National Audit Office

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL

HC 827
SESSION 2010–2011

31 MARCH 2011

**Ministry of Defence**

# The use of information to manage the logistics supply chain

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Ministry of Defence

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HC 827 Session 2010–2011
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Amyas Morse
Comptroller and
Auditor General

National Audit Office

28 March 2011

This report assesses whether the Department has the information it needs to deliver the right items to the right place, at the right time, and in the most cost-effective manner.



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The National Audit Office study team consisted of:

Anna Athanasopoulou, Ben Bourn, Ross Campbell, Simon Reason, Robert Sabbarton and Robert Watts


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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

Website: www.nao.org.uk

Twitter: @NAOorguk

# Summary

## Background

**1** Over the last decade the UK's armed forces have engaged in high intensity operations across the globe, notably Operation TELIC in Iraq, and the ongoing Operation HERRICK in Afghanistan, the Ministry of Defence's stated number one priority. Supporting these operations requires a significant logistics effort to ensure personnel and materiel (military supplies) get to the right place at the right time. In addition to supporting these operations, the Ministry of Defence (the Department) must also supply its forces across the globe, in permanent bases and training facilities, and whilst on exercise in some of the most inhospitable environments in the world.

**2** This report assesses whether the Department has the information it needs to deliver the right items to the right place, at the right time, and in the most cost-effective manner. When we refer to the supply chain we mean the processes involved in the availability, storage and distribution of materiel. The primary focus of this report is the use of information to manage the supply chain, not the performance of the supply chain. However, the majority of the Department's management information we were able to collect pertained to the Departments single biggest commitment – Afghanistan – and therefore we have used overall performance of the supply chain to Afghanistan as a case study for this review.

**3** **Part One** of this report sets out how the supply chain is managed, **Part Two** examines how the supply chain is performing, **Part Three** looks at how the Department uses information to manage the supply chain, and **Part Four** evaluates the plans in place to improve supply chain management in the future.

**4** This report is related to the National Audit Office's wider work in examining how Government is building its business intelligence capabilities in order to further its cost reduction and efficiency aims. Our report: 'Information and Communication Technology: Landscape Review', published in February 2010, discussed these issues in more detail.

### Key findings

**5** Many of the challenges facing the Department are different to those of a private organisation. The pace of military operations can be unpredictable and, as a consequence, the demands on the supply chain can ebb and flow. Moreover, the supply chain has to work in two directions, returning personnel and equipment from the front-line for rest, repair and replacement. Unlike the private sector, financial profit cannot be used as an indicator of success, and if the military supply chain fails the impact is not reduced profits, but increased risks to personnel and military tasks.

**6** Notwithstanding these factors there are many things that are within the Department's control and these can be benchmarked objectively against industry using the Supply Chain Operating Reference model. This benchmarking shows that the Department measures *reliability* (making sure materiel arrives) and *responsiveness* (making sure it arrives in time) comprehensively, but also that it measures few *cost* and no *agility* metrics (where agility is the ability to respond to external influences). This demonstrates that the Department is focused on getting materiel to where it is needed, with the cost of doing so a secondary concern.

## On the performance of the supply chain

**7 Performance has improved since our 2009 report on Support to High Intensity Operations.** We found that the Department has been largely successful in getting materiel into theatre, sending some 130,000 consignments to Afghanistan in 2010 and, in doing so, overcoming considerable logistical challenges ranging from volcanic activity, to attacks on convoys and customs problems in neighbouring states.

**8 Despite these improvements the Department is still not meeting its own performance targets, making deliveries on time in only 54 per cent of cases.** Highest priority items sent by air should arrive in theatre within five days; this was only achieved in around a third of cases. There is often a large variation in the time it takes similar items to move through the supply chain. The Department makes decisions on the appropriate mode of transport for an item based on urgency, the operational risks within the air, sea and ground delivery routes and the nature of the equipment being transported – these factors currently lead more deliveries to be sent by air than surface. Not enough financial performance information exists to evaluate the additional costs incurred.

**9 Failure to deliver the right item on time is primarily due to items being unavailable for transport.** For orders to be fulfilled items need to be available for dispatch and they need to move through the supply chain effectively. Where items did not arrive on time, over half of all failures were due to lack of item availability. This means that either the Department is not forecasting accurately usage and repair rates of materiel to ensure the right amount of stocks are held (an information issue, made more challenging by the dynamic nature of the Afghanistan operational environment), or suppliers are unable to respond to the theatre demand (a procurement issue).

## On the information used to manage the supply chain

**10 There are significant gaps in the information the Department produces, and the lack of visibility of its assets directly contributed to our qualification of the Department's 2009-10 resource accounts.** Good business intelligence is crucial if the Department is to succeed in running an effective and efficient supply chain. While the Department collects much of the information required, gaps remain. For example, the Department could not provide us with complete data on the costs of the deliveries to Afghanistan that we tracked. Moreover, the Department is unable to reconcile in a coherent manner the information it does possess on the location of its assets and its inventory and supply chain costs.

**11 Segmentation of the supply chain creates significant management challenges.** There are three distinct parts in the supply chain (in UK, in transit and in theatre) which on a day to day basis are managed by different entities within the Department. The practical consequence of this is that no single entity involved in operational management has access to all the information needed to manage the supply chain effectively. Furthermore, difficulties combining and reconciling financial and performance information mean that that financial considerations do not play an integral role in the decision making process.

**12 Due to a lack of reliable information about stocks, in order to ensure sufficient deliveries are made, the supply chain has to prioritise effectiveness over efficiency.** Without such information to inform its decisions, the Department focuses, understandably, on ensuring that deployed personnel have the supplies they need. This, however, represents a significant opportunity cost to the Department. Our view is that to compensate the Department must either be stockpiling more materiel than necessary in theatre, sending more than is necessary by air transport, or both. In the absence of reliable information, further work is required to estimate the cost consequences of this. The Department views an efficient split of air to surface deliveries to be around 20/80, but currently 70 per cent of individual deliveries to Afghanistan are sent by air, accounting for 31 per cent of the tonnage and at least 90 per cent of the Department's total transport costs. While we acknowledge that surface delivery routes can carry significantly higher risks and can be unsuitable for some equipment, such as ammunition, many routine items that could be sent by surface are being sent by air. Transferring just 10 per cent of items from air to surface delivery routes could save an estimated £15 million a year in Afghanistan alone.

**13 Business intelligence to support the supply chain falls short of general logistics industry practice.** We applied the Supply Chain Operating Reference model, an industry standard benchmarking tool, to the Department's business intelligence. Mindful of the challenges outlined in paragraph 4, this benchmarking identified several areas of weakness in the way the Department uses information to manage its supply chain:

**a** While some progress has been made, the Department has not yet fully defined, or agreed, the information it needs, or the data that should be collected, to manage the supply chain.

**b** The Department does not collect sufficient information on costs throughout the supply chain, and does not collate together what data it does collect, which limits its ability to maximise efficiency. Our analysis was hampered by the lack of available financial information.

**c** Data is not collected or available in a timely manner for all elements of the supply chain. Process and systems limitations, especially in the ageing and obsolete base inventory and warehousing systems, mean that management data is often up to four weeks old, which creates an environment in which management is reactive rather than proactive, and leads to many project teams conducting their own performance monitoring, duplicating effort with the central performance management team.

**d** Performance management centres of the supply chain are often staffed by non-specialist personnel who do not always have the necessary logistics or data analysis skills. As staff are assigned on two-year postings, by the time they are competent in the role they move on.

The Department's overall business intelligence capabilities (people, processes and technology) are immature, rating between 'reactive' and 'controlled' on our maturity scale. To achieve a similar performance to leading organisations we would expect it to achieve the highest level of maturity – predictive – where the Department can not only fulfil changing requirements with minimum disruption, but anticipate them. This has the potential to enable more effective management decision making, leading to a more efficient supply chain.

## On information risks in the supply chain

**14 The Department is exposed to considerable risks in the supply chain if information systems fail.** Some of the data systems are over 30 years old and are no longer supported by the manufacturers, resulting in a high probability of failure. The Defence Logistics Board recently raised the risk of failure in the base warehouse inventory management systems to critical. These systems tell the Department what assets it has, and where. If the systems fail the consequences will be severe and could lead to shortages at the front line within 30 days. The shortcomings of these systems undermines the effectiveness and the efficiency of the supply chain.

**15 The Department has acknowledged information gaps and committed significant funds to an improvement programme.** The Future Logistics Information Services project aims to deliver better systems infrastructure by moving data servers into more secure environments, which has the potential to reduce the risk of failure in some legacy systems. As currently funded, however, it will not negate the risk of failure across all base inventory warehousing systems, nor will it resolve the supply chain information capability shortfall.

## Conclusion on value for money

**16** We understand and support the Department's priority of ensuring that critical materiel is reliably available to support operations. We recognise that this necessarily involves carrying significant contingency supplies in theatre. However, it is clear that the logistics cycle would be significantly more efficient if directed by a modern information system supported by appropriate skills and procedures. It follows that the current logistics cycle is not value for money.

## Recommendations

**17** In order to provide value for money in the future the Department needs experienced people, effective processes, and robust technology. Good business intelligence is needed to determine and manage the level of contingency required to mitigate risk. The following recommendations highlight areas where the Department can improve.

**a** **There is limited focus on the efficiency of the supply chain.** Whilst it is correct that the Department concentrates, in the first instance, on getting supplies to where they are needed, the Department must collect better information on the costs of the supply chain and use this data to control costs and increase efficiency.

**b** **There is fragmentation in the operational management of the end-to-end supply chain due to the number of agencies involved.** During the course of its organisational review, the Department should assess the costs and benefits of bringing the supply chain process agencies, their respective performance management teams, and a supply chain finance function, under one roof.

**c** **There is no clear business intelligence strategy which outlines what data is needed to operate the supply chain.** The Department has begun to develop its approach, through documents like the Interim Defence Logistics Information Strategy, and it should build on this work to develop a comprehensive information strategy for its supply chain, and the Chief Information Officer should champion the importance of good supply chain information.

**d** **Legacy systems, especially those for base inventory and warehousing systems, represent a critical risk to the Department's ability to supply its personnel.** The Department should improve and upgrade all facets of its supply chain information data systems, especially considering the significant operational risks of continuing to use decades-old IT systems.

e **The Department should make more use of the Supply Chain Operating Reference benchmark.** The Department should identify opportunities to learn from others, and benchmark performance and processes where possible. It should do this with immediate effect.

f **Many roles in the performance management cells in the supply chain are filled by non-specialists who often lack the requisite skills, furthermore, skills developed in-role are often lost as staff usually stay in post for two years or less.** This is inefficient and risks value for money. The Department should ensure it has specialists in post, through:

- creating a specialist career path for logisticians to allow retention and reward of key skills; and
- implementing documented handover processes and mentoring of new staff.

g **The Department has not clearly identified which arrangements are best suited for increasing the awareness of its staff of the need for good data, or for improving skills to produce data.** The Department should develop its 'federated' model for producing good data on its business.

# Part One

## Supporting overseas military operations

**1.1** The United Kingdom has deployed military forces overseas at regular intervals over the last 20 years, for a range of activities including peacekeeping missions, training exercises, and combat operations. Currently the United Kingdom's main operational commitment is in Afghanistan (Operation HERRICK), with significant forces expected to remain deployed until at least 2015.[1]

**1.2** Supporting military operations, such as those in Afghanistan, requires intensive logistical effort. The weapons, clothing, food, fuel, ammunition and other equipment needed by military personnel have to be identified, requested, purchased, stored, transported and distributed to where they are needed. The Ministry of Defence (the Department) recognises that such operations are a high priority: it has identified Logistics as one of the eight key elements required to provide military capability[2], which is the main prerequisite for achieving its immediate goal to succeed in Afghanistan.

**1.3** Military logistics is defined by NATO as 'the science of planning and carrying out the movement and maintenance of forces'. In its most comprehensive sense, this includes not just the acquisition, storage and distribution of materiel (see glossary in Appendix Two for definitions) through the supply chain, but also maintenance and repairs, transport of personnel, and the provision of catering and medical services.[3] This study is primarily concerned with the information collected centrally to enable management of the supply chain.

### Management of the supply chain

**1.4** Defence Equipment and Support is the body within the Department responsible for managing the supply chain. It has an annual budget of £14 billion in 2010-11, which forms some 38 per cent of the entire defence budget. The Department estimates the value of materiel recorded in Defence Equipment and Support inventories at £34 billion in 2010.

**1.5** Up to April 2000, the Royal Navy, Army and Royal Air Force all had independent supply chains. These chains were designed during the Cold War-era, and as such were intended to support combat operations in Europe, with correspondingly short supply lines from warehouses in the UK and West Germany. Conflicts were predicted to be of relatively short duration, so stores would not need continual replenishment.

1 National Security Strategy, October 2010.
2 Ministry of Defence, How Defence works – Defence Framework, December 2010.
3 http://www.nato.int/docu/handbook/2001/hb0801.htm

Following the end of the Cold War however, the type of conflict the Department has engaged in has been more expeditionary and typically at long distances from the UK, and for more sustained periods of time.

**1.6** Individual service's supply chains were brought together with the creation of the Defence Logistics Organisation in 2000. Support to most UK forces overseas is now provided through the Joint Support Chain, which stretches from requirements identified by operational commanders right the way back to suppliers that meet these demands. The Joint Support Chain moves personnel and provisions into theatre and also returns it for rest, repair, upgrade, or redeployment.

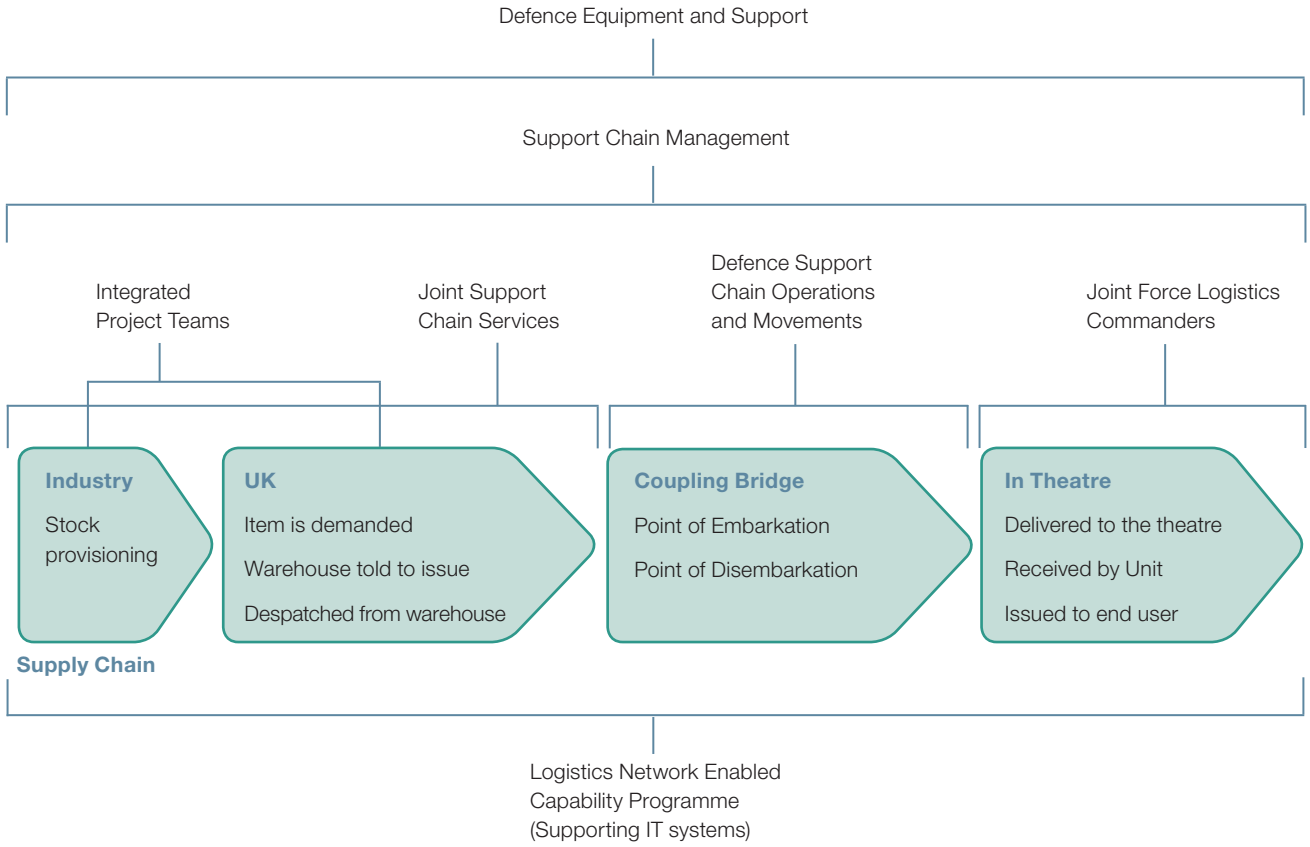
**1.7** Day to day management of the supply chain is now carried out by several organisations that sit in the Joint Support Chain organisation, which itself is part of Defence Equipment and Support (**Figure 1** overleaf):

- **Integrated Project Teams** are responsible for procurement and provisioning of individual assets, such as helicopters.
- **Joint Support Chain Services** (formerly the Defence Storage and Distribution Agency) is responsible for receiving goods from the commercial supply chain and delivery of those goods into the military supply chain through what is called the Purple Gate. This involves managing warehouses and munitions stores within the United Kingdom and Germany, and the preparation and distribution of these stores into the military supply chain.
- **Defence Support Chain Operations and Movements** is responsible for the transport of people and materiel to operational theatres through a single supply chain, called the 'Coupling Bridge'.
- **Support Chain Management** is responsible for establishing the procedures and processes for how the supply chain should work.
- The **Logistics Network Enabled Capability Programme** team take the lead on managing and improving supply chain information systems and business intelligence tools.

These organisations work together to move materiel to operating bases in theatre, such as Camp Bastion in Afghanistan; the final leg of the journey to forward operating bases is handled by individual unit quartermasters.

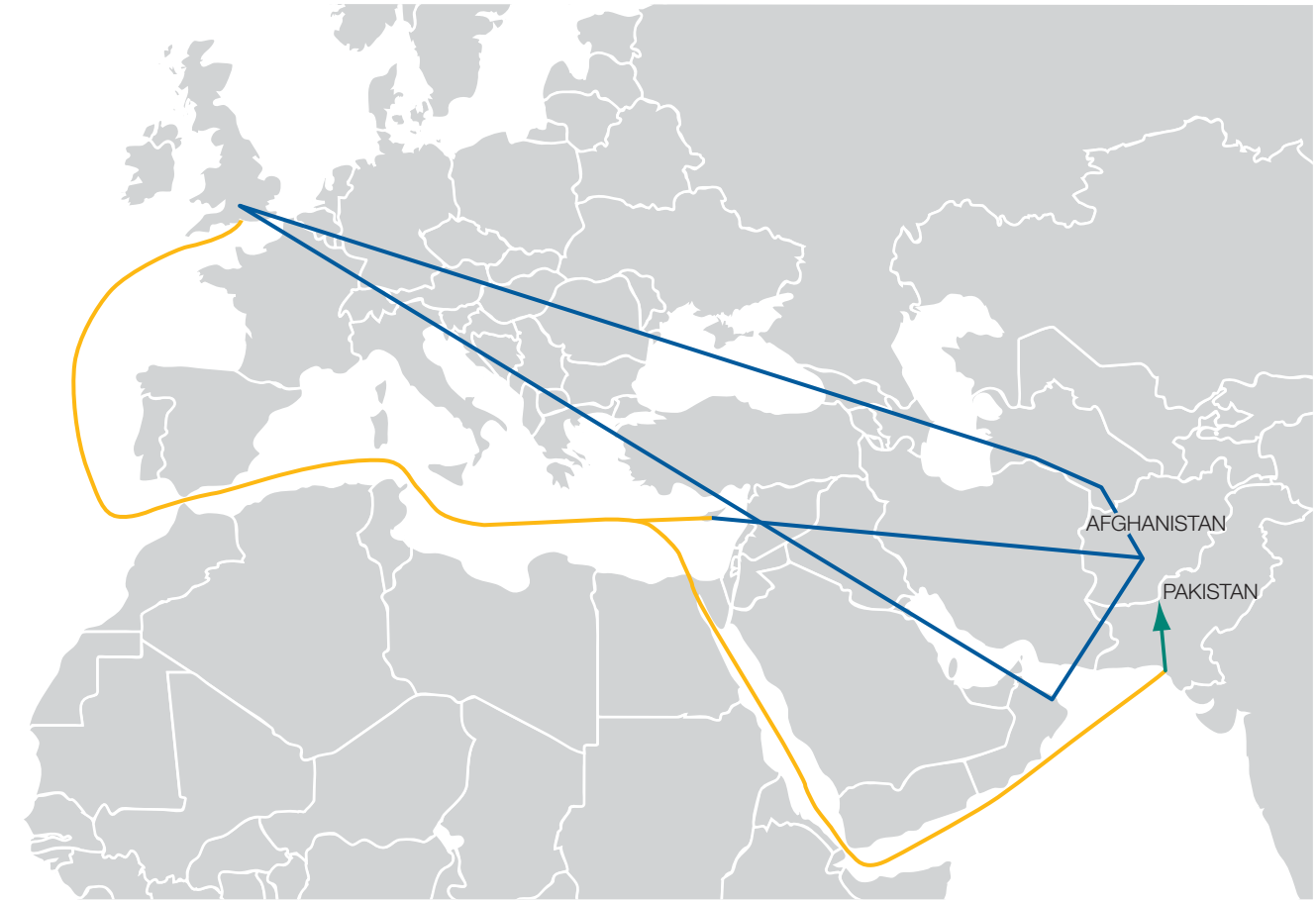
**1.8** Materiel should be sent to operational theatres through whatever combination of land, sea and air transport is best suited for the individual items, and how urgently particular items are required. For example, items that are needed quickly, such as those identified as Urgent Operational Requirements, can be flown to theatre, at a relatively high cost, while items that are required on a routine basis or are extremely large or heavy, can be shipped to theatre, which is slower but also much cheaper. There are two main supply routes to Afghanistan: flights from RAF Brize Norton and RAF Lyneham in England direct to Camp Bastion and Kandahar in Afghanistan; or shipping materiel from Southampton to either Cyprus (from where it is flown to Afghanistan) or Karachi in Pakistan, from where it is then transported into theatre overland (**Figure 2** on page 13).

## Figure 1
Organisation of the Joint Support Chain




*Source: National Audit Office*

**Figure 2**
Air and surface supply lines to Afghanistan




*Source: National Audit Office*

**1.9** While the majority of personnel and materiel reach the front line through the joint supply chain, some items are provided under separate arrangements. For example, in Afghanistan, fuel to front line troops is provided jointly to all Coalition troops through NATO supply chains.

**1.10** The Department uses an Operational Sustainability Statement to set priorities in theatres. These statements determine what urgency should be attached to getting different items to theatre, and sets performance targets for how quickly they should be delivered. In the statement the Department also sets targets for the levels of stocks to be established in theatre to satisfy operational demands, or provide a contingency buffer that can allow operations to continue even when the supply chain is disrupted (as happened when the Eyjafjallajökull volcano in Iceland erupted in April 2010).

## Information needed to manage the supply chain

**1.11** In order to carry out military operations, the Department needs to know what materiel is available, and whether it is in warehouses, in transit, or already in theatre. As it can take a significant amount of time to procure items from industry, to achieve the best results in operational and cost terms the Department needs to forecast what materiel will be needed, and when, and order them in advance. To facilitate accurate prediction, the Department collects a wide range of information on its logistics needs, stored in a multitude of data systems. These can be broadly categorised into three system types:

- **Data systems on individual products,** which can be categorised as follows:
    - **Stock and inventory management** – data systems for recording what is in warehouses and stockrooms, such as Stores System 3, or what materiel is already in theatre (such as the Management of the Joint Deployed Inventory system);
    - **Order processing** – data systems for collecting and processing demands from the frontline, such as the Unit Computer System for land forces; and
    - **Asset tracking and deliveries** – data systems for tracking stores that are in transit to theatre, such as the Visibility in Transit Asset Logging system.
- **Data systems for collating information.** In order to gain a strategic view of performance, data needs to be collected together from all the different data systems used throughout the supply chain. For example, the Support Chain Management Performance Measurement Cell has access to an Enterprise Data Warehouse designed for this purpose.
- **Systems for producing business intelligence from the data.** These include producing information that can be used to forecast demands for materiel for specific operations, allowing deliveries to be made in time to carry them out, or information that can be used to identify blockages in the supply chain and identify best practice. For example, the COGNOS reporting tool can be used by staff to create business intelligence from the data held in the Enterprise Data Warehouse.

## Evaluating good practice in supply chain information management

**1.12** Supply chain management can present greater challenges for armed forces than for private sector firms. Harsh environmental conditions and poor infrastructure can impede logistics support. Possible confrontations with hostile combatants during the last leg of the journey within operational theatres can also make supply missions harder to complete. At the same time, changing operational circumstances can make it harder to predict demands in future. For example, the recent proliferation of Improvised Explosive Devices (IEDs) has generated the need for extra protective equipment, including extra armour for vehicles such as Mastiff, all of which must be moved to theatre. Moreover, the expansion in the number of forward operating bases in Afghanistan's Helmand Province, from six to over 100, adds to the complexity of getting equipment to the front line. If the military supply chain fails the cost is not foregone profit, as in private sector organisations, but failed military operations and increased risk to personnel.

**1.13** It is conceptually difficult to determine the costs arising from increased risk of failing to meet military objectives, information which would be needed to make informed decisions on where scarce resources are best used. Such considerations do not, however, preclude the Department from seeking to improve its business intelligence capabilities and performance management.

**1.14** At the same time, good supply chain management is a vital enabler for many organisations, not just armed forces. Some parts of the military supply chain are comparable to supply chains in private sector organisations, for example deliveries within the United Kingdom face the same conditions regardless of whether it is a military or private sector delivery. Private sector firms from manufacturers to large supermarket chains rely on supply chains to get the right items to where they are needed quickly enough to meet consumer demand. This need has led to the development of a body of good practice in the field and widely used industry standards. Organisations such as the Supply Chain Council have developed the Supply Chain Operating Reference (SCOR) model, which is accepted across industry as a sound basis for examining the design and performance of any supply chain, specific military considerations notwithstanding. We have used good practice models such as the Supply Chain Operating Reference model to provide benchmarks against which the Department's practices could be considered.

# Part Two

## Performance of the supply chain

### The overall supply chain

**2.1** The Department makes deliveries to locations all over the globe, to UK bases such as the Falkland Islands, Gibraltar and Cyprus, and to operational theatres such as Afghanistan and Iraq. In total the Defence Equipment and Support Joint Support Chain organisation spent £347 million on the global transportation of items and personnel in 2010-11, 81 per cent (£281 million) of which was associated with providing support to the continuing operation in Afghanistan (**Figure 3**). The figures for air costs are likely to be a considerable underestimate as the Department could not provide us with cost data for military flights (which delivered close to half of the materiel delivered by air in 2010), it could only provide us with cost data for planes it had chartered.

**Figure 3**
The Department's supply chain transport costs (2010-11)

| Destination | Air (£m) | Surface (£m) | Total (£m) |
|---|---|---|---|
| Afghanistan | 254.0 | 27.0 | 281.0 |
| Iraq | 6.5 | 0.1 | 6.6 |
| Other | 10.0 | 49.0 | 59.0 |
| Total | 270.5 | 76.1 | 346.6 |

**NOTES**
1 Totals calculated using Department forecasts for 2011 data.
2 The figures for air costs are not complete; they cover commercial charter costs only.

*Source: Ministry of Defence*

## The supply chain to Afghanistan

**2.2** Following the reduction of troops in Iraq, Operation HERRICK in Afghanistan is now the Department's largest overseas operational commitment, and constitutes the vast majority of the Department's supply chain activities.

**2.3** The Department has set targets for how quickly deliveries are made to Afghanistan, with the time varying with how urgently the good is required. They range from five days for goods required immediately to between 77 and 87 days for routine deliveries. Within these overall objectives, the Department also sets targets for the individual stages of the delivery process (**Figure 4**). These targets only cover the supply chain up to depots in theatre, not to the front line point of need in every instance, so actual delivery times can be longer. This is because little data is collected centrally on the 'final mile' from secondary depots to forward operating bases.

### Figure 4
The Department's target times for each stage of deliveries to and from Afghanistan

| Standard Priority Code | Demand Transmission Time to UK | Demand Processing Time | Materiel Handling Time | Time for Distribution to UK point of Embarkation | Time for Distribution to Theatre | Average Time for in Theatre Distribution | Time for Receipt by Joint Support Chain Services Unit | Total Supply Chain Pipeline Time | Suggested Mode of Distribution |
|---|---|---|---|---|---|---|---|---|---|
| **Forward Supply Chain** | | | | | | | | | |
| 01 Immediate | Within 1 hour | | 1 hour | 22 hours | 3 days | 24 hours | | 5 days | Air |
| 02 Priority | 3 hours | 3 hours | 18 hours | 24 hours | 3-9 days | 2-9 days | | 7-20 days | Air |
| | | | | | | 4 days Kandahar | | 77 days | |
| 03/04 Routine | 6 hours | 18 hours | 3 days | 3 days | 66 days | 14 days Lashkar Ga | | 87 days | Surface |
| | | | | | | 10 Days Camp Bastion and Kabul | | 83 days | |
| **Reverse Supply Chain** | | | | | | | | | |
| 05 Immediate | | | 24 hours | 2 days | 3 days | 24 hours | 24 hours | 9 days | Air |
| 09 Priority | | | 5 days | 9 days | 9 days | 2-9 days | 14 days | 41 days | Air |
| 13/16 Routine | | | 10 days | 30 days | 41 days | 14 days | 35 days | 119 days | Surface |

*Source: Defence Supply Chain Operations and Movements*

**2.4** The challenges of getting goods into Afghanistan are considerable. It is a landlocked country, so goods are either flown in, or shipped by sea and then sent overland. Either route can be disrupted by events which can adversely impact supply chain performance: for example, surface deliveries were affected last year by customs issues, local strike action and increasing security threats. While usually less prone to disruption, even air deliveries can be affected by events, such as the eruption of the Eyjafjallajökull volcano in Iceland in April 2010. Such events influence decisions on the appropriate mode of transport for different items.

**2.5** Despite these challenges, the Department made 130,300 deliveries to Afghanistan in the year up to 8 December 2010. The Department estimates that in 2010 it sent 55,000 tonnes of materiel to Afghanistan, 31 per cent by air and 69 per cent by land. The average time a unit waits for an item has fallen since our last report, in 2009[4], with wait times for items required immediately (see Figure 4) falling from an average of 14.4 days in the period from January to October 2008 to 6.5 days between September 2009 and August 2010.

**2.6** Despite the reduction in average wait times, the Department is failing to meet its performance targets (**Figure 5**). Only 35 per cent of the 4,400 deliveries classified as immediate were made within the five day target time. Routine deliveries by air is the only mode which regularly exceeded target times, with 94 per cent arriving within 77 days. This, however, is not an appropriate target, because it was not envisaged that routine deliveries would go by air and, as such, 77 days is the target time carried over from surface deliveries. Overall, in the year up to 8 December 2010, only 54 per cent of the 130,300 consignments to arrive in Afghanistan were delivered in time to meet their target (**Figure 6**).

4 Comptroller & Auditor General, *Support to High Intensity Operations*, Session 2008-09, HC 508, May 2009.

## Figure 5

The Department's performance against supply chain targets for deliveries to Afghanistan

| | Consignments arrived in period | Target for delivery time (days) | Target for how many consignments should arrive within targeted delivery time (%) | Percentage arrived in time to meet target |
|---|---|---|---|---|
| Immediate (SPC 01) | 4,400 | 5 | 90 | 35 |
| Priority (SPC 02) | 77,600 | 20 | 75 | 72 |
| Routine surface (SPC 03/04) | 40,000 | 77-87 | 75 | 15 |
| Routine air (SPC 03/04) | 8,300 | 77 | 92 | 94 |
| **Total** | **130,300** | | | **54** |

**NOTES**

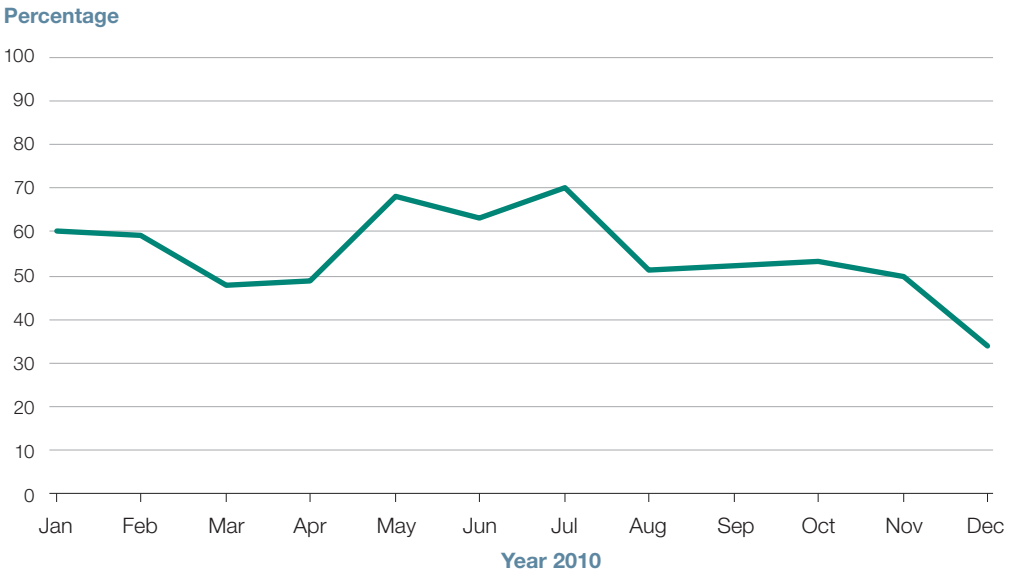
1 Period covered is 10 December 2009 to 8 December 2010.

2 Reliability target is the percentage of deliveries the Department wants to arrive inside delivery time target.

*Source: Defence Supply Chain Operations and Movements*

## Figure 6

Percentage of deliveries to Afghanistan arriving in target time

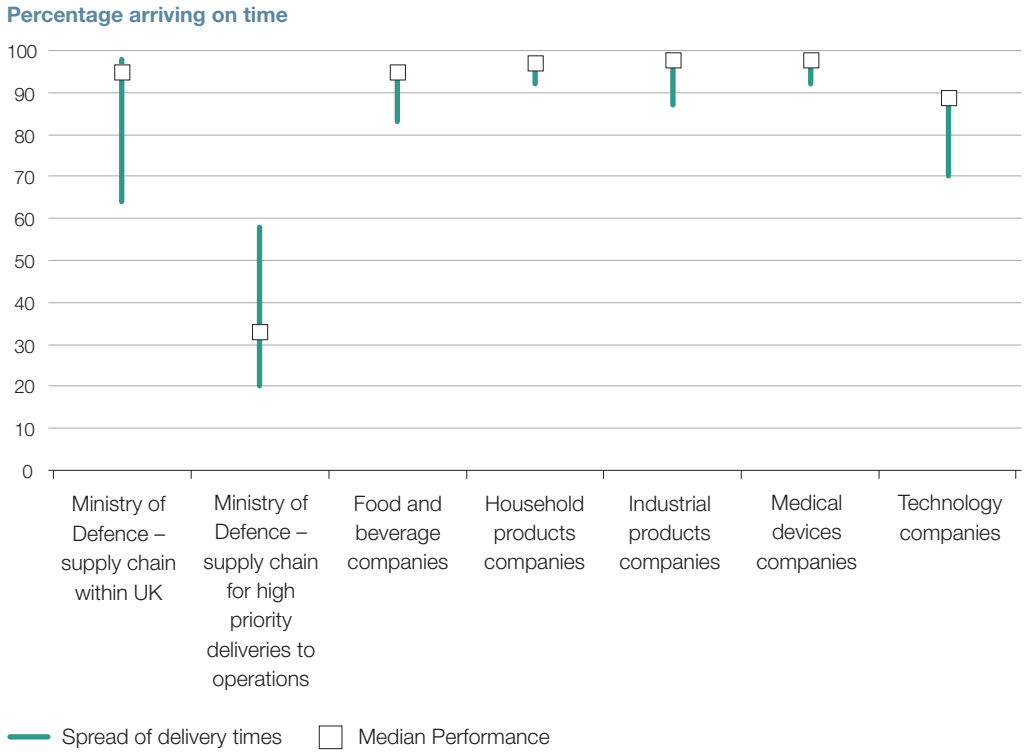



*Source: National Audit Office analysis of Ministry of Defence data*

**2.7** We benchmarked the Department's performance in making deliveries on time against organisations in the food and beverage, household and industrial product, medical and technology sectors (**Figure 7**). The Department delivers a uniquely diverse range of products to its end users, including consumables, foodstuffs, commodity items such as frequently used spare parts, sensitive high-value items and large, heavy and awkward items such as bridge parts and tank engines. There is no one industry standard sector which can be benchmarked to reflect this diversity, so several sectors were chosen to examine the extent to which this inherent product variance is seen to influence the private sector's best attempts at managing the supply chain. We found that the Department's performance in making deliveries within the UK (both for routine deliveries to UK bases and for the UK leg of deliveries overseas) compares favourably with all these sectors. Given the extra challenges associated with delivering materiel into operational theatres, the Department struggles to maintain this level of performance when urgent deliveries have to be made to them.

## Figure 7

The Department's on-time delivery performance benchmarked against selected private sector companies




**NOTE**

1 For industrial comparators, the spread is taken from the 25th to 75th quartile of companies, to remove outliers. Sample sizes for non-defence sectors was between 9 to 14 companies.

*Source: National Audit Office analysis of Ministry of Defence data, with additional data provided by Deloitte LLP*

## Reasons for failures to meet pipeline targets

**2.8** There are two reasons why a product might not arrive on time, causing targets to be missed:

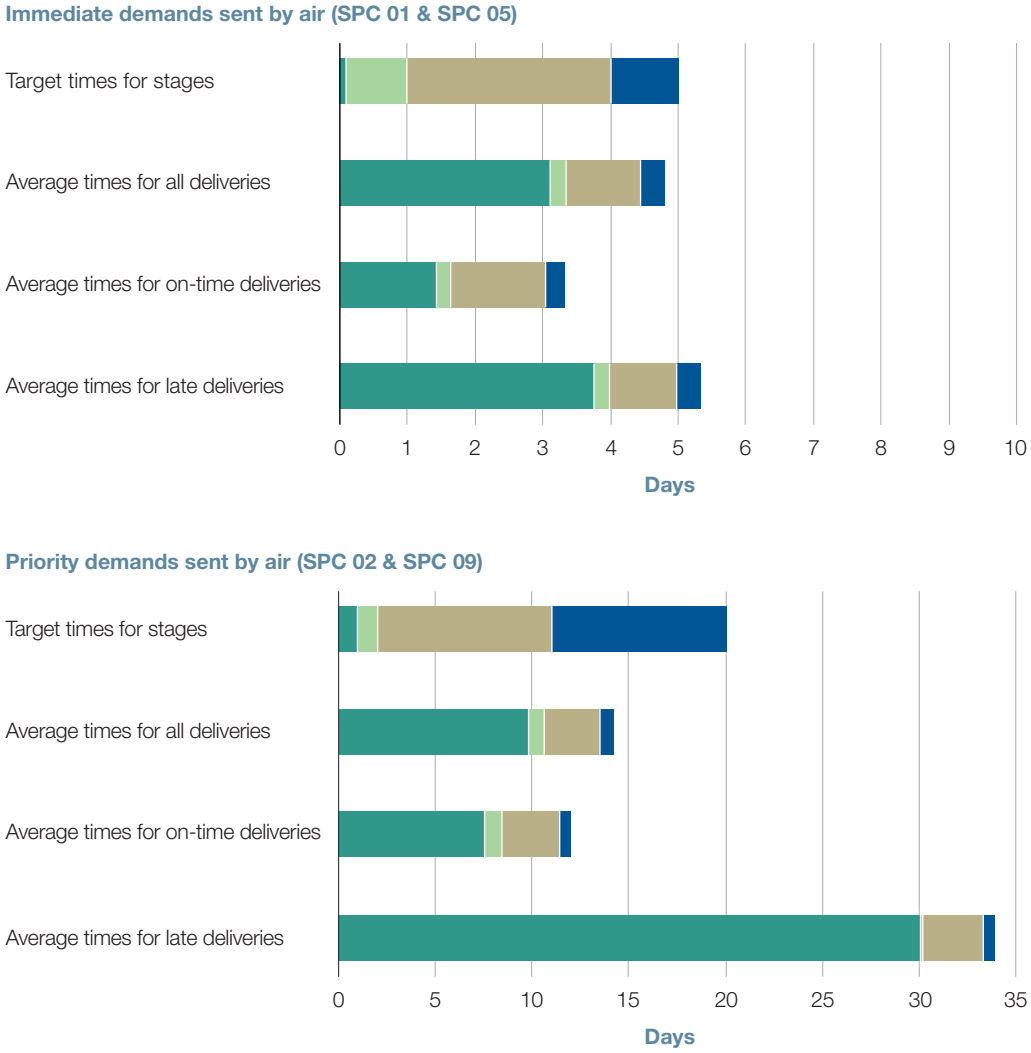
- **Provisioning failure** – not having the item ready for transporting to operational theatres within the required time, usually because there has been a failure to forecast demand, the manufacturer has not contracted to deliver the goods within the time specified, or the item is out of stock at the manufacturer; and
- **Pipeline failure** – delays in transit.

Of these, the Department suffers more from provisioning failure, than pipeline failure. For the 130,300 or so deliveries made to Afghanistan in the year to 8 December 2010, some 60,000 were late. Over 53 per cent suffered provisioning failure, and 30 per cent pipeline failure, while 17 per cent suffered both. Individual project teams are responsible for making orders from industry and ensuring the products are on shelves so they can be shipped to theatre, but contracted delivery times from suppliers are often too long to allow targets to be met, and, or, deliveries can be delayed. For example, in the six months to November 2010, on average over 40 per cent of deliveries from suppliers were 30 days or more overdue. We found that the organisation responsible for delivering goods in the UK, Joint Support Chain Services, does not always know what goods are being delivered from industry, or when they will arrive.

**2.9** In order to examine the demand and delivery process in more detail we selected a small basket of different items and tracked a sample of deliveries for each, from the initial demand by the unit right through to receipt in theatre (see Appendix Three). We compared order times to targets for each stage of the pipeline shown in Figure 4. We found that, as well as inconsistencies in the speed at which identical items are moved through the supply chain, the bulk of time was typically spent in the provisioning phase (processing the initial demand, getting the item from industry and readying it for transit in the UK) rather than transit itself (**Figure 8** overleaf). For example, we examined eight immediate demands for SA80 rifles that did not meet the five-day target for delivery to theatre, and we found the demands spent on average three days longer than targeted in the provisioning (demand processing and materiel handling) phase. We could not interrogate the data further to identify the causes of delays, such as a lack of stock, delays in receiving deliveries from suppliers or lack of appropriate packaging.

## Figure 8

SA80 rifle deliveries – average time spent in different stages of the supply chain




**NOTE**

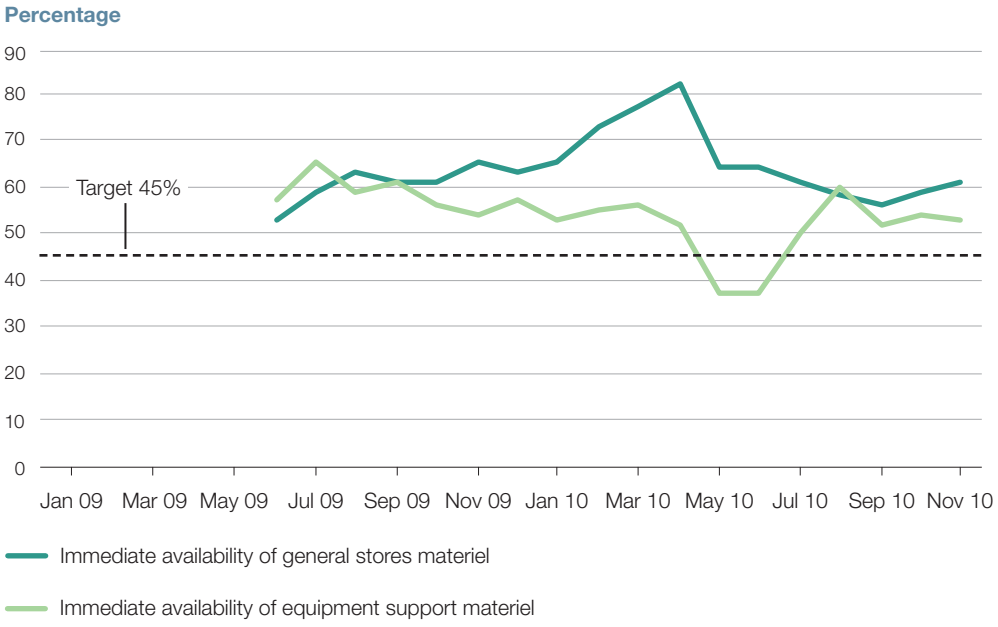
1 Sample size was 11 deliveries rated as immediate (3 on time, 8 late) and 71 deliveries rated as priority (64 on time, 7 late).

*Source: National Audit Office analysis of Ministry of Defence data*

## Stock levels in theatre

**2.10** When a front-line unit demands an item, before scheduling a delivery the Department usually checks whether the demand can be met from stocks already in theatre. The Department has set itself a target to ensure that 45 per cent of demands for general stores and equipment support materiel are met immediately. These targets have generally been exceeded between June 2009 and November 2010, as **Figure 9** shows. Keeping extra stock in theatre is one means by which the Department has sought to negate the impact of delays in getting goods to theatre. For example, the Department holds nine weeks of water supplies in theatre, and has another nine weeks held in the supply chain. Due to a lack of data, more work is required to calculate the extent of over-stocking and the additional costs created.

### Figure 9
Availability of general stores and equipment support materiel in Afghanistan




*Source: Ministry of Defence data*

# Part Three

## The collection and use of information

**3.1** Maintaining a reliable and efficient buffer of stocks in theatre, optimising the replenishment of these stocks, tracking deliveries to and from theatre, and ensuring they arrive where and when they are needed requires good quality logistics information and processes.

### The collection of supply chain information

**3.2** The Department has hundreds of data systems in place to capture information on all aspects of its stores and supply chain activity. Despite the fact that management of the supply chains of the individual Services has been brought together, the data systems supporting each of them have not been similarly combined. This has meant that while the Department as an organisation is configured to manage a single supply chain, the information available to managers comes from a complex set of data systems designed to support several separate supply chains, which have significant inter-operability issues.

**3.3** Through our analysis of data systems, we found that:

- **Many data systems are old and have limited functionality.** While some data systems are new and of good quality, much data, particularly for the base inventory and warehousing areas, is held on very old IT systems, some of which came into service over 30 years ago (**Figure 10**). These have limited capability and the scope to upgrade their capabilities is often extremely restricted, and many are no longer supported. Reliance on such systems means that it is very challenging to produce the business information required by stakeholders to run an effective and efficient supply chain. Furthermore, the Department has identified that the chances of these older systems suffering a catastrophic failure has risen to a critical level, which would have a major ability on the Department's ability to maintain front line operations.
- **Links between these systems are often incomplete, or data systems are incompatible,** which means it is very difficult to produce complete and accurate data on the end to end supply chain. For our process mapping exercise, we found that data on a single delivery could be spread across four different data systems. Data had to be manually pieced together to allow full visibility of how the delivery moved through the supply chain. For some of these systems, data has to be transferred manually to other systems using portable hard drives, in others, data has to be re-keyed. Such practices increase the probability of errors. Furthermore

the data systems of the Department's industrial partners are also not integrated, exacerbating data issues. This can mean that the Department does not have complete information about when stock will be arriving from industry to satisfy demands from the front line.

- **Data accuracy is questionable.** We found that data quality and accuracy remains an issue, for example, in the year to 8 December 2010, 4.5 million entries on the Visibility in Transit Asset Logging system were missing key data. This reduces the confidence users have in the data.

- **The Department does not have total visibility of assets, either in its stores or in transit to theatre.** The Department has several data systems that it uses to track individual deliveries while they are in transit. Data is not consistently recorded at all points in the supply chain (**Figure 11** overleaf), so the Department does not know where deliveries are at all points in the supply chain. On average 90 per cent of the SA80 deliveries we examined, for example, had their time and date of arrival at a UK airport recorded, but only eight per cent had a departure record. Furthermore, as data systems used on the front line are not linked to the Department's consignment tracking systems, there is no consistent receipting of goods at the end of the supply chain, which means the Department does not always know whether the goods actually arrived at the end-user. The implications of this lack of data are significant – for example, in our examination of the 2009-10 resource accounts[5] we found that the Department could not confirm the existence and location of nearly 6,000 Bowman radios worth some £184 million.

## Figure 10
The age of selected supply chain information systems

| Data system | In service date | System age |
|---|---|---|
| Movement of Materiel in Transit | 2008 | 3 |
| Warehouse and Transport Management System | 1999 | 12 |
| Base Ordinance Depot Management System | 1999 | 12 |
| Visibility in Transit Asset Logging system | 1994 | 17 |
| GLOBAL | 1992 | 19 |
| Stores System 3 | 1985 | 26 |
| Comprehensive RNSTS Inventory systems Project | 1982 | 29 |
| OASIS Stores | 1979 | 32 |

**NOTE**
1 See Glossary in Appendix Two for descriptions of these systems.

*Source: National Audit Office analysis of Ministry of Defence data*

5 Report of the Comptroller and Auditor General on the 2009-10 Resource Accounts of the Ministry of Defence.

## Figure 11

The percentage of deliveries whose location has been recorded correctly by the Department at each stage in the supply chain

| | | UK Coupling Bridge | | | |
|---|---|---|---|---|---|
| **Forward supply chain** | **UK (Joint Support Chain Services)** | **Brize Norton** | **Lyneham** | **Departure point not recorded** | **Operational Coupling Bridge** |
| Immediate (SPC 01) | 86 | 92 | 91 | 2 | 76 |
| Priority (SPC 02) | 82 | 90 | 94 | 6 | 69 |
| Routine surface (SPC 03/04) | 96 | _ | _ | 1 | 15 |
| Routine air (SPC 03/04) | 100 | 93 | 80 | _ | 86 |

| | | UK Coupling Bridge | | | |
|---|---|---|---|---|---|
| **Reverse supply chain** | **UK (Joint Support Chain Services)** | **Brize Norton** | **Lyneham** | **Departure point not recorded** | **Operational Coupling Bridge** |
| Immediate (SPC 01) | 100 | 87 | 0 | 36 | 73 |
| Priority (SPC 02) | 100 | 88 | 3 | 12 | 92 |
| Routine surface (SPC 03/04) | 100 | _ | _ | 14 | 78 |
| Routine air (SPC 03/04) | 100 | 83 | 0 | _ | 100 |

**NOTES**

1 The data system is Visibility in Transit Asset Logging (VITAL). Percentages are those deliveries where a complete and accurate VITAL action was recorded.

2 Departure point not recorded are deliveries which are recorded as leaving the UK but the data system did not record the specific point of departure.

3 Blank entries had no deliveries recorded, those with zero per cent had deliveries but none were correctly recorded.

*Source: National Audit Office analysis of Ministry of Defence data*

- **Basic information, including information on costs, is not always available.** Specific items should have an individual NATO Stock Number given to all identical parts. These numbers allow a member of any NATO force to identify any available stores of a part, as well as collect information on that part (such as its cost). From our process mapping, however, we found it difficult to do this – data on armour for the Mastiff vehicle had 20 different NATO Stock Numbers, but none had any information attached. More significantly, we could not collect the information on costs – either on parts, storage or transport – required to calculate the full cost of the deliveries we tracked. The only cost data we could obtain for our process mapping were some basic cost data for individual parts of generic journeys. This information gap means that supply chain management decisions cannot be informed by cost considerations.

## The analysis and use of supply chain data

**3.4** Making sure that appropriate, high quality data is collected is only one element of good performance management. Once recorded, data has to be collated, analysed and reported, to deliver usable business intelligence for managers to isolate bottlenecks, drive improvement, identify efficiencies and create accountability.

**3.5** The Department has made good progress in developing its Enterprise Data Warehouse as a repository for data from individual systems which can be interrogated to produce high-level performance information. Alongside this, the Department is using a COTS IBM reporting tool called COGNOS to query and analyse data in the warehouse. The Defence Supply Chain Operations and Movements Performance Management Cell uses this system to provide a monthly summary of performance metrics on the supply chain to managers, various boards and committees.

**3.6** The Department, however, faces significant challenges in producing usable business intelligence on stores or the supply chain. For example, there is no set of metrics which Department staff can use to examine how the end to end supply chain is performing at a strategic level. In our systems review we found:

- **The Enterprise Data Warehouse is not populated with all the data needed, and the COGNOS reporting tool is not fully effective.** Not all data required on the supply chain is available, not all data it has is input into the system, the Enterprise Data Warehouse is usually updated monthly and has to be manually updated when it is. At the same time, the COGNOS tool does not always pick up the correct data when producing reports, and individual queries can only be made through the contractor responsible for the warehouse which can lead to delays.

- **There is no single contact point for data.** There are many different agencies responsible for different parts of the supply chain, and there are three different performance management cells: one each in Defence Support Chain Operations and Movements, Support Chain Management and Joint Support Chain Services. None of these cells hold all the information needed to manage the entire supply chain, and they do not have complete visibility on who holds what information. Despite the best efforts of the specialists we worked with in the Department, we found it a difficult and time-consuming process to identify where specific pieces of data were held and who is responsible for administering them.

- **Data stored on different systems frequently contradict each other.** This means that it is hard to reconcile these conflicting accounts into a single version that is accepted by all stakeholders as being a true account. The lack of integration of performance and financial information systems in particular has directly contributed to our qualifying the Department's financial accounts. For example, in our examination of the 2009-10 resource accounts we found weaknesses in the processes for reconciling financial statements on inventories with the data stored on warehouse systems that led to their being significant discrepancies between them.

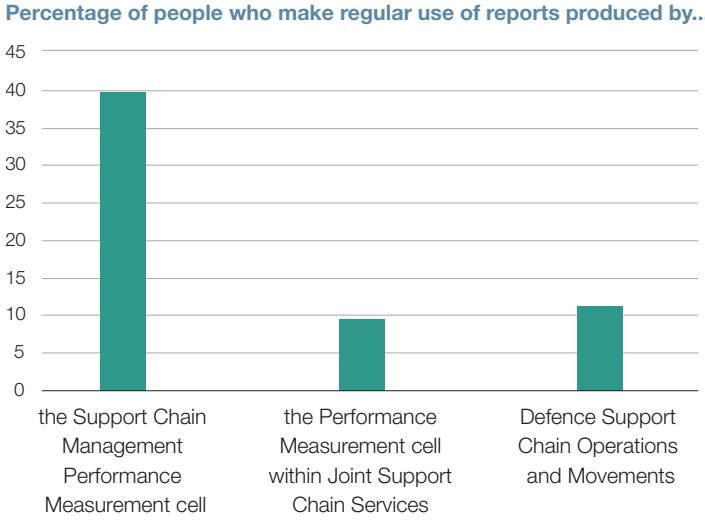
- **There can be a long lead time to produce performance reports.** Data is entered onto the Enterprise Data Warehouse with a lag of between one to four weeks, with the oldest lag we found 12 weeks. The reports produced, therefore, while useful to establish how the business has been performing historically, are not useful for managing the business in real time, or forecasting.

- **There is limited analysis applied to the data.** To be useful data must explain what is happening and offer enough information to explain why. While the Department has some good data systems which should provide this functionality, in general we found it impossible to identify root causes for over- and underperformance. For example, in our analysis of individual deliveries we could not obtain complete data to allow us to identify the specific reasons for individual pipeline and provisioning failures, or how long they persisted.

**3.7** Some staff expressed a low degree of trust in the performance data collected by the Department and the formal performance reports produced from it by the dedicated management cells. This impression is supported by responses to our questionnaire to Integrated Project Teams (responsible for purchasing and maintaining individual categories of equipment), which indicated that they tended not to use the formal reports they receive (**Figure 12**), with many preferring instead to produce their own performance reports.

**3.8** Business intelligence capabilities can be assessed as being in one of four stages of maturity (**Figure 13**). The Department's business intelligence capabilities (people, processes and technology) were rated by our consultants as being between Stage One (Reactive) and Stage Two (Controlled), where consistent access to reliable data is not possible. Given the issues listed previously for collecting and using data, it is perhaps not surprising that the Department is not routinely modelling and predicting future demands from theatre. Evidence of a lack of investment in technology and personnel is contributing to this low level of maturity.

## Figure 12
Usage of formal supply chain performance reports by project teams




*Source: National Audit Office*

## Figure 13
Business intelligence capability – stages of maturity for companies

**Stage 1 – Reactive**: some people, process and technology are in place to meet business intelligence needs.

**Stage 2 – Controlled**: a set of minimum requirements are in place and people, process and technology in place to meet them.

**Stage 3 – Proactive**: people, process and technology are mature and flexible enough to fulfil changing requirements.

**Stage 4 – Predictive**: people, process and technology are mature and flexible enough to not only fulfil changing requirements with minimum disruption, but anticipate them.

*Source: Deloitte LLP*

**3.9** Given the lead times involved in ordering and receiving materiel from industry, improving the Department's forecasting ability is a key requirement for it to be able to increase efficiency, by reducing stocks kept in theatre and through greater use of the slower but cheaper surface routes. Limitations in the Department's forecasting manifest itself in the number of deliveries sent by air, rather than surface; if requirements can be anticipated in advance then they can be sent routinely using slower surface routes. The Department has an aspiration to send 80 per cent of its deliveries by surface but less than half of deliveries are by this method (**Figure 14**). Surface routes can be inappropriate for some goods, due to factors such as size and higher security risks present in surface routes, so it is not a straightforward matter to switch deliveries from air to surface. But there are clear cost benefits to doing so – using generic cost data for transporting standard containers by surface and air to Afghanistan, we have calculated that even a 10 per cent switch from making deliveries using flights to using the surface line of communication to Afghanistan could save an estimated £15 million per year.

## Figure 14

Percentage of deliveries to Afghanistan going by surface (the rest by air) against aspirational target


*Source: National Audit Office analysis of Ministry of Defence data*

## Department reporting against industry standards

**3.10** The Supply Chain Operating Reference (SCOR) model identifies five categories of information that should be collected by an organisation to allow its supply chain to be managed effectively (**Figure 15**).

**3.11** The Department has started to set out what data it needs to run its business in various documents, including its Joint Service Publication 886, Logistics Sub-Strategy and Interim Defence Logistics Information Strategy. But the Department has not yet carried out a comprehensive exercise to determine precisely what data it needs to manage the supply chain effectively and efficiently. In order to assess the kinds of information the Department reports against what are considered best practice in supply chain management, we mapped the Department's performance measures against the five categories of information specified in the Supply Chain Operating Reference model. As **Figure 16** overleaf shows, there is an imbalance in the metrics reported by the Department, with the formal reporting in the Department concentrating almost entirely on responding quickly to requests for materiel and making sure they arrive. The Department's focus on reliability and responsiveness is understandable given the need to make sure troops overseas get what they need to perform the tasks required of them. However, the absence of reporting on other aspects of the model – agility (the ability to react to external influences), cost and, to a lesser extent, asset management efficiency – mean that the Department is not able to monitor how efficiently it is using its assets. This means there is limited scope to identify potential cost-savings or find opportunities for increasing the efficiency of the system.

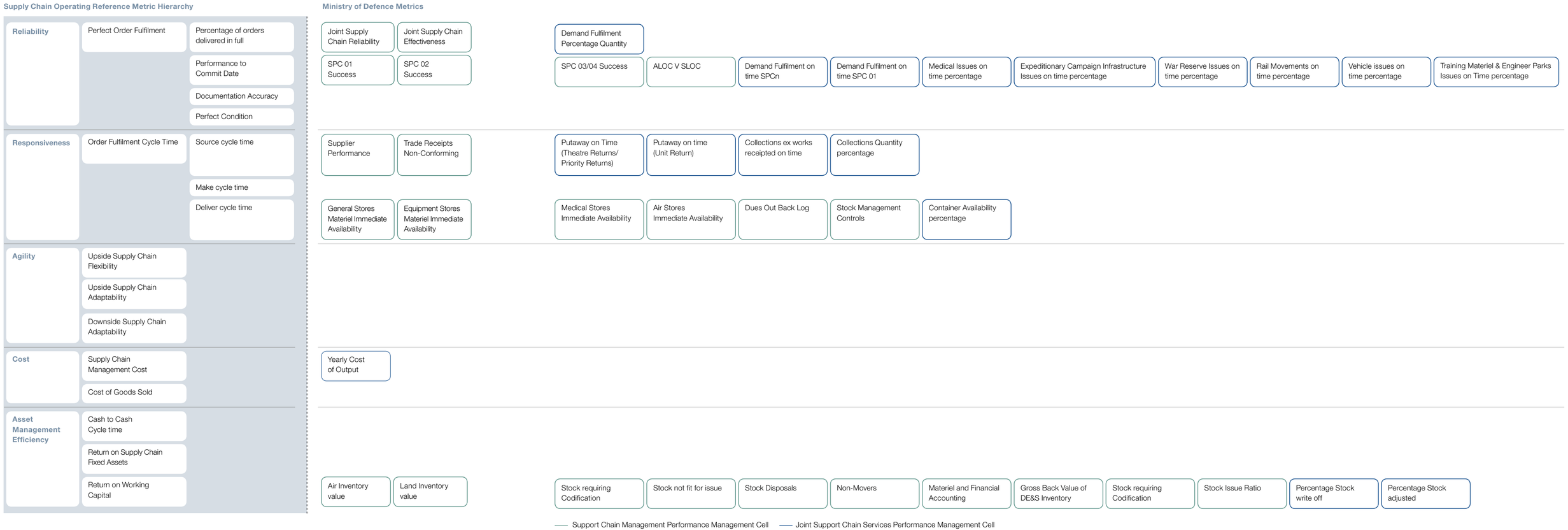
### Figure 15
Supply Chain Operating Reference model performance attributes

| | |
|---|---|
| **reliability** | the ability to perform tasks as expected, the predictability of the outcome of a particular process. Typical metrics include: on time, the right quantity, the right quality. |
| **responsiveness** | the speed at which tasks are performed. The speed at which a supply chain provides products to the customer. |
| **agility** | the ability to respond to external influences or marketplace changes. |
| **cost** | the cost of operating the supply chain processes. This includes labour costs, materiel costs, management and transportation costs. |
| **asset management efficiency** | the ability to efficiently utilise assets. Asset management strategies in a supply chain include inventory reduction and in-sourcing vs out-sourcing. |

*Source: Supply Chain Council*

## Figure 16

Supply Chain Operating Reference model reporting criteria mapped to the Department's reporting metrics




*Source: National Audit Office*

# Part Four

## Supply chain management in the future

**4.1** The Department accepts that it does not have all the data it needs to run its supply operations effectively and efficiently. It considers that there have been considerable barriers to improving its systems. These have included:

- The challenge of managing hundreds of data systems used by the three Services, and integrating the thousands of data systems used by the Department's industrial partners (one supplier has 2,000 different data systems to support the Department) and contractors.
- The limits on what existing data systems can do. Most logistics data systems were designed to support Cold War-style operations, and were never designed to be able to support extended overseas deployments, or work jointly with allies. Some systems are old and have limited functionality, so are simply not capable of producing the data required for current business needs and are difficult and costly to upgrade.

**4.2** There is a strong consensus amongst the staff we spoke to that the key requirement is to update or replace existing data systems, and integrate them so information can be quickly collected and used by management to drive improvements in the supply chain. This would require investment, but should facilitate improvements to forecasting and the response to routine demands from the front line. In turn, this should allow cost savings to be made through greater use of slower yet cheaper (surface) forms of transport, and correspondingly lower stock levels in theatre. The key constraint to upgrading systems appears to be their lower relative priority for the Department compared with other tasks, such as purchasing new equipment, which has meant that sufficient resources have not been available.

**4.3** The Department has identified its ageing legacy IT systems as a significant operational risk. The Defence Logistics Board concluded that the probability of one of the base inventory warehousing and management systems suffering a catastrophic failure had risen to a critical level. Such failures, if sustained for more than 30 days, could have a serious impact on the ability to maintain operations, in Afghanistan or elsewhere.

## The Department's improvement plans

**4.4** In order to mitigate these risks, and improve performance, the Department has developed a blueprint for improvement. This includes:

- **Future Logistic Information Services Delivery Partner** – in December 2010 the Department appointed Boeing Defence UK as delivery partner for the Future Logistic Information Services project, an £803 million 11-year contract which is intended to bring together under a single roof 270 legacy logistics information systems previously operated by 50 separate contractors under 120 contracts. Under the project, the number of data centres across the UK will fall from 15 to 2. Multiple benefits are predicted, including the elimination of infrastructure risk (for example, some information systems were contained in buildings that were suffering with water ingress), improved disaster recovery capability and greater responsiveness to data needs. The plan is for systems to be fully integrated in October 2012.
- **Management of the Joint Deployed Inventory** – currently being implemented across all Services (it is already in service with the Royal Air Force) with a full in-service date of 2014. It is the Department's future system for demanding, receiving, supplying and maintaining details of stores. The intention is that supply staff in all three Services will follow the same ways of working using the same application on a common IT system, providing accurate and up to date information. The intended result is that stocks ranging from clothing and rations, to ammunition and aircraft spares will be visible, regardless of which Service holds them in an operational theatre and where.
- **Joint Asset Management and Engineering Solutions** – provides global and near real-time visibility of asset and engineering data. The second phase of the rollout of this system will give a deployable capability providing real-time and global visibility of assets with the inclusion of engineering data and was initiated in March 2011.
- **Movement of Materiel in Transit** – brought into service in September 2008, this system is a web-based software application, providing capability to view materiel in transit in the forward and reverse supply chains across all three Services. It can also support trend analysis, forecasting and interrogation of data.
- **Performance Management for the Defence Support Chain** – a project which would automate the production of management reports from the Enterprise Data Warehouse, increasing the speed with which they are produced and distributed.

**4.5** Responsibility for improving logistics information systems sits with the Logistics Network Enabled Capability team, which has developed an overall plan for amalgamating and integrating the various systems used throughout the supply chain. It has developed architecture for what information systems will look like, although funding is not set aside to deliver this in full. For example, the Future Logistics Information Services proposal included the option of upgrading the base inventory management systems for an additional £70 million; the Department has identified weaknesses in these systems as a critical risk, however, funding has not yet been made available. Likewise, funding for the project to automate the production of management reports has yet to be approved. We also observed that compromises have been made between cost and functionality: some projects that have been funded have only been approved after costs were reduced, usually through stripping down their capability. The Joint Asset Management and Engineering Solutions system for example, can only transfer data between systems using a memory stick, which introduces a significant risk of data loss and error, because funding for more advanced functionality was not approved.

## Other barriers to improvement

**4.6** While the projects to improve data systems should dramatically improve the Department's ability to manage its supply chain, they are not by themselves enough to secure sustained improvement. In this review, we also found:

- **The supply chain is below its identified minimum staff complement.** As at 23 November 2010, Defence Equipment and Support determined that the number of staff working in the joint supply chain was, at 5,299, 101 posts beneath the minimum identified complement of 5,400. Such under-manning has affected the Department's ability to carry out its improvement plans for data systems.

- **Staff do not always have necessary skills, and those that do are not always retained due to post rotation.** We found that staff were in general highly committed to performing the tasks required of them, and we also found several centres of excellence which were able to produce data required quickly. Too often, however, we found that people involved in the production of supply chain information were not trained logisticians, or did not have the necessary data analysis and processing skills. Furthermore, as staff are usually assigned to posts for a fixed two-year duration, those that have developed the necessary skills are rotated out of post at the end of their assignment, meaning valuable skills and experience are lost.

- **Lack of awareness of staff of the importance of collecting data, especially in theatre.** While we accept that for staff, especially in the front line, collecting logistics data is a secondary priority, unless the accuracy and comprehensiveness of data fed into systems improves then investment in data systems will not yield all the intended benefits.

**4.7** The Department has many people and agencies involved in producing information on the supply chain, but has not identified what organisational arrangements are best suited for increasing awareness of the importance of good information, and disseminating knowledge on skills and best practices. Various options are open to the Department, including:

- Bringing together all data collection and business intelligence capabilities for the business into one central performance management team, ensuring there is one point of contact for data whilst avoiding wasteful duplication.
- Reducing the role of central teams and instead giving individual teams the resources to produce the reports they need.
- Adopting a 'federated' model, where a single central team provides overall business reporting, while providing the tools and training needed to allow teams to produce the business intelligence they need. The Department already uses this approach in some cases, with training for Support Chain Management Performance Measurement staff provided centrally.

## Benchmarking and working with others

**4.8** Some aspects of the Department's supply chain are similar to organisations within the private sector, for example sending items in the UK and to interim destinations across the globe short of the operational theatre. Additionally the supply chains are comparable to other Defence organisations which perform similar tasks. We found little evidence that the Department had benchmarked itself with others to see how well it is performing, or to learn lessons. While we accept that it might be difficult to find a single comparator that precisely matches the size and scope of the UK armed forces and the challenges they face, there is potential for at least partial benchmarking. And there are best practice models, such as the Supply Chain Operating Reference framework, which might be suitable for adaption by the Department.

**4.9** Indeed, we found that the Department had not taken all opportunities to integrate systems with others. For example, the Logistics Functional Area Services (LogFAS) is a set of software tools developed by NATO to support its deployment planning, including how to sustain forces in theatre and report on logistics efforts. It is used by many other organisations, but while some elements of the UK armed forces now use it, is has not yet been embedded into the Services so that its use has become routine. Given that in many war-fighting scenarios UK troops are likely to be engaged as part of a coalition there may be scope to unify supply chains further with coalition partners. Indeed, this is already happening in Afghanistan, as food, fuel and water supply chains are shared with other NATO forces.

# Appendix One

## Methodology

| Selected method | Purpose |
|---|---|
| **Process mapping of individual consignments or assets.** Our internal Decision Analytical Modelling (DAM) group identified four items (SA80 rifles, smoke bombs, armour for Mastiff vehicles and diesel engines) and tracked a number of individual deliveries along the supply chain for each of them. We visited MoD Abbey Wood and Bicester to speak to staff responsible for collecting the data and to confirm our understanding. | To examine what data is collected on individual deliveries, how much visibility there is of them. We also wanted to map the agencies responsible for managing the supply chain and the individual data systems used to store information. |
| **Analysis of the Department's performance data.** We analysed a variety of metrics including number of consignments arriving, performance against supply chain targets and reasons for failure. | To provide an overall view of the Department's performance in managing its supply chain. |
| **Document review.** We reviewed internal documents including Committee meeting notes, data system business cases, risk registers and other reviews. | To identify key issues, determine the Department's priorities for improvement and its improvement plans, and examine its awareness of risks. |
| **Review of the Department's business intelligence reporting.** We commissioned Deloitte to review the Department's production and reporting of information to run its business and compare it with best practice benchmarks. This review included a questionnaire to integrated project teams. | To examine how well the Department performs in producing business intelligence, compared to benchmarks and other organisations. |
| **Interviews with Department staff.** We spoke to staff in the Ministry of Defence, Defence Equipment and Support and its agencies responsible for the joint supply chain. | To collect the views of those working in the area about what the key issues are, what is working well and where improvements can be made, and what the key risks are. |
| **Best Practice Panel and expert advisors.** We convened a good practice panel which included Professor Alan Harrison of Cranfield School of Management, a private sector practitioner, a defence specialist and an ICT systems specialist. Further expert advice was provided by the Director of the National Audit Office Information and Communications Technology Team. | To confirm our understanding of the issues, provide technical assistance and information on alternative approaches to supply chain management. |

# Appendix Two

## Glossary

| | |
|---|---|
| Air Line of Communication (ALOC) | Air transport route connecting operating theatre bases with its supply base in the UK. |
| Base Inventory Management Systems (BIMS) | Systems providing visibility of global stock in a base depot, as well as provisioning, management, stock accounting and demand satisfaction accounting. |
| Base Ordinance Depot Management System (BODMS) | Warehouse management system at Bicester, UK. |
| Comprehensive RNSTS Inventory Systems Project (CRISP) | Comprehensive Royal Naval Supply and Transport Service Inventory Systems Project. |
| Coupling Bridge | The operational transport link between the UK and the theatre of operations. |
| Defence Support Chain and Operations Movements (DSCOM) | The agency responsible for coordinating delivery of support to operations. |
| Demand | A request for an item from the front line (usually base quartermasters). |
| Forward operating bases | Bases in theatre from which military operations are carried out. |
| Future Logistics Information Services (FLIS) | Programme to streamline and rationalise the Department's supply chain IT systems and processes. |
| GLOBAL | Deployable inventory and depot management system used by land units, encompassing returned stores, stocktaking, reconciliation and management reporting functions. |
| Joint Support Chain Services | The storage and distribution arm of Defence Equipment and Support, responsible for storage, maintenance, processing and distribution of materiel for the Department. |
| Logistics Network Enabled Capability Programme team (LOGNEC) | Team within Department responsible for managing and improving supply chain IT systems. |

| | |
|---|---|
| Management of the Joint Deployed Inventory (MJDI) | Future system for demanding, receiving, supplying and maintaining details of stores. |
| Materiel | Military equipment and supplies. |
| Movement of Materiel in Transit (MMiT) | Web-based software application, providing the capability to view materiel in transit in the forward and reverse supply chains across all three Services. |
| OASIS stores | System that allows units to demand, receipt, issue, stock-take and return all commodities of stores procured through any of the three Services. |
| Provisioning | The process of maintaining appropriate inventory store levels. |
| Secondary Depot | Bases in operational theatres where stocks are kept for use by front line troops. |
| Surface Line of Communication (SLOC) | Surface transport route (land and sea) connecting operating theatre bases with its supply base in the UK. |
| Standard Priority Code (SPC) | A code derived in accordance with the Standard Priority System (SPS) to facilitate the demand, supply and movement of materiel. |
| Stores System 3 (SS3) | The Army's stores management system. |
| Unit Computing System (UNICOM) | Computing system utilised by front-line units for placing demands. |
| Urgent Operational Requirements (UORs) | System to obtain urgent equipment for operations, supplementing the Department's long-term planned equipment programme. |
| Visibility in Transit Asset Logging system (VITAL) | Asset tracking system that provides visibility of deliveries in supply chain. |
| Warehouse and Transport Management System (WTMS) | Systems for the management of UK stores. |

# Appendix Three

## Process maps

## Forward supply chain order processing map – Rifle SA80 priority orders sent by air (SPC 02 & SPC 09)

### Afghanistan

**System used to place the order**

| | |
|---|---|
| Frontline | UNICOM |
| Secondline | GLOBAL |

### UK Warehouse

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Arrival date (%) | Departure date (%) | Systems used |
|---|---|---|---|
| Frontline | 100 | 100 | SS3, BODMS, VITAL |
| Secondline | 100 | 100 | SS3, BODMS, VITAL |

### UK Airport (UK coupling bridge)

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Arrival date (%) | Departure date (%) | Departure airport (%) | Systems used |
|---|---|---|---|---|
| Frontline | 53 | 20 | 87 | VITAL |
| Secondline | 100 | 5 | 77 | VITAL |

### Afghanistan (operational coupling bridge)

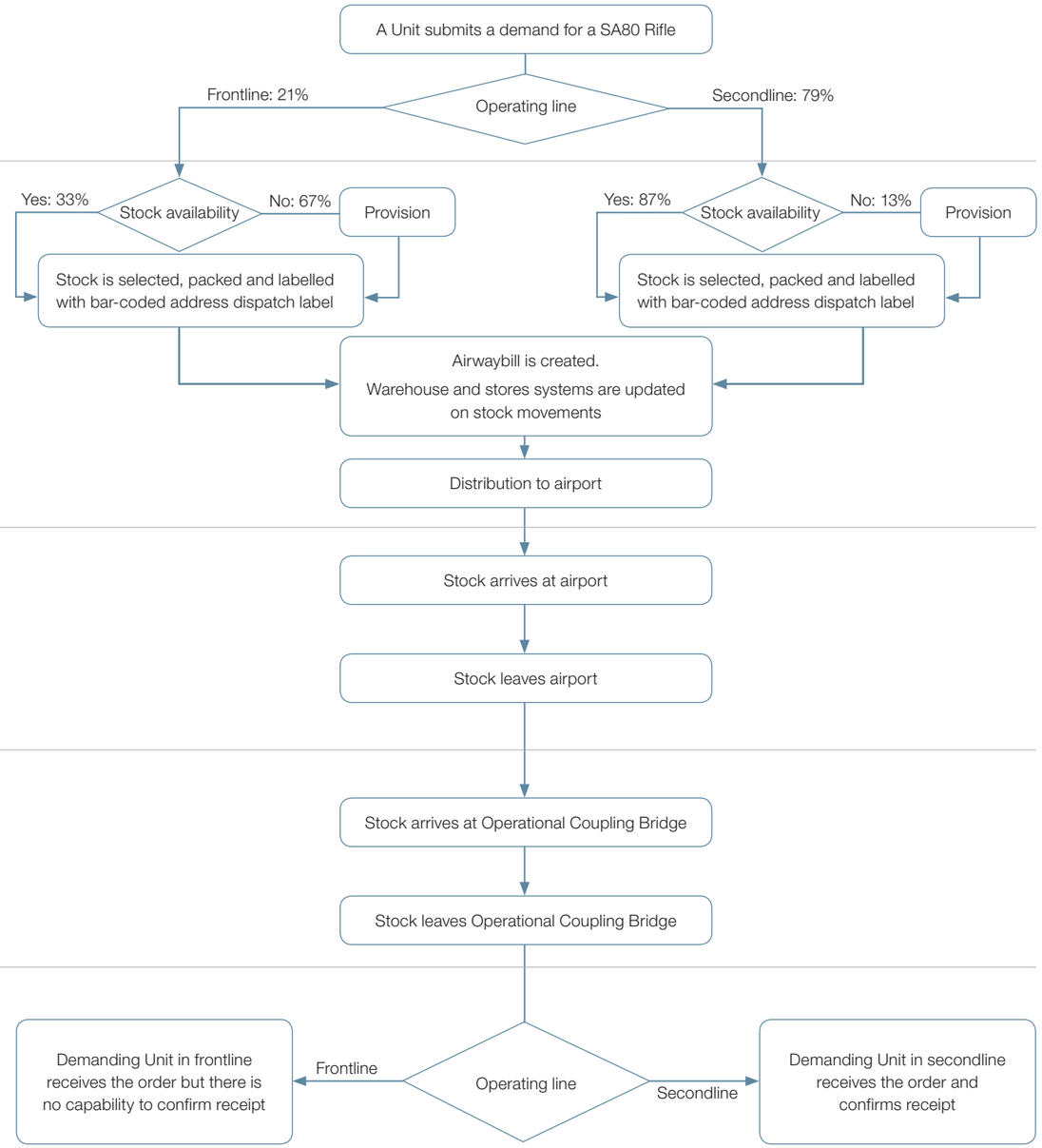
**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Arrival date (%) | Departure date (%) | Systems used |
|---|---|---|---|
| Frontline | 87 | 100 | VITAL |
| Secondline | 79 | 100 | VITAL |

### Afghanistan

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Receipt date (%) | Quantity received (%) | Receipt unit (%) | Systems used |
|---|---|---|---|---|
| Frontline | 0 | 0 | 0 | N/A |
| Secondline | 100 | 0 | 100 | VITAL, GLOBAL |




**NOTE**

1 Sample size 71.

*Source: National Audit Office analysis of Ministry of Defence data.*

## Forward supply chain order processing map – Mastiff armour priority orders sent by air (SPC 02 & SPC 09)

### Afghanistan

**System used to place the order**

| | |
|---|---|
| Frontline | UNICOM |

### UK Warehouse and industry

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Receipt information (%) | Arrival date (%) | Departure date (%) | Systems used |
|---|---|---|---|---|
| Frontline | 0 | 100 | 99 | Supplier's IT system, VITAL |

### UK Airport (UK coupling bridge)

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Arrival date (%) | Departure date (%) | Departure airport (%) | Systems used |
|---|---|---|---|---|
| Frontline | 96 | 3 | 49 | VITAL |

### Afghanistan (operational coupling bridge)

**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Arrival date (%) | Departure date (%) | Systems used |
|---|---|---|---|
| Frontline | 34 | 100 | VITAL |

### Afghanistan

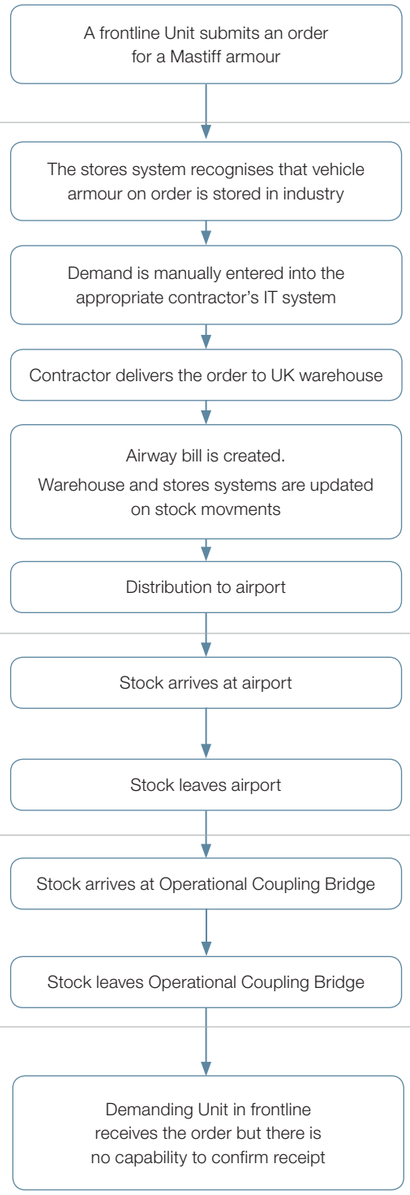
**Percentage of deliveries with information recorded on the Department's consignment tracking system**

| | Receipt date (%) | Quantity received (%) | Receipt unit (%) | Systems used |
|---|---|---|---|---|
| Frontline | 0 | 0 | 0 | N/A |

**NOTE**

1 Sample size 67.

*Source: National Audit Office analysis of Ministry of Defence data.*

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