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**Upgrades and surplus
weapons: Lessons from the
UK disposal sales agency**

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I. INTRODUCTION

Military cutbacks in the 1990s have led to a decline in the purchase of new weapon systems: the global value of transfers of major conventional weapons, as measured by the Stockholm International Peace Research Institute (SIPRI, 1996) fell from a peak of US \$46,535 million in 1987 to US \$22,797 million in 1995 (at constant 1990 prices).¹ Given the continuing demand for military security (albeit at lower levels in many parts of the world), the need to extend the operational life of existing systems, and to improve their operational performance in line with new technologies, is of growing importance to most modern armed forces. In many countries, exacting new safety and environmental regulations are also becoming an important requirement, although perceived operational needs remain the dominant reason for modernisation of weapons. As a result of these operational and regulatory requirements, spending on the modernisation and refurbishment of old equipment is generally thought to be taking a growing percentage of smaller defence budgets world-wide—although the evidence for this remains largely anecdotal, as explained below.

This paper examines the modernisation or upgrade market with a particular focus on UK surplus weapons. In Section 2 some of the definitional and methodological problems are discussed, and this is followed in Section 3 by a speculative look at the main global players in the upgrade market, on both the supply and demand side. Having set the context, the next two sections examine the global upgrade market for surplus weapons. Section 4 provides a brief overview of the market by looking at examples drawn from the specialist literature, and concludes with further speculation as to the motives for both suppliers and purchasers. Section 5 is a case study on the activities of the UK Disposal Sales Agency (DSA) and the associated upgrade work for UK defence companies. Analysis is hampered by the issue of commercial confidentiality which both the UK Government and private sector companies use to deny public access to information, such as the value of individual sales and work carried out on refurbishment and refitting. Our analysis concentrates, therefore, on the general relationship

¹ Although SIPRI includes second-hand or surplus weapons in their figures, the vast majority of these weapons are undoubtedly new.

between surplus sales and the broader dynamic of UK arms export policy. Initially we look at the pattern of sales generated and the DSA's stated policy of using surplus sales to stimulate new exports for UK defence companies. We also assess the various motivations for selling surplus equipment and the role that the MoD has played in maintaining the quality of UK capital equipment, even where much of it is destined for surplus. Drawing on evidence from the sale of surplus ships, we argue that the issue is more complex than simply maximising financial returns to the DSA but involves using surplus equipment as a 'loss-leader' for private sector contractors. This in turn, has implications for the economics of the arms trade and the potential role of surplus equipment as a form of hidden subsidy for private sector defence exports.

II. DEFINITIONS AND MEASUREMENT

There are considerable problems in defining and measuring equipment upgrades. This is partly due to the absence of any international or national database on upgrades (in itself probably a reflection of the lack of international concern with this issue) and partly due to the paucity and limitations of the information that is available. Although information on upgrades can be found in articles in the specialist defence literature, such as *Jane's Defence Weekly*, *International Defense Review*, *Aviation Week & Space Technology*, and (as from January 1997) *Jane's Defence Upgrades*², the variety of terms used—such as 'retrofits', 'refurbishment', 'modernisation', 'upgrade' and 'maintenance, repair and overhaul (MRO)' programmes—and the apparent lack of any agreed commonality or standards in their usage, make it extremely difficult to create an accurate picture of upgrade activity as a whole (or to make comparisons over time or between states). But while there is no completely adequate solution to this problem of terminology—after all, different writers and commentators will always use the same, or similar words differently—in this paper the term 'upgrade' is used as a generic concept: that is, it refers to the economic, organisational, and technological resources which are deployed by actors (states and companies) to significantly enhance the performance or value of existing major conventional weapon systems (ships, aircraft, missiles, tanks etc), small arms (guns, ammunition, grenades etc) and any supporting military infrastructure (bases, detection and warning centres, training facilities etc). Such a definition effectively includes all categories of defence-related transfers, with two exceptions: the transfer of new systems or components for systems currently in development or production; and general maintenance, repair and service contracts (i.e. those that keep weapon systems operational more or less within original specifications and life cycles).

It is relatively clear, therefore, that such upgrades represent a large proportion of the armaments market, particularly the trade in dual-use components both as intranational and international transfers. An analysis of defence-related contracts involving UK public agencies and UK-based companies confirms this point. Based on the information provided in *Jane's Defence Contracts* (January-June 1996), Appendix I lists all the known defence contracts awarded to UK-based companies over a six-month period. This small snapshot of defence activity in the UK reveals that 19 of the 75 contracts (25 per cent) fall into the category of upgrades (as defined above). The value of 15 of the 19 upgrade contracts

² The decision by Jane's Information Group to launch a new bi-weekly newsletter, *Jane's Defence Upgrades*, is itself indicative of the importance of this growing market.

is known, and these total US \$137.7 million (an average of US \$9.2m per contract). Of the 56 non-upgrade contracts the value of 37 is known, and these total US \$698.3 million (an average of US \$18.8m per contract). Thus, in terms of value, approximately 17 per cent of the contracts in Appendix I are for upgrades. Even allowing for a margin of error of 10 per cent (plus or minus) from this very small and random sample, the global value of upgrade contracts is likely to be substantial. Assuming therefore that between 5-25 per cent (by value) of the global arms trade relates to upgrade contracts, then the annual value of this market will be around US \$1140-5700 million (based on the above SIPRI estimate of \$22,797 million as the global value of arms transfers in 1995).

Indeed, this figure may underestimate the extent of the military upgrade market because of the perceived growth in both the transfer of dual-use technologies and black market transactions. The latter are hard to quantify and rarely show up in the statistics on the arms trade, although several commentators have suggested that there has been a significant increase in such activity in the last decade or so.³ If conflict zones, such as Iran-Iraq, Lebanon, Afghanistan, Southern Africa and Central America are generating a sizeable demand for black market weapons, they will also be looking for clandestine weapon upgrades. Transfers of dual-use goods, such as electronic components and aircraft parts, offer one way of meeting this demand.

The main focus of the contracts in Appendix I is the higher end of the weapons spectrum (rather than small arms or infrastructure upgrades). 11 of the 19 upgrade contracts are for major conventional weapon systems, two are for small arms and six for supporting infrastructure. A review of the articles on upgrades in the specialist literature⁴ supports this finding. Although none of the listed contracts appear to be in respect of surplus weapons, the relationship between upgrades and surplus weapons is often difficult to determine. Many surplus weapons are probably upgraded prior to becoming 'surplus' and thus cannot be readily identified until a later date (and post-upgrade). Indeed, on one level, the rationale for an upgrade is to prevent the weapon system from becoming surplus to requirements. Thus, the market for refits and reconditioning of readily identifiable surplus weapons (i.e. those defined by governments as surplus⁵) is likely to be a small proportion of the overall upgrade market. This surplus market can be subdivided into upgrades which take place after transfer of ownership and those undertaken prior to transfer.

³ In the mid 1980s, the illegal arms trade was estimated to be worth \$10 billion per year (Michael Klare, 1986).

⁴ For the purpose of this paper, the journals *Jane's Defence Weekly* and *Aviation Week & Space Technology* were reviewed, covering publication dates from June 1995 to February 1997.

⁵ See Susanne Kopte & Peter Wilke, 1995, p12.

While all the contracts listed in Appendix I appear to be demand-led (that is, they were initiated on the request of either a government or one of its agencies, such as the navy or air force, or by a company subcontracting work for a government order), it is clear that many upgrade programmes will be partly or wholly supply-led (that is, initiated by a company on the expectation of future contracts). Taiwan's Aerospace Industry Development Corp (AIDC), for example, is upgrading over 200 surplus F-5 aircraft, which will be offered for sale when newer fighters are introduced by the Taiwanese Air Force (*Jane's Defence Weekly*, 11 September 1996). The complexity of upgrade programmes is best highlighted by a few examples. The decline in new aircraft orders means that upgrade developments in the area of fixed wing fighter aircraft are particularly lucrative. In the case of the Russian MiG-21, for example, of which there are over 3,000 currently in service around the world, a diverse range of companies have developed or are in the process of developing, manufacturing and implementing structural and avionics upgrade packages—as shown in Table 1. The Indian MiG-21 upgrade programme is particularly complex, involving the integration of multi-nation sub-systems and collaboration at the prime contractor level between MiG-MAPO of Russia and Hindustan Aeronautics Ltd (HAL) of India. Two aircraft are due to be upgraded and tested in Russia, with the remainder being upgraded in India under a full technology transfer package (although delays and price rises are hampering progress).

TABLE 1: SELECTED UPGRADES TO RUSSIAN MIG-21

(a) Supply-led upgrades

Contractor (Country)	Development
Israel Aircraft Industries (IAI) (Israel)	MiG-21-2000 demonstrator
MiG-MAPO/Sokol (Russia)	MiG-21-93 demonstrator
MiG-MAPO (Russia) in collaboration with Aerea (Italy)	Modular weapons storage upgrade for both NATO and Russian weapons

(b) Demand-led upgrades

Government	Contractor (Country)	Contract
India	MiG-MAPO (Russia) in collaboration with HAL (India)	Modernise 120 aircraft
	Thomson-CSF (France)	Data and signal processors
	(US)	Laser gyro-inertial navigation systems
	IAI (Israel)	Improvements to cockpit layout
Romania	Elbit (Israel) in collaboration with Aerostar (Romania)	Upgrade 110 aircraft
Cambodia	IAI (Israel)	Upgrade 19 aircraft

Sources: Jane's Defence Weekly, 25 November 1995 and 24 January 1996; and Aviation Week & Space Technology, 16 September 1996.

III. THE PRINCIPAL ACTORS

1. Suppliers

There would seem to be three principal types of actor on the supply-side of the upgrade market: (mainly) public sector maintenance, repair and overhaul organisations (MROOs); large-scale, (mainly) private sector original equipment manufacturers (OEMs), often with separate maintenance, repair and overhaul divisions; and small and medium private sector component manufacturers (CMs). MROOs tend to be located within particular branches of the armed services and the work typically involves rebuilding and overhaul of weapons systems held in existing service arsenals—and much of this work is likely to be routine maintenance work, rather than upgrade activity. The size and scope of a country's MROO facilities will probably reflect the size and scope of its armed forces. In the US, for example, this work is carried out by about 89,000 people at 30 major depots, at an annual cost of about US \$13-14 billion. In the past these facilities have tended to be feather-bedded with guaranteed contracts, with federal regulations requiring 60 per cent of maintenance depot work to be handled by the government and a maximum of 40 per cent by the private sector. Today, however, some of these US depots are being phased out, while others face an uncertain future due to privatisation and outsourcing. Many of the MRO sites located at US military bases, for example, are expected to be privatised in the next few years, either in-place or through take-overs by OEMs.

The increased outsourcing by the US and other Western governments (and defence companies), together with the assumed growth in upgrade programmes generally, probably means that there is a modest horizontal proliferation in MRO industries. Two examples can be found in the recent literature. First, the French naval shipbuilder, DCN is building extensive facilities for maintenance and overhaul in Jeddah, Saudi Arabia, as part of the Sawari II contract (for two La Fayette class air defence ships). Future refits can therefore be expected to take place in Jeddah rather than in Toulon in France (*Jane's Defence Weekly*, 26 June 1996). The second example is provided by a new joint venture between Canada's CAE Aviation (which is certified by Lockheed Martin for the repair of C-130 Hercules transport aircraft) and the Shaheen Foundation of Pakistan. The joint venture company is expected to serve as a regional aircraft repair and upgrading facility specialising in Hercules transport aircraft. The first customer is expected to be the Pakistani air force which operates 14 C-130s. CAE Aviation is also involved in similar negotiations in Malaysia (*Jane's Defence Weekly*, 31 January 1996).

OEMs are clearly important players in the upgrade market. While it is reasonable to assume that the companies that were involved in producing the original weapon system (whether domestic, 'foreign' or as part of a collaborative effort) will have a strong interest in any subsequent upgrade contract, other players (often newly emerging defence companies in recipient countries) appear to be of growing importance. The aerospace sector, probably the largest upgrade market, provides a useful illustration. The US-built Northrop F-5, for example, has about 1,600 aircraft still in operation, and the OEM (Northrop Grumman) is not only doing F-5 upgrades for the US Air Force but is also looking for additional business abroad. However, given the widespread export of the F-5 (often with technology transfer and maintenance packages), recipient countries are often able to use their own companies to complete upgrades, as was the case with Bristol Aerospace in Canada (which recently modified F-5 airframes for the Canadian Air Force). Having gained this experience, Bristol Aerospace then becomes a stiff competitor for future F-5 upgrade work around the world. Other competitors include Israel Aircraft Industries (IAI),⁶ which recently won the Chilean F-5 upgrade contract (and is itself proliferating upgrade expertise through its teaming contract with the Chilean aerospace company Enaer), and Taiwan's Aerospace Industry Development Corp (AIDC) which, as described above, is preparing to become a major F-5 upgrade centre following recent government export approval for 200 surplus aircraft.

OEMs also face stiff competition from other prime contractors, particularly those within their own field of expertise, who may be trying to expand their services and offer maintenance and upgrade capabilities on equipment other than their own. General Electric, for example, offers maintenance contracts on both Pratt & Whitney and Rolls Royce aircraft engines, while Raytheon handles about 2,000 US military aircraft many of which were not originally built by the company. As mirrored elsewhere in the defence sector, the competition for upgrade markets is also leading to increased consolidation of MRO facilities among OEMs. In the US, for example, Miami-based Greenwich (a large, independent company specialising in turbine engine overhaul work) is planning to acquire Aviall's Commercial Engine Services Division for about \$280m, which would make it probably the largest engine, repair, maintenance and overhaul company in the world (*Aviation Week & Space Technology*, 11 March 1996). Another example of consolidation is Raytheon Aerospace Co. which absorbed the E-Systems Inc. military aircraft logistics support business. Finally, there is also evidence of teaming arrangements

⁶ The state-run IAI is also upgrading 54 Turkish Air Force Phantom F-4s in a controversial agreement that is being financed by a \$457 million loan to Turkey by the Israeli Government (*Jane's Defence Weekly*, 28 August 1996).

for upgrade contracts, such as the IAI (Israel)/Enaer (Chile) contract described above, and the joint bid by Northrop Grumman (US), CASA (Spain) and Samsung Aerospace (South Korea) to upgrade 38 F-5F fighters for the Korean Air Force.

If MROOs and OEMs are mainly involved with large upgrade programmes, it is CMs that often act as subcontractors on such programmes. Although there is little detailed information on the component market for upgrades, it seems likely that thousands of small and medium-sized CMs are involved, many of which will be dual-use manufacturers rather than specialised defence contractors. Some will actively seek niche markets. One such company, US-based Chrysler Technologies Airborne Systems Inc., specialises in modernisation work on military aircraft as well as carrying out routine maintenance. The company employs 2,000 workers including 250 engineers and a similar number of technical personnel. About 50 per cent of the company's annual sales of \$300 million were provided by military contracts in 1995 (*Aviation Week & Space Technology*, 11 March 1996). It seems likely that some of the suppliers listed in Appendix I will also fall into this category.

2. Purchasers

The paucity of data on upgrades makes it virtually impossible to determine which regions or individual states are leading the market in the purchase of upgrades. Again, one would expect some correlation between the size, scope and age of national inventories and the level of interest in the modernisation market. In short, countries with large defence budgets can be expected to be major purchasers of upgrades. Table 2 lists the major ongoing European fighter aircraft upgrade programmes, and shows that aircraft upgrade activity among the more affluent western nations is extensive. However, aircraft of all types are having their service life extended and having their combat capabilities enhanced in practically every advanced air force around the world. Two areas of particular interest are the former Soviet sphere of influence and Latin America. Writing in the Foreword to *Jane's Aircraft Upgrades*, editor Simon Michell (1995b) outlines the market opportunities arising from the break-up of the Soviet Union:

There are now a core of countries in central Europe, the Baltics and South-east Asia which, for a combination of reasons including lack of funds and realignment of economic-strategic dependence, will form air arms by mixing second-hand aircraft with new-build. It is very likely that these air forces will resemble the nascent Croation Republic Air Force which has managed to build up a force of former Soviet equipment such as MiG-21s and Mi-8/17

helicopters, despite the arms embargo. It is very likely that these new air forces will re-equip their aircraft with a mixture of western and Russian systems.

Similarly, in Latin America, a combination of factors—tight budgets (the combined annual defence spending of Chile, Argentina and Brazil is less than \$9 billion, and budgets are being squeezed by growing commitments to debt-reduction and social welfare programmes), greater oversight by civilian-led governments (in Chile and Argentina, for example, civilian governments are attempting to reign in the military in reaction to past human rights violations and other excesses) and growing civil economies and better job opportunities in the private sector (which means a larger proportion of the military budget is being spent on retaining the most skilled military personnel)—are also forcing military services to focus on modernisation rather than replacement of old equipment. Moreover, the picture in Latin America and the former Soviet Union is probably repeated in other parts of the world, particular in those debtor countries which are under increasing pressure from the IMF and World Bank to reduce their military budgets. In such countries, cuts in military spending are likely to be synonymous with increased demand for weapons upgrades. These countries (mainly in the South—broadly defined) are also much more likely to be purchasers of surplus weapons, and it is to some examples of upgrades to these categories of weapons that we now turn our attention.

TABLE 2: MAJOR EUROPEAN FIGHTER AIRCRAFT UPGRADE PROGRAMS

<i>Country</i>	<i>Aircraft</i>	<i>Prime Contractors</i>	<i>Upgrade</i>
Austria	J350E Draken		Sidewinder air-to-air missile
Belgium	F-16	Int. collaboration	Mid-Life Update (MLU) to 48 aircraft plus 24 options
	Mirage 5BA & BD	Int. collaboration	Mirage Systems Improvement Programme (MIRSIP)
France	Mirage 2000 & F1	Dassault/Thomson-CSF	Avionics upgrades
	Super Etendard	Dassault/Thomson-CSF	Modernisation of 56 aircraft, including new radar, inertial navigation system and other avionics
Denmark	F-16	Int.collaboration	MLU to 61 aircraft
Germany	F-4F Phantom		New radar
	Tornados	Possible collaboration with Italy	MLU
Greece	F-16s	Litton Industries (US)	Electronic warfare systems
Italy	Tornados	Possible collaboration with Germany	MLU
	F-104S Starfighter	Alenia	Improved avionics and missiles
Netherlands	F-16s	Int.collaboration	MLU to 136 aircraft
Norway	F-5s	Sierra Technologies	Tiger Paws weapons systems upgrade package
	F-16s	Int.collaboration	MLU to 56 aircraft
Spain	F-5B	Bristol Aerospace(Canada)	Structural upgrades on 23 aircraft
Switzerland	Mirage III	Swiss Federal Aircraft Factory	Structural modifications and avionics upgrades
UK	Tornados		MLU
	Harriers		MLU

Source: Simon Michell, 1995a.

IV. UPGRADES OF SURPLUS WEAPONS: SOME EXAMPLES

1. Aerospace

One of the main recipients of surplus US aircraft has been Israel. 25 F-15s were donated to Israel in 1991, for example, with a further 50 F-16s being donated throughout 1994 and 1995. In addition to F-15s and F-16s, other recent aircraft donations to Israel include a 42 AHA-64A Apaches; 10 UH-60 Black Hawk helicopters; and 25 ex-US army AH-1E Cobra attack helicopters. The majority of Israel's upgrade programmes take place after the original 'sale' and utilise locally developed subsystems and components. Future upgrades to the F-15s and F-16s, for example, are expected to utilise avionics systems developed under Israel's own cancelled Lavi fighter programme, including new radar and computer navigation systems (*Jane's Defence Weekly*, 19 June 1996).

In Europe, France is upgrading Mirage aircraft for countries all over the world—some of which will almost certainly involve surplus stock. Again, however, given the widespread export of the Mirage, a number of non-French companies are also involved in upgrade programmes. Ex-Belgium air force Mirages, for example, are due to be transferred to Chile, but only after completion of an upgrade programme (known as MIRSIP - see Table 2). Belgium withdrew its Mirage 5 aircraft at the end of 1993 and has been undertaking modernisation *prior* to transfer to the Chilean air force. The work consists of a service life extension programme, the addition of canards, a pressure refuelling system from Dassault, a new weapons delivery system as well as a navigation and reconnaissance system from the Belgium company Sagem. The Swiss Federal Aircraft Factory has also developed significant Mirage upgrade capabilities (having upgraded the Mirage aircraft within the Swiss air force inventory), and would be well placed to compete for surplus upgrade contracts.

In addition to the upgraded Mirage 5s and F-5s mentioned above, Chile is adding an Israel Aircraft Industries (IAI) Phalcon early-warning system and a converted Boeing 707 to its air force's fleet. The conversion of the Boeing into an aerial tanker will be undertaken by the Chilean state-owned aerospace company, Enaer, from a conversion kit supplied by IAI (*Aviation Week & Space Technology*, 4 March 1996). Another surplus weapon purchase in Latin America involving an upgrade is Argentina's acquisition of 36 ex-US Navy A-4 Skyhawks. These will be upgraded in the US prior to delivery.

The large volume of surplus weapons arising from the end of the Cold War are also prime targets for upgrades. In Germany, for example, a Russian-German joint venture known as MiG Aircraft Support Group (MAPS) is performing maintenance on MiG fighters inherited from the former East-German air

force. MAPS is also studying upgrades to increase engine and air-frame component service life (*Aviation Week & Space Technology*, 11 March 1996). And from NATO's surplus stock, Greece is thought to be considering purchasing upgraded F-4 Phantom IIs from Germany.

2. Ships

Countries known to be active in the transfer of surplus ships include the US, the Netherlands and the UK—the latter is discussed in more detail below. Recent transfers of decommissioned surface vessels by the US government include two *Newport* class tank landing ships bought by the Australian navy, for conversion into helicopter-carrying troop ships. These were 'sold as seen' and are due to be refurbished by Australian companies. The cost of refurbishment, however, has risen from US \$105 million to US \$155 million because of unforeseen problems with rusting (*Jane's Defence Weekly*, 27 March 1996). Thus, despite being generally regarded as a cheaper option than purchasing new equipment, conversion or upgrade costs of surplus weapons can sometimes be substantial.

In the case of the Netherlands, the upgrades to two *Kortenaer* class S frigates (originally commissioned in 1981 and 1983) will take place prior to their transfer to the United Arab Emirates in 1997-98. The ships are part of a surplus batch of three, and were also offered to South Africa, Malaysia and Greece—the latter having bought three ex-Dutch *Kortenaers* in 1992 (*Jane's Defence Weekly*, 17 April 1996). The contract is worth over US \$350 million and will provide 250,000 hours of work at Royal Schelde. The contract also includes a training package and option for the follow-on procurement of up to six new air defence frigates. The major overhaul is expected to extend the operational life of the frigates by seven years.

3. Land forces

There is some evidence that upgrades for Main Battle Tanks (MBT) are taking place after the original sale of surplus stock. Some versions of the US built M60A3 MBT, for example, have been phased out of front line service with the US Army and are being transferred to other countries free of charge. A US company is marketing an advanced fire control system which can be installed in the user's own facilities. Potential markets for this system (i.e. known importers of the M60A3) include Austria, Bahrain, Egypt, Greece, Israel, Oman, Saudi Arabia, Spain, Taiwan, Thailand, Tunisia and Turkey (*Aviation Week & Space Technology*, 11 March 1996). In addition to upgrades of MBTs, there is also a significant market

for engine upgrades for armoured vehicles. These can either involve new engine designs (although the development costs are often prohibitive) or more powerful versions of existing designs.

4. Supplier and purchaser motives

What are the motives for purchasing and selling upgraded surplus weapons? Clearly many countries (particularly in the South) buy upgraded surplus stock because it represents a cheaper (or occasionally a more clandestine) option than buying new equipment. It can also be a stepping stone to more advanced equipment. The UAE purchase of Dutch ships, for example, will provide an interim capability for the UAE navy—to bring it to the level of expertise to make the jump to the advanced missile frigates it is planning to acquire. Similarly, the proposed upgrade of 38 F-5F fighters for the South Korean Air Force are expected to prepare the pilots for the more advanced F-16s.

For suppliers, both governments and defence contractors alike, the sale of upgraded surplus weapons opens new market opportunities in a period of declining markets for new weapons. The sale of surplus Skyhawks to Argentina, for example, includes fairly substantial upgrade contracts for the US companies concerned. Lockheed Martin's contract is worth US \$280 million as the prime contractor for the upgrade work, and subcontractors, such as Westinghouse Electric Corp. (modified radar system) and Allied-Signal (cockpit upgrade) have contracts worth US \$30 million each (*Aviation Week & Space Technology*, 4 March 1996). But defence companies are not only involved in upgrade contracts for their own intrinsic value. The possibility of even more lucrative follow-on contracts is a strong imperative. US, UK, French, German and Dutch shipbuilders are all in the race for the planned acquisition of advanced missile frigates by the UAE, for example, but the Dutch sale of surplus frigates together with the associated training package, may end up giving them the edge. Similarly, the aforementioned upgrade of 38 F-5F fighters for the South Korean Air Force (jointly by Northrop Grumman, CASA and Samsung Aerospace) is expected to generate follow-on contracts for F-16s.

Finally, the supply of upgraded surplus weapons or spare parts can occasionally be used to circumvent export controls on new weapons. US front-line fighters are currently banned from export to South America, for example, because the US government fears that a re-equipment drive in the region would destabilise the fragile economies there. However, US policy does permit the sale of reconditioned 1950s and 1960s US combat aircraft, such as the A4 and A7 (although only Argentina has placed orders to date, for 36 ex-US Marine Corps A-4Ms). In another example, the UK Government secretly approved the supply of spare engine parts for Argentinian warships (originally sold as surplus by the UK in the



1970s) even though a UK arms embargo, imposed after the Falklands war, remains extant against Argentina. (Richard Norton-Taylor, 1996a and 1996b; and David Leigh and Jonathan Calvert, 1996).

V. CASE STUDY: THE UK DISPOSAL SALES AGENCY (DSA) AND UPGRADES TO SURPLUS WEAPONS

1. Defining the UK surplus

Surplus weapons are a small but growing element of the UK's arms trade. The policy of the Conservative administration was to generate maximum financial return on equipment no longer required by UK armed forces (and indications are that the Labour Party will follow a similar line now that it has formed the new government in May 1997). The end of the Cold War, the sale of surplus weapons did not receive any priority. The main element was the sale of ships to governments in South America and South East Asia. Over the ten years to the beginning of 1992, 35 ships were sold to other governments, raising £135 million (Public Accounts Committee, 1994, p. vii). But with the end of the Cold War, and MoD estimates that front line equipment would reduce by approximately 20 per cent, and stockholdings by 33-50 per cent, the Government began to give the issue serious consideration. The most significant force reductions are taking place in Germany and much equipment is being returned to the UK. However, surpluses, mainly accommodation stores and non-armoured vehicles, are being disposed of locally in Germany by the depot based in Munchengladbach which plays an important role in the overall disposal function. Such reductions represent the biggest drawdown since the end of the Second World War (National Audit Office, 1993, p. 9).

The most comprehensive review of UK defence capabilities since the end of the Cold War remains *Options for Change* (SDE, 1991). The main equipment reductions include six Tornado GR1 squadrons, four Phantom squadrons, two Buccaneer squadrons, part of one squadron of Nimrod maritime patrol aircraft, about 11 submarines and eight destroyers/frigates and 140 Chieftan main battle tanks. Some of the equipment is held in reserve, but many types are being phased out like the Phantom and Buccaneer aircraft, Leander frigates and Oberon submarines (National Audit Office, 1993, p. p. 9). Officially, the scale of the surplus is put down exclusively to the end of the Cold War but there were severe financial pressures building up during this period. Although the UK attempted to maintain a 3 per cent increase per annum in defence expenditure during the 1980s (in line with a NATO commitment), this was abandoned during the mid-1980s. Defence procurement expenditure peaked in 1985, declining in real terms well before the end of the Cold War. Reducing the size of equipment holdings and declaring surplus older equipment that required expensive servicing or modernization was one element of the drive to cut costs.

Traditionally, the UK has been most prominent in the sale of surplus naval equipment and there was little attempt previously to export surplus aircraft and army equipment because these were used for training and other purposes. But with the creation of a much larger surplus, airforce and army equipment is receiving growing attention. In the global context, a 1993 UK government survey of defence export sales estimates that second-hand sales were worth 3 per cent of the overall market with the top exporter being the US (with 69 per cent of the world market) followed by the UK (with 4 per cent). (National Audit Office, 1993, p. 18). Significantly, the Disposal Sales Agency (DSA) identified an accelerating trend for available surplus, increasing overall by 29 per cent in 1994-95 compared to the previous year. The DSA also estimated that the overall value of the UK surplus would be £2,000 million by 1997. (Disposal Sales Agency, 1995, p. .p5).

2. Structure and sales of the DAS

The Defence Sales Organisation (DSA)⁷ is responsible for the sale of British surplus equipment both in the UK and in Germany. In organisational terms it is a subsidiary element of the Defence Export Services Organisation (DESO) within the MoD and, although still accountable through the Secretary of State for Defence, Agency status provides it with greater control over its budget and performance targets. Overall, the Agency comprises mainly civilian staff with marketing, contracts, finance, policy and technical experience supported by specialist Service personnel for government-to-government sales. Staff costs in 1994 were £1.1million which represents 28 per cent of the Agency's operating costs and staff number were 101 including 42 civilian and industrial staff in Germany. (Disposal Sales Agency, 1994, p. 5). As shown by Figure 1, the DSA is structured along commodity groupings and its remit is to maximise the returns from the sale of surplus equipment, including capital equipment, smaller weapons and stores. Stress has been laid on the use of commercial contracts with private sector companies to maximise the sale of bulk stores allowing the Agency to concentrate its own resources on larger capital equipment sales to foreign governments. Table 3 provides a summary of sales income from 1987 through to 1995, of which ships make up the majority. Sales showed a considerable decline from 1989-92, ascribed by the DSA to the lack of naval orders, but subsequently the return from capital equipment

⁷ The Directorate of Sales (Disposals) was made responsible for the sale of surplus equipment in April 1990 to centralise the disposal function, and in August 1991 took responsibility for the disposal operation in Germany. As part of the general drive to encourage a more commercial culture in the civil service, the Directorate was given Agency status in 1994, and became known as the Defence Sales Agency (DSA).

increased substantially (again mainly naval vessels) while other surplus revenue has declined. Table 4 indicates the shift towards contracting out.

Box 1: DSA Organisational Structure

Chief Executive			
<i>Assistant Director Ships&Armaments</i>	<i>Assistant Director Contracts&Technical</i>	<i>Assistant Director Germany</i>	<i>Assistant Director Plans and Budget</i>
Marketing & Sales of Ships & Armaments, Armoured Vehicles, Ammunition, Small arms, Missiles, Helicopters, and Torpedos	Marketing & Sale of Aircraft, Vehicles, Industrial Products, Agreements with Industry, Technical Support	Marketing & Sale of ex-MoD Eqpt and stores in Germany	Strategic Planning, Budget, Policy, Health and Safety, Environmental Protection Agency Reports

Source: Disposal Sales Agency, 1994, Annex B

TABLE 3: UK GOVERNMENT RECEIPTS FROM THE SALE OF SURPLUS WEAPONS (1987/88 - 1994/95)

(Figures in £ millions)

	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95
Surplus Capital Equipment	42.9	43.4	9.7	8.9	8.7	22.6	39.6	53.9
Other surpluses	40.8	32.5	34.5	25.4	25.2	26.1	25.8	18.5
Gross Receipts	83.7	75.9	44.2	34.3	33.9	48.7	65.4	72.4

Sources: Public Accounts Committee, 1994, p. 2; Hansard, 30 March 1995.

TABLE 4: UK DSA SALES OF SURPLUS WEAPONS BY CONTRACT TYPE (1993/94 - 1995/96)

(Figures in £ millions)

	<i>government to government</i>	<i>contracted out</i>	<i>direct sales</i>
1993/4	41	18	12
1994/5	33	39	9
1995/6	37	37	4

Source: Disposal Sales Agency, 1995

TABLE 5: UK GOVERNMENT SURPLUS WEAPONS SALES (1995/96)

	<i>Receipts (£m)</i>	<i>% of total receipts</i>
Ships	33.4	42.8
Armaments and Aircraft	10.3	13.2
Contracts and Technical	29.1	37.3
Germany	3.6	4.6
Local Sales	1.3	1.7
Non MOD	0.3	0.4
Total	78	100

Source: Disposal Sales Agency 1995

TABLE 6: UK GOVERNMENT GROSS RECEIPTS FROM THE SALE OF SURPLUS WEAPONS (1989/90 - 1995/96) DAVIDSON

(Figures in £ millions, at 1995/96 prices)

89/90	90/91	91/2	92/3	93/4	94/5	95/6
47	37	37	53	71	81	78

Source: Disposal Sales Agency Annual Report and Accounts 1995/96

Compared to previous years, the financial returns still reflect the dominance of ship sales (see Table 5), although the Agency continues to stress the importance attached to building up sales of aircraft. For a more detailed analysis of sales policy and the available surplus see Appendix II. It is difficult to extrapolate on future sales, especially as the Agency actually saw a fall in gross sales in 1995-96 compared to the previous year (as shown by Table 6). However, the Agency estimates that revenue will increase by around 15 per cent for 1996-97, in line with their previous assessment that the peak years for the sale of surplus equipment will be in the late 1990s. A variety of helicopters and aircraft are being made available, as well as the usual number of frigates and support ships so future years may well see an increase in the proportion of sales for aircraft. Non-ship sales in the previous financial year included:

- Navy Lynx helicopter sales to Pakistan including aircrew and maintenance training programmes;
- Buyback agreement with a US company for Mk46 Lightweight Torpedoes;
- Sale of M109 Self Propelled gun spares to Austria; and
- Clearance by smelting and processing contracts, auctions and tender sales of 815 armoured vehicles (Disposal Sales Agency, 1996, p. 8).

3. DSA policy on surplus equipment

The rationale behind the sale of surplus equipment is neatly summed up in the Agency's annual report (Disposal Sales Agency, 1996, p. 7):

The disposal of capital assets to friendly foreign governments offers a real opportunity for British industry to promote new business on the back of these sales. Refurbishment and modernisation of surplus equipment can offer access to new markets. Surplus equipment can sometimes form the nucleus of larger export packages, offering the opportunity of marketing related new products and services, as well as long term support contracts.

The DSA is clearly stressing how its role is consistent with the overall drive of DESO to maximise defence sales. Rather than providing competition to private UK defence companies in their efforts to sell new equipment abroad, DSA surplus sales act as a lubricant for increased sales by UK companies in new markets. Analysis of the pattern of sales (Appendix II), reveals that surplus equipment is being sold predominantly to second-tier military powers. Compared to NATO allies and major importers such as Saudi Arabia, the main buyers of surplus weapons, Chile, Brazil, India and Pakistan do not possess the same purchasing power. Of course, these countries have a significant military capability and aspirations to purchase advanced military systems. Pakistan, for example, was in serious negotiations to buy up to three of the latest generation of UK frigates (the Type 23), but financial constraints were a major factor in its withdrawal from negotiations. Type 21s, with refit and support equipment such as the Westland Lynx helicopters, represented a cost-effective alternative.

In other words, the UK policy on surplus weapons complements rather than challenges new-build contracts such as that obtained by the UK specialist shipyard, Vosper Thornycroft, for Saudi Arabian minehunters. Developing relationships through surplus weapons with second-tier buyers is an important niche market which, in turn, provides valuable additional contracts to UK companies for refits and other forms of modernisation.⁸ Although the financial return would appear low compared to the original cost of equipment, these other factors illustrate how surplus weapons fit into the wider export strategy. This practice raises several questions about the complementarity of surplus and new weapon sales; the emphasis played on maximising financial returns to the government or on using a major surplus sale as

⁸ This may not always be the case, however. The market for surplus tanks, for example, is somewhat different to that for surface vessels. Many potential options for new tanks exist on the international market at relatively cheap prices. UK companies, already concerned about the potential effect of surplus Chieftans on the sale of newer tanks such as Challenger 1, have therefore been reluctant to start up support lines for old kit.

a sort of 'loss leader' through which to attract new defence work for the private sector including refurbishment and associated new equipment; and general issues about the economics of the arms trade, for example, whether DSA sales can be considered as a hidden subsidy alongside export credit guarantees.

Certainly, the revenue achieved on surplus equipment sales looks modest. Although the value of each contract is subject to commercial confidence and payments may be staggered over several years, the actual prices paid for a frigate would seem to be in the region of £5 million to £10 million—a very modest figure. Also, the MoD seems prepared to make the calculation that a basic level of modernisation in both frigates and aircraft is necessary, even when equipment is reaching the end of its service life, in order to ensure potential sales as surplus. The clearest example is the Type 22 frigate *Battleaxe*, one of the four sold to Brazil in 1995 (see Table 1 in Appendix II), which had undergone a refit only a year earlier. The refit was valued at £13.2 million, in itself nearly 45 per cent of the total value of surplus ship sales in the last financial year. Similarly, the Leander Class frigate *Andromeda*, sold to India in 1995 underwent a substantial refit in December 1991 valued at £27.4 million.

Of the Leander Class frigates available for sale in 1996, *Sirius*, like its sister ship *Andromeda* had a major refit in 1991 valued at £23 million and several other Type 22 ships of the same class as sold to Brazil have all undergone expensive refits (and are likely to be sold as surplus in future years). There can be a time-lag between refits and equipment being taken out of service during which these ships remain operational. But the fact that such expensive refits can be undertaken without any real possibility of their value being recouped (when sold on as surplus equipment), suggests that the MoD is more concerned with the potential for sales in order to encourage further private sector work rather than to maximise its own financial return (*Hansard*, 24 November 1995, cols 341-342).

Other factors obviously need to be assessed, including the cost of maintaining surplus equipment, which is a further incentive to sell. Upholder Class submarines, for example, cost £6 million per year in maintenance. Recent reports suggest that South Africa is in advanced negotiations for the purchase of all four Upholders but a final deal has yet to be confirmed (*Hansard*, 19 October 1995, col 357).⁹ Further evidence is provided by the conclusion of the arrangement between the UK and Italy for the leasing of surplus Tornado F3 aircraft. In this case the UK agreed to a leasing arrangement on 24

⁹ However, the efforts to sell the surplus Upholder Class submarines—an advanced design of diesel-electric submarine capable of 28 day transit, a top speed of 20 knots, equipped with noise reduction devices and armed with 18 torpedos - would only recoup a fraction of the £1 billion spent on the four submarines originally

aircraft for a period of ten years and for a fee of £100 million. Under the lease agreement there is an offset scheme under which Italian industry has opportunities to compete for UK defence work to the same value of the lease fee. Here the MoD has had to accept fairly modest financial benefits, although the Italian airforce will be responsible for all maintenance costs during the period of the loan (*Hansard*, 6 February 1996, cols 167-168).

There is real difficulty in finding accurate information on the details of refurbishment and modernisation subsequent to the sale of surplus equipment and carried out by the private sector on behalf of new, foreign owners. It is known, for example, that Davenport Naval Dockyard carried out a seven week package of work on *HMS Broadsword* before it was handed over to the Brazilian navy, but details of the nature and value of that work remain subject to commercial confidence. A similar picture emerges from other contracts including refit work carried out by Swan Hunter shipyard on a fleet auxiliary ship destined for Indonesia.

In general we can speculate that, given the age of the ships, the work would include essential refurbishment such as the overhaul of Rolls Royce engines, the replacement of older forms of electronic systems such as command and control communications systems and radar and the introduction of advanced weapons such as surface-to-air missiles. Similar issues are raised by the future sale of Lynx, Wessex and Gazelle helicopters which are all 1960-70s airframes. Other imminent DSA sales include the handing over of *Brilliant*, *Brazen* and *Battleaxe* to the Brazilian Navy, the marketing of *HMS Hecla* (Ocean going Survey Vessel) and Hercules, Tucano and Harrier aircraft. Communications with the DSA suggest that an internal analysis of the follow-on work generated by surplus programmes is a priority for assessing the full impact of the Agency in the next financial year, although it is not clear whether or in what form that information will be made available to the general public.

commissioned during the early 1990s. Canada was originally the preferred purchaser, and second-tier countries such as Chile and Malaysia have also expressed an interest.

VI. CONCLUSIONS AND EXPORT POLICY CONSIDERATIONS

Given that weapon systems are designed to last a long time—around 30 years for tanks and 40-50 years for ships—many existing systems will remain in national inventories well into the next century. But some are already being traded between states as surplus weapons, and given the extent of military cutbacks since the end of the Cold War, more can be expected to be traded as surpluses in the future. Upgrades play an important part in extending the service life and improving the military performance of such weapons. With the growing importance of information technologies, many of the upgrade components are inherently dual-use and the most advanced of them are to be found in the commercial world. One consequence of the focus on core dual-use capabilities for upgrades, such as communications software, electronics, microelectronics, computing and materials, is a further blurring in the distinction between civil and military transfers. As a result it will become more difficult to track proliferation trends simply by monitoring transfers of major weapon systems. Clearly the main data sources provide little insight into upgrade developments, and these deficiencies in our tools of analysis urgently need to be addressed—if indeed they can be. Technology control regimes for unclassified software and micro-electronics will be virtually impossible to police.

With the changed strategic environment there is an increase in the visibility of the arms trade from a political perspective, but with the increase in dual use technologies, a decrease in visibility from an industrial perspective. Moreover, the security implications resulting from state of the art technology being installed into ageing weapon platforms cannot be underestimated particularly if this work has been carried out in secret. What is needed therefore are international policies to provide multilateral controls, but to develop these will require a better understanding of the nature, extent and dynamics of the international upgrade market. To achieve this we will need more and better data and more careful empirical work.

As regards the UK case study, the DSA's role in the broader picture of UK arms exports is now clear and well established (although this role, and the significance of surplus weapons sales, has grown with very little public debate or analysis). Liaising closely with the private sector and recommending UK defence companies to the overseas purchasers of surplus capital equipment for work such as refurbishment, it acts as a facilitator for increased sales. The MoD, in an effort to develop longer-term relationships in new markets, seems prepared to enhance the potential for private sector sales by subsidising refits on capital equipment. The DSA, quite literally, acts as a flagship for UK Defence Ltd. The fact that UK taxpayers seem to be paying a hidden subsidy adds further concern to the already

dubious economics of the arms trade. Other factors are important, such as the cost of maintaining surplus equipment, but an economic calculation might lead to the conclusion that it would be better to take much of this equipment out of service without late modernisation packages, scrap them and reduce the availability of arms onto a market already glutted. Suffice to say, such calculations have not as yet been made by any UK Government (although a tougher line on arms exports has been promised by the new Labour administration).

Assessments of strategic considerations and the potential role of surplus weapons in areas of regional conflict are also absent. Official emphasis has been on the availability of weapons and the need to maximise financial returns. Only the most sensitive categories such as nuclear-powered submarines, and possibly some of the more advanced missiles, are excluded. Yet, the availability of relatively new and advanced equipment, and the pattern of sales to second-tier military powers in areas of regional conflict, merits serious consideration. As with the broader UK arms trade, the opportunity to recast international security policy at the end of the Cold War is being squandered in the pursuit of new markets. Given that the government has direct control over surplus weapons, an opportunity is being lost to gain international agreement on constraints. Instead, the UK presents the DSA as an example that other countries should emulate and encourages visits from overseas delegations.

Finally, a fuller analysis would require details of the value of individual surplus sales and the value of refurbishment and modernisation programmes. While the DSA's own analysis may provide more accurate data on which to make a clearer examination of the economics (and foreign policy implications) of surplus sales and the attendant work for the private sector, unfortunately, these are not in the public domain at present. Parliament should ensure that information is available on capital equipment and on the modernization programmes associated with these sales, particularly where they include advanced systems such as missiles.

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APPENDIX I: DEFENCE CONTRACTS AWARDED TO UK-BASED COMPANIES

Jane's Defence Contracts (January 1996 - June 1996)

CONTRACTS AWARDED BY UK GOVERNMENT OR COMPANIES

<i>Upgrade?</i>	<i>Type</i>	<i>Category</i>	<i>Specification</i>	<i>Why?</i>	<i>Purchaser</i>	<i>Supplier</i>	<i>Country</i>	<i>Value</i>
No			Manage satellite ground station		DRA	Thorn Security	UK	n/a
No			Maintenance services for flight simulators		MoD	Hunting Aviation	UK	n/a
Yes	Navigation system	A	CAPSAT flight following system to track helicopters	B	MoD	Airborne Data Services (ADS)	UK	n/a
No			Coating for Sea Wolf sea-to-air missile		MoD	Nullifire, Coating Services Division	UK	0.8
Yes	Infantry weapon	B	Conversion kits for 12.7mm M2HB machine guns	B	MoD	Manroy	UK	n/a
No			Supply military power cables as part of FEPDS		Hunting Engineering	AEI Cables	UK	n/a
No			Management system for RAF		MoD	Verax	UK	n/a
Yes	Naval weapon	A	Airframe refurbishment for Sea Dart	A,B	MoD	BAe Dynamics Division	UK	15.4 *
No			In-service support for Sea Dart		MoD	BAe Dynamics Division	UK	15.4 *
No			Calibration and maintenance of Sea Dart support equip.		MoD	BAe Dynamics Division	UK	15.4 *
No			Lease, maintain & manage 2,500 non-military vehicles		MoD	Ryder	UK	88.5
No			Flight inspection of military airfield landing & navigation aids		MoD	Flight Precision (subs of Cobham)	UK	15

No			Provide new body for 800 military ambulances		Land Rover	Marshall Specialist Vehicles	UK	19.5
No			Supply 8800 military vehicles		MoD	Land Rover	UK	300
No			Supply 16 tactical shelters to the RAF		Computing Devices	MSI-Defence Systems	UK	n/a
No			Supply 200 mobile cabins for British Army in Bosnia		MoD	Kudos 2000	UK	2
No			Supply of ammunition for a 120mm mortar developer		Royal Ordnance	Mecar (subs of Allied Research, US)	Belgium	11.5
No			Supply 50,000 anti-personnel rifle grenades		MoD	TAAS-Israel Industries	Israel	7
No			Supply 65 military vehicles		MoD	Steyr-Daimler-Puch	Austria	6
No			Software testing technology		MoD	Mercury Interactive	UK	0.7
No			Information technology services		MoD	EDS	UK	3.1
No			Logistics database		MoD	Intergraph	UK	1.9
Yes	Aircraft system	A	Installation of operational equip in RAF aircraft	B	MoD	FR Aviation	UK	38.8
No			air compressor and purification unit for Eurofighter		Eurofighter consortium	Ultra Electronics	UK	3.1
No			Supply of military loading vehicles		MoD	JCB	UK	n/a
No			Healthcare information system		MoD	Parity Solutions	UK	3
Yes	Warships	A	Mid-life electronics update on Type 42 and Type 22 ships	A, B	MoD	Racal-Thorn Defence	UK	54

No			Supply computerised artillery command and control system		MoD	GEC-Marconi	UK	n/a
No			Supply video recorders for Tornado GR4 programme		GEC-Marconi Avionics	Photo-Sonics International	UK	n/a
No			Naval engine shock protection system		GEC-Alsthom Paxman Diesals	Metalastik Vibration Control Systems	UK	n/a
No			Maintenance contract for helicopter sights		MoD	Ring Sights	UK	n/a
No			28 JCBs		MoD	JCB Hydrapower	UK	n/a
No			Missile component technology		Wellman Aerospace, Wales	Pendle Aeroform	UK	0.7
Yes	Naval Dockyard	C	Supply 2 switchboards to upgrade power distribution system	B	Devenport Management Ltd	Cutler-Hammer	UK	0.5
No			Redesign and manufacture magnetic binnacle compass		MoD	SIRS Navigation	UK	0.1
No			Management & maintenance contract at RAF High Wycombe		MoD	Mowlem Facilities Management	UK	27
No			Management & maintenance contract at RAF Halton		MoD	Mowlem Facilities Management	UK	27
No			Supply Skyfire Air Defence Trainers for RAF		MoD	CAE Inverton	UK	3
No			Computers for testing of avionics systems		MoD	SAIC	UK	0.3
Yes	Communications	C	Information system for Naval communications network	B	MoD	EDS, Defence Division	UK	3
Yes	Communications	C	Fibre optic network for naval training establishment	B	MoD	Pinacl Systems	UK	0.1

No			Computer systems for missile evaluation testing		Defence Research Agency	Concurrent Computer Corp	UK	n/a
No			Computer maintenance		GEC Marconi, Sonar Systems Division	ND Service Team	UK	0.6
No			2 passenger transport craft for Officer Sea Training		MoD	FBM Marine	UK	9.7
No			Cable harnesses for ASRAAM project		BAe	Cinch Connectors	UK	25
No			GPS services		MoD	Oceonics Positioning Services	UK	n/a
No			R&D for simulation software		Defence Research Agency	Frazer-Nash Consultancy	UK	n/a
No			Vehicle satellite communication and tracking system		MoD	BT Inmarsat	UK	n/a
No			Computer maintenance & support services		MoD	Laser-Scan	UK	0.7
Yes	Naval Dockyard	C	Modification of the Nuclear Utilities Building		MoD	Taymel	UK	12
No			Aircraft testing equipment		Defence Research Agency	Frazer-Nash Consultancy	UK	n/a

CONTRACTS AWARDED BY NON-UK GOVTS OR COMPANIES

Upgrade?	Type	Category	Specification	Why?	Purchaser	Supplier	Country	Value
Yes	NBC equipment	A	Supply chemical agent monitors	B	Italian Navy	Graseby Ionics	UK	0.2
Yes	Missile system	A	auxillary power unit for missile and radar systems	B	US manufacturer	Commercial Hydraulics Keelavite	UK	n/a
No			navigation equipment for new class of minehunter		Bazan, Spain	Marine Data	UK	0.1
No			Supply of computer-based information system		Rockwell Australia Ltd (RAL)	Lynwood Scientific Developments	UK	1.5
No			Supply 39 Otto Fuel Monitors		Canadian Navy	Graseby Ionics	UK	0.5
No			Training simulators for Leclerc MBT		French MoD	Thomson Training & Simulation	UK	n/a
Yes	Training system	C	Update 3 AlphaJet flight simulators	B	French MoD	Thomson Training & Simulation	UK	n/a
No			Manufacture canisters for Harpoon missiles		McDonnell Douglas, US	Lucas Aerospace Fabricated Systems	UK	1
Yes	Naval weapon	A	Support equipment for missile capability for UK submarines	B	Loral Systems, US	Strachan & Henshaw (part of Weir Group)	UK	6.8
No			Supply MRS 2000 communication system		Ascom AG, Switzerland	Siemens Plessey Systems	UK	15
No			150 containers to Russia for destroying nuclear weapons		US Defense Nuclear Agency	Strachan & Henshaw (part of Weir Group)	UK	18
Yes	Avionics	A	Navigation systems for UK RAF's 14 Chinook helicopters	B	Boeing Defense & Space Group, US	Racal Avionics	UK	6.8
No			Supply 12 excavators for service in Bosnia		Dutch Army	JCB	UK	n/a
No			Computer-based training systems		Canadian MoD	CAE Invertron	UK	n/a
No			Computer-based training system		Letov, Czech Rep.	Encore Computer	UK	0.1

Yes	NBC equipment	A	Chemical agent detector for Abrahams MBT	B	US Army	Graseby Dynamics	UK	1.5
Yes	Infantry weapon	B	87 sights for Mk 19 40mm grenade launcher	B	Saco Defense, US	Ring Sights Defence	UK	0.6
Yes	Naval system	A	Depth control system for underwater countermeasure decoy	B	Hazeltine Corp, US	Hymatic Engineering Co	UK	2
Yes	Aircraft system	A	Equip. for MPRS aircraft refueling conversion programme	B	Boeing Defense & Space Group	Flight Refuelling	UK	2
Yes	Parachute	C	Increase speed and reliability of reserve parachute	B	US Army	Irvin Aerospace	UK	4.3
No			Logistics system for disposal of surplus aircraft parts		Royal Jordanian Air Force	AeroEidetics	UK	35
No			Supply 50 Forward Observer Simulators		Bharat Electronics, India	Phoenix Simulation	UK	6
No			500 folding bunk beds/ 6 folding field accomodation units		Undisclosed African country	Kudos 2000	UK	0.1
No			Subsystems for Apache attack helicopters		Martin Marietta Overseas Corp, US	Siemens Plessey Systems	UK	55.5

Key: Category: A Conventional major weapon system
 Category: B Small arms
 Category: C Infrastructure
 Why?: A Extend Operational Life
 Why? B Improve Military Performance

APPENDIX II: UK SALES OF SURPLUS EQUIPMENT

1. Navy

The Navy advises the DSA on ships likely to become non-operational over the next two years and the Agency can either attempt 'hot' sales (i.e. with stores and equipment intact) or 'cold' sales (i.e. with stores and equipment removed). The DSA favours hot sales but depends on having sufficient time to market the ship prior to its non-operational date. A major issue has been that ministerial approval for disposal can often be less than eight months before the due date, which gives the Agency insufficient time for proper marketing or for potential buyers to assess their needs (National Audit Office, 1993, p. 14).

Thirty five former Royal Navy ships have been sold in the past 10 years for a total of £160 million but most of the sales were achieved before 1990. Between 1990 and 1993 only six ships were sold—four Leander frigates and two Rover Class replenishment tankers. Two Leanders were sold to Ecuador and two to Chile. Apart from Chile and Ecuador, other major customers have been India, Indonesia, New Zealand and Pakistan. Indeed, the majority of the Chilean Navy is composed of British-built ships and submarines including County Class Destroyers and Leander frigates. In addition Chile has bought an ex-RFA Fleet Tanker, guns, ammunition, stores and spares to support the purchase of warships (Public Accounts Committee, 1994, p. 24). Sales of major vessels for 1994-95 are shown in Table 1, indicating that the pace of sales accelerated considerably compared to the mid 1990s. During 1994-95, contracts were also signed with a variety of commercial shipbrokers/organisations to the value of £2.4 million. The most important was a commercial storage and marketing agreement with Leaffield Logistic and Technical Services (LLTS) which provides a disposal service for naval spares of Leander and Oberon class ships and submarines. An extension to the contract now covers all ship-related spares.

TABLE 1: NAVAL SALES, 1994-95

<i>Ship</i>	<i>Type of Vessel</i>	<i>Sold to</i>
HMS Hereford	Minesweeper	Bangladesh
HMS Carron	Minesweeper	"
HMS Waveney	Minesweeper	"
HMS Dovey	Minesweeper	"
HMS Andromeda	Frigate	India
HMS Broadsword	Frigate	Brazil
HMS Brilliant	Frigate	"
HMS Brazen	Frigate	"
HMS Battleaxe	Frigate	"
HMS Helmsdale	Minesweeper	"
HMS Ribble	Minesweeper	"
HMS Humber	Minesweeper	"

Source: Defence Sales Agency, 1995, p. 3.

The Royal Navy has made several classes of surface vessels and submarines available for disposal, including five Leander class frigates—the oldest class of frigate; six Type 21 (Amazon) and four Type 22 (Broadsword) frigates, as well as three Oberon class submarines and four Type 2400 (Upholder) submarines. Other surplus vessels include Royal Fleet Auxiliaries and Minesweepers. Some of these are now discussed in greater detail:¹

Leander Class Frigates

These were initially commissioned during the late 1960s, and even after various refits were reaching the end of their normal service with the Royal Navy by the early 1990s. Nine have been sold to foreign navies since 1982: Bacchante and Dido to New Zealand in 1982-83; Apollo and Diomedes to Pakistan in 1988; Penelope and Danae to Ecuador in 1991; Achilles and Ariadne to Chile in 1990-92; and Andromeda to India in 1995. Others have been disposed of for scrap or sunk as targets. Despite their age, they still carry a range of modern equipment including Exocet missiles.

¹. The following details on Royal Navy vessels are taken from Paul Beaver (1984), while contract details are from *Jane's Defence Weekly*, 4 February 1995.

Type 21 Frigates

Originally eight ships of this class were built and commissioned during 1975-78, of which two were sunk during the Falklands conflict. The remaining six were sold to Pakistan in 1994. These represent an advanced capability, including Exocet, Mk 32 torpedos, Seacat SAMs and Oerlikon air defence guns. The ship can carry Lynx HAS2 anti-submarine helicopters.

Type 22 Batch 1 Frigates

Four of these 3,500 tonnes ships were commissioned between 1979 and 1981 with a range of 4,500nms at 18 knots and a maximum speed of 30 knots plus. Armaments include 2x40mm Bofors GP, 2x6 Seawolf PDMS, four Exocet SSM and 2x3 Mk 32 STWS and up to two Westland Lynx HAS 2. In essence these are destroyer-size frigates and, although they lack a towed-array system, still represent an advanced naval capability. These were sold to Brazil in 1995 along with a separate agreement for three River Class minesweepers.

Rover Class Royal Fleet Auxiliaries

These Auxiliary Small fleet tankers are used mainly for supplying liquids and were commissioned in the late 1960s. Three were declared surplus, and two have been sold: *Green Rover* to Indonesia in 1991 and *Blue Rover* to Portugal. *Green Rover* was delivered after an extensive refit carried out by Swan Hunter, the UK shipyard.

Regent Class Royal Fleet Auxiliaries

The Regent Class are large tankers for carrying ammunition, food and stores and were commissioned in the late 1960s. One is currently for sale and another has been sold for scrap.

River Class Minesweeper

These were constructed as specialised mine countermeasure vessels and commissioned during the mid 1980s. Seven were declared surplus and sold to Bangladesh and Brazil in 1995 after undergoing extensive refurbishment.

Oberon Class Submarine

These diesel electric submarines were commissioned in the 1960s. Five were made surplus for sale (*Oberon, Oracle, Opposum, Opportune, Olympus*). Five others were sold for scrap or spares; two others were saved by preservation groups and one—*Orpheus*—sold to a Paris restaurateur! Only one has been sold for operational use—to the Egyptian navy in 1989—and it may have been fitted with UGM-84 harpoon anti-ship missiles and towed-array sonars.

Upholder Class Submarine

The Upholder is the latest, and possibly final class of diesel-electric submarines to be built in the UK. Only four were constructed during the 1980s and early 1990s against an initial requirement for ten, before being declared surplus. The estimated overall cost of the four was £1 billion. As yet no purchaser has been found but Canada has been in long negotiations which have not resulted in a sale while Malaysia and Chile have both expressed an interest. South Africa is now thought to be the most likely purchaser.

Support sales

Examples of the support sales that accompany the sale of a surplus vessel include: six complete ex-RN Wasp helicopters with spares sold to Malaysia in April 1988 and a further six incomplete Wasps in July 1992; three ex-RN Lynx Mk3 helicopters, MM-38 ship-to-ship missiles and six Seacat ship-to-air missile systems in support of the Type 21 sale to Pakistan (Lynx helicopters themselves are armed with both torpedos and anti-ship missiles); a land-based exocet missile system provided to the Chilean navy in 1994; and Seawolf missiles as part of the contract with Brazil for four Type 22 Frigates.

2. Aircraft

Many surplus aircraft have effectively reached the end of their service life and would normally be used only for training. (Shackleton aircraft, now available for disposal were described in the 1980s as 30,000 rivets flying in close formation!) The RAF often requires equipment for spares, particularly if the aircraft is no longer produced and the cost of setting-up a spares line may be greater than the financial returns from sale. The Agency would ideally like to offer a package of equipment and spares but previous surplus sales have fallen through because these facilities are lacking. However, the Agency has

been able to offer a package deal on Phantom aircraft and spares which indicates that the issue of support for more advanced surplus aircraft is being addressed (National Audit Office, 1993, p. 16).

Altogether six Tornado GR1 squadrons, four Phantom squadrons, two Buccaneer squadrons, and part of a squadron of Nimrod maritime patrol aircraft have been declared surplus. Expected to be added soon are at least 12 Tornado F3 fighters. Some of the equipment (for example, all the Tornado GR1 strike planes) is being held in reserve but about 25 Buccaneers and almost all the 40 Phantom fighters are available. In addition, five Lockheed Hercules Transport planes may be declared surplus even though the Hercules fleet is suffering from problems with availability and maintenance. There are substantial numbers of smaller aircraft, including Jet Provost Trainers for sale (*The Engineer*, 30 September 1994).

As mentioned above, in 1994 three ex-RN Lynx Mk 3 helicopters were delivered to Pakistan to equip the Pakistan Navy's newly-acquired Type 21 frigates with an option for three others. Also sold in 1994 was a Jaguar GR1 and three Jet Provosts to Oman. Perhaps the most interesting development was the leasing of a squadron of 12 Tornado GR1 strike aircraft to the United Arab Emirates in 1995—an agreement which includes RAF personnel as instructors (*Jane's Defence Weekly*, 4 February 1995 and *The Times*, 17 March 1995). Over 100 Jet Provost aircraft have been sold since the early 1990s to twenty different customers raising approximately £600,000. Various smaller sales include Skyflash missiles to FMV Sweden, Wasp Helicopter spares to the Malaysian air force, and Rapier missile spares to Oman (Defence Sales Agency, 1995, p. 4).

3. Army Equipment

The disposal of army equipment represents probably the most difficult area for the DSA. Much is only fit for scrap given its age and condition, or at best is used for hard target practice. Historically, army officials have often carried out scrapping without reference to the Agency. However, the Agency has identified greater potential reflected in the sale of mine clearing vehicles after the Gulf War. Increased numbers of AVCs, artillery, and MBTs are expected to be for sale through the mid 1990s. But many vehicles are still sold for smelting as the prices for base metals are sometimes higher than for complete vehicles sold through tender (*Jane's Defence Weekly*, 4 February 1995).

Small Arms

Overall, there are several hundred thousand small arms available as surplus although a large proportion will be sold for scrap. Between 1992 and 1995 40,000 small arms, rifles and hand guns were sold to

firearms dealers for overseas orders and 700 rifles sold on a government-to-government basis. These generated sales of £142,500 in 1992/93, £168,250 in 1993/94 and £200,260 in 1994/95 (*Hansard* 10 July 1995). Given the substantial quantities of ammunition and small arms for destruction, the Defence Evaluation and Research Agency (DERA) has expanded the operation of its specialist facility at Avocet, Shoeburyness in Essex. In 1993-94, 500 tonnes of conventional ammunition was incinerated and the facility can deal with between 1,500 to 20,000 tonnes per year based on current predictions on the level of surplus ammunition. Similarly, 93,000 small arms were destroyed in 1992-95 with a prediction of 90,000 small arms being available for destruction per annum in the next five years. Some concern has been expressed about the potential environmental hazard from the increased volume of incineration but DERA officials claim that the facility works within agreed environmental standards and will continue do so despite the increased workload (*Hansard*, 12 October 1995).

APCs and tanks

The most significant surplus is 700 Chieftan tanks (being replaced by Challenger 1 and 2). Only a small number were required to be destroyed under the terms of the CFE Treaty but, given their age and the lack of interest from potential buyers, almost all have been disposed of for scrap. An agreement was signed in October 1994 with Avestan Sheffield, one of Europe's largest producers of stainless steel, for the disposal of the Chieftans (as well as 2,000 FV 432 Armoured Personnel carriers) by smelting. Other older equipment, including Spartan APCs and Abbot 105mm self-propelled howitzers, are also likely to be scrapped (Defence Sales Agency, 1995, p. 4).

Other equipment

Actual sales include an agreement with the Austrian army in April 1994 for the purchase of all 117 British Army M109 Guns with the possibility of a spares package. Ammunition and Light Machine Guns have also been sold to the Bangladesh Navy, engineering equipment to the Lebanese Army, and ammunition to the Australian army in 1994 (Defence Sales Agency, 1995, p. 3).

Marketing agreements with the private sector

The DSA has marketing agreements with several private companies for the sale of army equipment including: 105mm Tank Hesh ammunition to Royal Ordnance/Australia; 105 mm ammunition to Royal Ordnance/Botswana; 120mm Instructional Ammunition to Vickers Defence Systems/Oman; 12 Scorpion CVR (T)s and associated equipment to Alvis Logistics/Chilean marines and 76mm

Ammunition to Alvis Logistics/Botswana and Chile. Marketing arrangements were also signed with Hall and Watts Defence Optics Ltd for gun sights and MSI Ltd for Seacat missiles non-explosive items (Defence Sales Agency, 1995, p. 4).

4. Surpluses in Germany

Germany represents a special case in the overall picture of UK weapons disposal. Rather than return large numbers of vehicles back to Britain, the Agency sells them through a contracted German company—VEBEG GmbH. There has been a significant increase in vehicle sales rising from 1,495 in 1990-91 to 4,530 in 1991-92. The auctioning of vehicles in the UK also generates a major financial return—£6 million in 1991 (Defence Sales Agency, 1995, p. 8).