INTERNATIONAL DEFENSE REVIEW

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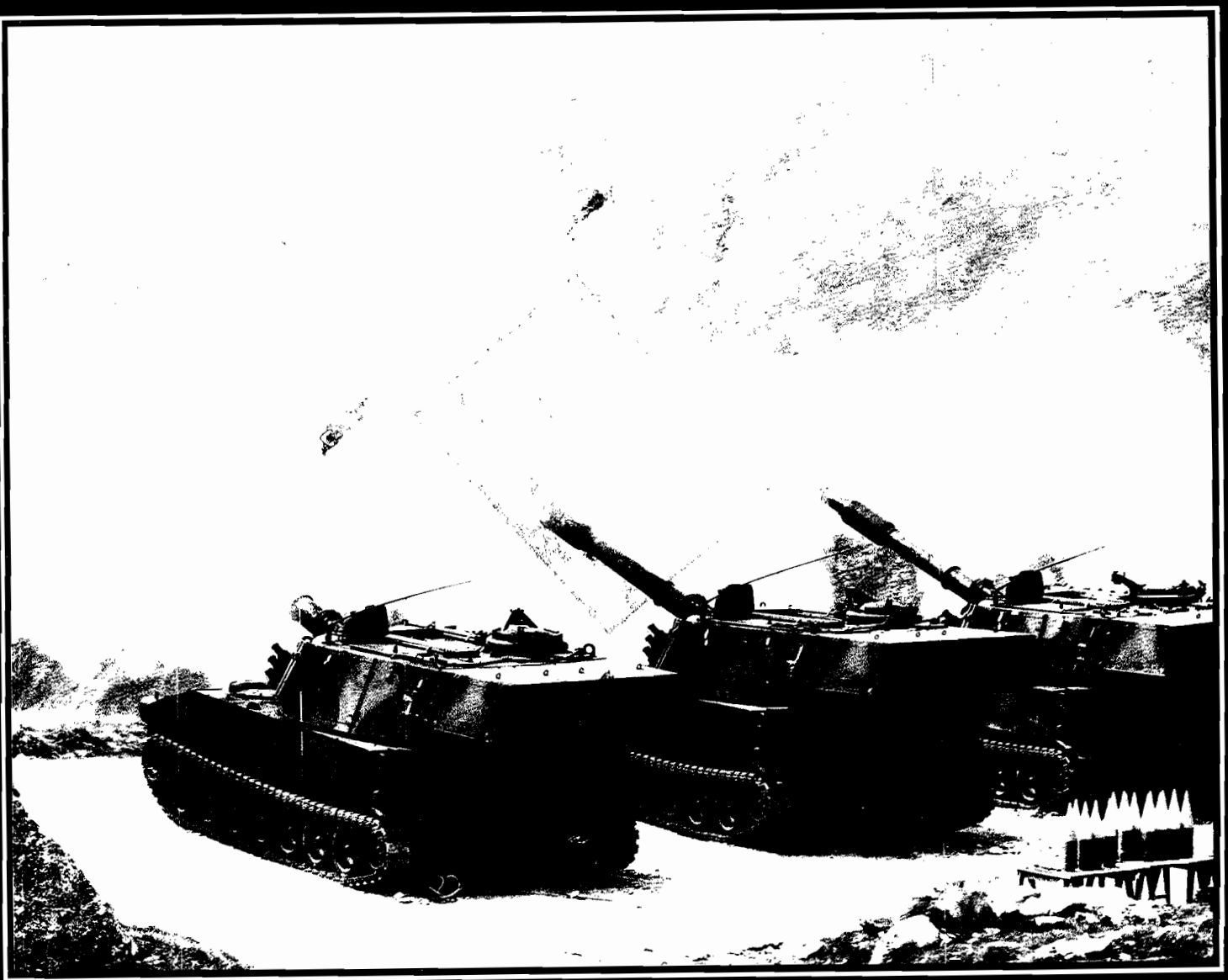

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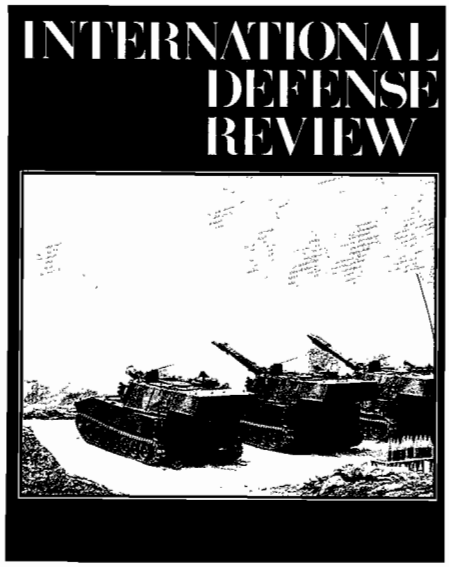

K+W Thun is proposing to modernize the Swiss army's M-109 howitzers by introducing a chromed 47-calibre tube for extended range (using non-NATO charges), a flick rammer, and an enlarged bustle which increases onboard ammunition storage capacity to 42 rounds. A feature on SP howitzer developments begins on page 929.

This month's edition of IDR also contains an editorial supplement "Defense Electronics & Computing No. 4", which is being sent to subscribers with the main issue.

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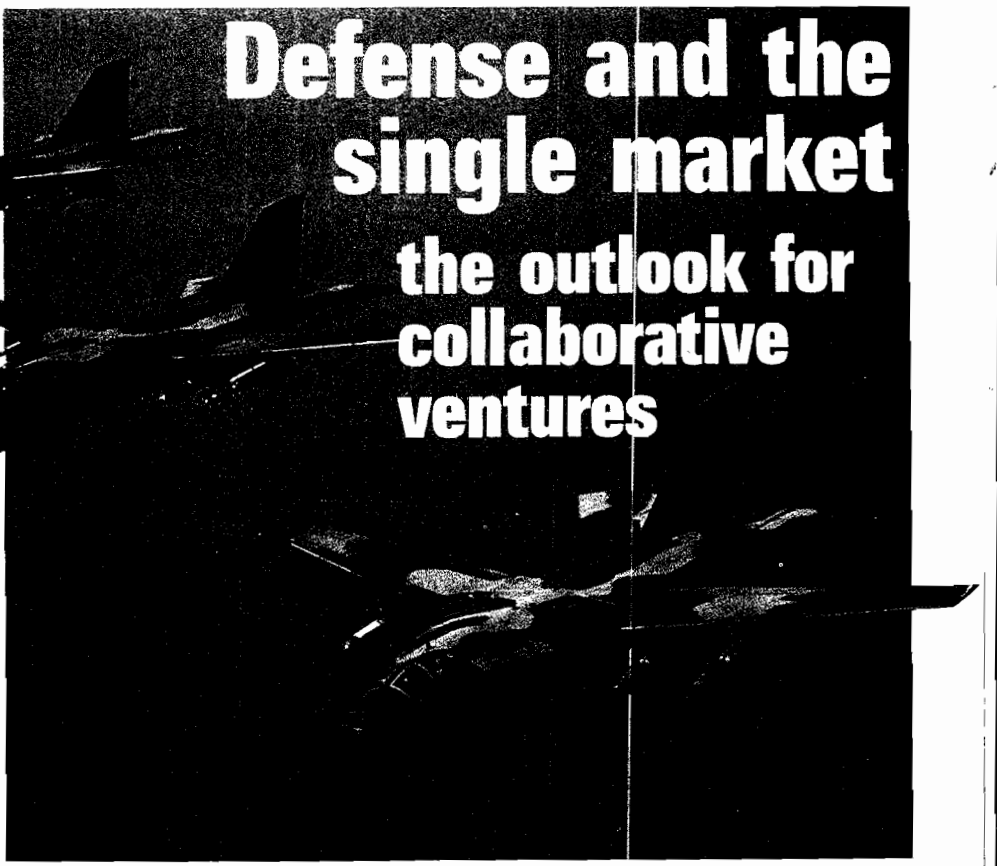
Increased, if uneven, détente between the United States and the Soviet Union has led to a mood in the West in favour of conventional disarmament, reduction of nuclear arsenals and a ban on chemical weapons. As a result, Western defense budgets are undergoing cuts and, with the costs of new generations of weapons systems increasing exponentially, countries have been encouraged to share the burdens of developing new systems and companies are expected to bear a growing proportion of the research and development costs.

Intra-European programs are reputed to be less successful than those co-sponsored – and therefore usually run – by the US, but European industry is now apparently eager to form co-equal transnational partnerships within Europe and to make such joint ventures work. The following article, based on two chapters of a forthcoming book,[1] outlines the trends in European co-operative production and procurement and the prospects for continued transatlantic collaboration.[2]

Defense and the single market

the outlook for collaborative ventures



The US refuses to share its most sophisticated technology with its allies, but the swing-wing box technology from the F-111 was one of 146 technologies licensed in the 1970s without which the European Tornado would have been more expensive to develop. As it was, Tornado came in at no more than 10–15 per cent over budget, which compares favourably with other swing-wing multi-role aircraft of that generation, including the F-111 itself.

European countries traditionally procure most of their weapons at home. For example, France and the UK purchase 70–80 per cent of their major weapon systems domestically. This bias in favour of national production, backed by preferential arrangements and subsidies to domestic firms, has been justified on military, political and economic grounds. Domestic arms production and arms transfers are widely viewed as important sources of national prestige and diplomatic leverage (Table 1).

Some collaborative projects, for example those undertaken by France and Germany, have been initiated as much for diplomatic reasons, such as the desire to indicate reconciliation, as from a need to strengthen joint security arrangements. However, such 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. In the minds of European (and US) politicians, economic justifications for national production tend to loom larger.

In the coming decade, the most significant decisions facing European planners and their US counterparts concern the extent to which defense industries are to be internationalized. The European Community's plan to integrate civil markets from 1992, proposals from the Independent European Program Group (IEPG) to integrate defense markets, and a series of NATO armaments projects, all highlight the renewed interest in internationalizing the industrial base of West European defense. The incipient arms-industry shakeout raises the question of how European governments are to decide which firms, or which consortia, should be allowed to continue designing and producing armaments.

European governments have traditionally coped with rising costs by subsidizing aerospace industries or by extending production runs by means of exports. For example, the French military aircraft manufacturer Avions Marcel Dassault exported 60–70 per cent of production over the past decade. However, the collapse of Europe's traditional export markets in less-developed countries from the mid-1980s onwards, particularly among OPEC members and partly as a result of the emergence of new competitors, means that exports often no longer suffice to keep the necessary subsidies at a level that European governments consider acceptable. Dassault must export around 40 aircraft a year to avoid radical restructuring; in 1986 and 1987 it received only one new foreign order.

Ad hoc collaboration

Germany, Italy and the smaller NATO countries rely less than France and the UK on domestic production and more on imports, co-production or co-development projects. Collaboration between European defense industries functioned up until the late 1980s primarily on a program-by-program basis and, within Europe, such an approach does not promote industrial rationalization. On the contrary, research resources and means of production are duplicated and, although co-operation has sometimes led to common program-

Table 1: Approximate percentages of major weapons procurement for various sources for European countries, 1985-1989

Country	Domestic	Co-Development	Co-Production	Imports
France	80 per cent	15 per cent	–	5 per cent
UK	75 per cent	15 per cent	–	10 per cent
FRG	25 per cent	40 per cent	20 per cent	15 per cent

Table 2: Current and future US/allied programs

Under the "Nunn amendment" to the US defense authorization bill for FY1986, the US Congress each year sets aside a sum for the US share of joint research projects. This is divided among the three services and the Office of the Secretary of Defense.

NATO co-operative research and development funding (in millions of dollars)

	FY1986	FY1987	FY1988	FY1989	FY1990	FY1991	FY1992
Army	10.4	28.6	12.7	74.2	26.4	28.1	15.0
Navy	5.2	20.2	43.2	5.2	48.8	22.7	15.0
Air Force	19.6	36.3	15.9	18.0	1.8	15.0	10.0
Agencies	19.4	36.9	53.2	34.4	27.2	19.7	10.0
Total	54.6	122.0	125.0	131.8	104.2	85.5	50.0

Selected current key US/allied co-operative R&D programs

US ARMY
Airborne Radar Demonstration System (ARDS)
FR, UK
Future Tank Main Armament (FTMA)
FR, GE, UK
MSAM/Co-operative Analyses of Ground Based Air Defenses
GE
Multi-Mode Seeker Demonstration (MMSD)
GE

US NAVY
AV-8B Radar Integration
IT, SP
Magnetic-Anomaly Detection (MAD) Sonobuoy
FR
Magnetic-Array Sensor (MARS) System (formerly Fiber-Optic Magnetic-Sensor Array)
NO
Multi-Functional Information-Distribution Systems (MIDS)
FR, GE, IT, SP
SAXON-FPN (Synthetic-Aperture Radar for Ocean-Surface Imaging)
GE
Surface-Ship Torpedo Defense (SSTD)
UK

US AIR FORCE
Advanced Avionics Architecure (includes Advanced Video Processing)
FR, GE
Co-operative Communications Network
AS
F-16 Derivative
BE, DA, NL, NO
Joint Surveillance Target-Attack Radar System (Joint-STARS)
Interoperability – SORPOS and SIDL
FR, IT, UK

DARPA
Armour/Anti-armour
UK, FR, GE
Advanced Short Takeoff and Vertical Landing Aircraft (ASTOVL)
UK
Electro-Magnetic Gun for Vehicle Integration
UK
Enhanced Fighter Manoeuvrability Demonstrator (X-31)
GE
Non-Acoustic Anti-Submarine Warfare
UK, NO

DCA
C^3 Interoperability
FR, GE, NL, NO, SP, UK
Post 2000 Tactical Area Communications
CA, FR, IT, UK, GE, NL, NO, SP

DIA
Battlefield Information Collection and Exploitation System (BICES)/TADMS
PO, SP, UK
Infra-red Missile Countermeasures
UK

DMA
Digital Chart of the World International Map and Chart Database
AS, CA, UK

Selected high-priority US/allied programs scheduled for FY1991/92

US ARMY
Alternate Multi-Mode Seeker Demonstration (AMMSD)
GE
COBRA Weapon-Locating Radar
FR, GE, UK
Covert Night/Day Operations in Rotorcraft (CONDOR)
UK
Electro-Thermal Gun Technology
GE
Surface-to-Air Missile Operation Center (SAMOC)
GE
Bistatic Radar Technology Demonstration
IS

US NAVY
Anti-Ship Missile Countermeasures
UK
Communications Systems Network
CA, FR, NL, UK
NATO Mechanical Mine Sweeper
FR, IT, SP, NL

US AIR FORCE
Over-The-Horizon Radar (OTHR)
AS
Super Cockpit Interface Development, Test, and Evaluation
FR

DIA
Tactical Aircraft Combat Survivability Improvements
IS

Selected proposed US/allied programs for future interest

US ARMY
Bistatic Radar Technology Demonstrator
IS

US NAVY
Automatic Ship Classification
GE

US AIR FORCE
Senior Guardian – datalink command and control
GE
Space-based Radar
CA

Key
AS: Australia, BE: Belgium, CA: Canada, DA: Denmark, FR: France, GE: Germany, IS: Israel, IT: Italy, NL: Netherlands, NO: Norway, PO: Portugal, SP: Spain, UK: United Kingdom
DARPA: Defense Advanced Research Projects Agency, DCA: Defense Communications Agency, DIA: Defense Intelligence Agency, DMA: Defense Mapping Agency

Source: Combined Annual Report to Congress on standardization of equipment with NATO Members and Co-operative Research and Development Projects with Allied countries, US Department of Defense, July 1991.

AMX single and two-seater flying over a Philippine volcanic lake.

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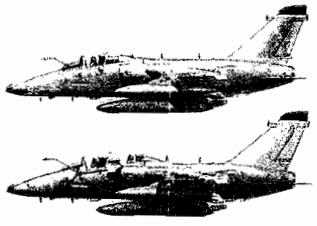

The AMX is a flexible platform for today's and tomorrow's avionics, surveillance and targeting systems. It carries conventional or smart weapons. And it's available in single-seat and two-seat versions, with identical dimensions and combat capability plus high parts commonality.

In squadron service, pilots approve the superb low level manoeuvrability and minimal workload by day or night. Moreover, the very low IR signature, active and passive ECM, multiple systems redundancy and damage tolerant structure set new standards for survivability.

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With its unparalleled flexibility, performance survivability and availability, the AMX is rewriting the economics of fighter procurement.

And it's ready for export right now.

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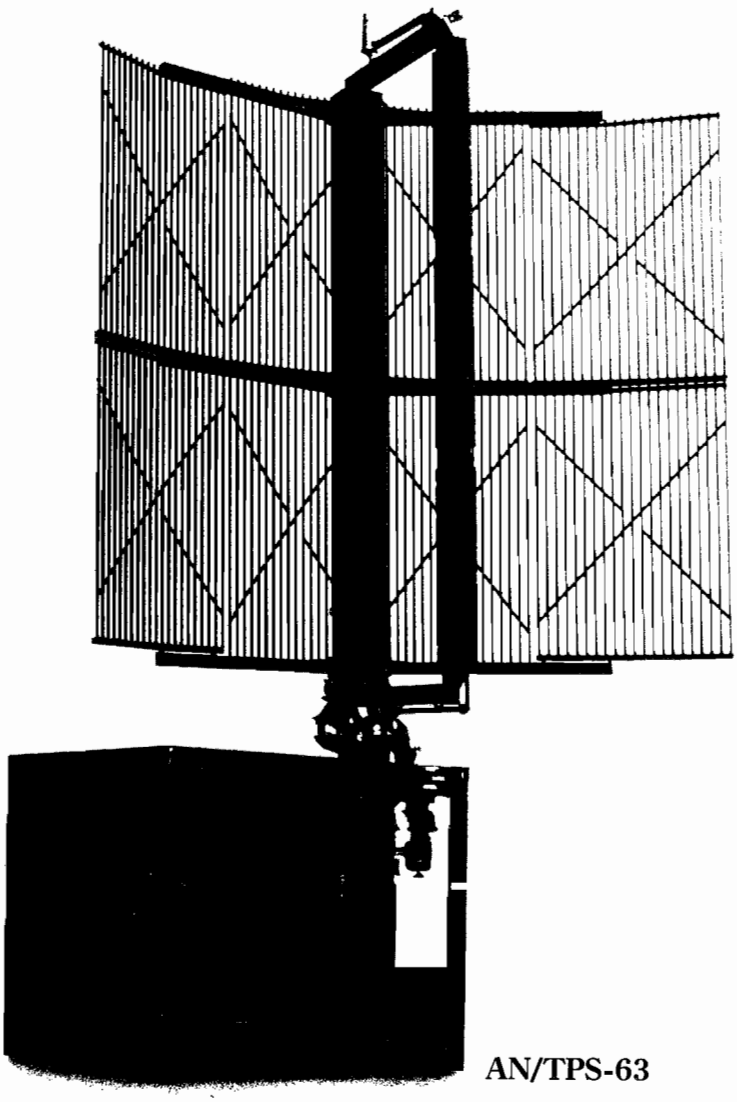

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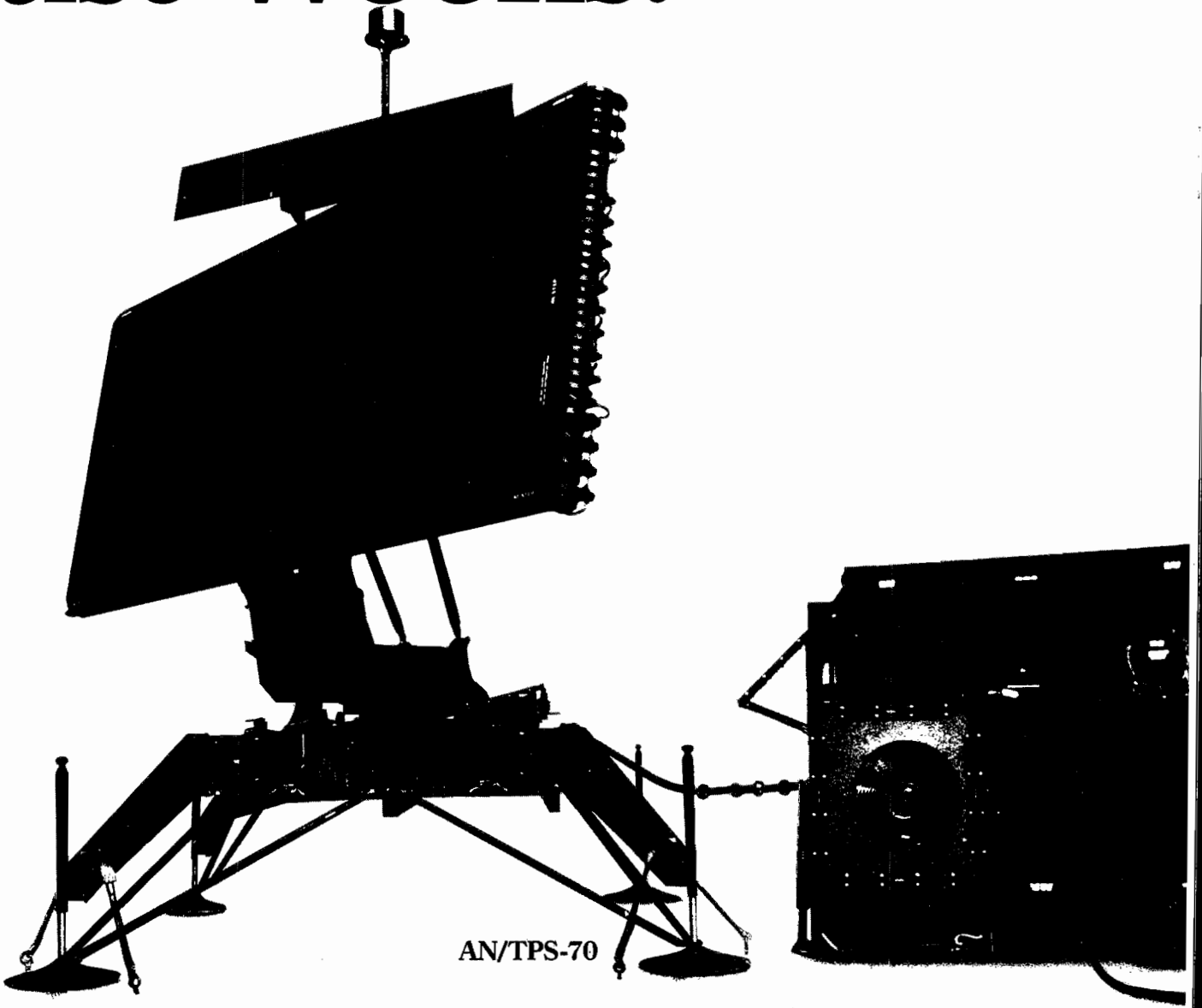

AN/TPS-70

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U.S. ARMY PHOTO

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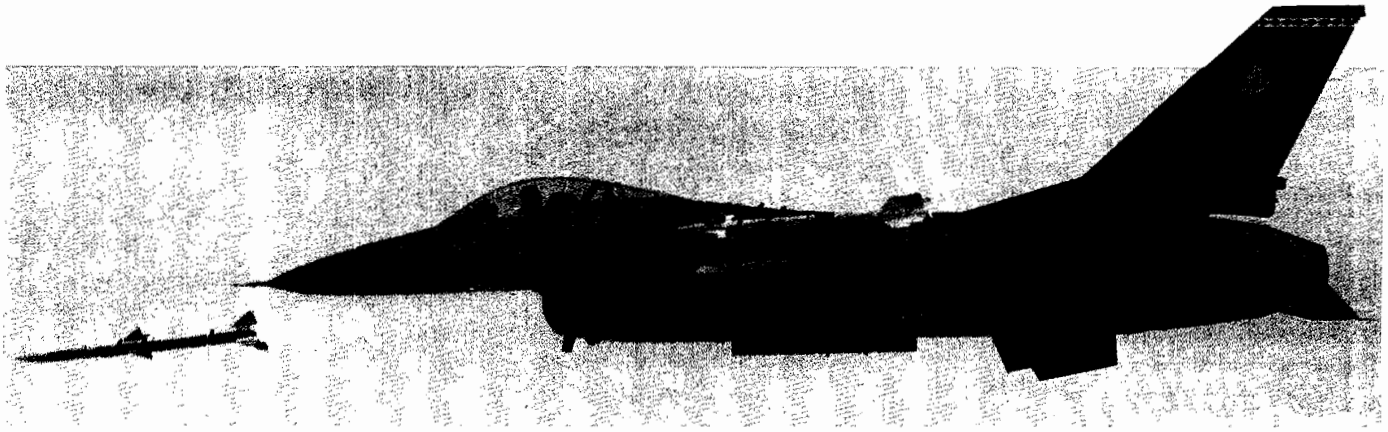

USAF/USN AMRAAM missile is launched from an F-16: by the end of the century this will be the only allied aircraft in NATO of non-European design. AMRAAM was one of the original "families of weapons" projects, and has as a result been the source of transatlantic controversy.

management structures, to transnational economic interest groups, or even to technology transfers, it seldom affects national industrial structures designed to meet independent production and security needs. Most intra-European corporate joint ventures to date have taken the form of exchanges of minor shareholdings and project-specific research and development (R&D) collaboration. As we enter the 1990s, however, the international network of defense industries appears to be undergoing changes that will drastically modify its character.

European governments are now studying ways to help guide the process of internationalization. Such proposals have been tabled in the European Community (EC), the NATO Council of National Armaments Directors, and the IEPG, an organization founded in 1976 that comprises all European members of the Atlantic Alliance, including France, but excluding Iceland.

Article 223 of the Treaty of Rome, on which the EC is based, specifically excludes arms production and trade from its remit, and the member states have hitherto insisted on maintaining this limitation. The EC "1992 initiative" aimed at liberalizing the internal commercial market from the end of that year will thus not affect military markets directly. Indirectly, however, the effect will be enormous: until the late 1970s, the military had a lead over the civilian sector in technological improvements, but in the increasingly crucial areas of microelectronics, data processing, and telecommunications the military sector sees itself forced to follow in the steps of the civilian market, whose low-cost innovative technology and flexibility are consumer-driven and funded. Consolidation and mergers in the electronics and telecommunications industries will therefore naturally affect the aerospace and defense industries. However, though electronic equipment constitutes a significant and rapidly increasing share of the most modern weapons systems (about 35–60 per cent of cost in modern aircraft), this is not typical of the armaments industry as a whole, in which electronics constitutes no more than 25 per cent of equipment purchases, and where most products remain custom-made.

Current initiatives

After years of serving as a rubber stamp for *ad hoc* projects previously negotiated between NATO governments, the NATO Council of Armaments Directors (CNAD) has begun to take a hand in developing military requirements. Many of the programs concerned involve US funding under the so-called "Nunn amendment" (Table 2). The Roth–Glenn–Nunn amendment to the National Defense Authorization for Fiscal Year 1986 sets aside several hundred million dollars a year for NATO collaborative projects. The US defense department has announced its intention to increase the proportion of military R&D conducted collaboratively from the current level of three per cent to 25 per cent by the end of the century. A new generation of C³I and infrastructure programs has integrated even the previously recalcitrant France to an ever greater degree into NATO procurement, notwithstanding some of these programs, such as AMRAAM (advanced medium-range air-to-air missile) and the frigate project NFR-90, have been the source of considerable controversy.

In November 1988, IEPG member countries approved a plan that designates the IEPG as the major organization for co-ordinating European defense industrial co-operation, and proposes a program 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 defense industries of Greece, Turkey and Portugal, and the creation of a small secretariat in Lisbon. It acknowledges the importance of co-ordinating military requirements, and accepts French proposals for a common European military research program modelled on European efforts in the civilian high-technology fields under the EUREKA and ESPRIT initiatives (the European Commission has also advanced a proposal for EUROMART, a European R&D program for the aerospace industry). The EUCLID pre-production research program (Tables 3 and 4) recently authorized by the IEPG should directly address the issue of high R&D costs. The most promising aspect of upstream R&D programs lies in the possibility of stimulating later corporate collaboration on industrial development and production for the market.

Most importantly, however, the IEPG 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.[3] It also 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 defense firms, such as Matra SA in France, which want to avoid being taken over by their larger compatriots, the companies often referred to as "national champions."

Free market v. *juste retour*

The application of free-market principles would introduce competition into the defense-procurement process, thereby promising, according to classical economic theory, increased efficiency and rationalization through greater economies of scale. Companies 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; they are reported to have resulted in cost savings totalling up to 10 per cent of procurement budgets.

To survive in the free market, defense manufacturers must utilize their design and production technology continuously in order to afford the heavy overhead and to remain at the forefront of R&D; this is the "follow-on imperative" – to assure each firm a constant flow of contracts. Accordingly, neither Britain nor France (and, increasingly, neither Germany as well) will award a major contract to a non-national firm or a consortium in which its firms do not participate. With life cycles of weapons lasting two decades or more, a producer which loses even a single large contract is unlikely to be around in a few decades to recoup the loss. 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 carefully co-ordinated between governments.

One serious flaw in the economic argument for free trade in arms is that optimal economies of scale are so great in some areas that the free play of market forces threatens to eliminate all but one producer – a situation known to economists as a "natural monopoly." (The underlying cause of this is that learning and R&D lead to increasing returns of scale. While competition, with the losers dropping out, can be seen as beneficial as long as there continue to be too many producers in the market, once an optimal number is reached, any further competition will push the industry toward monopoly.)

In the market for high-end fighters, for example, a global monopoly is close to being established by the US, which means a diminishing incentive to offer competitive terms to foreign buyers. Thus, even if defense trade barriers were eliminated and R&D spending equalized, US 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.

Governments can seek to prevent the formation of monopolies by subsidizing artificial competition. This can, however, be extremely expensive, particularly where large, complex weapons platforms are involved; it can be 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.

The real costs of such an approach must include those of keeping losing consortia in business as serious competitors over the decade or more before the next similar competition. The US spends an estimated $3–5 billion annually to keep non-economical producers in the military aerospace market and in Europe, where production runs are smaller, the figure is likely to be higher still.

Thus an IEPG model for competing consortia will function effectively 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 manufacture. Moreover, two competitive suppliers are no guarantee of a free market in arms, given the inherent nature of oligopolistic markets. "Dual-source procurement," one group of analysts explains, "is a classic case of duopoly that is, in fact, much closer to monopoly than to competition." In the production of smaller items, managed free trade can achieve the same results without the need for explicit corporate alliances.

In most European co-development projects, the costs and benefits are formally negotiated among the participants according to the principle of *juste retour*. This means that the share of work each participating nation receives, as well as the burden of financing it bears, is proportional to its procurement level.

From an economic point of view, *juste retour* works like a cartel. The participants divide market shares among themselves; in this sense, it has been criticized by economists for suppressing competition. If rigorously enforced, *juste retour* 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 clear main contractor.)

These disadvantages of *juste retour* have been greatly exaggerated. The common view that collaborative projects are intrinsically more costly than single-nation ones is not supported by the available data. 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.[4] This estimate has no basis in empirical analysis. On the contrary, data on the cost/ performance ratios of fighter aircraft, corrected for the length of production runs, demonstrate that European collaborative programs are, on the average, marginally *more* efficient than programs run by single European countries. (This is quite aside from the additional savings accruing to any single country by dividing the fixed costs of R&D and production among the collaborative partners). Moreover, the direct administrative costs of European projects tends to be low: the Anglo–Italo–German Tornado

Table 3: Research and Technology Projects (RTPs) approved under EUCLID (effective July 1991)*

CEPA 1:	*Modern Radar Technology*	(GE)
1.1	Radars. Mission related aspects	(GE)
CEPA 2:	*Silicon Microelectronics*	(FR)
2.1	Silicon on insulator technology	(UK)
2.2	Interconnection assembly	(FR)
2.3	Military qualification	(GE)
2.5	Silicon on insulator cell library	(UK)
2.9	User-programmable integrated circuits	(FR)
CEPA 3:	*Composite Structures*	(NL)
3.1	Aeronautical application technology	(GE)
3.2	Light ballistic optimization	(NL)
3.5	Technology for high-temperature composites	(FR)
3.8	Naval application technology	(NO)
CEPA 4:	*Modular Avionics*	(GE)
4.1	Modular avionics harmonization study	(?)
CEPA 5:	*Electric Gun* (Dormant)	(?)
CEPA 6:	*Artificial Intelligence*	(FR)
6.1	Advanced workstation for C^3	(UK)
6.2	High-speed pattern recognition environment	(FR)
6.3	Knowledge engineering	(NL)
CEPA 7:	*Signature Manipulation*	(SP)
7.3	Improvements of radar cross-section prediction codes	(SP)
7.8	Optimum shape design in electro...	(FR)
CEPA 8:	*Opto-electronic Devices*	(IT)
8.1	Affordable lightweight infra-red sensors	(UK)
8.3	Solid-state laser sources	(FR)
CEPA 9:	*Satellite Surveillance Technology*	(NO+FR)
9.1	Technology concepts and harmonization	(FR)
9.2	High-resolution optical sensor technology	(GE)
9.3	Advanced space synthetic-aperture radar	(IT)
9.4	Real-time processing and data handling	(NO)
9.5	Ground segment technology	(SP)
CEPA 10:	*Underwater Detection and Related Technologies*	(UK)
10.1	Low and very low frequency underwater sound propagation	(NL)
10.2	Towed-array heading sensors	(UK)
10.3	Hydrodynamic noise study	(FR)
CEPA 11:	*Technology in the Field of Human Factors including Simulation for Training Purposes*	(NL)
11.1	Training systems concepts	(NL)
11.2	Simulation techniques	(UK)
11.3	Mission and/or battle simulation	(GE)

CEPA=Common European Priority Areas (Nation)=Chair country
FR=France; GE=Germany; IT=Italy; NL=Netherlands; NO=Norway; SP=Spain; UK=United Kingdom.
*Of the 29 RTPs approved, two Implementing Arrangements have been signed (RTP2.9 between France and Portugal and RTP8.3 with France, Norway and the UK). Additional arrangements are near signing and first contracts with industry could be placed by the end of 1991.

Table 4: Areas of potential collaboration under investigation by the IEPG (effective March 1991)

Armoured bridgelayer interoperability: BE FR GE NL SP (UK)
Coastal minesweeper: BE NL PO (NO willing to contribute experience from national program)
Low-calibre individual and support weapons: BE FR GE SP (NL) (IT) (UK) PO IT
Anti-tank guided weapons, third generation: FR BE GE NL UK
Aimed controlled-effect anti-tank mine: FR GE UK
155mm artillery systems/Future artillery weapons systems: FR BE DE IT NO SP UK PO IT
Mistral SAM: FR BE DE IT SP NO
Maritime-patrol aircraft: FR IT NL (SP) (UK)
Stinger dual production: GE GR NL TU
Future large aircraft: IT BE FR GE SP TU (UK) PO
M483/M864 155mm artillery ammunition dual production: NL TU UK
Microwave landing system: UK BE DE FR GE IT NO SP NL TU
Sonobuoys and active dipping sonar/MAD buoys: UK FR GE IT
Vehicle robotics: GE FR SP UK NL
NBC: FR IT SP
Future frigates: FR GE NL SP
Submarine advanced propulsion: GE FR IT
Armoured reconnaissance vehicles: FR BE GE NL SP UK
Met equipment: UK NL GE
Tankers (air-to-air refueling): UK FR NL
Simulation: SP NL UK
Anti-tank light gun assisted round: NO FR GE NL SP UK (TU) (IT)

Key: Country first mentioned=Chair
(Country)=Observer
Country=Considering participation.

Countries: BE=Belgium; DE=Denmark; FR=France; GE=Germany; IT=Italy; NL=Netherlands; NO=Norway; PO=Portugal; SP=Spain; TU=Turkey; UK=United Kingdom.

project, for example, employed no more than 300 administrative employees, with 30 to 50 additional in each country.

Thus, arguments for buying US products "off-the-shelf" because of lower unit costs can be countered by proponents of intra-European procurement by drawing attention to the fact that US product prices are lower primarily because of large guaranteed production runs created by US military procurement. Between 1949 and 1978, to take one example, Germany and France produced 550,000 antitank missiles, while the US produced 410,000. The disparity between the length of US and individual European production runs creates cost differentials of 20–50 per cent.[5] European government R&D and procurement spending also represents only 25–40 per cent of the US figure. In 1986, government funding of defense R&D as a percentage of GDP was:
US: 0.88 per cent; UK: 0.60 per cent; France: 0.45 per cent; Sweden: 0.31 per cent; Germany (West): 0.13 per cent; Italy: 0.06 per cent.

The claim that collaboration leads to delays and cost-overruns also finds little statistical support. On average, European collaborative projects, while requiring somewhat more development time than US single-service projects, take only slightly longer than single-nation European projects, a fact that might be accounted for by their typically greater sophistication. However, the length of a program has here been measured from the beginning of develop-

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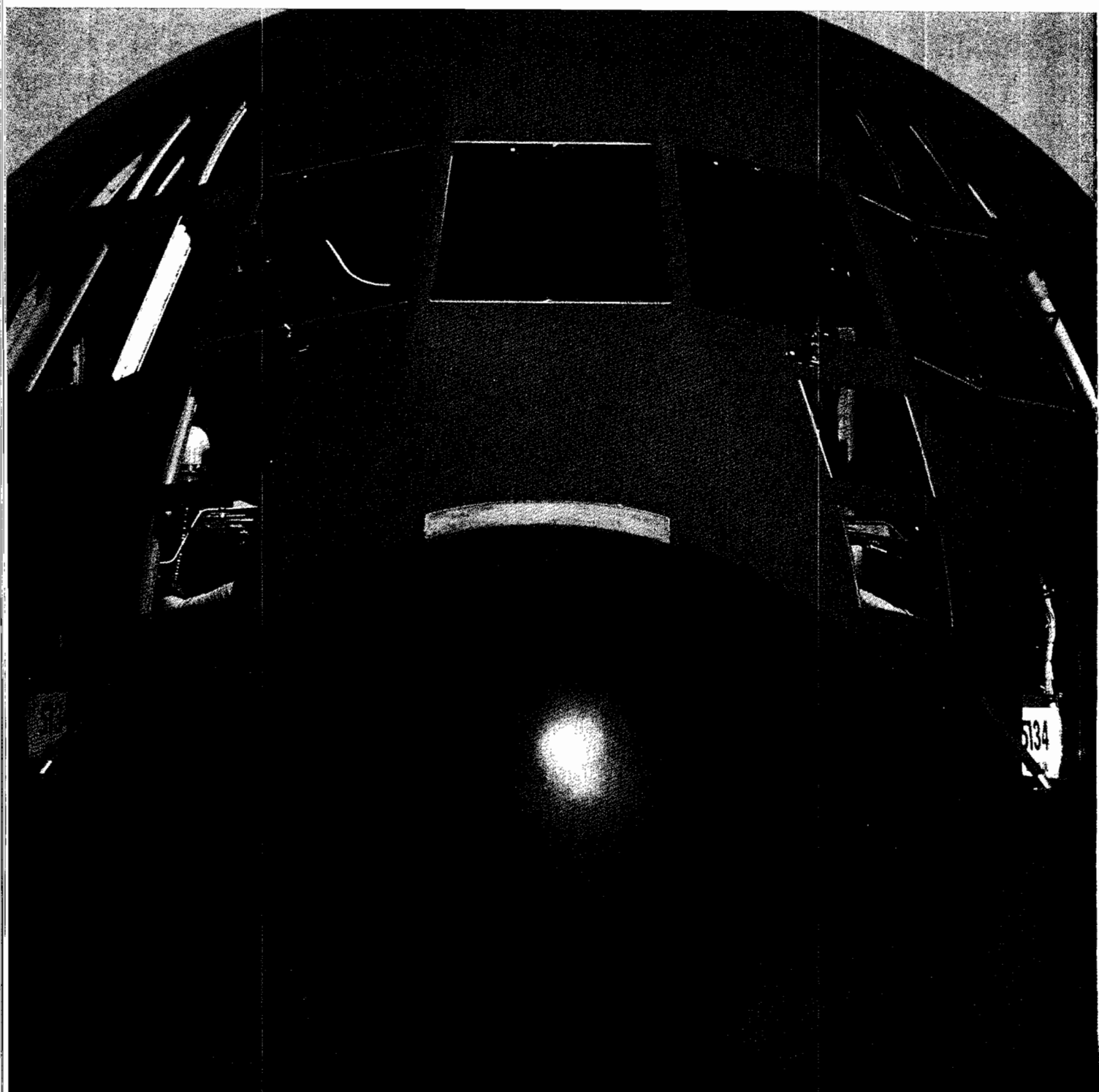

ment to production; if the time required to harmonize requirements were included, it is possible that collaborative programs would appear appreciably longer than others.) US multi-service projects require as much time as European collaborative projects, and it should be noted in passing that longer development times are not necessarily disadvantageous, for there is some evidence that US programs are on occasion rushed into production too fast. Similarly, the cost-overruns of collaborative programs are in no way exceptional. Despite publicity to the contrary, the cost of the Tornado fighter – properly adjusted for inflation, exchange-rate shifts and changes in military specifications – came in at no more than 10–15 per cent over budget, which compares favourably with other swing-wing multi-role aircraft of that generation, such as the General Dynamics/Grumman F-111.

Optimization v. flexibility

Collaborative projects are criticized for producing multi-role weapons that reflect a compromise between various national missions and hence are ill-suited to any single task. The disagreements among participants in programs like Tornado and EFA (European Fighter Aircraft or Eurofighter) suggest that there may be some truth to this allegation, but such problems are hardly unique to collaborative programs. Due to rising costs, almost all tactical aircraft now under development, including the US F-22, Rafale and EFA, are multi-role in concept. Indeed, the experience of some recent single-nation projects suggests that the latter are under even more pressure than collaborative projects to fulfil multiple functions. The French air force, for example, favoured the development of a naval version of the Rafale with joint funding from the navy, while the navy itself favoured off-the-shelf F-18s.

Collaborative projects may have gained an undeservedly negative reputation because of their high visibility. European single-country projects have in the past been cloaked in secrecy where possible, but recent debates such as that over the Rafale fighter or the now-defunct British Nimrod AEW demonstrate that when the facts are made public, national projects often become equally controversial. Co-development projects allow firms and governments to keep watch over each other – perhaps a more effective form of monitoring than that exercised by a single government. Collaboration may thus be the most acceptable way of regulating the monopolies necessarily formed in weapons-platform production.

Table 5: A three-tiered model of the evolution of the European defense industry

Model of Co-operation	Products	Approx. Development Costs
Collaboration	*Large Systems Design:* fighters, aircraft engines, helicopters, large missiles, nuclear systems (e.g. the products of the Euromissile, Tornado, and F-16 consortia)	$2 billion – 5 billion
Competing Consortia	*Medium-Sized Systems and Major Subsystems:* electronics, smaller missiles and armour (e.g. tanks, radar and avionics systems, small engines)	$500 million – 2 billion
Managed Trade	*Smaller Components* and *Low-Technology Systems:* small transport planes, conventional munitions, small arms, minor aerospace items (e.g. displays, precision equipment, some raw materials, rifles)	less than $500 million

Competition v. collaboration

While the principles of *juste retour* and free trade are largely mutually exclusive, neither by itself is a wholly satisfactory means of organizing all European arms production. The difficulty of reconciling the two is illustrated by the IEPG calling for both the creation of a "single European arms market" with competitive bidding and aid for "less developed" defense industries, but also *juste retour* over an "acceptable" period of time for each participant in collaborative projects.

The IEPG remains diplomatically vague about how all these conflicting requirements are to be served, but one way to reconcile competition and collaboration is to distinguish the types of products for which each is most efficient. In product lines such as fighter aircraft, with high fixed costs and natural monopolies, artificial competition is an expensive approach; in product lines with low fixed costs and large numbers of smaller items, the time and effort of negotiating a *juste-retour* agreement is unnecessary.

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 (Table 5):
(A) collaborative co-development on *juste-retour* terms for high-cost products,
(B) competing consortia for intermediate products (or items in which there is a great deal of product differentiation), and
(C) managed free trade for lower-cost products.

The collaboration model is appropriate for the production of large weapons platforms, where there is only one "national champion" per country and economies of scale are sub-optimal. Here, *juste retour* is a political necessity, since these projects are essentially uncancelable "core programs" for national champions. There are many areas for efficient European co-development, including tanks, ships, helicopters and large missiles.

The competing-consortia model is appropriate for small missiles, radar and major subsystems, that is, areas where each European government is willing to finance more than one firm or design team, and where there is a wide number of specialized markets in which to sell.

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 its own technological competence at all costs. Here competition might be most advantageous, since makers of components are often monopolists or oligopolists in their home market but, due to their small size, are difficult to regulate.

Boundaries between the above categories are necessarily sometimes indistinct. For example, the trade-off between competition and collaboration can be softened by subcontracting competitively in large projects. Competition sometimes becomes economical if sophisticated systems can be broken down into their specialized components.

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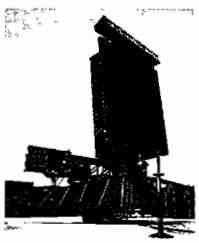

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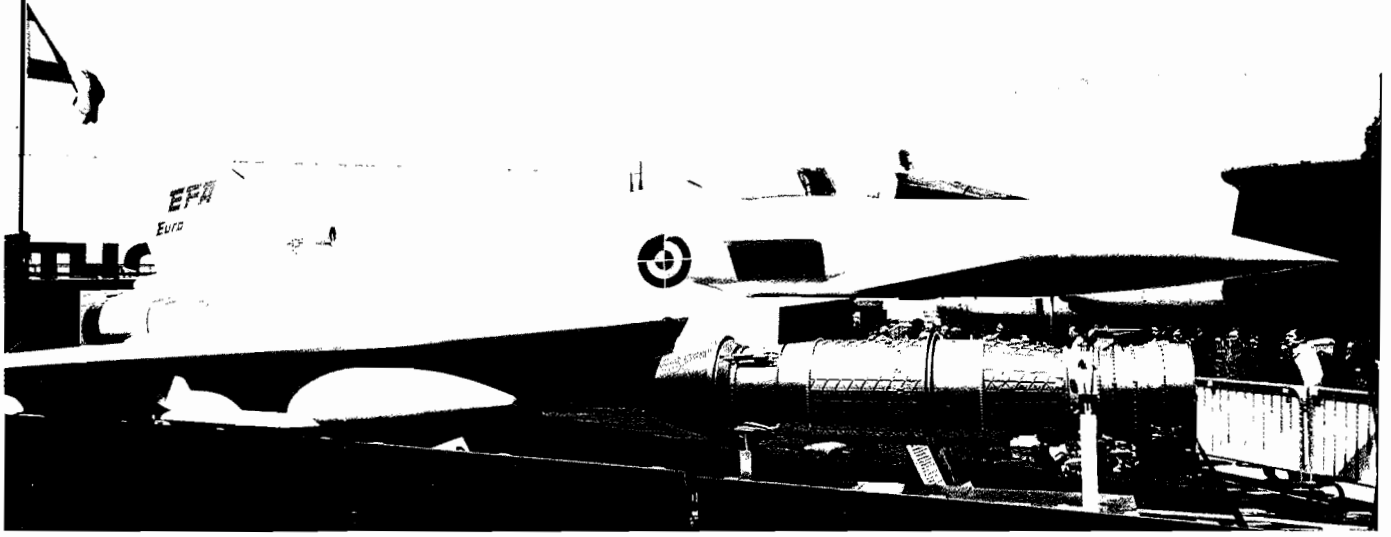


Competitive subcontracting at the subsystem level is found in many large US and European projects (EFA involved detailed cost estimates between two competing multinational radar consortia).

Squabbles over capabilities for the Eurofighter could lend credence to the tenet that collaborative projects produce multi-role equipment ill-suited to any task: but such problems are not unique to collaborative programs and even single-nation designs are increasingly forced by cost constraints to be multi-role in design.

Transatlantic trade v. protectionism

The equity of the transatlantic arms trade ("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 (Hawk aircraft, and the RITA battlefield communications system). The ratio of European to US imports has dropped from 8:1 in the late 1970s to currently 2:1. However, military imports into the US consist almost exclusively of components. Since the First World War, the US has imported only one very large system from abroad – the initial order of the British Harrier V/STOL aircraft for the US Marine Corps. Europeans assert that US procurement policy is actively protectionist. Although the "Buy American Act" can be and often is waived for arms procurement, the US Congress watches large procurements closely. In practice, European firms must generally find a US majority partner before bidding on US projects.

While European firms have sometimes been able to acquire US contractors without losing access to classified US technologies, most experience difficulties. The US government also refuses to share its most sophisticated technology with NATO allies (and release of complete data packages for European production of joint programs is also not always easy).

In spite of the European Commission's September 1988 proposal for a 10 per cent tariff on arms imports into Europe, Europrotectionism is not a viable across-the-board industrial strategy for the defense sector. In the first place, it is likely to be expensive. Moreover, the arms industries of many European countries depend, on transatlantic trade at the level of components for the measure of independence they enjoy. All countries in Europe, even France and Britain, rely to a greater or lesser extent on imports of US arms or the use of US licenses. Fifty per cent of the missiles currently procured by European governments are US designs, and between 10 and 30 per cent of the components in the Tornado (depending on the model) were US in origin.

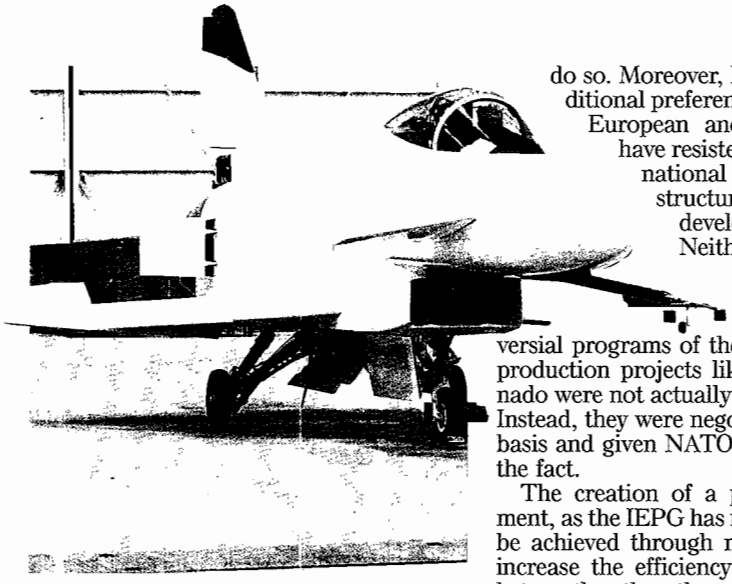
European dependence on the US at the level of complete systems will continue to decline, however. All combat aircraft being produced or developed in Europe (except the French Mirage 2000 and Rafale) and close to 75 per cent of missiles are already co-developed or co-produced. By the end of the century, over 80 per cent 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. Nonetheless, transatlantic trade in subsystems and components is increasing in importance.

To close the European market is to risk US 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 export interests in the US. The sale of even a minor weapons system can have a substantial impact on a defense sector the size of France's, for example. In a transatlantic arms-trade war, the Europeans would probably lose disproportionately, for their firms are dependent on the US for a higher percentage of their business than *vice versa*, and NATO members are unlikely to accept EC attempts to tax imported military goods, although they may be forced to concede the legal right of the Community to levy such tariffs.

In the long run, the central question facing European (and US) planners is whether European industry will be encouraged to evolve into a semi-autarkic European "pillar" with some subcontracting and government-to-government trade with the US, or toward a set of transatlantic corporate alliances and mergers between European and US firms, each with strong technological capabilities and links to other firms on its continent. The latter is by far the more attractive model, in part because both France and the US have generally rejected transatlantic government-to-government co-development on an equal basis.

The creation of a European-pillar model would permit transatlantic trade only through a "family of weapons" arrangement. This concept, introduced by the US in the 1970s, is a form of managed transatlantic trade in which specific product lines are assigned to countries. In theory 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, such an arrangement 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 advanced medium and short-range air-to-air missiles project (see *IDR* 4/1991, p.285).

Market-sharing agreements of this kind



Rockwell/MBB X-31A demonstrator may point the way to more promising types of transatlantic collaboration.

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 R&D 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 (see *IDR* 11/1990, pp.1285–86).

The extent to which such alliances are possible or profitable will depend on the extent to which US and European policymakers are willing to recognize them as legitimate. Key points are the conditions under which European firms are allowed to acquire US defense contractors, take part in US 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 preproduction projects like the Rockwell/MBB X-31A, a forward-swept wing, vectored-thrust demonstrator.

In view of the political and economic risks of ceding the European market to a US producer, however, it would be imprudent for the European nations to renounce their technological competence. 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 US giants. A similar argument holds for trade within Europe. Deliberations on the creation of a European defense-procurement agency must take account of the fact that international organizations can do little more than create a broadly permissive environment for voluntary international co-operation in arms procurement. They cannot micromanage such programs, and should not attempt to do so. Moreover, because of their traditional preference for autarky, both European and US governments have resisted attempts by international organizations to structure their co-development projects. Neither the IEPG nor the EC has ever initiated a project, and after controversial programs of the 1950s, NATO co-production projects like the F-16 or Tornado were not actually initiated by NATO. Instead, they were negotiated on an *ad hoc* basis and given NATO project status after the fact.

The creation of a permissive environment, as the IEPG has recognized, can best be achieved through modest measures to increase the efficiency of European markets, rather than through the creation of a centralized bureaucratic agency. 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 so far the IEPG has declined to require transparency where it is needed most: in the awarding of contracts to national suppliers.

Investing in the future

Like the defense industries of developed nations, newer suppliers of defense equipment based in less-developed nations have also been affected by the recession, but they are still able to produce competitive products at a low cost (Brazil and South Korea come to mind, and countries like Egypt are developing their arms-making capabilities). More worryingly, perhaps, for European defense producers is Japan's strategic decision to bolster its aerospace and defense industries by 15 per cent per year from now to the year 2000. Contrary to popular belief, there is nothing in the Japanese constitution that prohibits more than one per cent of GNP (Gross National Product) being devoted to defense expenditure; nor is there any legal bar in that country to the export of military equipment.

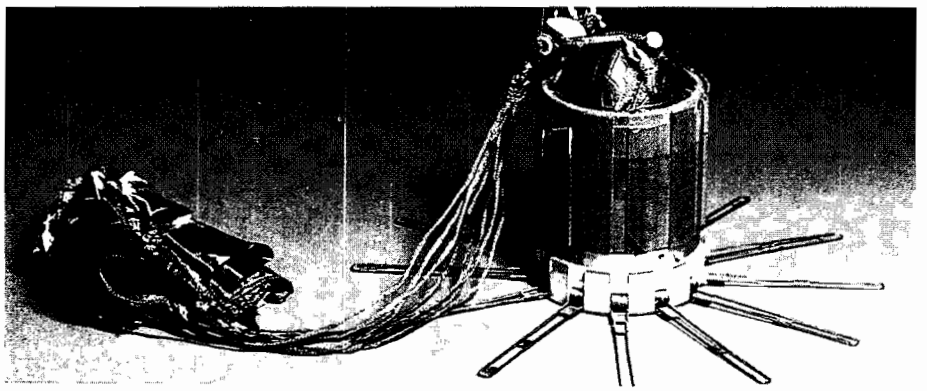
This combined with the other factors indicated has led European industry to search for the critical size that must be reached within its sector in order to earn a sufficient profit margin for reinvesting in new development. Industrial consolidation on a transnational basis will facilitate the expansion of accessible markets. The UK and Germany have already reduced state control over arms industries, and in France Matra has made the most of reprivatization, which offers greater flexibility, facilitates national and transnational consolidation of capital, and implies better access to financial markets.

Restructuring of the German aerospace industry began with the government's desire to make the Airbus project profitable by adding the necessary industrial assets. The principle of economic and financial complementarity of different industrial cycles in the civilian and military aeronautical sectors allows a linkage of budgets, as well as financing through military credit from the defense ministry of R&D projects that would be too risky (and hardly profitable) otherwise. Industrial consolidation in Germany is primarily domestic in nature and is headed by the automobile manufacturer Daimler-Benz, which now has a majority stake in Germany's aerospace industry as a result of successive acquisitions: MTU (100 per cent), Dornier (66 per cent), AEG (56 per cent, soon to be 100 per cent) and MBB (over 50 per cent). Holding company Deutsche Aerospace (DASA) is valued at $6.7 billion and is currently responsible for one-third of Germany's arms orders and over two-thirds of the government's new development programs. However, there are areas in the defense field that are not covered (or only partially so) by DASA: ground systems, air-to-air missiles, and naval construction. (DASA's withdrawal from this last sector was imposed by the German economics ministry at the time of the merger of Daimler-Benz and MBB.)

In the UK, the government chose to allow market forces as much free play as possible, thereby favouring the development of two exceptionally strong players – British Aerospace (BAe) and the General Electric Company (GEC). BAe acquired Rover, Royal Ordnance and many other smaller defense companies, and today has an annual revenue of $7.2 billion in the aerospace and defense sectors. GEC has acquired Ferranti radar and, together with Siemens, launched a successful takeover bid for Plessey, thus increasing its revenue from defense alone to $3.9 billion.

Several sizable companies still remain outside the spheres of British Aerospace and GEC – for example, Westland, Racal, Thorn EMI, Hunting, and STC/ICL, but the consolidation process continues: immediately after its privatization Short Brothers was sold to the Canadian group Bombardier and other major suppliers of Whitehall have reached a sub-critical size: principally Racal (defense radar and avionics) and Thorn EMI Electronics (which itself recently bought MEL, Philips' UK subsidiary. In France, major consolidations are also taking place in the defense industry. In the avionics sector, the state initiated the merger of Crouzet, SFENA, Thomson AVG, and Aerospatiale EAS, thus bringing four companies under public control. This new entity, Sextant Avionique, represents annual revenues of $9 billion. The merger was conducted through Crouzet, the only one of the four companies that was listed on the stock exchange.

Meanwhile, Thomson CSF has absorbed much of the defense interests of Dutch company Philips. Thomson has also formed a joint sonar business with the UK's Ferranti International. Matra, whose defense and space programs represent only 40 per cent of its business, and whose revenue from them ($1.4 billion) is relatively small even in domestic terms, has merged its space sector with that of GEC Marconi to form Matra Marconi Space. Matra has also taken a minority stake in Germany's major air-to-air missile-maker BGT (together with the Diehl group, which makes ammunition and sub-munitions). Italy's Aeritalia and



European production of the anti-tank mine payload for the MLRS launcher begins in 1992. An early form of transatlantic multinational co-development/co-production, the multiple-launch rocket system has weathered many problems (see *IDR* 7/1991, pp.685-86). A European consortium exists to build the launcher for European requirements.

Selenia have formed Alenia, held on a 50:50 basis, and Aerospatiale and Alenia have signed a long-term co-operative agreement for missile systems and formed a consortium (Eurosam) with Thomson-CSF to develop a family of anti-missiles which Spain has joined. Aerospatiale, Alenia and France's Alcatel Espace have signed a technical, production and marketing accord on satellites and associated space systems.

For the future, while governments may respond to lower budgets and diminished threat-perceptions by cutting programs, the major armaments projects that remain will be undertaken collaboratively.

The evidence is that in Europe, governments and industries are learning to collaborate more efficiently over time. Co-development consortia will thus continue to exist – 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.

As companies move toward closer transatlantic, as well as European, co-operation, both European and US institutions should remain flexible enough to accommodate these new, often project-based corporate alliances. ◆◆

Notes

1. *Emerging Dimensions of European Security.* Wolfgang Danspeckgruber, ed. Published in English by the Westview Press in co-operation with ICM Foundation International, Boulder, Colorado, 1991.
2. For assistance and comments thanks are due to Hans Binnendijk, Martyn Bittleston, Andrew Butfoy, Wolfgang Danspeckgruber, Oliver Debouzy, François Heisbourg, Ethan Kapstein, Raymond Vernon and participants of the First Liechtenstein Colloquium.
3. See IEPG, *Action Plan on a Stepwise Development of a European Armaments Market* and IEPG Luxembourg Communiqué of 9 November 1988, Atlantic News (No. 2065 Annex One, 15 November 1989). In this sense, the IEPG proposals must be understood in part as a method of heading off any future European Community efforts to get involved in regulating the armaments industries.
4. See Jean-Laurens Delpech, "La standardization des armements", *Revue de Défense Nationale*, May 1976. Delpech also asserted that the length of the program increased by the cube-root of the number of participants.
5. See Frederick P. Biery and Leonard Sullivan, Jr., *Assessing US Weapons System Modernization Cost and Performance Trends* (TR-3997- 3, Report prepared for the Office of the Secretary of Defense, Arlington, Virginia, April 1985). The authors find that economies of scale also give the US an advantage in producing later, modified versions of aircraft. The US also enjoys about a 10-year lead in aircraft performance, which it maintains by outspending the Europeans in R&D in this area.

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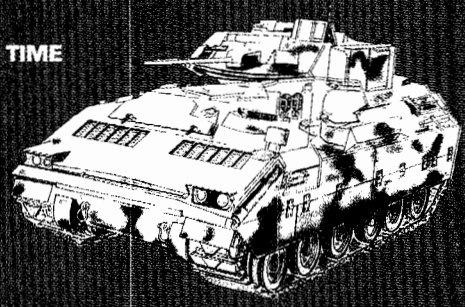

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