European Defence RTD in Context

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EUROPEAN DEFENCE RTD IN CONTEXT

1. INTRODUCTION

The aim of the paper is to give an overview of the major actors in defence RTD (research and technological development) affairs at the European level; and to indicate some of the key military, technological, industrial and political issues, which are shaping events. The emphasis in Discussion Paper 1 is on the *European* level of analysis and it does not discuss national systems, since these are referred to in Discussion Paper 2, and are to be developed in detail in later phases of the project.

2. THE SCALE OF EUROPEAN MILITARY RTD ACTIVITIES

In important respects, the scientific, technological and industrial base of western Europe, like that of the United States, has depended significantly upon substantial investments in the defence sector. Thus, various sources have estimated that more than half of European RTD expenditure is accounted for by defence-related activities and this remains the case despite post Cold War cuts in defence expenditures and the changing relationship between technologies of defence and civil origin. Clearly, changes in the scale and nature of defence RTD have implications for scientific and technological activity in Europe.

Defence RTD Expenditure

The scale of government defence RTD expenditure by leading economies remains substantial. Table 1 shows government expenditure for the seven leading industrial countries but excludes the significant expenditures made by the defence industry itself. Such figures show that defence continues to account for a substantial amount of government RTD expenditure in the leading European economies. Amongst the seven economies, note that Italy has the highest government defence RTD expenditure as a proportion of GDP and government defence RTD expenditure represents a very large share of all government RTD spending in the UK and France. The small proportion of RTD expenditure in Japan accounted for by defence should also be noted relative to the USA and European countries. At the same time, the figures also emphasise the scale of government defence RTD expenditure in the USA, which dwarfs that of the European countries in the table.

Transatlantic Comparisons

Certainly, such statistics emphasise the considerable differences between the defence RTD expenditures of individual European Member States and the United States of America. Indeed, there is a sense of vulnerability in Europe to the US defence industry not only with respect to the relative size of RTD expenditures but also related to the size of the US defence companies that have emerged from the consolidation process in the US. Thus, Lockheed Martin and Boeing are the largest defence companies in the world by some margin and Table 2 dramatically illustrates the scale of the size difference in defence revenues between them and the leading European companies. Prior to the completion of the planned acquisition of GEC Marconi by British Aerospace, the US has four of the five largest companies by defence sales, and seven of the top ten. The combined defence sales of the three largest European defence companies - British Aerospace, GEC and Thomson-CSF - at $19.9 billion, are only slightly more than the $18.5 billion reported by Lockheed Martin. The $22.8 billion in combined defence sales of the four largest European defence companies is only a little over 40% of the sales of the four leading US companies (James, 1998).

Indeed, it is the size of the leading US defence contractors that has finally forced European governments into serious consideration of trans-European defence industry restructuring, a matter which will be discussed in detail in a later section.

Table 2: The top 10 defence companies worldwide[1]

Company	Country	1997 defence revenues ($bn)
Lockheed Martin	USA	18.5
Boeing	USA	13.8
Raytheon	USA	14.4[2]
British Aerospace	UK	10.1
Northrop Grumman	USA	8.2
GEC	UK	5.77
Thomson-CSF	France	4.18
TRW	USA	3.8
General Dynamics	USA	3.65
United Technologies	USA	3.31

3. THE CHANGING MILITARY CONTEXT[3]

Cold War interests and requirements shaped the institutions for military R&D that we have today. To counter the perceived threat from the Soviet Union, the United States and its allies adopted a strategy of relying on high technology weaponry in which they held a comparative advantage, and the Soviet response in developing its own advanced weapons only served further to fuel a technological arms race. National security requirements justified a high level of funding and an emphasis on high performance developments that was seldom questioned throughout the Cold War. Military R&D programs were an indispensable element in the maintenance of this situation: through R&D defence companies developed new ideas, responded to emerging military requirements, and positioned themselves to reap the rewards of follow-on production contracts. Government management of this complex process focused on efficiency questions - particularly the question of contractual incentives and the problems of maintaining a semblance of competition in a market dominated by a single government customer - and on responding to a series of scandals centred on particularly costly programs. On the whole it was a remarkably stable environment, one in which the potential destabilising effect of continuous technological change was tamed through long-standing networks summed up under the rubric of 'the military-industrial complex.'

Changing Military Requirements since the End of the Cold War

Nevertheless, the end of the Cold War altered many of the long-established relationships in these military-industrial networks. In particular, in most countries budgets for military R&D have fallen along with total military spending, affecting both government and industrial laboratories.[4] Nevertheless, it is important to stress

[1] Source: James (1998).

[2] Pro forma figure for Raytheon Systems Company. The figure overstates Raytheon's defence sales as it includes some sales to commercial and non-defence government customers.

[3] This section is based on a forthcoming publication by Reppy and Gummett (1999).

[4] The Stockholm International Peace Research Institute (SIPRI) estimates that world military R&D has decreased by as much as 50 percent in real terms since the mid-1980s. *SIPRI Yearbook 1996* (Oxford:

Table 1: International comparisons of government defence R&D expenditure, 1994

	UK	Germany	France	Italy	Japan	Canada	USA
Defence R&D expenditure (£m)	2301.5	791.2	2927.4 (1)	375.9	486.9	127.4 (2)	24137.8
Percentage of GDP	0.35	0.08	0.43 (1)	0.60	0.03	0.04 (2)	0.57
Percentage of total government R&D expenditure	38.9	8.4	33.6	8.9	6.0	6.2	55.3

(1) Figure is for 1993
(2) Figure is for 1992

(Source: SET Statistics 1996)

from the outset that in many countries high technology weapons remain central to military doctrine, and military R&D is still a large and important component of government spending for R&D, one that would command our attention on size alone.[5] Recent changes in long-term prospects for military R&D and in R&D-performing institutions raise other important issues for government policy. Indeed, it is not clear whether traditional means of governance for R&D are adequate to the new challenges.

The Revolution in Military Affairs

The perceived importance of superior information and communications technologies to the outcome of the Gulf War has prompted many analysts to talk about a Revolution in Military Affairs. Stealth, precision weapons and advanced information systems are central to the RMA, which is playing an increasingly important part in US military thinking, particularly in the US. In the view of some commentators, the drive to realise the RMA will mean less emphasis on traditional platforms than on the critical systems that make them work (Center for Strategic and International Studies, 1998). This would suggest a relative decline in the importance of the manufacturers of those platforms and a growing role for suppliers of electronics, information and communications technologies. It would also necessitate a change in the way that governments procure equipment for military purposes. At the same time, US investment in the digitisation of the battlefield and an emphasis on more information-intensive warfare, has prompted concerns about a growing gap in military technology between the US and Europe which could threaten their ability to operate side-by-side (Nicoll, 1998).

4. TECHNOLOGICAL CHANGE

Not only has the military context for defence technology been changing, but also so has the sources of that technology.

Changing Environment for Military RTD

Whilst the end of the Cold War invalidated many of the assumptions that underpinned strategic and budgetary choices favouring military R&D, the environment for military R&D had already begun to change before then. Three drivers can be identified as being of particular importance. First, the cost of developing weapons systems and the technologies that underpin them is escalating; few countries (with the exception perhaps of the US) have military markets that are sufficiently large for the cost effective design, development and manufacture of such systems. At the same time, technological change and complexity means that individual countries find it increasingly difficult to keep abreast with technological developments across the whole spectrum of military equipment. In addition, technologies are increasingly dual-use, advanced technologies of civil origin may be required in defence equipment, and scientific and technological knowledge is increasingly international and the innovation process has an increasingly distributed character.

Oxford University Press, 1996), p. 384, fn. 6. One result of the end of the Cold War has been increased transparency with respect to military R&D, but there are still gaps in the data, especially for China.

[5] For a discussion of the relationship between military strategy and military R&D, see Greg Bischak, "The Implications of Alternative Security Doctrines and Policies for the Defense Science, Technology and Industrial Base," Paper presented at the Council on Foreign relations Study Group on Consolidation, Downsizing and Conversion in the US Military Industrial Base, New York, April 1996 (mimeo).

Changing Relations between Technologies of Defence and Civil Origin

The changing relationship between technologies of defence and civil origin deserves particular mention. For most of this century, it has been accepted that in all important defence-related areas, technology of defence-origin has led, indeed has driven, that of the civil sector. Increasingly, however, dual-use technologies are recognised as having important implications for policies on defence technology and procurement, the technology strategies of large defence companies and the view taken of the implications of national economic competitiveness for national security (Alic *et al*, 1992; Andrews, 1995; Cowan and Foray, 1995; James *et al*, 1998).

5. CONSOLIDATION IN THE DEFENCE INDUSTRY

The 1990s have also seen major structural, commercial and technological changes in the defence industries of Europe and the US. Consolidation, rationalisation and capacity reductions amongst large defence contractors have had a profound impact on direct employment and severe knock-on effects for defence-related suppliers. As a consequence, between 1989 and 1996, defence industry employment in those countries that today constitute the European Union fell by more than 450,000 (a decline of more than one-third). At the same time, the US saw defence industry employment fall by more than 1 million (James *et al*, 1998).

Differing Patterns of Restructuring in the USA and Europe

The pattern of industry restructuring in the United States and Europe has been different in important respects. The United States has seen a rapid consolidation of its defence industry in recent years associated at the prime contractor level with a series of so-called "mega-mergers". Although Europe's defence companies have already engaged in significant restructuring both within and across borders, the restructuring process in Europe has been slower than in the US, both as regards rationalisation of production capacity and consolidation of the defence industry, although there are important national variations (Gummett and Stein, 1997; Skons and Cooper, 1997; Wulf, 1993; Sandström and Wilén, 1993; Brzoska and Lock, 1992; Hébert, 1991). European firms have encountered important barriers to trans-European mergers, acquisitions and joint ventures. These barriers have included state ownership of some of Europe's largest companies, varying corporate laws and significant differences in production costs between national defence industries and defence contractors.

The Growing Dominance of the US Defence Industry and The European Response

What has emerged from this restructuring process is a defence industry where a fragmented European industry faces a number of very large US companies which can achieve competitive advantage from economies of scale and scope with regards to production and the development of technology. Notwithstanding the barriers to integration at the European level, the threat posed by the US defence industry is increasingly driving European companies to seek to consolidate.

The perceived threat to the European defence industry posed by the emergence of these huge US companies has given an added stimulus to its consolidation efforts, not least through attempts to establish a European Aerospace and Defence Company. Aerospatiale (France), British Aerospace (UK), DASA (Germany), CASA (Spain), Saab (Sweden) and Alenia (Italy), have agreed in principle to the formation of a European Aerospace and Defence Company (or "EuroCo") which would bring

together the companies' defence activities into a single entity. The final form that the entity would take is far from clear but, at any early stage of the negotiations, it became clear that political and commercial issues meant that the "big bang" merger of the six companies was highly unlikely. Attention has turned to possibility of a bilateral merger between two of the partners with the other partners joining as and when they are ready. Whilst speculation had focused on British Aerospace and DASA, the acquisition of GEC Marconi by British Aerospace is seen by many to have put back such bilateral deals, at least in the short-run.

A number of important European alliances have been forged or set in motion in recent years. In 1997, the French government's announcement of the partial privatisation of Thomson-CSF is seen by many as a critical step towards restructuring in the defence electronics sector; Matra-British Aerospace Dynamics, a joint venture between France's Lagardere and British Aerospace, has recently taken a 30 per cent stake in DASA's LFK missile subsidiary; and, British Aerospace and DASA acquired the defence electronics assets of Siemens (Lewis and Starr, 1997). More recently, Italy's Finmeccanica and GEC of the UK have announced their decision to enter into a joint venture. Such efforts are not new but are proceeding at an accelerated rate, with UK helicopter company GKN Westland's recently announced relationship with Italy's Agusta, the latest move in European consolidation.

6. THE POLITICAL CONTEXT

Certainly, there are continued political efforts to encourage closer integration within Europe both in research and technological development and (more controversially) in the fields of defence and security. However, the significance of many of these actions is as much symbolic as anything else and there are formidable political barriers at the national government level to closer co-operation in the fields of defence and European security. Similarly, various efforts in the field of defence by the European Union have been constrained by national political factors. Inevitably, any overview of the major actors in military RTD at the European level must recognise this political context and in particular the constraints on trans-European activities in this field.

Pressures for Action at the European Level

Nevertheless, these constraints notwithstanding, various forces and circumstances are raising to ever greater prominence the question of the formation of defence technology policy in Europe. Perhaps most significantly at present, the consolidation of the US defence industry and the perceived competitive threat from the largest US defence contractors has been argued to necessitate action at the European level (Commission of the European Communities, 1997). Technological change might also be seen to be driving changes at the European level. As observed by J.P. Contzen, a senior European Commission official responsible for the Joint Research Centre, new technologies today are increasingly 'the combination of several technologies'. They are, he suggests, 'super-technologies', and he goes on to conclude that future product or process inovation, be it civilian or military, will require the 'simultaneous mastering of several technological sectors' (Contzen, 1995). In addition, as the balance of demand for advanced technologies has shifted over the years more and more towards the civil sector, so leadership in technical change has also shifted increasingly to the civil sector. At the development and production levels, the four-nation *Eurofighter 2000* programme is but the most prominent current example of the imperatives driving governments and firms to pool resources of finance, expertise and

markets, in order to achieve economies of scale that offer some prospect of competing on price and quality with the considerably larger US firms and US market.

Issues of National Sovereignty versus European Identity

In all these policy areas, issues of national sovereignty versus European identity loom large. The reluctance to surrender competence to Brussels in this policy domain is one reason why the CFSP provisions were kept at the inter-governmental rather than the supra-national level, restricting the scope for initiative by the European Commission, and hence severely limiting the possibilities for linking the restructuring of defence R&D, or firms, to the other technological and industrial policy instruments of the European Union. Similarly, moves to establish the European armaments agency, led by France and Germany, were bogged down in a succession of difficulties, and only began seriously to advance in November 1996, with the formation, *outside* the frameworks of both the EU and the WEU, of the Joint Armaments Cooperation Organization (JACO - known in France as OCCAR - Organisation conjointe de coopération en matière d'armement). Its founding members are France, Germany, Italy and the UK; others may join in due course. It will be responsible for the management of several existing Franco-German programs, and will take over responsibility for a range of multilateral collaborative programs, beginning with a new family of wheeled infantry combat vehicles (known as VBCI in France, MRAV in UK, and GTK in Germany).

7. ACTORS AND POLICY MEASURES AT THE EUROPEAN LEVEL

There are a number of policy measures and actors at the European level which are relevant to the subject of this report. Measures have been implemented under the auspices of the European Community, European Parliament, the EUREKA programme and the Western European Union as well as through business-led initiatives. In this section we identify some of these policy measures and actors.

EUROPEAN UNION

There are conflicting views on the proper role of the European Union in the area of defence-related industrial and RTD matters. At the Member State level, some governments are more enthusiastic than others. Of course, Article 223 of the 1957 Treaty of Rome formalised the European Community's exclusion of defence from its joint responsibilities[6]. Only in cases where trade in dual-use items distorted the operation of the civil common market could the European Commission step in, and even then reluctantly because of the sensitivity attached by Member States to this area.

Common Foreign and Security Policy

A key step in this regard was the establishment of a common foreign and security policy (CFSP) under the Maastricht Treaty on European Union of 1992. The Treaty established a commitment to move towards a Common Foreign and Security Policy (CFSP), raising the prospect of 'the eventual framing of a common defence policy, which might in time lead to a common defence'. This treaty language was the result

[6] This 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 and 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.'

of a compromise between those who wanted a strong European defence and security identity, largely separate from NATO, and those who wished to maintain NATO as their primary security framework, albeit with a strengthened European component. Significantly, the same article of the Treaty (article J.4) called not on the institutions of the EU but on the Western European Union (WEU), 'to elaborate and implement decisions and actions of the Union which shall have defence implications'. The WEU had been resurrected in the 1990s to act as a bridge between the EU and NATO. Thus, military matters remained outside the area of supranational activities, being kept firmly at the inter-governmental level. (Gummett, 1996).

The Amsterdam Treaty of 1997 took matters a step further. In Article J.7, which replaced Article J.4 of the Maastricht Treaty, it stated that the common foreign and security policy "shall include all questions relating to the security of the Union, including the progressive framing of a common defence policy … which might lead to a common defence, should the European Council so decide". It further stated that the WEU was an integral part of the development of the EU, providing the EU with access to operational capability; and that the EU should accordingly "foster closer institutional relations with the WEU with a view to the possibility of the integration of the WEU into the Union, should the European Council so decide". Finally, and of particular significance for our discussion, was the provision that "The progressive framing of a common defence policy will be supported, as Member States consider appropriate, by Cupertino between them in the field of armaments".

This Article, careful though it is to acknowledge the primacy of the Council rather than the Commission in this sensitive policy area, nevertheless increases the scope for the Commission to take initiatives in respect of defence technology and industry. It is also noteworthy that, using the implicit provision in this Article to focus the attention of the Council of Ministers on defence matters, the Austrian Presidency was emboldened to call for the first time a meeting in 1998 of European Union defence ministers. The weeks preceding the event saw a high-profile debate between those Member States supporting a stronger EU role in defence, led by France, and those determined to prevent it, led by the UK (Tigner, 1998). Since then, however, the UK has reversed its position, in a series of ministerial speeches beginning with one by Prime Minister Blair in October 1998, and now proposes that the WEU might be folded into the EU as a distinct defence 'pillar', but still under the Council's rather than the Commission's control. While no conclusive reaction has yet emerged from other EU member states, the cumulative effect of these various developments has been to raise the salience of defence industrial and technological matters within the institutions of the EU generally.

European Commission Policy Statements

The European Commission has expressed its opinion on matters related to the restructuring of the defence-related industries in two recent Communications.

In September 1997, the European Commission published *The European Aerospace Industry: Meeting the Global Challenge*. This focused on the situation facing the European aerospace industry in a context of growing competitive pressures from the mega-merged US defence and aerospace companies and the need for a European response. The Commission identified as a priority the need to accelerate the restructuring of the European aerospace industry, noting the that whilst the primary responsibility lay with industry itself, Member States and the European Community

can facilitate this process through providing the necessary support structures, including launch aid and the co-ordination of RTD at the national and Community level. In addition, the Commission identified a number of accompanying measures as a priority, including RTD support, harmonisation of procurement requirements to create a European domestic defence market and the establishment of the European company statute.

November 1997 saw the publication of *Implementing European Union strategy on defence-related industries* and an accompanying *Action Plan for the defence-related industries.* This focused on the changes in the European defence-related industries and expressed the view that: "The need to implement a European Union strategy to keep up with the major changes in the European defence-related industries is becoming more pressing every day" (Commission of the European Communities, 1997b: p.2).The Commission identifies three reasons to take action at the European level: the European union must maintain its defence-related industrial and technological base as a basis for establishing a European defence identity and to sustain competitiveness and jobs in crucial manufacturing sectors; the European union is a preferred framework for action in this area complementing others such as national frameworks and those of the defence organisations to which most member States belong; and, the different instruments at the disposal of the European union need to be combined because of the particular nature of the defence-related industries as both a means of production and essential to foreign and security policy. The accompanying Action Plan included a list of fourteen actions including the simplification of intra-Community transfers of defence-related products, the creation of a European company statute, reform of public procurement and the use of the Community Framework programme to develop those civil technologies such as materials and Information and communication Technologies) which can contribute to the improvement of the defence technological base and the competitiveness of the industry.

The Framework Programme for Research and Technological Development

Whilst these Communications are interesting statements of intent, it is the Community's research programmes (and especially the Framework Programme for Research and Technological Development) which has provided concrete support for the European aerospace sector. Indeed, the European Commission has estimated that between one-quarter and one-third of Framework Programme funding could be described as dual-use. Whilst Community research programmes are formally aimed at civil objectives, the development of civilian applications of technologies of defence origin through technology transfer and R&D co-operation between civil and defence-related organisations can be supported by Community research programmes. Technology transfer activities and the specific technology stimulation measures for SMEs are two of the activities of the Framework Programme that are of particular relevance in this context. For instance, the Innovation Programme run by DGXIII/D encourages the exchange of research information and the absorption of new technologies by European companies. Defence-related organisations such as British Aerospace, Rolls-Royce, DASA, DERA and ONERA are active participants in Community programmes.

The Structural Funds

Under the current Structural Funds regime, the KONVER programme of support to defence-dependent regional economies has underpinned a number of the diversification initiatives described in the country studies. The purpose of KONVER,

which is a Community Initiative providing support for economic diversification in areas heavily dependent on defence-related activities through the encouragement of commercially viable activities not related to defence. KONVER has supported local and regional policy initiatives that have proved useful to defence-related SMEs seeking to use their technological capabilities to diversify into new non-defence activities. Eligible areas are those in which actual or announced defence-related job losses have totalled 1,000 or more since 1990. Established in 1994, the budget for KONVER is ECU 630 million for the period 1993-99. We note that the Commission has announced that it proposes to reduce the number of Community Initiatives under its reform of the Structural Funds. It appears that this will mean that the KONVER programme will not be continued after the end of 1999. The European Social Fund and the European Regional Development Fund have also been used, within the eligibility rules of the programmes, to respond to structural and social challenges arising as a consequence of the changes in defence-related sector.

INTERPRISE and IBEX

The European Community also operates programmes to encourage networking between European firms. These are general measures that can, and are, used by defence-related companies. INTERPRISE (Initiative to Encourage Partnerships among Industries or Services in Europe) provides a forum for inter-company meetings to allow companies to identify new partners and customers. One of the initiatives it supports is DECIDE (Civil Diversification of European Defence Industries) aimed at companies in the defence sector or operating with clients in the sector. The European Commission also encourages and supports International Buyers' Exhibitions (IBEXs) targeted at SMEs in regions eligible under Objectives 1, 2 and 5(b) of the Structural Funds. Like the INTERPRISE programmes, IBEX seeks to stimulate contacts between firms and has organised an event focused on the aeronautical engineering sector.

European Parliament Initiatives

The European Parliament has expressed a range of views on matters of Europe defence RTD and industry restructuring. Some members of the European Parliament oppose any sign of a shift of the UE into the field of defence. At the same time, others and particularly those with defence-dependent constituencies, have sought to encourage new initiatives. A recent development at the European level is the Aerospace and Defence Regional Initiative And Network in Europe (ADRIANE), a European Parliament Initiative supported by the European Commission. The network aims to encompass all sectors involved in aerospace and defence work: industry and SMEs, local and regional representatives of aerospace and defence communities, work force representatives and education and training bodies. ADRIANE has three primary objectives related to networking and co-operation, employment generation and the development of new technologies. Networking and co-operation between SMEs in the aerospace and defence sector permits the exchange of experience and information and enables greater coherence in responding to the demands of larger industrial players. Equally, the wider defence community has a role in the exchange of information on a European level between trade unions, universities and local and regional authorities. ADRIANE also hopes to enable SMEs to pool their resources to allow representation in the main areas of European decision making. Networking can also allow the sharing of new developments by universities, colleges and research institutes and technological development through closer co-operation between industry and research centres at the European level.

EUROPEAN-LEVEL PROCUREMENT INITIATIVES

In 1996, two trans-European armament agencies were formed. OCCAR (Organisation de Cooperation Conjointe en Matiere d'Armament) was created as a joint management organisation for France, Germany, Italy and the UK, and the Western European Armaments group (WEAG) was established as a subsidiary body of the WEU. Table 3 describes the main features of the two organisations.

Table 3: Characteristics of OCCAR and WEAG

	OCCAR	WEAG
Principles/goals	· Consolidate programme management · Co-ordinate long-term requirements and develop a common investment policy · Improve European industrial base competitiveness · Replace programme specific "juste retour" concept with an equitable balance over multiple programmes & years · Open membership to European countries that accept these principles & plan to participate in a major co-operative programme · Give preference to equipment to whose development a country has contributed within OCCAR	Promote European armament co-operation, strengthen the European defence technology base & create a European defence market. Offer an appropriate legal framework for a future European armament agency.
Programmes administered	MILAN & HOT antitank missiles; ROLAND surface-to-air missile; Tiger helicopter; Brevel drone	Existing defence research & technology projects
Membership	France, Germany, Italy, UK	Belgium, Denmark, France, Germany, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Span, Turkey, UK
Organisational status	A management organisation located in Boon with no legal charter to administer contracts	A WEU subsidiary located in Brussels with legal authority to administer contracts.

(Source: General Accounting Office, 1997).

OCCAR's lack of legal standing has effectively rendered the organisation powerless and, since its formation in 1996, members of OCCAR have tried, without success, to have members of the WEU accept it as the basis for a pan-European arms procurement agency. One of the main sticking points has been said to be that the large arms producing countries and smaller arms purchasers have different agendas.

Against the background of this impasse, the members of OCCAR announced in August 1998 that they were to seek to give the organisation legal status. Their aim was said to have an open structure to allow other nations to join. However, given that one criterion for new members is said to be that they must bring with them a project for collective management, some observers believe that it is likely that the new OCCAR will continue to be closed to smaller WEU nations (Barrie and Mackenzie, 1998).

EUROPEAN RTD PROGRAMMES OUTSIDE THE EUROPEAN UNION

In addition, there are a number of RTD programmes that operate at the European level outside the framework of the European Union. In particular, EUCLID, GARTEUR and EUREKA are noted here.

EUCLID

The Western European Union is seeking to encourage increased European defence industrial co-operation, and the Western European Armaments Group has responsibility for the EUCLID co-operative research and technology programme(European Cooperation for the Long-term In Defence) .

GARTEUR

We also see in Europe steps towards trans-national research organisations that embrace both civil and military interests. The best example is GARTEUR, (Group for Aeronautical Research and Technology in Europe) , which was formed in 1973 by representatives of the government departments responsible for aeronautical research in France, Germany and the UK. The Netherlands, Spain, Italy and Sweden joined later. Initially GARTEUR supplied an information exchange service, but it soon progressed to organising limited co-operative programmes on an à la carte basis, and then added promotion, planning, co-ordination and review of joint activities. GARTEUR works through groups covering particular disciplines (e.g. aerodynamics), with representatives from government, research establishments and industry. In parallel with GARTEUR, an industrial group was established, comprising senior R&D managers from the principal companies. It has regular meetings with the Executive Committee of GARTEUR, and has similar relations with the lower levels in the structure.[7]

Without the mechanics being entirely clear, it seems that GARTEUR provided a setting for discussions between the aeronautical research establishments of the seven member states (the 'RE7' talks) about future collaboration. It appears to be from this network that the 'Joint Position on the Future Role of the Aeronautical Research Establishments in Europe', emerged in January 1994.[8] The document [which came into operation in late 1994] envisages that: "A federative process starting with an association, and to be followed by a partnership, should finally lead to a 'Union of National Aeronautical Research Establishments in Europe.'" It proposes progressive integration of programmes and facilities in the civil sector, with EU support, but notes that "A potentially much larger field of co-ordinated RE [Research Establishment]

[7] We are grateful to Alain Deckers for supplying information on GARTEUR. Further details come from *GARTEUR Guide*, published by the GARTEUR Council, 1993 edition, available from any of the participating laboratories (e.g., DERA, Farnborough, UK).

[8] Of the seven "editors" of the RE7 document, five were their nation's representatives on the GARTEUR Council; the other two were from Spain and Italy and presumably were the link persons between GARTEUR and those two countries, which do not enjoy full membership.

involvement would be opened up by an established European Cupertino in military aeronautics." It further envisages the eventual establishment of a common defence research strategy, possibly resulting in the establishment of a European Defence Research Agency. It remains to be seen how far and how fast these plans will evolve, but it is clear that this is an example of an active policy network representing the interests of government research establishments and companies both to member governments and to the European Commission, and with a firm eye in respect of the Commission on lobbying for financial support for aeronautical reset in Europe, regardless of the traditional civil-military boundary.

EUREKA

Like the European Community Framework Programme, EUREKA is directed at civil objectives. However, there is growing discussion about the scope for the development of a "dual-use EUREKA" (for instance, see James *et al*, 1998). Here it is sufficient to note that the objective of EUREKA is to raise, through closer co-operation among enterprises and research institutes in the field of advanced technologies, the productivity and competitiveness of Europe's industries and national economies of the world market. It seeks to achieve this through encouraging and facilitating increased industrial, technological and scientific co-operation on projects developing products, processes and services having a world-wide market potential and based on advanced technologies.

8. CONCLUSIONS

The aim of this paper has been to give an overview of the major actors in defence RTD affairs at the European level. The paper has identified some of the key military, technological, industrial and political issues, which are shaping events, and has described some of the main institutions that are emerging as Europe enters the twenty-first century. We hope that the paper will complement the work being undertaken on national systems by the CREDIT/METDAC network.

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