantage of industry's capabilities in such areas as supply chain performance, inventory management and asset tracking. The Department is increasingly drawing on wider industry logistics and manufacturing expertise in repair contracts for current equipments and this appears to be delivering, or have the potential to deliver, benefits.

The best of industry have overtaken the Department in implementing efficient logistics solutions

3.11 The best of industry have overtaken the Department in implementing innovative and efficient logistics solutions. However, the most efficient operations are designed often for rapid turnover or a narrow range of products or for relatively predictable demand or a combination of these factors. And the majority of industry does not match up to the standards of the best of class, and this may be particularly true for parts of the defence sector. Nonetheless, the Department acknowledges that it lags behind best practice against industry comparators that it has benchmarked against, particularly in: the overall performance of the support chain including repair loop times (paragraph 1.18); asset tracking; the structure of the supply base; and relationships with suppliers. Other logistics practitioners and experts that we spoke to highlighted other areas of industry best practice in inventory and supply chain management - including IT solutions, management information, vendor appraisal systems, supplier development, and partnering arrangements.

The Department's innovative solutions in the land environment rely on industry capabilities and these appear to be delivering benefits

3.12 TRADERS (The Rapier DIrect Exchange of Repairable Spares) is an innovative partnering agreement agreed between the Department and Matra BAe Dynamics for the support of the Rapier Field Standard B short range air defence system. Under the contract, the company will procure consumable spares and deliver them direct to the users' locations, and provide a "direct exchange" service for repairables that cannot be repaired by the user. The company is contracted to meet 85 per cent (rising to 95 per cent) of demands within a standard delivery time. In order to provide the service, the company conducts repair and reprovisioning of consumable spares, and subcontracts storage and delivery to Unipart Defence Logistics. The advantages for the Department of this scheme include:

a guaranteed availability of repairables to users for the remaining lifetime of the equipment;

b risk transfer to the contractor including, for example, the support of test equipment;

c an incentivised contract with gainshare mechanisms;

d replacement of six contracts with a single agreement; and

e anticipated savings of around three per cent over the alternative approach.

The Department considers TRADERS to be an important pathfinder project for trialling this type of arrangement where the operational risk is low. The IPT is currently considering whether the arrangements should be extended to the improved Rapier Field Standard C which is more important operationally, and the cost of repair is greater.

3.13 A similar direct exchange scheme for repairables is provided for Phoenix - a target acquisition and surveillance system (based around an unmanned aerial vehicle) which is primarily deployed in support of AS90 and MLRS artillery (Appendix 2). The Royal Electrical and Mechanical Engineers carry out repairs at front-line units, and BAe Systems is responsible for in-depth repair. BAe Systems staff are co-located with the MLRS regiments and operate an exchange point at each facility at which fit repairables can be exchanged for broken ones. The IPT responsible for the support of Phoenix considers that these arrangements are working well. However, the arrangements for the formal performance management of the company have not operated for periods of the contract because a large proportion of spares were deployed on operations in Kosovo, outside of the company's direct control. The IPT is working on more robust performance measures for a new contract

which is due to be let with BAe Systems in September 2002. The direct exchange scheme is also enabling the Support Chain Integrated Business Team, under the Accelerated Lean Delivery Programme (paragraph 2.9), to work with the Surveillance IPT and BAe Systems to provide a total asset visibility solution.

3.14 A further innovative solution will enable cost saving modifications to be incorporated into the repair programme. One aim of the Beacon Initiative within the Tanks Systems Support IPT is to improve the reliability of the TN-54 gearbox, currently used in the Challenger 2 main battle tank and the Challenger Armoured Repair and Recovery Vehicle. The manufacturer of the gearbox, David Brown Engineering Ltd, has proposed an enhancement package that will improve its reliability and durability by between 33 and 100 per cent. David Brown and ABRO previously shared the in-depth repair of the gearboxes. In future, however, David Brown is likely to be responsible for the in-depth repair and upgrade of all of the gearboxes because the reliability improvements depend on the repair and modification process as well as design and materials. Any improvements in reliability will result in savings for the Department. David Brown will be paid a bonus only if the targets for enhanced reliability are fully met. The IPT is considering how, in the longer term, it could achieve a service-based contract for the TN-54 gearboxes under which responsibility for the supply chain as a whole is passed to the contractor.

Developments in whole fleet management may increase industry involvement

3.15 The Department is considering changes to the way land fleets are managed and is set to implement an approach called "whole fleet management". This involves the active management and rotation of equipments through unit holdings, training fleets, and storage pools of equipments ready to be deployed on operations. It is radically different to the current approach to equipment management in which Army units hold the full complement of equipment that they need. Whole fleet management will require capabilities in:

a the husbandry of equipment fleets, including asset tracking, usage and health monitoring and configuration management;

b distribution and storage, including in controlled humidity environments; and

c repair and overhaul.

While the Department is currently considering how the service should be provided, it seems likely that a leading industial player or consortium would be best placed to achieve this. The Department intends to implement a whole fleet management solution for most land equipments in 2005, subject to satisfactory trials.

Limitations in industrial repair capability lead to partnerships between industry and ABRO

3.16 This section notes that not all parts of industry are well placed to carry out repair and overhaul and identifies the developments in relationships between industry and ABRO that are evolving as a consequence.

3.17 Despite trends towards contractor logistics support, and the success of increased industrial involvement in current repair programmes, parts of industry acknowledge that they currently do not have well developed repair and overhaul capabilities. Some original equipment manufacturers, as prime contractors, carry out only a limited amount of the actual manufacturing of parts and their core capabilities lie instead in equipment design supply chain management, assembly and systems integration. Traditionally, they have not been interested in repair or remanufacture work, unless it is repair by replacement of parts, and do not have the facilities to do some of the work. Some of the manufacturers that are increasingly involved in equipment support are therefore looking to ABRO to provide this remanufacturing expertise and capability.

Alvis Vehicles Limited and Vickers Defence Systems have both entered into partnering agreements with ABRO

3.18 Alvis Vehicles Limited and Vickers Defence Systems both entered into partnering agreements with ABRO in 2001. The Alvis-ABRO agreement is not tied to any specific programme but signals Alvis's intent to consider how it can work with the Agency in future, probably starting with proposals relating to the repair and upgrade of the Warrior armoured fighting vehicle. The Vickers-ABRO partnering agreement is also a statement of intent to work together on a number of programmes, including export work, but centres principally around the anticipated contract for the base inspection and repair of Challenger 2 (paragraph 2.11). For this work, Vickers will be the prime contractor and ABRO the key subcontractor. Vickers will provide technical expertise about the design, the manufacturing process and quality and test regimes, and ABRO will

conduct the remanufacturing and repair work - the contract will be worth in the region of £10 million a year, with the work share roughly split 90 per cent to 10 per cent in ABRO's favour. The current intention is that the risks and rewards under the contract will be shared - possibly 40 per cent to the IPT, 30 per cent to ABRO and 30 per cent to Vickers.

ABRO intends to work more closely with other potential industrial partners

3.19 ABRO intends to make its capabilities and facilities available to those equipment manufacturers that are contracting with the Department for future programmes. However, as one key supplier observed, to partner effectively in this business means handing over intellectual property and helping ABRO to generate capabilities that it does not already have. As such, despite the fact that defence companies frequently collaborate on one programme and compete on another, they may be wary of partnering with ABRO if ABRO bids against them on programmes or partners closely with a number of their direct competitors.

Part 4

ABRO is moving to Trading Fund status but important issues are unresolved

4.1 The Department has, to date, allocated a major share of its major repair and overhaul workload to its in-house provider, ABRO. The Department is now moving ABRO to Trading Fund status. This Part of the Report examines the background to, and implications of, this decision for ABRO and for the land equipment support sector generally. We found that the move to Trading Fund status provides clear business advantages whilst preserving options for the future. In moving forward, the Department needs to develop a clearer view of the future role, shape and longer-term ownership of ABRO to address significant risks to the cost-effectiveness of the Department's major repair and overhaul business.

The Department is in the process of moving ABRO to Trading Fund status

4.2 ABRO has been a defence agency since April 1993. As part of a process of continuous improvement, the Department undertook a formal Next Steps Review in 1997 to determine how Army Equipment Support might be better delivered, including the role then played by ABRO. The Review proposed a number of structural changes relating to ABRO, including the moving of ABRO's procurement task to the multi-disciplinary groups it proposed for equipment support (later to become IPTs). It also included a Prior Options review of ABRO workshops and concluded that these should be restructured as a Trading Fund[6].

4.3 The Prior Options process ruled out the abolition of ABRO, wholesale contractorisation or retention of ABRO as a Vote-funded workshop agency. Privatisation was considered feasible but, at the time, potential industry bidders indicated that they may bid for ABRO workshops only if certain preconditions were met, or that their offers would be heavily dependent on them. Most importantly, bidders would have required measures of certainty over their future workload. Trading Fund was therefore determined to be the optimal solution on value for money grounds. This strategy was confirmed in the Department's Strategic Defence Review White Paper, and the Department is vesting the Trading Fund on 1 April 2002.

Trading Fund status provides clear business advantages

4.4 Trading Fund status will move ABRO onto a more commercial footing and offers ABRO and the Department a number of benefits. There will be greater exposure to competitive pressure, pricing will be more equivalent with that by industry than before, and ABRO will increasingly be subject to the risks carried by industry. The Department also intends that the Trading Fund will improve the efficiency and effectiveness of ABRO's operations as a result of greater management flexibility, with an enhanced ability to innovate and develop the Agency's business. Nonetheless, the Department will continue to test the benefits of the Trading Fund and is planning to review ABRO's operations in 2005.

Trading Fund status leaves key issues unresolved

4.5 This section considers the case made by the Department for retaining ABRO. It sets out the Department's approach to the ownership of the Agency and the role that it is required to fulfil, particularly as regards the degree of flexibility, surge and dual sourcing needed and its ability to compete with industry on an equal footing.

6 *There is no statutory definition of a Trading Fund, but HM Treasury describe a Fund as " a self accounting unit which, while remaining under the control and management of a Minister, [has] greater freedom to manage its financial and other affairs. In particular, [it] is able to use its income to settle its liabilities and retain any cash balances at the year end." (Guide to the establishment and operation of Trading Funds, Central Accountancy Team, HM Treasury, January 2001).*

The military case for retaining ABRO is unclear

4.6 The Department has work in hand to determine the minimum in-house logistics capabilities, including repair and overhaul, that are needed to integrate successfully contractor logistics support with the military supply chain on operations. As a first step, the Department has had preliminary discussions with a research provider to identify what tools or models could be used for this work. However, progress has been slow because the Department has focused its limited resources on higher priority tasks.

4.7 ABRO has produced a business case for its establishment as a Trading Fund and the Defence Logistics Organisation has produced an accompanying strategy. Together, these formed the business case to Defence Ministers and HM Treasury. The case made by the Department for retaining ABRO in-house is not that it has a strategic role in a military sense, but that it provides benefits both to the defence mission and to the effective management of logistics support. This position acknowledges the earlier conclusion of the Prior Options process which was that the strength of the strategic cases for the retention of in-house in-depth repair and overhaul facilities were neither singly nor collectively convincing and would not rule out privatisation. However, the Department's business case acknowledges:

a that ABRO provides repair by repair and remanufacturing, rather than only by replacement;

b its ability to switch between work at short notice;

c its access to intellectual property;

d its knowledge and experience of the Army's requirements; and

e its ability to support obsolescent equipment.

The Department considers that the Trading Fund route represents an appropriate way forward as it will provide ABRO with the opportunity and imperative to become more efficient, while retaining the advantages of keeping it within Departmental ownership.

4.8 It is not clear how the lack of a strong case for keeping ABRO in-house for military strategic reasons reconciles with the existing policy of retaining in-house repair and overhaul for key operational equipments (paragraph 1.12b). In a letter to the Defence Manufacturers Association in August 1998, the Department reaffirmed this policy and stated that the retention of the in-house capabilities provided by ABRO was essential for strategically vital equipments. But not all strategically vital equipments are repaired by ABRO. For example, the commander's and gunner's sights on the Challenger 2 tank are not repaired in-house because of their technical complexity. The policy for retaining in-house repair and overhaul for key operational equipments is supported by business process instructions which guide IPTs into considering ABRO as the first option for major repair and overhaul.

4.9 We found that IPTs' views on the strategic importance of ABRO varied. Some staff referred to ABRO being strategic in support of key operational equipments or in the generation of sustainability (paragraph 1.18). Others referred to other benefits of using ABRO but did not refer to the in-house capability as strategic. While the move to Trading Fund does not prevent these capabilities being retained, the business case does not address which, if any, will be. If the Department follows the conclusion of its earlier Prior Options Review, over the longer term, the viability of ABRO overall and of specific capabilities will be determined by the market alone.

4.10 The Department has not fully defined the need for either surge and flexibility or for dual-sourcing and so cannot know what level of ABRO capacity is needed:

- The Department values surge and flexibility (paragraph 1.12c) and the business case for Trading Fund acknowledges that there are such benefits from having an in-house provider, but does not attempt to quantify them. A June 2000 study of repair capacity in the Department suggested that ABRO's minimum surge capacity is built in at 30 per cent, a similar level to that that the Department contracts for with industry. But ABRO's surge capacity for individual repair programmes is likely to be much higher, up to 300 per cent in some cases, because resources can be shifted from different repair lines. Some industrial manufacturers and repairers cannot shift resources in this way because they handle a much smaller range of items, although those that run similar commercial lines told us that, in times of emergency, they would be able and willing to shift resources from them to work for the Department. Half of the IPTs that we spoke to regarded ABRO as important because of its capacity for surge and flexibility at short notice.

- Dual sourcing has primarily been used as a way of maintaining competitive tension, but it is also a way of managing operational risk. Guidance to IPTs on the need for retaining in-house repair capabilities acknowledges that dual sourcing increases the likelihood of surge being possible and protects supply against company liquidation or contractual disputes. Several IPTs told us that they considered dual sourcing to be important for maintaining "security of supply" for the repair of key sub-assemblies. It should be recognised, however, that many of the parts and sub-systems used by ABRO to repair sub-assemblies are themselves purchased by ABRO from a single source. The Department's

business case for Trading Fund, however, does not attempt to quantify the level of dual sourcing that is required, and the increasing involvement of industry in through life support (paragraphs 3.2 to 3.9) means that dual sourcing is unlikely to be pursued for future equipments.

4.11 It is not clear, on the other hand, that there are alternatives to in-house repair by ABRO for some legacy equipments. The Department has not, as part of its business case for the Trading Fund, or for any other purpose, identified how much major repair and overhaul work there is for which ABRO is the only possible provider. The Prior Options Review concluded that, in practice, industry would provide a repair capability for equipments for as long as the Department was willing to pay the asking price. However, two IPTs told us that ABRO is crucial for the repair of legacy equipments which are obsolescent in respect of commercial technology - for example, the Clansman radio system (paragraph 1.5). And, because ABRO repairs a wide range of items, it is better placed than many industrial repairers to reclaim obsolete components from one type of equipment for use in another. The Engineering Support Systems IPT reported that industry either lacked the capability or willingness to repair some of its legacy equipments.

It is not clear to what extent truly competitive procurement of repair and overhaul can be sought

The Department has achieved very little competition in the major repair and overhaul of land equipment

4.12 The Department's policy for all procurement (or acquisition) is to use competition wherever possible to ensure that it gets value for money. However, we found that only a small proportion of the total amount of repair work is competed and that little of ABRO's work has been competed in the past. For our sample, only 17 per cent of repair lines were subject to formal competition (paragraph 1.9 and Figure 4). Moreover, some of the competition that had taken place was between different industrial providers rather than between ABRO and industry. And so, even though ABRO had been awarded all of the work on 59 repair lines in our sample (35 per cent), it had won only four repair lines (two per cent) in competition.

4.13 There were also 11 dual sourced repair lines in our sample (seven per cent), but for all of these, the Department had not conducted full competitions but had allocated work on the basis of repairers' costings for a single item. The Department considered that industrial repairers priced the initial allocated 30 per cent proportion on the basis that they could win some, or all, of the "competed" segment (paragraph 1.12b). However, whilst one industrial provider told us that it had confidently priced on the basis that it would win all of the "competed" segment, another was unclear about the proportions it was being allocated, and that poor or non-existent forecasts for the volume of demand made it difficult to price. The Department might achieve better value in any future dual sourcing by asking repairers to provide different prices according to the percentage, or preferably the actual volume, of work for which they bid.

The Department now aims to increase competitive pressure on ABRO, but this will take time, and needs to be on a level playing field

4.14 The move to Trading Fund status will increase commercial pressures on ABRO. It will need, in future, to compete with industry for potential work as the Department ceases to allocate work under previous arrangements. It is important, therefore, that the Department ensures that appropriate mechanisms are in place to ensure that competition between ABRO and industry is on a level playing field, in particular contract letting, bid pricing and risk transfer.

The Department intends to compete 30 per cent of ABRO's allocated work

4.15 The Department has set a target for competing 30 per cent of ABRO's workload, by value, within three years of the move to Trading Fund status. The target applies to the Land environment as a whole, rather than to individual IPTs who may choose, therefore, to compete more or less than 30 per cent of their ABRO work. (In fact, the competition of one or two major repair programmes - such as a base overhaul programme - would be sufficient to meet the target.) Initially, the Department intended that the target should be set at 80 per cent of the work currently allocated to ABRO. This target was reduced, however, because IPTs are not able quickly to compete many of their repair programmes. In part, this is because they do not have detailed repair specifications and will need either to pay ABRO to produce them or ask industry to produce full repair specifications from a "cardinal points specification" (an outline specification) provided by the IPTs. The resources required by IPTs to run competitions will also impact on progress.

It is important to separate contract letting from repair provision

4.16 To be effective, competition must be on a level playing field, in terms of the competitive process, and equivalent pricing conditions and risks placed on bidders. Before the establishment of IPTs, ABRO controlled the letting of the Department's repair contracts, and provided repair by its workshops. While the Department attempted to maintain appropriate

separation between the ABRO Procurement Group and the ABRO workshops, industry sometimes perceived competitions to be biased. Following the Prior Options review (paragraph 4.2), the Department moved the contract letting function from ABRO into the multi-disciplinary groups that are now IPTs (paragraph 1.7). And IPTs told us that, following Trading Fund, they will increasingly treat ABRO like any other contractor.

Prices should be on an equivalent basis

4.17 It has been hard to compare ABRO and industry prices in the past, whether for uncompeted or competed work, but this is now improving. Previously, the full cost of using ABRO on uncompeted work, the majority of ABRO's workload, has been unclear. In part this is because, under the old Vote funding system, ABRO drew 'free' spares from the Army's supply system and did not pay for transport and infrastructure services provided by other parts of the Department. Also, ABRO's work was traditionally measured in terms of the number of man hours required to complete it, rather than as a cash or resource cost. The Department introduced cost measurement in monetary terms for ABRO's main programmes in 2000-01, and ABRO has introduced systems that build up costs from around 400 individual cost centres.

4.18 Where work has been competed between ABRO and industry, there have been some differences in the pricing structure. To date, ABRO's prices have included many overhead costs including accommodation, utilities, security and ABRO management but have excluded insurance (the Department self insures, as is common across government). And marketing, selling and profit have not been a normal part of its pricing structure. Some bids have also excluded transport costs and have only included notional prices for spares. (For the cases that we examined, however, IPTs were able to take these factors into account when comparing ABRO and industry tenders.)

4.19 While the above costs will all be included under Trading Fund arrangements some important pricing differences will remain. Industry has expressed concerns that the setting up of a Trading Fund is not, in itself, sufficient to ensure that ABRO sets its prices on a comparable basis with industry. In particular, ABRO has been able to price competitive work on an 'incremental' or marginal cost basis, with no variation in unit price for substantial variations in volume. In effect, therefore, all of the overhead costs have been spread over non-competed work. This is in accordance with Treasury guidance because the competed work is a very small proportion of ABRO's total workload, but it is not necessarily on the same basis as for industry bids. Industry, of course, are free to price incrementally when making competitive bids and, occasionally, where for example they are trying to break into a new market, they may even bid at a loss. However, as one firm told us, some industry providers are unable in practice to price in this way for the Department's repair work because the work accounts for a substantial proportion of their turnover and they must therefore recover all of their overhead costs (plus profit). Although, as a Trading Fund, ABRO will charge 'full cost' prices for its non-competitive work, it will continue to have some freedom in determining when to incrementally price for competitions.

4.20 Our financial audit work noted problems with some ABRO cost capturing systems, particularly inconsistencies between workshops in the booking of staff time and spares to specific jobs, and a degree of inaccuracy in booking[7]. ABRO is aware of these problems and has had a project team working on improvements for over a year.

It needs to be clear whether ABRO and industry carry the same financial risks

4.21 There are also differences in the comparative levels of risk carried by ABRO and industry. Specifically:

- ABRO has not had to carry the same risks as industry in relation to warranties. ABRO undertakes to re-repair any sub-assemblies that fail in use within a specified time, in the same way as industry provides warranties. IPTs do not collate information on the number of warranty returns (paragraph 2.23), although they believe these to be low. Under the vote-funded arrangements described at paragraph 1.10, the overall volume of ABRO's work is fixed and the risk of poor quality work effectively resides with ABRO's customers who, if the level of warranty returns was substantial, would be able to load less work onto ABRO. Under Trading Fund, the cost of providing warranty repairs will reduce ABRO's profits but, given the apparently low numbers, the risk is not significant.
- ABRO has not, in the past, had to carry the same levels of risk as industry in provisioning spares, especially those for which there is a long lead time between order and supply. Industry has to forecast spares and materials usage against firm priced tenders and, more importantly for enabling contracts, against poorly estimated or unknown repair quantities (paragraph 2.18). As a result, industry carries the risk of losing money on unused spares. In contrast, ABRO has been able to draw spares from the Army's supply system on demand and, more importantly, to return any unused spares into Army depots. The Department's business case for Trading Fund acknowledges that ABRO has backloaded £20 million of stock in the last 12 to 18 months. For the first year of Trading Fund, ABRO will continue to draw spares from the Army supply system, but will provide spares-inclusive

7 *Our financial audit work covers ABRO's submission to the overall Departmental Resource Account (DRAc) and the Agency's management accounts, but we are not required to provide a separate audit opinion on the Agency's DRAc submission.*

prices and be committed to paying for spares once they have been ordered. Nonetheless, ABRO will still not carry the same level of risk as industry because, where existing stocks are high, it will not need to demand "long lead" spares well in advance.

4.22 Overall, the Department needs to continue to work towards "contracting" with ABRO on the same basis as with industry, with comparable pricing and risk transfer. It also needs to ensure that IPTs are clear about the basis for competition between ABRO and industry and take account of any remaining differences. For example, if ABRO retains the freedom to price incrementally on competed work, IPTs should be aware that this is the case and that the overheads are being covered by the non-competed work. Arguably, insisting that ABRO bid on the basis of full costs would make costs more transparent. However, this could also enable industry to price incrementally in the short term and win business from ABRO, before enjoying a monopoly position in the longer term.

There are limits to the cost-effectiveness of competition

4.23 It is possible that increasing the level of competition could reduce the cost-effectiveness of in-house repair. A certain amount of competition should engender a more commercial approach within ABRO and enhance its efficiency. However, if the result of competition is that ABRO loses work to industry then, not only could strategic capabilities be lost, but the price of ABRO's remaining work would increase since a smaller volume of work would bear its fixed overheads. A substantial contraction in ABRO's workload could of course lead to rationalisation but smaller reductions are more likely to lead to under-utilisation of assets. The competing away of ABRO work on a large number of small repair programmes could also mean that the Department, whilst enjoying savings on individual contract prices, incurs extra resources in managing a larger and more diverse supplier base.

4.24 Intellectual property rights may also be a significant constraint on increased competition, given the proportion of work that is currently awarded non-competitively for this reason (paragraph 1.11 and Figure 5). And, whilst this might be overcome by negotiating additional rights, this is likely to be costly for the Department.

Opportunities for competition are likely to reduce

4.25 The Department's pursuit of partnering between ABRO and industry will reduce further the opportunities for competition, as ABRO is often the only feasible competitor to original equipment manufacturers, particularly given the restrictions caused by intellectual property rights (paragraph 1.10). Privatisation would likely have the same effect, depending on the route pursued - certainly any wholesale or piecemeal acquisition by existing equipment manufacturers would contract the repair sector further.

For the present time, ABRO will remain in-house

4.26 The Department has decided that, for the present, ABRO will remain under the ownership of the Secretary of State for Defence. It has not made any decisions about the longer-term future ownership of ABRO. Some of the benefits of ABRO described above could be provided under private sector ownership, especially if, as would be needed to maintain ABRO's surge capability and flexibility, ABRO was kept as a coherent whole with similar capabilities. However, to achieve this, the Department will have to overcome significant constraints imposed by restrictive intellectual property rights which, if left unchanged, would prevent ABRO from carrying out a large amount of repair work under private ownership. And other benefits, such as the ability to enable competition in a market in which there are relatively few players, would be severely degraded if ABRO was to be purchased by any of the current key industrial players - such as the original equipment manufacturers.

There are risks arising from the key unresolved issues

4.27 This section considers the benefits to the Department of ABRO's transition to Trading Fund and the risks to land equipment support that arise from the key unresolved issues discussed above relating to: the unclear military case for retaining ABRO; questions over the extent to which truly competitive procurement of repair and overhaul can be achieved; and uncertainty over the longer-term ownership of ABRO. It shows that there are clear benefits from the move to Trading Fund. But, in spite of the measures put in place, there is a risk that the Department will not achieve all of the benefits that could be obtained from IPTs acting in a fully co-ordinated way. In addition, there is a risk that ABRO may unduly drive the Department's strategy, although the Department has arrangements to safeguard against this.

4.28 There are a number of clear benefits from the move to Trading Fund. IPTs should have much improved visibility of the costs of repair by ABRO and will have greater freedom to test the market by competing work that was previously allocated to ABRO. ABRO itself seems to have a much improved understanding of its business as a result of the detailed planning for Trading Fund, including the preparation of a business case and associated financial projections. And the pressures of trading and competition will help ABRO's management to drive through further planned efficiency gains.

4.29 There is a risk that IPTs' pursuit of targets could erode strategic in-house capabilities, or make in-house support not cost-effective. Empowered IPTs are driven by their targets, especially savings targets, but these tend to reflect efficiencies for the support of an individual equipment, not for the Department as a whole. This risk is exacerbated because IPTs are unclear about the Department's strategy for ABRO and therefore may take localised decisions on repair sourcing which will erode ABRO's capabilities or its capacity to provide effective competition.

4.30 The same risks apply to decisions taken by IPTs within the Defence Procurement Agency in respect of whole life support solutions for new platforms, although the Director General Equipment Support (Land) must endorse support solutions identified by them for land equipment.

4.31 IPTs have to, however, pursue objectives that are consistent with those of the business unit within which they are located, and consistent with the wider Defence Logistics Organisation and Departmental corporate frameworks. In addition, to try to ensure that IPTs act in a fully co-ordinated way, the Department has devised a "Support Solutions Envelope". This provides guidance to IPTs on the support solutions that they can pursue without further approval. Where an IPT wishes to pursue an innovative approach that is outside the envelope, it will have to identify the benefits to the Department as a whole. Within the Land environment, the Department also has a Customer Advisory Group for ABRO, tasked with ensuring that the approaches taken by IPTs do not inadvertently put ABRO capability at risk. However, these measures are somewhat regulatory and process-based. A more effective solution may be to have a clear strategy for the future of logistics support, including ABRO, which is clearly communicated to IPTs so that they can ensure that their own support strategies are in line. The success of IPTs in focusing on their targets also suggests that the Department needs to define targets for the corporate efficiency and effectiveness of support that could be cascaded to IPTs as an incentive to achieve a corporately coherent approach.

4.32 ABRO intends to consider primarily the interests of the Department as its owner and major customer. Nonetheless, there remains a risk that, in the face of unresolved key issues, ABRO will take decisions that constrain the Department's future options. To mitigate this risk, the Department has established a Ministerial Advisory Board for ABRO which will act on behalf of the Secretary of State for Defence in fulfilling the Department's stewardship responsibilities for the Trading Fund, a key part of which is to provide corporate direction and reconcile issues relating to ABRO's relationships with the rest of the Department.

4.33 The Department has not made a strong case for retaining in-house repair and overhaul for military strategic reasons, even though some stakeholders see ABRO's role in the support of military operations as important (paragraph 4.10). But it is unclear whether the Army believes that ABRO's future should be left entirely to market forces. Although content that IPTs should compete 30 per cent of ABRO's allocated workload, were increased competition to lead to the substantial erosion of ABRO's capabilities - including its flexibility, ability to surge, ability to repair legacy equipment and its feasibility as an alternative or dual source - the Army customer may ask the Defence Logistics Organisation to reconsider this approach.

4.34 Unless the Department is clear about its medium to long term strategy, resolving the key issues discussed above, industry may continue to have concerns about ABRO as a competitor and about whether or not competitions are conducted on a level playing field. This could impact on their willingness to continue to work in the sector or to partner with the Agency. One important supplier to the Department told us that it would reconsider the partnership it planned with ABRO if ABRO were to partner also with its competitors or to compete directly on other programmes or in other markets. In order to maximise the benefits of partnering the provider intended to work openly with ABRO, sharing its own proprietary technical data and information on production and management processes (paragraph 3.19). It was concerned therefore that, if ABRO was to partner with others, it could (possibly inadvertently) disclose such commercially confidential information and give away competitive advantage.

Appendix 1 The methods we used

1 The main elements of our work were:

- a survey of 10 Integrated Project Teams;
- detailed examination of 14 case example equipments/ sub-assemblies; and
- visits to industry and other organisations.

2 We are grateful to the organisations, including the Department, who assisted us with this work.

We conducted a survey of Integrated Project Teams

3 We carried out a survey of the 10 Integrated Project Teams within the Equipment Support (Land) business unit of the Defence Logistics Organisation who manage major overhaul and repair work. We did this to gain an overview of: the size and variety of land fleets supported by the teams; the performance of those fleets in meeting availability targets; the level and performance of major repair and overhaul activity; and the allocation of work between ABRO and industry. We analysed the data collected to inform our selection of a sample of case study equipments for more detailed examination. The Integrated Project Teams that we surveyed were:

- Combat Support Equipment;
- Combat Support Vehicles (Support)*;
- Engineer Systems Support*;
- Field Artillery Systems Support*;
- Guided Weapons Systems Support*;
- Information and Communications Systems Support* - responsibility for this team later moved from the Equipment Support Land business unit to the Defence Communication Services Agency;
- Light Armoured Systems Support*;
- Surveillance, Target Acquisitions and Special Project Systems Support*;
- Tank Systems Support*; and
- Workshop Systems Support.

We undertook detailed examinations of selected case examples

4 We visited eight of these Integrated Project Teams - indicated with an asterisk in the list above - who were responsible for the support of 14 land equipments and/ or sub-assemblies that formed our sample (details of specific equipments and sub-assemblies are given at Appendix 2). The case examples were chosen to reflect criteria including: equipment type and age; operational significance; value of repair business; types of repair; and repair providers.

5 Our detailed work for each case example included interviews with key staff within each Integrated Project Team, including Team leaders, equipment support managers, repair managers, spares supply managers, and commercial managers. We sought information, in particular, on the equipment, its performance, and its repair and maintenance policy and strategy.

6 For each case example, we also identified a sample of repair lines including those for the scheduled repair of whole equipments and key sub-assemblies, and for the planned repair of sub-assemblies and other repairables. Generally, we selected the top 10 key cost drivers (in terms of annual spend on the repair line) and up to five randomly-chosen lower value repair lines - although for some case examples, there were not this many repair lines. For each of the repair lines in our sample, we conducted detailed examination of relevant contract files to obtain information on repair spend, repair sourcing, contract monitoring and the performance of repair providers. We also asked the Department to use a new software tool to interrogate the land stores system and provide us with data on repair loop times for each repair line. And we conducted our own analysis of stock data in the stores system.

We examined the Department's arrangements for managing equipment support

7 In addition to this detailed fieldwork with Integrated Project Teams within the Equipment Support (Land) business unit of the Defence Logistics Organisation (at Andover), we visited a wide range of Departmental stakeholders. A full list is provided in the table at the end of this Appendix, but work included:

- Visits to the Headquarters of the Defence Logistics Organisation (at Bath) and to the Department's central Acquisition stakeholders to examine the business improvements programmes underway in the equipment support area, and more widely;
- Discussions with staff at the Defence Procurement Agency (Abbey Wood), including selected Integrated Project Teams, to understand the Department's likely future approach to equipment support, including contractor logistics support arrangements;
- Work at the Army Base Repair Organisation (and with its Defence Logistics Organisation owners and customers) to understand its business, its pricing arrangements, and its business strategy including the move to Trading Fund. We drew as well on work undertaken by our colleagues to audit ABRO's contribution to the Departmental Resource Accounts; and
- Visits to the Army's Land Command (at Wilton and Netheravon), to understand equipment support from the customer's perspective, and to discuss the proposed Whole Fleet Management arrangements.

We discussed equipment support, including both repair and wider logistics issues, with key industrial providers and experts

8 We visited six companies currently involved in the major repair and overhaul of land equipment. At each company we interviewed senior directors and their staff to find out about their management of equipment support activities undertaken on the Department's behalf, including: the allocation of repair programmes to them; work scheduling and forecasting; repair performance and warranty support; innovative support arrangements; and their role on future equipment programmes. We also visited experts in the field of logistics, to find out about the latest developments and best practice in collecting and using management information. These organisations are listed in the table opposite:

The stakeholders within the Department and other organisations that we visited

Defence Logistics Organisation	
Headquarters	Directorate Logistics Strategy Directorate Cost and Performance Management Directorate Corporate Strategy Support Chain Integrated Business Team Whole Life Costing Integrated Business Team
Equipment Support (Land)	Directorate Technical Directorate Support Chain Directorate Resources Integrated Project Teams: ■ Combat Support Vehicles (Support) ■ Engineer Systems Support ■ Field Artillery Systems Support ■ Guided Weapons Systems Support ■ Information and Communication Systems Support ■ Light Armoured Support Systems ■ Surveillance, Target Acquisitions and Special Project Systems Support ■ Tank Systems Support
ABRO	Headquarters (Andover) Workshops: ■ Bovington ■ Bicester ■ Donnington
Equipment Spares Provisioning and Procurement Agency	Equipment Spares Provisioning and Procurement Agency (since incorporated into Integrated Project Teams)

Defence Acquisition	
Defence Acquisition	Smart Acquisition Support Team
Defence Procurement Agency Headquarters	Specialist Procurement Services Cost Forecasting Group Integrated Project Teams: ■ Combat Support Vehicles (Heavy) ■ Combat Support Vehicles (Light)

Customer	
Army Headquarters Land Command	Equipment Support Staff Division (Netheravon) Command planning teams (Wilton) Whole Fleet Management Integrated Project Team (Wilton)

Industry	
Alvis Plc	Headquarters (London)
BAe Systems	Meeting at National Audit Office
David Brown Engineering Ltd	Headquarters and manufacturing facility (Huddersfield)
Perkins Engines Company Ltd	Headquarters and manufacturing facility (Shrewsbury)
Thales Air Defence Limited	Meeting at National Audit Office
Unipart Defence Logistics	Headquarters (Oxford) Storage and Distribution Centre (Donnington)
Vickers Defence Systems	Headquarters and manufacturing facility (Newcastle) Manufacturing and test facility (Leeds)

Others
Professor Martin Christopher of the Cranfield School of Management
Her Majesty's Treasury
KPMG

Appendix 2 Details of case example equipments

In-service land equipments for which we carried out full case examples

AS90 155mm - Self Propelled Howitzer

Manufactured by BAE Systems. 179 AS90s have been built for the British Army. The AS90 entered service in 1992. Fleet size: 174.

Examples of repairables in our sample:

- Dynamic reference unit
- Main transmission
- Turret control computer

Challenger 2 - Main Battle Tank

Built by Vickers Defence Systems Ltd. The UK ordered 127 Challenger 2 in 1991, and 259 in 1994.

Examples of repairables in our sample:

- TN54 gearbox
- Engine CV12 6A
- Hydrogas suspension unit

Clansman

Manufactured by Siemens Plessey Defence Systems. Clansman tactical radios provide the British Army with HF and VHF communications. Fleet size: 61,700. Average length of service - over 25 years.

Examples of repairables in our sample:

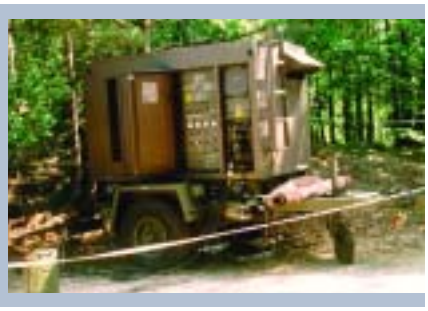
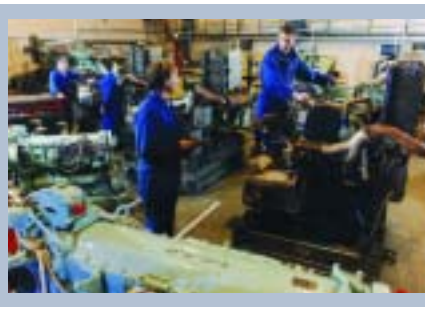
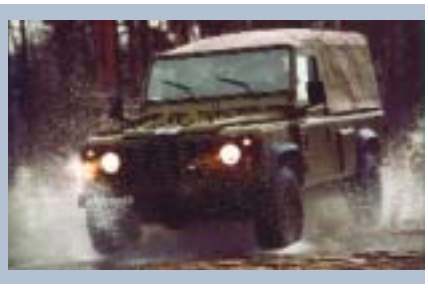
- RT329 transmitter
- Receiver 353
- UK/RT353 power supply

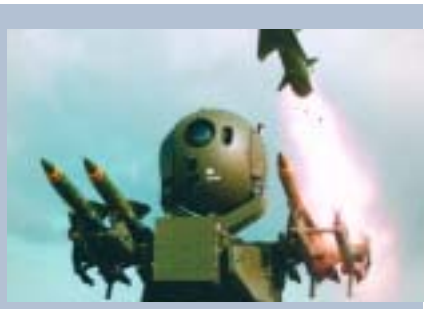
Combat Vehicle Reconnaissance (Tracked)

Designed and produced by Alvis Vehicles. The CVR(T) family of vehicles came into service in 1972. Fleet size: 1,608.

Examples of repairables in our sample:

- Periscopic sight
- J60 petrol engine
- Communications control unit

Demountable Rack Offloading and Pickup System (DROPS)	Two types of vehicle: the Medium Mobility Load Carrier (Leyland), and the Improved Medium Mobility Load Carrier (Foden). Fleet size: 1,236. Average age of fleet: 7 years. Examples of repairables in our sample: ■ Engine ■ Hydraulic lift ram ■ Axles	
Foden 6x6 Recovery Vehicle	Manufactured by Foden. Heavy recovery vehicle employed in support of the wheeled logistic vehicle fleet to recover immobilised vehicles. Fleet size: 350. Average age of fleet: 15 years. Examples of repairables in our sample: ■ Perkins 290 diesel engine ■ Axles ■ Winch assemblies	
Generators	All types. Fleet size: 7,198 Examples of repairables in our sample: ■ Generator set ■ Control unit ■ Circuit card assembly	
K60 Engine (FV430 sub-assembly)	The K60 Engine, built by Rolls Royce, powers the FV430 series of Armoured Fighting Vehicles (pictured). Introduced in 1962	
Land Rover sub-assemblies	The engines and gearboxes used in Truck Utility Light / Medium - Land Rover Defender 90 and 110s (4x4). Fleet size: 15,000 (approximately). Half the fleet has been replaced by the Land Rover (Wolf), which entered service in 1997.	
Multiple Launched Rocket System (MLRS)	Manufactured in Europe by an international consortium of companies from France, Germany, Italy and the UK. Fleet size: 63. Average fleet age: 9 years.	

Phoenix Unmanned Air Vehicle (UAV)	Manufactured by BAE Systems. The Phoenix Battlefield Surveillance, Acquisition and Targeting System provides real time surveillance by day and by night. Fleet size: 198. Examples of repairables in our sample: ■ Air vehicle taxi - wing ■ Air vehicle pod - sensor turret ■ Ground data terminal	
Rapier - Field Standards B and C	Manufactured by BAE Systems. The Rapier is an air defence missile system. Fleet size: 105 (Rapier B: 48; Rapier C: 57) Examples of repairables in our sample: ■ Command transmitter modulator ■ Active cooling module ■ Primary power supply	
Stormer SP HVM	Manufactured by Alvis Vehicles Ltd. The British Army selected Stormer in 1986 to carry the Shorts Missile Systems' (now Thales Air Defence Limited) Starstreak High-Velocity Missile system. Fleet size: 135. Examples of repairables in our sample: ■ Control consoles ■ Engine ■ Drive coupling	
Warrior - Tracked Armoured Fighting Vehicle	Developed by Alvis Vehicles. Entered into service in 1987. Fleet size: 786. Examples of repairables in our sample: ■ Ordnance 30mm cannon ■ X300 gearbox ■ Engine	

Future equipments for which we discussed support arrangements
All Terrain Vehicle Protected (ATVP)
Bucher Duro ATV (Project Cormorant)
Heavy Equipment Transporter (HET)
Multirole Armoured Vehicle (MRAV)
Support Vehicles
TAVERN Urban Patrol Vehicle
Wheeled Tankers