9. Arms production

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I. Introduction

Arms sales by the 100 largest arms-producing companies (the 'SIPRI Top 100') increased again during 2004, although the increase was less dramatic than in the previous year. Sales by US companies continued to account for the bulk of this increase. While there was significant merger and acquisition activity in 2005, this was at a slower pace than in 2004. Another round of consolidation may follow which will see moves into other sectors to gain increasingly valuable skills and services and the continuing move by non-US firms into the lucrative, growing and now more accommodating US market.

While the post-cold war restructuring of the international arms industry has shown some signs of subsiding, important changes are still taking place. Consolidation among European companies continues and is likely to be reinforced by the increased political commitment in the European Union (EU) to harmonize rules for arms procurement and by the adoption of the 2005 Code of Conduct on Defence Procurement, which accepts competition in arms procurement among member states.[1] At the same time, the consequences of the 'global war on terrorism', including added emphasis on homeland security, and the experiences in Iraq are creating demands for new, private industrial services and products, and in turn are drawing new kinds of suppliers into the international arms market.

This chapter describes developments in the major arms-producing companies in 2004 and 2005. In addition, it looks at the development of the arms industry since the end of the cold war. Section II considers the data on the 100 largest arms-producing companies in the world (excluding China) in 2004.[2] In section III the long-term trends in arms production are described

[1] European Defence Agency, The Code of Conduct on Defence Procurement of the EU Member States Participating in the European Defence Agency, 21 Nov. 2005, URL <http://www.eda.eu.int/reference/eda/EDA - Code of Conduct - European Defence Equipment Market.htm>. Denmark does not participate in the Code of Conduct. See also 'EU agrees to open defence market', BBC News Online, 21 Nov. 2005, URL <http://news.bbc.co.uk/1/4458014.stm>; and chapter 16 in this volume.

[2] SIPRI has focused on the top 100 arms-producing companies annually in an effort to capture the trends in the overall arms industry. The choice of the top 100 companies was motivated by the fact that this is the highest number for which it was deemed realistically possible to gather data. This group of companies is fairly representative of the arms industry, accounting for roughly three-quarters of the value of global arms production in 1996. Chinese companies are excluded because of lack of data. See Sköns, E. and Weidacher, R., 'Arms production', *SIPRI Yearbook 1999: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 1999), pp. 389, 409; and Sköns, E. and

* The authors are grateful to Elisabeth Sköns for comments and guidance and to Jurgen Brauer, Ron Smith and Herbert Wulf for comments on earlier drafts.

Table 9.1. Regional and national shares of arms sales for the SIPRI Top 100 arms-producing companies in the world excluding China, 2004 compared to 2003

Arms sales figures are in US$ b., at current prices and exchange rates. Figures do not always add up because of the conventions of rounding.

Number of companies	Region/ country	Arms sales (US$ b.)[a]		Change in arms sales, 2003–2004 (%)		Share of total arms sales, 2004 (%)
		2003	2004	Nominal[b]	Real[c]	
41	**North America**	**147.7**	**170.3**	***15***	***12***	***63.5***
40	USA	147.3	169.8	*15*	*12*	*63.3*
1	Canada	0.5	0.5	*2*	*–7*	*0.2*
40	**Europe**	**71.0**	**82.1**	***16***	***2***	***30.6***
11	UK	26.3	32.4	*23*	*7*	*12.1*
8	France	17.6	19.8	*12*	*0*	*7.4*
1	Trans-European[d]	8.0	9.5	*18*	*6*	*3.5*
3	Italy	5.6	6.6	*19*	*6*	*2.5*
6	Germany	5.7	5.2	*–8*	*–18*	*1.9*
4	Russia[e]	3.1	3.1	*2*	*–14*	*1.2*
2	Sweden	2.3	2.3	*11*	*1*	*0.9*
2	Spain	1.7	1.7	*27*	*12*	*0.6*
1	Switzerland	0.7	0.7	*6*	*–3*	*0.2*
1	Norway	0.4	0.4	*–7*	*–12*	*0.1*
1	Finland	0.4	0.4	*64*	*49*	*0.1*
9	**Other OECD**	**8.2**	**8.2**	***11***	***3***	***3.1***
6	Japan	6.5	6.5	*12*	*5*	*2.4*
2	Korea, South[e]	1.3	1.3	*3*	*–4*	*0.5*
1	Australia	0.4	0.4	*19*	*2*	*0.2*
10	**Other non-OECD**	**7.8**	**7.8**	***6***	***1***	***2.9***
4	Israel	3.5	3.5	*0*	*–1*	*1.3*
3	India	2.3	2.7	*15*	*8*	*1.0*
1	Singapore	0.9	0.9	*–3*	*–8*	*0.3*
1	South Africa	0.5	0.5	*0*	*–16*	*0.2*
1	Brazil	0.3	0.4	*38*	*23*	*0.1*
100	**Total**	**233.4**	**268.3**	***15***	***8***	***100.0***

OECD = Organisation for Economic Co-operation and Development.

[a] Arms sales include both sales for domestic procurement and export sales.

[b] This column gives the percentage change in arms sales in 2003–2004 calculated in current dollars.

[c] This column gives the percentage change in arms sales in 2003–2004 calculated in constant dollars.

[d] The company classified as trans-European is EADS, which is based in three countries—France, Germany and Spain—and registered in the Netherlands.

[e] Data for Russian and South Korean companies are uncertain.

Source: Appendix 9A, table 9A.1.

along with the SIPRI Arms Production Project's analysis of these trends. Section IV provides some conclusions. Appendices 9A and 9B include tables of the Top 100 arms-producing companies in 2004 and acquisitions in the North American and West European arms industry in 2005. Appendix 9C provides an analysis of developments in the Russian arms industry.

II. Recent trends

The SIPRI Top 100 arms-producing companies, 2004

The value of the combined arms sales of the SIPRI Top 100 arms-producing companies in the world (excluding China) in 2004 was $268 billion (see table 9.1).[3] Companies in the United States and Western Europe accounted for most of this amount. The dominance of US companies is particularly striking. Of the total arms sales of the Top 100 companies, 63.3 per cent was accounted for by 40 US companies; and 29.4 per cent by 36 West European companies. Four Russian companies accounted for 1.2 per cent of the total value.

There was a marked expansion in total arms sales of the Top 100 in 2004 compared to 2003. However, this increase of 15 per cent (in nominal terms) was not as dramatic as in the previous year: the increase in 2003 over 2002 was 25 per cent.[4] Indeed, owing to the continued deterioration of the value of the US dollar during 2004, the increase in 2004 over 2003 was even smaller in real terms: just over 8 per cent. This is still a significant increase, especially since it followed a year of great increase, and suggests that the decline in arms sales by the largest arms-producing companies that occurred during the 1990s has ended.

The composition of firms on the Top 100 for 2004 did not change a great deal (see table 9.2), but the companies that entered and exited the list are interesting for several reasons. Four companies left the Top 100 in 2004. Two of these were Russian: Uralvagonzavod, which dropped from a ranking of 98 to 136, and MMPP Salyut, which fell less dramatically from 96 to 109. While Uralvagonzavod's arms sales decreased in 2004, its total sales increased by more than 60 per cent between 2001 and 2004 as a result of a strong increase in civil sales. Most of this increase is from building rolling stock for Russian Railways,[5] but the company also produces, for example, road-building equipment and consumer commodities that are increasingly exported.[6] The third company to exit the SIPRI Top 100 list for 2004 was the Japanese company

Weidacher, R., 'The economics of arms production', ed. L. Kurtz, *Encyclopedia of Violence, Peace and Conflict* (Academic Press: San Diego, Calif., 1999), p. 137.

[3] There may also be other companies that are large enough to appear in the Top 100 list but for which insufficient data are available.

[4] Sköns, E. and Surry, E., 'Arms production', *SIPRI Yearbook 2005: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2005), pp. 383–416.

[5] Lantratov, K., 'Airplanes give way to submarines', *Kommersant*, 9 June 2005, URL <http://www.kommersant.com/doc.asp?id=584099>.

[6] 'The "steel flow" of Urals tanks', *Diplomat*, no. 5 (133), 2005, URL <http://www.diplomatrus.ru/200505/uk/02-06.php>.

Table 9.2. Companies that entered and exited the SIPRI Top 100 list of arms-producing companies in 2004

Rank				Rank			
2004	2003	Company	Country	2004	2003	Company	Country
Entering companies				*Exiting companies*			
99	106	Embraer	Brazil	106	97	Komatsu	Japan
68	S	MTU Aero Engines	Germany	109	96	MMPP Salyut	Russia
100	116	Patria	Finland	136	98	Uralvagonzavod	Russia
71	142	Armor Holdings	USA	S	65	Alvis	UK

S = Subsidiary company.

Source: SIPRI Arms Industry Database.

Komatsu, which slipped marginally from rank 97 to rank 106. However, arms sales data for the Japanese companies in the Top 100 represent new military contracts rather than arms sales. Because money for these contracts may be paid out over several years, these data can provide only a rough estimate of arms sales for the year.[7] The fourth company, the British tank maker Alvis, lost its independent ranking in the list after its $651 million acquisition in 2004 by BAE Systems.

The German company MTU Aero Engines 'entered' the list as an independently ranked company, having previously been listed as a subsidiary of DaimlerChrysler. The company was sold to private equity firm Kohlberg Kravis Roberts & Co. in late 2003.[8] The rapid increase in arms sales by Armor Holdings, which climbed in ranking from 142 to 71, is indicative of the financial windfall from the conflict in Iraq for companies that supply body and vehicle armour. Armor Holdings' total sales increased from $365 million in 2003 to $980 million in 2004, with revenues from its Aerospace and Defense Division expanding by 560 per cent over the same 12 months. The company produced 3945 reinforced or 'up-armoured' high-mobility, multi-purpose wheeled vehicles (HMMWVs) in 2004, compared to 873 in 2003.[9] Patria, the Finnish producer of armoured vehicles, increased its arms sales by 64 per cent (or 49 per cent in real terms) from $220 million in 2003 to $358 million in 2004. Patria's Defence Material and Maintenance business accounted for 75 per cent of total sales in 2003 and 83 per cent in 2004. The Brazilian aircraft producer Embraer entered the list for 2004 at rank 99. This is likely to be the result of the start of deliveries in December 2003 of a light attack version

[7] There is a low level of transparency in Japan in data on arms production. Surry, E., *Transparency in the Arms Industry*, SIPRI Policy Paper no. 12 (SIPRI: Stockholm, Jan. 2006), URL <http://www.sipri.org/>.

[8] MTU Aero Engines, 'KKR Acquires MTU from DaimlerChrysler AG', Press release, 21 Nov. 2003, URL <http://www.mtu.de/en/press/Press_Archive/pressearchiv_2003/>.

[9] Armor Holdings, '2004 Annual Report', Jacksonville, Fla., URL <http://ccbn.mobular.net/ccbn/7/1067/1126/>, p. 6.

of the Super Tucano aircraft to the Brazilian Air Force.[10] There also appears to have been a decision by the company's management to refocus its priorities on defence. The company more than doubled its arms sales (both in value and as a percentage of total sales) in 2003 over 2002. In the mid-1990s the percentage of Embraer sales that were arms sales was as high as 30 per cent. By 2000 it had declined to just 3 per cent of total sales. In 2003 the percentage had risen again to 12 per cent, and for 2004 the share was 10 per cent.[11] However, Embraer's increase in arms sales cannot be seen as a sign of any broader resurgence in the Brazilian defence industry, which collapsed in the late 1980s and early 1990s.[12]

Mergers and acquisitions in 2005

Acquisition activity continues in the world arms industry, albeit at a less rapid pace than during the 1990s. One major difference from that period is that the largest arms-producing companies have order backlogs and are currently 'awash in cash'.[13] Companies may have been using, and will continue to use, some of this free cash flow for spending on acquisitions.[14]

Two factors continue to drive further consolidation in the arms industry. The first is the rush into those sectors of the arms industry that company managers and investors consider to be expanding. These are primarily the military services sector, which supplies services and logistical support to armed forces, and the information technology (IT) sector, which provides products and services in support of network-centric programmes. In order to succeed in these sectors, companies continue to seek to acquire smaller companies that have particular skills that they lack.[15] The second factor is the desire of non-US-

[10] Johan, S., 'Flying training & trainer aircraft', *Asian Defence Journal*, Jan./Feb. 2005, p. 17.

[11] In 2004 a company spokesperson indicated that Embraer wants to increase its military revenues to 20% of gross revenues. 'ACS win good new for Embraer, analysts say', *International Air Letter*, 9 Aug. 2004, p. 5.

[12] A major factor in the collapse—when 2 major Bazilian arms producers, Engesa and Avibras, filed for bankruptcy—was the end of the 1980–88 Iraq–Iran War. Perlo Freeman, S., 'Offsets and the development of the Brazilian arms industry', eds J. Brauer and J. P. Dunne, *Arms Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets* (Routledge: London, 2004), pp. 187–204. Also see Brauer, J., 'The arms industry in developing nations: history and post-cold war assessment', eds J. Brauer and J. P. Dunne, *Arming the South: The Economics of Military Expenditures, Arms Production and Trade in Developing Countries* (Palgrave: Hampshire, 2002), pp. 101–27.

[13] Wayne, L., 'Cash puts U.S. military contractors in bind', *New York Times*, 13 May 2005, URL <http://www.iht.com/articles/2005/05/12/business/contract.php>.

[14] According to one estimate, 'free cash flow'—the amount of cash that a company has left after paying all its expenses, including investments—at the world's 8 largest defence companies grew from $8.9 billion to $17.75 billion in 2004. The analysis was conducted by J. P. Morgan and reported in Ratnam, G., 'Industry's full pockets: surplus cash, tight U.S. budgets may mean wave of acquisitions', *Defense News*, 16 May 2005, p. 16.

[15] Another incentive for acquiring a company that has employees with official security clearance is that the acquiring company avoids delays (of 2 years or more) in getting these itself. Interview with Frank Lanza, Chairman and Chief Executive of L-3, in Ratnam, G., 'DOD expected to let L-3 buy Titan', *Defense News*, 6 June 2005, p. 4.

based companies to access the lucrative US market by acquiring (either directly or through a local subsidiary) a US arms-producing company.[16]

Five very large acquisitions that were concluded in 2005, each with a deal value close to or greater than $2 billion, make it a particularly significant year for arms industry consolidation.[17] In 2004 there was only one acquisition of comparable size.[18] By far the largest and most strategically noteworthy acquisition of 2005 was that of United Defense (USA) by BAE Systems (UK) for $4192 million.[19] This was the largest ever acquisition of a US defence company by a non-US company. An extraordinary result is that a British company is now the sixth-largest contractor for the US Department of Defense (DOD).[20] The deal may also have an impact on the still-fragmented European land systems market and lead to consolidation in Europe.[21] Three of the large acquisitions in 2005 were in the IT sector. L-3 Communications (USA) acquired the Titan Corporation (USA) in a deal valued at $2650 million.[22] General Dynamics (USA) announced an agreement to acquire Anteon International (USA) for approximately $2200 million; and DRS Technologies (USA) spent $1970 million to acquire Engineered Support Systems (USA).[23] The fifth significant arms industry acquisition for 2005 was that of MTU Friedrichshafen (Germany) from DaimlerChrysler (Germany) by the private equity group EQT (Sweden). This transaction, which had been a source of considerable controversy and political debate in Germany,[24] also included the Off-Highway Division of Detroit Diesel (USA) and was valued at approximately $1900 million. With the sale of MTU Aero Engines to a US private equity firm in late 2003,[25] DaimlerChrysler has thus divested itself of all its major arms-producing activities other than its 30.9 per cent share in EADS.[26]

[16] Chuter, A. and Tran, P., 'UK firms flex muscles in US market', *Defense News*, 22 Aug. 2005, p. 16.

[17] See appendix 9B.

[18] This was the acquisition by Finmeccanica of GKN's 50 per cent share in AgustaWestland.

[19] BAE Systems, 'BAE Systems completes acquisition of United Defense Industries; creates global land systems enterprise', Press release, 24 Jun. 2005, URL <http://www.uniteddefense.com/pr/pr_20050624b.htm>.

[20] Rothman, A. and Lococo, E., 'BAE buys United Defense to tap U.S. military sales', Bloomberg.com, 7 Mar. 2005, URL <http://www.bloomberg.com/apps/news?pid=10000102&sid=aBEULP6oGE.Y>.

[21] Some analysts have argued that the deal will make smaller European land systems companies 'relatively weaker' in terms of their ability to compete for large contracts. This may encourage them to consolidate. Ratnam, G. and Chuter, A., 'BAE to buy United Defense, shaking land market', *Defense News*, 14 Mar. 2005, p. 1.

[22] L-3 Communications, 'L-3 Communications completes acquisition of the Titan Corporation, completes related debt offerings and tender offer', Press release, 29 July 2005, URL <http://www.titan.com/investor/press-releases/press_releases_display_2005.html?id=33&select=5>.

[23] DRS Technologies, 'DRS Technologies to acquire Engineered Support Systems', Press release, 22 Sep. 2005, URL <http://www.drs.com/press/archivelist.cfm>.

[24] The German Government threatened to veto the sale in order to protect local defence production capabilities. Agüera, M., 'Germany tightens rules on foreign ownership', *Defense News*, 19 Sep. 2005, p. 20; and Agüera, M., 'Battle entangles MTU sale', *Defense News*, 22 Aug. 2005, p. 22.

[25] MTU Aero Engines (note 8).

[26] On a smaller scale, the company continues to produce heavy vehicles, including trucks used by militaries.

BAE Systems' acquisition of United Defense highlights an important development in the industry: BAE Systems is not alone in its strategy of gaining access to the US market by acquiring a US company. For example, another British company, QinetiQ, acquired two US aerospace and defence companies in 2004 and another two in 2005.[27] VT Group (UK) also acquired a US company, the Cube Corporation, and announced its intention to double the size of its business in the USA by 2008.[28] Other major non-US arms producers that have publicly stated their intention to increase their sales in the USA, possibly through acquisitions of US companies, include Thales[29] and Finmeccanica.[30] Efforts by non-US companies to access a greater part of the large US procurement budget in this way have been characterized as an 'uphill battle', however, because of the ongoing political debates in the USA about the procurement of foreign military equipment.[31]

III. Developments in the arms industry since the end of the cold war

The challenges at the end of the cold war

The cold war arms industry reflected what is now seen to have been a very specific set of international and domestic forces. Post-cold war developments have transformed the global military economy, not least as a result of trends in military expenditure and technology that have reinforced US dominance. Unlike that of most other countries, US military spending has been growing rapidly.[32] The fixed costs of research and development (R&D) for major systems continue to grow, both for platforms and for the infrastructure (e.g., satellites and strategic air assets) and information systems needed to support network-centric warfare. All states but the USA thus face structural disarmament, in the sense that they cannot afford to produce a comprehensive range of their own weapon systems because of the fixed costs of replacing conventional military capability with modern systems comparable to those of the USA. This is a particular problem for the other powers that aspire to a military capacity of global significance, in particular the other permanent

[27] QinetiQ's strategy is 'to focus on defence and security markets, especially in the US which represents [the company's] greatest opportunity for expansion'. QinetiQ, 'US expansion strategy delivers for QinetiQ', Press release, 6 July 2005, URL <http://www.qinetiq.com/home/newsroom/news_releases_homepage/2005/3rd_quarter/QinetiQ_annual_results_summary.html>

[28] Anderson, G., 'VT aims to double US growth in three years', *Jane's Defence Industry*, vol. 22, no. 7 (July 2005), p. 12.

[29] Tran, P., 'Thales plans to double U.S. sales', *Defense News*, 10 June 2005.

[30] Finmeccanica's Chief Operating Officer, Remo Pertica, has said the company is 'specifically interested in a company that would act as a bridgehead into the US Department of Defense'. Vogel, B., 'Finmeccanica aims for US market', *Jane's Defence Industry*, vol. 22, no. 7 (July 2005), p. 15.

[31] Vogel (note 30).

[32] US military expenditure increased by 50% in real terms in 1996–2005. China and Russia have also increased their military expenditure tremendously in recent years (by 165% and 49%, respectively, in 1996–2005). See appendix 8A in this volume.

members of the United Nations Security Council: China, France, Russia and the United Kingdom.

Current developments in the arms industry include the increasing internationalization of production, the increasing importance of IT companies within the defence sector and the 'privatization' of services that were once provided by the military.[33] These have led to important compositional change in the industry. The information in previous editions of the SIPRI Yearbook provides an insight into the changes that have taken place over the years. Indeed, the factors other than arms control that were specifically raised in *SIPRI Yearbook 1990*—the budget environment, changing technologies, West European integration, changes in military doctrine and the emergence of new producers[34]—could all be used to discuss the present situation, although the discussion would be rather different.

Work on arms production at SIPRI during the 1980s was concerned with the growth in arms production in the developing world, which was a cause for concern for some commentators.[35] The SIPRI studies concluded, however, that the attempts to establish self-sufficiency in these countries were unlikely to be successful.[36] At the end of the cold war, as domestic demand for military equipment fell, the concern was the risk of increased arms exports and its likely impact on international security. The focus of research thus shifted to the major arms-producing companies in the West.

The SIPRI Arms Production Project was set up in the environment of the ending of the cold war: there were political changes in Eastern Europe, negotiations on conventional arms control (in the Conference on Security and Co-operation in Europe and negotiations on the Treaty on Conventional Armed Forces in Europe, the 1990 CFE Treaty), changing technologies, overcapacities, expansion of the number of producers, and the cascade[37] of weapon systems within the North Atlantic Treaty Organization (NATO).[38] Although the Soviet Union still existed in 1990, the analysis in *SIPRI Yearbook 1990* predicted the need for restructuring of the international arms industry and the

[33] Sköns, E., Bauer, S. and Surry, E., 'Arms production', *SIPRI Yearbook 2004: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2004), p. 389.

[34] Anthony, I. et al., 'Arms production', *SIPRI Yearbook 1990: World Armaments and Disarmament* (Oxford University Press: Oxford, 1990), pp. 319–21.

[35] E.g., a 1981 RAND report predicted that: 'If borne out in future research, one would predict arms production in growing numbers of countries in an economically developing world.' Alexander, A. J., Butz, W. P., and Mihalka, M., 'Modeling the production and international trade of arms: an economic framework for analyzing policy alternatives', RAND Note, RAND Corporation, Santa Monica, Calif., 1981, p. 17.

[36] Brzoska, M. and Ohlson, T., SIPRI, *Arms Production in the Third World* (Taylor & Francis: London, 1986); Wulf, H., 'Developing countries', eds N. Ball and M. Leitenberg, *The Structure of the Defense Industry: An International Survey* (Croom Helm: London, 1983); and Anthony et al. (note 34).

[37] In the early 1990s NATO planned a large internal arms transfer programme to compensate for the removal of equipment under the terms of a possible CFE agreement. Second-hand equipment from the more developed member countries would be transferred to the less developed members, who would then destroy equipment which was already planned for replacement.

[38] Anthony et al. (note 34). See also Anthony, I., Allebeck, A. C. and Wulf, H., SIPRI, *West European Arms Production* (Oxford University Press: Oxford, 1990); Brzoska, M. and Lock, P. (eds), SIPRI, *Restructuring of Arms Production in Western Europe* (Oxford University Press: Oxford, 1992); and Wulf, H. (ed.), SIPRI, *Arms Industry Limited* (Oxford University Press: Oxford, 1993).

likely difficulties, suggesting that: 'On balance, these trends are likely to lead to a reduction in the size of the world industrial arms base. Difficulties are likely to be encountered by private companies (mainly in the United States and Western Europe) as well as by state-owned factories (mainly in the Soviet Union) that are heavily dependent on arms production.'[39]

Issues of conversion—the use of military resources for civil purposes—were a focus of attention, with considerable debates on how changes could be achieved.[40] In this context the purpose of the 1990 Yearbook chapter was: 'to describe the trends affecting the arms industrial base and to present data on the size and characteristics of the arms industry in the East and West'.[41] The authors also stated that 'Since over-capacities already exist—with additional capacities in the stage of installation in Third World countries and Japan—governments in the West should seriously plan for conversion of parts of the arms industry; otherwise corporations may truly consider themselves as "victims of peace".'[42] Such statements represent an impressive insight into the issue that would dominate the sector over the next decade, although the authors could not know the degree to which changing geopolitical, technological and social drivers would restructure the industry.

There have been limitations to the coverage of the SIPRI Arms Production Project, caused by the lack of both data availability and reliability. A network of experts with local knowledge assisted the SIPRI team, but there were problems with coverage of the Soviet Union and its allies because of lack of reporting by governments. While state ownership in Western countries also limited transparency, it was nevertheless easier to get information on member countries of the Organisation for Economic Co-operation and Development (OECD), and these accounted for most of the data in the tables. Consistency has increased over the years. One way of overcoming the lack of comparable information for major producers has been to include special studies by country experts, who could use a wider range of information to evaluate the changes taking place.[43]

[39] Anthony et al. (note 34), p. 317.

[40] E.g., Brzoska, M., 'Success and failure in defense conversion in the "long decade of disarmament"', eds K. Hartley and T. Sandler, *Handbook of Defense Economics*, vol. 2 (Elsevier: Amsterdam, forthcoming 2007); Southwood, P. 'Disarming military industries' (Macmillan: London, 1991); Markusen, A. and Yudken J., *Dismantling the Cold War Economy* (Basic Books: New York, N.Y., 1992); Hartley, K., *Economic Aspects of Disarmament: Disarmament as an Investment Process* (UNIDIR: Geneva, 1993); Dumas, L. J. (ed.), *The Socioeconomics of Conversion from War to Peace* (ME Sharpe: New York, N.Y., 1995); Gansler, J. S. *Defence Conversion: Transforming the Arsenal of Democracy* (MIT Press: Cambridge, Mass., 1995); and Dunne, P., 'Conversion in Europe: challenges and experiences', eds B. Moller and L. Voronkov, *Defensive Doctrines and Conversion* (Dartmouth Publishing Co.: Aldershot, 1996), pp. 56–62.

[41] Anthony et al. (note 34), p. 317.

[42] Anthony et al. (note 34), p. 368.

[43] The Soviet Union and Russia have had such treatment. E.g., Cooper, J., 'Russian military expenditure and arms production', *SIPRI Yearbook 2001: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2001), pp. 313–22; and appendix 9C.

The cold war arms industry

The defence industry had unique characteristics during the cold war. The high level of military expenditure in the period after World War II encouraged corporate involvement in lucrative defence orders, while the high R&D expenditure influenced the structure and performance of the companies. High R&D expenditure also influenced the trend in costs, making them higher than civil costs, and the nature of production—with short production runs, technologically advanced and concerned with performance rather than cost minimization—limited the potential for economies of scale and learning.[44] While other large companies were similar in structure, the products produced by defence firms and the sub-systems they integrated had different technological forms and requirements. Thus, civil and military products and production processes differed, as did the nature of capital equipment, with labour skills and the organization of production becoming increasingly specific to the sector.

The monopsonistic[45] structure of the market and the nature of the product led to an emphasis on the performance of high-technology weaponry rather than on cost; the financial risk was borne by government, which often financed R&D and in some cases provided investment in capital and infrastructure. The characteristics of the industry also led to elaborate rules and regulations on contracts, which were seen as necessary in the absence of a competitive market and to assure public accountability.[46] In addition, military contingency planning for the worst case led to ever-increasing demand to modernize equipment, with cost only a minor concern. In such an environment, close relations developed between contractors, procurement executives and the military, leading to a 'revolving door' through which military and civil servants moved to defence contractors with which they had dealings and defence contractors moved into the bureaucracy.[47] It was not surprising that the vested interests in military production formed a powerful interest group, the 'military–industrial complex', which was capable of pushing for increases in expenditure when there was no obvious change in threats to security.[48]

[44] Ball, N. and Leitenberg, M., *The Structure of the Defense Industry: An International Survey* (Croom Helm: London, 1983); Melman, S., *The Permanent War Economy* (Simon and Schuster: New York, N.Y., 1985); Dunne, P., 'The political economy of military expenditure: an introduction', *Cambridge Journal of Economics*, vol. 14, no. 4 (Dec. 1990), pp. 395–404, and Lovering, J., 'Military expenditure and the restructuring of capitalism: the military industry in Britain', *Cambridge Journal of Economics*, vol. 14, no. 4 (Dec 1990), pp. 453–68.

[45] While in a monopoly situation there are many customers but only one supplier, in a monopsony there are many suppliers (in this case, national arms producers) but only one customer (the national government).

[46] Dunne, J. P., 'The defence industrial base', eds K. Hartley and T. Sandler, *Handbook of Defense Economics*, vol. 1 (Elsevier: Amsterdam, 1995), pp. 592–623.

[47] Adams, G., *The Iron Triangle: The Politics of Defense Contracting* (Council on Economic Priorities: New York, N.Y., 1981); and Higgs, R. (ed.), *Arms Politics and the Economy: Historical and Contemporary Perspectives* (Holmes and Meier: New York, N.Y., 1990).

[48] Dunne, J. P., 'The changing military industrial complex in the UK', *Defence Economics*, vol. 4, no. 2 (Mar. 1993), pp. 91–112; and Lovering, J., 'Restructuring the British defence industrial base after

These characteristics tended to favour those firms that specialized in defence work over other potential competitors. They knew their way around the red tape and had the contacts and links within the state. These firms became experts at getting money out of government, rather than being successful in commercial markets. The companies sought involvement in the development programmes for technologically advanced weapon systems as the best means of obtaining the subsequent production contracts. In some cases this led to 'buy ins', where firms understated risk or cost in order to win initial contracts and made up the losses later. In addition, some programmes saw 'gold plating', where the military continually asked for additions or technological improvements over the contract period. This allowed renegotiation of contracts or additional payments, usually to the advantage of the contractor.[49]

As a result of the structure of the market there were barriers to both entry and exit (market-related, technological and procedural). This led to the cold war defence industrial base being remarkably stable in the composition of main contractors. Moreover, unlike most other manufacturing industries, which went multinational, the arms industry remained national. Smaller countries, which could not afford the large fixed costs, imported major weapon systems.[50]

The post-cold war arms industry

Trends in world military spending can be divided into two major periods in the post-cold war period: a marked decline from the cold war peak in 1987, then a bottoming out around 1998 and an increase in 1998–2005. Indeed, world military spending in 2005 exceeded (in real terms) the peak of spending during the cold war.[51] The USA, which became the major superpower, has been the main contributor to the upward trend in world military expenditure. In 2005 the USA accounted for 48 per cent of world military expenditure, with the combined expenditure of next five largest spenders—the UK, France, Japan, China and Germany—less than half that of the USA. The 26 members of just one military alliance, NATO, account for 70 per cent of world military expenditure in 2005.[52]

With the fall in demand following the end of the cold war, the ability of even the major powers to maintain a domestic defence industrial base was

the cold war: institutional and geographical perspectives', *Defence Economics*, vol. 4, no. 2 (Mar. 1993), pp. 123–39.

[49] Dunne (note 46).

[50] Dunne (note 46); and Renner, M., *Economic Adjustment After the Cold War: Strategies for Conversion* (Dartmouth Publishing Co.: Aldershot, 1992).

[51] See chapter 8 in this volume.

[52] A further issue of increasing importance is the 'hidden' defence spending that appears in national accounts under headings other than defence. E.g., major actions are paid for from contingency funds; in the new environment of the war against terrorism, what was once defence expenditure appears elsewhere; and there is increased use of civil companies to undertake what would have been the work of the armed forces, but not necessarily recognized as defence, such as post-conflict reconstruction in Iraq. Brauer, J., 'United States military expenditure', Unpublished manuscript, College of Business, Augusta State University, Feb. 2005, URL <http://www.aug.edu/~sbajmb/paper-US_milex.pdf>.

called into question.[53] Governments had to decide whether to allow mergers and acquisitions which would reduce competition and, in particular, whether to allow mergers and acquisitions which involved foreign partners. In Europe, the UK led the way to the degree that its government definition of the national defence industrial base was concerned only with the location of production and not with the ownership of the firm.[54] Some smaller European producers, such as Belgium and Norway, followed the UK. In France and Germany the issue was much more controversial and continues to be so.[55] The change in the security environment made it harder to justify previous levels of support for the industry and so competitive procurement policies aimed at value for money were introduced in a number of countries.[56]

The end of the cold war produced not just a quantitative change in the number of weapons required, but a qualitative change in the types required.[57] During the cold war, planning was straightforward—it was fairly clear where, how and with whom war would be fought if it came. After the cold war there was much less certainty. As Western governments considered the new geopolitical environment, it became apparent that the cold war weapons that made up the bulk of the NATO inventory were unlikely to be what was now required.[58] Given the long lead times and the commitments made by government bodies, research teams and companies, there are still pressures to continue to produce these weapon systems and to find roles for them. There has, however, been a clear and important qualitative change in the nature of technology as civil technology became increasingly important for weapon systems.[59] This was a marked change since, from the end of World War II to the 1980s, military technology had tended to be ahead of civil technology. By

[53] Dunne, J. P., Garcia-Alonso, M., Levine, P. and Smith, R., 'Concentration in the international arms industry', Discussion paper no. 03/01, School of Economics, University of the West of England, Bristol, Jan. 2003, URL <http://carecon.org.uk/DPs/>; Markusen, A. R. and Costigan, S. S., 'The military industrial challenge', eds A. R. Markusen and S. S. Costigan, *Arming the Future: A Defense Industry for the 21st Century* (Council on Foreign Relations Press: New York, N.Y., 1999), pp. 3–34

[54] The first clear and explicit statement of the change in British policy was made in British Ministry of Defence, 'Defence industrial policy', Ministry of Defence Policy Paper no. 5, Oct. 2002, URL <http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/PolicyStrategy/>, p. 9.

[55] Serfati, C. et al. (eds), *The Restructuring of the European Defence Industry: Dynamics of Change*, European Commission, Directorate General for Research, COST Action A10 (Office for Official Publications of the European Communities: Luxembourg, 2001), in particular Mampaey, L., 'Ownership and regulation of the defence industrial base: the French case', pp. 123–144; and 'Germany tightens rules on foreign ownership', *Defense News*, 19 Sep. 2005, p. 20. For a discussion of the 'strong influence of the French Government on the French defence industry' see Lundmark, M., 'To be or not to be: the integration and the non-integration of the French defence industry', Base data report FOI-R-1291-SE, Swedish Defence Research Agency (FOI), Stockholm, July 2004, URL <http://www.foi.se/FOI/templates/PublicationPage____171.aspx>, pp. 16–17; Mussington, D., *Arms Unbound: the Globalization of Defense Production* (Brassey's: Washington, DC, 1994); and Kapstein, E. B. (ed.), *Global Arms Production: Policy Dilemmas for the 1990s* (Harvard University Press: Cambridge, Mass., 1992).

[56] On the UK see Dunne, J. P. and Macdonald, G., 'Procurement in the post cold war world: a case study of the UK', eds Serfati et al. (note 55), pp. 101–22.

[57] See chapter 15 in this volume.

[58] Bailes, A. J. K., Melnyk, O. and Anthony, I., *Relics of Cold War: Europe's Challenge, Ukraine's Experience*, SIPRI Policy Paper no. 6 (SIPRI: Stockholm, Nov. 2003), URL <http://www.sipri.org/>.

[59] Branscomb, L. M. et al., *Beyond Spinoff: Military and Commercial Technologies in a Changing World* (Harvard Business School Press: Cambridge, Mass., Apr. 1992).

the 1990s in many areas, particularly electronics, military technology lagged behind civil technology, and military technology was often obsolete before it came into service. Whereas in the past the spin-off of military technology to the civil sector tended to be an important argument for the value of military production, the focus is now more on 'spinning-in' civil technology to the military. Many areas of technology that were once the preserve of the military and security services, such as cryptography, now have primarily commercial applications. In addition, the use of standard commercial components is an increasing feature of the arms industry: many components of major weapon systems are commercial off-the-shelf products, produced by manufacturers that would not consider themselves part of the arms industry. The major contractors have become increasingly systems integrators, retaining the characteristics of defence specialized firms.[60]

In the post-cold war world the arms industry's size, structure and trade are still determined by government policy, as the national government is the main customer and regulates exports. However, there have been clear changes in the structure and nature of the industry. The reduction in demand has led to a situation in which, outside the USA, many companies have become national champions, in many cases monopolies or close to it, with a consequent need for cross-border restructuring.[61]

Concentration

The most striking change in industrial policy was in the USA. During the cold war, industrial planning was undertaken through the DOD, although not explicitly. This changed in 1993: a merger wave was stimulated when the Deputy Secretary of Defense, William J. Perry, addressed a dinner attended by defence industry executives and openly encouraged consolidation—this became known as the 'last supper'.[62] The presence of financiers at this meeting illustrates the increasing role of financial capital in the arms industry.[63] To promote the consolidation, the DOD allowed companies to write off restructuring costs against military contracts, with the expectation of large costs savings which never materialized.[64] The policy ended when the DOD

[60] Dunne, J. P., Garcia-Alonso, M., Levine, P. and Smith, R. P., 'The evolution of the international arms industry', Unpublished manuscript, School of Economics, University of the West of England, Bristol, Aug. 2005, URL <http://carecon.org.uk/Armsproduction/Evolution2forWolfram.pdf>; and Markusen, A. R., 'The post-cold war persistence of defense specialized firms', eds G. I. Susman and S. O'Keefe, *The Defense Industry in the Post Cold War Era* (Elsevier: Oxford, 1998), pp. 121–46.

[61] The situation also meant that any introduction of competition would need to be from foreign firms. This can be implicit rather than explicit, by creating contestable markets with potential competition from abroad, although there may be problems of making incumbents believe that these external competitors would enter the market. Dunne (note 46).

[62] Perry is reported to have said that he hoped several aircraft firms, 3 of the 5 satellite firms, and 1 of the 3 missile companies would disappear through mergers. Markusen (note 60), p. 138. A description of the meeting is in Turpak, J. A., 'The distillation of the defence industry', *Airforce Magazine*, vol. 81, no. 7 (July 1998), URL <http://www.afa.org/magazine/July1998/>.

[63] Sköns and Surry (note 4), p. 387. For an analysis of the role of Wall Street in the restructuring of the US arms industry during the 1990s see Markusen (note 60).

[64] Sköns and Weidacher, 'Arms production' (note 2), p. 397.

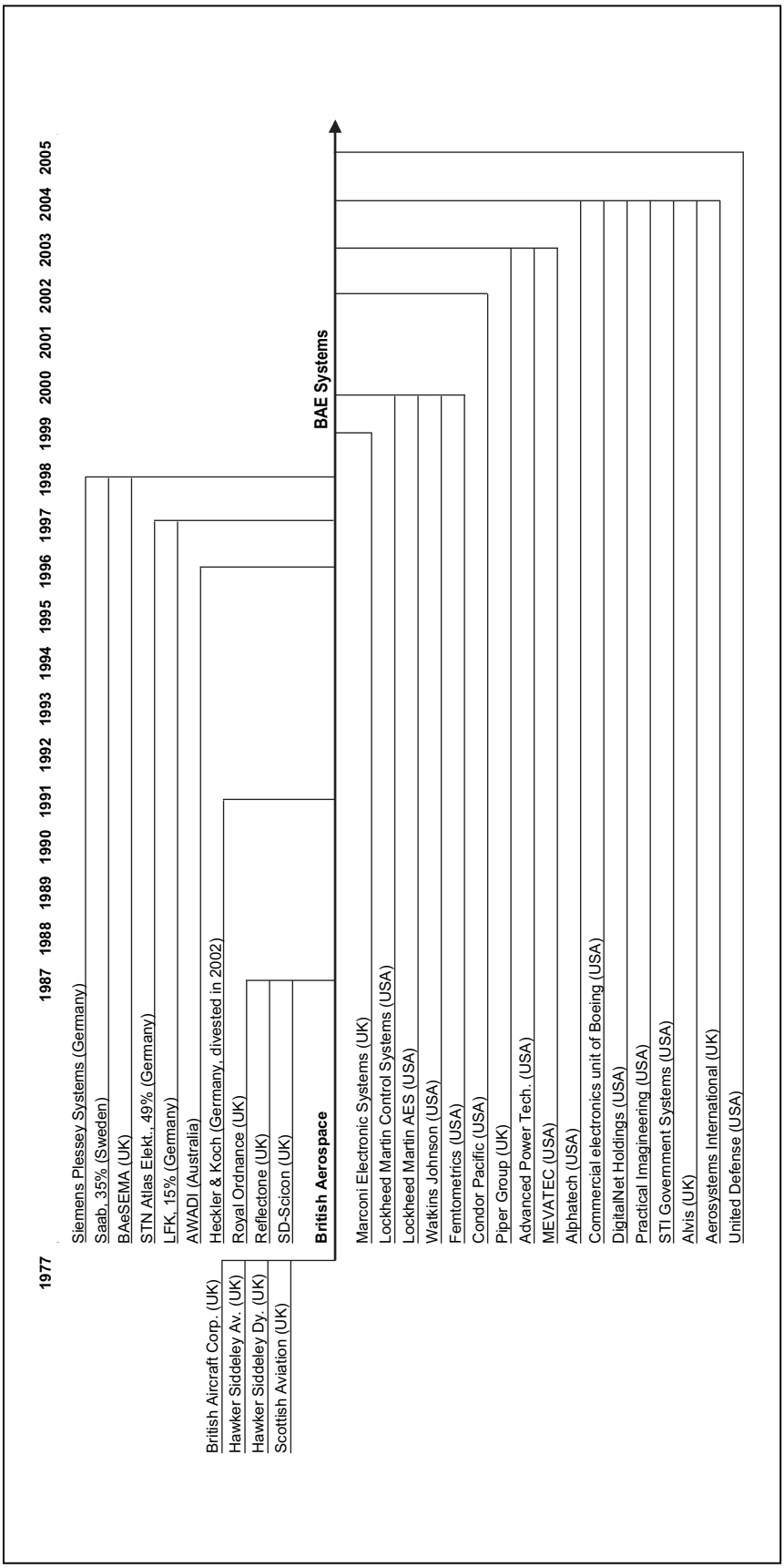

Figure 9.1. The formation and major acquisitions of BAE Systems, 1977–2005

This diagram ignores BAE System's civil acquisitions of the 1980s and focuses on it path to defence specialism. The full complexity of these mergers and acquisitions cannot be represented. For more details see the SIPRI Arms Production Project website, URL <http://www.sipri.org/contents/milap/>.

decided it had gone far enough and blocked the merger of Lockheed Martin with Northrop Grumman in early 1997.[65] This left four major US contractors in 1998: Boeing, Lockheed Martin, Northrop Grumman and Raytheon—which are now four of the top five companies in the SIPRI Top 100 for 2004.[66]

In Europe the process of post-cold war adjustment was more complicated, since restructuring necessarily involved cross-border mergers, which raised political issues.[67] The major players in Europe also had quite different ownership structures than those in the USA. For example, in France, Italy, Portugal and Spain there was a high degree of state ownership of companies at the end of the cold war. This made the kind of financially driven merger boom that took place in the USA more difficult in Europe. Nonetheless, the driving forces in Europe were similar and led to an increase in concentration. There have been recent moves to integrate European defence markets and further consolidate the sector.[68]

There were three waves of activity in the evolution of BAE System's defence activities (see figure 9.1). First was the consolidation in 1977–87 of the British companies that made up British Aerospace. Then came the acquisitions of European defence interests and of Marconi's defence business in the late 1990s. Finally, the focus moved to acquisitions of US companies. In this phase the change in name to BAE Systems reflected the company's aim of internationalization and its intention to enter the US market. The evolution of Thales reflects the different experience of the European industry, with continued government ownership and, until recently, opposition to cross-European consolidation (see figure 9.2). There was a short wave of acquisitions in the early 1990s, then a major wave of acquisitions across the world in the late 1990s. The company's name was changed from Thomson CSF to Thales in 2000 following the acquisition of the British company Racal. With this acquisition, Thales became the second largest contractor to the British Ministry of Defence (after BAE Systems).[69] The change in European government attitudes is further reflected in the evolution of EADS (the European Aeronautics, Defence and Space Company; see figure 9.3), which was formed in 2000 from DASA (a subsidiary of Daimler) of Germany, Aérospatiale Matra of France and CASA of Spain. EADS developed its defence position through acquisitions in the early 2000s.

[65] Markusen and Costigan (note 53), p. 4.

[66] Sköns and Weidacher, 'Arms production' (note 2), pp. 394–98, in particular figure 10.1. The British company BAE Systems is 4th in the Top 100. The 6th, General Dynamics, adopted the strategy of spinning off defence divisions which specialized in areas in which it was not dominant and concentrating on those where it was, becoming a smaller firm in the process. Markusen (note 60).

[67] Ripley, T., 'Western European industry ownership jigsaw', *Defence Systems Daily*, 31 May 2005, URL <http://defence-data.com/ripley/pagerip1.htm>. The current structure of the European defence industry is described as a 'spaghetti bowl' in Vlachos-Dengler, K., *Off Track?: The Future of the European Defense Industry* (RAND: Santa Monica, Calif., 2004).

[68] Valasek, T., 'EU wants more defense competition, lower costs', ISN Security Watch, 1 Dec. 2005, <http://www.isn.ethz.ch/news/sw/details.cfm?id=13686>.

[69] Defence Manufacturers Association, 'Thales UK PLC', Member listings, URL <http://www.the-dma.org.uk/Secure/Groups/NonMemberDets.asp?ID=817>.

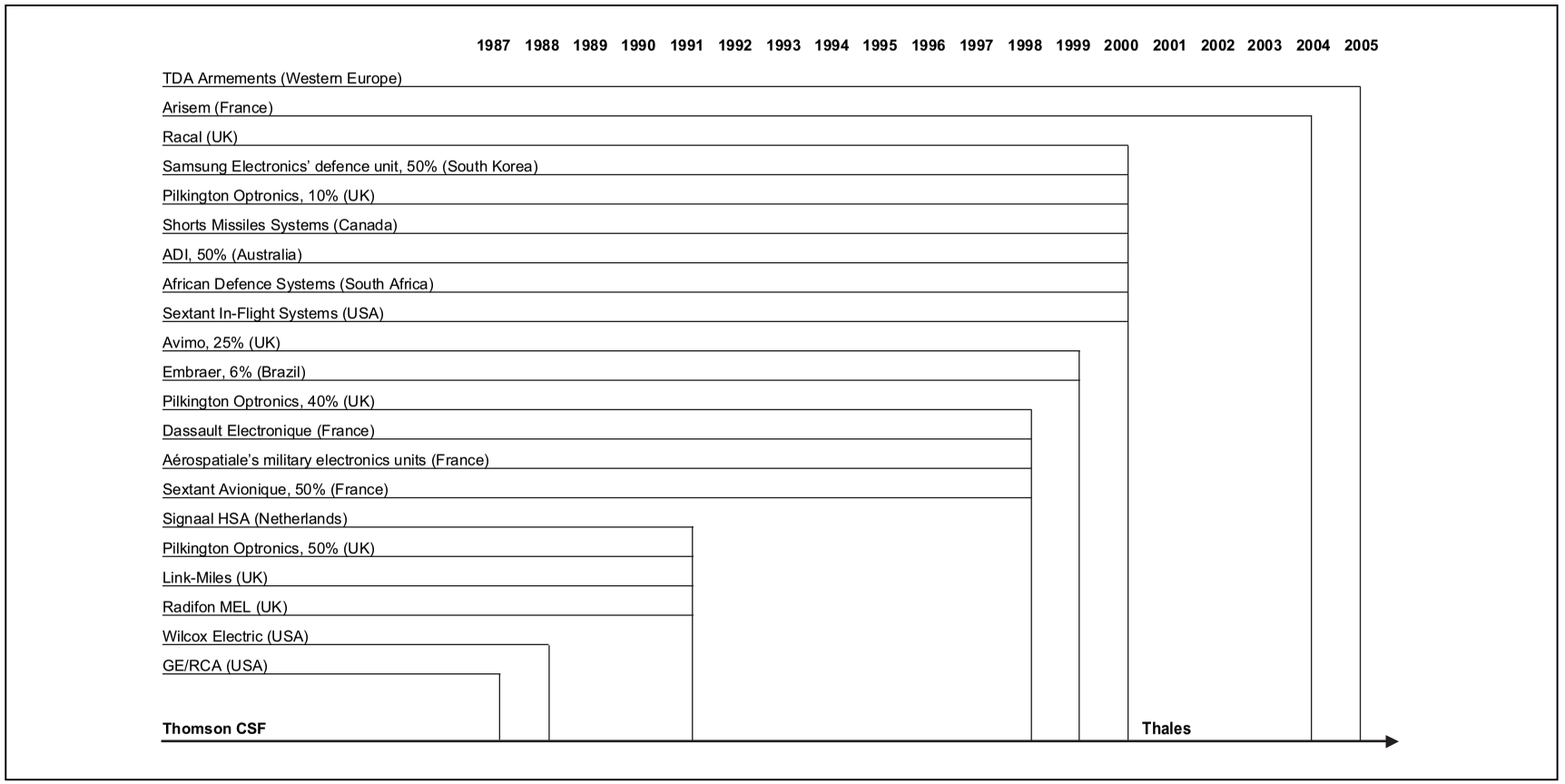

Figure 9.2. The formation and major acquisitions of Thales, 1987–2005

The full complexity of these mergers and acquisitions cannot be represented. For more details see the SIPRI Arms Production Project website, URL <http://www.sipri.org/contents/milap/>.

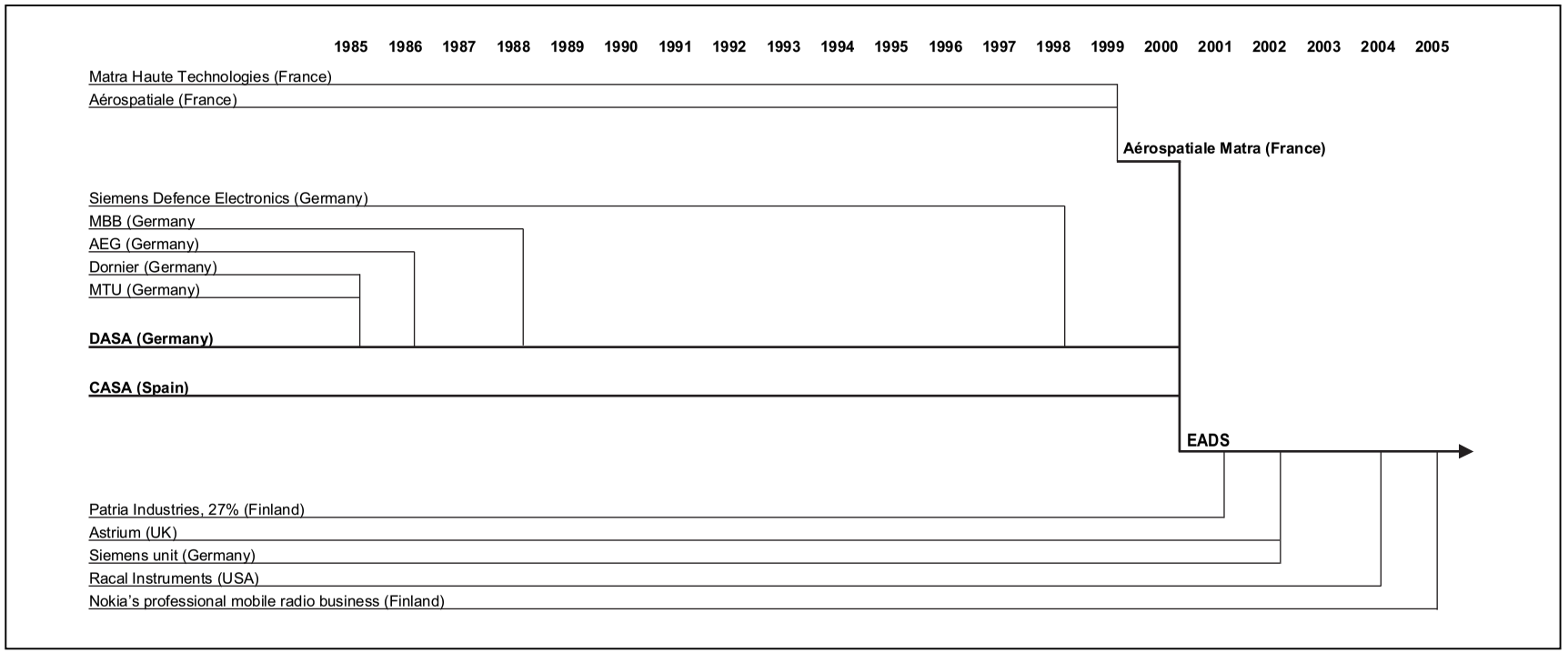

Figure 9.3. The formation and major acquisitions of EADS, 1985–2005

The full complexity of these mergers and acquisitions cannot be represented. For more details see the SIPRI Arms Production Project website, URL <http://www.sipri.org/contents/milap/>.

Table 9.3. Concentration of the arms industry, 1990–2003

Figures are percentage shares of the sales of the SIPRI Top 100 arms-producing companies.

	Share of total arms sales				Share of total sales			
	1990	1995	2000	2003	1990	1995	2000	2003
Top 5	22	28	41	44	33	34	43	45
Top 10	37	42	57	61	51	52	61	61
Top 15	48	53	65	69	61	64	71	72
Top 20	57	61	70	74	69	72	79	80

Source: SIPRI Arms Industry Database.

Structural changes

As a result of the merger and acquisition activity since the end of the cold war, there has been a clear change in the structure of the industry. This is shown in table 9.3, which shows the changes in concentration of the Top 100 arms-producing companies in the period 1990–2003. At the end of the cold war the international arms industry was not very concentrated, with the top 5 companies accounting for 22 per cent of the total arms sales of the SIPRI Top 100. It is noticeable that the concentration in total sales was higher than in arms sales, with the top 5 companies accounting for 33 per cent of the total sales of the Top 100. By 2003 this had changed significantly, with the top 5 firms accounting for 44 per cent of total arms sales. This large increase in the share of the top companies is continued further down the list of companies, as shown for the top 10, 15 and 20. In all cases, the big change occurred between 1995 and 2000. Total sales in the period 1990–2003 were also more concentrated in a few companies but, since concentration of total sales was already high in 1990, the increase is not so great. The top 5 companies accounted for 33 per cent of the total sales of the top 100 in 1990 and 45 per cent in 2003. By 2003, concentration of total sales was very similar to that of arms sales. This may reflect increasing specialization on defence sales by the major players.[70]

Although by 2003 the five largest arms-producing firms accounted for 44 per cent of the total arms sales of the Top 100, this is still a very low degree of concentration compared to other high-technology markets. The market for major weapon systems would probably have become more highly concentrated, like those for civil airliners or pharmaceuticals, if national governments had not inhibited the growth of multinational firms to protect their defence industrial base.[71] The international arms market has been dominated by US

[70] Computing the coefficient of variation of the Top 100 for the same years shows an increasing spread of the size distribution for arms and total sales, with arms sales having a lower spread than total sales in 1988 but increasing more. The results also show that the spread of arms shares across the companies was constant until 1998 and then declined in 1998–2003.

[71] Until the 1970s government procurement rules in many countries restricted the purchase of telecommunications equipment from foreign suppliers and determined the number of firms. The easing of

companies. BAE Systems is the only European company to have consistently been in the top 5 of the Top 100, having made a successful push for sales in the US market and gaining special status in bidding for US contracts.[72] European companies are important, however, with Thales, EADS and Finmeccanica in the top 10. Nearly all arms-producing companies have shown a rise in arms sales between 1998 and 2003 and, apart from the rise of Halliburton, the top 20 companies are relatively stable.

The process of significant concentration in the arms industry since the end of the cold war evolved in phases. The most intensive period of concentration was between 1993 and 1998. The process has continued, but slowed down, since then. This is clearly illustrated by figure 9.4, which shows the cumulative shares of the total sales of the Top 100 companies in 1988, 1993, 1998 and 2003. The curves for 1988 and 1993 almost overlap, showing almost no change in the size distribution, but there is a clear increase in concentration between 1993 and 1998, and a further, although smaller, increase between 1998 and 2003.

Company strategies

Faced with the reduction in demand for arms after the cold war, a number of strategic options were open to companies. They could convert their plants to civil production, diversify to produce additional civil products or other military products, divest from military production, cooperate with other companies or increase military specialization. They also had the option of increasing their exports, whether through new sales and marketing strategies or by finding new markets. However, their choices were constrained by government policy towards their national defence industrial base and by the nature of the financial systems within which they operated. In principle, the conversion of plants producing military products to producing civil products was an option, but there are very few examples of a successful conversion strategy in this narrow sense in this period. There were more examples of attempts to convert at company, rather than plant, level and of diversification into civil production, but these also had limited success. Some argue that this was a result of firms' internal political battles being won by the advocates of 'downsizing and focus-

procurement rules that followed the liberalization of the telecommunications market led to very rapid concentration in the world telecommunications industry. This is what might be expected to happen if governments ceased to interfere in the market structure of the arms industry. Sutton, J., *Technology and Market Structure* (MIT Press: Cambridge, Mass., 1998).

[72] The special status of BAE Systems Inc., as the US unit is known, dates to the later years of the administration of US President Bill Clinton, when the company became the only subsidiary of a foreign defence contractor to win a blanket 'national interest determination' from the DOD, giving it streamlined handling of approvals to work on classified contracts. The parent company does not enjoy the same level of trust. The special security status and track record of Rockville, a BAE Systems subsidiary, allows it to compete on contracts and buy companies more easily than other foreign units. 'Hands—and arms—across the sea', *Business Week*, 14 Nov. 2005, URL <http://www.businessweek.com/magazine/content/05_46/b3959161.htm>.

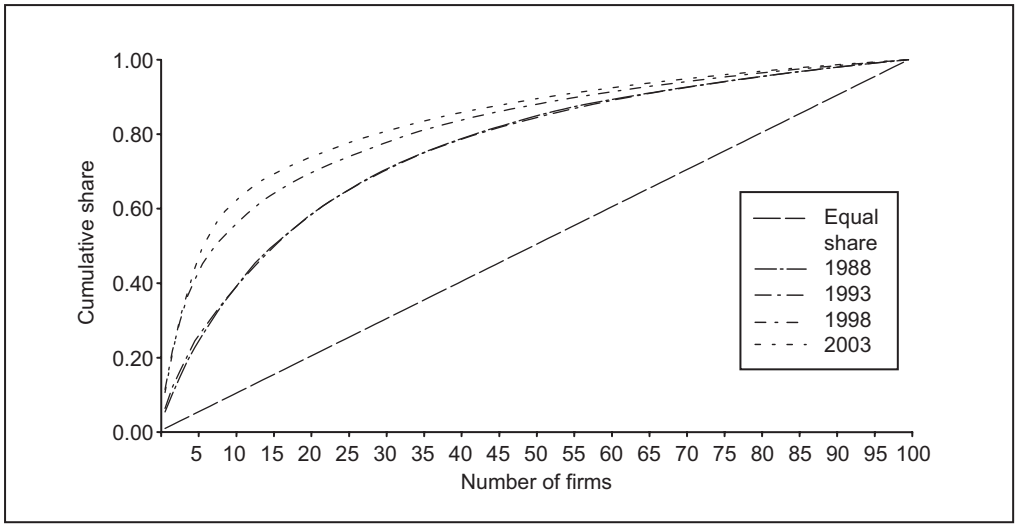

Figure 9.4. Size distribution of the SIPRI Top 100 arms-producing companies in 1988, 1993, 1998 and 2003

Each curve shows the cumulative share of the total arms sales of the Top 100: the first point on each curve is the share of the largest company; the second point is the total share of the top 2; the third point the total share of the top 3, and so on. If all companies in the Top 100 had an equal share of the total, then the line would be straight; the further the curve deviates from the straight line, the greater the concentration.

ing' or 'diversifying further into defence' over the advocates of 'convert and diversify into civil', rather than a failure of conversion per se.[73]

The experience of the companies certainly varied as they developed their policies to counter the reduction in the demand for arms.[74] Diversification involved developing new commercial activities either through the organic growth of new businesses or by acquiring existing businesses. It had more chance of success where the firm could build synergies between the military and civil parts of the business, which was more likely to be in firms with relatively low shares of arms sales. Probably the most impressive diversification was that of the British defence company Racal, which built, and then spun off, the Vodafone mobile phone business. The remaining defence components of Racal were ultimately sold to Thomson CSF of France to form the multinational Thales. There are more examples of unsuccessful diversification. British Aerospace bought a construction company, a property company and an automobile company. There were plausible tactical justifications for each acquisition, but they did not work. British Aerospace divested each of them and became more focused as a defence company.[75] Some companies, for

[73] Markusen (note 60).

[74] Dunne et al. (note 60); Smith, R. and Smith, D., 'Corporate strategy, corporate culture and conversion; adjustment in the defence industry', *Business Strategy Review*, vol. 3, no. 2 (summer 1992), pp. 45–58. See also note 40.

[75] Some argue that British Aerospace Enterprises, the company's venture capital arm, had a potential for success that was never achieved because of the change in corporate strategy. Feldman, J., 'The rise and fall of British Aerospace Enterprises', Mimeo, National Institute for Working Life, Stockholm,

example, Daimler Benz, made acquisitions of smaller companies to develop the conglomerate into a broad-based technology company and so reduced their dependency on arms production.[76] For a time, there was also a widespread belief that synergies were possible between automobiles and aerospace, particularly defence aerospace, something on which Saab had based its advertising. The automobile companies Ford, General Motors and Daimler had all acquired defence units. Ford and General Motors subsequently sold them and Daimler spun off its defence unit, DASA, into the merger with Aérospatiale Matra and CASA to form the multinational EADS.[77]

After the consolidation that followed the 1993 'last supper', the remaining US arms producers no longer based their business plans on a broad-based and diversified product range but on specialization in defence products. This was reinforced by Wall Street transactions, which encouraged companies to concentrate on what the stock market called 'pure play' and 'core competences'.[78] Where competition regulations made it possible, selling defence divisions to competitors was an attractive proposition in a number of cases, since they were worth more to the competitor, who gained increased monopoly power. In the USA, General Dynamics was an early exponent of this strategy and shrank itself rapidly and profitably. In the UK, GEC sold its defence divisions to British Aerospace in 1999 and turned itself into a purely commercial company, renamed Marconi, which proved to be a disaster.[79]

Cooperation has always been common among aerospace and defence companies. They can use collaboration, joint ventures and strategic alliances to cut costs—by sharing high R&D and other overhead costs and pooling orders to increase production runs—without losing independence.[80] Joint ventures are partnerships or conglomerates, often formed to share risk or expertise, where two or more businesses agree to share profit, loss and control in a specific enterprise. They are seen as a good way for companies to combine without having to merge. However, joint ventures can be difficult to manage and companies generally prefer direct control, when they can get it. One of the success stories in military aerospace is the longstanding link between the partly state-owned French aero-engine company Snecma and General Electric of the

2000. That process of change is described in Evans, R. and Price, C., *Vertical Take-off* (Nicolas Brealey Publishing: London, 1999).

[76] Stephan, M., 'An evolutionary perspective on corporate diversification', Paper prepared for the Workshop on Evolutionary Economics, Buchenbach, 14–17 May 2003, URL <http://www.infokom.tu-dresden.de/papiere buchenbach 2003/CorporateDiversificationPatternsVersion2April2003.pdf>; and Renner (note 50).

[77] James, A. D., 'Comparing European responses to defense industry globalization', *Defence & Security Analysis*, vol. 18, no. 2 (June 2002), pp. 123–43. See also 'Big 3 no longer major players in U.S. defense', *Automotive News*, 31 Mar. 2003, URL <http://www.autonews.com/apps/pbcs.dll/article?AID=/20030331/FREE/303310763>.

[78] Markusen, A. (note 60); Dunne et al. (note 60); Oden, M., 'Cashing in, cashing out, and converting: restructuring of the defense industrial base in the 1990s', eds Markusen and Costigan (note 53), pp. 74–105.

[79] Marconi was hit by the end of the high-tech boom and ended up effectively bankrupt. 'Q&A: Marconi refinancing deal', BBC New Online, 29 Aug. 2002, URL <http://news.bbc.co.uk/2/2219039.stm>.

[80] Hartley, K., 'Aerospace: the political economy of an industry', ed. H. W. de Jong, *The Structure of European Industry*, 2nd edn (Kluwer: Dordrecht, 1988), pp. 329–54.

Table 9.4. Company strategies and analysis of arms-producing companies that survived in the periods 1990–2003 and 1990–98

Fate of the 1990 SIPRI Top 100 arms-producing companies	
Had exited by 2003	18
Had merged or been acquired by 2003	25
No data for 2003	4
Survivors in 2003	53

Analysis of companies in 2003[a]	Arms sales an increased or constant share of total sales	Arms sales a decreased share of total sales	Total
Winners	12	13	25
Diversifiers	2[b]	13	15
Rearmers	7	0	7
Losers	4	2	6
Total survivors	**25**	**28**	**53**

Analysis of companies in 1998[a]	Arms sales an increased or constant share of total sales	Arms sales a decreased share of total sales	Total
Winners	2	9	11
Diversifiers	0	33	33
Rearmers	6	0	6
Losers	4	3	7
Total survivors	**12**	**45**	**57**

[a] 'Winners' are companies that increased arms sales and increased civil sales; 'diversifiers' are those that decreased arms sales and increased civil sales; 'rearmers' are those that increased arms sales and decreased civil sales; and 'losers' are those that decreased arms sales and decreased civil sales.

[b] For these 2 companies, arms sales as a share of total sales remained constant.

Source: SIPRI Arms Industry Database.

USA.[81] Strategic alliances are arrangements between companies that pool, exchange or integrate selected business resources for mutual benefit, while remaining separate entities. Strategic alliances are less complicated than joint ventures. They take many forms and have become more sophisticated and flexible over the past few years. Companies may choose an alliance that involves simple market exchanges or cross-licensing agreements, or they may form a more complicated partnership that includes cooperative manufacturing arrangements or joint-equity ventures. All of these variants have been adopted by arms companies over the past two decades.[82]

The specializing companies, which acquired the defence divisions others divested and often shed civil activities, have also tended to diversify into other

[81] Wood, P. C. and Sorenson, D. S. (eds), *International Military Aerospace Collaboration* (Ashgate Publishing: Aldershot, 2000). In May 2005 Snecma merged with Sagem to form SAFRAN.

[82] Dussage, P. and Garrette, B. 'Industrial alliances in aerospace and defence: an empirical study of strategic and organizational patterns', *Defence Economics*, vol. 4, no. 1 (Jan. 1992), pp. 45–62.

weapon systems so that they can market a full product range. Such companies realized the need to internationalize and acted upon it. Even before the current wave of restructuring, companies were expanding supply chains internationally, building international joint ventures and taking strategic shares in foreign companies as an alternative to ownership. This trend has clearly accelerated with the support of governments and has led to marked changes in ownership structures. BAE Systems now sells more to the US DOD than to the British Ministry of Defence, and the French company Thales is the second largest defence contractor in the UK.[83]

Another means of replacing domestic demand was through increased exports. Governments, mindful of the need to keep costs down by maintaining or increasing the scale of production of domestic arms producers, supported and encouraged the search for orders abroad. Arms exports became heavily subsidized, both directly and indirectly, through diplomatic pressure, aid, insurance provision, assistance with offset arrangements and so on.[84] This led to increased competition among arms producers but failed to prevent the inevitable consolidation within the industry.

The different strategies adopted can be identified by considering the company data.[85] The companies can be classified as: (*a*) winners, with increased arms sales and increased civil sales; (*b*) diversifiers, with declined arms sales and increased civil sales; (*c*) rearmers, with increased arms sales and decreased civil sales; and (*d*) losers, with decreased arms sales and decreased civil sales. Diversifiers could have converted plants or diversified through organic growth, acquisitions or divestment. In table 9.4 the civil production of the sample—the Top 100 arms-producing companies for 1990—was estimated and the frequency distribution for these four categories considered both for those companies with increasing arms shares and for those with decreasing arms shares.

Of the 53 companies that still existed in 2003, the largest group is the winners, about half of whom had a decreased share of their total sales represented by arms sales, meaning that arms sales became less important to the company. While the results for the period 1990–2003 are interesting, they cover a relatively long time period. Since there could have been changes over the period in the strategies and success of companies, it is useful to consider the results over a shorter period, 1990–98. In 1998 there were a similar number of survivors, but a much smaller proportion of these had increased their arms sales (as would be expected in the short term) and there are fewer

[83] James (note 77). The USA now accounts for 40% of BAE Systems' annual sales. 'Hands—and arms—across the sea' (note 72). Thales employs 12 000 people at 70 locations in the UK. Armed Forces, 'Thales UK', Defence Suppliers Directory, 2006, URL <http://www.armedforces.co.uk/companies/raq400d01d167144>.

[84] Cooper, N., *The Business of Death* (Taurus Academic Studies: London, 1997); Jackson, B., *Gunrunners' Gold* (World Development Movement: London, 1995); and Ingram, P. and Davis, I., *The Subsidy Trap: British Government Financial Support for Arms Exports and the Defence Industry* (Oxford Research Group: Oxford, 2001).

[85] Brzoska, M., Wilke, P. and Wulf, H., 'The changing civil military production mix in Western Europe', eds Markusen and Costigan (note 53), pp. 371–405.

Table 9.5. Regional distribution of the SIPRI Top 100 arms-producing companies, 1990 and 2003

	Share of total arms sales (%)		Number of companies	
Region/country[a]	1990	2003	1990	2003
North America	***60.8***	***63.2***	**49**	**39**
USA	*60.2*	*63.0*	47	38
Canada	*0.6*	*0.2*	2	1
Western Europe	***33.1***	***29.2***	**40**	**36**
UK	*10.4*	*11.4*	13	12
France	*12.0*	*7.5*	11	9
FRG/Germany	*5.0*	*2.2*	8	5
Italy	*3.4*	*2.7*	3	3
Switzerland	*1.1*	*0.3*	2	1
Sweden	*0.3*	*0.9*	2	2
Spain	*0.9*	*0.6*	1	2
Norway	–	*0.2*	–	1
Trans-European	–	*3.4*	–	1
Other OECD	***3.2***	***3.3***	**5**	**10**
Japan	*3.2*	*2.6*	5	7
South Korea	–	*0.5*	–	2
Australia		*0.2*	–	1
Other non-OECD	***3.0***	***4.6***	**6**	**15**
Israel	*1.2*	*1.5*	3	4
India	*1.1*	*1.0*	2	3
Singapore	–	*0.4*	–	1
South Africa	*0.7*	*0.2*	1	1
Russia	–	*1.5*	–	6

FRG = Federal Republic of Germany; OECD = Organisation for Economic Co-operation and Development.

[a] This table refers only to parent companies: the arms sales of foreign subsidiaries are included in the sales of the parent company, not in the country where the production actually takes place. The Top 100 for 1990 covered only OECD member states and developing countries (excluding *inter alia* China and Russia). By 2003, the Top 100 covered most of the world, but still excluded China.

Sources: Anthony, I., Claesson, P, Sköns, E. and Wezeman, S. T., 'Arms production and arms trade', *SIPRI Yearbook 1993: World Armaments and Disarmament* (Oxford University Press: Oxford, 1993), table 10.3, p. 428; and Sköns, E. and Surry, E., 'Arms production', *SIPRI Yearbook 2005: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2005), table 9.1, p. 384.

winners and more diversifiers. While these figures show a high degree of diversification, they tend to understate the degree of conversion overall, as companies that successfully moved out of arms production became less visible—they leave the Top 100 and so do not count as 'survivors'—and gradual policy changes may not make headlines. In addition, according to the Bonn International Center for Conversion (BICC), it is possible that the less

visible, small- and medium-sized companies have been more successful diversifiers than the large companies among the Top 100.[86]

Looking at the changes in the regional distribution of the Top 100 arms-producing companies (see table 9.5), the dominance of US-listed companies is consistent: they made up 60 per cent of arms sales in 1990 and 63 per cent in 2003. The share for European companies declined from 33 per cent to 29 per cent over the same period. Interestingly, the USA saw a decline in the number of firms in the Top 100 from 49 to 39, while for Europe the decline was only from 40 to 36, reflecting the very different nature of the industry and the restructuring experience in the USA and Europe.[87]

Increasing internationalization of the supply chains is changing the organization of production. Apart from cross-country purchases of finished goods, companies are also changing their supply chain, an example being BAE Systems' purchases in South Africa.[88] The growth of offsets deals has encouraged this development and given importing countries the opportunity to develop niche markets, by being part of the supply chain of a major international producer.[89] Arms-producing companies are determining preferred suppliers from a wider range of companies.[90] While the companies rely on domestic support through procurement and support for exports, and so are not truly 'transnational', they have internationalized. Governments are increasingly willing to recognize that the costs of high-technology defence R&D and smaller national production runs mean that economies of scale need to be met through international collaboration and industrial restructuring. This is very different from a few decades ago, when governments aimed to maintain a comprehensive national defence industrial base. Major non-US defence companies are also buying defence contractors in the USA as a means of entering the US market, as discussed in section II above.

Acquisitions activity in the arms industry in 1988–89 and in 2005 can be compared by considering the tables of acquisitions in this volume and *SIPRI Yearbook 1990*.[91] There is much less activity in the earlier period, with 18 transactions noted for 1988–89 and 54 for 2005. This may possibly be attributed to better data collection for 2005, but the change in the level of

[86] This is argued in Bonn International Center for Conversion, *Conversion Survey 1998: Global Disarmament, Defense Industry Consolidation and Conversion* (Oxford University Press: Oxford, 1998), p. 232.

[87] Note that the US-based subsidiaries of European companies have their arms sales registered in the table as those of the European parent company.

[88] Dunne, J. P. and Lamb, G., 'Defence industrial participation: the experience of South Africa', eds Brauer and Dunne, *Arms Trade and Economic Development* (note 12), pp. 284–298; and J. P. Dunne, 'The making of arms in South Africa', *Economics of Peace and Security Journal*, vol. 1, no. 1 (Jan. 2006), URL <http://www.epsjournal.org.uk/Vol1/No1/issue.php>, pp. 40–48.

[89] There is concern over the cost and sustainability of such policies. Dunne (note 88); and Brauer, J., 'Arms trade, arms industries and developing countries', eds Hartley and Sandler (note 40).

[90] Hartley, K., Dowdall, P. and Braddon, D., 'Defence industry supply chain literature and research review', Department of Trade and Industry, London, Oct. 2000; Braddon, D., 'The matrix reloaded: what future for the defence firm?' *Defence and Peace Economics*, vol. 15, no. 6 (Dec. 2004), pp. 499–507; and Dowdall, P., 'Chains networks and shifting paradigms: the UK defence industry supply system', *Defence and Peace Economics*, vol. 15, no. 6 (Dec. 2004), pp. 535–50.

[91] See table 9B.1 in appendix 9B; and Anthony et al. (note 34), table 8.7, p. 336.

activity and the range of countries involved as acquirer and acquired are striking. The attempt by European firms to move into the US market is very clear, with seven transatlantic acquisitions of US companies in 2005.[92]

The period covered by the SIPRI Arms Industry Database has been one of considerable change and restructuring in the arms industry. While the concentration of major arms producers seems to have stopped in the USA in 1997, it is still continuing at the level of the smaller companies and in the supply chain. Unlike earlier consolidation, which was driven by the need to survive in a declining market, the recent activity seems to be driven more by the need to acquire technology than by the desire for growth.[93] While there has been some activity in Europe, there is still some way to go in terms of restructuring and increasing concentration. A major driver of restructuring is the growing transatlantic nature of the industry, in terms of both the European companies' aspirations to become major players in the US market and the USA's acceptance that 'interoperability requirements, the benefits of cooperative defense programs, and an increasingly global industrial infrastructure require that the [US DOD] be prepared to accept the benefits offered by access to the most innovative, efficient, and competitive suppliers worldwide'.[94]

The changing nature of the arms industry

There have been marked changes in the structure of the international arms industry since 1990 and there are likely to be changes in the future. Future prospects for the industry are shaped by a range of factors, including the following.

1. *The changing nature of warfare*. It seems unlikely that the USA and Europe (that is, NATO) will face an enemy that can provide a symmetric response; asymmetric conflict is most likely. This can change the nature of warfare and lead to more informal, guerrilla-type conflicts with implications for the weapon systems required.[95]

2. *The rate of obsolescence of some major weapon systems, such as fighter aircraft*. Recent commentators have suggested that many fighter aircraft are coming to the end of their life and will need to be replaced.[96]

[92] This is also discussed in Jones, S. G., 'The rise of Europe's defense industry', US–Europe Analysis Series, Brookings Institution, Washington, DC, May 2005, URL <http://www.brookings.edu/fp/cuse/analysis/>.

[93] Sköns, Bauer and Surry (note 33). See also section II above.

[94] US Department of Defense, 'Annual arms industrial capability report to Congress', Washington, DC, Feb 2004, URL <http://www.acq.osd.mil/ip/ip_products.html>, p. ii.

[95] Dunay, P. and Lachowski, L., 'Euro-Atlantic security and institutions', *SIPRI Yearbook 2005* (note 4), p. 5

[96] According to one report, 'by 2011, the [global fighter aircraft] market will reach a new post-cold war peak, with deliveries reaching $16 billion'. Report by the Teal Group (a US consulting firm) reported in Fabey, M., 'U.S. JSF casts long shadow on fighter market', *Defense News*, 6 June 2005, p. 18. See also Frost & Sullivan, 'Future fighter aircraft requirements in emerging economies', Press release, 30 Mar. 2005, URL <http://www.prnewswire.co.uk/cgi/news/release?id=142913>. There is also an increased use of unmanned air vehicles (UAVs) and the establishment of a network-centric warfare

3. *The new security environment and its demands for new types of military missions*. There is likely to be an increasing role for NATO and EU troops in crisis management and peacekeeping roles around the world.[97] This changes both the nature and structure of the required armed forces and the type of weapon systems they need.

4. *The new technologies introduced as a result of the war on terrorism*. The 'global war on terrorism', which confronts an uncertain enemy, and US homeland security have stimulated the demand for communication and surveillance technologies. Where companies do not have these technologies, they are acquiring them.[98]

5. *The degree of outsourcing of services from the military sector (armed forces and defence ministries)*. Defence ministries (particularly the US DOD) are increasingly using private companies to undertake tasks that would have been done by the military in the past.

On the other hand, long lead times and large capital investment in major weapon systems result in considerable inertia. Indeed, the military have always been relatively conservative, fighting battles with the weapons of the last war, leading to considerable inertia in procurement and planning. There are still weapon systems coming into service that were designed for the cold war, for example, the Eurofighter Typhoon.[99]

An important remaining question is how much the nature of the industry has changed. It is still greatly influenced by political pressures, both domestic and international. Governments dominate the demand for the products of the sector, and their spending and direct influence inevitably determine industrial structure: governments still decide where to buy, how to buy and what to buy, although they may now make different decisions than they would have in the past. They can still influence the size and structure of the industry, entry to and exit from the industry, efficiency and ownership, and the level of technology and exports, although they now have less control over prices and profits. In most countries the state still provides infrastructure. However, pressure groups and lobbyists are increasingly important in the governance of the industry, with Europe following in the footsteps of the USA as European state ownership and control are reduced.[100] In Europe the increased privatization of defence companies, the reduced barriers to foreign ownership and greater non-domestic procurements all continue to influence the industry.

environment. Jensen, D., 'Avionics outlook 2006: rising expectations', *Avionics Magazine*, Jan. 2006, URL <http://www.defensedaily.com/cgi/av/show_mag.cgi?pub=av&mon=0106>.

[97] Dunay and Lachowski (note 95), p. 6.

[98] Sköns and Surry (note 4), p. 387.

[99] The delays are outlined and the experience of other fighters discussed in Dane, B., 'Bumpy road for fighters', *Aviation Week & Space Technology*, 17 Jan. 2005, URL <http://www.aviationnow.com/media/pdf/sb05_fighters.pdf>, pp. 20–24. See also Forsberg, R. (ed.), *The Arms Production Dilemma* (MIT Press: Cambridge, Mass., 1994).

[100] See, e.g., Slijper, F., 'The emerging EU military–industrial complex: arms industry lobbying in Brussels', Transnational Institute Briefing Series no. 2005/1, Amsterdam, May 2005, URL <http://www.tni.org/pubs-docs/briefings.htm>.

The major defence contractors, or at least their defence sections, still differ from civil companies. While less risk is now borne by government and there is less emphasis on performance at the expense of cost, defence contractors still face elaborate rules and regulations in procurement and government's close links with procurers have been replaced by less formal but not necessarily less effective mechanisms (e.g., lobbying). Non-defence specialists continue to face considerable barriers to entering and exiting the market—marketing, procedural or technological. However, the technological barriers remain high only for specialists in particular areas.

While companies have been internationalized in terms of markets and their supply chains, they seem loyal to their home base. Incumbents are still favoured by the way in which contracts are set up and the major contractors remain expert at getting money out of governments. Governments have overhauled their procurement practices to try to deal with the 'gold plating' and the cost and time overruns of the cold war industry. As a consequence, they involve companies earlier in the development of equipment to meet particular security needs. The European Defence Agency (EDA) was established to help EU member states develop their defence capabilities for crisis-management operations under the European Security and Defence Policy. The EDA is intended to encourage EU governments to spend defence budgets on meeting future challenges, rather than past (cold war) threats, and to help identify common needs and promote collaboration.

As defence budgets declined, companies and governments made greater efforts to export weapons, particularly to developing countries. More recently, importing countries have used offsets to justify arms purchases, and arms-exporting countries and companies have thereby become involved in a process of questionable value that could potentially increase the number of producers and exacerbate the problems of overcapacity in certain areas.[101]

It would seem, therefore, that many of the characteristics of the old defence industrial base remain in spite of the extent of changes in the industry's structure. However, the clear internationalization of production, the changes in ownership, the 'spin-in' of civil technologies (such as IT and communications technology) and the increased number of civil companies in the supply chains all make this look like a very different industry. It is also one that is less easy to define and much more difficult to research, meaning that there is some concern as to how transparent the processes of procurement and production will be in the future.

With the growth of privatization across Europe it is likely that the financial sector will become increasingly important in the arms industry, as it has in the UK and the USA. The differences between the financial and corporate governance systems in most European countries and those in the UK and the USA have influenced the ways in which the respective industries have restructured. The 'last supper' in the USA involved financiers as well as companies, and

[101] eds Brauer and Dunne, *Arms Trade and Economic Development* (note 12)

Wall Street played an important role in the restructuring that followed.[102] Similarly, in the UK the financial sector and shareholders aided restructuring through their influence on company policies. In Europe the greater government ownership and the 'hands-on' involvement of institutional shareholders and bankers in company policy through their positions on boards of directors reduced the degree and speed of restructuring. The involvement of banks, investment firms and holding companies in the restructuring currently taking place in the European arms industry suggests that the process will speed up in Europe.[103] While most of the British defence industry was privatized in the past two decades, in much of the rest of Europe the state still owns a lot of the defence industrial base, although this is changing. Privatization of the major contractors is increasingly taking place in Europe and, together with the increase in foreign ownership and non-domestic procurements, is likely to have a major influence on the European industry.[104] In addition, there are previously civil companies involved in communications and IT that are feeding off demand from the 'revolution in military affairs' and the war on terrorism and expanding the international defence industrial base.

The privatization of defence services and support is a further important trend. This has been made apparent in Iraq, with companies taking on support roles that in the past the armed forces would have undertaken, even in areas of conflict. A big growth area is the provision of security—guarding people and buildings. There is a new periphery of private security companies with government contracts and 'homeland security' business and a new group of civil companies that are becoming involved in defence production.[105] The trad-

[102] Markusen (note 62).

[103] See section II above; and Sköns and Surry (note 4), p. 387. Financial companies involved include the Carlyle Group, TCG Financial Partners and Veritas Capital.

[104] Under the British Government's Private Finance Initiative (or Public–Private Partnerships) the public sector contracts to purchase services on a long-term basis in order to take advantage of private sector management skills, while it is private finance that is at risk. These services include concessions and franchises, where a private sector firm takes on the responsibility for providing a public service, including maintaining, enhancing or constructing the necessary infrastructure. This initiative is having an important impact on state–industry relations in the UK and is influencing government policy abroad. It could also lead to new entrants into the defence market. On the impact of private financing on military expenditure data see chapters 7 and 8 in this volume.

[105] For an analysis of the new developments see Wulf, H., *Internationalizing and Privatizing War and Peace* (Palgrave Macmillan: Basingstoke, 2005). Wulf distinguishes between private military companies—companies supplying consulting and planning, logistics and support, technical services and repairs, training, peacekeeping and humanitarian assistance—and private security companies—companies supplying property protection, crime prevention and correctional services (pp. 43–47). There are no detailed estimates of the size or value of these sectors, only rough approximations of their general magnitude. Peter Singer has estimated the annual revenues of the private military industry at *c*. $100 billion. Singer, P. W., *Corporate Warriors: The Rise of the Privatized Military Industry* (Cornell University Press: Ithaca, N.Y., 2003). The OECD has similarly made a rough estimate of the annual turnover of the private security sector, at $100–120 billion. Organisation for Economic Co-operation and Development (OECD), *The Security Economy* (OECD: Paris, 2004), URL <http://www.oecdbookshop.org/oecd/display.asp?SF1=DI&ST1=5LMQCR2JFHKB>, p. 8. If these estimates are accurate, then these 2 types of companies would have combined annual sales of *c*. $200 billion. See also Holmqvist, C., *Private Security Companies: The Case for Regulation*, SIPRI Policy Paper no. 9 (SIPRI: Stockholm, Jan. 2005), URL <http://www.sipri.org/>; and Brauer, J., 'An economic perspective on mercenaries, military companies, and the privatisation of force', *Cambridge Review of International Affairs*, vol. 13, no. 1 (Apr. 2000), pp. 130–46.

itional arms producers have discovered this new market and are buying up some of the start-up companies, the so-called private military firms.[106] The changing security environment is likely to have a further impact on this wider security industry, but there is at present little available information on the development of the relevant companies. The increasing privatization of defence and post-conflict reconstruction services could be producing a group of influential, profit-chasing companies that have a vested interest in conflict. This could lead to pressures on governments to extend conflicts or initiate new ones. In the past the arms-producing companies had a vested interest in the production of weapons and in increasing demand for them, but they did not necessarily benefit from actual conflict. As Herbert Wulf argues, there is a need for an international governance structure to deal with the erosion of the state monopoly of force.[107]

The developing world

While these changes were taking place in the developed world, adjustments were also taking place in the developing world. Research at SIPRI in the 1980s had correctly assessed that the observed fast growth in arms production capacity in developing countries would be inadequate to permit self-sufficiency or create competition for the developed world.[108] The end of the cold war and the superpower confrontation removed much of the pressure and support for the maintenance of high military burdens in the developing world. The lack of superpower involvement generally reduced tensions, military and military-related aid, and the scale of conflicts (although the number of conflicts increased).

While the large arms industries in China and India are to a great extent insulated from external competition, some other relatively more advanced arms-producing countries in the developing world have also sustained their arms production, for domestic procurement as well as for exports. During the five-year period 2000–2004, there were seven developing countries among the 30 largest exporters of major weapons: China, Israel, South Korea, Brazil, Indonesia, South Africa and North Korea.[109] India comes further down on the list in spite of its large arms industry. It has a strong import dependency and its rate of self-reliance in arms procurement is only 30 per cent.[110]

Among the remaining developing countries, by the late 1990s, 20–30 were engaged in some form of arms production and arms exports or re-exports.[111] Indigenous arms production efforts are often justified on economic grounds, providing spill-over or spin-off effects on civil industry and foreign exchange

[106] Wulf (note 105), p. 194.

[107] Wulf (note 105), p. 207. See also Holmqvist (note 105).

[108] Brzoska and Ohlson (note 36).

[109] Wezeman, S. T. and Bromley, M., 'The volume of transfers of major conventional weapons: by recipients and suppliers, 2000–2004', *SIPRI Yearbook 2005* (note 4), table 10A.2, pp. 453–54.

[110] Markusen, A. R., DiGiovanni, S. and Leary, M. C. (eds), *From Defense to Development: International Perspectives on Realizing the Peace Dividend* (Routledge: London, 2003), p. 191.

[111] Brauer (note 12).

earnings through exports, although there is no convincing economic argument or evidence that such economic benefits exist.[112] Offset arrangements and licensed production have often been seen as a means of promoting domestic production and improving the technological level of the systems produced, although some countries now seek the technical know-how to be an intelligent customer rather than aiming to become a producer.[113] Producing small arms and relatively unsophisticated weapon systems is an achievable goal for most developing economies with some industrial base, but developing an arms industry capable of producing large advanced weapon systems is no longer feasible.[114]

These trends were reflected in the SIPRI Top 100 arms-producing companies: although a number of companies based in developing countries have shown some potential of becoming international players, none has made it so far. Indeed, the changing nature of arms production and the restructuring of the market have reduced the opportunities for less-established companies to become more than links in the supply chains of the major international players.

IV. Conclusions

In 2004 there was yet another substantial increase in arms sales by the Top 100 arms-producing companies, although the increase was less pronounced than in 2003. The USA continues to dominate the industry and the companies in the list are little changed. There was some important merger and acquisition activity in 2005, but at a slower pace than in 2004. Further consolidation and restructuring are likely, particularly in Europe, and the industry is likely to continue to expand its supply chain, across both industries and countries. Governments will focus more on capability than on production. Non-US companies will continue to attempt to access the US market and the industry is likely to continue to internationalize.

There have been marked changes in the international arms industry since the end of the cold war and further change can be expected. The arms market continues to have a set of unique characteristics, such as the considerable barriers to entry and exit. Some companies have 'survived' from the traditional cold war arms market while others have managed to exit or enter the new market. A noteworthy trend has been the privatization of defence services and support, which has expanded the security services industry as a periphery around the core arms industry. This could have implications in terms of accountability and transparency and certainly has implications for SIPRI's Arms Production Project. While the project has been a valuable source of

[112] Brauer (note 12); and Brzoska and Ohlson (note 36). Brauer argues that the evidence suggests that the arms industries in developing countries depended crucially on already established civil capacities and there in no evidence that arms exports provided net foreign exchange.

[113] Brauer, J. and Dunne, J. P., 'Arms trade offsets and development', *Africanus*, vol. 35, no. 1 (2005), pp. 14–24.

[114] eds Markusen et al. (note 110).

impartial information, data and research, which has greatly improved the understanding of the post-cold war arms industry, these changes present new challenges. Meeting them will require further data collection and research activities in order to capture the changing nature, extent and visibility of the international arms and security industry.