Chapter 2

Current trends in naval shipbuilding

2.1 Australia's naval shipbuilding sector is influenced by worldwide developments and cannot be examined in isolation. Since the end of the Cold War, the global shipbuilding industry has undergone significant transformation. This chapter considers the broader context of the industry as a background for the committee's consideration of developments in Australia. It examines the factors shaping worldwide trends in naval shipbuilding and looks specifically at the experiences of major naval shipbuilding countries. In particular, the committee looks at demand and supply patterns, the effects of changing technology, and the dynamics of the international market.

2.2 A delegation of committee members who visited South Korea and the United States (U.S.) witnessed first hand some of the developments taking place overseas in the naval shipbuilding and repair industries.

The experience overseas

2.3 Today's modern military forces rely on new and advanced technology to build greater defence capability—they want qualitative efficiency based on advanced technology rather than quantitative force based on manpower.[1] This desire for technological superiority is manifest in the increasing demand for more complex naval vessels with better, smarter technology. Most notably, the weapons, sensor and communication systems in modern warships are becoming more sophisticated. For example, Raytheon Australia surmised that because of 'increasing combat effectiveness and the need to constrain crew sizes future naval vessels are likely to be increasingly complex with greater use of automation and systems'.[2] Making a similar observation, the United Kingdom's Ministry of Defence (MOD) noted that:

> A manpower-intensive platform-heavy and predictable doctrine has been replaced by the requirement for sophisticated, rapid and precise military solutions.[3]

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1 China as an emerging global power provides a good example of this trend in military modernisation. See Senate Foreign Affairs, Defence and Trade References Committee, *China's emergence: implications for Australia,* March 2006, pp. 81–86.

2 *Submission 35*, p. 8.

3 Ministry of Defence, Policy Paper, Paper no. 5, *Defence Industrial Policy*, October 2002, p. 7.

Falling demand, increased capability

2.4 This quest for improved capability through developments in technology is expensive and creates tension between the desire for cutting edge technology and the ability to pay for it. Vice Admiral Paul E. Sullivan, U.S. Commander of the Naval Sea Systems Command, noted that the cost of warships has continued to increase. Furthermore, he informed the House Armed Services Committee on Shipbuilding that the costs relating to combat and weapons systems are the 'single largest driver in shipbuilding, even if costs of the weapons themselves are excluded'.[4]

2.5 Dr Donald Winter, U.S. Secretary of Navy, highlighted the challenges created by the cost and affordability factors determining a country's shipbuilding program. He identified how these two inter-related forces—the rising costs associated with advances in technology and a decline in the overall demand for naval vessels—are influencing defence policy:

> The nexus between technology and resources is the driving factor behind the dramatic changes in our plans for new ships…We are being pulled in two opposite directions.
>
> On the one hand, the Navy exerts constant pressure on itself and on industry to increase the capabilities of our platforms through the application of advanced technology. This costs money. At the same time, the Navy is under pressure to control costs. The greater capabilities, generally, the higher the costs—which means that the Navy can afford to buy fewer platforms. But that too drives up the cost per ship. Both factors—greater capability and lower numbers of ships—are pushing the cost of shipbuilding to prohibitive levels.[5]

2.6 He concluded:

> The upshot is clear: technology has provided us with extraordinary capable ships but we cannot afford to buy as many of them as we would like.[6]

2.7 He then spelt out the predicament facing maritime countries seeking to maintain their naval capability:

> We need a new shipbuilding model that can cost-effectively provide significant increases in capability at low rates of production.[7]

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4 Vice Admiral Paul E. Sullivan, Ms Allison Stiller, Rear Admiral Charles Hamilton, II, statement before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006, p. 6.

5 Dr Donald C. Winter, Secretary of Navy, 'Sea Air Space Exposition', Marriott Wardman Park Hotel, Washington, D.C., 4 April 2006, p. 3.

6 Dr Donald C. Winter, Secretary of Navy, 'Sea Air Space Exposition', Marriott Wardman Park Hotel, Washington, D.C., 4 April 2006, p. 4.

2.8 Indeed, the increasing demands for improved capability at an affordable cost have produced dramatic shifts in the industry. Businesses have adopted new practices and entered into a range of different arrangements.[8]

New shipbuilding model

2.9 The South Australian government noted how the challenge for military shipbuilders to manage the increasing cost of ship design, development and construction in a fiscally constrained environment is leading to significant structural changes.[9]

> Faced with tight defence budgets and with little prospect of amortising military ship building costs through increased export or commercial activity, Governments have led the rationalisation process to ensure capability is maintained.[10]

2.10 This trend toward consolidation from a larger industrial base with shipbuilders amalgamating to a few in number is occurring in many maritime nations.[11] In 2002, the UK MOD noted that this re-structuring was also evident among the major sub contractors:

> Consolidation and globalisation at the level of prime integrators, as well as of sub-primes or specialist high level sub-systems suppliers, look set to continue if defence companies are to remain profitable and retain the capability to undertake large defence projects. Cost and capability pressures on national governments will not diminish, and even the US may struggle to retain a wholly independent national capability in all areas of defence. The process of consolidation has not concluded, and companies, responding

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7 Dr Donald C. Winter, Secretary of Navy, 'Sea Air Space Exposition', Marriott Wardman Park Hotel, Washington, D.C., 4 April 2006, p. 4.

8 The UK Ministry of Defence explained that in the 1990s new market conditions emerged, brought about by constrained budgets, increasingly technologically advanced solutions and the drive for greater efficiency, which forced 'radical restructuring within and across national borders'. Ministry of Defence Policy Paper No. 5, *Defence Industrial Policy*, October 2002, pp. 8–9.

9 *Submission 9*, p. 17.

10 *Submission 9*, p. 18.

11 See for example, John Sprat, 'Naval shipbuilding—last chance', *Asia-Pacific Defence Reporter, June 2004*, p. 19. See also comments by Dr Paul Richard Brabin-Smith, 'Priorities for Defence innovation in Australia, *The Business of Defence: Sustaining Capability*, CEDA, August 2006, p. 31 and Mark Thomson, 'Competition in Australian Defence procurement', *The Business of Defence: Sustaining Capability*, CEDA, August 2006, p. 73.

> to the need to position themselves in a changing market, will continue to seek restructuring opportunities. [12]

2.11 The same cost pressures have encouraged an increasing mutual interdependence among prime companies and also among major sub-prime contractors. This interdependence looks likely to continue.[13] For instance in the United Kingdom, BAE Systems and VT Shipbuilding have entered a cooperative arrangement for the Type 45 destroyers. This approach has 'allowed both parties to plan and invest for the longer term, train new workers and deliver benefits through economies of scale, with each facility gearing up to produce deliverables across the entire class'.[14] According to the Managing Director of BAE Systems Naval Ships:

> This longer term, co-operative approach to Type 45 has enabled both businesses to develop their warship building capabilities for the future at the same time providing value for money.[15]

2.12 This trend toward business consolidations, partnerships and alliances cuts across industries and national borders as countries are finding that, especially with highly complex systems, they cannot be self-sufficient in all aspects of a ship's design and construction.

Globally integrated production systems

2.13 Changing technology and the increasing costs associated with the design and development of state-of-the-art communication and combat systems in particular has meant that few countries or companies in their own right can produce such sophisticated and expensive systems. There is a trend toward what the department of Industry, Tourism and Resources termed 'globally integrated production systems'.[16] For example, Professor Peter Dombrowski noted that the U.S. Navy has taken steps to explore promising technologies developed elsewhere in the world. He used the HMS *Triton* as a model for the future which involves collaborative development between the United States and Great Britain. He explained:

> Such collaborative development offers the possibility of sharing R&D costs and combining technical capabilities to produce a more innovative product than might have been otherwise possible. In addition, if ultimately

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12 Ministry of Defence Policy Paper No. 5, *Defence Industrial Policy,* October 2002, pp. 8–9.

13 Ministry of Defence Policy Paper No. 5, *Defence Industrial Policy,* October 2002, pp. 8–9.

14 Vic Emery, Managing Director, BAE Systems Naval Ships, 'An Industry Perspective on UK Naval Construction', *Naval Construction in the 21st Century' conference*, Newcastle, UK, 12 and 13 October 2004.

15 Vic Emery, Managing Director, BAE Systems Naval Ships, 'An Industry Perspective on UK Naval Construction', *Naval Construction in the 21st Century' conference*, Newcastle, UK, 12 and 13 October 2004.

16 *Committee Hansard*, 3 July 2006, p. 70.

> satisfactory to both parties, it could provide for a larger production run since, presumably, both partners will have a stake in procuring offspring of the developmental model.[17]

2.14 He maintained that joint ventures, teaming and licensing arrangements that would allow the U.S. government and American shipbuilders to develop cooperative relationships with foreign companies were feasible. He suggested that cooperation between U.S. and overseas shipyards would be as likely to involve yards such as Bender and Bollinger as the big six, thereby potentially broadening the shipbuilding landscape.[18]

A new 'heavy industry' sector

2.15 A growing synergy in technologies is also occurring which is influencing the approach to the construction of naval ships. One of the major benefits flowing from the new construction methods is that it allows other industries to use the same facilities. Although naval shipbuilding is a highly specialised industry, there are strong parallels with the infrastructure needs of the oil and gas sector and the resources sector more generally.

2.16 This complementarity in technologies is evident in Australia. The Western Australia Chamber of Commerce and Industry observed that the risk profile for an oil and gas platform or an LPG plant is similar to the defence industry which encourages the technologies used in these sectors to blend.[19] It saw a unique opportunity for both industries to take advantage of the growing similarity between the two sectors:

> These industries are merging and their technologies are merging right across the world, and it is about who is the centre of technical excellence.[20]

2.17 The Western Australia Chamber of Commerce and Industry observed the extent of this blending and integration of technologies:

> It is like telecommunications: a merging of technologies is occurring in engineering. There are three things happening. Centres of technical

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17 Peter Dombrowski, 'The Globalization of the Defense Sector? Naval Industrial Cases and Issues', *Globalization and Maritime Power*, ed. Sam J. Tangredi, Washington, D.C., National Defense University Press, 2002, p. 9 of 16. http:www.ndu.edu/inss/books/books_2002/Globalization_and_Maritime_Power_Dec_02/12_ch11.htm (accessed 4 September 2006).

18 Peter Dombrowski, 'The Globalization of the Defense Sector? Naval Industrial Cases and Issues', *Globalization and Maritime Power*, ed. Sam J. Tangredi, Washington, D.C., National Defense University Press, 2002, p. 11 of 16. http:www.ndu.edu/inss/books/books_2002/Globalization_and_Maritime_Power_Dec_02/12_ch11.htm (accessed 4 September 2006).

19 *Committee Hansard*, 3 April 2006, p. 27.

20 *Committee Hansard*, 3 April 2006, p. 22.

> excellence in engineering are being established around the world, and engineering companies from around the world are coming together in one spot. If I am an expert in defence, I am basically trying to win defence contracts out of a place in the United States and I am engineering worldwide. If I am an expert in oil and gas, I am setting up in Houston, Yokohama and Perth and engineering oil and gas projects, and I have all my engineers doing that in one spot. There is a merging of engineering across the planet into bigger and bigger engineering centres.[21]
>
> We are also starting to see integration. Communications, especially broadband, have allowed people to move information 24 hours a day. Right at the moment, our engineers in Perth would be using companies to do drafting in India—and they will be working. Then they will move to San Diego and all around the planet to get their engineering and drafting done.[22]

2.18 In effect, naval shipbuilding can no longer be viewed as a discrete industry sector with capacity and productivity assessed on the basis of individual shipyards. Shipbuilding in the new technology era is part of the emerging heavy engineering sector. It is a process of collaboration and integration spanning the cutting edge of the electronics and IT industries. This partnership between companies and across sectors is also happening in the context of globalisation with alliances being formed between companies in different countries.

A protected industry

2.19 Even with a growing reliance on globally integrated production systems to supply and install high technology systems, many countries want to continue to build their own complex naval vessels. As much as possible they want to retain sovereignty over their own defence capabilities.[23] Thus, naval shipbuilding countries throughout the world seek to maintain a degree of control over their domestic industry by providing some form of direct or indirect assistance to their naval shipbuilding industry.[24] Vice Admiral Paul E. Sullivan told a subcommittee of the U.S. House Armed Services Committee on Shipbuilding that protection through direct or indirect subsidies can take different forms in the naval shipbuilding industry. He cited monetary grants given by a government to lower the price faced by producers (or

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21 *Committee Hansard*, 3 April 2006, p. 20.

22 *Committee Hansard*, 3 April 2006, p. 20.

23 *Committee Hansard*, 3 July 2006, p. 87.

24 See for example, Vice Admiral Paul E. Sullivan, Ms Allison Stiller, Rear Admiral Charles Hamilton, II, statement before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006, p. 10.

consumers) of a good, or mechanisms such as soft loans, debt guarantees, tax shelters, provision of equity capital and other types of assistance.[25]

2.20 A number of witnesses also remarked on the various incentives offered by governments to their naval shipbuilders in order to sustain a domestic shipbuilding capability (see also paragraphs 9.9–9.14). The Australian Shipbuilders Association asserted that some countries maintain industry protection in the form of 'hidden tariffs and subsidies that provide a false perspective on their efficiency'.[26] Rear Admiral Doolan (retired), National Defence Committee, Returned and Services League of Australia, contended that:

> Nations design and build and market warships to other nations for explainable reasons. They gain economically, industrially, scientifically and strategically. In sum, they sell warships to other countries because it is in their national interests to do so. Variations to industrial relations regimes, taxation laws, shipbuilding subsidies and a host of other like mechanisms are available to vendor governments marketing warships to other countries at a cost that is less than that for which the vessels can be produced in the buyer state. More to the point, most if not all of these mechanisms can be kept from public scrutiny under one guise or another.[27]

2.21 Tenix also drew attention to the range of government benefits in the form of subsidies and protective legislation that are used to shield the local industry from overseas competition.[28] The U.S. Jones Act is often cited as a form of protection.

Major shipbuilding economies

2.22 To examine more closely changes underway in the naval shipbuilding industry, the committee considers developments in two major military shipbuilding economies—the U.S. and Europe with a special emphasis on the UK. It also briefly discusses developments in the major shipbuilding countries in Asia.

The United States

2.23 The U.S. provides an example of a country where the demand for naval shipbuilding and repair has been falling for some time resulting in a significant decline in the production of warships. Orders for U.S. warships declined 60 percent during the decade following the end of the Cold War. The total number of warships in

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25 Vice Admiral Paul E. Sullivan, Ms Allison Stiller, Rear Admiral Charles Hamilton, II, statement before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006, p. 10.

26 *Submission 36*, p. 7.

27 *Committee Hansard*, 3 July 2006, p. 61. See also statement by Mr Kim Gillis, *Committee Hansard*, 18 August 2006, p. 39.

28 *Submission 26*, p. 3.

the U.S. Navy reached a peak at the end of the financial year 1987 then began to decline. In 2002, the number of ships in the U.S. fleet was just over half the number of the 1980s that comprised almost 600 ships at its peak.[29] The number of battle force ships in the Navy fell below 300 in August 2003 and by March 2005 had fallen to 288.[30] In March 2006, the U.S. Navy had 281 ships.[31] Recently, before the U.S. Armed Services Committee, Admiral Mike Mullen expressed concerns that the current rate of shipbuilding did not provide the stability America 'must possess to preserve its vital industrial base'.[32]

2.24 This steady drop in demand precipitated significant consolidation in the industry with shipyards closing or merging. In 1990, there were 14 U.S. yards capable of constructing large commercial ships and sophisticated warships and cutters. According to Dr Scott Truver, National Security Programs, Anteon Corporation, 'since then mergers, acquisitions, and closings have consolidated the nation's new construction capabilities for highly complex, large warships to just six private yards, owned by two corporations'—General Dynamics and Northrop Grumman.[33] Following the same pattern, the U.S. Navy's shipyards have consolidated and realigned facilities, falling from eight yards in 1990 to four in 2004.[34] For example, to reduce overheads and sustain engineering excellence, the Navy merged two West Coast facilities in 2003, Puget Sound Naval Shipyard and the Bangor-based Navy Intermediate Maintenance Facility.[35]

2.25 In pursuit of greater efficiencies, the U.S. Navy has developed a new model for its ship maintenance and repair operations. The objective 'is to take the four public

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29 Curt Weldon, Hearings on National Defense Authorization Act for Fiscal year 2003–H.R. 4546, House of Representatives, Committee on Armed Services, Military Procurement Subcommittee meeting jointly with Military Research and Development Subcommittee, 20 March 2002, p. 8.

30 Ronald O'Rourke, CRS Report for Congress, *Potential Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, updated 25 May 2005, p. CRS–68. He noted that 'the total number of battle force ships in the Navy reached a late Cold War peak of 568 at the end of FY 1987'.

31 Admiral Mike Mullen, Opening Statement before the Senate Armed Services Committee, 9 March 2006.

32 Admiral Mike Mullen, Opening Statement before the Senate Armed Services Committee, 9 March 2006.

33 Scott C. Truver, 'U.S. Shipyards Navigate between a Rock and a Hard Place', U.S. Naval Institute, *Proceedings*, March 2004 and also Vice Admiral Paul E. Sullivan, Ms Allison Stiller, Rear Admiral Charles Hamilton, II, statement before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006, p. 9.

34 Scott C. Truver, 'U.S. Shipyards Navigate between a Rock and a Hard Place', U.S. Naval Institute, *Proceedings*, March 2004.

35 Scott C. Truver, 'U.S. Shipyards Navigate between a Rock and a Hard Place', U.S. Naval Institute, *Proceedings*, March 2004.

repair yards and operate them as a single enterprise: common business practices, common procedures to flow the work force among the yards to accommodate surges of work and try to create efficiencies'.[36]

2.26 The 1990s also witnessed the creation of joint ventures between foreign and U.S. shipyards, 'primarily motivated by the desire to construct certain ship types within the United States and to compete in the U.S. market'.[37]

The U.S.—the Arms Export Control Act and the International Traffic in Arms Regulations (ITAR)

2.27 The U.S. has a clearly stated and well-established protectionist policy for their shipping industry. *The Merchant Marine Act, 1920* stipulates that no merchandise shall be transported by water between points in the United States either directly or via a foreign port in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States.

2.28 The U.S. believes that such measures are necessary to ensure that the country has a merchant marine of 'the best equipped and most suitable types of vessels sufficient to carry the greater portion of its commerce and serve as a naval or military auxiliary in time of war or national emergency'.

2.29 This statutory requirement that all U.S. flag ships be built in the U.S. means that the U.S. shipbuilding industry is effectively shielded from genuine competition from overseas. The substantial volume of shipbuilding created by this legislation assists productivity in the U.S. On the other hand, other countries are effectively closed out of the U.S. shipbuilding market. The Australian Manufacturing Workers Union highlighted the closed nature of the industry:

> …the recent US free trade agreement failed to get access to the US shipbuilding industry, symptomatic that the US government, for all of its rhetoric about free trade, sees shipbuilding as a key strategic industry and is not prepared to sell it out for supposed gains in a free trade agreement with Australia.[38]

2.30 The U.S. also has stringent policies that control the sale of defence articles and defence services. The policy, reflected in the *Arms Export Control Act 1976* (AECA), rests on the premise that all such sales must be consistent with the foreign

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36 Vice Admiral Phillip Balisle, Naval Sea Systems Command, 'Building more efficient support for Navy's ships, 28 March 2005, excerpts from interview reproduced *Federal Times.com.* See also Scott C. Truver, 'U.S. Shipyards Navigate between a Rock and a Hard Place', U.S. Naval Institute, *Proceedings*, March 2004.

37 National Security Assessment of the U.S. Shipbuilding and Repair Industry, May 2001, Executive Summary. See also paragraphs 2.11–2.12.

38 *Committee Hansard*, 28 June 2006, p. 42.

policy interests of the United States. The following strict conditions apply to the sale or lease of defence articles and services—the sale or lease would strengthen the security of the United States and promote world peace; the recipient agrees not to transfer title to, or possession of, the article or service without prior approval; the recipient has the capability and intent to maintain and protect the security of the article or service and is eligible to purchase or lease the article or service.[39] The International Traffic in Arms Regulations (ITAR), which provides for the promulgation of implementing regulations, executes the AECA statutory authority to control the export and import of defence articles and services.[40]

Europe

2.31 The shipbuilding industry in Europe has also experienced consolidation over the past decades with job losses and yard closures. According to a recent UK Ministry of Defence White Paper, Europe has twelve military shipbuilding companies with most in the UK, France, Germany, Spain, Italy and the Netherlands.[41] The industry in Europe, however, has taken a different course from that taken in the U.S.

2.32 The UK Ministry of Defence noted that in the United States, changing market conditions prompted the consolidation of the industry into a handful of 'super' prime contractors. With regard to Europe, however, it found that:

> …although major companies such as BAE Systems and European Aeronautic Defence and Space Company (EADS) have emerged, the general pattern of industrial restructuring so far has been to create joint ventures—MBDA, Agusta-Westland—rather than consolidation on the US model. This reflects Europe's history of collaborative programmes, and allows a degree of national control to be retained. The disadvantage is that it is more difficult to create synergies and strong managerial structures. Some European companies have also widened their markets by investing into the industries of other countries, presenting themselves as multinational companies with more than one national identity: notably BAE Systems, Rolls-Royce and Thales, but with smaller companies also having significant interests abroad.[42]

2.33 Mr Günter Verheugen, Vice-President of the European Commission responsible for Enterprise and Industry, commented more directly on the influence

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39 Section e, *The Arms Export Control Act.* See also Peter F. Verga, Deputy Under Secretary of Defense, 2000, www.dami.army.pentagon.mil/pub/dami-fd/10.31.200.1300.ppt (accessed 20 September 2006).

40 U.S. State Department, http:www.pmdtc.org/itar_index.htm (accessed 29 September 2006).

41 Ministry of Defence, *Defence Industrial Strategy: Defence White Paper,* presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 73.

42 Ministry of Defence Policy Paper No. 5, *Defence Industrial Policy*, October 2002, pp. 8–9.

that national interest has on the rationalisation process in European shipbuilding industry. He stated that:

> The Commission is neither driving nor holding back the emerging trend of consolidation of naval shipbuilding yards. But whilst national consolidation has already begun in some countries, further cooperation between yards is hampered by diverging operational requirements of national navies and the absence of a truly common market for defence equipment.[43]

2.34 A recent report endorsed by the Interparliamentary European Security and Defence Assembly noted that the process of consolidation 'had turned out to be far more difficult than in the United States'. It also observed that European companies and governments are yet to adopt a common and cooperative approach to naval shipbuilding with countries focusing on their own particular concerns.

> The European naval defence industry today has to contend with the existence alongside one another of companies of different nationality, subject to different rules and with ties in certain cases to different governments. Market pressure alone is not enough to bring European companies closer together: to make large-scale reorganisation happen, government intervention is necessary.[44]

2.35 Indeed, Professor Keith Hartley, Centre for Defence Economics, University of York, observed that there had been relatively few 'giant' mergers of the type that characterised the U.S. and European aerospace industries. He explained:

> Typically, the European warship industry is structured around a national leader which forms a domestic monopoly. These include BAE Systems in the UK; DCN (state-owned) in France, Fincantierei (state owned) in Italy; Izar in Spain (state owned, comprising a merger of the Bazan yard and the private civilian yard, Astilleros Espanoles); HDW and Thyssen in Germany; and Kockums in Sweden.[45]

2.36 He maintained that European maritime nations place a high value on retaining an independent industrial capability in warships and support their warship building

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43 Günter Verheugen, Vice-President of the European Commission responsible for Enterprise and Industry, European Maritime Policies and Perspectives, Maritime Industries Forum, Bremen, 25 January 2005.

44 Assembly of WEU, the Interparliamentary European Security and Defence Assembly, *The Future of the European Naval defence industry*, 6 December 2005, p. 3 of 19. A Communication from the Commission to the Council, The European Parliament, The Economic and Social Committee and the Committee of the Regions stated bluntly that 'Wide-ranging co-operation between yards is still hampered by diverging operational requirements from national navies.' Commission of the European Communities, 2003, p. 13.

45 Keith Hartley, Director, Centre for Defence Economics, University of York, *Naval Shipbuilding in the UK and Europe: A Case for Industrial Consolidation?*, n.d., p. 2.

through preferential purchasing; ie a buy British or buy French policy.[46] This means that despite the pressure to consolidate, the shipbuilding industry in Europe is characterised by duplication with 'many countries and yards involved in the design and build of destroyers and frigates (9 countries), small warships (6 countries) and conventional submarines (5 countries)'.[47]

A protected industry

2.37 As noted above, European maritime nations support their warship construction through preferential purchasing policies which favour the home industry.[48] Indeed, naval shipyards in a number of member states of the European Union are state-owned or state-controlled.[49] The European Union recognises that Defence industries are of a strategic nature and therefore have a special relationship with the state:

> As sole clients, states determine demand for products on the basis of military needs linked to their strategic objectives and thus define the size of the market. They participate, to varying degrees depending on the country, in the financing of R&D, thus influencing the technological know-how and long-term competitiveness of industry…State control also extends to industrial restructuring, although to a more limited degree, and even to the level of shareholding…
>
> States may…see fit to set up special supply guarantees. The maintenance of a purely national industrial capacity for defence may seem a reliable way of being able to respond to strategic interests and emergency situations (military operations).[50]

2.38 It accepted that state support is required because production volumes are limited and the risk of commercial failure high.

2.39 On this matter of protection, Tenix noted in its submission that the European Economic Union has implemented measures to prevent subsidies for commercial

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46 Keith Hartley, Director, Centre for Defence Economics, University of York, *Naval Shipbuilding in the UK and Europe: A Case for Industrial Consolidation?*, n.d., p. 2.

47 Keith Hartley, Director, Centre for Defence Economics, University of York, *Naval Shipbuilding in the UK and Europe: A Case for Industrial Consolidation?*, n.d, p. 2.

48 See paragraphs 2.31–36 and chapter 9—Productivity paras 9–14.

49 Commission of the European Communities, Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, 'LeaderSHIP 2015: Defining the Future of the European Shipbuilding and Repair Industry—Competitiveness through Excellence', 2003, p. 14.

50 Commission of the European Communities, *Green Paper: Defence procurement*, 23 September 2004, pp. 4–5.

vessels, but that no similar prohibition exists for naval shipbuilding projects.[51] Its concern, however, was with the benefits that accrue to European shipbuilders:

> Many shipbuilders in Europe who specialise in large naval vessels are Government-owned and derive considerable financial advantage from that ownership.[52]

2.40 Despite the costs involved, the European naval shipbuilding nations continue to strive for national independence in warship construction. Their governments, as major buyers, or in some cases the only buyers of warships, use their purchasing and political power to protect their domestic shipbuilding industry.

Ship repair

2.41 With regard to ship repair, the UK Ministry of Defence noticed the move toward rationalisation in the industry and a similar pattern of influence exerted by the respective nations:

> Similarly, there are extensive military ship repair facilities throughout Europe and within the US, many still controlled by national governments; consolidation and rationalisation is also evident in this area. To date, rationalisation has not extended across borders, although some cooperative programmes have been pursued by European governments. Retaining national military support facilities is widely seen as an essential requirement for mounting and supporting operations of a first class Navy.[53]

2.42 The committee now turns to look in more detail at developments in the naval shipbuilding industry in the UK.

The United Kingdom

2.43 The United Kingdom is an example of a member of the European Union that has witnessed a decrease in ship orders resulting in a series of closures and consolidations of naval shipbuilders.[54]

2.44 In 2005, the RAND Corporation produced a report, commissioned by the UK's Ministry of Defence, that examined the domestic capacity for naval ship construction (The UK's naval shipbuilding 2005 report). It noted that the end of the Cold War brought about a profound reduction in naval shipbuilding for the UK as

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51 *Submission 26,* p. 3.

52 *Submission 26,* p. 3.

53 Ministry of Defence, *Defence Industrial Strategy: Defence White Paper,* presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 73.

54 The UK's Naval Shipbuilding 2005 Report, p. 12.

requirements lessened and the country sought to capitalise on the 'peace dividend'. After 1970, the Royal Navy combatant fleet experienced a marked and steady decline in its size. In 2000, it had shrunk to about 60 per cent of its 1970 size.[55]

2.45 The resultant fall in ship orders caused a series of closures and consolidations of naval shipbuilders.[56] According to the UK's naval shipbuilding report, the industry in the UK also underwent a period of de-nationalisation in the late 1980s:[57]

> From 1985 to 1990, designated shipyards were sold off. Coincidently, this period also corresponded to the time when naval ship orders began to decline. At the start of privatisation, the naval shipbuilders were, for the most part, profitable. Soon after privatisation finished, the bottom fell out of the market and these shipyards struggled to survive. There were too many shipyards chasing too few programmes. The intense competition that ensued during this period—driven by the MOD policy to compete work—led to very low bids from firms that were simply looking to fill their yards with work…although this situation may have led to better prices for the MOD, it left the shipyards in a vulnerable state. Certainly, there was little investment, modernisation, or upgrades in the shipyards during this period.[58]

2.46 This situation resulted in a number of shipyards going into receivership while others re-structured under single ownership.[59] The Ministry of Defence reported that ownership of UK warship yards has consolidated to the extent that by 2005 only two main companies existed with the skills necessary to design, manufacture and integrate complex warships.[60]

2.47 Similar to other European nations, the UK places a priority on retaining its industrial capability in warships. Professor Keith Hartley noted in particular that the British government is the only buyer of nuclear-powered submarines for its navy, and is 'willing to pay the price of creating and retaining' its national submarine industrial base.[61]

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55 The UK's Naval Shipbuilding 2005 Report, p. 12.

56 The UK's Naval Shipbuilding 2005 Report, p. 14.

57 See for example, Professor Martin Edmonds, Director, Centre for Defence and International Security Studies, 'UK shipbuilding: a new Direction?', 2001.

58 The UK's Naval Shipbuilding 2005 Report, p. 15.

59 The UK's Naval Shipbuilding 2005 Report, pp. 15–16.

60 Ministry of Defence, *Defence Industrial Strategy: Defence White Paper*, presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 73.

61 Keith Hartley, *Naval Shipbuilding in the UK and Europe: A Case for Industrial Consolidation*, n.d., p. 5. He made the same observation about the French government.

South Korea, Japan and China

2.48 There is little information available about the military shipbuilding industry in Asia. It is without doubt, however, that countries such as South Korea, Japan and China now dominate the construction of commercial vessels. According to the 2004 global order book position, South Korea secured 37.6 per cent of the outstanding orders; Japan had a 28 per cent share while China accounted for 14.2 per cent of the orders.[62]

2.49 The South Korean shipyards are renowned for their efficiency in producing commercial tankers. Their business model is based on high-rate production and they have forward orders running for many years.[63] Dr Stephen Gumley, DMO, told the committee that Defence had purchased the *Delos*, a 37 000-tonne vessel, from a South Korean shipyard for $A50 million.[64] He maintained that the production capacity of these shipyards was 'just phenomenal'.[65] Indeed, Lieutenant General David Hurley recalled a tour of those yards:

> …we…asked the Koreans if they would be interested in building a 20,000-tonne LHD, they looked down their noses because they 'don't build tugs'. It was just a size they do not consider…[66]

2.50 According to a 2003 report by First Marine International Limited, South Korean shipyards took over 50 per cent of the container ship market in 2002, over 40 per cent of the oil tanker market and significant shares of the gas and chemical tanker markets. South Korean shipbuilders are endeavouring to pursue the higher value sectors to maximise profits, in particular the LNG carriers. They are yet to make their mark to any significant degree on the passenger ship sector, which is also a high value added sector.[67]

2.51 The committee's delegation to South Korea obtained some insights into naval shipbuilding in that country. The Republic of Korea's naval shipbuilding industry is structured around three major primes. Daewoo Shipping and Marine Engineering (DSME) and Hyundai Heavy Industries (HHI) are the principal suppliers of frigates and destroyers, while Samsung Heavy Industries also supplies landing craft. DSME's majority shareholder is the Republic of Korea Government, while Hyundai is completely privately owned.

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62 ACIL Tasman, *Naval shipbuilding in Australia: A background briefing*, 9 February 2006, p. 10.

63 See statement by Mr Kim Gillis, *Committee Hansard*, 18 August 2006, p. 46.

64 *Committee Hansard*, 18 August 2006, p. 44.

65 *Committee Hansard*, 18 August 2006, p. 45.

66 *Committee Hansard*, 18 August 2006, p. 46.

67 The European Community, *Overview of the international commercial shipbuilding industry*, Background Report, First Marine International Limited, May 2003, p. 18.

2.52 Members of the delegation were interested to observe that, due to the scale of their production and diversified commercial product base, both DSME and HHI are each able, in effect, to operate Common User Facilities within one company. The efficiencies derived from economies of scale, automation and modular construction were clear.

2.53 While naval construction comprises a small proportion of DSME's production, representatives commented that the technology gain and prestige associated with naval construction are key drivers for DSME's naval building program. Representatives noted that it is the profit from commercial building which makes naval shipbuilding viable, although the Republic of Korea government does make down payments for naval acquisitions. Naval shipbuilding also forms a small component of HHI's construction work and representatives confirmed a preference for commercial work. The naval vessels produced by HHI include submarines, destroyers, frigates, corvettes, patrol vessels, fast attack craft and logistic support vessels. HHI is developing a 10 000 tonne Aegis destroyer (HDD-10000) and a 16 000 tonne Landing Platform Dock.

2.54 Japan produces mainly bulk carriers for the home market, oil and chemical tankers and gas carriers. The Japanese shipbuilding industry has lost a considerable share of the container ship market to Korea.[68] Chinese builders concentrate on tankers and bulk carriers and hope to achieve the capability to build LNG carriers.[69] The Government of South Australia submitted that China will emerge in the next decade as a serious low cost competitor as it expands its shipbuilding infrastructure and starts to build more complex ships.[70]

Segmentation in the shipbuilding industry

2.55 A 2006 study by ACIL Tasman surmised that this growing segmentation of the shipbuilding industry is 'an indication of the continuing cost competitiveness of Korea and China in the tanker and bulk carrier end of the construction market and the growing specialisation of industrialised countries in the high-end shipbuilding'.[71]

2.56 The Australian shipbuilder Austal agreed with the view that the move in the production of the larger and less complex steel ships from Europe to Japan, South Korea and China was due mainly to cost efficiencies, particularly the labour component associated with the construction of large steel commercial vessels:

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68 The European Community, *Overview of the international commercial shipbuilding industry*, Background Report, First Marine International Limited, May 2003, p. 18.

69 The European Community, *Overview of the international commercial shipbuilding industry*, Background Report, First Marine International Limited, May 2003, p. 17.

70 *Submission 9*, p. 17.

71 ACIL Tasman, *Naval shipbuilding in Australia: A background briefing*, 9 February 2006, p. 12.

> The technology associated with the majority of very large steel ships for commercial applications is relatively simple, mature and well understood, and contracts are generally awarded on the basis of price and delivery times. As a result, global construction of very large steel ships has steadily migrated to lower cost countries—principally from Western Europe to Asia (South Korea, Japan and increasingly China) and to some extent Eastern Europe.[72]

2.57 Thiess Pty Ltd also drew the committee's attention to the shift of major shipbuilding activity away from developed countries to countries with cheaper labour. It explained:

> Korea and China, but particularly Eastern European countries such as Poland and Romania, have benefited from that evolution. However, it is interesting to note that ships with high value adding are still constructed in first world regions such as Western Europe. Large complex passenger vessels are all being built in countries like Norway or France. Only lower value cargo ships with low levels of technology are being constructed in less developed countries.
>
> This indicates that cost of labour is only a small parameter in the overall cost of a complex vessel such as a naval ship. Capacity to program manage huge projects, expertise in a large number of disparate disciplines and capacity to integrate and resolve problems across a wide variety of technologies are not typically second or third world competencies.[73]

2.58 Clearly, the shipbuilding industry divides into sectors according to the degree of complexity involved in the construction of the ship. At the moment, countries such as Japan, South Korea and China have captured the global market for large steel hulled ships associated with relatively simple and well established technology, mainly tankers and bulk carriers. While fiercely competitive in this sector, they are not major competitors in the naval shipbuilding sector where even countries with a long tradition and recognised capability struggle to keep pace with advances in technology.

2.59 The committee now turns to international developments in the methods of producing a naval ship.

Current trend—growing complexity in the construction of naval vessels

The fall in demand for naval vessels coupled with the ever increasing advances in technology, such as the use of 2D/3D computer aided design and modularisation are revolutionising the way ships are built. The concept of shipbuilding has shifted away from the traditional method where ships were constructed on a slipway and built up as

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72 *Submission 7*, p. 5.

73 *Submission 22*, p. 12. See also evidence from Rear Admiral Rourke, (retired), *Committee Hansard*, 3 July 2006, p. 105.

they went forward. Although modular construction has been used in Australia for many decades, this method of construction has become increasingly complex as the modules themselves increase in size and sophistication. Ships are now designed to be built in large modules that can be near complete before final consolidation. The Chamber of Commerce and Industry of Western Australia noted:

> Most ships used to be stick built. All the people would turn up on site and start by levelling the ground. They would then put a stick—a piece of steel—in the ground and bolt it down. It would be like a meccano set. They would build it that way. That is the way people traditionally built worldwide—stick build. Engineering has changed. Our ability to integrate has allowed us to move away from the stick build concept. We can build a 3,000, 4,000 or 5,000 tonne module somewhere, roll it up and plonk it down. So now we have modularisation—integration.[74]

Building in modules

2.60 The trend toward building a ship using modules has dramatically changed the dynamics of shipbuilding and according to the Government of South Australia has 'proved to be the most cost effective way to deliver modern warships'.[75] Some commentators refer to this change as a 'paradigm shift' in the construction of modern ships which allows more flexibility and reduces cost and risk.[76] The use of modular assembly is now common practice:

> The world has changed. It is all about integration—being able to bring big bits together into a central point and those bits come from all around the world.[77]

2.61 Modular ship production starts with hundreds of smaller subassemblies such as piping sections, ventilation ducting, other shipboard hardware and major machinery items being joined together. These sections are then assembled with other shipboard sensors and weapons to form ship modules.[78] The Government of South Australia described the final assembly of modules into the finished product:

> Modules, often weighting hundreds of tons, and between 60% to 90% complete, are then moved to the final consolidation site where they are aligned and then welded together on land to form the completed ship hull.[79]

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74 *Committee Hansard*, 3 April 2006, pp. 20–21.

75 *Submission 9*, p. 14.

76 The Hon. Francis Logan and Mr John O'Hare, Government of Western Australia, *Committee Hansard*, 3 April 2006, p. 93; ADI, *Committee Hansard*, 28 June 2006, p. 3.

77 *Committee Hansard*, 3 April 2006, p. 19.

78 *Submission 9*, p. 14.

79 *Submission 9*, p. 14.

> A floating dock, slipway or shiplift is used to launch the completed hull… Following launch, final ship outfitting is completed at the wharf, systems are set to work, and pre-delivery certification and onboard crew training finalised.[80]

2.62 The integration of modules means that only one major site is needed to assemble the various parts of the ship that have been constructed elsewhere. Thus, a wide network of sites for construction of ship modules is now involved which, according to the Australian Industry and Defence Network Inc. (AIDN), accounts for 60 to 80 per cent of fit outs. Mr David Miller, Executive General Manager of Tenix, stated that 'it is simply the way we do business'.[81] He explained the advantages of this method of construction:

> The primary driver is simply that it allows you to distribute work across a large area. It lets you, as a shipbuilder, concentrate on the high-end value of the problem, which is bringing various building blocks together so that you can take the module work itself and subcontract either to other shipyards or to steel fabricators who are not necessarily shipyards. [82]

2.63 Many other witnesses also highlighted the benefits that derive from this new approach particularly the potential to lower construction costs significantly and to better plan and implement the various phases of a project:

> Imagine a module with seven different fabrication yards all building at the same time. You can crunch your schedules together, because they are all building a different bit and they are using their own skill sets. So you can crunch project times together and you can have the same amount of control, because it is all computerised. It is basically crunching it together and it is reducing costs—and that is what is driving the engineering world right at the moment.[83]

2.64 According to a recent study of major shipyards, the U.S. is yet to embrace fully this modern state-of-the-art shipbuilding technology. It found that, with a few exceptions, the extent of module construction in U.S. yards was 'disappointingly low'. It concluded:

> This is often the result of building legacy designs where vessel design did not incorporate outfit modules. Although most yards now accept the benefits of outfit module building, they, and in some cases the Navy, appear to be reluctant to spend man-hours re-designing legacy vessels and few are familiar with the spatial design techniques that make module building

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80 *Submission 9*, p. 14.

81 *Committee Hansard*, 20 April 2006, p. 3.

82 *Committee Hansard*, 27 April 2006, p. 3. See also ADI, *Committee Hansard*, 28 June 2006, p. 3.

83 *Committee Hansard*, 3 April 2006, p. 21.

> highly efficient and effective. In addition, most yards lack dedicated module assembly facilities and, even in those yards that are active in module building, the work is often carried out in dispersed areas within different buildings or even in the open.[84]

2.65 During the delegation's visit to the U.S.A., members witnessed the technological advances being made in naval shipbuilding and the move toward modular construction. Modularisation techniques now apply both in platform construction and systems design. In relation to platforms, larger modules are being produced allowing more fit-out and testing to occur on land earlier in the build process. The delegation noted that international benchmarking studies have assisted U.S. shipbuilders to improve their efficiency and production processes. In relation to systems, open architecture is enabling system components to be packaged and configured to specific requirements and combined with commercial off the shelf products.

2.66 For example, the delegation noted Bath Iron Works' (BIW) enhanced use of modular technology and the major efficiency gains achieved through this technology. The advent of mega units (larger modules, weighing up to 1400 tons) has enabled BIW to build ships in 21 separate units. Previously 25 units, each weighing up to 480 tons, were required. A key advantage of the larger mega units is that a greater proportion of ship fit-out can be undertaken prior to the ship's final assembly.

2.67 BIW participated in the U.S. Department of Defence's International Benchmarking study and has been able to use the experience to improve its efficiencies. In 2000, BIW rated below both the average US shipyards and international yards on a range of productivity criteria. By 2005, it was well above U.S. averages and slightly above international averages.

2.68 It should be noted that, according to Mr Miller, Executive General Manager, Tenix, Australia is one of the countries leading the world with developments in modular construction.[85] Modularisation in Australia will be discussed in chapter 6.

Modern construction and the challenges for the prime contractor

2.69 The continuing advances in technology present a particular challenge for naval shipbuilders who need high order technological as well as managerial skills. The success of any project depends on the expertise that shipbuilders bring to the integration of the various modules. As noted by the Western Australia Chamber of Commerce and Industries, the emphasis is on the future and the ability to integrate:

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84 First Marine International, *First Marine International findings for the global shipbuilding industrial base benchmarking study, Part 1: Major shipyards,* August 2005, p. 24.

85 *Committee Hansard*, 27 April 2006, p. 3.

> It is no longer about your ability to fabricate. Fabrication is a separate skill— and half a ship could come in or half a plant could come in.[86]

2.70 The growing requirement for highly complex systems in modern warships makes these systems and their integration a central concern to today's shipbuilders. ADI explained:

> …the role of traditional shipbuilding has changed away from a focus on platform—in other words, hull—construction to combat communications and command and control systems, as the demands of modern naval capability have become more sophisticated.[87]

2.71 The Collins class submarine built in Australia illustrates some of the complexities faced by a modern naval shipbuilder:

> Aboard the Collins, we have 108 systems integrated into a pressure hull, one of which we are required to safety certify. It is a safety-critical piece of equipment. That alone makes it an engineering and technical challenge. The shipbuilder, or the submarine builder, in that case, is responsible for integrating those systems into the vessel. The combat system constitutes a system and there are the communications system and other systems. Even by the time we are done with everything that can be construed as a related part of the combat and C3I system, we still have 100 systems that are integrated which work to keep the platform in motion, keep the crew safe at deep-dive depth and a lot of other things.[88]

2.72 The challenge for modern naval shipbuilders is to manage these extremely complex projects and the relationships between subcontractors. The critical role of bringing together increasingly sophisticated systems as a functioning whole means that the role of designing and integrating them is a highly difficult and very expensive undertaking. Companies, such as Raytheon as a Mission System Integrator (MSI), assume a prominent role in the construction of a modern naval vessel. Mr Ron Fisher, Managing Director, Raytheon Australia, explained:

> …in the US model for the DDG1000, Raytheon is the MSI and it has Northrop Grumman and Bath Iron Works, along with Lockheed Martin, as part of the subcontract. As the mission systems integrator, it is responsible for putting it together. In that sense, that is the new model going forward, rather than the traditional primes.[89]

2.73 Indeed, officials from Lockheed Martin told the committee's delegation visiting the U.S. that with Australia's Air Warfare Destroyers (AWDs), the anti-air

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86 *Committee Hansard*, 3 April 2006, p. 21.

87 *Committee Hansard*, 28 June 2006, p. 3.

88 *Committee Hansard*, 4 September 2006, p. 12.

89 *Committee Hansard*, 3 July 2006, p. 22.

warfare system, the combat system and the ship need to be built as a single entity with the integrated Aegis system providing the basis for the ship design. They noted that Australia is 'buying an Aegis ship, not buying a ship and putting Aegis on it'.

2.74 Further underlining this point, Lockheed Martin representatives explained to the committee's visiting delegation that systems integration is the major area of risk for naval shipbuilding programs. They stressed that while advanced technology exists and its performance is proven, the business models underpinning projects can be the most difficult factor to manage. To illustrate the skills needed to manage partnerships effectively, especially those responsible for major systems, they cited a recent major multi-national integration project—the F310 Frigate for the Norwegian Navy. The vessel included weapons and systems built in Italy, France, Norway and Germany and the ship was built in Spain.

2.75 According to ADI, shipbuilders must ensure that all components of the project—design, platform construction and the installation and integration of platform, combat and command support systems and the test and evaluation regime—produce an end product that is 'safe for our sailors and fit for purpose'.[90] ADI explained that to deliver the 'fully integrated package of capabilities, the core competencies of a successful prime tenderer must now be prime contracting, project leadership and project management'. It noted:

> Project management delivers the ability to ensure that schedules are developed and managed, costs are controlled, risks are identified and mitigated, resources are available when and as required, subcontractors are managed, overseas technologies are introduced and management tools are current and are applied. Modern shipbuilding also demands comprehensive systems design and development and the ability to manage the software development to schedule cost and performance—a critical success factor for modern projects. Finally, it demands systems integration and testing that demonstrates to government that the product, as specified, meets its requirements.[91]

2.76 Mr Ron Fisher, Raytheon, also underlined the crucial role of the modern shipbuilder as project manager. He noted that the shipbuilder fails if the shipyard, the fabricators and the module builders are not aligned.[92] ASC explained the skills needed for success:

> An efficient shipbuilder must be able to employ creatively advanced technology and associated systems to design processes for constructing parts of a ship in a logical sequence, to manage the complexity of bringing the thousands of sub-systems together in a workable and harmonious

90 *Committee Hansard*, 28 June 2006, p. 4.

91 *Committee Hansard*, 28 June 2006, p. 3.

92 *Committee Hansard*, 3 July 2006, p. 14.

> manner, and to test and set-to-work subsystems and then the entire ship system. Indeed, the fewer the number of complex ships to be built, the more importance is placed upon the ability to effectively design all aspects of the vessel and then employ advanced techniques to model, plan and schedule production/construction so that mistakes can be avoided and opportunities for improvements can be incorporated before any steel is cut.[93]

2.77 Clearly, shipbuilding is not primarily about metal shaping or fabrication. It is a highly complex undertaking that requires specialist skills to integrate modules in the final assembly of a naval vessel in order to satisfy all conditions of the contract. Shipbuilders throughout the world face this challenge but ultimately it is the responsibility of governments, as the sole buyers of naval vessels, to ensure that their shipbuilding projects are managed properly and effectively. Australian shipbuilders are no exception, they require highly developed skills to manage the complex task of ship construction. Defence similarly needs to be able to oversee and effectively manage a major naval acquisition project from inception to final product. These matters are taken up in part IV of the report.

Developing and retaining a skilled workforce

2.78 A number of studies have shown that the dramatic changes taking place in the shipbuilding industry place increased demands on the workforce, particularly given the rapid rate in the development of technology. Highly skilled people are needed to design, build and integrate the modules that comprise a large weapons platform. The 2005 UK's shipbuilding report noted:

> The design of modern naval ships is now done using sophisticated three-dimensional computer-assisted design (CAD) tools. Thus, the design workforce must be highly skilled and educated. Production also requires many proficient skills or trades, such as electricians, welders, and painters. Testing these complex systems also requires commissioning and test specialists to verify functionality. For certain skills, it might take years to become proficient (e.g., nuclear-qualified welders and commissioning engineers). The workforce for the production trades might peak in the thousands for a typical naval vessel. [94]

2.79 Even in some areas of steel fabrication, military standards are higher, for example in welding and surface flatness.[95]

2.80 It should be noted that the skills critical to the shipbuilding industry take time 'to build and effort to sustain'.[96] Specifically, the 2005 Rand Report on the UK's naval

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93 *Submission 17*, p. 9.

94 The UK's Naval Shipbuilding 2005 Report, p. 3.

95 See Defence Industrial Strategy, Defence White Paper, presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 74.

shipbuilding industrial base mentioned workers who have an intimate knowledge of naval shipbuilding rules and standards that are crucial to a company's naval success.[97] It stated:

> …it can take test and commissioning engineers 10 to 20 years working in the industry to become fully proficient. Furthermore, these engineers cannot be easily replaced in the short term by technical experts from other industries or even other shipbuilding fields (eg. submarines or naval surface ships).[98]

2.81 The RAND Corporation warned about the potential loss of expertise should these people leave the industry:

> Once made redundant, they [UK shipyards] believe, many of these highly skilled persons will not return to the shipbuilding profession.[99]

2.82 Most countries face difficulties in building-up and maintaining a highly skilled workforce to support their naval shipbuilding industry.[100] In the UK, 'design engineers are in short supply; and the intellectual support of underpinning science and technology is also fragile in some areas'.[101]

2.83 The U.S. also has concerns about retaining a skilled workforce especially where gaps in production mean that highly qualified and skilled workers leave the industry.[102] A consequence of the fall in demand for naval vessels in the U.S. has been

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96 Defence Industrial Strategy, Defence White Paper, presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 73.

97 The RAND Corporation, *The United Kingdom's Naval Shipbuilding Industrial Base: The Next Fifteen Years*, prepared for the United Kingdom' Ministry of Defence, 2005, p. 69. Note also statements by the Royal Institution of Naval Architects, Australian Division, that it takes at least 15 years for an individual to be educated, trained and developed into a senior professional naval architect capable of providing suitable advice in relation to a naval shipbuilding project. It stressed that such expertise cannot be switched on and off on a project basis. *Submission 14*, p. [2].

98 The RAND Corporation, *The United Kingdom's Naval Shipbuilding Industrial Base: The Next Fifteen Years*, prepared for the United Kingdom' Ministry of Defence, 2005, p. 69.

99 The RAND Corporation, *The United Kingdom's Naval Shipbuilding Industrial Base: The Next Fifteen Years*, prepared for the United Kingdom' Ministry of Defence, 2005, p. 69.

100 See for example, *Submission 17*, p. 9.

101 Defence Industrial Strategy, Defence White Paper, presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 74.

102 Statement of Cynthia Brown, President, American Shipbuilding Association, before the Committee on Armed Services, House of Representatives, 30 March 2004.

the erosion of the skill base in the shipbuilding industry.[103] Indeed, the ability to develop and maintain the expertise and higher order capabilities to sustain an in-country shipbuilding industry depends significantly on movements in demand. The situation in Australia regarding the availability of a skilled workforce is discussed in full in chapter 7 and further in chapter 15.

Peaks and troughs in demand for naval vessels

2.84 A number of commentators have remarked on the important role that governments have in assisting their domestic industry better manage the work flow. They point to the dominant position of governments in determining demands on the naval shipbuilding sector.[104] John F. Schank from the RAND Corporation, observed that the Ministry of Defence in the UK and the Department of Defense in the U.S. essentially set demand conditions—'they decide the nature of the programs in terms of their number and size; the nature of the market, that is, whether it's run by competition or allocation; and, at least indirectly, the number of firms that will survive'.[105] The following section briefly discusses the difficulties caused by uneven demand flows.

The United States

2.85 The U.S. faces workforce problems created by fluctuations in demand, with the boom and bust cycle in the technical areas of shipbuilding a particular concern.[106]

2.86 The recent U.S. study into major shipyards suggested that the government and Navy could assist shipbuilders by working with industry to smooth demand in order to provide more stable employment. Both the shipbuilding industry and government were concerned about the fluctuations in the shipbuilding workload and realised the need for a stable shipbuilding program to ensure 'minimum sustaining employment levels and retention of critical skills'.[107] The recently announced Chief of Naval

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103 Keith Hartley, Director, Centre for Defence Economics, University of York, *Naval Shipbuilding in the UK and Europe: A Case for Industrial Consolidation?*, n.d.

104 Richard E Self, President, Advanced Technology Institute and Executive Director, National Shipbuilding Research Program, before the House Armed Services Committee, Projection Forces Subcommittee, 4 April 2006; Roscoe Bartlett, Projection Forces Subcommittee, House Armed Services Committee, 5 April 2006.

105 John F. Schank, The RAND Corporation, 'Trends in the United Kingdom's Naval Shipbuilding Industrial Base. Lessons for the United States', Testimony presented before the Senate Armed Services Committee, Subcommittee on Seapower, 6 April 2006, p. 7.

106 First Marine International, *First Marine International findings for the global shipbuilding industrial base benchmarking study, Part 1: Major shipyards*, August 2005, p. 27.

107 Vice Admiral Paul E. Sullivan, U.S. Navy Commander, Naval Sea Systems Command, et al, before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006.

Operations' 313 ship fleet of the future was intended to address these concerns.[108] This plan, designed to produce a more stable and predictable funding environment, would provide industry with a definitive direction to develop strategic long-range plans.[109]

2.87 It should be noted, however, that industry recognised that it also had a role in adjusting to the movements in workload. The President of Northrop Grumman, Mr Philip Teel, considered that managing movements in demand was nothing exceptional and should be considered part of the job of running a naval shipbuilding program. He told the committee's visiting delegation that managing workforce volatility remained an issue regardless of the shipbuilding schedule, as the build process for each ship itself has workload peaks and troughs.

The United Kingdom

2.88 Having experienced a downturn in demand, rationalisation and erosion of capability in the shipbuilding industry, the UK has embarked on its largest naval shipbuilding program in many years. This development has created problems for the UK government.[110] The ambitious proposal to expand the UK's naval capability will test the existing shipbuilding industrial base. The RAND report recorded that shipyard sources in the UK had expressed concern about the workload gap between 2003 and 2006 when it was anticipated that shipyard owners could lay off workers they may need in the future. It noted that the shipyards are worried that unless the Ministry of Defence starts other programmes earlier than planned, shortages of certain kinds of highly skilled workers, such as design engineers, might occur.

2.89 Mr John F Schank noted that one of the most significant findings coming out of their research was the 'importance of a comprehensive, long-term MOD

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108 Chairman Roscoe Bartlett, Opening Statement, Hearing on the Evolving Missions of the U.S. Navy and the Role of Surface and Subsurface Combatants, 15 March 2006, House Armed Services Committee.

109 Vice Admiral Paul E. Sullivan, U.S. Navy Commander, Naval Sea Systems Command, et al, before the Subcommittee on Projection Forces of the House Armed Services Committee on Shipbuilding, 5 April 2006.

110 John F. Schank, The RAND Corporation, 'Trends in the United Kingdom's Naval Shipbuilding Industrial Base. Lessons for the United States', Testimony presented before the Senate Armed Services Committee, Subcommittee on Seapower, 6 April 2006, p. 1. He told a U.S. Senate committee that 'This effort will be challenging, because it follows a period of reduced warship demand that has led to consolidation and reduction in the capacity of the UK shipbuilding industrial base and in the oversight resources available to the MOD'. See also Lord Drayson, uncorrected transcript of oral evidence, House of Commons, Minutes of Evidence taken before Defence Committee, 'Future Carrier and Joint Combat Aircraft Programmes', 25 October 2005.

shipbuilding strategy or plan.[111] He suggested that a strategic plan would help eliminate the 'boom and bust' cycle that characterises ship production and design in the UK:

> It would allow the MOD to make more efficient use of shipyard facilities and workforce skills and exploit the government's 'smart buyer' expertise. It would help the MOD better understand the financial implications of its acquisition strategy and anticipate problems by allowing it to independently assess shipyard demand. It should also lead to reduced cost and schedule risk through greater program certainty.[112]

2.90 Professor Martin Edmonds also referred to what he believed was the absence of an overall government industrial strategy towards the UK naval shipbuilding sector.[113] Indeed, the UK's Defence White Paper stated:

> We have been working to smooth out the long term cyclical demand for naval warships and provide a more predictable future for ourselves, and industry. But this more stable future can only be achieved if the design, manufacturing, support and integration capacity within the industry is matched to that pattern of demand.[114]

2.91 Clearly, developing and sustaining the high level of skilled workers needed to sustain a modern shipbuilding industry is a major challenge for the industry worldwide.

Conclusion

2.92 Over recent decades, the global naval shipbuilding industry has faced major challenges with dwindling demand for ships but increased pressure for more highly sophisticated and expensive systems and weaponry. Advances in technology are accelerating the changes. To accommodate these shifts, the naval shipbuilding

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111 John F. Schank, The RAND Corporation, 'Trends in the United Kingdom's Naval Shipbuilding Industrial Base: Lessons for the United States', Testimony presented before the Senate Armed Services Committee, Subcommittee on Seapower, 6 April 2006. He explained further: 'By a strategic plan, we mean one that would require that the MOD define its shipbuilding goals and future courses of action for the next several decades, establish a schedule or roadmap to achieve its plan, and identify future investments that would be needed, for example in facilities or workforce skills', p. 2.

112 John F. Schank, 'Trends in the United Kingdom's Naval Shipbuilding Industrial Base. Lessons for the United States', Testimony presented before the Senate Armed Services Committee, Subcommittee on Seapower, 6 April 2006, p. 2.

113 Professor Martin Edmonds, Director, Centre for Defence and International Security Studies, Lancaster University, 'UK Shipbuilding: a new direction', 2001, http://www.global-defence.com/2001/SeaSpart3.html (accessed 10 November 2005).

114 Defence Industrial Strategy, Defence White Paper, presented to Parliament by the Secretary of State for Defence by Command of Her Majesty, December 2005, p. 77.

industry has undergone a period of transition marked by consolidation with fewer major producers. Furthermore, these remaining producers are increasingly looking to form alliances or cooperative arrangements to meet the demands of constructing a modern warship.

2.93 Broader heavy engineering capacity has also developed based on modular cad/cam design and manufacturing techniques which have rendered more traditional ship yard facilities obsolete and inefficient.

2.94 Without doubt, the advances in production technology will continue and the countries that keep pace with such developments will improve their international competitiveness. High order computing skills, the use of automation and robotics and the capability to integrate highly complex operating systems using a modular approach will be paramount to a modern cost-effective shipbuilding industry. As noted earlier, the costs of achieving such a high level of capability are great.

2.95 Even with a growing reliance on a globally integrated production system to supply and install high technology systems, many countries place a priority on building their own complex naval vessels—as much as possible they want to retain their own capabilities.[115] Advances in technology and the change to modular construction have also created considerable demand for a highly skilled and stable workforce. Naval shipbuilding nations face the difficult task not only of developing but retaining skilled workers especially with the boom and bust nature of the industry.

2.96 The many demands on the shipbuilding industry mean that maritime countries across the globe face a common difficulty in finding the most cost-effective way to maintain an up-to-date naval shipbuilding capability. They must address issues created by the falling demand for ships, the escalating costs of construction and of keeping pace with advances in technology, as well as the need to develop and retain skilled workers. In light of these challenges, the governments of countries keen to maintain their naval shipbuilding capability are under pressure to review their approach to the industry. Recent studies conducted into the U.S. and the UK naval shipbuilding industries highlighted the important role that governments have in assisting the industry to adjust and succeed.

2.97 As a nation with an established naval shipbuilding industry, Australia confronts similar challenges as overseas countries in sustaining the industry. Having discussed the international context, the committee, in the following two chapters, looks at the effect that past and current naval shipbuilding projects have had on Australia's capability.

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115 *Committee Hansard*, 3 July 2006, p. 87.