

The European armaments industry at the crossroads

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In the coming decade, one of the most significant decisions facing European defence planners, as well as their US counterparts, will concern the extent to which their defence industries will be internationalized.¹ The '1992 Plan' of the European Community (EC), the proposals of the Independent European Programme Group (IEPG) for integrating defence markets, and a series of new NATO armaments projects highlight the heightened interest in internationalizing the West European defence industrial base. This article examines the causes and consequences of the recent trend towards opening European defence industries to international competition, and explores the dilemmas facing policy-makers charged with crafting European defence industrial policy. These policy-makers face three fundamental questions: What is the appropriate mix between free-market competition and state-to-state collaboration in Europe? Should European armaments procurement be based on a notion of 'European preference' that discriminates against foreign products? What institutional form should European armaments co-operation take?

European procurement policy: the traditional model

European governments possess four options for procuring major weapons systems. In order of increasing national independence, these are: (i) import weapons from abroad; (ii) produce weapons under a foreign licence ('co-production'); (iii) design and produce weapons in co-operation with foreign nations ('co-development'); and (iv) design and produce weapons domestically. Unless a country enjoys a decisive comparative advantage in the production of a given weapons system and can procure enough domestically to permit the exploitation of large economies of scale – a situation which European countries enjoy only in a few, relatively specialized areas – it faces a trade-off between 'independence' and price. Without large exports, the closer towards domestic production a nation moves, the higher the unit price of the weapons system.

Despite high costs, European countries procure most of their weapons at home. The UK and France purchase 70–80% of major weapons systems domestically, bolstered by about 5–10% imports (mostly certain transport and surveillance aircraft) and 15–20% licensed production (largely from the US) and international co-development projects (mostly European).²

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Slightly higher percentages of co-production and co-development for the UK reflect reliance on the US for nuclear and other technologies, and a commitment to the *Tornado* and European Fighter Aircraft (EFA) projects. West Germany and Italy and the smaller NATO countries, because of their lack of nuclear weapons, relatively low military research and development (R&D) spending, and lack of traditional export markets, rely less on domestic production and more on imports, co-production or co-development projects. European co-development has generally taken the form of *ad hoc* intergovernmental arrangements negotiated on a project-by-project basis.

Table I: Approximate percentages of major weapons procurement from various sources for European countries, 1985-9

Country	Domestic	Co-development	Co-production	Imports
France	80%	15%	-	5%
UK	75%	15%	-	10%
FRG	45%	25%	20%	10%

Note: These figures are drawn from official figures, and include major weapons systems: armour, artillery, tactical vehicles, naval vessels, aircraft, rockets, missiles and space satellites. These systems generally total 40-60% of French, West German and UK equipment procurement budgets. As many of the projects may involve foreign components, these figures should not be taken as a measure of 'European content'. The following sources were used: François Fillon, *Rapport fait au nom de la Commission de la Défense Nationale* . . . (Paris: Assemblée Nationale, 1987), pp. 73ff; UK Ministry of Defence, *Statement of the Defence Estimates 1989*, vol. II (London: HMSO, 1989), pp. 5, 11, 13, 15-19; SIPRI, *World Armaments and Disarmament Yearbook 1988* (Oxford: Oxford University Press, 1988), pp. 129-201, *passim*; *The Military Balance* (London: IISS, various years); US Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers* (Washington DC: ACDA, various years); Edward Kolodziej, *Making and Marketing Arms: The French Experience and its Implications for the International System* (Princeton, NJ: Princeton University Press, 1987), pp. 98-9, 153-5; Seventh Report from the House of Commons Defence Committee of Session 1987-1988, *The Defence Estimates* (London: HMSO, 1988), p. 35; and selected Jane's reference publications.

The basis in favour of national production, backed by preferential arrangements and subsidies to domestic firms, has been justified on military, political and economic grounds. The capacity to develop weapons suited to a nation's particular strategic environment or restock troops or modify equipment from domestic sources is often cited as an important wartime asset.³ Domestic production can reduce vulnerability to boycotts or blockades. Arms transfers are widely viewed as important sources of national prestige and diplomatic leverage. Some collaborative projects, particularly between France and West Germany, were initiated in part for diplomatic reasons, ranging from the Franco-German desire to seal their reconciliation in the 1950s to Helmut Schmidt and Valéry Giscard d'Estaing's plan two decades later to strengthen security collaboration.

Yet these security-related concerns are rarely of decisive importance. The lists of equipment that cannot be procured abroad by European governments purely for reasons of national security are reportedly quite short.⁴ In the minds of European (and American) politicians, *economic* justifications for national production tend to loom larger.⁵ Compared to imports, domestic armaments production is believed to bolster national economies through job creation, stronger capital investment, technological spin-offs and export possibilities. National programmes help to avert large imports of arms from abroad, which might cause significant pressures on the balance of payments. Protectionist policies aimed at keeping redundant industries in business are ubiquitous.

The crisis of the European defence industry

This traditional European approach to defence procurement, consisting of domestic procurement backed by *ad hoc* collaboration and occasional imports, is now universally agreed to be in crisis. Its roots lie in the increasing sophistication of armaments systems, which has increased their unit cost exponentially and reduced the number produced accordingly. If declining quantities of weapons were being offset by increases in quality, there would be little cause for concern. But this is not the case: the cost of a given unit of increased performance (the cost/performance ratio) of new fighter aircraft, for example, has been steadily increasing for three decades at a real annual rate of between 0.5 and 1.2%.⁶

This unsatisfactory trade-off between quantity and quality can be explained by two factors. First, the higher performance of each successive generation of weapons can be bought only through an increase in up-front research, development and production costs, both in absolute and percentage terms.⁷ For example, fixed costs total between 30–40% of the total cost of new fighters developed by a single European country.⁸ The only way to amortize the increasing share of fixed costs without disproportionate increases in the unit price is to lengthen, not shorten, production runs.

The second reason for the unsatisfactory trade-off between quality and quantity is the existence of 'learning economies', an industrial phenomenon whereby employees and managers engaged in the production of highly complex systems require considerable experience before they learn to work efficiently. This 'learning curve' effect is significant: a common rule of thumb for aerospace is that the unit price declines by 15–20% for each doubling of production. The more complex the system, the more severe the R&D and learning diseconomies created by shorter production runs. These trends have led to a situation that one leading analyst has termed 'structural disarmament' – a syndrome whereby the decentralization of Western defence production condemns it to become more inefficient as it becomes technologically more sophisticated. This effect is particularly striking as compared to the Warsaw Pact, where transnational rationalization permits longer production runs of fewer designs.

Until recently, European governments coped with rising costs by subsidizing aerospace industries, or by extending production runs through exports. A firm like Avions Marcel Dassault, the French military aircraft manufacturer, exported 60–70% of production over the past decade. However, exports no longer suffice to keep the necessary subsidies at a level that European governments consider acceptable. Not only have fixed costs continued to increase, but a number of new trends that emerged in the mid-1980s have limited production, including the sudden collapse of the less-developed country (LDC) export markets and declining real defence budgets in the developed West. Dassault, for example, must produce around 40 export aircraft a year to avoid radical restructuring; in 1986 and 1987, it received only one new foreign order.⁹ The shrinking of LDC export markets, particularly among Arab states, is worrisome to European producers like Dassault because it appears, at least in part, to be a permanent result of the emergence (or re-emergence) of new competitors. Recent developments in Eastern Europe are likely to exacerbate downward pressure on production runs.

NEW TRENDS TOWARDS COMPETITION AND GLOBALIZATION

European governments, unwilling or unable to continue providing the large amounts of capital necessary to retain a national defence industry, have moved to introduce more competition into national defence industries. The UK Ministry of Defence took the lead in 1983 with its reforms designed to achieve 'more value for money'. The French government, led by the Délégation Générale pour l'Armement, has shifted R&D from government to industry, and is exploring options for turning the government arsenal, GIAT, into a nationalized company with 'private status' (*société de droit privé*).¹⁰ The West German government has encouraged Daimler-Benz to venture into the military electronics and aerospace industry, with the long-term goal of replacing some state subsidies with private capital.

However, the potential savings from competition are surely not much greater than 10% of equipment costs at the most.¹¹ National measures of this kind do not attack the root cause of rising costs, which is inadequate production runs. In the past few years, governments, realizing this, also began to encourage new forms of international co-operation. It is now part of the standard operating procedure of French, West German and UK procurement officials to seek out options for collaborative production of major systems. European governments are also increasingly prepared to contemplate procuring foreign systems. An unprecedented element is the willingness to countenance international collaboration between firms in the form of mergers and acquisitions (M&A), transborder investment and the launching of common product lines.

These industrial moves have been heralded as the beginnings of the long-awaited horizontal integration of the European defence industry. But this activity is not yet leading to the formation of armaments firms of a truly European scale. Most recent M&A in the defence sector have been

between firms based in the same country, as with the Daimler-Benz takeover, the merging of Thomson and Aérospatiale's avionics activities, and British Aerospace's purchase of Royal Ordnance. As far as cross-border M&A are concerned, market forces appear thus far to be leading towards *transatlantic*, rather than *European*, integration. Most international M&A have involved UK (and a few French) purchases of US domestic firms, or American purchases of UK firms. Recent M&A are also limited sectorially. Most involve the purchase of electronics firms in order to integrate production vertically, rather than horizontal integration to increase economies of scale in a single product line. Such vertical concentration may actually render defence production less efficient, since it suppresses competition for subcontracts.¹²

For the moment, European horizontal integration is largely limited to symbolic 'corporate alliances' – exchanges of small amounts of ownership, or collaboration in certain product areas – rather than M&A. Such alliances offer the prospect of strengthening the trend towards international rationalization of production only if they result in common projects. This, in turn, depends on governmental initiatives.

GOVERNMENTAL PROPOSALS

How far the process of industrial rationalization continues and the extent to which it affects procurement decisions will thus depend on the decisions of politicians. Rationalization would result in the elimination of excess capacity in European arms industries, estimated at 60,000 jobs in the French industry alone.¹³ But the prospect of an arms industry shake-out raises the question of how European governments are to decide which firms (or consortia of firms) should be permitted to continue designing and producing armaments. It is disagreements over this point, more than any other, that have thwarted agreement on recent proposals for large European collaborative projects. Proposals which may help shape this process have been tabled in various international organizations: the EC, the NATO Council of National Armaments Directors (CNAD), and the IEPG (founded in 1976 and comprising all European members of the Atlantic Alliance, excluding Iceland, but including France).

THE EUROPEAN COMMUNITY

Since Article 223 of the Treaty of Rome specifically exempts arms production and trade from the jurisdiction of the EC, the EC plays a sharply circumscribed role in defence sectors. The '1992 initiative', aimed at liberalizing the internal commercial market by the end of that year, will not affect military markets directly.¹⁴ It may, however, have an important *indirect* effect on defence production, particularly in areas dependent on dual-use technologies. These effects will most likely be found in those areas of technological spillover between civilian and military technology where civilian technology is leading, since it is in these sectors that competitiveness depends on the rationalization of civilian production.¹⁵

The most striking cases are in the electronics and telecommunications industries. If large corporate alliances and takeovers, such as the Siemens-GEC raid on Plessey, are successful, governments may be left with little practical alternative but to permit the international integration of military electronics.

One must be careful, however, not to extrapolate this trend too far. Even though electronics equipment comprises a significant and rapidly increasing share of modern weapons systems – reaching 35–60% of cost in modern aircraft – it is not typical of the armaments industry as a whole, in which electronics comprise no more than 25% of equipment purchases and where most products are still custom-made.

THE NATO COUNCIL OF NATIONAL ARMAMENTS DIRECTORS

The NATO CNAD, after years of serving as a rubber stamp for *ad hoc* projects previously negotiated between NATO governments, has begun to take the initiative in developing military requirements for programmes like the NFR-90 (the ‘NATO frigate’) and new infrastructure programmes. Many of these programmes involve US funding under the so-called ‘Nunn Amendment’ (the Roth-Glenn-Nunn Amendment to the National Defense Authorization for FY 1986), which sets aside \$(US) 100–150 million a year for NATO collaborative projects.¹⁶ The US Department of Defense has announced its intention to increase the percentage of military R&D conducted collaboratively from the current level of 3% to 25% by the end of the century. A new generation of C³I and infrastructure programmes have integrated even the previously recalcitrant France to a greater degree into NATO procurement decision-making. More recently, however, some of these programmes, like the advanced short-range air-to-air missile (ASRAAM) and the NFR-90, have been the source of considerable controversy and may be abandoned.

THE INDEPENDENT EUROPEAN PROGRAMME GROUP

The most detailed and potentially most far-reaching initiatives come from the IEPG. After nearly a decade of relative inactivity, the IEPG began in the mid-1980s to meet at regular intervals and appointed a group of ten ‘wise men’, headed by former Dutch Defence Minister Vredeling, to make recommendations for improving the competitiveness of the European defence industries and the efficiency of European procurement. Their two-volume report, *Towards a Stronger Europe*, completed in February 1987, made numerous recommendations, including that European governments open up national procurement to European competitors.¹⁷

In November 1988, IEPG defence ministers approved an ‘Action Plan’ that designated the IEPG as the major organization for co-ordinating European defence industrial co-operation, and proposed a programme for creating a ‘common European arms market’. The plan calls for open bidding procedures, a standardized reporting system for cross-border contracts, aid for the defence industries of Greece, Turkey and Portugal, and the creation of a small secretariat in Lisbon. The importance of

harmonizing military requirements was acknowledged, and French proposals for a common European military research programme modelled on EUREKA or ESPRIT were accepted for discussion. Most importantly, the plan calls for more open competition for contracts, subject to the proviso that the gains from all projects should balance one another out ('*juste retour*' or 'fair return') over an 'appropriate' period of time.¹⁸ Finally, the plan recommends more European co-development projects, particularly in the form of 'competing consortia' – a compromise between free trade and collaboration whereby governments foster competition between multinational consortia, each of which contains a member from each procuring country. This approach is strongly supported by smaller defence firms, such as MATRA in France, who wish to avoid being taken over by larger 'national champions'.

Two principles of co-operation: free market vs *juste retour*

In order to assess the relative merits of these proposals, it is necessary to see that underlying them are two opposing principles by which the distribution of production between countries can be organized. The first is the *liberal* or *free-market* principle, according to which production shares are decided by market forces, based on the free movement of capital, persons, goods and services. This principle underlies attempts to inject competition into the procurement process. The second is the *juste retour* principle, according to which production workshares and design tasks are negotiated between governments, with each participating country assuming costs and receiving benefits in proportion to the percentage of finance provided and the number of units procured by its government. While it is often assumed that competition is inherently superior to collaboration, in fact each approach has its advantages and disadvantages.

THE FREE MARKET

The application of free-market principles would introduce competition into the defence procurement process, thereby promising, according to classical economic theory, increased efficiency and rationalization through greater economies of scale. Firms would be free to merge or combine in any way, and European governments would solicit bids from all firms on the international market. Decisions over the survival of firms would be left to market forces. Procurement officials cite recent experiments with competition between (domestic) systems producers, particularly in the US and the UK, which have reportedly resulted in cost savings totalling up to 10% of procurement budgets.

Yet there are powerful political, military and economic arguments against complete liberalization, either in Western Europe or the US. As noted above, governments have military reasons for favouring domestic control over some defence technologies. More importantly, European politicians would be unlikely to permit any 'national champion' armaments manufacturers to go out of business. The need to maintain solvent firms in the face of high fixed costs creates political pressure – an effect

known as the 'follow-on imperative' – to assure each firm a constant flow of contracts.¹⁹ With life-cycles of weapons lasting two decades or more, a producer who loses even a single large contract is unlikely to be around in a few decades to recoup the loss. Thus, neither the UK nor France (and increasingly not West Germany either) will award a major contract to a non-national firm or a consortium in which its firms do not participate. Even if these domestic political obstacles could be overcome, any attempt to open arms procurement across-the-board to foreign suppliers would have to be co-ordinated painstakingly between governments. As Philip Gummert and William Walker have observed, 'liberalization in one country, particularly a relatively small one, may be self-defeating if it is not part of an international trend.'²⁰

Most of these analysts assume, however, that *if* liberalization were politically or militarily possible, it would be economically desirable. In fact, however, the classical economic argument for free trade in arms is misleading. The arms market does not and cannot function as a free market. It is a highly regulated oligopoly with a number of inherent market imperfections. Given these market imperfections, policies which are 'second best' from a classical economic perspective are often more effective than free competition at encouraging efficiency and rationalization.²¹

One such imperfection is that efficiency in arms production does not result primarily from inherent comparative advantages in the factors or conditions of production (e.g., labour costs, organizational skill, etc.), but from the length of domestic production runs and subsidized R&D spending. The size of domestic markets and the amount of money spent by governments on military R&D and procurement vary widely, and would grant an advantage, perhaps decisive, to firms in countries, such as the US, France or the UK, which are willing and able to invest in large R&D and procurement budgets.

Many critics of European procurement policy, from US Congressmen to European generals, respond that European governments should nevertheless buy American products 'off-the-shelf'. US industry, it is said, has a comparative advantage in this area; European industry would do best to specialize in other products.²² There is an undeniable military logic to this argument, since US aircraft are the cheapest on the market and Europeans could conceivably purchase greater numbers, but the available evidence suggests the appeal to classical economics is spurious. Data on cost/performance ratios provide the best measure of how efficiently various firms produce a given 'unit of weapons performance'. According to data on fighter production, US producers are not, at least in aerospace, the cheapest because they are more efficient than their European counterparts. Instead, their prices are lower primarily because they enjoy the advantage of large, guaranteed production runs created by US military procurement, as well as greater R&D spending.²³ Any small transatlantic discrepancies in efficiency are insignificant compared to the disparity between the lengths of US and European production runs, which create cost differentials of between 20–50%.²⁴

Where European producers receive adequate R&D support and can achieve production runs of a scale similar to those enjoyed by US firms by exports or domestic procurement – as in West German *Leopard* tanks, French *Mirage* jets or Euromissile anti-tank missiles – European producers, both national and collaborative, have occasionally captured a predominant share of the world market.²⁵ Yet such areas of potential European advantage are few, because European R&D and procurement spending represents only 25–40% of the US figure. Transatlantic free trade – if it could be negotiated – might well lead to the domination of European markets by American firms, just as some UK and French firms would threaten to dominate a closed European free-trade area.²⁶

Some might argue that the market advantage that results from relatively high R&D spending is deserved: those nations willing to devote resources to military R&D and procurement should reap the benefit. But this uncovers a second, more fundamental flaw in the economic argument for free trade in arms, which is that optimal economies of scale are so great in some areas, such as fighter production, that the free play of market forces threatens to eliminate all but one producer – a situation known to economists as a ‘natural monopoly’.²⁷ Under a global monopoly – which is close to formation, for example, in the market for high-end fighters like the Advanced Tactical Fighter (ATF) – the incentive to offer foreign buyers competitive terms would vanish.²⁸ Competition would be extinguished and the remaining firm could charge monopoly rents – as Boeing reportedly does on sales of the B-747 civilian jetliner, on which some analysts claim it charges a 25% premium. US firms are accused of having attempted to do this on prospective sales of the advanced medium-range air-to-air missile (AMRAAM) in Europe.²⁹

The existence of natural monopolies means that even if trade barriers were eliminated and R&D spending were equalized, American producers might dominate world markets simply because of their current market position – the legacy of four decades of assured access to generous R&D spending and a large domestic market. For many Europeans, one of the lessons of the *Lavi* and Japanese FSX fighter cases, where the US used its dominant power to shape foreign defence industrial decisions, is that the attractive prices or offsets that European producers gained in the past were due to the existence of competitors, either in Europe or in the US. The same argument applies *within* Europe: if the market were closed to American firms, certain French and UK firms might be able to establish a permanent monopoly over certain products.

Governments can seek to prevent the formation of monopolies by subsidizing artificial competition. But subsidizing competition in the face of a natural monopoly can be extremely expensive, particularly where large, complex weapons platforms are involved – perhaps more expensive than tolerating and regulating a collaborative monopoly. Artificial competition requires that the buyer(s) award minimum sustaining quantities and minimum R&D subsidies to both competitors. As Thomas McNaugher observes, ‘historic trends toward the purchase of more

expensive aircraft in smaller numbers have long since passed the point at which competitive production of key aerospace systems is likely to pay for itself, let alone save money.³⁰ The point is being reached where the same can be said of competitive development and prototyping of aircraft. For example, *each* of the two consortia competing for the US Air Force ATF contract will spend around \$800 million, in addition to over \$500 billion of government subsidy, developing its respective prototype.³¹

The same objections apply to the IEPG model of competing consortia. Such an arrangement would be stable only if European governments can afford to finance and procure from more than one source. In many areas, such as aircraft production, competition between consortia would involve the deliberate duplication of R&D, prototyping, testing or production – the costs of which may already be beyond most European nations.

Are European countries, which are on the whole less concerned with technological superiority and more with price than the US, likely to perceive a net gain from paying the high price of competition? It seems unlikely. Even if they were so inclined, the scale of expenditure would probably require interstate agreements on a continental scale, which simply brings European countries back to the sort of collaborative projects that free trade was intended to replace.

JUSTE RETOUR

European governments have considerable experience with co-development projects. In most such projects, the costs and benefits are formally negotiated between the participants according to the principle of *juste retour*, according to which the share of work each participating nation receives, as well as the burden of financing it, is proportional to the percentage of the production it procures. Once this basic rule is set, the precise tasks allotted to each country are carefully negotiated, generally with efforts made to distribute the technologically challenging portions equitably. *Juste retour* has been the basis of nearly all successful European collaborative projects.

From an economic point of view, *juste retour* works like a cartel, in which the participants divide market shares between them; consequently economists criticize it for suppressing competition. If rigorously enforced, it imposes inherent limits on economically efficient subcontracting. Disagreements between firms are not adjudicated by corporate executives, but by politicians. Government intervention is widely believed to introduce many unnecessary inefficiencies into collaborative projects, such as prolonged diplomatic negotiations, multiple production lines, inflated administrative costs, and delays due to the lack of a clearly responsible main contractor. The uncertainty connected with the management of international projects is widely believed to account for excessive cost overruns. These problems, along with the rise of newly competitive defence industries (like those of West Germany and Italy) demanding an equal share in European projects, have led some to suggest that 'the heyday of co-operation is behind us'.

Europe, they argue, cannot support a further increase in the proportion of intergovernmental collaborative projects.³²

There is much evidence to suggest, however, that the disadvantages of collaborative programmes organized by *juste retour* have been greatly exaggerated. The widespread view that collaborative projects are intrinsically more costly than single-nation ones is not supported by the available data. One oft-cited version of the conventional wisdom on this point can be traced back to a bold, back-of-the-envelope estimate by a French *haut fonctionnaire* in the 1970s, who proclaimed that the unit cost of a weapons system increases by the square-root of the number of countries participating in its development.³³ The Cartesian elegance of its logic notwithstanding, this estimate has no empirical basis. On the contrary, the data on the cost-performance ratios of fighter aircraft cited above demonstrate that European collaborative programmes are, on average, marginally *more* efficient than programmes run by single European countries. (This is quite aside from the additional savings accruing to any single country lengthening production runs or by dividing the fixed costs of R&D and production with its collaborative partners.) Moreover, the direct administrative costs of European projects tend to be low: the *Tornado* project, for example, employed no more than 300 administrative employees, with 30–50 additional in each country.³⁴

The claim that collaboration leads to delays and cost overruns finds similarly little statistical support. On average, European collaborative projects, while requiring somewhat more development time than American single-service projects, last only slightly longer than single-nation European projects – a fact that might well be accounted for by their greater sophistication.³⁵ Nor are the cost-overruns of collaborative programmes in any way exceptional. Despite much bad publicity, for example, the cost of the Anglo-Italo-German *Tornado* fighter – properly adjusted for inflation, exchange-rate shifts and changes in military specifications – came in at no more than 10–15% over budget, which compares very favourably with other swing-wing multi-role aircraft of that generation, such as the still-born Dassault *Mirage-VG* and the notorious General Dynamics/Grumman F-111.³⁶

Another criticism of collaborative projects is that they tend to produce multi-role weapons that reflect a compromise between various national missions and hence are ill-suited to any single task. The disagreements between participants in programmes like *Tornado*, *Alpha Jet* and *Transall* suggest that there may be some truth to this allegation, but such problems are hardly unique to collaborative aircraft. Due to rising costs, almost all tactical aircraft now under development, including the ATF, *Rafale* and EFA, are multi-role. Indeed, the experience of some recent single-nation projects suggests that they are under even more pressure than collaborative projects to fulfil several functions.³⁷

Thus, the available data do not support the view that collaborative programmes are, on average, less efficient than single-nation programmes. Those who argue that the era of large collaborative projects is ended are

overly pessimistic. Co-development consortia will persist – whether under the guise of ‘teaming’ among US firms, corporate alliances among European firms, or government-sponsored transnational projects – because there is no realistic economic alternative for the production of complex systems.³⁸ All combat aircraft being produced or developed in Europe, except the French *Mirage 2000* and *Rafale*, as well as close to 75% of European missiles, are already co-developed or co-produced, and there is evidence that governments and firms are learning to collaborate more efficiently over time.³⁹ It should be noted, however, that collaborative production is not particularly advantageous for weapons where fixed costs are low and optimally efficient economies of scale are no larger than a national market. In such cases, there is little incentive to invest time and effort into negotiating and managing an international arrangement based on *juste retour*.

Striking a balance between competition and collaboration

The principles of *juste retour* and free trade are, to a large extent, mutually exclusive. The difficulty of reconciling the two is illustrated by the IEPG Report, which calls for a ‘single European arms market’ with competitive bidding, while recommending aid to ‘less developed’ defence industries, and that each participant must get *juste retour* over an ‘acceptable’ period of time. The IEPG remains diplomatically vague about the resolution of this tension. Neither principle by itself is a wholly satisfactory organizing principle for all European arms production.

One way to reconcile competition and collaboration is to distinguish the types of products for which each is most efficient. The advantages and disadvantages of each type of international co-operation can be summarized by considering a European arms procurement system as consisting of three tiers (see Table II): (i) *collaborative co-development on juste retour* terms for the most expensive products; (ii) *competing consortia* for the intermediate products (or products in which there is a great deal of product differentiation); and (iii) *managed free trade* for lower-cost products.

The *collaboration model* is appropriate to those areas, like the production of large weapons platforms, where high fixed costs and natural monopolies render competition too costly. Typically, there is only one ‘national champion’ per country and economies of scale are still suboptimal. In this area, *juste retour* is a political necessity, since these projects are essentially ‘core programmes’ for national champions which cannot be cancelled. There are many additional opportunities for efficient European co-development, including the production of main battle tanks, ships, helicopters and large missiles. The *competing consortia model*, on the other hand, is appropriate to those areas, like small missiles, radars and major subsystems, where each European government is willing to finance more than one firm or design team, and where there are a wide number of specialized markets in which to sell. Finally, the *managed free-trade model* works well in niches of the armaments market where there are numerous small or extremely specialized producers, each selling goods

for use in a number of different weapons systems, and where no country sees a decisive strategic interest in maintaining technological competence. Typically, fixed costs are low and production runs long. Moreover, this is an area where competition might be most advantageous, since components makers are often monopolists or oligopolists in their home market, yet are difficult to regulate due to their small size.⁴⁰

Table II: Model of the evolution of the European defence industry

Model of co-operation	Products	Approximate development costs
Collaboration	<i>Large systems design:</i> fighters, aircraft engines, helicopters, large missiles, nuclear systems (e.g., the products of the Euromissile, <i>Tornado</i> and F-16 consortia)	\$2-5 billion
Competing consortia	<i>Medium-sized systems and major subsystems:</i> electronics, smaller missiles and armour (e.g., tanks, radar and avionics systems, small engines)	\$500 million-2 billion
Managed trade	<i>Smaller components and low-technology systems:</i> small transport planes, conventional munitions, small arms, minor aerospace items (e.g., displays, precision equipment, some raw materials, rifles)	less than \$500 million

The boundaries between these categories are sometimes indistinct. For example, the trade-off between competition and collaboration can be softened by subcontracting in large projects competitively. Competition sometimes becomes economical if sophisticated systems can be broken down into specialized components. Competitive subcontracting at the subsystem level is found in many large US and European projects, such as the EFA, in which a battle, involving detailed cost estimates, broke out between two competing radar consortia. Nonetheless, the extent to which subcontracts can be awarded competitively often remains limited by the need to fulfil obligations of *juste retour*, regardless of whether the contract is negotiated by procuring governments or by the firms themselves.

European preference and transatlantic trade

The equity of the transatlantic arms trade (the 'two-way street') has long been debated in NATO. In recent years, the US government has shown an

increasing willingness to co-produce European systems like the *Hawk*, *Harrier* and the RITA battlefield communications system. The ratio of European imports to US imports has dropped from 8:1 in the late 1970s to about 2:1 today. But US policy still generates controversy in Europe. Since World War I, the US has imported only one major system from abroad – the initial order of the UK *Harrier* V/STOL fighter by the Marine Corps. On investment policy, Europeans assert, US procurement policy is actively protectionist. Although the ‘Buy American Act’ can be and often is waived for arms procurement, Congress watches large procurements closely. In practice, European firms must generally find a majority US partner before bidding on projects. While some European firms, such as Plessey, have been able to acquire American contractors without losing access to classified US technologies, most experience great difficulty. The US government refuses to share its most sophisticated technology, such as ‘stealth’ anti-radar detection measures, with its NATO allies, even through exports.

If the US protects its market, many Europeans ask, why shouldn’t Europe? The French Minister of Defence, Jean-Pierre Chevènement, has advocated the creation of a European ‘community-preference’ zone as a possible response.⁴¹ One concrete suggestion to implement this has been the European Commission’s September 1988 proposal for a 10% tariff on arms imports into Europe.⁴²

But Euro-protection is not a viable across-the-board defence industrial strategy. First, it is likely to be expensive. The *Nimrod* case, in which the UK government poured nearly two billion pounds into development of an airborne command-and-control system before cancelling the project, is the most obvious example of the potential costs. But the arms industries of many European countries are also dependent on transatlantic trade at the level of components for the measure of independence they enjoy. All countries in Europe, even France and the UK, rely on imports of American arms or the use of US licences. Fifty per cent of the missiles procured by European governments are US designs, and between 10–30% of the components in the *Tornado* (depending on the model) were American in origin. In the early 1970s, Gen. David C. Jones, then Air Force Chief of Staff, arranged to provide licences for 146 essential technologies – including the Texas Instruments terrain-following radar and the essential swing-wing box technology from the F-111 – without which the *Tornado* would have been much more costly or perhaps impossible.⁴³

Certainly, some of this dependence at the level of complete systems will decline naturally. For example, by the end of the century, over 80% of the Allied aircraft in NATO will be European designs, the only exceptions being upgrades of the existing Belgian, Dutch, Norwegian and Danish F-16s. But transatlantic trade in subsystems and components is nonetheless increasing in importance.

The second disadvantage of closing the European market is the risk of American retaliation. By virtue of its sheer size and technological power, the US presents a unique market opportunity for Europe, and some

European firms already have substantial and increasing export interests in the United States. The sale of even a minor weapons system, such as RITA, can have a substantial impact on a defence sector the size of France's. As a result of acquisitions in the US, Plessey has increased its exports from 10–50% of sales in less than a decade, while GEC Avionics has become the largest supplier of head-up displays to the US Air Force.⁴⁴ French firms like Thomson are deeply involved in new NATO infrastructure projects.

These export interests would be placed at risk by European protection. Since the FSX controversy, US Commerce Department officials now play a statutory role in all such decisions, reflecting their political sensitivity after the FSX case. Retaliation against European firms doing business in the United States is not implausible. Mack Mattingly, a senior US official serving as NATO Assistant Secretary General for Defence Support, fired a warning shot in March 1989 when he criticized the IEPG for excluding observers and thereby worsening its reputation as 'an inward-looking, cozy Europe-only club, not . . . a contributor to wider Atlantic cohesion'.⁴⁵ Neither side can afford such conflict, but in a transatlantic arms-trade war it is the Europeans who will probably lose disproportionately, for their firms are dependent on the US for a higher percentage of their business than American firms are dependent on Europe. There will be no increase in exports of major US systems to the five largest countries in Europe, but exports of components will continue and new opportunities for collaborative projects may emerge.

Attempts by the EC to tax imported military goods are unlikely to be accepted by the member states, although they may be forced to concede the legal right of the Community to levy such tariffs. One possible outcome would be the establishment of an 'end-user' criterion for assessing tariffs on dual-use goods, which would probably result in a further reduction in the number of military goods subject to EC tariffs.

In the long run, the central question facing European (and US) planners is whether European industry will be encouraged to evolve towards the model set forth in the IEPG Report, a semi-autarkic European industrial 'pillar' with some subcontracting and government-to-government trade with the US, or towards a set of transatlantic corporate alliances or mergers between European and American firms, each with strong technological capabilities and links to other firms on its continent.⁴⁶ The latter is by far the more attractive model. The creation of a European pillar would permit transatlantic trade only through a 'family of weapons' arrangement, whereby specific product lines are assigned to countries. In theory, for example, it might seem logical to negotiate an arrangement whereby European firms specialize in low-end fighters and US firms in high-end fighters. In practice, however, this would require an unrealistic amount of international trust, and would surely fall victim to the same syndrome of divergent expectations and bureaucratic or industrial opposition that befell the AMRAAM/ASRAAM project. Market-sharing agreements of this kind have a poor history, in part because it is always easier for the larger partner to back out of its part of the bargain. Nor

would co-development on an equal basis – an area in which the US, with its large domestic market and tradition of insular procurement policies, has little experience – be likely to be accepted in the US. Hence it is alliances or joint research and development projects at the industrial level, rather than projects or trade negotiated state-to-state, that offer the best prospects for creating reliable collaborative partners on both sides of the Atlantic. Here, the Nunn programmes are a valuable precedent.

The extent to which such alliances are possible or profitable will depend on the extent to which American and European policy-makers are willing to recognize them as legitimate. The role of the American government will be decisive. The key points are the conditions under which European firms are allowed to acquire American defence contractors, take part in American projects, maintain access to classified information, arrange their own technology-sharing arrangements free of Congressional interference, and export the results of common development projects. A first step may take the form of transatlantic industrial collaboration on various pre-production projects like the Rockwell-MBB X-31A forward-swept wing, vectored-thrust demonstrator. Now is the time for negotiations on bilateral liberalization of the terms of transatlantic teaming.

Given the political and economic risks of ceding the European market to an American producer, however, it would be imprudent for the European nations to renounce their technological competence entirely. If there is to be a transatlantic free-trade zone, it must await the creation of European (or transatlantic) conglomerates able to compete with the American giants. A similar argument holds for trade within Europe.⁴⁷

A European armaments procurement agency?

The lesson of the previous involvement of international organizations in arms procurement is that they can do little more than create a broadly permissive environment for voluntary international co-operation. Neither the IEPG nor the EC has ever initiated a project; NATO has not done so since two controversial aircraft projects in the 1950s, the *Atlantic* and the G-91. Instead, they were negotiated on an *ad hoc* basis and given NATO project status after the fact.⁴⁸

The creation of a permissive environment, as the IEPG has recognized, can be best achieved through modest measures to increase the efficiency of European markets, rather than through the creation of a centralized bureaucratic agency.⁴⁹ Realistic measures might include transparency provisions, publications of bids and contracts, and harmonization of procurement codes. The difficulty of the task is demonstrated by the fact that as of yet the IEPG has declined to require transparency where it is needed most: in the awarding of contracts to national suppliers.

Another promising form of collaboration is the pre-production research programme modelled on the EC ESPRIT programme. A European defence research programme, as proposed recently by French Prime Minister Michel Rocard, would directly address the issue of high R&D costs. The most promising aspect of upstream R&D programmes lies in the

possibility of stimulating later corporate collaboration on industrial development and production for the market.⁵⁰ Such organizations have been successful in civilian electronics and aerospace, particularly when industry has been involved at an early stage in the planning of projects. Moreover, such a programme would pose a minimal threat to the transatlantic arms trade, particularly if it co-exists with the increased spending on internationally collaborative R&D foreseen by the Pentagon.

Conclusion: the long term

A partial deregulation of both inter-European and transatlantic arms production is under way. A number of international institutions have offered blueprints for the future. The model proposed here is a 'three-tiered' system of defence procurement in Europe: collaborative projects for large R&D-intensive projects, a system of competing consortia for medium-sized projects, and 'balanced' free trade for smaller goods. The EFA project, increasing collaboration in the helicopter and missile sectors, and attempts to expand the Franco-British cross-purchasing agreement offer some indications that Europe may be moving in this direction. Events in Eastern Europe and US Secretary of Defense Cheney's recent announcement of budget cuts can be expected to strengthen the rationale of collaboration, but may simultaneously create new pressures, particularly from industry, for defence industrial autarky.

Collaborative projects have been unjustly maligned. Collaboration remains an indispensable element in the European defence industrial base. Its poor reputation for cost control is exaggerated according to the data presented here: collaborative projects are as efficient as European single-nation projects. Where competition imposes excessive costs, it remains a realistic and legitimate strategy to avoid the creation of foreign defence-industrial monopolies, even if it results in weapons that cost more than end-of-series American products. Firms themselves are moving towards closer transatlantic co-operation. Both European and American institutions should remain flexible enough to accommodate these new, project-based corporate alliances.

In conclusion, it is worth stepping back for a moment to place these trends in global perspective. In his comprehensive study of the French armaments industry, Edward Kolodziej has observed that both the spectacular rise and the current crisis of the French armaments industry are part of a larger process by which defence industrial capabilities are diffusing throughout the globe. Europe is caught in a difficult position in this process of globalization, sandwiched between the large, technically pre-eminent US and the LDC that are making inroads into less sophisticated sectors.⁵¹ If this trend continues, increasing costs will force nations that currently possess comparative advantages in defence production – France and the UK, as well as the US – to accept collaboration, with some resultant loss of industrial predominance, as the necessary price of maintaining efficient armaments production and strong allies.

Notes

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² There are some European co-production projects, such as Italian and Dutch licensing of the German *Leopard I* tank, and transatlantic co-development projects, such as the NFR-90.

³ An example is the development of modified radar systems for UK helicopters by Westland during the Falklands/Malvinas conflict. See Trevor Taylor and Keith Hayward, *The UK Defence Industrial Base: Developments and Future Policy Options* (London: Brassey's, 1989), pp. 102–103.

⁴ For Sir Peter Levene's short-list of UK goods not being made available for cross-border competition, see Philip Gummatt and William Walker, 'Changes in European Defence Procurement and Industrial Capabilities' (Paper presented at the ISA Conference, London, 1989), p. 6.

⁵ This conclusion is based on interviews and case studies in Andrew Moravcsik, 'Endgame in Europe: The Political Economy of International Collaboration in European Strategic Industries' (Dissertation, Department of Government, Harvard University, 1990). While negotiations in the 1950s and 1960s may have been blocked by disagreements over geopolitical priorities or operational military concerns, a common thread behind more recent failures – as was the case in the French retreat from the EFA project, the West German withdrawal from the Franco-German tank project, the UK decision to produce the *Challenger* tank, and many transatlantic projects – has been the interest group and bureaucratic pressure for an active industrial policy, which implies protection of national industry and the freedom to export. For the views of two heads of state, see Helmut Schmidt, 'Plädoyer für die Fusion', *Die Zeit*, 28 July 1989, pp. 18–19, and the

interview with François Mitterrand in *Libération*, 23 November 1988.

⁶ For the statistics on increasing cost per unit performance, see Jacques S. Gansler and Charles Paul Henning, 'European Acquisition and the US', *Defense and Diplomacy*, June 1989, pp. 29–62. The performance of aircraft was assessed using TASCFORM, a measure of static performance potential developed by the Analytic Services Corporation under contract to the Office of the Under Secretary of Defense–Policy, US DoD.

⁷ See François Heisbourg, 'Public Policy and the Creation of a European Arms Market', in Pauline Creasey and Simon May (eds), *The European Armaments Market and Procurement Cooperation* (London: Macmillan Press, 1988), pp. 60–88. One explanation of rising R&D costs is that aerospace technology is pushing certain core technologies developed during or shortly after World War II to their extremes. At extreme points on the technology cost-effectiveness curve, the cost of additional performance increases quickly. See Thomas L. McNaugher, *New Weapons, Old Politics: America's Military Procurement Muddle* (Washington DC: Brookings Institution, 1989), pp. 1–16.

⁸ This was the finding of the French parliamentary report on the *Rafale* project. The estimate assumes domestic procurement of 338 planes and exports of roughly the same number. Michel Bernard, 'Projet de Rapport d'Information sur L'Avion de Combat Tactique', *mimeo.*, January/February 1988.

⁹ Aaron Karp, 'The Trade in Conventional Weapons', in SIPRI, *SIPRI Yearbook 1988* (Oxford: Oxford University Press, 1989), pp. 175–201.

¹⁰ See *Interavia*, May 1989, p. 391 for statistics on France, where government-financed R&D declined from 72% to 46% between 1978 and 1986. The importance of economic concerns in restructuring the French defence industry is demonstrated by the difficult negotiations between the Minister of Defence and the unions, which led to a commitment that workers would not be laid off.

¹¹ Taylor and Hayward, *op. cit.* in note 3, p. 78.

¹² See Laurens van den Muyzenberg and Godfrey Spickernell, 'Restructuring the Defense Industry' (a report by HB Maynard Management Consultants, n.d.). On the distinction between vertical and horizontal integration, see Philippe Cothier, 'The Economic Dimension of European Security' (Paper delivered at the First Annual Liechtenstein Colloquium, Vaduz, March 1989). On anti-competitive effects of vertical integration in the US, see Jacques Gansler, *The Defense Industry* (Cambridge, MA: The MIT Press, 1980), p. 45.

¹³ Estimate by Jacques Battistella, Director of Defence and Space Development, SA MATRA.

¹⁴ Article 223, clause IB, of the Treaty of Rome reads: 'Any Member State may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions or war material; such measures shall not adversely affect the conditions of competition in the common market regarding products which are not intended for specifically military purposes.' *Treaties Establishing the European Communities* (Luxembourg: European Communities, 1983), p. 279. The issue of the common external tariff on dual-use goods is treated below.

¹⁵ See Carla Reed, "'Europe 1992" and the Future of Transatlantic Defence Cooperation', *Defence*, July 1989, pp. 507-12.

¹⁶ The 1986 authorization set aside \$125 million for the American share of joint NATO research projects: \$25 million to each service, \$25 million to the Office of the Secretary of Defence, and \$25 million for side-by-side testing. The following year, \$190 million was set aside. There is a growing list of 'Nunn projects' funded from this source, with over a dozen added in 1988 alone. In 1986 and 1987, respectively, \$23 million and \$13 million were actually spent on comparative test programmes. In 1989, 32 items, predominantly European in origin, will have been evaluated. See RAND data and Martyn Bittelston, 'Procurement Practice' (London: IISS, *mimeo.*, 1989), p. 94.

¹⁷ IEPG, *Towards a Stronger Europe* (Report by an Independent Study Team, Vols I and II), 1987.

¹⁸ See IEPG, 'Action Plan on a Stepwise Development of a European Armaments Market' (*mimeo.*, n.d.); and 'IEPG Luxembourg Communiqué of 9 November 1988', *Atlantic News*, no. 2,065, Annex One, 15 November 1989.

¹⁹ James Kurth, 'Aerospace Production Lines and American Defense Spending', in Stephen Rosen (ed.), *Testing the Theory of the Military-Industrial Complex* (Lexington, MA: Lexington Books, 1973), pp. 135-56.

²⁰ Gummert and Walker, *op. cit.* in note 4, p. 8. See also William Walker and Philip Gummert, 'Britain and the European Armaments Market', *International Affairs*, Summer 1989, pp. 419-42.

²¹ Gansler, *op. cit.* in note 12, Chs I and II.

²² This was a prominent argument in the FSX debate; it has also been mentioned in the NATO burden-sharing debate. Sen. Timothy Wirth termed the FSX a 'nerve end that reaches all the way to 1992'. *Aviation Week & Space Technology* (hereafter *AW&ST*), 12 June 1989, p. 137.

²³ The relevant data are cost/performance ratios, corrected for economies of scale. In an industry where economies of scale are decisive, a comparison of prices of the 2,000th F-16 and the 200th *Rafale* tells us little about underlying economic efficiency. Once the data are corrected for the larger economies of scale in the (largely protected) US market, the cost/performance ratios of European programmes are within 5% of those of US first-of-series programmes.

²⁴ The comparative data are found in Gansler and Henning, *op. cit.* in note 6. See also Jacques Gansler, *Affording Defense* (Cambridge, MA: The MIT Press, 1989), pp. 300-10.

²⁵ West Germany and France produced 550,000 anti-tank missiles between 1949 and 1978, while the US produced 410,000. Edward A. Kolodziej, *Making and Marketing Arms: The French Experience and its Implications for the International System* (Princeton, NJ: Princeton University Press, 1987), p. 158.

²⁶ In 1986, according to Gummert and Walker (*op. cit.* in note 4), government funding of defence R&D as a percentage of gross domestic product was: US 0.88%,

UK 0.60%, France 0.45%, Sweden 0.31%, FRG 0.13% and Italy 0.06%.

²⁷ It might be objected that competition, with the losers dropping out, could be beneficial as long as there continue to be too many producers in the market. But once an optimal number is reached, any further competition will push the industry towards monopoly.

²⁸ I have simplified the argument somewhat. According to strategic trade theory, certain types of imperfect competition (e.g., natural oligopolies, increasing returns to scale) imply that import protection and export promotion by governments may be welfare maximizing for the nation as a whole. For a discussion of these theories, see Klaus Stegemann, 'Political Rivalry among Industrial States: What Can We Learn from Strategic Trade Theory?', *International Organization*, Winter 1989, pp. 73–100.

²⁹ A European consortium was formed by MBB, AEG, BAe and Marconi for European licensed production of the AMRAAM. Hughes and Raytheon initially asked licensing fees of 25%. Although this request was negotiated down to 13%, it is still far above the 3–5% normal in the industry. The Europeans asserted that such prices preclude efficient European production. US firms have also been charged with a reluctance to release complete data on the AMRAAM to European firms. The European side – the ASRAAM – produced by a German-UK-Danish consortium is stalled because of UK financing problems. See *International Defence Review*, August 1988, p. 883. Many Europeans are also concerned about a repetition of their experience with the *Roland* missile, which was licensed to the US, improved by American firms after an expenditure equal to 2.5 times the original development costs, procured in large numbers by the US government, and then sold back to smaller NATO allies. Claude Serfati, 'European Cooperation in Defence Industries: A Path to the Cross or to Prosperity?', Paper at the European Research Groups on Interfirm Technological Cooperation Agreements, Nanterre University, 21–22 November 1988.

³⁰ McNaugher, *op. cit.* in note 7, p. 83. See also Dan G. Boger, Willis R. Greer, Jr,

and Shu S. Liao, 'Competition in Defense Acquisition: Myths and Facts', *Defense Analysis*, May 1989, pp. 245–55, who present empirical data demonstrating that 'competition has resulted in added net costs to the government as often as it has produced the desired net saving.'

³¹ This estimate of \$800 million understates the real costs of competition, since it does not include the costs of keeping losing consortia in business as a serious competitor over the intervening period, often a decade or more, before the next competition. The figure is from a lecture by Donald J. Atwood, US DoD, at Harvard University, 17 October 1989. The US spends an estimated \$3–5 billion annually to keep non-economical producers in the military aerospace market. Gansler, *op. cit.* in note 12, p. 257. This observation is even more apt in Europe, where production runs are smaller.

³² Heisbourg, *op. cit.* in note 7, pp. 75–6. Heisbourg stresses the *political* limitations to co-operation. He points to the difficulty of organizing co-development consortia among equal partners and the resulting difficulty of organizing Franco-German or Anglo-German consortia now that the West German armaments industry is in a position to demand an equal role.

³³ For the original formula, see Jean-Laurens Delpech, 'La standardization des armements', *Revue de Défense Nationale*, May 1976, p. 33. Delpech also asserted that the length of the programme increases by the cube-root of the number of participants. For commentaries, see Mark A. Lorell, *Multinational Development of Large Aircraft: The European Experience* (Santa Monica, CA: RAND Study R-2596-DR&E, July 1980), p. 5; Herbert Wulf, 'Europäische Zusammenarbeit in der Rüstungsproduktion: Ziele, Probleme, Perspektiven', in Lothar Brock and Mathias Jopp (eds), *Sicherheitspolitische Zusammenarbeit und Kooperation der Rüstungswirtschaft in Westeuropa* (Baden-Baden: Nomos Verlag, 1986), pp. 113–14. For more rigorous estimates, though also not based on systematic cost/effectiveness data, see Keith Hartley, *NATO Arms Co-operation: A Study in Economics and Politics* (London: Allen and Unwin, 1983).

³⁴ See Gansler and Henning, *op. cit.* in note 6; Gansler, *op. cit.* in note 12. On the

number of Panavia employees, see Ian MacKintosh, *Sunrise Europe: The Dynamics of Information Technology* (Oxford: Basil Blackwell, 1986), pp. 232–3.

³⁵ In these studies, the length of a programme is measured from the beginning of development to production. If the time required to harmonize requirements were included, however, it is possible that collaborative programmes would appear longer.

³⁶ On the *Tornado* cost overruns, see MacKintosh, *op. cit.* in note 34, pp. 232–3; and IEPG Report, *op. cit.* in note 17, Vol. II, pp. 109–23.

³⁷ The *Rafale* project has pitted the French air force, which favoured the development of a naval version of the *Rafale* with joint funding from the navy, and the navy itself, which favoured off-the-shelf procurement of the F-18. Conflicts between the military and civilians, as well as within the military, have been an endemic consequence of the French policy of national independence in military aerospace. See *Le Monde*, 28–29 December 1986 and 21–22 June 1987; Kolodziej, *op. cit.* in note 25, pp. 161, 337.

³⁸ Even large industry-led consortia (such as the GE-SNECMA alliance in civil aeroengines) employ the *juste retour* principle internally. See *Interavia*, May 1989, p. 392.

³⁹ The *Tornado* was largely contracted on a cost-plus basis, while the norm for the EFA is fixed-price contracts.

⁴⁰ Gansler, *op. cit.* in note 12, p. 165.

⁴¹ Jean-Pierre Chevènement, Speech at the European Session of the Institut des Hautes Etudes de Défense Nationale, 22 November 1988, cited in David S. Yost, 'French Perspectives on West European Defense Cooperation', *mimeo.*, June 1989, p. 81.

⁴² *Jane's NATO and Europe Today*, 20 June 1989, p. 6.

⁴³ Thomas A. Callaghan, Jr, *Pooling Allied and American Resources to Produce a Credible, Collective Conventional Deterrent* (Washington DC: report prepared for the US DoD, *mimeo.*, August 1988), p. 141. Some European governments also rely on the threat of importing from the US to generate negotiating leverage *vis-à-vis* other European governments (or their own industry), as have the West Germans in the *Tornado* and EFA negotiations.

⁴⁴ *AW&ST*, 12 June 1989, p. 167; *Interavia*, July 1989, p. 669.

⁴⁵ Quoted in *Jane's Defence Weekly*, March 1989, p. 344. On the new role of the US Commerce Department, see *AW&ST*, 7 April 1989, p. 28.

⁴⁶ Here I follow van den Muyzenberg and Spickernell, *op. cit.* in note 12, pp. 10–11.

⁴⁷ François Heisbourg, 'A European Defence Industry: Dream or Reality?', *NATO's Sixteen Nations*, December 1988, p. 24. The opportunities for political exploitation of the monopoly are obvious.

⁴⁸ Some national programmes, such as the *Hawk* missile and the NADAG, have nonetheless been based on NATO specifications.

⁴⁹ Heisbourg, *op. cit.* in note 47.

⁵⁰ Heisbourg, *op. cit.* in note 47, p. 26. For example, the Franco-German research centre at St Louis had much to do with the two countries' steady collaboration on anti-tank weapons. R&D programmes have this effect because they work over the long term to dilute opposition to collaboration from industrialists and industrial policy officials, which has been the largest obstacle to collaboration in the past.

⁵¹ Kolodziej, *op. cit.* in note 25, Ch. 8.