A comprehensive analysis of emerging competences and skill needs for optimal preparation and management of change in the EU defence industry

Final report

May 20, 2009

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Executive Summary

The European defence industry is a strategic sector of the EU economy, not only because of its contribution to EU security, but also because of its importance in terms of employment, value added and exports, because of its contribution to regional development, and because of its contribution to a number of other industries, notably through innovation.

Yet, today, the industry is facing important challenges: like other industrial sectors, the defence industry is required to deliver increased efficiency in order to provide value for money to its customers and, at the same time, protect its shareholders' interests. At the same time, demand is increasingly constrained by national defence budgets, whilst competition is growing at world level. Restructuring has become unavoidable. To minimise the negative consequences of restructuring in the social sphere, **anticipation** is essential – and in particular **anticipation of skills needs**.

In that context, the objectives of the study were to:

- Identify and describe the challenges to which the EU defence industry is confronted;
- Identify the regional distribution of defence activities, and the areas of employment concentration across the EU, in order to identify the areas most likely to be concerned by restructuring in this sector;
- Conduct a foresight exercise in order to identify and describe potential future trends in activity, by key segment of defence;
- Draw the main implications of the possible future development scenarios on employment: which jobs will be in high demand, which categories will decline in importance, which will change over the coming years, hence requiring changes in skills;
- Identify and describe emergent job profiles, given future trends in product development and market organisational structure, and the associated training needs;
- Raise awareness of possible future employment trends amongst the defence industry' stakeholders, including in terms of emerging profiles and future skills needs;
- Provide the background information that is necessary to fuel discussions on how to improve strategic sector planning in education and training systems.

The key challenges for defence industries

As indicated on the chart on the next page, one of the key challenges for defence industries in general is the **future trend in national defence budgets** – both within the EU and at world level. Already before the recent economic downturn, defence budgets were either growing very slowly in real terms, or already falling, on the back of tight budget policies throughout the EU in order to cut back the public debt' share of GDP. Ageing and structurally rising social budgets were indeed putting a lid on the potential growth of public expenditures – in particular expenditures on defence, if not on defence & security.

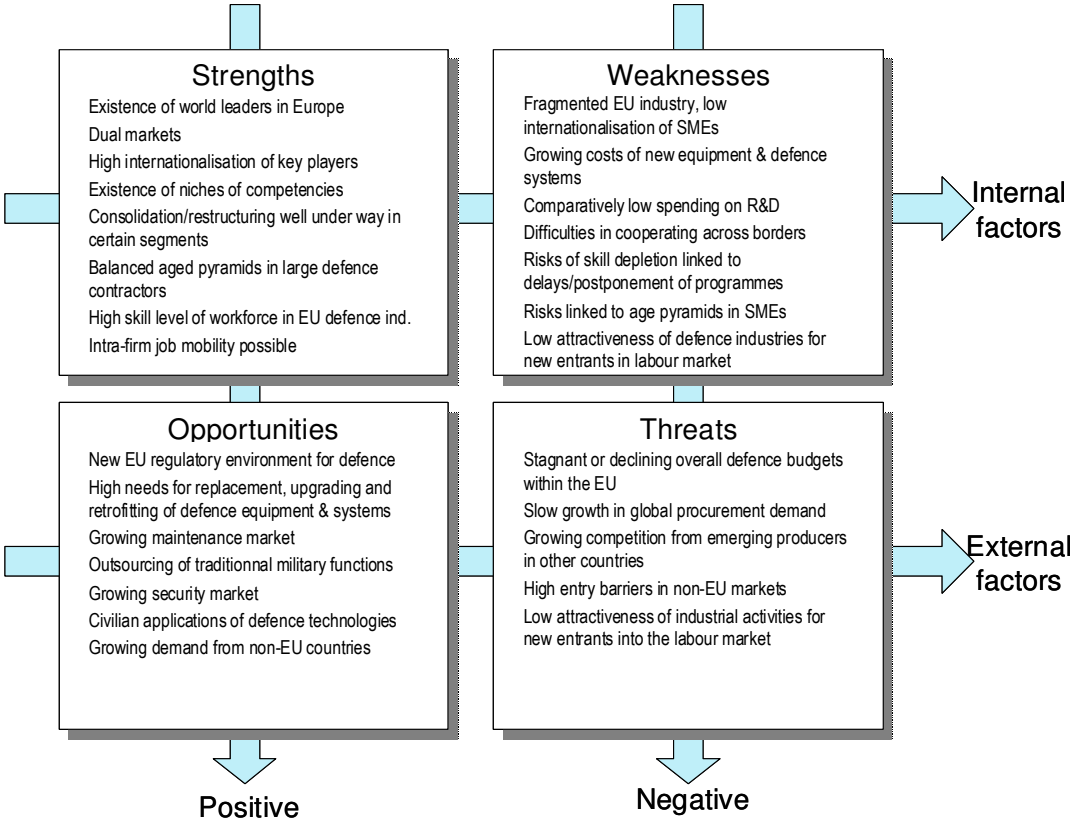
Given the consequences of expansionary fiscal policies in 2008 and 2009, aimed at preventing a collapse of the financial sector and limit the extent of recession, public indebtedness has grown again. It will take many years before the public debt to GDP ratio returns to the pre-crisis level. In the meantime, expansionary defence procurement budgets are highly unlikely. Given that equipment costs rise typically faster than inflation, the slow (nominal) growth in defence budgets means stagnant or declining budgets in real terms, hence overall reductions in defence equipment expenditures.

Other challenges include the **fragmented nature of the industry,** and **the high concentration of employment in certain regions:** although the defence industry is more vertically integrated than other industrial sectors, there are thousands of diversified SMEs which serve the larger

defence contractors. Altogether, there are presently too many companies in the sector in the EU, many of these being too small to survive in an increasingly competitive and global environment. At the same time, the **high concentration of employment** in certain regions is a source of vulnerability and is perceived as a threat on the social front.

Finally, comparatively **low spending on R&D in the EU** as compared with the US and other leading technology producers (such as Japan) is perceived to potentially hamper the EU industry's future technological competitiveness.

Summary of the key strengths, weaknesses, opportunities and threats for defence industries



Yet, there are also opportunities which the industry has to prepare itself for: among these are the **fast growing markets for certain products and equipments** such as drones, civilian applications of space technologies and equipment related to the growing security market, and there are also **high replacement needs** for certain types of equipment (air carriers, missiles, etc…). In addition, **demand from non-EU countries is also growing faster than within the EU**.

To make the most of these future opportunities, the industry has engaged a **general process of consolidation** in Europe: acquisition activity has accelerated in the past years, including across borders. Large defence contractors have emerged, which are now able to threaten the US giants and competitors in other parts of the world. Among these key EU players are Thales, Safran, BAe, EADS, MBDA, etc. The consolidation is, however, still underway in some segments. In the **naval industries, as well as in the land vehicles and land defence equipment industries,** there are still too many producers which operate at national level and develop competing programmes at EU level. This leads to a misallocation of (scarce) resources.

Past and potential future trends in employment

Direct employment in the EU defence industry is estimated to be between 350 000 and 750 000, depending on the source considered. The fairly wide range reflects the type of companies that are included in the estimate: for the lower figure, only the large defence producers are taken into account, whereas the higher estimate also includes some smaller companies which sell a significant share of their production to the defence companies.

Including indirect employment, BIPE estimated that **up to 1 640 000 persons were concerned by the trends in defence equipment and services' production in Europe in 2006**. This later number covers all the direct and indirect employment, i.e. it includes all salaried workers employed by prime contractors as well as Tier 1 and Tier 2 suppliers (component and system manufacturers), many of which are SMEs.

Since 1993, defence employment levels have declined substantially in most EU countries. In 2003, employment levels in Slovakia were only 10% of the 1993 level; in Hungary employment had fallen by 70%. In France, the reduction was 30% over the same ten-year period.

On average in the EU-27, one job in two disappeared in this sector between 1993 and 2003, as the number of people employed[1] dropped from 1,522 to 722 thousands. Again, the 2003 employment level differs from the number recorded by BIPE looking at the individual companies' job figures – the difference being probably due to a focus on the larger groups in the BICC figures.

Generally speaking, the employment in the four key segments of defence industries (land, naval, aerospace, electronics) is both highly skilled and highly specialised. In particular, one finds a higher proportion of engineers and scientists, and higher levels of qualification in the defence industry than for industry as a whole. Yet, in all segments (aerospace, naval, land and electronics), skill needs have changed over time. In particular, one observes **an upward trend in the average competency level required at the recruitment stage.** One also observes, in most defence sectors, **an ongoing shift from manual workers to professionals and technicians** of various types, as well as to **engineers and computer programmers.** Skilled workers nevertheless remain in high demand (which is not the case for un-skilled workers).

Two final observations on the present employment situation in defence industries, which bear consequences for the future, are:

1. There appears to be no "age-trap" in the large defence contractors: most have anticipated the ageing phenomenon in industry, and re-balanced the age pyramid at work. Therefore, in the large companies at least, one does not expect a "recruitment boom" in the next 5-10 years. This may, however, not be the case for many SMEs: those which have a high proportion of workers aged 50 or more are at risk of losing skills and know-how as these leave for retirement in the next 10-15 years.
2. The skills needed in defence activities are, with some exceptions, not significantly different than those required in civilian activities. For those companies engaged in dual markets, the impact on employment of cyclical trends in activity in defence activities can partly be attenuated through internal mobility of workers. There are, however, some highly specialised and technical activities for which internal mobility is not an option: these functions need to be identified and specifically supported in order to avoid skill depletion when programmes are delayed.

Future trends in employment will depend on the trend in procurement, on the future organisation of production at EU and world levels, and on technological change. For all three factors, the trends are likely to differ across defence industry segment: replacement orders and trends in

[1] Source; BICC Conversion surveys, 1993 to 2006.

maintenance and retrofit needs indeed vary across segment, as does the degree of externalisation of production, the geographical organisation of production, and the rate of R&D and innovation. For example, whereas the electronics' industry spends up to 14% of its turnover on R&D, the share is only 12% for aerospace, 10% for naval industries and 6% for land equipment industries. Delays in new programme launch can have major impacts on employment in industries such as defence, where employment is highly specialised, so that the future trends in research budgets – both public and private – will have a major influence on future trends in skill needs by sector.

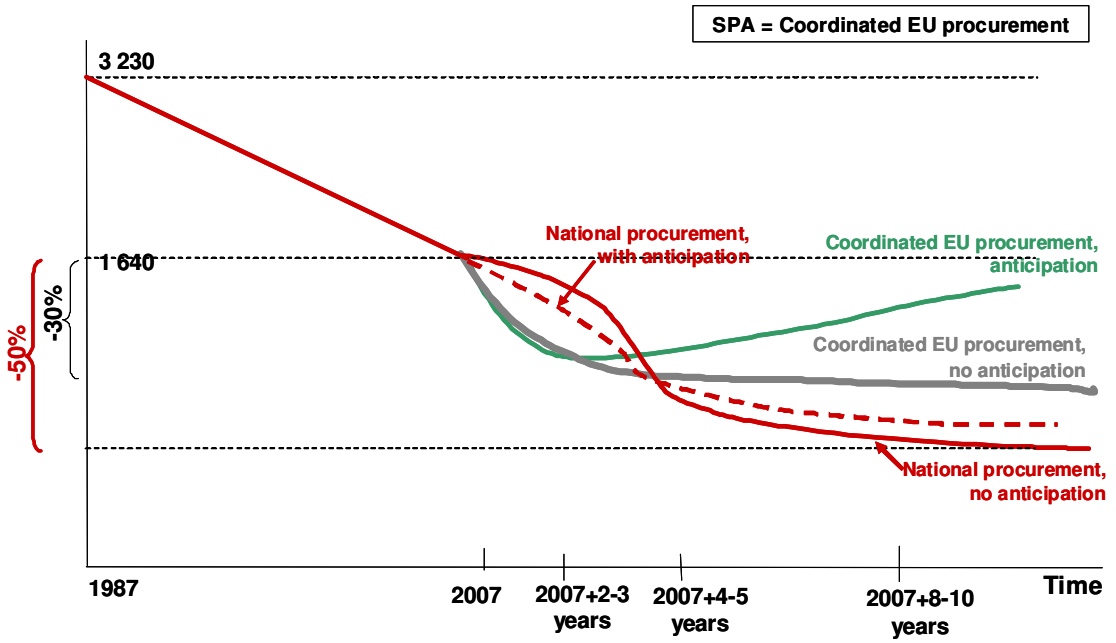
Different scenarios have been presented, which differ based on the degree of intra-EU coordination of procurement and production, and on the degree of preparation of change.

- The first scenario, entitled "Coordinated EU procurement with preparation of change", assumes a rapid shift towards coordinated equipment purchases at EU level, with due "preparation" of change by the industry' stakeholders; in this scenario, employment falls rapidly in the first years due to re-organisation of production, the rationalisation of duplicated R&D programmes and the concentration of production in fewer locations. Yet, the financial savings made possible by this rationalisation of production at EU-level makes it possible for governments to step up R&D expenditures, helping the defence companies to remain innovative and regain competitiveness in world markets. This leads, after a few years, to a stabilisation – and possibly even to new increases – in employment levels. Indeed, with appropriate anticipation of change, synergies are developed between defence and civilian activities, to the benefit of the EU civilian aerospace, railway rolling stock, automotive, shipbuilding and other equipment industries.
- The second scenario, entitled "Coordinated EU procurement, no preparation of change" assumes that the early shift to more coordinated EU procurement has not been preceded by due preparation by the industry' stakeholders. Market forces are left at play to define who wins the orders, and restructuring takes place as events unfold, leading to difficulties for companies to maintain skills when they are not directly involved in a particular defence programme;
- The third scenario, entitled "National procurement – no anticipation of change" assumes a continued a preference for national procurement. If this scenario makes it possible to save jobs in the first years of the forecast, after a few years, however, the lack of funding for new programmes and the absence of competition between players at EU level, eventually lead to losses in external competitiveness and more rapid falls in employment from 2011-2012 onwards than in the first scenario;
- The fourth scenario assumes a continuation of national procurement policies albeit with preparation of change: the fall in overall employment is greater in the short term than in the third scenario, but the long term result is nevertheless below the "coordinated Eu procurement" scenario, as R&D expenditures have fallen behind due to budget constraints and continued duplication of efforts at EU level.

The chart below illustrates the trend in employment in the sector as a whole – including indirect employment – in each of these four scenarios, and compares the expected outlook with past trends in employment between 1993 and 2003.

As illustrated, the scenarios lead to a wide range of possible outcomes – with total employment (direct + indirect employment) falling between 30% or 50% over the next 10 years depending on the scenario. The "worst-case" scenario is a continuation of the trend initiated in 1993 in the EU as a whole, when employment fell by 50% between 1993-2003 (Source: BICC Conversion Surveys), even though the 1993-2003 coincided with deep restructuring in eastern Europe as part of their transition to market economies. The 30% decline represents a continuation of the trend observed in France in the past 10 years, with falls in employment approaching 3% per year in defence industries, slightly higher than the average decline in employment observed in industry as a whole.

Change in direct and indirect employment levels as a result of the changes in production and organisation of EU defence industries



Source: BIPE

The trend in employment in each defence-market segment will be similar to the above pattern, albeit with differences in the rates of magnitude of the change, depending on the market considered. Thus, a slower decline in employment than shown here is expected in the aerospace industry, whereas a faster decline is likely to be registered, especially in the long term, for the naval and land defence industries.

Consequences of these prospective changes on competencies and skills needs

The analysis of trends in skill needs across segments of defence industries indicates a number of trends common to all sectors:

- There is an ongoing shift from manual workers to professionals and technicians of various types, as well as engineers and computer programmers;
- The numerisation of functions and organisational changes linked with technical progress lead to a growing demand for machine operators;
- Within all occupations, there is a continuing increase in the importance of computer skills and know-how;
- Risk management has grown in importance; this is particularly the case with risks linked to IT and communication, but not only;
- The internationalisation strategies of most prime contractors lead to a new distribution of skills and competencies needs across Europe.

The table below shows the link between contextual changes and changes in skills needs in the coming years.

Impact of context changes on skill needs in the defence industries

Context changes	Consequences for employment and skills needs
• Re-organisation of production in a tiered structure	• Impact on governance, operating practices and management • Reduction in number of hierarchic levels & shift to matrix type organisations cause a need for more collaborative working environments, cutting across functions ➔ team workstructures, polyvalence • Increased need for certain support functions: ‣ Cost control, quality control, procurement, marketing and sales
• Externalisation of activities	
• Improvement in productivity and efficiency	
• Increased internationalisation of operations linked to the Pan-Europeanisation of production	• Internationally oriented competencies (language, communication,…) • Focus on marketing and commercial skills • Management of procurement, of subcontracting, optimisation of logistics (incl. for maintenance)
• Need for increased RTD and new programmes	• Expert skills for the production and handling of new materials & technologies (composites, robotics, etc.) • Specialisations in the manufacturing, maintenance and recycling of technical materials (composites, energy efficiency, etc.) ; • Competencies focused on protecting the environment and work ethics
• Increased (non-price) competitiveness	

Source: Eurostrategies

The table shows the types of skills that will be in higher demand, and the types of functions that may develop or, on the contrary, become less important in the coming years, irrespective of the future development scenario.

Consequences for the industry' stakeholders

To prepare the changes ahead, the following are needed:

- Increase visibility on future procurement trends: in an industry in which programmes are launched for the long term, and a large share of the activity is linked to retrofitting and maintaining existing equipment, one could expect companies to have a better visibility on the future trend in orders;
- There appears to be a need for "employment observatories" that would provide information on past and present employment levels, and on planned employment and skills needs, taking into account foreseen trends in orders; these observatories ought to be launched at regional level (and coordinated at EU level) in order to help local stakeholders to anticipate future skill needs and launch the necessary training or re-training programmes;
- These observatories could also constitute databases of "good practices of anticipation and management of change and restructuring at company and regional level";
- The observatories could also include analyses of the consequences of different types of redeployment measures or of practices aimed at improving employability, in order to help users to assess under which condition a given measure is likely to be most effective;
- Improve the attractiveness of the industry to young workers: although there appears to be no "age trap", there is a continued need for new skills and replacement of workers leaving the sector; even if employment levels fall "on average", the companies will continue to recruit, and need to find the right competencies on the market, and to be able to retain them;

- Improved education and training system, in order to provide the young people with the technical skills needed that are in growing demand;
- Identify "best practices" in preparing and managing change in this sector: the examples provided during the Forum were considered to be somewhat specific and not necessarily adaptable to other companies or local situations; there is a need to define, with the social partners, "good practices";
- Help regions diversify their activity in order to reduce their dependence on a single – or only a few – sectors: in many regions, one finds a high dependence on defence-related activities. Given the synergies between defence activities and certain civilian equipment producing sectors (civilian aeronautics, space, automotive, shipbuilding, electronics or even railway rolling stock), there is a case for attracting new investments in these areas, or for developing "cross-regional clusters" of competencies by building linkages between the region's defence industry and other regions" related civilian activities;
- Help SMEs' to grow in size and improve their degree of internationalisation (i.e., ability to work with foreign partners or clients, and to accompany their existing clients in their international expansion) and develop a presence on distant markets (whether these are EU or non-EU markets) by ensuring that they have access to finance for LBOs, takeovers or mergers, and adequate guarantees;
- Create a level-playing field for businesses;
- Increase support for R&D;
- Improve co-ordination of policies across the EU, and across governmental bodies within the EU Member States in order to:
    - smooth out procurement cycles;
    - reduce barriers to trade, which hamper the competitiveness of EU industry;
    - foster cross-border mobility of workers, especially for displaced workers.

Introduction: the overall context for defence industries

The defence industry is a key sector for the EU economy, not only because of its technological and economic policy aspects, but also because of the number of jobs dependent upon it. The sector covers a wide range of activities, such as the production of:

- Small arms and ammunition (snipers, rifles, …), and artillery (light machine guns, mortars, automated grenade launchers, remote controlled weapon systems, man portable air defence systems, rocket launchers, etc.);
- Aircrafts, helicopters and Unmanned Aerial Vehicles (UAVs);
- Space equipment and services;
- Electronic equipment (reconnaissance, SIGINT, command&control,…) ;
- Engines and propulsion systems;
- Missiles;
- Military vehicles (including command vehicles, main battle tanks (MBT), armoured fighting vehicles (AFV), infantry fighting vehicles (IFV), assault bridges and engineering vehicles…), and parts thereof;
- Naval vessels and warships (including battleships, amphibious assault ships, command and control ships, cruisers, destroyers, frigates, carriers, submarines, aircraft carriers, minesweepers, operational support ships, military sea lift ships, diving support vessels, patrol boats, navigation training vessels, range support vessels, etc.);
- Various types of services (maintenance, support, training, logistics, transport);
- Plus all the inputs (products and services) and equipments (machinery, buildings, infrastructure) that are used at some stage during the production process.

The sector is also key to the successful transformation and growth of a number of other industries: because defence markets cover a broad spectrum of products and services ranging from non-war material, such as office equipment, to complex weapon systems and highly sensitive material such as nuclear biological & chemical equipment, a large diversity of companies operate in, or work for, the sector. Among these are material-producing companies (including composites), mechanical engineering, electrical and electronic producing companies, as well as companies involved in R&D, design, building and testing of prototypes, etc.

In other words, the defence industry constitutes a key client and end-market for industrial and service sectors.

In addition to its impact on other industries, on technological progress and on innovation, through its spill-over effects on innovation in civilian industries, the competitiveness of the European defence industry is vital to the credibility of the nascent European Security and Defence Policy.

A particularity of the defence industries, however, compared to other industrial sectors such as agri-food or automotive, is that most firms involved actually produce dual use goods and technologies, i.e. products and technologies which have both civilian and military applications (i.e. electronics, vehicles, civil aviation, shipbuilding etc).

Today, the industry is facing important challenges: like other industrial sectors, the defence industry is required to deliver increased efficiency in order to provide value for money to its customers and, at the same time, protect its shareholders' interests. With demand constrained by national defence budgets and growing competition at world level, a re-organisation of activities at European, national, and local levels is unavoidable. **Anticipation** – and in particular **anticipation of skills needs** - is therefore essential in order to minimize the negative impacts of change and make the most of opportunities.

In this context, this study seeks to:

- Define future trends in employment, by key segment of the defence industry, and qualify future recruitment needs;
- Identify the regional distribution of defence activities, and the areas of employment concentration across the EU;
- Identify and describe emergent job profiles, given future trends in product development and market organisational structure, and the associated training needs;
- Raise awareness of possible future employment trends amongst the defence industry' stakeholders, including in terms of emerging profiles and future skills needs;
- Provide the background information that is necessary to fuel discussions on how to improve strategic sector planning in education and training systems.

This study complements an earlier study coordinated by BIPE for the European Commission, which analysed the challenges to which the European defence industry is confronted and described four possible development scenarios, and their implications for future employment levels (direct and indirect employment)[2]. The present study also fits within the framework of the Community Programme for employment and social solidarity – PROGRESS – which seeks to:

- Improve the knowledge and understanding of the situation prevailing in the Member States and in other participating countries through analysis, evaluation and close monitoring of policies;
- Support the development of statistical tools and methods and common indicators, where appropriate broken down by gender and age group;
- Support and monitor the implementation of Community law, where applicable, and policy objectives in the Member States and assess their effectiveness and impact;
- Promote networking, mutual learning, identification and dissemination of good practice and innovative approaches at EU level;
- Enhance the awareness of the Stakeholders and the general public about EU policies and objectives pursued;
- Boost the capacity of key EU networks to promote, support and further develop EU policies and objectives where applicable.

The study was undertaken during the period from October 2008 to end May 2009.

[2] « Anticipating Restructuring in the European Defence Industry", A study coordinated by BIPE for the European Commission Employment Directorate, March 2008.

Challenges and opportunities facing the EU defence industry

The challenges

The study by BIPE for the European Commission[3] identified the following challenges for the European defence industry:

- **Stagnant or declining overall defence budgets within the EU,** leading to slow (and, in some countries, negative) growth in demand;
- **The changing role of force,** which impacts the demand mix;
- **Low spending on R&D in the EU,** as compared with the US and other leading technology producers (Japan, …), which potentially hampers the EU industry's future technological competitiveness;
- **The outsourcing and privatisation of traditional military functions,** such as services, logistics and information technology, and the emphasis on network-centric programmes which impacts both the organisational structure of the industry, and employment upstream from these traditional functions;
- The fact that there is, at present, **no Single European Market for defence industries**; over the past years, a series of measures have been taken to address this problem; the latest package of measures is that presented by the Commission on 5 December 2007: this comprises the European Commission Communications and the legislative package of new competitive measures for defence industries and markets (COM(2007) 764,765 and 766, dealing among other with intra-EU trade. The proposed new legislative package aims to create a genuine European market in this sector without sacrificing Member State control over their essential defence and security interests;
- The **dominance of (often national) champions,** highly dependent on trends in (primarily in their own country's) national procurement budgets, and the relative lobbying power of their government;
- The **fragmented nature of the industry:** although industry is more vertically integrated than other industrial sectors, there are thousands of diversified SMEs which also serve defence industries; altogether there are presently too many companies in the sector in the EU, many of these being too small to survive in an increasingly competitive and global environment;
- The **high concentration of employment** in certain regions is a source of vulnerability and is perceived as a threat on the social front;
- **On-going restructuring in eastern Europe,** where the defence industry is still in a transition phase;
- **Rapidly rising production costs,** due to the large variety, high technicity and increased complexity of defence equipment and systems; this creeping up of production costs constitutes a particular issue given the slow potential growth of military procurement budgets;
- **Mixed experiences with cross-border cooperation:** intra-EU and international cooperation, however, becomes increasingly important in order to avoid duplication of programmes in a budget constrained environment;
- The **growing concentration of the industry at tier 1 level,** creating concern for suppliers

[3] The study was undertaken by BIPE in coordination with Wilke, Maack & Partners, Prof. Keith Hartley from the Centre for Defence Economics at the University of York, Professor O. Bergstrom from the Institute for Management of Innovation and Technology (IMIT) in Stockholm, Mr. Ganczewski, from ZT Konsulting, in Warsaw as well as a number of other international experts.

and subcontractors at higher rank levels; yet…

- A **need for consolidation at EU level in the naval and land vehicles and land defence equipment industries** – where too many producers operate at national level and develop competing programmes at EU level, leading to misallocations of resources.

In addition to these mainly European problems, other sources of difficulties for EU producers arise from:

- The **lack of dynamism of world market demand;**
- **Difficult entry conditions** in the more dynamic world markets – due in part to regulatory constraints, but also to geopolitical factors and, in some cases, protectionism.

The opportunities

Yet, there are a number of opportunities on which the EU defence industry could capitalise:

- **Fast growing markets for certain products and equipments**, such as drones and civilian applications of space technologies and equipment related to the growing security market;
- **High replacement needs** for certain types of equipment (air carriers, missiles, etc…);
- **Growing demand from non-EU countries**: the EU accounts for about one third of world exports markets today. This could grow in the coming years with the changing geo-political environment and the possible consequences of the economic crisis which is spreading to the world starting from the US: in the US, the depth of the crisis may lead to a (temporary at least) diversion of public resources away from fundamental or military oriented R&D, towards the upgrading of existing infrastructure and the financing of social programmes, with a renewed focus on education and health in particular.
- Furthermore, although European companies have to date only captured a small margin of the US procurement market – mainly due to trade restrictions in the US - there is a potential for the EU to increase its market share in the US through the **diffusion of globalisation strategies in the defence sector** : this reflects the role of offsets, but also results from spill-over effects on defence production-chains of growing globalisation of civilian value added chains, in aeronautics and electronics for example);
- **Recent measures in the EU to improve coordination of RTD, avoid duplication of efforts** (in particular through the efforts by the EDA), **internationalise procurement,** as well as **coordinate procurement at EU level** and **overcome protectionism within the EU**, all that whilst maintaining a **sufficient level of competition between players**, will hopefully further enhance the EU's competitiveness and create opportunities for increasing Europe's share of world markets;
- The **high specialisation and concentration of employment in certain EU regions** is not only a threat (in case markets collapse), but also **a strength,** as it reflects the existence of effective "clusters" of skills: in such high-tech clusters, companies can combine strengths in order to diversify into, and create, new markets, and develop new products and applications through the development of civilian applications of technologies, materials and processes initially developed for defence purposes (example: advanced communications technologies but also composite materials, space applications, technical textiles, etc.);
- Major Pan-European companies have emerged through the **general process of consolidation** underway in Europe: acquisition activity has accelerated in the past years, including across borders. The large defence contractors are now able to threaten the US giants and competitors in other parts of the world. Among these key EU players are Thales, Safran, BAe, EADS, MBDA, etc.

All these are intrinsinc strengths which the industry can capitalise upon. Yet, in order to do so, stakeholders will also need to have **anticipated correctly their employment and skill needs.**

Factors of uncertainty and risks

For the sake of completeness, there are also a number of factors whose influence on the future of the European defence industry can either be positive or negative, hence which create uncertainty in the market and which make the anticipation of future trends and the preparation of change difficult:

- In recent years, **private equity groups** (financial investors) **have started investing in the sector;** given the recent troubles in world financial markets, and the general uncertainties concerning some of these financial funds' strategies, the impacts of the changes in shareholding structures on the sector as a whole, and on employment needs, are difficult to anticipate;
- The **recent deterioration in the overall business climate** creates a risk of mounting protectionism, both from the US but also from other countries already present in – or with ambitions in – the defence sector (Russia, China, India…). In the aerospace industry, for example, the cancellation, in 2008, of the original award of the tanker aircrafts contract for the US Army to Airbus is an example of the power of lobbying groups and their potential consequences for the EU military aerospace industry;
- The **impact on competitiveness of growing concentration in some market segments** in the EU will have to be closely monitored: until recently, price was not much of an issue because of the preference given to national suppliers; sufficient financial margins could thus be generated to finance R&D programmes which provided a competitive edge. In the future, however, as markets are liberalised and competition heightens as budget constrained governments become more price sensitive, "price" may become a much more important competitiveness factor. Yet, increased industry concentration remains a target at EU level, given the destructive competition which is presently going on in certain segments, such as land vehicles or fighter aircrafts, and the waste of resources from programme duplication;
- Another factor of uncertainty is the consequence on EU industry and on future employment of the **increased presence of foreign (non-EU) investors in Europe**: US defence producers for example have acquired a number of companies in Spain, in part to facilitate growing their share of the EU procurement market. Yet, the penetration of foreign investment - whichever its origin - into European companies entails a risk of technology transfer to the home country at a later stage, possibly leading to the closure of the plant in the EU; if foreign shareholding of prime defence contractors remains limited, the situation for Tier 2 and higher firms – especially those involved in dual markets – is not well known, and could change rapidly if credit conditions tighten within the EU: some cash-hungry SMEs could turn more easily to foreign financial investors to secure their survival;
- A last factor of uncertainty is the **speed at which change will take place.** This is particularly true in the land and naval defence industries, where the concentration movement is less advanced than in aerospace or missiles: who will be the EU leaders in these segments tomorrow, where will they be located, what skills will they mobilise, which will be in less demand?

Given these uncertainties, four scenarios were defined by BIPE in the study referenced earlier. These looked at different futures for the industry, depending on the speed of change from national to coordinated procurement at EU level, and on the degree to which change is "anticipated" – i.e. prepared by the industry's stakeholders (governments, at national and local level, and companies).

All scenarios indicated major consequences for employment: although the common trend of all scenarios is a **trend decline in employment levels**, this does not exclude continued **recruitment needs** due to the "natural" exit, from the sector, of people attaining the age of retirement, to inter-sectoral mobility and to an expectation of **significant change in the overall skill mix**, as will be confirmed in the next chapters.

The need for an **on-going monitoring of the changes underway** and, even more importantly, for **anticipating forthcoming changes** in order to prepare the future, were therefore important conclusions of the study.

The objectives of this follow-up study are to further detail the types of changes that are likely to happen in the coming 5-10 years in order to provide to the industry's stakeholders the information that they need to prepare change.

Study objectives

The European Council of 22-23 March 2005 stated that "Europe must renew the basis of its competitiveness, increase its growth potential and its productivity and strengthen social cohesion, placing the main emphasis on knowledge, innovation and the optimisation of human capital". In the same line, the Spring European Council of 2006 has called for a comprehensive approach to innovation as a main driver for growth and jobs.

By the Council Resolution of 15 November 2007 on the new skills for the new jobs (2007/C 290/01), the Commission has been invited to analyse the need for **added-value advisory mechanisms to strengthen the identification of new types of jobs and skill needs at the European level**, making use of existing sectoral skills activities and projects under lifelong learning, enterprise and social dialogue policies.

Within this context, and given the importance of the EU defence industry to the EU economy, **the objectives of this study were to:**

- Conduct a foresight exercise in order to identify and describe emergent job profiles, skills and competencies and the associated training needs;
- Draw the main implications of the possible future development scenarios on employment: which jobs will be in high demand, which categories will decline in importance, which will change over the coming years, hence requiring changes in skills;
- Draw the implications of changes in sector skill needs for education and training, and draw recommendations.

The final objective was to produce **sector references** for a strategic management of human resources, for a stronger synergy between innovation, skills and jobs, taking into account the sector in its global context and encouraging these references to be adapted to national and regional specificities.

The methodology was designed bearing in mind the possible uses of the results by the industry's key stakeholders. Among them are the need to:

- identify new drivers for job creation and/or renewal;
- have a forward-looking view of future trends in existing activities, and identify emerging activities, in order to support sector innovation and employment; this calls for a need to review the factors that will shape future changes in skills needed;
- raise awareness of changing job profiles in each sector amongst those involved in the vocational guidance, employment services and competence validation systems;
- improve strategic sector planning in education and training systems;
- encourage the development of partnerships for innovation, skills and jobs at sector level, involving all stakeholders.

The next chapter presents the actual employment situation in defence industries, measuring employment levels and past trends therein, and looking at the composition of employment by gender, age structure, and skill type. The chapter then looks at the geographical distribution of employment across the EU, in order to highlight the countries/regions highly dependent on future trends in defence activities.

The following chapter analyses potential future trends in defence activities by main segment, looking at four key segments: aerospace, land defence systems, naval defence industries and electronics. Although there are commonalities between these four segments, each will face a different future, hence the consequences for employment and skills needs vary across segments.

Having defined the possible outlook for activity and employment by main segment of defence industries, we then look at the implications in terms of skills needs and in terms of recruitment needs. The final chapter draws some conclusions and presents recommendations. The report also includes a number of annexes related to the Restructuring Forum on Defence organised in Brussels on December 8-9, 2008. In particular, a summary of the discussions which took place during the different workshops is presented in one of the annexes.

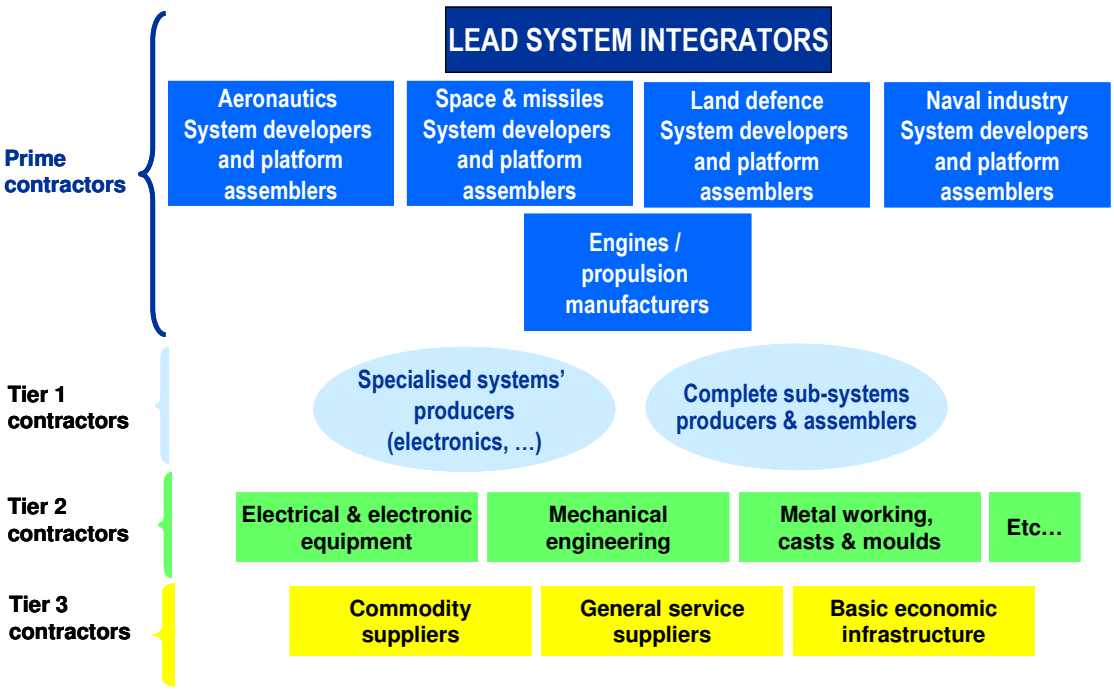
Present employment levels and structure

Employment levels

As outlined in the study referenced to earlier[4], the European defence industry is organised in a tiered structure, which creates some challenges when trying to count employment levels.

The figure below presents the defence industry's tiered structure:

The defence industry's tiered organisation



Source: BIPE

In the above, prime contractors include lead system integrators, along with system developers and platform assemblers.

The prime contractors produce **complete weapon systems**. They are mainly large companies specialised on defence production and services. Among the prime contractors, the Lead System Integrators (LSI) assemble defence systems from several defence domains (ex: aircraft carriers). Others are specialised in only one area (aerospace for example), but again produce and assemble different systems/modules. Examples of prime contractors in the EU are BAE Systems (UK), EADS (Netherlands), Thales (France) and Finmeccanica (Italy), the later specialised in helicopters and armoured vehicles, and Saab (Sweden) for fighter aircraft, along

[4] See the study coordinated by BIPE in coordination with Wilke, Maack & Partners, Prof. Keith Hartley from the Centre for Defence Economics at the University of York, Professor O. Bergstrom from the Institute for Management of Innovation and Technology (IMIT) in Stockholm, Mr. Ganczewski, from ZT Konsulting, in Warsaw as well as a number of other international experts.

with Nexter (France) and Krauss-Maffei-Wegmann (Germany) in major battle tanks, and TKMS (Germany), Fincantieri (Italy) and DCNS (France) in naval vessels.

Tier 1 contractors produce complete sub-systems or major components. Often, these are also risk sharing partners:

- These are often specialized firms (engines, electronics,…), subcontracted by the prime contractors;
- Examples are Rolls Royce (UK), Groupe Safran (France), MTU (Germany) and Indra (Spain).

Tier 2 contractors produce components and supply services:

- These are usually small and medium enterprises (SME), but the category also includes subsidiaries of the major defence producers (prime contractors and sub-contractors);
- Tier 2 contractors often produce dual-use goods or services; these companies are therefore not always listed as defence producers since they operate at the margin of the defence sector.

Tier 3 contractors are commodity suppliers or supply generalist services. This level also includes all providers of « general economic infrastructure » services (transport network and services, communications, externalised training, etc.).

Because at all levels of the value chain firms produce dual goods, the number of jobs that are dependent on trends in defence production is much higher than the number of jobs directly involved in the production of the defence equipment and related services. Indeed, many defence companies, including LSI, will develop synergies between their civilian and military units in order to generate economies of scale or economies of scope, develop civilian applications for military technologies and vice versa, etc.

The total number of jobs directly or indirectly involved in the production of defence equipment therefore includes, beyond those jobs specifically involved in the production of defence equipment, all the jobs in civilian operations of companies also selling on defence markets, as well as the jobs in companies supplying materials, components, general inputs and services which enter in the production of defence equipment (steel industry, mechanical engineering, composite materials, general electronics, rubber & plastics, etc.).

The chart on the next page illustrates the variety of sectors that are both up- and down-stream from defence industries, and whose employment levels partly depend on trends in production and R&D in the defence sector.

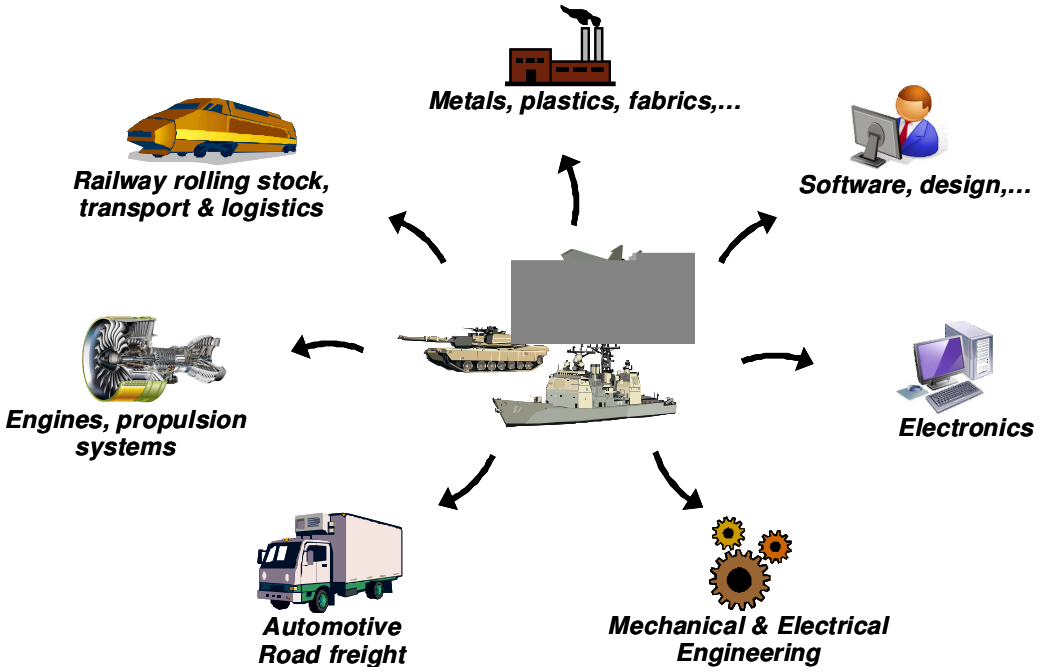
For example, defence industries purchase materials, equipment and services from a whole range of other industries such as the metal- and non-metallic minerals' industries, plastics, textiles, chemicals, mechanical, electrical and electronic equipment, but also from companies involved in software and design, transportation, logistics, etc. Part of the employment in those industries is thus directly dependent on the level of activity in defence industries.

Similarly, defence industries generate value and lead to employment creation further downstream, through diffusion effects: equipment, technologies, materials developed originally for defence often find applications in the civilian sphere: the best known example is the Internet. But there are many other defence products or technologies which have found applications in the civilian market: this is the case of all civilian applications of earth observation systems, for example.

Finally, downstream from "defence industries" stricto sensu are a whole range of activities which can be undertaken either within the defence sphere, or outside it through the externalisation of services: these entail, for example, maintenance and repair operations, which are increasingly outsourced to specialised (private) companies for which defence is only one client market

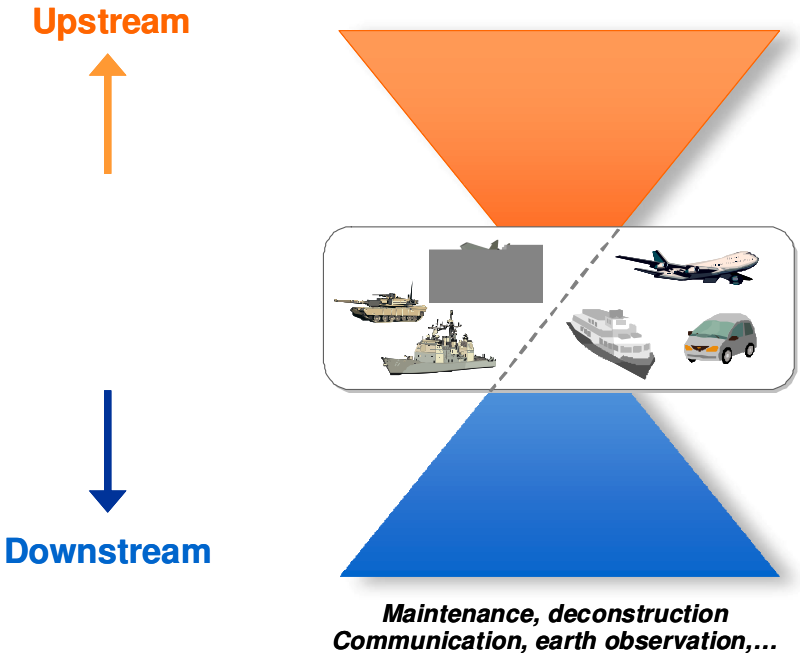
amongst many. The same applies to refurbishing, or deconstruction at the end of life of the equipment.

Defence industries depend on a whole range of other industrial and service sectors



Source: Eurostrategies

Direct and indirect employment in defence industries



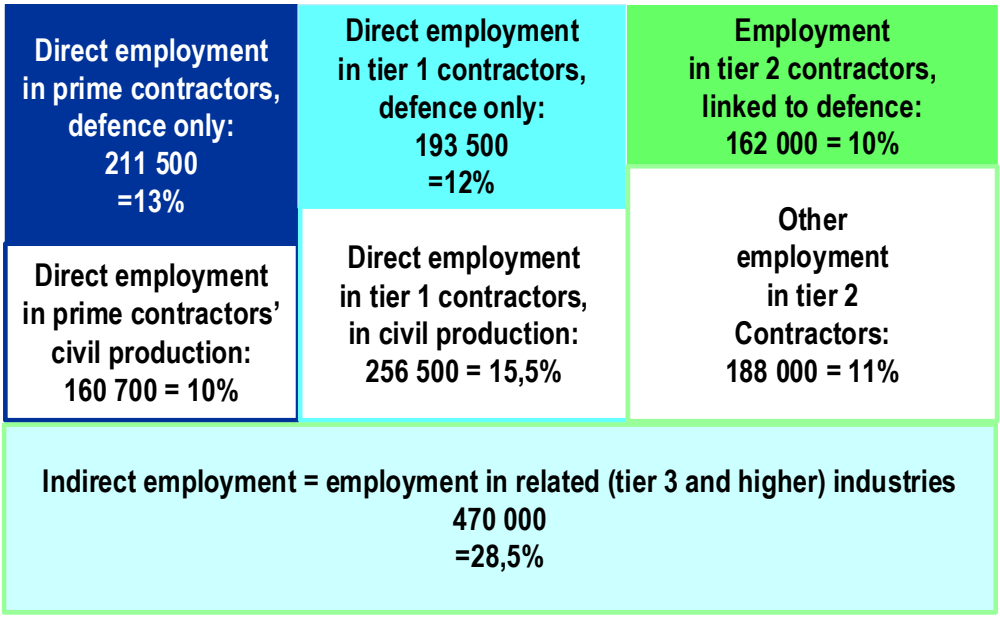
Source: Eurostrategies

Based on an identification of the key companies operating in Europe in each of the main four market segments of defence (military aerospace, naval defence industries, electronics industries and land defence systems), estimates of **direct employment in defence industries** vary **between 350 000 and 750 000**. Including indirect employment, BIPE estimated that **up to 1 640 000 persons were concerned by the trends in defence equipment and services' production in Europe in 2006**. This later number covers all the direct and indirect employment, i.e. it includes all salaried workers employed by prime contractors as well as Tier 1 and Tier 2 suppliers (component and system manufacturers), many of which are SMEs.

The figure below shows the composition of employment in defence industries, as well as the number of jobs indirectly depending upon defence activities.

The numbers in the figure may, however, still underestimate the true final figure, given that the methodology to estimate this has put the emphasis on jobs created **within** the defence industries, as well as **upstream** from defence industries, but excludes jobs in sectors or activities which have emerged because of diffusion effects, such as the development of civilian applications of military technologies.

Estimated direct and indirect employment levels in 2006



Source: BIPE

Overall, one finds that 13% of the 1,640,000 jobs "directly or indirectly" concerned by the developments in EU defence industries are directly employed in Prime Contractor companies in areas or activities specifically related to defence. Another 10% is employed by those same Price Contractor companies, but in activities geared to civilian markets, such as general electronics or civilian aerospace. Of course there are often synergies between the activities, if not technological at least in terms of financial organisation and cash flow management, and in terms of shared resources and fixed costs' allocation, which enable these companies to generate economies of scale or benefit from economies of scope. All this explains the "exposure" or vulnerability of the "civilian" jobs to what happens in the defence area.

Strict defence employment, according to this methodology, accounts for 567 000 salaried people in the EU-27 in 2006. This is higher than the close to 400 000 direct jobs estimated from ASD figures of direct employment in the aeronautics and defence industries. The "defence only" employment estimate using the ASD figures has been made by assuming that the share of

defence employment in aeronautics is equivalent to the share of turnover on defence aeronautic equipment.

Direct employment breakdown in 2007 based on ASD figures

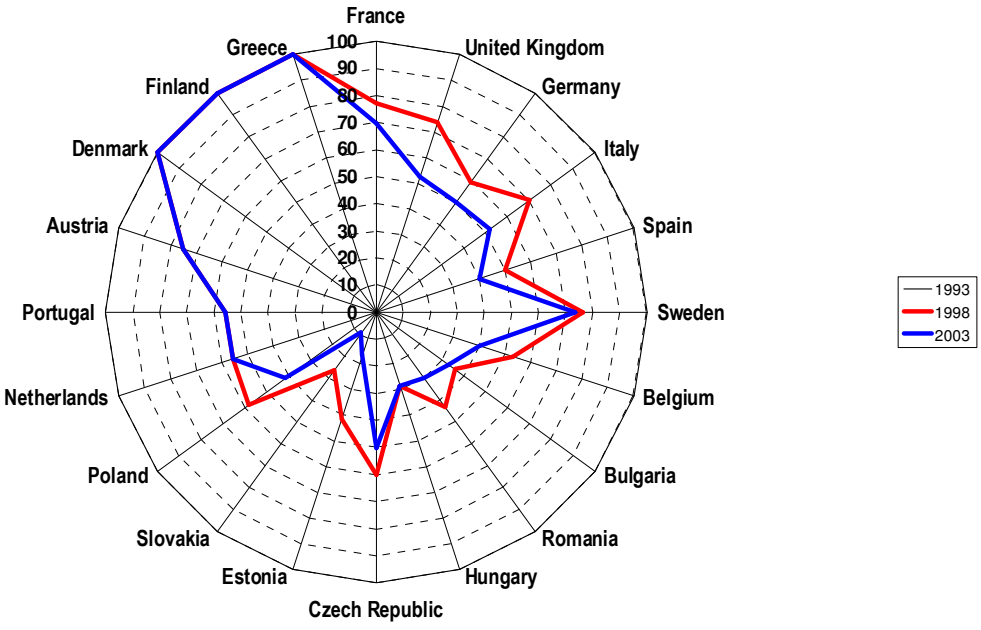
	Employment level in 2007	Share of total
Aeronautics - total	**442 100**	**68,1%**
- civilian estimated)	*256 418*	*39,5%*
- military (estimated)	*185 682*	*28,6%*
Space	**29 637**	4,6%
Naval	**71 100**	11,0%
Land	**106 200**	16,4%
Total direct employment	**649 037**	100,0%
Total direct defence employment	**392 619**	60,5%

Source: ASD, with Eurostrategies' estimate of breakdown between civilian and military aeronautics employment

Past trends in employment

Since 1993, defence employment levels have declined substantially in most EU countries. Based on the data from the BICC Conversion Surveys, unfortunately not updated since 2003, and constituting only a part of the total defence employment in the EU, one can measure the extent of the decline in employment by country over the past decade:

Trend in employment by country between 1993 and 2003



Source: BIPE

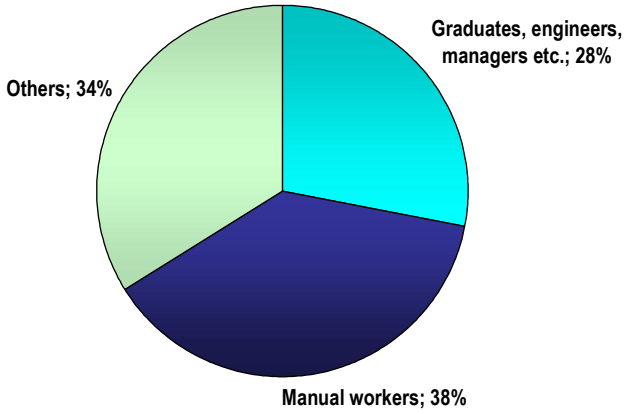
Starting from a level of 100 in 1993, one observes declines in employment ranging between -90% in Slovakia, and -70% in Hungary, to -30% in France for example. The number of jobs lost in EU defence industries is thus considerable. Yet, the transformations are on-going, impacting the future recruitment needs and skill mix.

On average for the EU as a whole, the BICC figures indicate a 50 % decrease in employment levels between 1993 and 2003, the number of people employed having dropped from 1,522 to 722 thousands. Again, the 2003 employment level differs from the number recorded by BIPE looking at the individual companies' job figures – the difference being probably due to a focus on the larger groups in the BICC figures.

Skill mix

According to the Aerospace and Defence Industries Association of Europe (ASD), which looks at employment in the defence and aerospace industries (for the later, including the civilian aerospace activities)[5], engineers and skilled workers presently account for approximately 2/3 of total employment.

Composition of employment in aeronautics and defence, by skill level, in 2006



Source: ASD

Generally speaking, the employment in the four key segments of defence industries (land, naval, aerospace, electronics) is both highly skilled and very specialised. In particular, one finds a higher proportion of engineers and scientists, and higher levels of qualification in those sectors than for industry as a whole.

[5] Note, however, that despite the fact that the ASD includes the direct employment in civilian aerospace activities in its figures, the total number of persons employed recorded by ASD is less than the total number of jobs recorded here, or even than the total number of jobs in prime contractors and Tier 1 companies, in civilian or military activities: the ASD counts 650,000 jobs in 2007, compared with 822,200 in the BIPE job count (which includes civilian activities of non-aerospace Tier 1 companies though…).

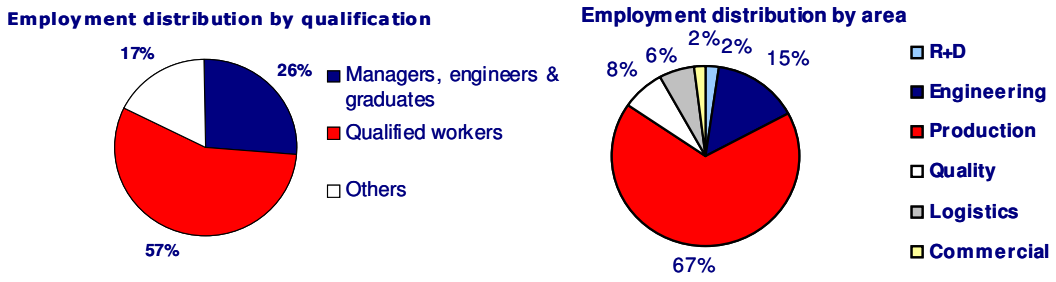
Yet, in all segments, skill needs change over time. Indeed:

- The poor labour market situation of the past decades has **raised the average competency level at the recruitment stage**: this is a common feature at the economy-wide level, which has also been observed in defence industries;
- In most defence-industry sectors, there is an ongoing **trend-shift from manual workers to professionals and technicians** of various types, as well as **engineers and computer programmers**;
- Changes in the organisation of work, technological progress, the numerisation of functions and the need to cut costs have led to a growing demand for **machine operators** as opposed to traditional blue collar workers;
- Within all occupations, there is a **continuing increase in the importance of computer skills and know-how**;
- Skilled workers nevertheless remain in high demand (which is not the case for un-skilled workers).

Another illustration of the particular skill mix of defence industries is provided below, in the case of the Andalusia region of Spain, specialised in aerospace production. Among the 6 200 jobs which are spread over 130 companies, two-thirds are directly involved in production, 15% in engineering functions, 2% in R&D and 8% in quality control. Despite this "production-heavy" job composition, 57% of the persons employed are qualified workers, and 26% are managers, engineers and graduates.

Example of skill mix distribution in an aerospace region: Andalusia

6 200 jobs in the region in 130 companies

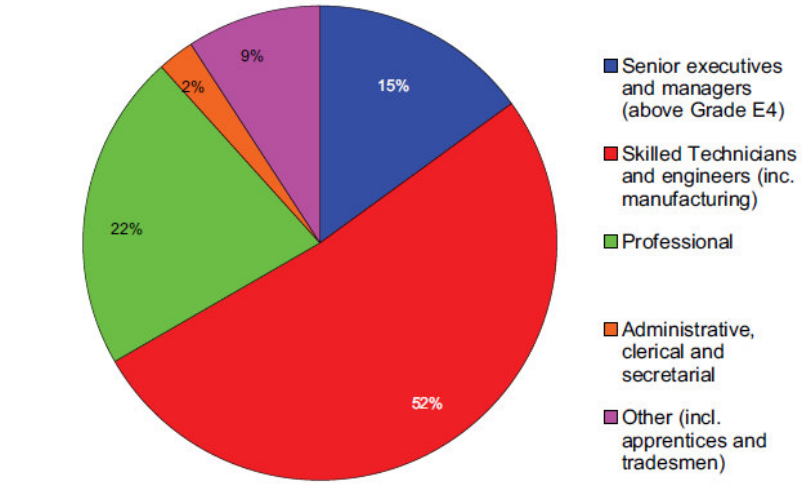


Agencia de Innovación y Desarrollo de Andalucía
CONSEJERÍA DE INNOVACIÓN, CIENCIA Y EMPRESA

The trend for a higher share of managers & engineers, and continued high demand for skilled workers is also visible in France, as illustrated by the skill distribution of the young people recruited after leaving the education system in 2007: out of 2 500 recruitments of young people in the aerospace and defence sectors, 40% where hired in engineering and managerial functions, 17% specialised technicians, and 30% were qualified workers (source: GIFAS).

Finally, in the UK, one also sees a clear bias towards skilled technicians and engineers at BAE Systems, where this category accounts for more than half of the total workforce.

BAE's employment by skills split, 2007



Source: Oxford Economics, BAE Systems

Rate of job turnover

To assess future recruitment needs and anticipate the social effects of restructuring on employment, it is important to take into account not only the future trends in **employment levels** and the **trend-changes in skills needs** (or possible breaks in that trend), but also the **rate of job turnover**. Everything else being equal, a high rate of natural turnover reduces the social costs of restructuring: by natural turnover, one means voluntary departures towards other sectors such as autos, or departure for retirement. Given the skill mix used in defence industries, and the competences that are used, turnover between companies, and even within a given company, between its civilian and military operations, is comparatively high. In France for example, GIFAS, the association of aeronautics and defence industries, reports recruitment rates of 7 to 8% per year in recent years, despite stable net employment levels.

Companies involved in dual markets claim that – with a few exceptions such as nuclear engineers – there were no major differences between the skills needed for defence production and those needed for the production of civilian equipment and components. Intra-firm mobility can thus be used as a buffer in cases of downturns in one of the key end-market.

Age distribution

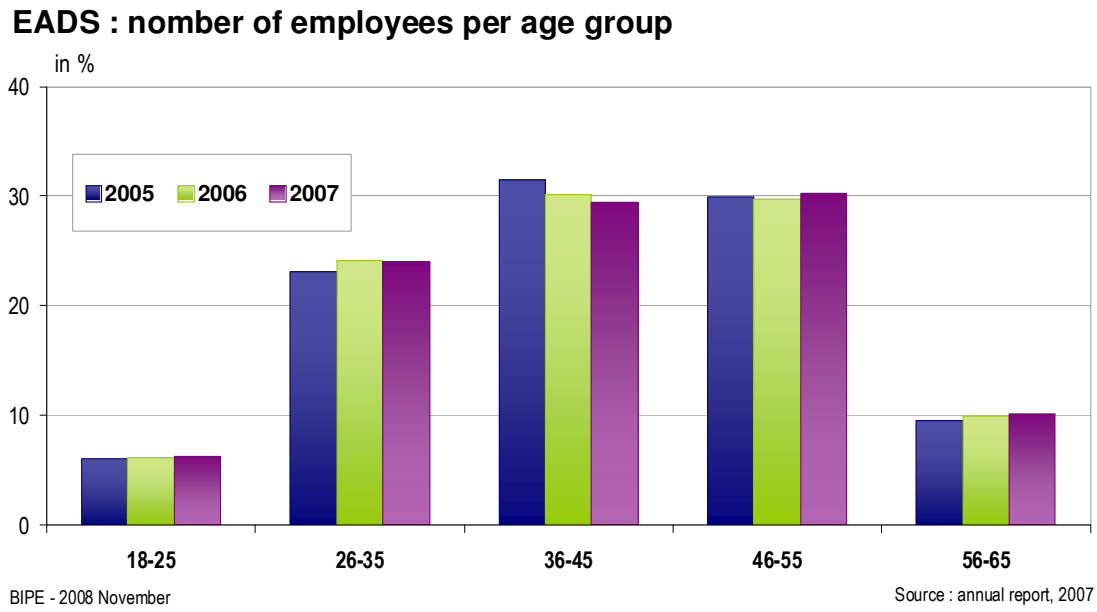
The age pyramid of employment is also a crucial element to assess turnover rates. Because the industry is highly concentrated, the information provided by the larger companies on the skill composition of their workforce can be deemed to provide an accurate view of the average age pyramid structure of the LSI, and of future recruitment needs.

In several industry segments, the 1980s and 1990s have seen a concentration of age structures in the 35-50 age range, due to low recruitment rates of young people entering the job market, and a broad use of early-retirement schemes. This reduced the share of workers aged 55

(sometimes even 50) and higher. As a result, a high proportion of the workforce is in the same age-range – meaning that when these will reach the age of retirement the replacement needs will surge.

The charts below show the age pyramid of a number of prime defence contractors.

Age pyramids in defence industries: the example of EADS



The first chart (above) shows the age pyramid of EADS' combined civilian and military operations. As illustrated, in 2007 30% of the workforce is in the 46-55 years old range, a fairly stable share in the past 3 years. Yet, the share of those in the 36-45 years of age has been declining whilst that of workers aged 56-65 has grown.

More than 10% of EADS' workforce is now aged 56 and over. Within the next 10 years, those will leave for retirement, along with some of those presently in the 46-55 years age range. These departures will be complemented by a "natural" rate of attrition as others in the company change job, either to go to another company in the same sector, or to move to another sector, or exit the labour market altogether.

The Thales age pyramid shows the age pyramid by gender. It also points to a distorted age pyramid, with a fairly high proportion of staff aged 50 and over.

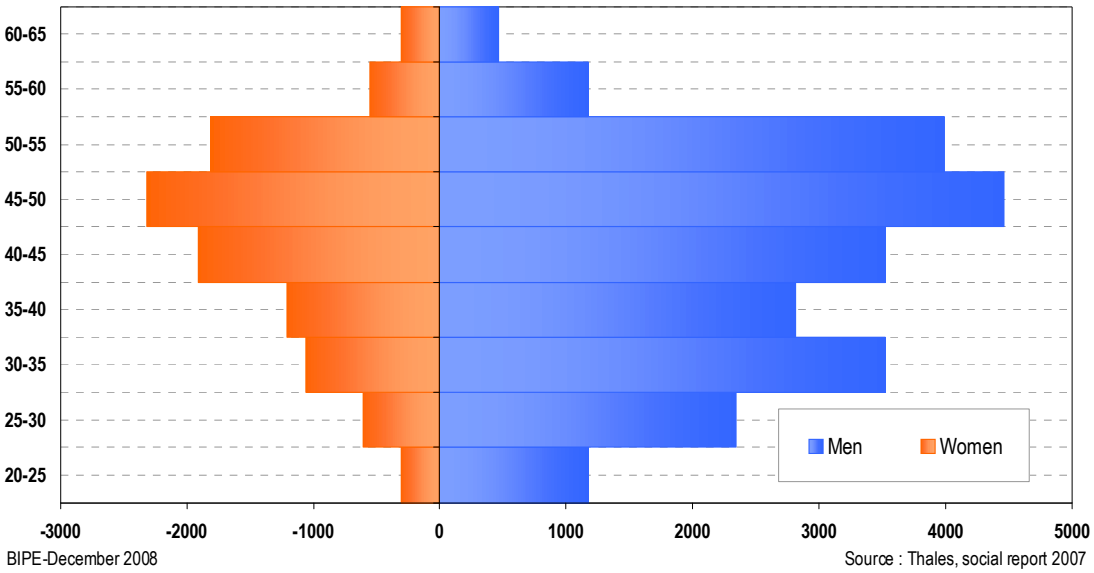
The share of workers aged 55 or more is low, however, indicating no imminent retirement boom.

The same applies to BAE systems, where women only represent 20% of the total. The share of workers approaching retirement age is less than 10%, and the average age of retirement is itself higher than in the two previous companies analysed.

As an indication of the relative share of staff presently employed that is likely to leave for retirement in the coming 5-10 years, the next chart shows the combined age pyramid of those three EU giants.

Age pyramids in defence industries: the case of Thales

Thales : age pyramid for the french employees

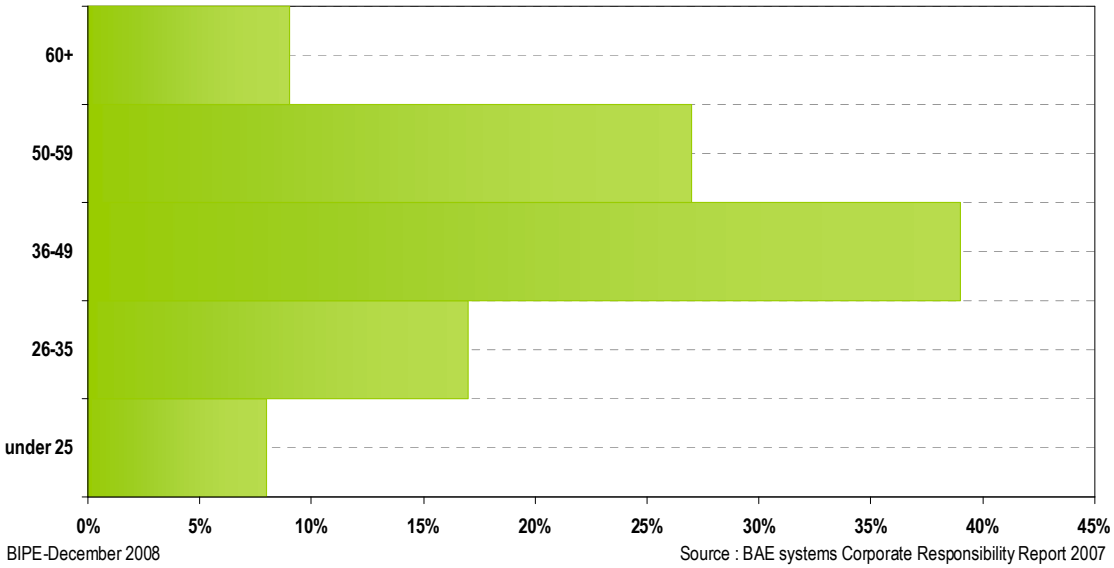


BIPE-December 2008

Source : Thales, social report 2007

Age pyramids in defence industries: the example of BAE systems

BAE : age diversity (80% male, 20% female, employee numbers 97 500)

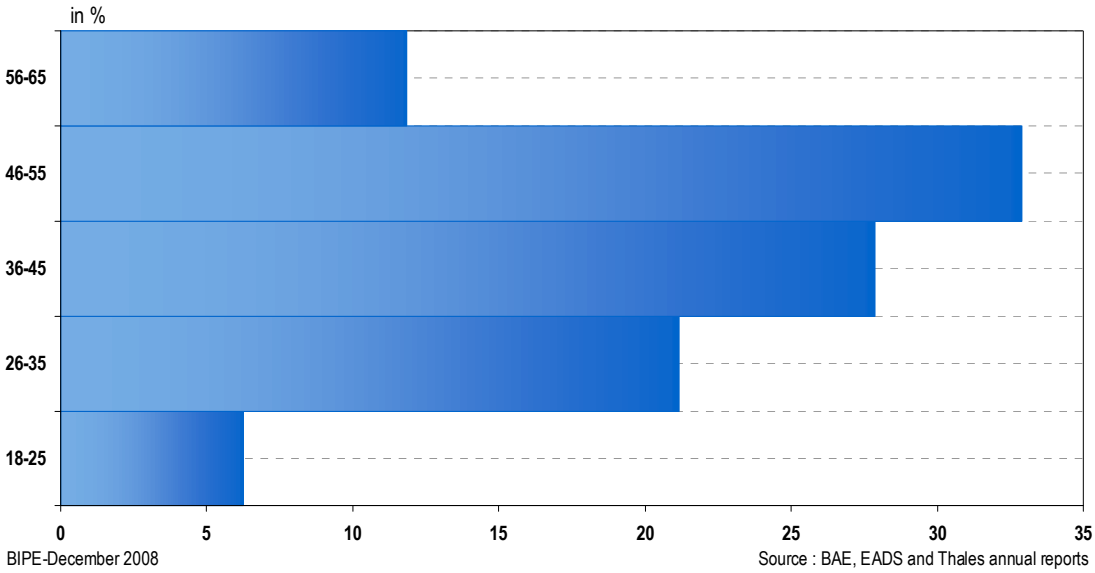


BIPE-December 2008

Source : BAE systems Corporate Responsibility Report 2007

Age distribution in the main three EU defence companies

Age diversity in the main european defence companies

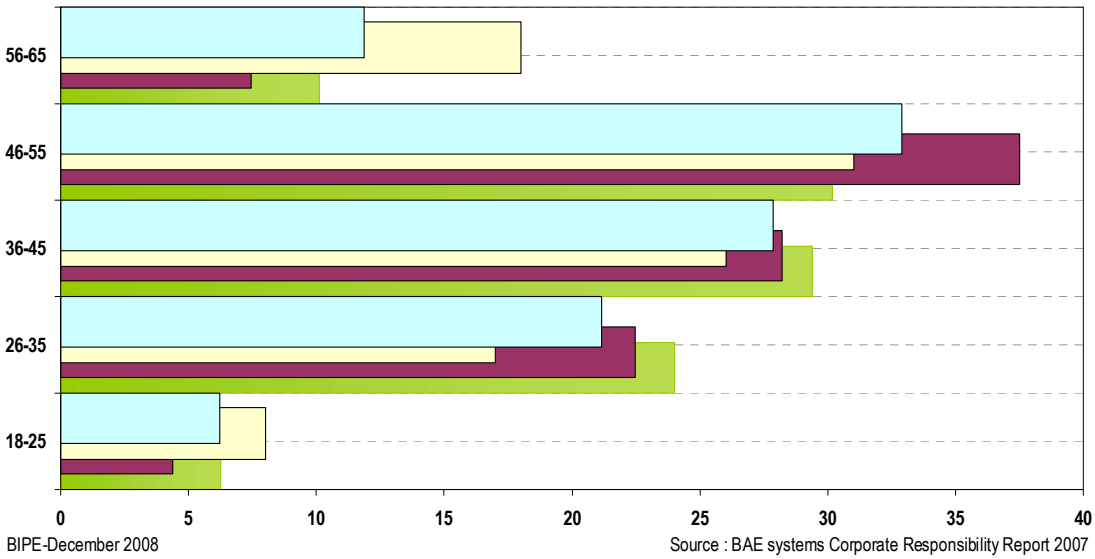


As illustrated, the share of the workforce likely to leave for retirement in the next 10 years ranges between 8% and 17%. This is less than in other industrial sectors.

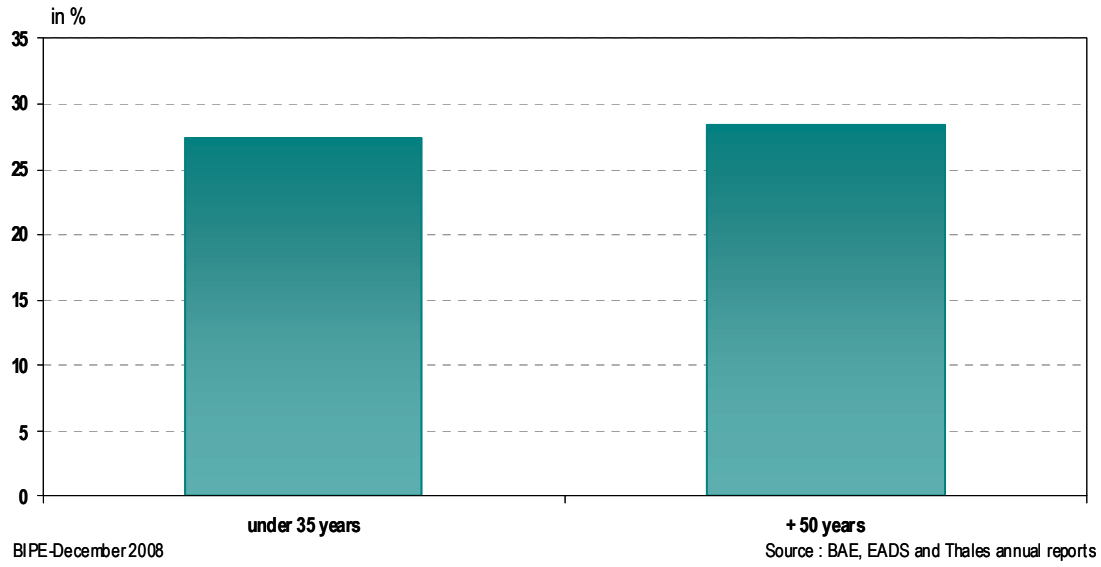
Although the transmission of knowhow clearly has to be organised, there is no evidence of a forthcoming « demographic trap », at least in tier 1 firms.

In fact, most prime contractors have “managed” the age pyramid in such way that the share of young people (aged 35 or less) has grown in the past years, and is today close to that of workers aged 50 or more.

Age distribution in the main EU defence companies



Age diversity in the main European defence companies



Gender distribution

Looking at the gender distribution of employment, one finds a high imbalance. The share of women working in defence industries is generally well below 20%, with most of the positions occupied by women being executive or administrative functions.

The feminisation of the workforce is a stated goal for many companies, in particular those faced with skills shortages. For example, EADS has committed to a long-term plan for the promotion of women in aerospace, and has set two priorities:

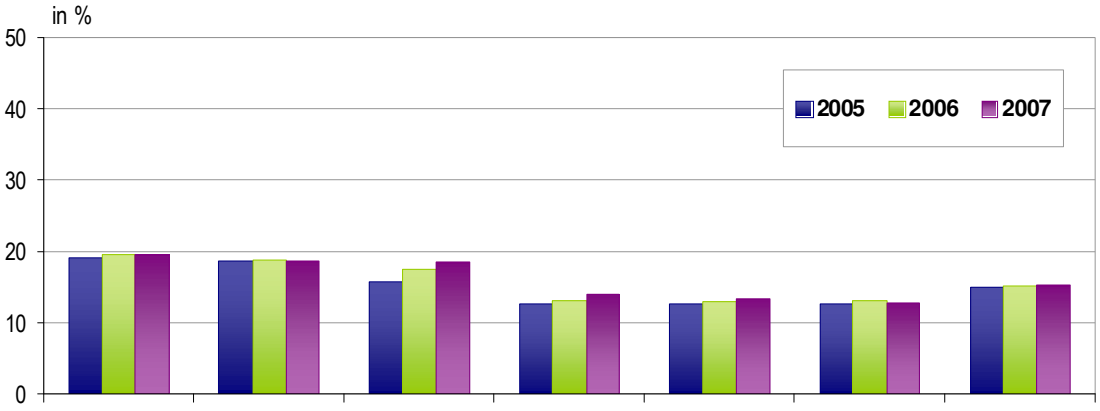
- at least 20% of its annual recruitment will be women;
- EADS will strengthen links and communications with universities and schools in order to promote engineering studies among young girls and women, and to help high potential and specialized female students to enter the aerospace industry.

End 2007, only 5% of the executive positions and 8% of the senior manager positions in EADS were held by women.

At BAE Systems, women represented 21% of the staff in 2007, up from 19% in 2005. Further improving the ratio is also a target for BAE Systems, which it seeks to achieve through awareness training for senior leaders, and the launch of a Group-wide women's network, among other initiatives.

At Saab, women represent 8% of the Board of Directors and 8% of "other senior executives", and 20% of the total workforce in the production units based in Sweden.

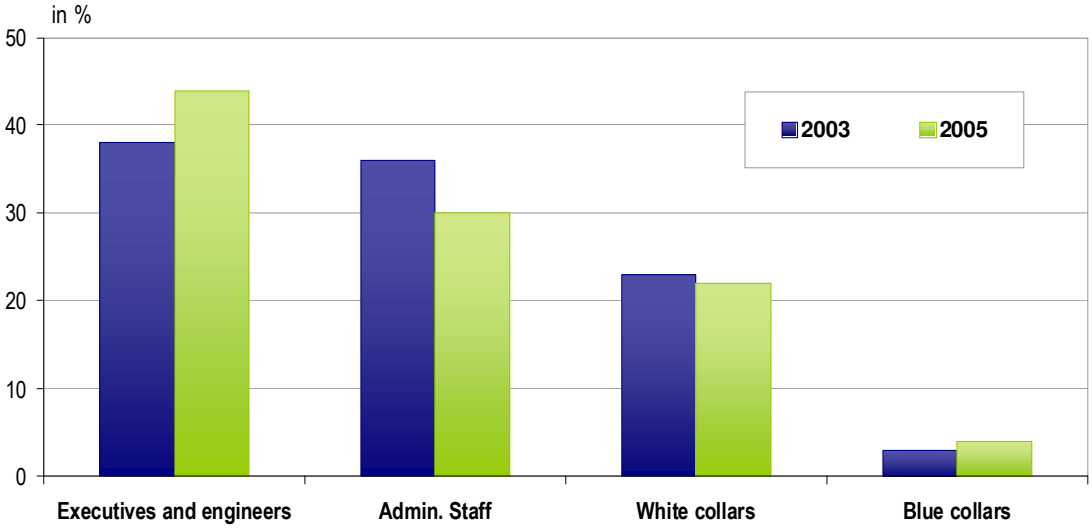
EADS : share of women



BIPE - 2008 November

Source : EADS annual report, 2007

Eurocopter : women status



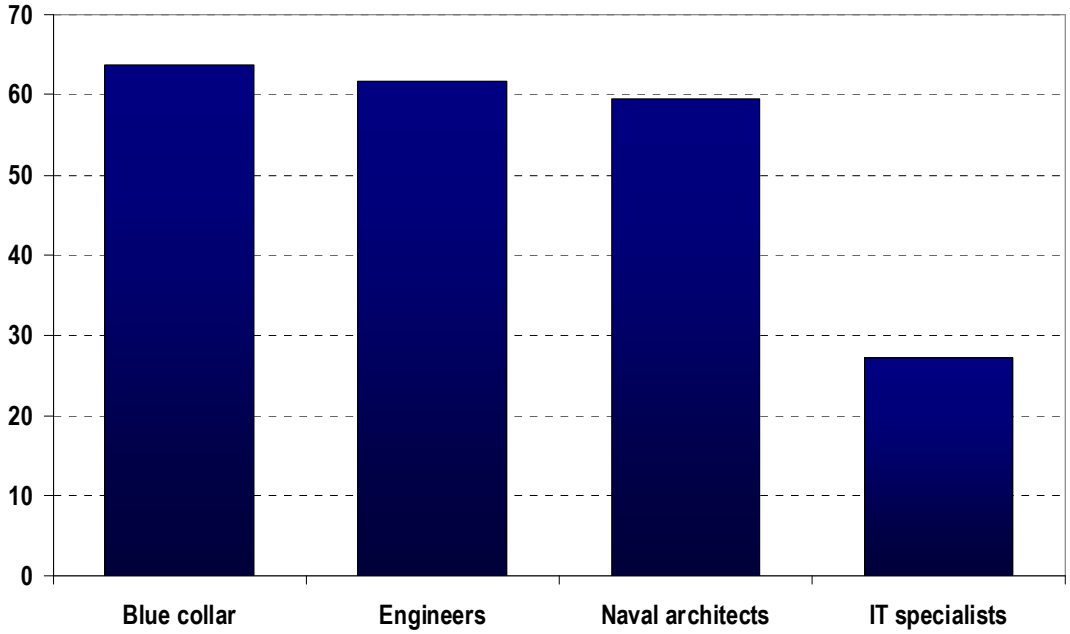
BIPE - 2008 November

Source : annual report, 2007

Other

In 2008, skill shortages were reported in some segments of the European defence industry. The chart below shows the percentage of firms which, in a recent survey of naval producers, reported difficulties in recruiting workforce.

Percentage of firms reporting difficulties in recruiting workforce in the naval industry



Source: Ikei study for the EC

The study by Rand[6] of the UK naval industry finds similar results: respondents highlighted the difficulties in finding and recruiting experienced professional engineers who are naval architects, electrical (power) engineers, systems engineers, and mechanical engineers.

Similarly, the study done for the EU on skills needs in shipbuilding[7] found that there were difficulties in recruiting qualified and skilled blue/white collar workers in all types and regions of European shipbuilding. On average, 55 percent of the EU-15 yards claimed to have problems in recruiting white collar workers, and 35 percent of these yards see problems in the recruitment of blue collar workers. Tensions related to the shortage of blue and white collar workers, however, vary by country. Unsurprisingly, the problems in recruitment were comparatively higher in those countries where the shipbuilding industry has a bad image.

Distinguished by the types of yards, recruiting problems appear to be higher in the merchant ship sector. In this case more than 41 percent of the yards have problems in recruiting blue collar workers and nearly one third of the yards have problems in recruiting white collar workers.

Similar problems are reported in the aerospace industry, where the high number of pending orders and the steady order intake in the civilian part of the industry creates capacity shortages in production. Whereas the larger firms can rely on their relative attractiveness to attract young people leaving the education system or coming from other sectors, this is not the case for the small and medium sized enterprises which often have to content themselves with those candidates remaining on the labour market after the larger producers have filled their own recruitment needs.

[6] Sustaining key skills in the UK Naval industry – a Rand report written for the UK Ministry of Defence by Hans Pung, Laurence Smallman, Mark V. Arena, James G. Kallimani, Gordon T. Lee, Samir Puri and John F. Schank, 2008.

[7] "Shipbuilding in Europe: Structure, employment, perspectives", by the Institute Labour and Economy at the University of Bremen (February 2006) based on an EU-wide survey of shipbuilding companies.

Labour shortages reportedly mainly concern engineers – the financial sector being, until recently, a major competitor for industrial companies – and certain categories of qualified workers (involved in machining operations, welding, and metal-working).

Geographical distribution of production across the EU

The regional distribution of production and employment varies across the EU. Because different regions are specialised in different segments of EU defence industries, one has to take into account the specific trends on each market segment, and the employment location patterns, in order to define how each EU region will be impacted by future changes. Knowing where the activities are located is important and an essential step to the anticipation of the effects of restructuring.

Indeed, different countries are specialised in different activities:

- Although the prime contractors and lead system integrators are typically located in the main 5 EU defence producing countries (France, Germany, Italy, the United Kingdom, and Poland), as well as in the Scandinavian countries (Sweden and Norway, for aerospace and naval), many **small and mediums sized companies** in countries like Austria, Belgium, the Czech Republic, Denmark, Finland, Greece, Portugal, as well as Romania and Bulgaria are also engaged in defence production;

- In the land equipment sector, it is mainly small companies which produce small arms and ammunition & low calibre artillery, but there are many other SMEs engaged in the production of parts of military vehicles. The same applies to **the thousands of SMEs** engaged in the production of parts and components of naval vessels and military aircrafts, as well as military electronics and subsystems for weapons and components thereof. These SMEs are not necessarily all based close to their key client – they **can be located anywhere**;

  A further difficulty in locating defence industry clusters arises from the fact that, often, the smaller companies are **not classified as defence producers** since they operate on (dual-) markets, even if their employment and, sometimes, their survival, depends on trends in defence markets.

- The "juste retour" policy long applied for defence contracting within the EU has meant that many small European countries and regions not originally involved in defence production have since developed capabilities, and sometimes created real poles of employment specialisation. This is the case for example of Portugal, where the maintenance of military aircrafts is undertaken at a former military airport near Lisbon. Poland, the Czech Republic and many other central European economies have also benefited from intra-EU offsets to limit the negative social impacts of restructuring after they switched from planned to market economies, and to foster their integration into Western Europe's industrial supply chains.

In summary, despite the difficulties in providing an accurate view of the regional location of defence industries in Europe, it remains important to do a first mapping, however imprecise, in order to better anticipate future trends in, and the consequences of, restructuring. Indeed, slow progress in industrial consolidation in the past decades has led to the emergence of redundant capacities and excess employment in certain segments of defence industries – hence to the duplication of certain skills.

Moreover, to identify future trends in skill and competence needs, one also has to take into account the fact that, in certain regions, high levels of employment in defence has favoured the emergence of **dynamic employment clusters**, some of them reaching beyond defence industries, which provides them potentially greater stability and strength to weather external shocks.

The impact of change in defence industries will therefore vary across regions:

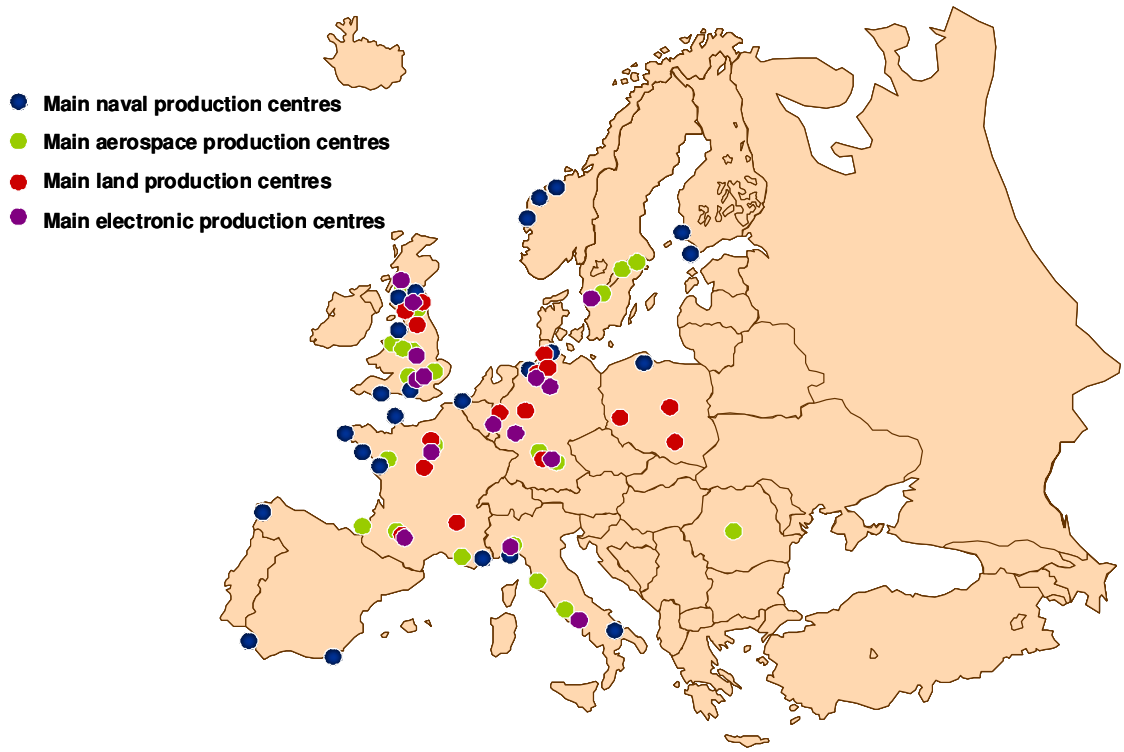
- based on their local economic structure (presence of civilian activities linked to defence? Nature of the defence activity? Degree of exposure of (other) local firms to defence activities? Existence of related activities or clusters of activities? Etc.
- based on their labour market situation, both:
  - within the defence firms (competences and skill mix, age distribution, etc.),
  - in the region as a whole (location of training schools and facilities, degree of attractiveness of region, etc.

The chart below locates the key defence production centres across the EU, in the four main defence segments.

The first map shows the location of the production units of the prime defence contractors involved in all segments of defence. In total, more than 70 production centres are identified in the EU and Norway – all these production centres being complemented by a host of other regions with subcontractor, supplier and service capabilities. Below, we review the production location by key industry segment.

Note that in most industry segments there is a special division of labour between Western European and Central & Eastern Europe, the former region hosting the bulk of design activities, as well as the research and development of the prime contractors, whereas the central and eastern European subsidiaries of these groups are most often concentrated on equipment production or maintenance and repair operations.

Location of the main defence production centres



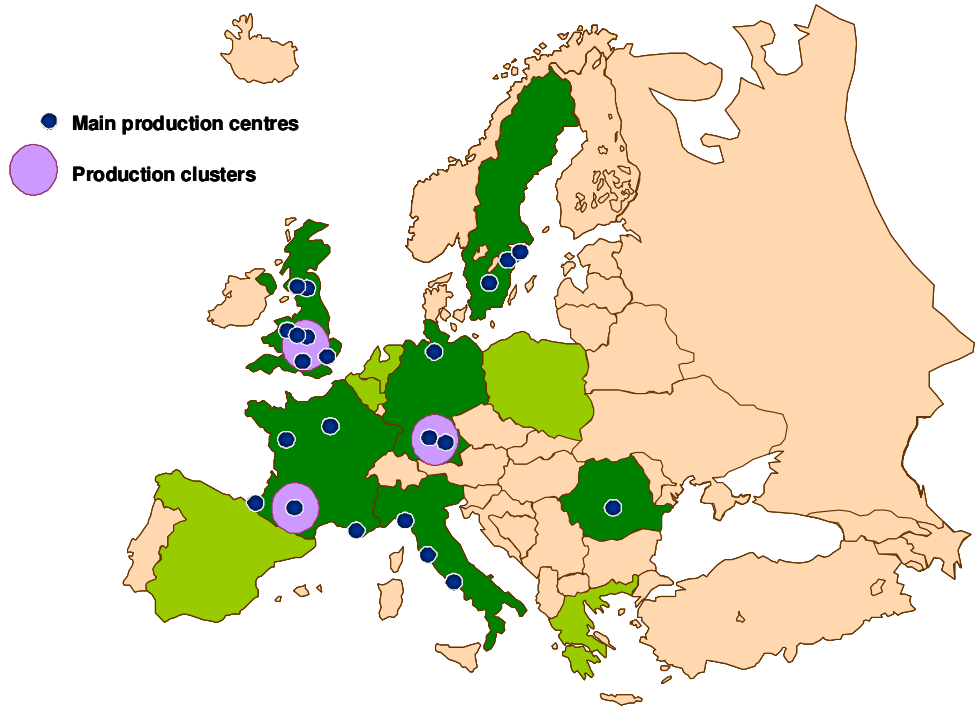
Source: Eurostrategies

Military aerospace industry

The chart below shows the location of employment in the military aerospace industry:

- In the UK, one finds several areas of employment concentration, notably around BAE Systems' production units (in the North, around Preswick and Dunfermline, in the Centre at Warton, Samlesbury, Brough and Cheadle, and in the South in Malvern, Waddington, Coninsby and Cottesmore). Thales has production sites in Rugby, Newbridge and Glasgow. EADS has units in Newport, Wimborne and Portsmouth. And there are also operations by Smith Aerospace (in Birmingham, Wolverhampton, Orchan and Burnley), Goodrich (in Woverhampton and Birmingham) and Honeywell (in Aberdeen, Moterhwell, Cheadle, Warton, Redditch, Shepherd and South Shield). Although the UK Defence Industrial Strategy has recently reaffirmed the objective of maintaining core skills and an aerospace industry capable of supporting sovereignty, there is growing awareness that this may have arrived too late: as stated in the UK Defence Industrial Strategy "The current size of the aerospace sector is [deemed] unsustainable, and rationalisation and reduction in terms of both infrastructure and employment are inevitable"[8].

Military aerospace production centres



Source: Eurostrategies

- In France, the key aerospace production regions are the Midi Pyrénées and Aquitaine regions (around Toulouse and Biarritz), with the former more specialised in civilian aerospace and the latter in military aerospace and defence systems. There are also poles of employment concentration in the Provence-Alpes-Côte d'Azur and the Pays de la Loire regions, where a number of aerospace equipment suppliers can be found. Finally, the Ile de France is a major research region, hosting operations by Thales, EADS, and Dassault. Eurocopter is located in Marignane and La Courneuve.
- In Germany, the Eurofighter operations are close to Kassel, Donauworth, Ottoburn whereas

[8] Source : UK Defence Industrial Strategy, 2005-06.

EADS has numerous operations throughout in the country, yet not all involved in military aeronautics.

- In Italy, Finmeccanica is the main military aerospace producer, with production units in Genoa, Naples and Rome.
- Spain hosts EADS Casa and has production units in the Sevilla area.
- In Sweden, SAAB is based in Linkoping and around Järfalla and Kista, and Stockholm.
- Romania has military aerospace production operations linked to MBDA.

The circles show areas of high local density of aerospace employment, the three main European producing regions being in Southern France, Germany (with two key employment poles around Breme and Bavaria, which together account for close to half of total aeronautics employment in Germany) and in the United Kingdom (Central/Southern England). Yet, this does not mean that there are not other regions highly dependent on aerospace employment.

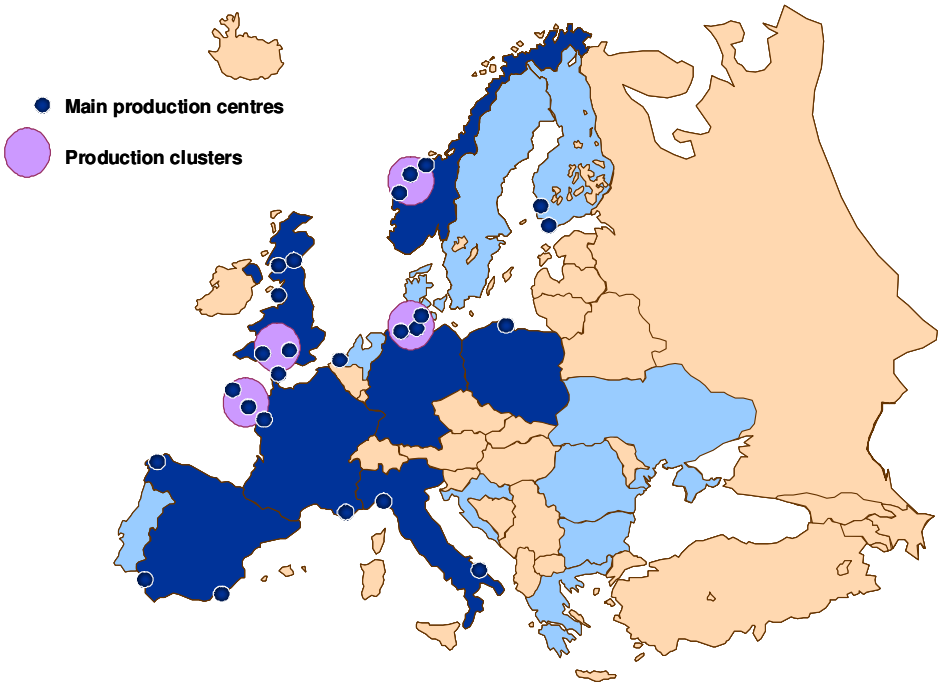
Naval defence industry

In the naval defence industry, the main production centres are in coastal regions:

- In the UK, BAE Naval has operations in Portsmouth (through its 50% share of the Fleet Support Lrd), on the Clyde (Naval ship business), and at Barrow (submarines); there are also operations in Rosyth and Govan. Altogether, 3,000 employees or so are employed in these different locations. Altogether, BAE Systems represents a 39% of the UK shipyards' employment (including civilian shipbuilding activities). Babcock has a dockyard at Rosyth and the Babcock Naval Services Support Business on the Clyde; DML Group owns the Devonport Royal Dockyard and has acquired the Appleshore Shipbuilders business in North Devon; Rolls Royce is responsible for the design and manufacture of all nuclear steam-raising plants for nuclear-powered submarines; and VT Group owns Portsmouth-based VT Shipbuilding and has a 50% stake in FSL with BAE Systems. Thales is also present with some 1,000 employees in Bristol, Fleet and Templecombe. Around these prime contractors are a myriad of smaller companies and suppliers accounting for several more thousand jobs.
- In France, the main naval defence producer is DCNS, with 13,000 employees around Toulon (2,500), Lorient (2,000), Cherbourg (2,400), Brest (3,200) and Nantes (1,010).
- Germany is the world's fourth largest naval equipment producer, with 40 shipyards; yet, only five are linked to defence activities. These are structured around the industrial conglomerate Thyssen Krupp Marine Systems AG (TKMS) which employs 8,300 people of which 5,900 on the production sites of Hambourg, Kiel, Rensburg and Emden. Some 2,400 workers are working abroad, notably in Sweden (due to the acquisition of Kockums-Karlskrona) and in Greece (through the purchase of the Hellenic Shipyards-Skaramangas). In Hambourg, the shipyards are involved in the production and maintenance of surface vessels and commercial boats. There are also four independent medium sized shipyards: Lürssen (Brême), Abeking&Rasmussen (Lemwerder), Flensburger Schiffbau (Flensburg) and Peene Werft (Wolgast): these occupy approximately 2,800 people in dual activities. Germany's naval defence industry produces surface vessels and conventional submarines, but, unlike the situation in France with DCNS, there is no single player in Germany capable of undertaking the complete system integration of military equipments due to the dispersion of skills across a number of independent industrial actors (involved in engineering, platform assembly, system production and equipment production).
- In Italy, Fincantieri accounts for over 9,200 employees in 8 yards, among which operations in Genoa and Bari. Fincantieri accounts for 76% of the total Italian (direct) shipbuilding employment in both military and civilian activities.
- In Spain, the naval defence industry is mainly represented by Navantia, with 5,500 jobs in and around Ferrol, Carthagena and Cadiz. Navantia alone accounts for approximately half of all employment in Spain's shipyards – including civilian shipbuilding activities.

- In the Netherlands, Damen employs 8,000 persons in Vlissingen. The company also has operations in Poland (in Gdynia).
- In Finland, Aker Yards' Finnish yards is the source of employment concentration around Turku, Helsinki and Rauma, with 3,900 employees; these operations are also involved in cruise vessels' production.
- Bulgaria, Romania and Ukraine also have regional employment concentrations in naval industries. In Romania, Aker Yards of Norway dominates the shipbuilding industry, as one third of all workers in (civilian and military) shipyards are working for Aker Yards. Taking into account the number of the employees working at the yards of Deawoo (Mangalia) and Damen (Galatz) in Romania, more than 80% of the Romanian shipyard workers are employed by foreign shipyard-groups.
- Norway's Aker Yards has operations in Brevik, Sviknes and Brattvaag.

Naval defence industry poles of employment



Source: Eurostrategies

Land defence industry

The location of land defence activities is even more varied, due to the wide variety of products in this segment. The key producing countries are France, the United Kingdom, Germany and Poland. There are also production centres in Sweden, Denmark, Spain and Greece, along with the Netherlands and several central European economies.

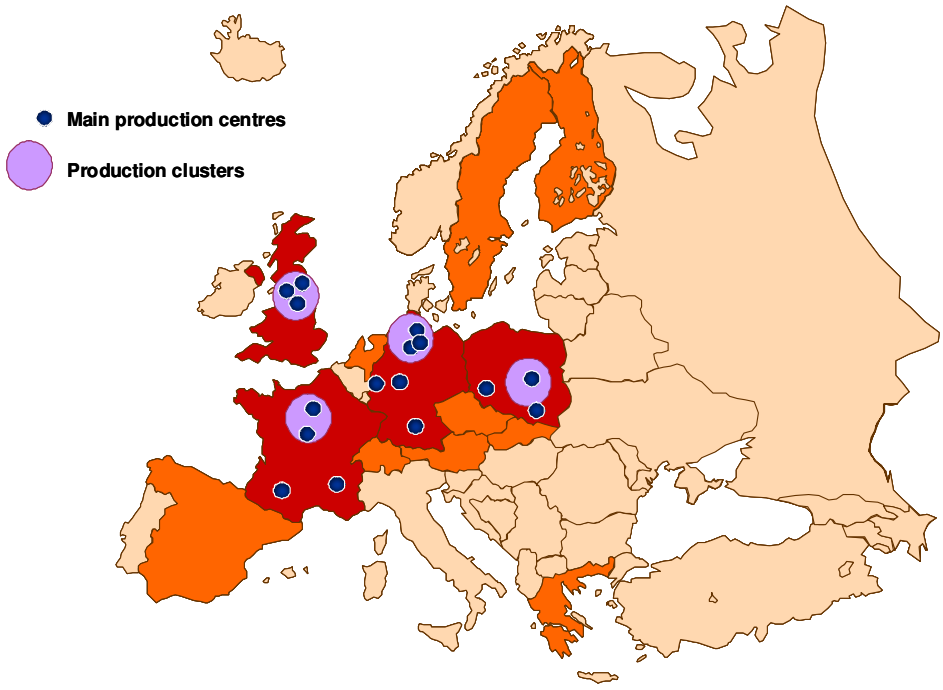
The key producers by country are as follows:

- In the United Kingdom, BAE Systems has production units in Wolverhampton, Newcastle, Barrow, Leicester, Telford, Birtley and Badway Green. The past years have seen a spate of mergers and acquisitions in the UK land defence industry. According to UK defence experts, these along with the market orientation of UK procurement policy which did not give automatic preference to national suppliers have changed a lot the land defence industry.

Some consider that the later is now no longer able to produce all the equipment required by its army[9]. Of the five companies that existed in the sector a few years ago (Alvis, GKN Defence, Royal Ordnance, Vickers Defence Systems and Vickers Shipbuilding and Engineering Ltd), there is today only one company, BAE Systems Land Systems, which is part of the recently formed BAE Systems Land and Armaments whose headquarters are… in the US.

- In France, Nexter produces from Bourges, Tulle and Roanne, while Thales has operations in Toulouse and Paris.

Land defence industry poles of employment



Source: Eurostrategies

- In Germany: KMW has units in Munich, Bonn, Constance and Hambourg, while Rheinmetall has production centres in Dusseldorf, Kassel, Breme and Kiel.
- In Sweden, BAE Hägglunds produces out of Örnsköldsvik and Karlskoga.
- In Poland, Bumar has production units in Warwaw, Wroclaw and Cracovia.

In land defence, the main competition within Western Europe is between Germany's two major armoured vehicle producers (Krauss-Maffei Wegmann and Rheinmetall), French-owned Nexter, Finland's Patria, BAE Systems and General Dynamics subsidiaries at Mowag (in Switzerland), Steyr-Daimler-Puch (in Austria) and Santa Barbara Sistemas (in Spain).

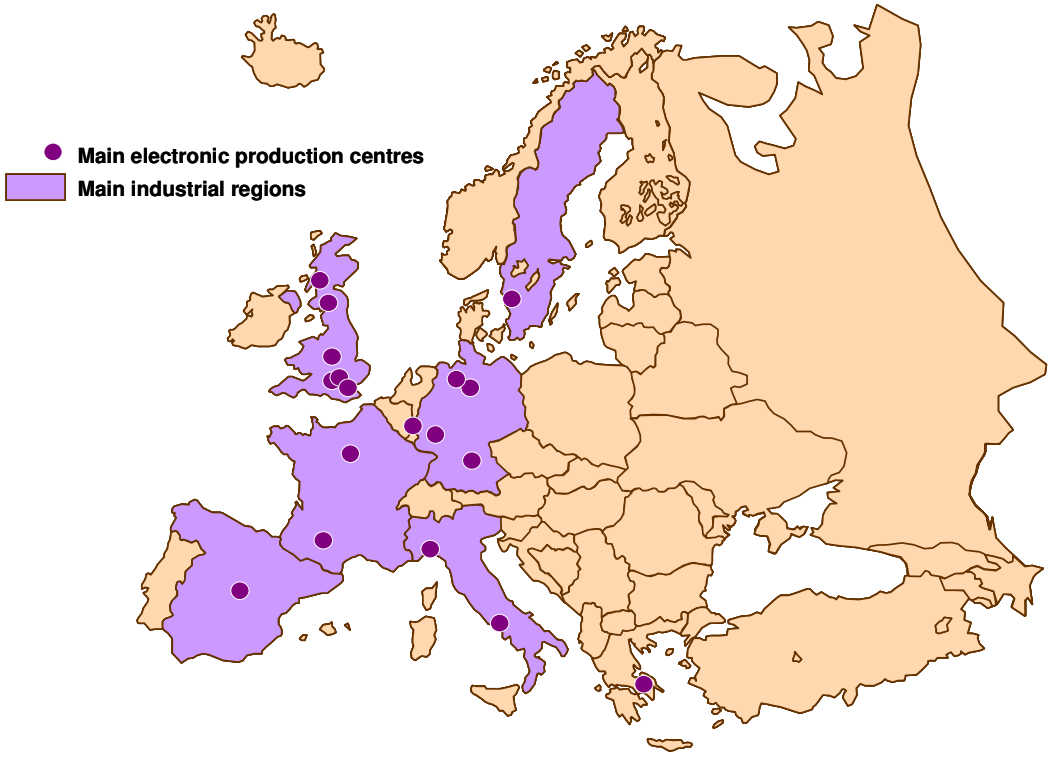
[9] Source : **UK Defence Industry – No pain, no gain -** JANE'S DEFENCE WEEKLY (JDW) March 29, 2006 v. 043 no. 014

Electronic defence industry

As is the case with all the other segments, the electronics industry is quite spread out across the EU. There are poles of employment concentration in the UK, Germany, France, Italy, Spain and Sweden, as illustrated. In particular, one notes the presence of Sagem and Safran in the Paris area.

A number of producers also involved in other segments are also key players of the electronics production for defence. Among these are Finmeccanica (Italy), Rheinmetall (Germany), as well as Thales (in France and the UK) and BAE Systems (mainly in the UK, but also spread out internationally).

Electronic equipment for defence - poles of employment



Source: Eurostrategies

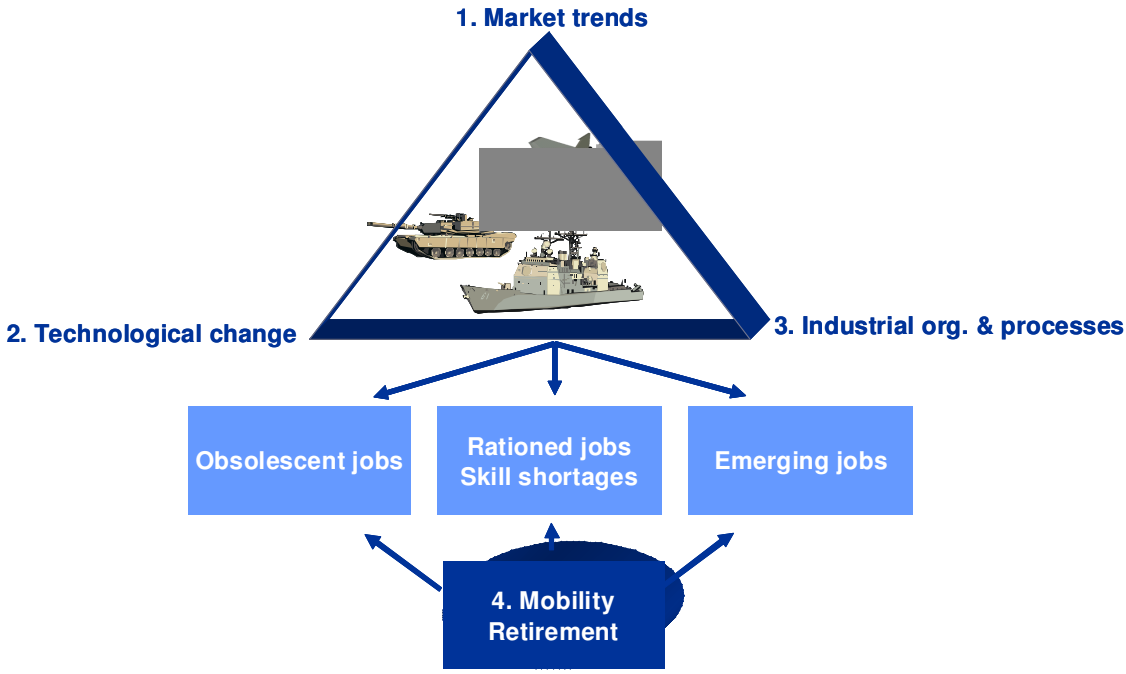
The outlook for production by main defence segment

The foresight framework

Given the specificities of defence markets, and the variety of production locations and employment concentration centres, one cannot look at future skills needs without analysing the potential trends in production and employment in each of the four main defence segments. Indeed, the types of skills required in aerospace, naval, land or electronics industries vary, as does the share of skilled versus unskilled work.

Below, we outline the framework that we applied to anticipate future trends in employment, skill needs and changes in competences in each segment.

The foresight framework



Source: Eurostrategies

At the general level, the main factors impacting future trends in employment and skill needs by segment are (1) demand factors (market trends), (2) technological change, and (3) changes in industrial organisation and processes.

1. Demand factors, or Market Trends, cover:

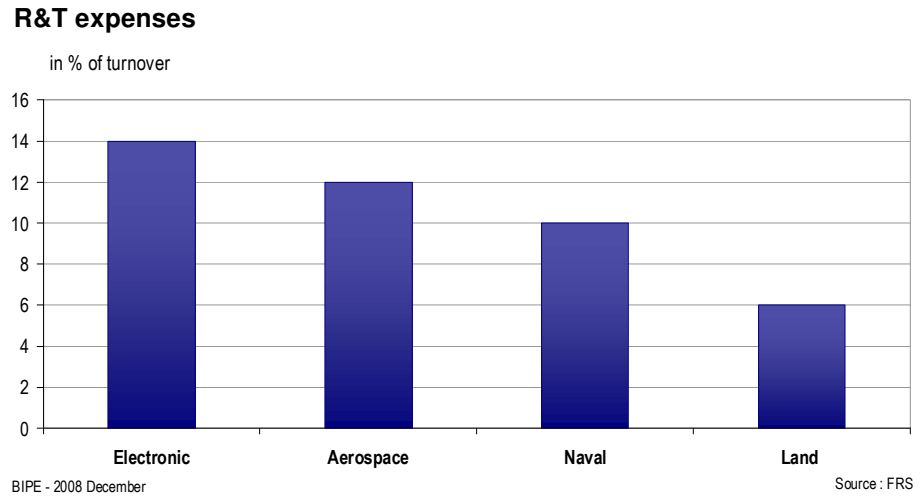
- New equipment demand, as well as needs for replacement, maintenance and retrofit of existing equipment;
- Trends in Government defence budgets (which can cause crowding out and constrain actual order levels);
- The competitive positionning of EU (and national) producers; this partly depends on past trends in R&D.

These demand factors are both European and global.

At **European level**, the main factors of change are:

- **The changing role of force**, which changes the demand mix: for example, globalisation leads both to a growing scope of international military operations, and to a need for coordinated international rescue efforts (e.g. in connection with natural disasters). One also sees nascent cooperation on global health and environmental issues. The increased vulnerability of global infrastructure (including transport and communication infrastructure) is also a cause for concern on the economic front, which may lead to changes in the role and missions of armed forces. Finally, one sees a growing global demand for civil security, a segment closely related to defence and which has a particularly strong future potential.
- Stagnant or declining overall defence budgets within the EU: the flatter demand spending in Europe has prompted European prime producers and their suppliers to **target other, more dynamic, world markets**; yet, competition with the US and other countries is significant in these third country markets.
- **National defence procurement are shrinking**.
- The quest for new markets has led to **increased FDI into third-country markets**, including in the US: in the aerospace and defence sector, EU acquisitions in the US have increased by a factor of four between 2006 and 2007 (mainly originating from the UK); this means that EU producers have a growing production base outside the EU.
- **Comparatively low spending on R&D** is a serious weakness for the long term: as indicated in the introduction, Europe's competitiveness it at stake in several defence segments, due to much lower R&D efforts than the US or other competing countries (Israël, for missiles, for example): in 2005, the EU countries spent approximately € 2.2 billion on defence RTD. In 2006, the figure increased to € 2.5 billion, which is only one-sixth of the US RTD expenditure on defence. On average, the EU Member States allocate 1.1% of their military budget to RTD expenditures, compared with 3.3% in the United States.

RTD expenditures by main market segment

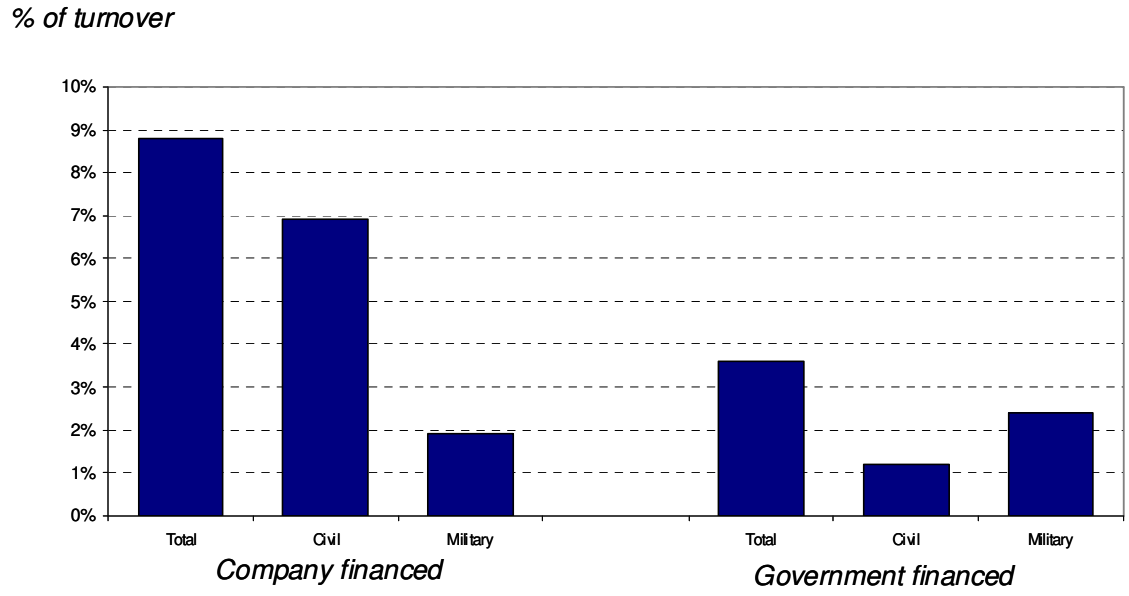


By market segment, the segments which have seen the lowest share of R&D effort in the past years at overall European level are naval and land defence industries – two segments in which Europe has in fact been losing ground compared to other world producers.

Yet, when compared to expenditure on R&D for civilian production, the share of R&D for military purposes in European aeronautics is strikingly low, as illustrated below. Considering that 42% of the total aeronautics' turnover in 2007 was achieved in the military sphere (among which 13.5% for military exports outside Europe, a figure up from 8% in 2006, and 28.5% military sales within Europe, up from 26% in 2006), the 2% R&D share in turnover is

very low. The levels of public funding is marginally higher, but varies significantly across countries. In Germany, a higher share of RTD in defence is internally financed by the firms than in countries like France and the UK[10].

Source of Aeronautic R&D expenditure in turnover



Source : ASD

- In some countries, like the UK, one has seen a **growing emphasis on cost-effectiveness** through the opening up of markets to competition; the UK Defence Industrial Strategy of 2005-06 for example has paved the way for more international investment in defence assets – in particular from the US; US producers have, however, been more cautious vis a vis other EU countries, viewed as more volatile in terms of the level of defence spending; other reasons for the US' lack of interest in continental European markets are the perceived difficulty in reorganising/rationalising the supply base, the "national champions" policy of certain countries, and union pressures.
- Yet, the opening of UK defence markets to competition has led to the multiplication of urgent operational requirements (UOR), which have recently led to a new emphasis on the **reduction of risks linked to operational dependence on other (non-UK) suppliers**. As a result, and under the impulse of the Defence Equipment & Support Agency (DE&S), fruit of the merger between the DPA and DLO, a new strategy has been defined which fosters long term partnership agreements between producers, and long term supply contracts covering maintenance, upgrading and retrofitting, and logistical support, in particular for airplanes and military vehicles.

At **global level**, the main forces of change in the medium to long run are:

- The lack of dynamism of world market demand;
- Difficult entry conditions into the more dynamic markets;
- Regulatory factors, and in particular the changes in the regulatory environment for trade;
- Geo-political factors, and their consequences: indeed, changes in the geo-political situation have led to change in EU missions which in turn impacts the equipment mix in demand.

[10] Source : JANE'S DEFENCE WEEKLY (JDW) March 23, 2005 v. 042 no. 013

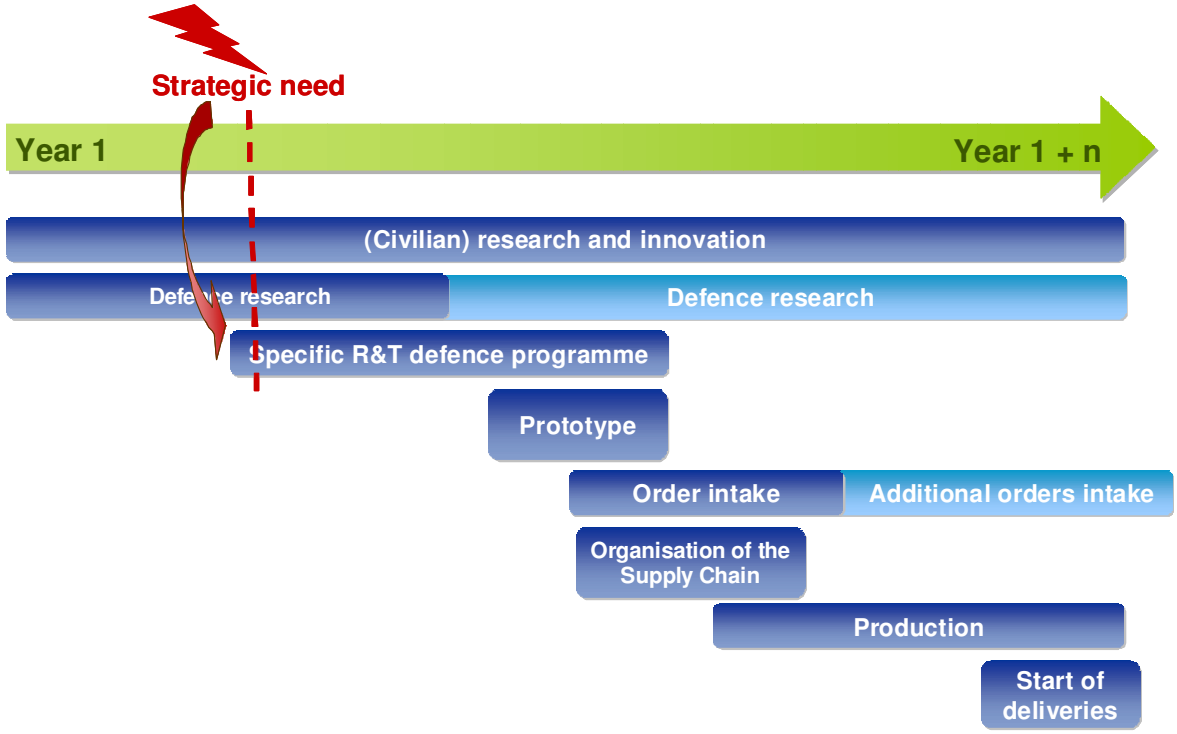
In the short term, several major programmes in the US and in Europe are still in the "ramp up" phase of production. This will drive production and employment trends in the next 3 to 5 years. In particular, military commitments in Iraq and Afghanistan are supporting high demand for spares, overhaul and retrofit of existing equipment, notably of land defence vehicles.

2. Technological change

Technological change is ongoing, through the diffusion of the product of civilian and military R&D into materials, components, equipments, production processes, etc. Yet, in the defence industry, even breakthrough technologies do not immediately alter the outlook for production, as military programmes are typically very long programmes.

In all capital goods' producing sectors, there can be a big gap between "needs" that are perceived by end-users, the actual conception of an equipment that meets that need, the registration of the first orders for that equipment and the start of production and mass delivery. This is true in the automotive industry, it is also true in the railway rolling stock industry (with the high speed train, for example), and is even truer in defence where the full cycle, from programme initiation to final product delivery, is often more than 10 years. This important "time gap" has to be taken into account when assessing the impact of technological change on employment.

The "time gap" in defence industries



Source: Eurostrategies

In defence, as illustrated above, there are many "strategic needs" which existing technologies do not yet fully address. Research programmes are thus continuously under way in order to find solutions or alternatives. These take place both in the civilian and in the defence spheres. Once a technological breakthrough is achieved, this can trigger the launch of a specific research programme aimed at applying the technological breakthrough to the "strategic

problem" to be solved. Progress in this area eventually results in the design and development of a prototype which, if successful, is marketed, leading to order intakes. At that point, the production chain – which until then had been experimental in nature, as opposed to geared to massive production runs – has to be organised. This can take some time, so that when the equipment delivery effectively begins, a number of years have usually gone by since the start of development.

As indicated above, in defence industries, the "time gap" can easily exceed 10 years. This is a very long time for companies to be investing without immediate returns, but on the positive side it means that – at least theoretically – once orders are generated the industry has several years of visibility over future production trends – hence several years of visibility on employment needs.

3. Industrial organisation and processes

The third main family of factors of change are supply-side factors, notably those linked to the organisation of the industry, and to the changes in processes. In this family of factors one finds both:

- **Changes in shareholding structures**, mergers and acquisitions and/or the launch of joint defence programmes, which can alter the production and employment prospects;
- The impact on employment of corporate strategies, such as increased subcontracting, internationalisation of production, and the **externalisation of certain functions** such as maintenance, repair and logistics. All of these have major consequences on employment trends in Europe.

As stressed earlier, theses strategies are already in place in many segments of the defence industry, but their relative impact varies by segment so that it will be analysed on a case by case basis in the next sections.

At the local level, the social consequences of future developments vary depending on another set of factors:

- Local employment structures;
- The structure of the supply mix;
- National and regional government policies:
  - For example, UK policy is focused on maintaining and enhancing high-tech systems engineering competencies, and system integration capabilities;
  - Poland puts emphasis on niche capabilities defined based on national security interests;
  - Countries like Portugal have developed niches of capabilities through the « juste-retour » principle, which it will likely seek to defend.
- National, EU and NATO priorities will impact the allocation of funds for RTD and technical progress: this will have spill-over effects at regional and local levels;
- The age pyramid structure will impact job turnover, hence recruitment needs;
- The level and trend in cross-sectoral and regional mobility, and migration trends, will impact firms' location strategies;
- The skill mix of the work force also impacts companies' location strategies: for example, although they do not rank amongst the largest producers, there are niches of expertise and strong capabilities in certain defence segments in Spain, the Czech Republic, etc.;

Relevant factors of change at local level

The degree of anticipation and preparation of change will finally impact local employment trends. Yet, companies are not identical in the face of restructuring: differences in size, resources, sectors, independence or dependence on companies at other levels of the supply chain all influence the way the social consequences of a given event are handled.

Outlook for production by segment

As indicated earlier, because defence contracts are typically long term contracts, in most segments, equipment needs are generally known until 2015. Yet, the timing of production is less certain: some orders may not materialise or can be postponed. Below we review demand and production trends by key defence segment.

Aerospace

In the military aerospace industry, it is replacement demand that will drive the market: an estimated 5,000 out of 8,000 aircrafts have to be replaced.

Maintenance and repair are also key market drivers: indeed, the future trend in activity in defence reflects the growing importance of the "integrated support approach", which combines maintenance, repair and overhaul (MRO), and retrofit and upgrading activities, into one single contract. This can make it difficult to differentiate logistics activities (MRO) from upgrading activities, although the skills required for one and the other vary. Yet, in defence, it is still often the same groups that are involved in both lines of activity, unlike what happens in the civilian sphere where there are numerous MRO operators.

In terms of new programmes, delays with the 5th generation of aircrafts are a cause for concern, as these could jeopardize production levels beyond 2015. Fortunately, demand remains high for helicopters, drones and military tactic aircrafts.

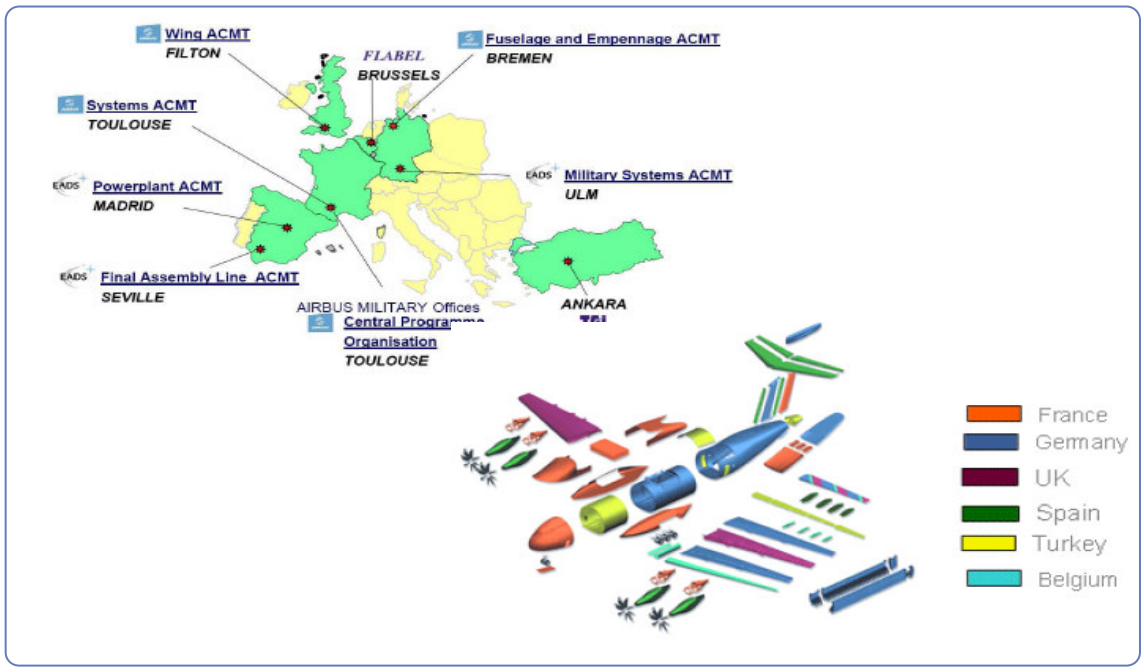
Yet, before the 2015 horizon, the successive delays affecting the production of the A400M transport aircraft (due to difficulties with its propulsion system) constitute a source of tensions in those regions that are highly dependent upon this model, such as Bremen in Germany, Filton in the UK, and Southern Spain.

Overall, production trends have nevertheless been good in recent years, and are expected to remain so in the next 5-10 years[11]. In fact, i**n this sector, the main concern is not one of insufficient demand but more one of capacity constraints, due to the high level of orders in the civilian industry**. Despite the recent increase in the number of cancellations, the level of order books remains high and guarantees several years of production for most ranges of civilian aircrafts.

[11] For example, in 2007, according to company sources and to ASD, Saab Gripen reaffirmed its strong position in 2007, with several tender requests worldwide and an order to upgrade 31 aircraft in Sweden. Regarding Eurofighter International, by end 2007 there were 53 Typhoon aircraft deliveries to the UK and 84 to the other European partner countries. Delivery for the Tranche 2 Typhoon aircrafts was due to start in 2008. The year 2007 was also excellent for European manufacturers of tactical air transporters: Alenia Aeronautica was awarded a long-term € 2.4 billion order of 78 C-27J aircraft in the US, while EADS CASA delivered 7 C-295 aircraft. In the helicopters segment, Eurocopter achieved another 30% order increase from € 4.9 to 6.6 billion, which will continue to boost future production. AgustaWestland reached revenues of almost € 3 billion and an order backlog of € 9 billion through new orders of € 3.97 billion in 2007, the main one being a € 1.2 billion order for 51 attack A129 helicopters by the Turkish Army.

The figure below illustrates the geographical split of the A400M production.

The geographical distribution of the A400M work packages



Source: EADS

Naval defence industries

In the naval industry, both the replacement market and new demand are dynamic:

- Order books for the last generation warships (aircraft carriers, frigates, destroyers, submarines) are solid;
- There is a rapidly growing demand for maintenance activity, given the age of the fleet in operation.

Yet, competition is also strong, including from non-EU producers, which limits the potential development of EU-based production. Germany's naval business appears to be one of the most consolidated in Europe, since Germany's steel and engineering giant ThyssenKrupp bought Howaldtswerke-Deutsche Werft (HDW) in 2004, merging it with its own shipyards, Nordseewerke and Blohm & Voss, to create ThyssenKrupp Marine Systems Group (TKMS). Sweden's Kockums and Greece's Hellenic Shipyards were also absorbed into this conglomerate, having been subsidiaries of HDW.

TKMS now has a leading position in the non-nuclear submarine market, with a 70% world market share, and the penetration of foreign markets is at the core of its strategy. Orders have been placed by Turkey, and a partnership has been signed with Fincantieri for the delivery of submarines for the Italian navy, but the orders from Italy are coming in slowly.

On the surface vessel market, the group is more dependent on domestic markets – as is the case with other producers in that range in other EU countries – and competition from non-EU producers is growing due to limited defence procurement budgets of potential clients, and the more aggressive strategies of South Korean, Chinese and US producers (Northrop Gruman and General Dynamics Marine Systems).

France's DCNS and Spain's Navantia are facing similar challenges. Close to 75% of DCNS' turnover is presently accounted for by national procurement: for the company, the growth of its international presence is key to its future development. Partnerships are thus being developed with countries in Asia (Singapore, Malaysia, India) and the company is developing an "infrastructure, networks and maintenance" production line with Veolia Environnement in order to tap into externalized defence markets such as the management of naval bases, airports and other military bases, as well as civilian ports.

In the UK, the Defence Industrial Strategy (DIS) aims for significant improvements in sector performance, and expects a strong programme of work for UK shipbuilding over the next 10 years as several programmes come on stream (Type 45 destroyer, Astute submarine, Future Carrier and Military Afloat Reach and Sustainability (MARS)). Yet, these will be followed by a new period of downturn once these programmes come to an end, since the government cannot afford to support the current pace of successive new platforms. Furthermore, part of the production of the above programmes may take place offshore. In parallel, given the fragmented nature of the industry and the need for productivity improvements, the MoD has called a halt in the competition for ship refits and has instead switched to a "partnership" approach, through a Surface Ship Support Alliance. Similary, a Surface Warship Support Alliance has seemed preferable to a pure competitive approach, for surface warship upkeep and fleet time support.

In summary, if the short term will see continued growth in the production levels of naval defence equipment, the years after will see slower growth in production and a likely reduction in the total number of people employed in the sector in Europe, as well as a growing share of staff employed in "related" or new activities, such as infrastructure management, i.e. "externalized" from naval defence industries stricto sensu.

Land defence industries

The conflicts in Iraq and Afghanistan have brought the focus back to armoured vehicles, causing a new wave of new orders and demand for retrofitting of existing equipment in recent years. As a result, main suppliers like KMW of Germany saw its sales increase by 70% in 2006, in large part due to the demand for its Leopard 2 MBT, the Dingo and Dingo 2.

In the sector, the short term outlook is nevertheless bleaker than in the other two markets, and the acceleration only takes place in the medium to longer term. Indeed:

- The renewal of the "median vehicles" fleet (i.e. between 20-40 tons), which is presently underway, will likely go on until 2015;
- But the renewal of heavy tanks will only take place in the longer term (up to 2030?). Note, however, that this may be postponed in case of budgetary constraints.

In the UK, a number of programmes are underway in order to upgrade the existing AFV fleet in order to ensure that the vehicles remain effective until they are replaced by new systems. Since 2004, BAE Systems is a key player in military land systems. Until then BAE was mainly present in this segment through its RTD activities. Since then the Group has embarked on a distinct and cohesive strategy and entered both the tracked and wheeled vehicle sectors, in part through acquisitions.

IFVs are also due to be upgraded, with much of this upgrading activity going on until 2025. The DPA's priority is the FRES (Future Rapid Effect System), but at this stage there is no guarantee that BAE Systems will be the lead systems integrator for FRES. Its main competitor is General Dynamics, so the location of employment is uncertain. For other contracts too, competition has benefited to non-UK producers. For example, MAN of Germany won the contract for the Future Support Vehicle (FSV). This illustrates the growing difficulty in mapping new orders to production locations….

The result of these prospects is the projected growth in production illustrated on the figure below, which takes into account likely turnover growth by segment, given the relative value of the contracts. The graph shows an acceleration of production activity in the aerospace segment between 2010 and 2015, followed by a slowdown thereafter, while the rate of growth of production of land defence equipment progressively rises, albeit remaining moderate, and that of naval defence equipment decreases progressively over time due to weakening orders and growing competition from non-EU producers (including Norway).

Electronics

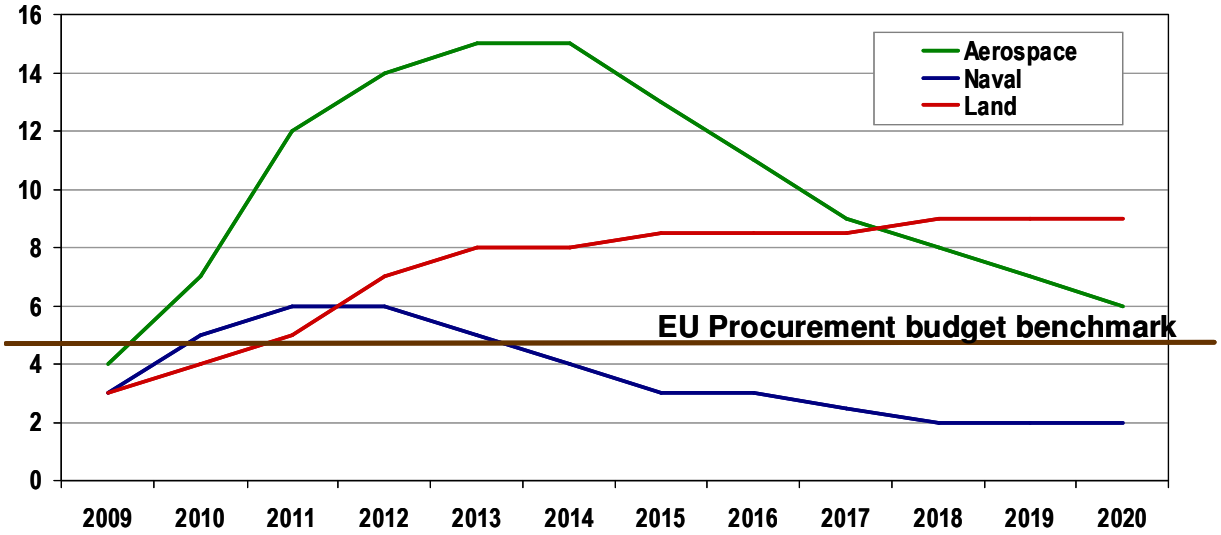
As emphasized by ASD, electronics has become a major element of defence (and most other equipment) industries, through embedded applications (both transversal and at sectoral system level), and as a provider of autonomous systems. The companies involved in defence electronics are closely linked to the LSI, and the trend in their activity – at least for the military part of it - is closely linked to prospects in the other three segments of the industry analysed above: aerospace, land and naval defence. Therefore, we do not analyse specifically the trends in activity on this segment.

Overview of possible production trends on the three main segments

The figure below shows the possible trend in annual production growth, given registered and announced trends in orders on each market, and taking into account the relative importance of the different markets. Note that most growth rates reported are above the trend-growth in national government procurement budgets, showing that the trend in new orders expected is probably on the optimistic side, and there will have to be crowding out.

Possible future rates of growth of activity by key segment, in %

"Demand" trends in the defence industry until 2020, in the absence of budget constraints



Source: Eurostrategies

Consequences for employment globally

Trend in employment in different scenarios

The consequences of the above trends in production on employment and skill needs will vary depending on restructuring patterns, on the production location and externalization strategies of the prime contractors, and on the degree of anticipation and preparation of change, as this will influence the countries and regions' attractiveness for production. Yet, given productivity trends and the need to increase the cost effectiveness of production, the overall trend will be a continued decrease in employment levels in the EU, in line with past trends.

Below, we recall the four BIPE employment scenarios[12], taking a longer view starting in 1987 in order to put the projected future trends in perspective. Clearly, these scenarios presented an extreme view of what could happen in the industry, yet in doing so they make it possible to quantify a possible "range" for future employment trends – the actual outcome being probably somewhere between the top and bottom lines.

In the "coordinated EU procurement" scenario presented on the chart on the next page, which assumes a rapid shift towards coordinated equipment purchases at EU level, with due "preparation" of change, employment levels fall rapidly in the first years due to re-organisation of production, to the rationalisation of duplicated R&D programmes and to the concentration of production in fewer locations, most likely per equipment type. The financial savings made possible by this re-organisation, however, makes it possible for governments to step up their financial support of R&D programmes, helping the defence companies to regain competitiveness in world markets. This leads, after a few years, to a stabilisation – and possibly even to new increases – in employment levels. The rise in employment in the longer run in the "Coordinated EU procurement with anticipation" scenario reflects the fact that, with appropriate anticipation of change, one can make the most of synergies between defence and civilian research and enhance the relative competitiveness of the EU civilian aerospace, railway rolling stock, automotive, shipbuilding and other industries.

The scenario assuming a continued a preference for national procurement enables to save jobs in the first years of the forecast, however the lack of funding for new programmes and the absence of competition between players at EU level eventually hampers the European industry's external competitiveness and leads to more rapid falls in employment from 2011-2012 onwards.

Different trends in employment are also foreseen given the degree of preparation of change: the anticipation of change in policy orientation is supposed to make it possible for firms to encourage a transition of workers to other industries than defence, and to foster new business creation through financial support or other means.

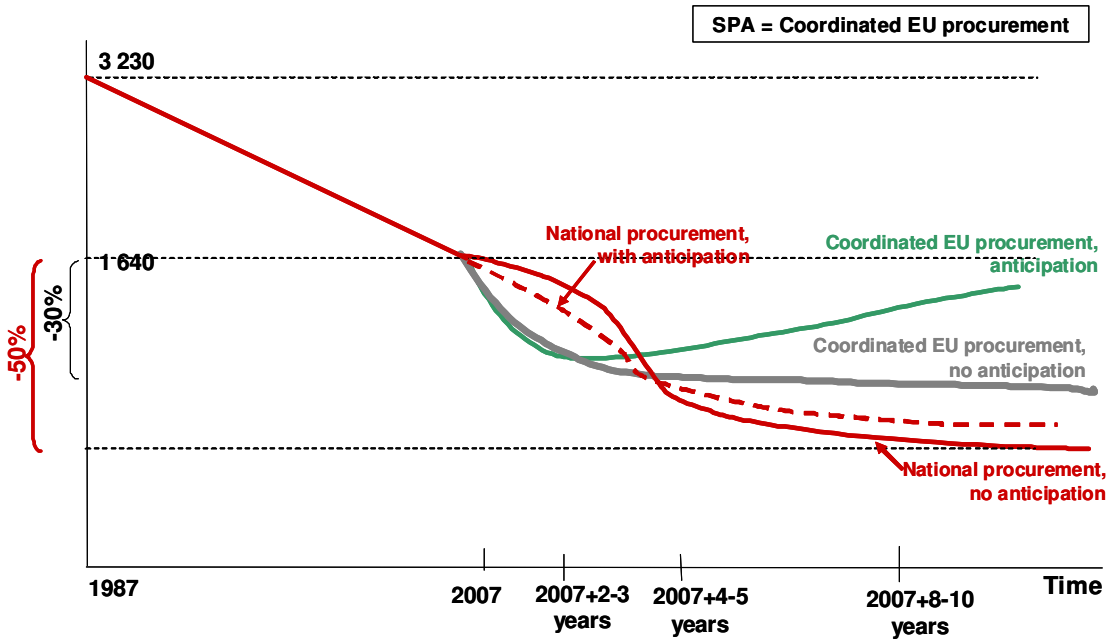
On the contrary, lack of anticipation means more abrupt changes later in time, and more difficulties to re-employ dismissed personnel, implying lower long term employment levels than when change is duly prepared.

As illustrated, the scenarios define a range of possible outcomes – with total employment (direct + indirect employment) falling between 30% or 50% over the next 10 years depending on the scenario. The "worst-case" scenario is a continuation of the trend initiated in 1993 in the EU as a whole, when employment fell by 50% between 1993-2003 (Source: BICC Conversion Surveys), even though the 1993-2003 coincided with deep restructuring in eastern Europe as

[12] See reference before.

part of their transition to market economies. The 30% decline represents a continuation, for the EU-27, of the trend observed in France in the past 10 years, with falls in employment approaching 3% per year in defence industries.

Change in direct and indirect employment levels as a result of the changes in production and organisation of EU defence industries



Source: BIPE

Consequences for employment by segment

The consequences of these four scenarios on employment on each of the different market segment will be similar to the above patterns, with only changes in the rates of magnitude of the change, depending on the market segment considered. Thus, a slower decline in employment than shown here is expected in the aerospace industry, whereas a faster decline is likely to be registered, especially in the long term, for the naval and land defence industries.

Consequences on the skill mix needed

This chapter looks at the impact of the different scenarios on the types of skills that will be in demand in each market segment. For example, we seek to define the extent to which the outlook in the given segment relies on:

- greater employment flexibility;
- changes in processes, location strategies, outsourcing strategies or other;
- more – or less - multi-skilled workers;
- a greater focus on innovation and R&D;
- high rates of skill transfer, and the sharing of knowledge across the value chain;
- more emphasis on productivity growth;
- etc.

In order to do so, we have sought to map the nature of future defence-related competencies with the forces affecting them, the sector's occupational profiles, and on skills needed. The analysis takes into account the strengths, weaknesses, opportunities and threats facing each segment in order to identify the skill needs and gaps of the sector.

General trends in skill needs

Past trends in mergers and acquisitions confirm the strategic importance of a company's competencies mix, and its influence on employment prospects both within the company and in the region where the plant is located. In fact, several acquisitions undertaken in the past in the sector had as key motivator the acquisition of "**scarce**" or "**sensitive**" skills. This is likely to be again the case in the future, as companies in several segments of the defence industries re-organise their activities along different production lines, externalising some activities in order to share development risks and focusing on their core businesses.

At the same time, the future 'innovation' model in the defence industry is thus one of increased cooperation between companies, at European, if not international, level.

In all defence segments, skills needed vary at the different stages of production:

- **New programme launches** entail:
  - RTD, design, prototyping, new materials' development, testing, etc…
- **Manufacturing** entails:
  - Materials & components manufacturing, mechanical engineering, traditional & modular construction, fibreglass/composite materials mould construction, metalworking, assembly, installation, cleaning, painting, outfitting, testing activities, logistics, cabling & wiring…
  - These tasks are the role of 'architects', designers, different types of engineers, people specialised in manufacturing and in the handling of materials (cutting, shaping, bending, welding, blasting, etc.), plumbers, machinists, electricians, logisticians, crane and tower operators, etc.
- **Repair and maintenance** entails:
  - Altering, converting, installing, cleaning, painting and maintaining existing equipment.
  - These operations require similar skills as above, and often special certification of employees in order to ensure that they are entitled to intervene on specific types of equipment.

In addition, developments in IT in such a sensitive sector as defence has led to important steps being taken in order to audit and review processes, and raise the level of awareness of employees to the security of information systems. In parallel, most companies have stepped up controls in order to ensure permanent compliance of their own employees, but also of externalised resources and subcontractors working on the site, with the group' security policies. This has led to an increased demand for quality control, and for the control of operational processes, as well as IT experts.

Other competences in growing need, or at least considered to be essential to the maintenance of operational sovereignty of defence operations, include:

- high level cryptography and information assurance;
- the ability to understand and integrate complex systems;
- the ability to act as an "intelligent" customer; and,
- very specialised research capabilities.

The "intelligent" customer requirement reflects the fact that, as reliance on commercial-off-the-shelf equipment increases, there may be a need for the customer to add itself the technological features needed. The defence industry also has to be able to respond to that customisation need.

Given the above, it is not surprising to find that, in all segments, the skill mix has changed over time, and will continue to change:

- In most sectors, there is an ongoing shift from manual workers to professionals and technicians of various types, engineers and computer programmers; skilled workers are in particularly high demand in several segments (aerospace, naval);
- Changes in the organisation of work, technological progress, the numerisation of functions and the need to cut costs lead to growing demand for machine operators as opposed to traditional blue collar workers;
- Within all occupations, there is a continuing increase in the importance of computer skills and know-how;
- Risk management has grown in importance; this is particularly the case with risks linked to IT and communication, but not only;
- The internationalisation strategies of most prime contractors leads to a new distribution of skills and competencies needs across Europe:
    - Safran and EADS are growing their international presence;
    - In the UK, the DIS has encouraged a greater internationalisation of procurement, hence of associated employment;
    - In France, Nexter and DCNS have both posted a trend decline in employment in the past 10 years, and are not very present in other countries than France, but are looking for new market expansion opportunities; cooperation agreements are negotiated with other EU producers, in the naval and land defence industries;
    - The exception to this growing internationalisation trend is Thales, which is in fact already very present abroad. The company seems to have recently reduced the share of employment in other countries than France, from 45% of the total to 43% of the total.

Below, we review specific trends in skills needs by market segment.

Changes in skill needs in Military Aerospace

ASD figures indicate that highly skilled jobs (engineers, managers) represent 35% of total employment in European aeronautics. Most of the manual workers – who account for 33% of all employees – have been trained to the highest level, for them to be able to cope with the requirements of this highly sophisticated industry. Another 32% of the workforce is comprised by technicians, draughtsmen, craftsmen, secretaries, etc. These have generally received an education below university level.

No technological breakthrough is expected in the military defence industry in the coming years – one rather expects continuous progress. As a result, the competences that are already present within the companies ought to be able to adapt to tomorrow's requirements. Yet, the occupations linked to numerical systems are undergoing radical transformation.

- Although one does not expect massive emergence of new professions, there should be a (continued) regular rise in the average qualification levels required;
    - Basic skills remain highly valued (welding, casting, ….): in this area of specialisation, there are niches of tensions which limit companies' expansion programmes within Europe; some prefer to open new production units in the Maghreb region or in Asia, where there are no such skill shortages and wage levels are low;

  - In contrast, there is a reduced need for unskilled workers;
- Companies also see a rising need for competencies in support functions, but no major change in the overall mix of qualified workers versus technicians, engineers and management;

The reorganisation of the civilian aerospace industry, which is taking place under the impulse of EADS' power 8 programme, will have consequences on the organisation of the whole supplier structure, since one of EADS' goals is to create big Tier 1 contractors who can then organise the Tier 2 level, and so forth. These reorganisation changes will call for changes in the skills and competence requirements in the prime contractor companies, but also in Tier 1 and Tier 2 firms. For example, the externalisation, by key aerospace producers, of entire work packages has forced the Tier 1 contractors to acquire **certification competencies** that they did not originally have in house. Another example is the merger between Snecma and Sagem, whereby the combination of the mechanical engineering expertise of Snecma, and the electrical and electronic engineering expertise of Sagem made it possible for Safran to acquire the competencies that it lacked for Sagem Défense et Sécurité (Sagem D&S, where the avionic and navigation activities are hosted) to become a full, first-class, systems integrator. A third example is the partnership between Thales and Diehl, through Diehl Aerospace owned at 51% by Diehl and 49% by Thales. The partnership aims at merging the competencies of the two partners to offer complete systems – hence to move from a "buyer furnished equipment" model (BFE) to a "supplier furnished equipment" model (SFE).

In parallel, buoyant activity in civilian industries also puts pressure on resources available: as a result, there appear to be labour shortages in Germany, the United Kingdom and Spain, and to a lesser extent in France. These labour shortages are due to:

- Competition with other industrial sectors at the recruitment stage;
- The (relative) lack of attractiveness of engineering education for young people;
- The fact that, within engineering schools, the focus on "general" engineering education means a loss of young graduates to other sectors (until recently, the main recruiting sector was finance), and a need for industrial employers to organize complementary training after graduation;
- Companies also mention difficulties in recruiting systems engineers with a background or past experience in communications or civilian aerospace manufacturing;

In the UK, the recent realization of the absence of critical size of the aerospace industry – of which BAE Systems is the largest representative – implies that the negotiations between BAE Systems and the MoD will play a key role in defining the future terms of the business rationalization and transformation to come, and the types of skills that will be needed to operate, support and upgrade fighter aircrafts. Yet, in the meantime, BAE Systems has expanded internationally through takeovers and organic growth, and has operations elsewhere in Europe and in the US. Beyond BAE Systems are Raytheon, Lockheed Martin, Finmeccanica and Thales, but the geographical distribution of skills needed to supply the UK's aerospace defence needs will still essentially depend on BAE's strategy.

For SMEs, the coming years will likely see:

- Increased emphasis on portability and transferability of skills across firms;
- A growing need for mutualisation of skills/training (through economies of scope).

Attractiveness of employment in the military aerospace industry

There appear to be problems of attractiveness in the aerospace industry and suppliers thereof. The low degree of attractiveness is not only evident when it comes to choosing the general

career-path, but also at the exit of the education system, when it comes to selecting the first job. In countries like France, for example, mechanical' engineering occupations appear to be more attractive than electrical engineer' occupations: a recent survey indicated that, out of 1000 apprentices in France, 25% chose the aerospace sector, wile 55% chose the automotive sector;

Yet, the space industry is a special niche:

- The civilian part drives the military segment;
- There seems to be less labour shortages problems since the early 2000' crisis.

Change in skill needs in the Land Defence Industry

As in the other defence sectors, the skill mix in land defence is skewed towards technical workers and engineers. The proportion of engineers is highest in those companies most involved in RTD: for example, at Germany's KMW, 25 per cent of the workforce comprises development engineers, due to the importance of R&D.

The land defence industry has to face up many challenges, both from an industrial and from an employment/skill mix point of view:

- In comparison with aviation and space, the land defence industry produces more heterogeneous products (vehicles, munitions …), which means that most producers in this market are exclusively dependent on defence activity;
- Because of the level of specialisation required, some skill needs are not fulfilled by general education programs:
  - Additional (in-house) training is required, meaning extra costs for the companies;
- The share of RTD expenditures in turnover is lower than in the other defence industries; duplication of programmes at EU level means potential losses in competitiveness due to a waste of resources and the maintenance of excess capacities. As a result:
  - Blue collar workers run an important risk if markets are not Europeanised rapidly;
  - Yet, researchers and engineers involved in R&D are at risk if EU coordination improves.

Urgent action is needed in this area to define a coordinated strategy to preserve the EU's land defence industry future.

Changes in skill needs in the Naval Defence Industry

The table on the next page illustrates the variety of skills used in naval defence industry, according the classification by Rand[13].

In the future, the main engines of growth in the naval defence industry will be the fleet replacement needs, and the needs for maintenance and retrofitting of existing ships.

This rise in the relative share of maintenance activity will modify the traditional occupational mix:

- There is a need to maintain competencies in past technologies, for the repair and reconstruction activities,
- Yet, integrated weapon systems have become more complicated, requiring highly technical types of skills;

[13] Sustaining key skills in the UK Naval industry – a Rand report written for the UK Ministry of Defence by Hans Pung, Laurence Smallman, Mark V. Arena, James G. Kallimani, Gordon T. Lee, Samir Puri and John F. Schank, 2008,

- And, network systems in international and inter-army context are being developed, also requiring different types of skills;

Moreover, some specific defence programs require “ad hoc” skills which cannot be provided by the “general” schooling system (because they are too specialised, too technical or too sensitive). As a result, the producers in this area need to secure the renewal of strategic occupations (with background) through internal training programmes.

Delays with the launch of certain programmes – like a new aircraft carrier – can lead to the “underemployment” of crucial skills, hence extra costs. To avoid skill depletion, in this and in other defence subsectors, many defence companies finance the development of prototypes and/or demonstrators, sometimes with government assistance, in order to secure the skills that may otherwise be depleted or people who may leave to other sectors – at least until new programmes are effectively launched.

Rand’s categorisations of skills in naval defence

RAND Maritime Technical Skill Categories

Group	Skill Category
Detailed designers	Electrical and control
	Mechanical/fluids
	Hull/structural/arrangements
	Other detailed design
Professional engineers	Acoustics/signatures/dynamics
	Combat systems and integration
	Electrical and control
	Mechanical/fluids
	Naval architecture/marine
	Hull/structural/arrangements
	Testing, commissioning, and acceptance
	Safety/environmental
	Welding/metallurgy/materials
	Propulsion
	Nuclear specific
	Other engineering
Technical managers	Programme management
	Planning and production support

Source: RAND, 2008

In summary, in this segment, future trends are likely to be a pursuit of past qualification shifts at recruitment level.

Summary of trends in key skills needed in defence industries

To sum up this section, context changes linked to technological progress and to changes in the organisation of production and processes are also impacting the required skill mix:

- **Focus on cost reduction** will, in time, lead to:
  - More competition in procurement;
  - A rise in the average size of firms (search for economies of scale will prompt more mergers and a growing concentration of SMEs, along with the development of networks of firms);
  - An increased externalisation of tasks : the trend, pervasive in civilian industries, has already spread to the defence industries in countries like the United Kingdom, and will likely spread to continental Europe as cost pressures grow;
  - As a result, one will see the emergence of a more structured, tiered, value added chain;
  - More focus than in the pas twill be put on productivity gains; and,
  - The re-organisation of production across production sites/regions, in order to eliminate duplication of programmes and efforts, and reduce excess capacities, will lead to a whole reorganisation of production across the EU.

- **The « Pan-Europeanisation » and the internationalisation of production** will lead to demands for a more internationally focused workforce, and a greater focus on language skills (especially in managerial functions);

- **Increased competition** in the industry (including intra-EU competition) will require increased RTD spending, hence a greater demand for highly specialised, technical, skills.

The table below shows the impact of these changes in the overall context for defence industries on the types of skills that will be sought for in the coming years.

Impact of context changes on skill needs in the defence industries

Context changes	Consequences for employment and skills needs
• Re-organisation of production in a tiered structure	• Impact on governance, operating practices and management • Reduction in number of hierarchic levels & shift to matrix type organisations cause a need for more collaborative working environments, cutting across functions ➔ team workstructures, polyvalence
• Externalisation of activities	
• Improvement in productivity and efficiency	• Increased need for certain support functions: ‣ Cost control, quality control, procurement, marketing and sales
• Increased internationalisation of operations linked to the Pan-Europeanisation of production	• Internationally oriented competencies (language, communication,…) • Focus on marketing and commercial skills • Management of procurement, of subcontracting, optimisation of logistics (incl. for maintenance)
• Need for increased RTD and new programmes	• Expert skills for the production and handling of new materials & technologies (composites, robotics, etc.) • Specialisations in the manufacturing, maintenance and recycling of technical materials (composites, energy efficiency, etc.) ; • Competencies focused on protecting the environment and work ethics
• Increased (non-price) competitiveness	

Source: Eurostrategies

In terms of recruitment needs, we saw that there appears to be no « demographic trap » in the large EU defence companies: most have anticipated the retirement wave and re-balanced their age pyramid. Yet, in the (many) SMEs which are part of, or supply, the sector, the risks of skill depletion are much greater than for the larger companies.

If job turnover and mobility per se do not seem to be a problem, however, attractiveness is an issue, as emphasized earlier. As a result, labour shortages are already present in certain areas.

The lack of visibility of future trends in activity by segment, and at national and local levels, which is due to changing agendas and to « cyclical » procurement budgets also make it difficult to retain competencies. As one of our contacts explained:

> *« Focus on return and profits make it difficult to keep highly experienced resources in-house when the field they are specialised in sees ongoing postponements of programmes… »*

Finally, capability losses are a real source of concern: there is a need to identify the « critical technologies and capabilities » that will be needed in the coming years, given the geopolitical context and the role that the EU wants to play in the global context – and, once those capabilities are defined, to « pay the cost" to keep those skills even when programme are postponed.

Increased mobility between defence and civilian activities can, however, help to mitigate the effects of cycles.

Implications for education and training

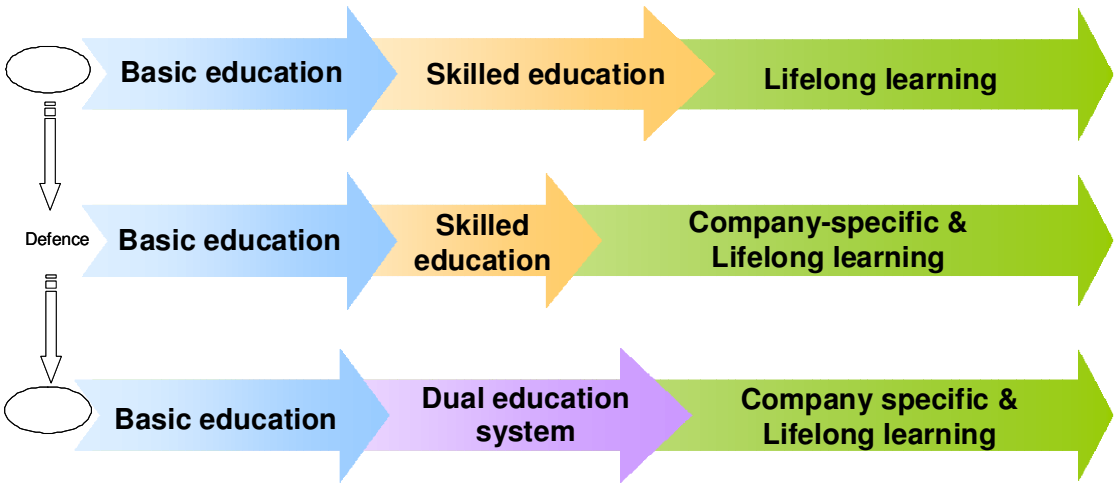
This section draws from the results of the analysis to date in order to assess the adequacy of present education and training schemes in fulfilling the future needs of companies involved in the defence industries. This section also draws on the results of a literature survey and a review of past studies in different EU Member States on the organisation, and assessment, of the education system.

- From an HR point of view, the key feature of defence industries is the need to protect intellectual property and secure technical know-how;
- Basic education provides generalist skills, but technology companies need more :
  - "When asked about how 'work-ready' Scottish school leavers are, Katie Hutton, Head of Operations, Skills Interventions Team, Skills Development Scotland said that they left school with the majority of the general skills required for work, but there are still many areas that employers have to provide training to cover";
- Nowadays there is a consistent bias in the educational system in favour of academic occupations as opposed to vocational training:
  - "The system is often unhelpful in encouraging a parity of esteem for the different routes chosen by students";

As a result, several companies have developed their own schooling system, even for the civilian activities (example: Airbus, in Nantes; Thales). Others have put the emphasis on **linkages with higher education institutions** in order to adapt the supply of skills to the levels needed to serve their industry.

Yet, in most sectors, the specificity of defence industries implies internalised training, hence comparatively higher human resource costs than in other companies and sectors. Cross-company or cross-sector mobility are therefore also more expensive than for civilian activities …

The relative importance of basic & skilled education, and lifelong learning, in different sectors



Source: Eurostrategies

The geographical distribution of future skill needs

As restructuring occurs along a Pan-European base, the demand for skills will vary across regions. The education systems will have to adjust.

Many in the industry are calling for the development of « centres of excellence » in Europe, whereby certain regions would specialise in certain types of production and host training institutions that would supply the required skills, to the region itself and to other regional markets. This would effectively create « educational hubs ».

Yet, for the "centre of excellence" concept to be effective, certain conditions must be met:

- These Centers of Excellence will have to take on both research and manufacturing activities;
- They have to be totally independent of national governments (to avoid a given country government's exclusive control of a sensitive technology and/or process);
- Their objective has to be to supply graduates trained in the given area to any EU country needing that skill. This calls for increased workforce mobility.

Indeed, experience[14] shows that, to maximise the chance of their leading to applications that respond to market needs, research activities have to be located close to production centres. Linkages between fundamental research and industry are also important in order to facilitate the transfer of knowledge beyond the early innovation stage, and to ensure that the companies can find locally the skills that they will need to organise the production on a large scale.

The need for independence from national governments results from the need, for the Centres of Excellence to fulfil their role, to train personnel and develop innovations that can serve the whole EU industry. The Centres of Excellence's role will be to develop sensitive technologies and train personnel in highly specific areas, to **irrigate** thereafter the whole EU industry. The mobility of personnel has to be high in order to maximise cross-fertilisation of skills and competencies across the EU, and make it possible to capitalise on the best experiences from all parts of the EU.

[14] This experience is often reported in the literature on clusters and regions of innovations, where the importance of the "triple helix" is stressed – the triple helix representing the synergies developed when industry, research/education and government institutions work towards common goals.

Several Centres of Excellence could therefore be created throughout the EU, each having different areas of specialisation, but be complementary to each other and inter-linked in order to foster knowledge transfer. These could be financed partly through research grants provided by the companies, and partly through sponsorships or grants by the Member States.

Some problems remain:

- Companies themselves often are the key source of know-how: this is why the link between companies and the centres of excellence has to be so strong, and why the location choices that will be made for those centres – if the idea goes ahead – will totally reshape the EU defence industry;
- In the regions in which certain production lines will be de-emphasized or closed, there are specialised jobs whose conversion can be difficult;
- There can be issues with national security (due to sensitive technologies and processes);
- Governments, which are the principal clients of defence companies, themselves have conflicting objectives: they want both to ensure a return on investment, and avoid over-reliance on other states, even if they are allies and partners.

Other problems and issues are that:

- The location of the « excellence centres » will influence the location of the future civilian activities;
- Cross-country mobility of the workforce will have to be enhanced.

Recommendations for the different categories of stakeholders

Implications for public policy makers at EU and national levels

For national governments as « clients » of the European defence industry, as well as for the EU and for the EDA, there is a need to:

- Provide (better) long term visibility on the programmes: as recalled by one expert « Defence is an area in which technically one can see at least 10 years ahead ». It is certainly ironic that in this same industry uncertainty is so high concerning employment prospects; Such visibility is important to enable the companies to plan their resources – in particular the skills that they will need, several years ahead – and to organise their production in such way as to minimise demand cycles. Coordination of EU procurement could contribute to this objective of "minimising cyclical effects" on employment needs, through an appropriate scheduling of new orders and/or maintenance and retrofit programmes at EU level. The visibility could be granted by guaranteeing orders and scheduling equipment replacement and new programme launch, and securing the budgets therefore. This certainly creates some rigidity for national budget planners, who would have to commit not only the current year's defence budget, but also engage expenditures for forthcoming years, but the benefits in terms of long term growth and competitiveness for the industry are certainly worth it. The EDA could play a role in keeping track of new orders and the needs for refurbishing, maintenance or retrofitting of equipment in all EU MS, thereby giving the industry a better sense of upcoming orders;
- Take into account what the industry needs to maintain competitiveness. Among these needs are the need to:
  - « Retain » specific skills, even when they are temporarily un-used: this may imply putting in place specific training programmes, providing appropriate financing, or adapting contractual provisions to make it easier to "re-hire" someone who would have been temporarily displaced in another unit or even company because of delays in a programme launch;
  - Maintain and step up investment in RTD, even in cyclical downturns, when pressures to allocate public expenditure to other budget items such as health or social expenditures, increases. In this context, it might be useful to launch a study aimed at quantifying the "cost" (on employment, in terms of competitiveness, or other) of cyclicality of defence expenditures: the purpose would be to validate the view that the cost of procurement cycles and volatile budgets is both high and avoidable;
  - Assess the need for a specific SME policy, focused on:
    - the anticipation of transmissions, « financing for transition », client/market diversification;
    - the mutualisation of skills and of training in order to generate economies of scope;
    - organising the portability and transferability of skills across firms (recognition of experience acquired in the firm, building of bridges between degrees and between diplomas, etc.).
  - The move towards the creation of « Excellence centres » would be a good step in those directions, but, as indicated earlier, is not a sufficient initiative. It has to be complemented by other measures at local level.

- Policy makers also have a role to play in the identification of "best practices for preparing and managing change" in this sector: the examples presented during the Restructuring Forum on December 8 & 9, 2008, were considered by many participants to be too specific and not necessarily applicable to other companies or to different local contexts; given the scarcity of economic literature on this subject, there appears to be a need to define, with the social partners, what can be considered a "good practices", under what circumstance or under what conditions;

Implications for policy makers at regional level

Companies and regions must « anticipate » future resource needs and plan accordingly, working in a coordinated, cluster, approach. This could be done by launching regional employment observatories aimed at tracking trends in employment, measuring the impact of policy measures and anticipating future needs, including skill needs. These "observatories" are further detailed below.

Specific studies of the outlook for defence industries in the regions most dependent on this sector also appear to be essential in order to anticipate and prepare changes: these studies ought to benchmark regions against one another in order to define their respective strengths and weaknesses and identify areas of future collaboration to minimise the negative impacts of change.

In many Member States, regions also have a responsibility in the education and training system. Where this is the case, dialogue with the companies and anticipation of future needs through the employment observatory should help regions define the needs in this area.

Regions also have a role to play in fostering the development of a balanced local economy, avoiding excessive reliance on a single industry. Many regions involved in defence activities are highly reliant on this sector. Yet, given the synergies between defence activities and certain civilian activities such as aeronautics, space, automotive, shipbuilding, electronics or even railway rolling stock, there is a case for attracting new investors in these areas, and/or for developing "cross-regional clusters" of competencies, by building linkages between the region's defence industry and other regions" related civilian activities.

Finally, regions can also put in place appropriate policies to support SMEs, to help them to grow in size and overcome temporary shocks: for example, they can put in place specific policies aimed at facilitating SMEs access to finance for LBOs, takeovers or mergers, provide guarantees, support R&D, offer mutualised infrastructure, etc.

Implications for companies

The companies themselves are the first concerned by the need to anticipate and prepare change. Dialogue with the social partners is an essential component of the preparation process. Yet, before preparing change, it is important to anticipate it: this supposes putting in place specific processes to forecast employment, recruitment and skills needs, under different scenarios, and to prepare contingency plans. Their HR management responsibility extends not only to the social partners but also to their suppliers and other external contractors, potentially immediately impacted by the future strategy that will be put in place. This is why the "observatory" and cluster approach to managing change has been suggested in this report.

Companies also have a role to play in improving the attractiveness of the industry to young workers: as indicated earlier, even though there appears to be no "age trap", the companies will continue to recruit. Offering attractive jobs and career prospects will be essential if they want not only to find the right competencies, but to retain them.

Implications for all stakeholders

For all stakeholders, there is also a need to:

- Improve the sector's attractiveness to young people: indeed, although there appears to be no demographic trap amongst the larger companies, this is not necessarily the case for SMEs, many of which have high shares of their workforce in the 50-60 years old range. Moreover, even in the larger firms, between 25-30% of the staff will leave for retirement in the coming 5-10 years, in addition to the "natural" mobility of those moving to another company or in another sector, so that recruitment needs will remain positive. Improving the sector's attractiveness will therefore be important in order to ensure that the companies can find locally the skills that they need to develop their activities. The attractiveness can be improved by granting higher salaries, but also by improving career prospects.
- Improve the attractiveness of industrial occupations in general: many industrial sectors experience difficulties in retaining workers; this means extra-costs linked with the need to train new entrants, organise skills transfer and avoid skill depletion – in addition to the risk of losing competences to a competitor. Better career prospects and "safer" employment are one option: both companies and public authorities have a role to play in this regard, the former to avoid the negative cost of excessive turnover. The latter because there is often a social cost associated with mobility. Regions can play a role in fostering balanced economic development in the region, hence creating "alternatives" for displaced workers. National authorities can launch campaigns to provide a better visibility to industrial occupations, and thereby seek to increase the number of students in technical and scientific courses.

Finally, there appears to be a need for "**employment observatories**" that would provide information on past and present employment levels, and on planned employment and skills needs, taking into account foreseen trends in orders; these observatories ought to be launched at regional level, in order to help local stakeholders to anticipate future skill needs and launch the necessary training or re-training programmes.

These local observatories, coordinated at EU level, could also constitute databases of "good practices of anticipation and management of change and restructuring at company and regional level".

The observatories could also include analyses of the consequences of different types of redeployment measures or of practices aimed at improving employability, in order to help users to assess under which condition a given measure is likely to be most effective.

Conclusions and key findings

Even if the anticipation of skill needs can only be done by defence industry segment, there are common trends in all segments.

Although no « breakthrough » technology is identified that will radically change the mix of competencies that are needed in the next 5-10 years, technological progress is a major goal for the industry in order to maintain its competitiveness:

- Yet, RTD mobilises specific skills and competencies;
- The quality of basic education and the availability of the most sophisticated equipment/technologies in the schools are important;
- More efforts will have to be made to succeed in this area, where the gap with the US has widened.

To assess the social consequences of restructuring, one needs to:

- Look at future skills needed by market segment (land, aerospace, naval, electronics);
- Take into account the possible inter-changeability of the workforce between the defence, security and civilian sectors;

Once Pan-European restructuring really gets under way, increased geographical mobility of the workforce will be a requirement;

Location decisions made for defence activities will have a key impact on civilian activities, especially in the case of:

- Aerospace, notably propulsion systems and RTD;
- New materials;
- Electronics;

The role of the EDA is thus very important in this respect: indeed, the EDA encourages Member States to cooperate more in common procurement projects, and improves transparency in the EU defence equipment market by means of the Regime/CoC of Defence Procurement.

Also, whereas there is general agreement that increased internationalisation of skills and openness to « other countries » will have to increase, low international – and even cross-regional – mobility of technical personnel will be an issue. Indeed, if young graduates are generally geographically mobile, skilled workers and technicians are typically recruited locally. Hence, the availability of skills at local level will need to be closely monitored and coordinated with the companies present locally.

Hence, regions are a key actor in the management of transition.