FOI-R--0125--SE

June 2001

ISSN 1650-1942

User report

Mattias Axelson

Defence Industry Shift

– from manufacturing to services

Issuing organization	Report number, ISRN	Report type
FOI – Swedish Defence Research Agency Defence Analysis SE-172 90 Stockholm	FOI-R--0125--SE	User report
	Research area code 1. Defence and Security Policy	
	Month year June 2001	**Project no.** A1143
	Customers code 1. Research for the Government	
	Sub area code 11 Defence Research for the Government	

Author/s (editor/s)	Project manager
Mattias Axelson	Martin Lundmark
	Approved by
	Scientifically and technically responsible

Report title

Defence Industry Shift – from manufacturing to services

Abstract (not more than 200 words)

The defence industry in Sweden – as well as the defence industry in other parts of Europe and the USA – is transforming from manufacturing as the main source of revenue to becoming a service producing industry. This ongoing shift is due to several coinciding developments, for example the increased use and importance of commercial technologies in defence production as well as changes in demand. Services and development of technological solutions is becoming the focus of customer demand and the demand for relatively long series of platforms is in decline. In services and advanced technological solutions much technology is of commercial origin – often from rapidly changing technology areas. This brings increased complexity as well as technological uncertainly to the defence industry. Defence companies need to change their strategic focuses and business models to manage the new environment. New business models will include increased collaboration in networks of both commercial and defence companies as well as making early development phases and services equal sources of revenue of production. The defence industry's management of this shift and not least the integration with commercial companies, will determine much of the future of the defence industry in Sweden – but there are many roads to the future.

Keywords

Sweden, defence industry, electronics, software, information technology, uncertainty, business strategy, international collaboration

Further bibliographic information	Language English
ISSN 1650-1942	**Pages** 53 p.
	Price acc. to pricelist **Security classification**

Utgivare	Rapportnummer, ISRN	Klassificering
Totalförsvarets Forskningsinstitut - FOI Försvarsanalys 172 90 Stockholm	FOI-R--0125--SE	Användarrapport
	Forskningsområde 1. Försvar- och säkerhetspolitik	
	Månad, år Juni 2001	**Projektnummer** A1143
	Verksamhetsgren 1. Forskning för regeringens behov	
	Delområde 11 Försvarsforskning för regeringens behov	
Författare/redaktör Mattias Axelson	**Projektledare** Martin Lundmark	
	Godkänd av	
	Tekniskt och/eller vetenskapligt ansvarig	

Rapportens titel (i översättning)

Försvarsindustrin i förändring – från tillverkning till tjänster

Sammanfattning (högst 200 ord)

Försvarsindustrin i Sverige genomgår en omställningsprocess från tillverkande industri till att bli tjänsteproducerande. Den pågående förändringen beror på ett flertal faktorer, bland annat ökad användning av kommersiella teknologier och förändringar i efterfrågan. Tjänster och mjukvaru-applikationer efterfrågas alltmer, och i minskande grad plattformar. Teknologier inom dessa områden är i ökande grad av kommersiellt ursprung. Inom dessa områden är det hög osäkerhet, både vad gäller efter-frågan och den framtida teknologiutvecklingen. Försvarsindustrin kommer att genomgå en förändringsprocess för att hantera dessa osäkerheter och anpassa sin verksamhet till nya förutsättningar. De pågående förändringarna ställer krav på förändring av företagens affärsmodeller. Nya affärsmodeller innefattar bland annat ökad samverkan i nätverk bestående av både kommersiella företag och traditionella försvarsföretag, men också former för att göra tidiga utvecklingsfaser och tjänster likvärdiga intäktskällor med produktion. Hur försvarsföretagen klarar denna omställning och inte minst integrationen med kommersiella företag sker kommer att avgöra mycket framtiden för försvarsindustrin i Sverige – men det finns flera vägar in i framtiden.

Nyckelord

Sverige, försvarsindustri, elektronik, mjukvara, informationsteknologi, osäkerhet, affärsstrategier, internationell samverkan

Övriga bibliografiska uppgifter	**Språk** Engelska
ISSN 1650-1942	**Antal sidor:** 53 s.
Distribution enligt missiv	**Pris: Enligt prislista** **Sekretess**

FOI1004 Utgåva 07 2001.05 www.signon.se/FOI Sign On AB

PREFACE

The FOI Defence Industry Programme, FIND, has studied defence industry transformation processes and corporate strategies in Western Europe and the US for the Swedish Ministry of Defence since 1990. Defence industry globalisation and increasing importance of commercial technologies in weapon systems are major drivers of current defence industry changes. The FIND-programme seeks to analyse these processes and make conclusions on their impact on the defence industry in Sweden and on national defence materiel supply. This report focuses on the defence industry shift that is under way in Sweden as a response to these transformation processes. Thus, it is an important contribution to the ongoing debate about the future of the defence industry in Sweden.

This report is the FIND-programme's latest contribution to the international defence industry research. It complements previous FIND reports on defence industry globalisation and supply chain management. Information about our previous and present research is presented at http://www.foi.se/find.

The FIND-programme and the author are greatly indebted to all those people who so willingly gave their time of discuss issues of defence industry shift. The author also wishes to acknowledge colleagues at FOI whose comments and advice gave substantial contributions to the final version of report. Dr Patrick Regnér, Stockholm School of Economics, reviewed the report and the author wishes to thank him for excellent contributions.

Stockholm, June 7 2001

Mattias Axelson
Author
mattias.axelson@foi.se

Martin Lundmark
Programme Manager
martin.lundmark@foi.se

EXECUTIVE SUMMARY

The defence industry in Sweden is going through a shift. It is in the process of leaving the era of industry production as the main source of revenue and is entering a new age where development of technological solutions and services are the core business activities. It is a development that can also be seen in defence industries elsewhere in Europe and in the USA. The drivers of this development are growing use and importance of commercial technologies in defence systems, changing procurement policies and demand as well as increased cross-border defence industry integration.

It is in defence electronics and software that this development has the most immediate impact. Thus, these segments face the task to keep up with the fast technological cycle times on the commercial market and to develop defence applications based on commercial technologies. In addition, traditional platform manufacturers face the challenge of integrating electronics and software to add new functionality to platform systems. Entering the path of network centric defence systems, the demand of the armed forces will be directed on systems that give platforms new functionality, rather than series of manufactured platforms.

To manage developing new products in this context, defence companies need to integrate their capabilities and resources with technologies and knowledge developed by other companies. Consequently, the industry's resource base is becoming global and competition as well as integration is also becoming global in scope and impact. The defence industry in Sweden is therefore in a process of becoming integrated in an international network of commercial and defence companies. Thus, the term network companies will be increasingly relevant when describing defence industry organisations.

Companies choose strategies based on the combination of changes in their environment and the organisation's capabilities. Strategic responses to the defence industry shift will consequently be of different kinds. The strategic responses are, nevertheless, likely to comprise combinations of; focus on core niches, outsourcing of production, close collaboration with commercial companies and diversification into commercial markets. At the core of these strategies are new business models that make early development phases and services equal to production as sources of revenue.

DEFENCE INDUSTRY SHIFT

"Systems, services, E-commerce and solutions are the future."
John Weston, CEO, BAE Systems

Background

Perhaps the most important development within the defence industry is the increasing use of commercial technologies in defence materiel. This development has its origin in the capacity of commercial industries to develop sophisticated technologies cheaper and better than the defence industry – and faster. This is particularly evident in the increasingly important defence electronics and software sectors, which includes information technology (IT) and telecommunications[1]. This development is due to the fact that commercial companies in these sectors are forced to innovate and develop new products at very high speed and can produce at low costs, due to global production lines and economies of scale. Consequently, defence companies can not keep up with that speed in innovation and compete with the lower costs. (Eriksson, 1997, pp 37-43; Defence Science Board, 1999, pp v-vi; Axelson and James, 2000, p 52; James, 2000, pp 1-3; Molas-Gallart, 2001, pp 1-5)

Commercial technologies are often globally available and their spread is not restricted by the same regulations as defence products. It is not always evident which technologies could be used for military purposes and it might be even less evident what they could be used for. The commercial technologies and competencies that could be used for competitive military applications could be

[1] These technologies are used in several defence system areas. Of particular interest for this report are C4ISR (command, control communication, computer, intelligence, surveillance and recognisance) systems, since these areas are important for the development of the future Swedish defence. Furthermore, commercial technologies are extensively used in various software applications that give weapon systems much of their capabilities. (Nilsson, 2000, p 7)

developed in Singapore as well as in Stockholm or Silicon Valley. Consequently it becomes difficult to determine which companies have the capacity to develop and deliver military technologies. Possible dual-use technologies are therefore spread globally without the restrictions surrounding defence specific technologies. (Defence Science Board, 1999, pp, v-vi; Axelson and James, 2000, pp 37-38)

This development has the consequence that the defence industry to a lesser extent develops new technologies and instead focuses on creating military applications based on commercial, globally available technologies. Defence specific research and technology developments, carried out by defence corporations are reduced to specialised technology areas where there are no commercial equivalents, for example certain stealth technologies. (Axelson and James, 2000, pp, 57-59, 64)

The capabilities of defence systems increasingly depend on embedded solutions such as software applications. Therefore, from a military perspective it is to a declining extent the number of platforms that determine military capacity, but rather the intelligence in the platform systems and functionality of system of systems. The future defence materiel demand from the armed forces in Sweden will therefore – unless the geo-political climate changes dramatically – to a relatively limited degree include platforms such as new fighter jets and ships. Instead subsystems that improve the capacity of platforms and solutions and services related to for example command, control, communication and intelligence, C3I, will constitute the major demand. This trend will change the defence industry's role for national defence material supply. The direction seems to be that the defence industry will be deemed as a qualified provider of solutions and concepts and less as a traditional weapons manufacturer. This would mean that the value delivered by the defence industry would be knowledge and technology presented in the intelligence of advanced systems. From a business perspective these developments mean that it increasingly becomes an advantage to focus on selling defence solutions and services instead of platforms. (Eriksson, 1997, pp 43-44; Axelson and James, 2000, p 65; Howe, 2001; SOU 2001:21 pp 64-65)

To deal with these changes the defence industry in Sweden as well as defence industries in other European countries and the USA are going through a shift. It is a shift in both task and content. This shift certainly brings both opportunities and challenges to defence companies. The opportunities lie in the growth potential for those companies who successfully transform into solution providers and manage to expand into new markets. The challenges are to manage the shorter cycle times, greater uncertainties, harder international competition as well as the transformation of companies' internal mindsets.

Problem and purpose of the study

Like in all major changes in society, the outcome of the defence industry shift is by no means given. The strategic policy issue is what the long-term impact will be on national defence materiel supply. This is closely connected to the issue of which companies could and should provide competitive defence materiel to the Swedish armed forces. Countries like Sweden that to a major extent still rely on a domestic defence industry for defence materiel supply – most of the countries with a tradition of relative self-sufficiency still do – face the question of what does this shift mean for the domestic defence industry?

The purpose with this report is to outline and analyse what the strategic consequences should be for companies and what the corporate responses could be to the defence industry shift. In addition the report suggests policy responses to the defence industry shift.
Important questions are:

- What are the drivers of the defence industry shift?
- What specific challenges is the defence industry in Sweden facing given the defence industry shift?
- What could be the defence industry's strategic responses to these challenges?

Delimitation

Without hardly any exception, the defence industry in Sweden is going through a period of fundamental change. This development has significant implications for defence electronics and software companies. The defence electronics and software industry are widely expected to become core providers of the future competencies, technologies and systems that will comprise the new Swedish defence – not least because of the growth expectations of the information technology area. At the same time – other parts of the defence industry must adopt new technologies and develop their products in response to the development in electronics and software. Electronics and software therefore become crucial integrated parts of platform systems. It is through the integration of changes in different segments of the industry that the defence industry shift gains impact. The prime focus of the report is therefore on the process of defence industry shift and on its major strategic consequences for defence companies in Sweden.

Method and report outline

This section discusses the background of the report, the use of sources and its outline.

The word shift is used to stress that there is a fundamental transformation process underway within the defence industry. Defence companies in all sectors are about to leave the industrial era when production was the core activity and platforms its ultimate products. They enter a new era characterised by the emerging information age where networks are the important organisational forms and services, solutions and integration of systems constitute the core of the defence industry production.

The perspective of the report is based on literature about the economy's ongoing globalisation and transformation from the industrial era to the information age. (See amongst others: Reich, 1991; Ohmae, 1995; Castells, 1996; Dicken, 1998, Held et al, 1999). This is the second report by this author about the changes within the defence industry in the light of the contemporary development of the global business environment. The previous report analysed the globalisation process and its impact on the international defence industry[2].

The material of this report was assembled during January and February 2001 through personal discussions with senior managers within the defence industry in Sweden and officials from the armed forces and government agencies. Seminars and defence industry conferences have also been important for developing an understanding for the issues covered by the report. It was supported by a review of literature connected to business strategies, business complexity and uncertainty as well as defence journals covering defence industry development. In addition, official documents such as government's bills and earlier studies conducted by the author and colleagues were used.

The selection of personal sources was based on how they could contribute with strategic insights in relation to the changes within the Swedish armed forces, defence materiel policies and the industry development. All personal sources are placed on key positions within their organisations such as president, vice president and director of business development. The theoretical literature was selected for its relevance for understanding industry transformation processes and strategy development under uncertainty. Other sources were selected due to their coverage of defence industry development and defence materiel issues.

The report uses a combined descriptive and explanatory approach. The report begins with an overview of recent defence industry development in Sweden and abroad. It proceeds with a discussion about the increasing importance of new technologies and the defence electronics[3] industry. The new business environment of the defence industry is discussed and its impact on defence

[2] Axelson M., and James AD., (2000), The Defence Industry and Globalisation - Challenging Traditional Structures, FOA User Report, FOA Defence Research Establishment: Stockholm

[3] Defence electronics industry refers to companies with defence business in electronics as well as software.

companies is analysed. In addition, the report analyses how the defence industry could manage this shift process. In the last section – conclusions – major implications for the defence industry due to the ongoing shift are highlighted and possible strategies for managing this process are outlined.

THE DEFENCE INDUSTRY IN SWEDEN – STRIVING FOR A NEW ROLE

This section will discuss the present situation within the defence industry in Sweden. It will cover both industry and government policy development. The situation within the defence industry in Sweden cannot be fully understood without relating it to the international defence industry context and the process of defence industry globalisation. Therefore, this section addresses the process of defence industry globalisation.

The international development

The defence industry has been under pressure for some time – both in Europe and in the USA – as a consequence of the growing cost and technological complexity of advanced weapons systems. The end of the Cold War meant a sharp fall in defence budgets and that accelerated its decline. Since the international market has declined, there is overcapacity within the industry. This means that competition on the international market has become more intense. The globalisation of the worlds financial markets has created an increased pressure on companies to deliver high shareholder value. During the last decade – on the stagnating defence market – that has often been difficult, even though 2000 showed exceptionally positive development of defence stocks. (Axelson and James, 2000, p 29; Credit Suisse First Boston, 2001)

Defence companies have been forced to find new strategies to deal with these macro changes and the result is a development of increasing global integration of the defence industry. The intensification of cross-border collaborative projects, alliances and mergers and acquisitions are particularly evident in Europe. Meanwhile, the transatlantic integration is also increasing. For example, during the year 2000 the US firm United Defense acquired of Bofors Weapon

Systems of Sweden and defence contractor of the UK BAE Systems acquired business units from Lockheed Martin. The number of high profile transatlantic joint ventures increases. For example, Thales (former Thomson CSF) of France and Raytheon of the US announced a joint venture in the radar business – Thales Raytheon Systems, TRS – in December 2000. In addition, relationships with the defence industry in South East Asia have increased. The emerging globalisation of the defence industry brings broadening and deepening of cross-border collaborative ventures, ownership through mergers and acquisitions and the growing importance of globally available commercial technologies. (Axelson and James, 2000, pp 35-41; James, 2000, 111-118; Lundmark, forthcoming)

Cross-border ownership within the defence industry has increased during the last two years. The merger of French, German and Spanish defence industry to form the European Aeronautic Defence and Space Company, EADS, and the French company Thales acquisition of British Racal are two examples of this process. The globalisation of the defence industry is driven by efforts to receive access to new markets and sources of finance. This development might mean that the relationships between states and defence companies change. Thus transnational companies are likely to be less dependent on certain governments than companies based on one main national market. Consequently, the state could be expected to lose some of its traditional influence over defence companies. (Axelson and James, 2000, pp 35-41)

The main purpose with the increasing number of cross-border collaborative ventures is to share development costs, receive access to new technologies and new markets. Transatlantic defence industry collaboration is increasing, which is expressed not least by American companies' interest in European defence programmes. One such example is Boeing's entry into the European Meteor beyond-visual-range air-to-air missile (BVRAAM) team. Major European joint ventures are, for example, Matra BAe Dynamics and Eurocopter. A result of the growing number of collaborative projects and ventures is a complex network of corporate relationships. Companies that collaborate in one area, are competitors in other areas. For example, BAE Systems and EADS – the two major aerospace companies in Europe – are integrated in several collaborative projects and ventures. (Bjurtoft, 1998. P 18-19, Axelson and James, 2000, pp 45-47, Fothergill, 2000)

The number of companies that develop and manufacture platforms such as fighter aircrafts', will decline internationally since such projects are too expensive and complicated for most corporations. When it comes to developing new major platforms, like a new fighter aircraft model, hardly any company could be expected to perform the task of development and manufacturing entirely on its own. The current defence budgets can not finance long serial production of platforms, which means that the outlook for making money as a

platform manufacturer is declining. Furthermore, there are, for example, too few fighter aircraft projects in the pipeline to supply all present aircraft manufacturer with future orders. Therfore, it is likely that development and manufacturing of major platforms will be carried out – as often is the case already – by a network of independent companies. This development could be a driver for further integration of the defence industry - globally. (Eriksson, 1997, pp 40-41, 43, 95-97; Saab Tech Systems, 2000; Uchitelle, 2000, p 1-9)

The present situation of the defence industry in Sweden

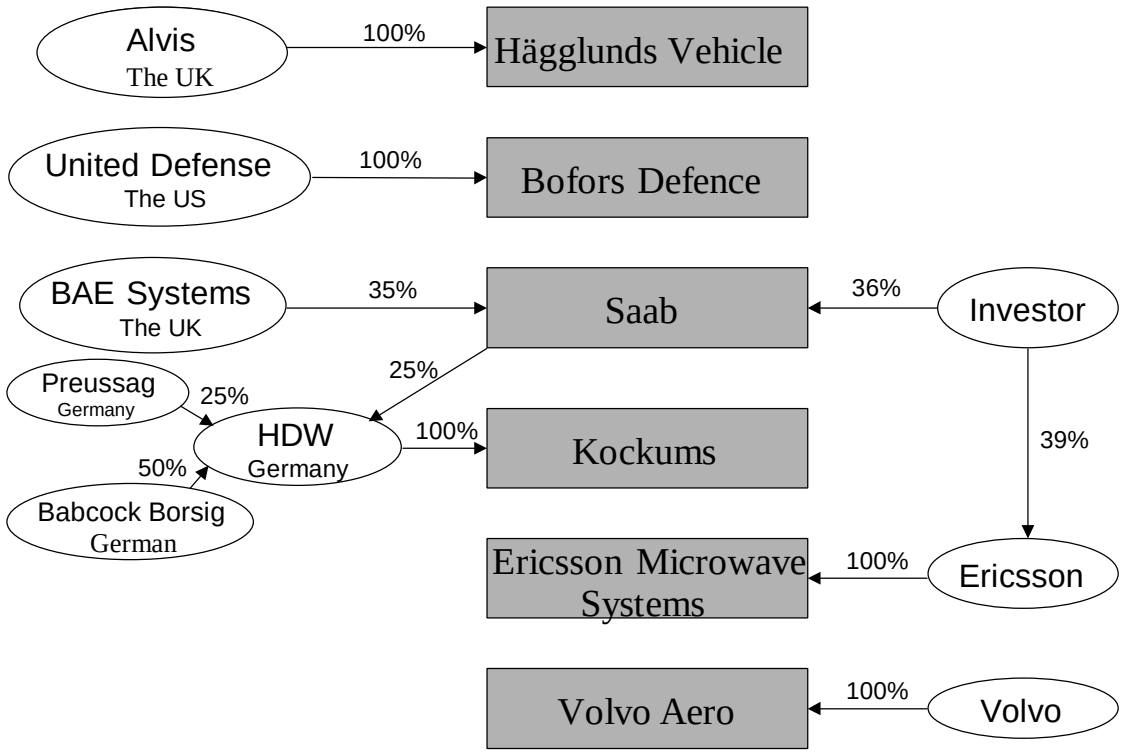
The defence industry in Sweden is when compared internationally relatively small and the domestic market does not provide a big enough base for long-term competitiveness and growth. The present situation is a result of a number of coinciding developments. The defence procurement budget has been almost unchanged during the 1990's but still the financial base has become too small to allow defence companies to manage the increasing costs and the complexity associated with research, technology and development. Now In 2001, the outlook for the coming years is a declining defence procurement budget of several billion Swedish kronor. (Swedish Armed Forces, 2001)

From a policy perspective, it became evident during the 1990s that this development would mean that domestic industry could not maintain its position as provider of competitive defence materiel by international standards to the Swedish armed forces. The government policy has therefore supported international integration of the defence industry in Sweden. The intention was an international integration of the defence industry in Sweden that would allow it to become embedded in an intentional defence industry structure. That would imply that the defence industry should be able to share development and productions costs with foreign partners, receive access to new knowledge and technology and obtain access to foreign markets. This has also changed procurement policy. It has become more preferable that the national procurement agency FMV could purchase more on the international defence market, in order to achieve best possible value for money. (Ministry of Defence (Swedish) (1999), p 103; see government bills Prop. 1996/97:4; Prop. 1998/99:74).

The post cold war period's changes have meant increased international integration of the defence industry in Sweden. The defence industry in Sweden is presently involved in a number of international relationships, spanning from collaborative projects to equity integration. The major defence company in Sweden, Saab AB, is owned to 35 percent by BAE Systems. The armoured vehicle manufacturer Hägglunds is a wholly owned subsidiary of Alvis Plc. Since the autumn of 1999 the German shipbuilder HDW owns the ship and submarine manufacturer Kockums, in which Saab has a 25-percentage stake.

Nordic defence corporations have merged in the ammunition and explosives segments and formed the transnational corporations NAMMO and NEXPLO. United Defense acquired Bofors Weapon Systems from Saab in September 2000. These mergers and acquisitions are examples of an international trend of defence industry consolidation, which is likely to continue. Therefore, further restructuring and international integration by the defence industry in Sweden is to be expected. (Axelson and James, 2000, p 61)

Ownership of the major defence companies in Sweden



Source: The FIND Programme, June 2001

The geo-political climate in Europe has made it possible for Sweden to reduce its defence expenditure and simultaneously launch a renewal of the armed forces. It is a renewal in terms of content and tasks. This implies that new materiel systems are needed. The rapid technological development means that ordering long series of systems brings with it the risk of having obsolete materiel in the future – if new threats arise. The guiding principles for defence procurement will therefore be evolutionary materiel development and flexibility in order to adapt to changes within the area of materiel procurement. Future Swedish defence orders are to a significant extent expected to comprise simulators, demonstrators and various services. The purpose is to continuously develop new knowledge and technology in order to be able to keep up with change. (Ministry of Defence (Swedish) (1999), p 94; SOU 2001:21, pp 43, 45, 74-76, 79; SOU 2001:22 pp, 12, 17)

Policy documents regarding defence industry and defence materiel underline the importance of a continued international integration. Government support will be directed at areas where the defence industry has the best potential in becoming successful and areas that due to special reasons must be accessible to the country. The areas that seem to have best growth potential on the Swedish defence market during the next five to ten years are defence electronics systems and software producers. Traditional defence industry segments face stagnating or falling domestic demand. In areas such as torpedo systems and artillery systems, no new domestic orders are expected for the next five to ten years. Even in the prioritised electronics areas, it is uncertain how much will be invested, and who will receive the orders and when. (Ministry of Defence (Swedish) (1999), p 104; SOU 2001:21, p 24; Axelson and James, 2000, discussion with Official from the Swedish Armed Forces)

The consequence of the increasing research and development costs and the domestic demand is that the home market is to small for the defence industry in Sweden. Thus it will not have sales in parity with the financial resources necessary to keep up with the international pace in defence research and development. On a broader scale – except for possibly a few niches – the consequences might be that the defence industry in Sweden will have to leave the role as system integrator and developer of advanced systems and become niche supplier of subsystems. To avoid such development, other financial sources than the state, the Swedish market and some exports have to be found. A prerequisite for a future advanced defence industry in Sweden would therefore be access to foreign projects and customers.

Defence industry segments – such as aerospace – need government supported collaborative projects in order to achieve access to international markets. If the politicisation of defence industry affairs declines, some industry segments could compete and prosper based on their own strengths. International over-capacity in certain segments will drive companies to continued international consolidation. It could be questioned how likely such development would be, thus when it comes to defence industry issues governments will for the foreseeable future have concerns about national security and jobs. Nevertheless, a continued cross-border consolidation process could generate true integration of companies' activities – a creation of transnational defence companies. This would reduce the political motives to favour domestic industry – at least in areas less important to national security. The Framework Agreement between the six European countries, France, Germany, Italy, Spain Sweden and the UK is certainly important in fostering such development. However, much remains to be done of governments' policies in this area and it is likely to be difficult – if possible – to create an open defence market.

The increasing importance of defence electronics

Major parts of the defence industry in Sweden are transforming to meet the new market and technological conditions, but in defence electronics and software the major changes are taking place. The major electronics and software companies[4] are parts of Saab and Ericsson Microwave Systems (EMW). However, Hägglunds Vehicle is, for example, also working on integrating electronics and software to add new functionality to its systems. That development will have far-reaching consequences for companies business potential. Those who successfully manage to develop new complementary applications to traditional platforms are likely to have the potential to achieve future growth. (Discussions with representatives for EMW, Hägghlunds Vehicle and Saab Tech Systems)

The speed in technology development means that military systems have to be frequently upgraded – this often means new software – to remain competitive on the battlefield. Defence companies' face the challenge of upgrading military systems with life cycles decades longer than commercial technologies that are used for the military applications. Thus, commercial technologies that are used for military applications lose their commercial relevance long before the military systems do. This means that many defence corporations have to manage different clock speeds[5] in their product portfolio. In segments with high electronics and software content such as command, control and communication, there is a rapid clock speed in innovation and development of military application based on commercial technologies. To stay competitive on the increasingly global defence electronics market, defence corporations have to develop cutting edge solutions faster than before. Clock speed is somewhat slower on the upgrade market, but it is essential to make use of leading commercial technologies from the volatile commercial technology market in order to provide the customer with competitive upgrades. At the same time defence corporations have to manage the heritage of old defence materiel that do not change much – except for upgrades – and also the slow clock speed in the development of new platforms. (Fine, 1998, pp, 28-30, 41, 96-98; Williams, 1998, 226-232; Andersson and Lilliecreutz, 2000, P 54; Axelson and James, 2000, pp 65-66; Hedvall, 2000, p 22)

[4] The defence electronics industry in Sweden consists of Saab, Ericsson Microwave Systems (EMW) – part of the Ericsson group – and a few small niche companies. Saab's defence electronics businesses span over a great variety of activities and are organised in several different companies within the Saab group. EMW are primarily focused on areas such as microwave communications, surveillance and information systems.

[5] Clock speed refers to the speed of product development and organisational change, which in many industries is speeding up. However there are differences in the clock speed between industry segments, for example, the life time of a fighter aircraft are several decades, while electronics and software have life times of only months or a few years. (Fine, 1998)

Related to this development, the defence industry is to an increasing extent developing defence applications based on commercial off the shelf, COTS, products. One reason is to cut costs another is due to that COTS products are being developed faster than defence technologies. The changing pace of commercial technologies is – as mentioned – high, which makes it difficult to find upgrades for ageing defence systems based on commercial technologies. It could become difficult to purchase original COTS products only after only a few years. To manage that problem new systems are built on modularity, which means that outdated parts of systems can be replaced by new technologies. Such technologies do not necessarily exist when a system is first constructed. That means that it is impossible to predict which technologies will be crucial for future defence capabilities. By using modularity systems which can be upgraded as the technological development evolves. The demand for modularity is also a result of an evolutionary defence procurement policy. (Eriksson, 1997, p 96; Kindvall, et al, 2000, p 14, James, 2000, p 2, 6; SOU:54, pp 79-81; discussion with Saab Tech Systems representatives)

As mentioned, profitability within the defence will primarily be derived from knowledge and technology embedded in different defence solutions. Long production series will step down as the prime key to profitability. All this means that the outlook for traditional defence industry segments – such as torpedo systems and artillery systems – is bleak, while the market conditions are favourable for defence electronics and software companies. The positive outlook for defence electronics and software are due to several coinciding developments. Electronics are increasingly becoming decisive integrated parts of all defence systems since electronics systems represent much of the platform's capabilities. Advanced computer simulations are increasingly used in defence research, technology and development. Furthermore, when the domestic and foreign defence forces begin implementing network centric defence systems demand will rise for systems, that provide real time data and data fusion. Additionally, demand will increase for command, control and communication systems as well as for sensors. (Askelin, 2000, pp 4-6; Dahlander, 2000, pp 6-8; SOU: 2000:54, pp 83, 85; Svensson, 2000, pp 22-23)

The defence industry in Sweden as well as the defence industries in other countries has responded to the declining market and increasing costs with consolidation, downsizing, diversification, and export promotion. The results have in some cases been successful but defence companies have often failed to meet the expectations of the investment community. In the long run, it is necessary for defence companies to deliver value through growth. Therefore, the growth expectation in defence electronics – in combination with the prospects of stagnating or declining growth in most other defence industry areas is a major cause of the shift in defence companies' business focus. Thus business focus turns to areas where value can be delivered with greater certainty. Major defence

companies such as Northrop Grumman have turned the strategic focus to electronics – in particular information technology. Saab AB is also changing the balance in its product portfolio to business areas related information technology. In fact, the revenue of Saab's business unit Systems & Electronics (former Infomatics) exceeds that of the Aerospace unit. It is the company's strategy to expand the electronics business by delivering solutions to the future Swedish network centric defence as well as to develop its position on international defence markets. The key competencies in electronics areas are, for example, information gathering, data fusion, decision support, and communication. Focusing on core competencies, Saab has sold off Bofors Weapon Systems and is in the process of selling most commercial business units. (Defence Systems Daily, 2000; Saab, 2000; Saab, 2001; Northrop Grumman, 2000)

EMW has benefited from being a part of the Ericsson group by taking use of knowledge and of commercial technologies from other Ericsson companies in the group. EMW has however moved from being almost entirely a defence company to diversifying into the commercial market – defence technologies have been important in developing the commercial business. It now has core competencies in sensors – for example the Erieye –, microwave communications and information systems. EMW is bidding for building the future Swedish command, control and communication systems. Both EMW and Saab stress their ability to adapt commercial IT solutions to military applications. This transformation implies that these companies will have to manage the faster clock speed and the complexity of global technology flows. Certainly, this brings new challenges and ultimately new business logic to the defence industry and it holds the potential to redefine its role and structure. (Saab, 2001; discussion with representatives for EMW, 2001)

THE NEW BUSINESS ENVIRONMENT

The same development that has begun transforming the defence industry is already taking place in many industries and it is to a great extent enabled by the use of information technology, IT. The increasing use of IT creates new opportunities for communication and increases access to information, for organisations as well as for individuals on a global scale. This releases resources in the economy – capital and labour – and that improves efficiency and increases productivity. Meanwhile, the use of IT has begun to gain impact how corporations in different industries organise, how they procure and with whom they collaborate. Within the defence industry this development means an opportunity to deal with the challenges following the shift in demand towards knowledge intensive product areas and increasing competition. The pressure from investors does not give defence companies many other options than to redefine their businesses and take use of the opportunities embedded in IT. (Askelin, 2000, pp 4-6; Cohen, et al, 2000, p 17, 20, 34; Economist, 1, 2000, p 6, 10; Economist, 2, 2000, p 1-7; Evens and Wurster, 2000, p 23-28)

The use of IT solutions increases the access and exchange of information within and between companies. With the use of IT solutions, transaction costs are reduced. Distribution of information between companies was before the implementation of IT relatively more expensive and complicated than now. That made vertically integrated companies the best organisation form to deal with the costs of sharing information. Even though vertically integrated companies were effective by the standards of previous decades, they risk being too slow and inefficient to keep up with change in the present business environment. Thus, it seems flexibility and speed are required to keep-up with competition and it could be argued whether vertically integrated companies are effective at that. The poor financial performance of several major defence companies might indicate that big is not better when the pace of change is high. With the spread of IT in the economy many of the difficulties and costs for collaboration and co-ordination decrease, which forces the rules of competitiveness to change. For

example, the use of IT creates new opportunities for organising production, research and development within the defence industry. This development could mean that old structures and borders between industries, between companies and within companies' becomes blurred and new structures and actors enter the business stage. Change becomes more rapid and technological complexity as well as business uncertainties increase. In response to that, competition becomes more intense and any advantages short term. In this environment it is essential to be able to innovate and commercialise at a much faster speed than before. For many companies – irrespective of industry – this means that to stay competitive they have to transform their business focus and business models to allow increased flexibility. (Fine, 1998, pp 28-30, 41; Williams, 1998, pp 4, 111-123; Hagel and Singer, 1999, pp 133-137; Askelin, 2000, pp 4-6; Cohen, 2000, p 20; Economist 1, 2000, p 34; Evens and Wurster, 2000, pp 36-37; James, 2000, pp 83-87)

A trend within the defence industry is changing supply chain management. The traditional structures with a prime contractor at the top of a supply chain with several subsequent levels are being replaced. Increasingly, companies collaborate more closely with a few strategic suppliers. Suppliers organise in clusters where information is exchanged. In some cases the use of IT enables completely new forms of organising collaboration. For example Saab Tech Systems has some collaboration with other corporations organised in virtual teams. This development creates new options for companies to outsource and thereby improve focus on core competencies. Integrated and flexible network structures are therefore successively replacing the traditional structures. The structure that evolves in many industries is one of horizontally integrated companies. (Evens and Wurster, 1999, 94; Hagel and Singer, 1999, p 138-139, 141; Bovet and Martha, 2000, p 28; Cohen, 2000, p 20-21; Birkenshaw and Hagström, 2000, p 206, Saab Tech Systems, 200, discussion)

Defence Industry e-commerce

Defence companies generally need to improve their profitability by increased sales, but cutting costs and increased efficiency remain important in the struggle to meet the investment community's expectations. With IT a new way of cutting costs and improving efficiency is emerging – e-commerce. The potential benefits with e-commerce between companies are lower transaction costs in procurement and production – because of, for example, reduced costs and times for administration and other processes. Even though the exact benefits of e-commerce are too early to judge, the use of e-commerce opens new opportunities for collaborating and organising activities in the value chain, such as research, production and marketing. This could create new opportunities for small and medium sized companies. The relationships between actors in the supply chain change – as mentioned in earlier sections. Currently the use of e-

commerce supports the trend of companies seeking to decrease the number of suppliers and developing close and trust-based collaboration with a few main partners. Meanwhile, there is another, opposite trend indicating that suppliers of commodities are facing harder competition as it becomes easier to identify low cost companies on a global scale. One expected consequence is that the middleman in transactions becomes obsolete, as it becomes easier to purchase directly from producers. Such development opens the door for further cost reductions and increased efficiency. The end customer is also receiving a new, more active role by for example being able to personalise products. (Curry and Kenny, 1999, p 20; Hagel and Singer, 1999, p 138-140; Sahlman, 1999, p 101; Financial Times, 2000, p I, V; Finnegan, 2000, p, 35; Fisher, 2000, p 1-2; Slowotzky, 2000, p 41)

As in several industries, for example oil, auto and aerospace-defence, companies are coming together and forming electronic business to business (B2B) e-marketplaces. During the late 1990s companies like Boeing and Raytheon has been experimenting with their own e-commerce systems, now defence companies merge their efforts to reduce costs and increase efficiency through e-commerce. During the spring of 2000 the big four aerospace and defence contractors BAE System, Boeing, Lockheed Martin and Raytheon announced they would form an e-marketplace – Exostar. (Boeing, 2000, p 1-5; Parkes, 2000, p IV; Reuters, 2000, p 1)

A number of other defence industry related e-marketplaces are either operating or in preparation. To become successful an e-marketplace needs a critical mass of sellers and buyers. This raises questions about possible monopoly conditions when a small number of companies control their own marketplace. The main reason for creating these marketplaces is that the founders – which tend to be the major companies in the industry – hoping to reduce procurement costs by making it easier to find lower cost suppliers for standard products. To avoid monopoly conditions it is crucial that the marketplace will be open to all wishing to participate and that information is neutral. (Bates, 2000, p 8; Financial Times, 2000, p I, XI; Financial Times, 2000, 1-2; Kelly, 2000, p, 33; Wall, 2000, p, 38)

Other forms of B2B e-commerce are developing and could be as important as e-marketplaces. It is, perhaps with different forms of electronic partnering that B2B will have its most significant impact. For example, virtual collaborative teams are already operating on development of defence solutions. It might become possible to form integrated data environments. The base for such e-commerce is trust between the participating parties. (Bjurström, 1999, p 130-132; Baldwin, 2001, p 142; discussion with Saab Tech Systems, 2001)

E-commerce – in all its forms – is still in its infancy and its full potential has yet to be realised. Within the defence industry – as in other industries – it is likely to face challenges in the forthcoming years. Several challenges in the defence industry context are related to the fact that there is a wide range of policy issues regarding national security that remain to be solved. Most of these issues are related to e-marketplaces, virtual teams and other direct forms of e-commerce. Interaction is likely to be regulated by agreements and trust between the parties. Challenges facing e-marketplaces are managing content, functionality and security of information. With such issues unsolved it is unclear which defence related products and services could be traded on-line. (Financial Times, 2000, p I; Kelly, 2000, p, 33; Wall, 2000, p, 38)

The special condition within the defence industry makes it likely that e-commerce on e-marketplaces will be restricted to commodities and simple services. That implies that e-commerce of dual-use technologies might have more potential than defence products. A pressure on suppliers to reduce prices could be expected assuming defence industry e-commerce in some years time is a substantial part of business to business within the defence industry. This in turn would drive a new wave of consolidation of small and medium-sized firms. This would also be in line with the wishes among the big defence companies, for example Boeing, to reduce the number of suppliers and instead develop close collaboration with a few. Although the competition might increase among lower tier companies, e-commerce also holds opportunities for small and medium sized companies to reach out to a bigger market and potential new customers. It is likely that defence companies could benefit more from other forms of e-commerce than e-marketplaces. The possibility for development of defence solutions such as software creates new options for collaboration and could improve access to knowledge and technology.

In short, it seems as if defence industry e-commerce could become an important factor in transforming the industry, but it remains to be seen how. What e-commerce will mean for the defence industry in Sweden is consequently an open-ended question. Emergence of new supply chain strategies could be expected and increased interaction and integration with other companies through virtual networks is likely – in for example the development of new software. In the future, IT based services related to upgrading and support will be developed – Volvo Aero is already underway to launch a net based service for the Gripen engine (discussion with Vovlo Aero, 2001).

NEW DEFENCE INDUSTRY STRATEGIES

The defence industry in Sweden faces a shift in the process of adaptation to international competition and in changing business focus from platform manufacturing to becoming a provider of technology and knowledge. It has to become an international actor more integrated in international networks than today. It has to transform its business focuses and business models to keep up with technological changes as well as changing customer demand. In order to successfully respond to these changes, new strategies must be developed and implemented. This section will outline how these strategic challenges might be dealt with.

Strategy of change and uncertainty

"*It is not the strongest of the species that survive nor the most intelligent but the one most responsive to change*" Charles Darwin

In the defence industry shift stability is an exception and defence companies have to adapt to evolutionary change at an increasing pace – in particular within defence electronics and software. Preparing for the future would not be difficult if the future was known, but the future for the defence industry is uncertain. Success requires getting ahead of the industries changing curve, in the defence industry as well as in other industries. Failing to change in time, will bring falling revenues and declining profitability. Consequently, transformation will take place in a crisis atmosphere. (Dreborg et al, 1994, p 30-35; Fine, 1998, 31-37; Williams, 1998, p 221; Hamel and Prahalad, 1999, p 46, 50)

The major uncertainties facing the Swedish defence industry are political uncertainty, market uncertainty, and technological uncertainty as well as competence uncertainty. These uncertainties are interrelated, so the development on one issue is likely to have an impact on the others. Political uncertainty is related to how defence spending will develop and which areas will be prioritised. Swedish defence materiel procurement is expected to decline during the next ten years. The decline will be from approximately 24 billion Swedish

kronor (SEK) to approximately 17 billion SEK per year. It is expected that electronics sectors will be prioritised, in particular command and communication systems. However, how much and on which systems is not known. The defence electronics industry in Sweden also faces the uncertainty of how the procurement policy will develop. Until now, the domestic defence industry has been favoured by FMV[6], but that policy is changing to procurement in international competition. Some niches are likely to remain protected from international competition.

Another issue is market uncertainty, i.e. how the international defence materiel market develops. Will market logic with free competition open up other countries' defence markets or will the political logic dominate with protectionism and favouritism of domestic defence companies. The outcome from this will determine much of the export potential of the defence industry in Sweden. The issue of market logic is of fundamental importance for future export potential of command and communication systems developed for a network centric Swedish defence. It is likely that these areas will remain relatively protected by governments – due to concerns of national security. An open-ended question is therefore if Swedish investment in a network centric defence would give the defence industry in Sweden competitive advantages that could be exploited on the international market.

Technological uncertainty refers to the issue whether it will be possible in the next few years to develop systems that perform data fusion, decision support and other aspects of the future network centric defence. It is also an issue of what technologies will be required and if the defence industry in Sweden will have access to required technologies and resources. The technological uncertainty is closely related to competence uncertainty. Does the defence industry have the know-how in-house or in its external network, to perform the various tasks increasingly complicated defence systems require?

Despite the uncertainties, it is necessary for long-term competitive advantage to get ahead of change. How defence companies manage uncertainty will influence strategic decisions about the future. There is no universal law of how to deal with uncertainty. It is rather what specific circumstances facing individual companies that should decide its strategy towards uncertainty. However it is important to keep in mind that uncertainty is not merely a threat, it also contains opportunities. The major challenge is how to enhance openness and willingness to learn within organisations – to view uncertainty as an opportunity. Therefore, it is important not to try to avoid complexity and ambiguity but instead embrace a flexible and creative strategic approach. (Dreborg et al, 1994, pp 15-18; Hamel and Prahalad, 1999, pp 46, 50; Regnér, 2000, p 37)

[6] FMV, Försvarets materielverk, is the Swedish defence procurement agency. www.fmv.se

Generally, strategies dealing with uncertainty could be active or passive. An active strategy means making sequential decisions as things evolve. With a passive strategy the aim is making one major decision, which is sustainable no matter what happens. Any well-managed strategy should in most cases contain both active and passive elements. The defence industry in Sweden faces a range of possible futures, thus the degree of uncertainty is high. Under such circumstances an active strategy is often better because it allows flexibility to deal with unexpected events. (Dreborg et al, 1994, pp 15-18)

In the complex business environment of defence electronics, strategy creation has to become dynamic. Companies need a view of the future of the defence industry in order to manage the active strategy. With an active strategy, the view of the future must not contain static goals but a vision of how the company will be like. From there, companies can begin a transformation process of developing the skills, capabilities and organisation that they perceive important for future competitiveness. At the same time it can make incremental decisions as the environment changes – strategic opportunism. (Dreborg et al, 1994, pp 15-17; Courtney, Kirkland and Viguerie,1999, pp 18-19; Hamel and Prahalad, 1999, p 46)

In complex business environments where advantages are short-term, companies could develop a portfolio of options in order to manage continues renewal and at the same time make long-term investments. The purpose would be to create renewable advantages in areas with future growth potential. This means making initial investments that give the company a range of alternatives to scale up investments in the future. By creating options, companies achieve the flexibility to respond to the environment as changes evolve. In sum, an adaptive strategy with options allows defence companies to have broad portfolio of business opportunities. Consequently, if a company sees an opportunity, it might have the option to grasp it thanks to earlier small investments. (Courtney, Kirkland and Viguerie, 1999, pp 2-5, 18; Stalk, Evans and Shulman, 1999, p 182; Williams, 1998, pp 126- 128, 141-143)

Partners and partnership structures

Defence companies are, as mentioned, operating in a market with increasing technological complexity and rapid change on the supply side. Therefore, it is essential that defence companies manage to find and integrate key knowledge and technologies and in order to deliver cutting edge products – by international standards. Thus, innovative integration new commercial technologies and knowledge becomes increasingly decisive for the capability of military products – and ultimately for corporate competitiveness. A prerequisite for access to commercial technologies is to have a global network of commercially high technological actors. Defence industry companies are therefore collaborating increasingly with other defence companies and companies within the

commercial sector. Companies – within the defence industry and other industries – strive to gain leadership in one or a few market segments; by focusing on their core competencies, by mergers and acquisitions as well as engaging in strategic alliances. Increasingly, it is not size in terms of market dominance and revenue that is the foundation for sustainable growth but rather the size of and the competence in companies' networks of partners, suppliers and customers. The involvement with other companies may be in the form of joint ventures, integrated project teams, outsourcing and other integrative frameworks. One trend is an increasing importance of economies of scope rather than economies of scale[7]. On the other hand, scale of production is as important as ever and is one of the main drivers for defence industry consolidation in recent years. This means size has different meaning for different parts of the defence industries value chain and consequently each part of the value chain require specific collaborative forms and strategies. (Williams, 1998, pp 178-180; Andersson, and Lilliecreutz, 2000, p 48; Axelson and James, 2000, p 59; James, 2000, pp 85-86; Lundmark, et al, 2000, pp 19, 23)

The main characteristic of this development is the increased importance for competitiveness of being part of a network that provides resources that the company can not obtain on its own and opportunities for cost sharing. Thereby, increasing the size of and the competencies in companies' networks have crucial impact on companies' competitiveness. This is a completely different approach to collaboration than was required only a few years ago. It requires flexibility and adaptability, since change is constant and uncertainty is high. Those companies that fail to develop a position in appropriate international networks will fail to meet the demands on the competitive defence market – the demands of the Swedish procurement agency FMV is hardly an exception. To meet these challenges defence companies transform their organisational mindsets.

What partners and partnership structures are appropriate?

Defence companies' strategies are increasingly global in scope. Thus developing relationships with defence companies in other countries could bring about improved options to share investment costs, obtaining resources of technology and receiving help to enter new markets. The stronger the presence is in a foreign market, the better the opportunities are for a foreign company to receive orders from national procurement agencies. In the efforts to obtain a strategic position on the international armaments market, defence companies engage in different relationships with other companies. What would different partners and

[7] Economies of scope means using the same skills for solving different problems. Economies of scale mean the bigger the proportion of costs for an activity, on for example investments, that are shared the more significant the shared cost savings become.

partnerships structures mean for the defence industry in Sweden? (Axelson and James, 2000, p 58)

A strategy to obtain a stronger position on the international defence market and to receive access to other companies' resources means participating in international alliances and collaborative projects. Teaming up in alliances or collaborative projects with foreign defence companies means less risk than equity investments because it is – for example – easier to exit if the other party does not possess the required capabilities. To become an attractive partner internationally it is in most cases necessary to have development or sales orders from the domestic government. Other important factors are technological competence, cost efficiency, creativity and trust, as well as a network of industrial and political contacts. Internationally, the defence industry in Sweden has a good reputation particularly due to technological skills. In the case of EMW the link to the Ericsson group should be of interest for both defence and commercial companies. It is nevertheless rather uncertain if international alliances and collaborative projects exert a strong enough foundation for long term growth and allowing the industry to keep up with the international development. The common juste-retour practise means the defence industry in Sweden receive shares in collaborative projects equivalent to the Swedish orders. However, a small share could be important both for the country and the company – if the content of the Swedish part is vital for the project, which for example is the case in the missile project Meteor. A successful development of the infrastructure for the Swedish network centric defence would make the participating companies attractive on the international defence market – at least as niche suppliers. (Axelson and James, 2000, pp 59, 63; Lundmark et al, 2000, pp 20-23)

Collaborating with commercial companies' is essential for access to new technologies and knowledge. Partnerships with commercial companies could be on co-development projects, which could create long-term mutual resource exchange. Another form of defence – commercial partnerships could be on ad hoc bases for example when defence companies acquire hardware and computer programmes for military applications. To achieve access to specific commercial technology it might be interesting to acquire foreign commercial companies. However, it could be questioned whether acquiring commercial technology companies would generate more value than alliances.

An alternative or complement that could strengthen the defence industry in Sweden internationally and create access to new competencies is acquisition of the non-foreign owned defence industry in Sweden. Foreign owners could be interested in placing some research and development on their business units in Sweden – one example is the decision of German HDW to give Kockums lead in the groups endeavours to develop capabilities to meet future demand of ships

and submarines adjusted for network centric warfare. By acquiring defence companies in Sweden the foreign defence contractors could obtain access to technological competence and possibly government money for defence related research and development. Thereby, some defence application ability and some system integration competencies could remain within the country and flows of foreign competencies in those areas would strengthen the industry. That would be good for stakeholders and for the competence level within the defence industry in Sweden. However, participating in international joint ventures could probably bring the same benefits. (Axelson and James, 2000, p 64; Lundmark et al, 2000, p 23; Kockums, 2001, discussion)

Another strategy, acquisitions of foreign companies would strengthen the defence industry in Sweden. Thus it would become a local actor in foreign markets. It is likely that such a position would make it easier to get access to other countries procurement agencies, get to know their needs, important persons and to offer local jobs, which increases the chances of receiving orders. The acquisition of a company means receiving access to the acquired company's competencies and increasing the options for a strong commitment from the other party. However, such access is regulated within the defence industry by for example technology transfer polices. So, even though acquisitions of foreign defence companies would make sense from a business perspective, political acceptance by the companies' governments is uncertain. Also, mergers and acquisitions often fail to deliver expected value. Creating demanded value from mergers within the defence industry could be excepted to be even more difficult as political restrictions are likely to hinder business decisions such as the closure of plants. (Axelson and James, 2000, pp 64-66, Saab Tech Systems, 2001, Brealey and Myers, 1996)

The partners and partnership structures that are most appropriate depend on situation and objective. However, it seems focusing on alliances would in most cases generate more value than mergers or acquisitions – even though negotiations for establishing defence industry alliances often are very complicated and take long time. Defence companies striving for access to new technologies and markets generally seem to benefit from being part of a network of other defence companies and commercial companies. Mergers and acquisitions could nevertheless be valuable in order to establish a position on a new and important market, thus access to, for example, the US market require presence.

A merger between commercial and defence companies?

Required technological capabilities for developing high-level defence systems are found not only in traditional defence companies but also in commercial companies. Thus, as mentioned, a shrinking number of technology areas are

uniquely military. It is therefore important to recognise the potential of commercial companies becoming major defence contractors. A compelling argument for an increased intervention by commercial companies on the defence market – primarily in defence electronics and software – is that commercial competencies and systems in many areas could be adapted for military purposes relatively easily.

The extent of resources many commercial companies have in areas such as telecommunications and IT, make it possible for such companies to develop systems for military use faster and cheaper than many traditional defence companies. In areas such as IT security and system of systems integration the defence market could provide an appealing experiment ground for commercial companies seeking future growth potential on commercial markets in these technological areas. The defence market could also provide a stable long-term cash flow for commercial companies.

The major argument against a significantly increased intervention by commercial companies on the defence market is the same issue that causes concern among traditional defence companies – low growth potential and poor profitability. The stock markets would probably not be thrilled by telecommunication companies that aim at the defence market. Any major investments in the defence market by commercial companies are therefore not particularly likely to occur on a broad scale in relation to engagements on commercial markets. Nevertheless, companies such as Microsoft, Cisco Systems and Sun Microsystems are engaged in defence projects. In the case of Microsoft the purpose is to enlarge the company's customer base in defence information technology. In no case are these commercial companies aiming at becoming defence contractors. (Ratnam, 2001, p 12) The defence market might, however, be more interesting for small and medium-sized niche companies, since that market is a valuable reference and allows experiment with new solutions.

The competitive advantage of defence companies is their capability to develop systems that have the robustness required by war conditions and their customer relationships. Thus receiving a defence order is just as much a matter of having the right personal relationships as having the best product. These advantages are hard and expensive to copy. So despite the changes in favour of commercial companies', barriers of entering the defence market remain – at least for some time. For commercial companies, collaborating with defence contractors should be a compelling way of entering the defence market. It is a necessary change for traditional defence companies to keep up with collaborative relationships with commercial telecommunication, and IT companies that have the required commercial competencies for development of defence applications. Focusing on a few capabilities that are hard to copy – by commercial companies and major defence contractors – and offering through life support are the keys to

competitiveness. However, would such a role provide a base viable enough for long term competitiveness and profitability?

It seems that the difference between the defence industry and other industries becomes blurred. The findings of this report indicate that the unique characteristic of the defence industry is reduced when business models are transformed from manufacturing to service and from vertical supply chains to integrated networks. It has to shift from being a manufacturer to becoming a provider of solutions, but by doing that it loses much of its unique attributes related to development of defence applications. As suggested earlier in the report, by developing a set of options defence companies could create a readiness to grasp opportunities and at the same time reduce the risks of a few big and uncertain investments. A portfolio of options should be broad within the scope of companies core competencies. The following paragraph outlines what could be one possible option.

Perhaps, defence companies from the electronics sector could operate on both commercial and military markets rather than specialising only in military systems. What would such a strategy mean for the defence electronics industry in Sweden? It should be worth considering whether to integrate with commercial companies through mergers or alliances in order to secure access of commercial technologies and to build a platform for entering commercial markets with its competencies. Defence companies that develop experience from system of systems integration in the defence sector will have competencies that could be competitive on commercial markets. If, for example, the defence industry manages to become a successful system of systems integrator such management ability could be an export area – both in defence and commercial markets.
The history of defence industries trying to enter commercial markets has, however, few success stories. Generally, defence companies seem to have an inability to manage customer relations in commercial markets. In this case, history is not a road map to the future. It should be possible for traditional defence companies to outsource marketing to partners. Furthermore, by hiring people from commercial industries it should be possible to develop a sense of how to design solutions and services to meet the demand in commercial markets.

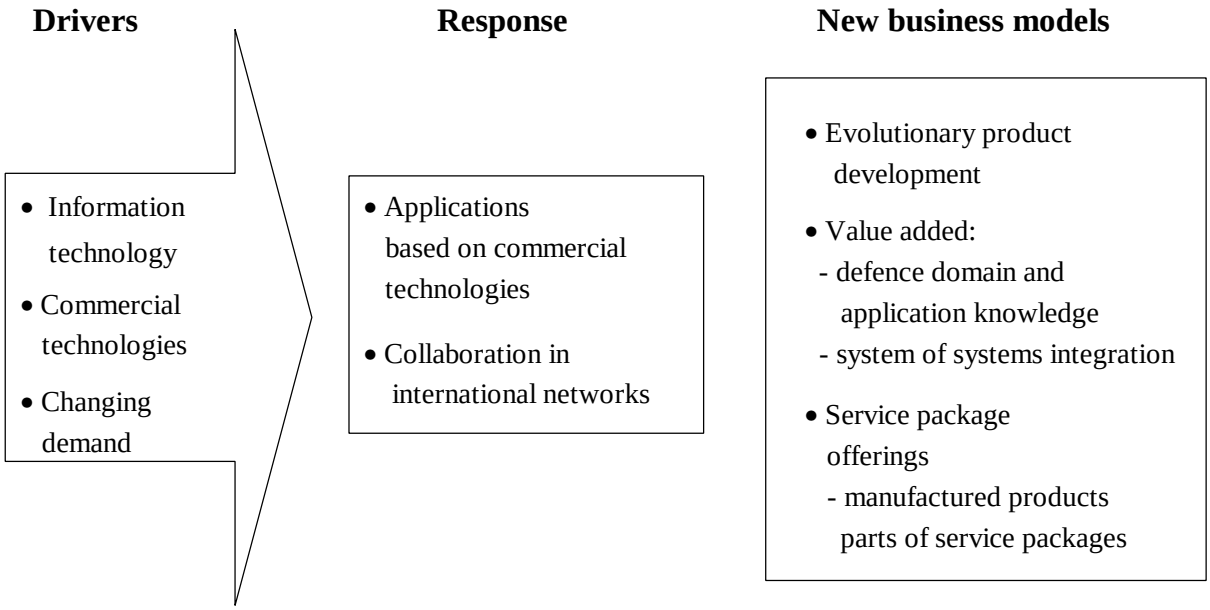
It could be expected that mergers between defence companies and commercial companies – notably from information technology and telecommunication sectors – are likely to be become increasingly common. This does not only have to mean equity mergers but also mergers of content without equity integration, i.e. integration of activities by alliances or joint ventures. Relationships are the glue that holds such business structures together. What such integration will bring to the defence industry and what it will mean for the development of new weapon systems is obviously uncertain – but the unexpected should be expected.

New business models

One of the major issues facing defence companies in Sweden is how to become more service oriented – even to some extent consultants – and less manufacturing oriented. Such a shift requires new business models i.e. new ways of making money. The crucial question is then – what should the new business models be like?

The main issue when considering what business models are appropriate is how value will be created in the future. The real value added – as mentioned in previous sections – is in the future not likely to be in manufacturing hardware – such as platforms – but rather in designing systems and system of systems integration. Developing demonstrations and managing simulations are services that are expected to have an increased share of defence industry revenue. This changes the traditional role of the defence industry and it faces the challenge to change its self-image as manufacturer in order to adapt to the role of service provider. It is the ability to develop new knowledge and technologies that creates competitiveness as a service producer.

Towards new defence industry business models



Source: The FIND Programme

Defence development projects have usually lasted for several years, in many cases several decades. With an evolutionary acquisition process, such an approach is no longer fully applicable. Defence industries have to leave the big bang project model and develop an evolutionary model, which focuses on scope rather than scale. The development phase has to be shorter and if production is

ordered – in most cases there will not be any or only a very limited production – the production processes has to become faster than now. The method that could be applied is focused on short projects – from a couple of month up to one year. Such projects would be partly overlapping in time. When starting a new project that builds on the first and continues like that, they are never finished there are only goals on the way – unless the whole programme is terminated. (Hedvall, 2000, pp 9- 13; Eriksson, 1997, pp 95-104; Cap Gemini Ernst & Young, 2000, presentation at FMV, discussion with representative for Aerotech Telub, 2001; discussion with E Anders Eriksson at FOI, 2001)

No single company could be expected to have all the capabilities required to develop major systems in the new business environment that is emerging in the Swedish defence industry context. The capabilities that are required are probably spread across different actors, in Sweden and abroad. Such actors include commercial companies, different defence companies, universities and government agencies. It is the centrality of a company's position in its networks that determines much of its access to resources. The higher the degree of centrality the better its access to resources. To accomplish such a complicated task as to deliver solutions in network integration to the Swedish defence it is probably a must to match the customer demands with both internal and external competencies. Thus, in technologically complex and rapidly changing business environments competitive advantage is gained by those companies that manage to identify and exploit the combined capabilities in the company, and in their external network of relationships – including both defence and commercial companies. For example, Saab, is therefore working on improving supplier relationships and supply chain management. Saab, not least for securing access to new technologies and knowledge perceives closer collaboration with companies such as BAE Systems and Raytheon as important. Customer relationships are particularly important for successful sales because of the high degree of political influence and interests on defence procurement and supply issues. Such relationships could be hard to establish on foreign markets and it might therefore be better to outsource customer relations or to manage those together with another company that knows the particular market. (Doz and Hamel, 1998, pp 223-224; Axelson and James, 2000, pp 58-59; Birkinshaw and Hagström, 2000, p 5; Saab AB, 2001)

When developing new business models the issue of the future for manufacturing is at stake. In other industries – for example consumer electronics – companies in many cases no longer consider in house manufacturing as a core competence. Such activities consequently are outsourced to other companies, which often have specialised on manufacturing. The remaining core business is application development competencies. This does not mean in house application development but rather being able to co-ordinate internal capabilities with external collaboration with other organisations or simply by the purchasing of

state of the art solutions. Outsourcing is already relatively common in the defence industry, but would further outsourcing be a way forward for defence companies? Concerns about national security often constrain what defence companies actually can do. The technological and business conditions facing different defence companies are simply too diverse to reach general conclusion of whether outsourcing of all production is good. However since solutions rather than serial manufacturing is demanded by the armed forces, revenue will primarily derive from development and not from production. Thus, defence companies will have to continue to focus on development because that is the essence of defence industry business in the years to come. This development could in fact mean it becomes inefficient and costly for companies to have manufacturing capacity. It therefore seems reasonable that defence companies develop business model where development and customer relationships are the core activities and manufacturing is outsourced or co-ordinated with other companies within an international network. It might be feasible to solve the issue of production capability by viewing production capability as a service that generates extra value for the customer. Consequently, the customer, i.e. the Swedish government, will have to pay for the degree of production capability it wishes to have access to. (Eriksson, 1997, pp 38-38, 98-102; Eriksson, 2001 p,4; Hagel and Singer, 1999, p133-137; Andersson and Lilliecreutz, 2000, pp 51-52; Kindvall, et al, 2000, p 18)

A defence industry capable of delivering state of the art defence solutions will have to focus on development of applications based on commercial technologies or technologies and services that are uniquely defence specific. The new business models must support that. Companies must not wait for development to say what new business models are best. An active strategic management of change and uncertainty is required to grasp the opportunities of the defence industry shift – and to shape the future of the company.

CONCLUSIONS

This study has analysed the shift of defence industry in Sweden, from platform manufacturing as the prime source of revenue to a situation where solutions and services are of increasing importance. The development in the defence industry is of importance for the creation of a network centric Swedish defence and for national security of supply. Defence companies are becoming increasingly integrated with commercial companies and dependent on the rapid technology development in commercial electronics areas. Its resource base is global and competition as well as integration is also becoming global in scope and impact.

The outlook of the future global defence industry structure is an emergence of a network of integrated companies, which could be labelled as network companies. There will be a few major companies that constitute the central nodes in the network. These network companies will focus on combining in-house capabilities with external resources to develop new applications and services for the armed forces of Europe and the USA. The prime goal of the companies is to achieve access to new technologies, new markets and to spread costs as well as receiving new sources of finance. The major change from the governments' perspective – at least in Europe – is a situation with companies being international while most procurement is still national.

This section will consider the implication of the defence industry shift for the defence industry in Sweden.

Strategic choices facing the defence industry in Sweden

The defence industry in Sweden needs to become more integrated internationally with both commercial and other defence companies. It is important to establish a central position in both commercial and defence industry networks in order to receive access to resources such as new knowledge and technology. It is also necessary to obtain better access to foreign markets and foreign sources of capital. With the emerging globalisation of the defence industry, the defence companies in Sweden are to small too become one of the key players, except for – perhaps – in a few niches. This means it is possible for

defence companies to be central nodes in international networks, but only in a few niches or through integration with major foreign defence contractors.

The changing demand of defence materiel, including the increased demand for simulations, demonstrations as well as services make new business models necessary. Defence companies will have to decide whether they wish to transform to a situation were services and development of technological solutions are their core activities and manufacturing less so. Ultimately it is a choice of becoming a niche player in few high technology areas or moving down the ladder and becoming a supplier of defence commodities.

For most traditional defence companies in Sweden this means a challenge in finding a balance between new business models focusing on development of solutions and services and remaining some production capacity. The balance depends on the combination of customers' demand and companies' strategic intent. Those companies striving for a position, as highly capable producers of solutions and services will have to consider to what extent production could be moved to other countries or companies, in order to reduce costs. If it, for example, would be cost effective to have an option to use other countries defence industry for production of the short series demanded by the domestic market, the industry would have to consider moving its production abroad. Whether this would be appropriate from the government's perspective is uncertain, but it comes down to how much the government wishes to pay for remaining production capacity within the country.

To manage to stay competitive in the environment of increasing technological complexity and international competition, the defence industry in Sweden needs to continuously benchmark its competitiveness on the international market. It has to make sure it has a portfolio of options that enable alternative and flexible business decisions in response to what opportunities and difficulties that emerge. To develop a set of options, integrating with companies from different sectors of the economy is of vital importance. Merely working in a network of other defence companies will not create a base viable enough to take use of opportunities derived from developments in other sectors, such as software companies in the entertainment business. Therefore, defence companies will have to increase their collaboration with commercial companies.

As mentioned, the change on the defence market makes it essential to international integration. In the process of intensified international integration the defence industry will have to decide what areas that should be prioritised – i.e. what will be the future business areas. Priorities should be based on areas where the companies have relative competitive advantages internationally or strong domestic demand – where it is favoured due to concerns about national security. Defence industries could choose a combination of different strategies,

such as outsourcing, diversification, divesting as well as mergers and acquisitions. It could benefit from focusing on defence application development in a few niches and strive for establishing an international position in those niches. One such niche is developing competence for management of system of systems integration. As the markets of system of systems integration emerge, defence companies in Sweden should be able to develop such competencies in the defence context. Experiences made in the Swedish defence context means that a set of new competencies would be developed, which might be expanded into other markets than the defence market.

This study shows that the defence companies in Sweden – at large – is under way to transform from manufacturers to become service providers. It is a process that in parts requires different competencies and business models than those traditionally applied within the defence industry. Willingness to embrace the future and what the defence industry shift brings will determine much of the difference between those companies that are going to become successful and those who will fail on the defence market in the years ahead.

To conclude:

Background of the shift

- The major drivers of the defence industry shift are the development of information technologies, the increased importance of commercial technologies for defence applications, all in combination with changing demand.
- It has become possible with the information technology development to create new systems with new kinds of functionality. Consequently, demand shifts from platforms to solutions and services that improve the functionality of each platform and the defence system as a whole.
- This means defence companies are facing the challenges of managing falling demand in several sectors and transforming their businesses to meet the demands of their new environment.

Corporate response to the shift

- Defence companies in Sweden will – at large – have to transform to become niche players in a few defined business segments. It is too early to identify those areas but it is important that companies move on to decide what those niches will be.
- Defence companies will have to push forward the process of developing models for increasing profits in developing technological solutions and services. Production will have to be viewed upon as a declining strategic capability. Consequently, new models for organising production must be developed – e.g. outsourcing and establishing international production consortia.

- Co-operation with commercial companies will be of vital importance for the technology transfer necessary in the development of new defence applications and services.
- Defence companies, primarily in the electronics and software sectors, should consider entering commercial markets. This has been done before without much success but with the right partners some areas could definitely be exploited commercially.
- The system of systems integration market new and still emerging. It will become a new growth area within the defence sector. To successfully exploit the potential of this new business segment intense collaboration with companies from the commercial telecommunication and information technology sectors are required.

Implications for the defence industry policy

Will a substantial defence industrial capability remain in Sweden at all? The answer is by no means given, but it very much depends on whether the industry manages to transform from the industry structures focused on production to a new service oriented industry structure. A shift of the defence industry in Sweden is underway. However, the future development is uncertain. The changes in the defence industry environment indicate that the defence industry in Sweden has become too small and too unfocused to remain competitive – when judged by international standards. Parts of the defence industry in Sweden have already launched strategies adapted to the consequences of current changes. Further restructuring of large parts of the defence industry in Sweden must be expected, including changes of business scope and forms of international integration.

The main policy conclusion is that it must be recognised that the process of defence industry restructuring and internationalisation is far from being finalised. The defence industry in Sweden has just begun the process of international integration and collaboration with defence and commercial firms. Equally, the process of developing new business models is only about to begin. Political decisions will shape much of how these process proceeds. Based on the findings of this report, the following issues are suggested as particularly important for the development of the defence industry in Sweden and consequently for future national defence acquisition.

- The government must make firm decisions about what defence industry areas that should be prioritised for government support. Supporting a wide range of activity results in an insufficient concentration of recourses with an apparent risk of achieving bleak results.
- Make sure that new procurement models are implemented in the state. This is crucial for the industry's development of new business models – where

money can be made early in the development phase as well as on production and on maintenance services.

- Do not favour the defence industry in Sweden in future materiel programmes if it cannot show an extensive use of commercial technologies and knowledge. This is important in order to avoid long-term lock-in and inability to make use of the fast development of commercial technologies and knowledge.

RELATED FIND REPORTS

A previous FIND report, "The Defence Industry and Globalisation[8]", studied the impact of the globalisation on the defence industry in Sweden and abroad. The globalisation of technology was identified as one of the major drivers of defence industry globalisation. This study has continued the trail of technology globalisation and analysed its consequences for the defence industry in Sweden – labelled the defence industry shift.

The FIND project is continuing to study the implications of globalisation. Presently the author of this report is working with a research project on the emerging system of systems integration industry. The framework for this development is largely set by the features of globalisation, such as the increased importance of commercial globally available technologies as well as the blurring lines between different industries. That report seeks to identify the industry structures that could evolve to manage the complex task of developing a system of systems for a network centric defence.

Another ongoing FIND report analyses the prerequisites for a process of further transatlantic defence industry integration. The issue of transatlantic integration is a major element for the future of defence industry globalisation and is therefore of crucial importance for the defence industry in Sweden. Consequently, the transatlantic development has far reaching implications for Sweden's long-term supply of defence materiel.

Further research

Further research is required to understand the dynamic and potential of cross-industry interaction, i.e. how the interaction between defence companies and companies from the information technology and telecommunication sectors are

[8] *Axelson M., and James AD., (2000),* The Defence Industry and Globaliation - Challenging Traditional Structures, *FOA User Report, FOA Defence Research Establishment: Stockholm*

used for creation of new technologies and as a solution for defence. For example, what might be the role of software producing companies in the entertainment business, such as computer games, in the development of applications for defence networks?

It is in the interaction between defence and commercial companies that the process of globalisation has its greatest potential to influence the development of new defence capabilities. Thus, resources and talent spread globally could be pooled together in the combined corporate and governmental struggle to enhance competitive advantages of domestic defence firms. The aim would be to study how such cross-industry interaction could be managed deliberately to create advantages in strategic areas such as access to competencies and development of innovation capability.

BIBLIOGRAPHY

Andersson, M. and Lilliecreutz, J., (2000) *Supply Chain Strategies and Sub-Tier Structures*, FOA User Report, FOA Defence Research Establishment, Stockholm.

Askelin, J.I., (2000) Kanonverkstaden blev tankesmedja, *FOA Tidningen*, December 2000

Axelson M. and James A.D., (2000), *The Defence Industry and Globaliation - Challenging Traditional Structures,* FOA User Report, FOA Defence Research Establishment, Stockholm

Baldwin, K., (2001) The challenges of E-business, World Defence Systems: Procurement Edition, *Royal United Services Institute for Defence Studies*, Sovereign Publication Limited, London

Bates, J., (2000) Aerospace Firms Use Caution in Building Joint Web Site, *Defence News*, July 24, 2000

Birkinshaw, J. and Häggström, P., (2000) *The Flexible Firm*, Oxford University Press, New York

Bjurström, E., (1999) *Många vägar in i framtiden*, A & U Förlag, Stockholm

Boeing (2000) Boeing, Lockheed Martin BAE Systems and Raytheon to create B2B Exchange for the Aerospace and Defence Industry, *www.boeing.com/newsrelease,* March 28 2000

Bovet, D. and Martha, J., (2000) Biogen Unchained, *Harvard Business Review,* May-June 2000, Boston, MA

Brealey, R. and Myers, S., (1996) *Principles of Corporate Finance*, McGraw-Hill, New York

Cap Gemini Ernst and Young, (2000) Presentation at FMV about Internet and the new Economy

Cohen, S., et al, (2000) Tools for Thought: What is New and Important about the E-conomy, *http://e-conomy.berkeley.edu/*

Courtney, H. Kirkland J., and Viguerie, P., (1999) Strategy Under Uncertainty, *on Managing Uncertainty*, Harvard Business Review, Boston, MA

Credit Suisse First Boston, (2001) *Global Aerospace & Defence Directory and outlook*, Equity Research 2001

Curry, J. and Kenney, M., (1999) E-commerce: Implications for Firm Strategy and Industry Configuration, *http://e-conomy.berkeley.edu/*

Dahlander, P. (2000) The submarine – a versatile platform in a RMA network, *Militärteknisk Tidskrift*, Number 4 2000

Defense Science Board, (1999) *Final Report of the Defense Science Board Task Force on Globalization and Security*, December: Office of the Under Secretary of Defense for Acquisition and Technology: Washington DC.

Defence Systems Daily, (2000) *Northrop Grumman sells Aerostrucutres, focuses on defence electronics*, 2000 06 13

Doz, Y.L. and Hamel, G., (1998), *Alliance Advantage, The Art of Creating Value through Partnering*, Harvard Business School Press, Boston, MA

Dreborg K-H., et al, (1994), *Planera för det okända? Om hantering av osäkerhet*, Försvarets forskningsanastalt, Stockholm

Economist, 1 A Survey of the New Economy: Untangling e-commerce, *The Economist*, 23 09 2000

Economist, 2, A Survey of E-Management: Inside the Machine, *The Economist*, 11 11 2000

Eriksson, E.A., (1997), *Teknologisk och industriell bas för försvarets anpassningsförmåga*, FOA Scientific Report, FOA Defence Research Establishment, Stockholm

Eriksson, E.A., 2001, Who will harness the power of the Network, Paper for the *CRIA Conference –"The Internet and State Security Forum*" Trinity College, Cambridge, 19 May 2001

Evans, P. and Wurster, T., (1999) Getting Real About Virtual Commerce, *Harvard Business Review*, Nov-Dec 1999, Boston, MA.

Evans, P. and Wurster, T., (2000) *Blown to Bits: How the New Economics of Information Transforms Strategy*, Harvard Business School Press, Boston, MA

Fisher, A., (2000) Global Landscape: Benefiting from E-business, *Financial Times* (on line publications: www.ft.com) as of 15 05 2000.

Financial Times, (2000) Lex: B2B blues, *Financial Times* (on line publications: www.ft.com) as of 08 05 2000.

Financial Times, (2000) Special issue on Business to Business Marketplaces, *Financial Times*, 18 10 2000

Fine, C.H., (1998) *Clock Speed, Winning Industry control in the Age of Temporary Advantages*. Perseus Books, Reading, MA

Finnegan, P., (2000) Internet Squeezes Second-Tier Firms, *Defence News*, April 17 2000

Fothergill, N., (2000) Presentation at the IBC defence industry conference September 2000, London

Hagel, J. III. and Singer, M., (1999) Unbundling the Corporation, *Harvard Business Review*, March-April 1999, Boston, MA

Hamel G. and Prahalad, C.K., (1999) Competing for the Future, *Harvard Business Review on Managing Uncertainty*, Boston, MA

Hedvall M., (2000) *Hur snabbt kan en framtida svensk försvarsindustri färdigutveckla och producera materiel i händelse av ett hot?* FOA User Report, FOA Defence Research Establishment, FOA: Stockholm

Howe, J., (2001) Globalisation: a view from inside a European company in Britain, World Defence Systems: Procurement Edition, *Royal United Services Institute for Defence Studies*, Sovereign Publication Limited, London

James, A.D., (2000) Dual-Use and the Civil-Military Technology Relationship, paper presented to the 2000 *INES Conference*, June 15-17 Stockholm

James, A.D., (2000) *Strategies of Mid-Sized US Defence Electronics Companies*, FOA User Report, FOA: Stockholm

James, A.D., (2001) The prospects for a transatlantic defence industry, *in Chaillot Paper 44*, The Institute for Security Studies of Western European Union, Paris

Kelly, E., (2000) Web Wars, *Flight International*, 16-22 May 2000

Kindvall G., et al, (2000) *Nya paradigm för teknologi- och materielförsörjning – Evolutionär materielförsörjning i nätverk*, FOA User Report, FOA Defence Reseach Establishment, Stockholm

Lundmark M., et al, (2000), *Striving for security of supply – the Swedish model of mutual dependencies*, FOA User Report, FOA Defence Research Establishment, Stockholm

Lundmark M., (2001, forthcoming) Drivers for Transatlantic Links in the Defence Industry, FOI User Report, FOI Swedish Defence Research Agency, (former FOA), Stockholm

Ministry of Defence (Swedish) (1999), *Det Nya Försvaret*, Ministry of Defence (Swedish) (1999), Defence Bill 1999/2000:30.

Molas-Gallart, J., (2001) Dual-use and the interface between military and civilian technology: a comparative approach, appendix in: *Försvar och industri i internationell konkurrens*, IVA Royal Swedish Academy of Engineering Science, Stockholm

Nilsson P., (2000) From brute force to brainpower, *Militärteknisk Tidskrift*, Number 3, 2000

Northrop Grumman, (2001) http://www.northgrum.com/

Parkes, C., (2000) Netting business, *Financial Times*, July 24 2000

Ratnam, G., (2001) Hunting for Partners, *Defence News* June 4 2001

Regnér, P., (2000) Strategy Creation in Complexity – Adaptive and Creative Learning Dynamics, Conference paper, *The Institute of International Business at the Stockholm School of Economics*

Reuters, (2000) C7R News B2B Review – MyAircraft, *www.business.reuters.com*, November 9 2000

Saab AB, (2000) Interim report Q1- Q3 2000

Saab (2001) *www.saab.se*

Slowotzky, AJ., (2000) The Age of the Choiceboard, *Harvard Business Review*, Jan-Feb 2000, Boston, MA

Stalk, G., Evans P. and Shulman, LE., (1999) Competing on Capabilities, *Harvard Business Review on Corporate Strategy*, Boston, MA

SOU 2000:54 *Det militära försvarets materielförsörjning*, Fritzes offentliga publikationer, Stockholm

SOU 2001:21 *Försvarsmateriel på nya vilkor*, Fritzes offentliga publikationer, Stockholm

SOU 2001:22 *Forskning och utveckling för totalförsvaret*, Fritzes offentliga publikationer, Stockholm

Svensson, P., (2000) Information fusion in the future Swedish RMA defence, *Militärteknisk Tidskrift*, Number 3 2000

Swedish Armed Forces, (2001), *Defence acquisition plan*, OH presentation Nov. 2001

Uchitelle, L., (2000), Who's afraid now that big is no longer bad? *New York Times*, www.nytimes.com/2000/11/05

Wall, R., (2000) Aerospace E-Biz Ventures Encounter Regulatory Pitfalls, *Aviation & Space Technology*, May 15 2000

Williams, J.R., (1998) *Renewable Advantage: Crafting Strategy Through Economic Time*, The Free Press, New York

Interviews conducted for the study

Ericsson Micowave Systems, (Feb. 2001)

Kockums, (May 2001)

Hägglunds Vehicle, (April 200)

Saab AB, Saab Tech Systems, (Jan. 2001)

Saab AB, Aerotech Telub, (Feb. 2001)

Swedish Armed Forces (Nov. 2000)

Volvo Aero, (April 2001)