

*National Approaches to
Shipbuilding and Ship
Procurement*

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Edited by
Douglas L. Bland

Defence Management Studies Program
School of Policy Studies, Queen's University
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The Claxton Papers

The Queen's University Defence Management Studies Program, established with the support of the Canadian Department of National Defence (DND), is intended to engage the interest and support of scholars, members of the Canadian Forces, public servants, and participants in the defence industry in the examination and teaching of the management of national defence policy and the Canadian Forces. The program has been carefully designed to focus on the development of the theories, concepts, and skills required to manage and make decisions within the Canadian defence establishment.

The Chair of the Defence Management Studies Program is located within the School of Policy Studies, and the program builds on Queen's University's strengths in the fields of public policy and administration, strategic studies, management, and law. Among other aspects, the program offers an integrated package of teaching, research, and conferences, all of which are designed to build expertise in the field and to contribute to wider debates within the defence community. An important part of this initiative is to strengthen links to DND, the Canadian Forces, industry, other universities, and non-governmental organizations in Canada and in other countries.

This series of studies, reports, and opinions on defence management in Canada is named for Brooke Claxton, Minister of National Defence from 1946 to 1954. Brooke Claxton was the first post-Second World War defence minister and was largely responsible for founding the structure, procedures, and strategies that built Canada's modern armed forces. As defence minister, Claxton unified the separate service ministries into the Department of National Defence; revamped the *National Defence Act*; established the office of Chairman, Chiefs of Staff Committee—the first step toward a single Chief of Defence Staff; organized the Defence Research Board; and led defence policy through the great defence rebuilding program of the 1950s, the Korean War, the formation of NATO, and the deployment

of forces overseas in peacetime. Claxton was a master of Canadian defence politics: he was active, inventive, competent, and wise.

A Shipbuilding and Ship Procurement Strategy for Canada

The Royal Canadian Navy at the end of the Second World War had a fleet of some 400 warships of many types. After 1950 and through the Cold War Canada's much smaller but technically advanced navy became a highly specialized anti-submarine force employed mainly in the North Atlantic. The fleet and other Canadian maritime operations were supported by a successful, modern shipbuilding industry that provided naval and other seagoing vessels to the country. Slowly at first and then more rapidly, this industry began to fade as the national defence budget shrank and opportunities to build new ships diminished. Indeed, naval shipbuilding in Canada virtually disappeared in the late 1980s.

Governments have announced new shipbuilding and ship procurement strategies in every White Paper on defence policy since 1964, yet these strategies were, in fact, mostly "start and stop" expediencies. Year by year, the Canadian navy became smaller and less capable of conducting complex operations. As the demand for ships declined, industries withered.

Today, naval ships are old, strained, and several are well passed their operational life. The Conservative government is committed to redressing this situation and it has, as other governments have in the past, announced a new shipbuilding and ship procurement strategy for Canada. But announcements, even those involving an estimated \$30 to \$50 billion investment, cannot produce warships in the absence of a shipbuilding industry to do so. Thus, the government faces an expensive challenge to build not only ships but at the same time a complex industry with the capacity to build ships.

Other nations face many of the same problems confronting the Canadian government today. Each has developed strategies and means and methods appropriate to their particular circumstances; nevertheless, most national strategies have many common factors.

In November 2009, a national and international conference on developing a shipbuilding and ship procurement strategy for Canada was held at Queen's University, Kingston. The organizers, presenters, and participants to this conference assumed that political, military, and industrial leaders in Canada could benefit from the experiences and efforts of other nations to build and sustain their navies and the industries that support them. This *Claxton Paper* records in its pages and in the accompanying DVD several

of the expert presentations delivered at this conference. We hope, too, that it provides a host of useful concepts that may guide Canadians as they work to reinvent a national shipbuilding capability to support the rejuvenation of Canada's navy.

The editor and the authors wish to thank Ellen Barton for her thorough and professional job as copyeditor, as well as Mark Howes and Valerie Jarus for their continued, accomplished efforts to change the work of "mere scholars" into an attractive, readable publication. We all thank Heather Salsbury for her unflagging good spirits and willing support to the Chair of Defence Management Studies. The Chair acknowledges the support given to Defence Management Studies at Queen's University by the Department of National Defence and Breakout Educational Network, Toronto, Canada.

*Douglas L. Bland
Chair, Defence Management Studies Program
School of Policy Studies, Queen's University
Kingston, Canada, June 2010*

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DVD: “A Shipbuilding and Ship Procurement Strategy for
Canada” (see sleeve on inside back cover)

CHAPTER 1

United Kingdom Warship Procurement Strategies: Accident or Design?

Stuart Young and Jonathan Davies

Background – United Kingdom Industrial Context

The approach to warship procurement for the United Kingdom's Royal Navy has changed considerably in the post-Second World War period. Furthermore, many of the decisions made in that period have had a direct impact on the size and shape of today's naval maritime industrial sector in the United Kingdom which has, in turn, influenced the procurement strategies that are pursued by the UK's Ministry of Defence (MoD) to deliver maritime capability.

Immediately after the Second World War, the British government envisaged varying warship-building rates in order to even out the slumps and booms in merchant vessel building, as shipbuilding was highly cyclical in nature.¹ However, the post-war period was marked by economic growth and a rapid and sustained increase in commercial shipbuilding. British shipbuilders' priority was therefore to clear their berths of naval work and focus on commercial orders. In any case, warship orders decreased as the Admiralty attempted to keep abreast of rapid technological change and tight budgetary constraints.

It took until the early 1950s for a clear warship procurement strategy for the Royal Navy to emerge, and the first major post-war warship orders (for a range of anti-submarine, anti-aircraft, and air-direction frigates) were placed in 1951–52. However, the new technologies used in these ships resulted in increased costs and significant building delays. Ultimately, as

a result of a policy to retain maximum warship-building capability, a total of 15 shipbuilding yards were involved in the construction of 26 vessels. During this period, pressure on the defence budget increased and the Admiralty had to look at ways of reducing expenditure.

In parallel with this, the seller's market for commercial ships meant that there was little incentive for British shipbuilders to modernize their facilities, despite lengthening delivery dates and rising costs. However, as shipbuilders in Northern Europe and the Far East developed new facilities, competition increased and the seller's market turned into a buyer's market, resulting in the exposure of the inherent problems in the British shipbuilding industry.

Productivity in the industry was low, and the poor wages and working conditions failed to attract good quality staff. By the late 1950s shipbuilding in the United Kingdom was facing a crisis, and the lack of commercial orders was compounded by a slump in orders from the Royal Navy. Pressure increased on the Admiralty to place new orders, but budgets would not permit this. In order to reduce costs, the Admiralty announced in 1960 that it would return to competitive tendering with fixed prices in order to encourage efficiency and economy. It was acknowledged that this approach might result in a reduction in warship-building firms and, indeed, by 1965 ten UK shipyards had either closed or merged with other yards.

A 1966 government report had recognized the ongoing problems in shipbuilding and recommended the segregation of warship orders into three yards as part of a program of wider rationalization in the industry.² At that time the government order book for ships had a value of nearly £200 million across 12 yards. The government was reluctant to accept the political ramifications of reducing capacity to just three yards with resultant localized unemployment, and eventually a compromise of three specialist naval shipyards, and a number of other yards with a mixed capability, was reached.

UK shipbuilding continued to lose international market share with launches reduced from 12 percent of the world total in 1963 to 5 percent in 1971, and the government had to step in to save three major yards. A further review of the industry suggested that there was still overcapacity and that further rationalization down to three warship yards was required, noting that the specialist warship yards had been consistently profitable between 1967 and 1971.³ The situation was then compounded by the oil crisis in 1973 and a collapse in shipbuilding worldwide. As a result, the government nationalized the industry and British Shipbuilders was formed in 1977.

In 1979, the incoming Conservative government announced its intention to privatize the industry. Its objective was finally achieved by 1986 with six yards sold as designated warship builders. This had the effect of reducing commercial shipbuilding capacity while doubling warship capacity—a puzzling decision considering the economic environment at that time. Furthermore, the designated warship yards could not access the European Community’s Shipbuilding Intervention Funds in order to supplement meagre warship orders with commercial builds. However, the Ministry of Defence hoped that the increase in warship capacity would result in lower costs through competition.

The policy of competition was not readily apparent, as orders were placed with some yards to ensure their survival or to satisfy political objectives. World events took another turn in 1989 with the end of the Cold War, and in 1991 the Conservative government published “Options for Change,” which outlined a further reduction in warship numbers.⁴ By this time, Vickers Shipbuilding and Engineering Ltd. (Barrow-in-Furness) had been established as the lead yard for nuclear submarines, Yarrow (Glasgow) for frigates, and Vosper Thornycroft (Southampton) for minesweepers. This left the other yards fighting for the few remaining orders. By the late 1990s the objective of having three warship yards, as outlined in 1966, was finally achieved. Two of these yards, VSEL and Yarrow, were owned by GEC Marconi Marine but these were subsequently sold to British Aerospace (now BAE Systems), with the third owned by the VT Group (previously Vosper Thornycroft). Through a long and painful post-war history for the industry, privatization had finally succeeded in driving down prices through competition and reducing capacity. The three yards were owned by two companies, and the government, through its Defence Industrial Strategy, encouraged these companies to work together in a joint venture (BVT Surface Fleet) to deliver a responsive warship design, and a build and integration capability to meet the Ministry of Defence’s requirements. In September 2009 further rationalization occurred when BAE Systems bought out VT Group’s share in BVT, thus leaving UK warship building in the hands of one company.

UK Defence Industrial Strategy

The UK’s Defence Industrial Strategy was published in December 2005 and presented, in the short to medium term at least, an optimistic view of naval ship procurement.⁵ It assumed that spending on the maritime sector would grow over the next ten years as work for the T45 Destroyer, Astute

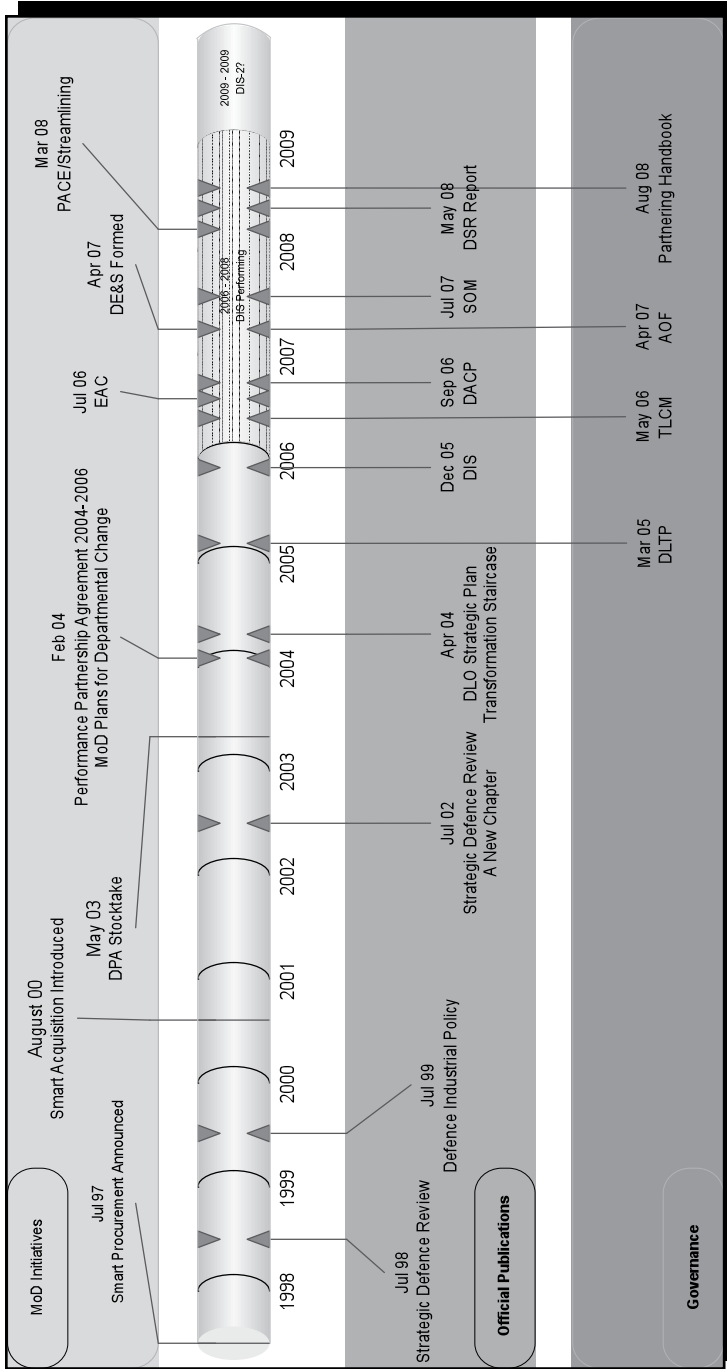
Attack Submarine, Future Carrier, Maritime Afloat Reach and Sustainability, and Future Surface Combatant came online, but that there would be a downturn after that.

The Defence Industrial Strategy followed the evolution of a policy originating in 1983 of using competition to achieve best value for money. This had superseded a long period of preferential purchasing, support for national champions (buy British), cost-plus contracts, and a “cosy relationship” between the Ministry of Defence and the UK defence industrial base.⁶ In 1998, the new Labour government’s Strategic Defence Review introduced a number of new initiatives to the defence environment (Figure 1)—including Smart Procurement, Private Finance Initiatives, Public-Private Partnerships, and Resource Accounting and Budgeting—all of which have had an impact on how the MoD has acquired defence capability from industry.

The 1998 Strategic Defence Review gave a clear vision of the UK’s desired defence capabilities over the next 15 years. This included the type and scope of operations that UK forces would be involved in, a restructuring of forces with an emphasis on joint forces composed of elements from all three services, and an emphasis on power projection and rapid deployment, requiring two new aircraft carriers and their associated aircraft and a maritime and air strategic transport capability.

In order to acquire these new capabilities, Smart Procurement was introduced with the mantra of “cheaper, faster, and better.” Smart Procurement adopted a more streamlined approach to acquiring equipment capability by reducing the number of approval decision points to two (Initial Gate and Main Gate), aligned to the new CADMID (Concept, Assessment, Development, Manufacture, In-Service, and Disposal) procurement cycle.⁷ Smart Procurement was subsequently renamed Smart Acquisition, reflecting the wider scope of activities needed to deliver effective defence equipment capability. An incremental approach to acquiring systems was also introduced with the process being managed by Integrated Project Teams, comprising Ministry of Defence, Military, and Industry representatives. It was estimated that this new approach would save some £2 billion in acquisition costs over the ten-year period to 2008. It is not the intention of this paper to assess, in any detail, the success or otherwise of Smart Acquisition. However, it is difficult to ascertain cost savings. Procurement cycle times have, if anything, extended over this period, an issue that current initiatives are attempting to address, and project delays, whilst easing short-term budgetary problems, tend to have a negative impact on cost in the longer term.

Figure 1. Ministry of Defence Procurement and Acquisition Initiatives, 1997–2009



Note: MoD = Ministry of Defence. DPA = Defence Procurement Agency. EAC = Enabling Acquisition Change. DE&S = Defence Equipment and Support Organisation (formed from DPA and DLO). PACE = Performance, Agility, Confidence and Efficiency (DE&S Change Program). DLO = Defence Logistics Organisation. DIS = Defence Industrial Strategy. DACP = Defence Acquisition Change Program. SOM = Support Options Matrix. DSR = Defence Support Review. DLTP = Defence Logistics Transformation Program. TLCM = Through-Life Capability Management. AOF = Acquisition Operating Framework.

The Strategic Defence Review also saw advantages in the use of Private Finance Initiatives (PFIs) and Public-Private Partnerships (PPPs), including

- costs savings from lower construction costs and lower life-cycle costs,
- transfer of risk to the private sector, and
- increased incentivization of the private sector to innovate in delivery of services.

PFI deals now account for some 3.3 percent of defence annual expenditure, with £5.7 billion of private sector investment and 57 arrangements in place.⁸ Once again, savings are difficult to quantify but delivery performance (80 percent of projects on time, 70 percent within budget) is good. A further major benefit has been greater stability in key programs over the longer term.⁹

Resource Accounting and Budgeting encouraged the wider use of PFIs by including depreciation charges for fixed assets in budgets and business cases, which provided the incentive to get things off the balance sheet. Thus, in 2005, the UK Defence Industrial Strategy was published with the following aims:

- to conduct a strategic view of defence capability requirements going forward, by sector, specifying which industrial capabilities the government wished to see retained in the UK for defence reasons to meet these requirements;
- to provide detail on the principles and processes that underpin procurement and industrial decisions; and
- to investigate how the mismatch, or gap, between the MoD's plans and the level required to sustain desired industrial capabilities on-shore might be addressed.

Non-sector specific aspects of the strategy included

- the recognition that the bedrock of procurement policy was long-term value for money. Competition may be an appropriate approach in some circumstances but other models should also be considered, depending on the nature of the marketplace;
- the need to speed up the decision-making process significantly; and
- the need to improve the earned profit margins available to industry based on good performance if global investment capital was to be attracted into the UK defence industry.

Elsewhere, the strategy recognized the difference between warship and commercial building: the cost of a warship is typically 70 percent systems and 30 percent hull construction and outfitting, whilst for a commercial ship the figures are typically 20 percent systems and 80 percent hull construction. As a result, the strategy sought to retain only a minimum ability to build and integrate complex ships in the UK. However, it identified as a priority the need to retain and develop the systems engineering capability to design complex ships and their combat systems from concept to the point of build, and to manage and support the associated maritime capability through life (50 percent of the spending in the maritime sector is on support). Equally, the strategy recognized the need for the MoD to retain the intelligent customer skills it needed in order to control the procurement and support processes, with a particular focus on managing the risk associated with complex maritime platforms.

It is worth examining the steelwork fabrication/hull construction issue further. Despite the fact that the Defence Industrial Strategy de-emphasized the sovereign requirement to construct warship hulls in the United Kingdom, at the same time it recognized the need to retain the relevant skills, for example, to fit specific equipment to meet operational requirements (as was required in 1982 for the Falkland Islands campaign). The Secretary of State also noted that modern warship platforms were becoming increasingly complex and required specialist construction techniques to meet signature and nuclear biological chemical and damage control requirements, and that these must also be maintained under UK sovereignty. Furthermore, sustainment of the necessary high-value skills demanded that there be an appropriate skills development path. The implication of the strategy is that all complex front-line warship platforms will be designed and fabricated in the United Kingdom, along with the wider system design and integration activity. Less complex auxiliary ships can be built overseas, but the need to sustain skills may require that they also be constructed in the United Kingdom. The UK shipbuilding industry must therefore be sized accordingly, noting that defence is the major customer, with naval ships accounting for 85 percent of construction in UK shipyards. This capacity is achieved through three warship yards (BAE Systems in Glasgow, Barrow, and Portsmouth), with further capacity primarily focused on support and upkeep at Swan Hunter, Devonport Management Limited, Babcock Engineering Services, and Fleet Support Limited. The “three shipbuilders” concept, which had its origins in the 1970s,¹⁰ had finally been realized.

Further rationalization is still ongoing. The Secretary of State for Defence hinted that an alliance/partnering approach might be exploited by

the Future Carrier (CVF) program.¹¹ Under MoD influence, BAE Systems and the VT Group established a joint venture, BVT Surface Fleet, in July 2008. In fact, the creation of BVT Surface Fleet was conditional on the signing of contracts for the new Queen Elizabeth class of aircraft carriers. With the aim maintaining the UK's surface warship-building capability, the MoD guaranteed that BVT would receive orders for the majority of its naval vessel requirements over the next 15 years, including the Queen Elizabeth Class aircraft carriers and the Future Surface Combatant (FSC). The later variants of the Maritime Afloat Reach and Sustainability (MARS) ships were also to be included if this program went ahead.

At the time, VT Group's CEO, Paul Lester, said he saw the arrangement as helping to overcome the "lumpy" nature of the shipbuilding business,¹² which was dependent on large contracts placed at irregular and often lengthy intervals. It also removed the potential for an ongoing battle between VT Group and BAE Systems for warship-building work, which could have led to the loss of vital capacity and skills.

The establishment of BVT brought together BAE Systems' two shipyards on the River Clyde in Scotland (Scotstoun and Govan) and VT Shipbuilding's two facilities in Portsmouth (VT Shipbuilding and VT Hal-matic), as well as BAE Systems' design facility in Bristol. BAE Systems Submarine Solutions, at Barrow-in-Furness, was not included in the deal. In anticipation of VT Group's increasing focus on engineering-based support services, an option was included in the agreement allowing VT Group to sell its 45 percent shareholding to BAE Systems after 1 July 2009. As predicted, VT Group announced its intention to do this in January 2009. The sale was finally completed in September 2009, resulting in BAE Systems managing all the major warship yards in the United Kingdom.

The optimum size of UK warship-building capacity is open to debate. As already suggested the warship order book currently looks very healthy, and construction of the T45, CVF, Astute, MARS, and FSC is likely to fully utilize the currently available capacity (although this might change significantly as a result of the forthcoming UK Strategic Defence Review). Beyond about 2016, when work will reduce to a longer-term steady state, it is likely that the current capacity will not be economically sustainable. At this point the aim of the Defence Industrial Strategy to retain a sustainable UK sovereign shipbuilding industry that provides complex warship construction, support, and skills growth will have to be revisited.

The strategy also highlighted the problems identified in a 2005 RAND report,¹³ namely, the poor performance of the sector, with major maritime projects encountering delays and cost increases. Changes in specifications

and requirements accounted for 46 percent of schedule slippages, with a further 23 percent caused by lack of technical information. Both factors could be better controlled through improved project management and communications between the MoD customer and industry to deliver affordability and productivity improvements. The maritime sector was also criticized for its increasingly high overheads and a skills base spread across too many entities. Ineffective procurement strategies and commercial arrangements were blamed for failing to incentivize rationalization or efficiency improvements. The Secretary of State for Defence characterized the situation as “unsustainable” and envisaged industry restructuring and consolidation as necessary to creating a viable and sustainable business aligned to steady-state demand.¹⁴ The Defence Industrial Strategy anticipated both horizontal consolidation across the core shipbuilding activities and improved integration of procurement and support activities in order to achieve efficiencies. Government intervention to some degree was not precluded. This consolidation was seen as a matter of urgency; the degree to which this has occurred will be examined in the case studies included in this paper.

Turning to procurement strategies, although the Secretary of State for Defence envisaged that competition would continue to be used when appropriate, it envisaged that alternative, more sophisticated strategies would be used to deliver greater value for money and long-term sustainability. The CVF Alliance approach, detailed later in this paper, was quoted as an example. Other options were not discussed.

The Defence Industrial Strategy also addressed the minimum level of activity, or core workload, that would be required to sustain the key capabilities in the maritime sector. As this paper focuses on acquisition strategies at the program level, the achievement of a long-term and visible core program is not discussed in detail here. However, it should be recognized that the acquisition and support strategies that are adopted will impact on the demand for support from the maritime sector to meet the core workload, and that the MoD’s declared policy of not paying a premium for capacity beyond that required to deliver the core workload will, in turn, influence the size and shape of industry in the maritime sector.

In addition to maintaining the core workload to sustain the shipbuilding capability in the United Kingdom, the Defence Industrial Strategy recognized that similar issues applied to the platform design capability. Maintaining platform design is a through-life capability, but the strategy proposed combining new build and support design activities to provide a more sustainable capability. However, early concept and architectural design requires a subset of this skilled workforce, which can easily be lost

if long gaps emerge between first-of-class design efforts. As a result, the strategy proposed an eight-year “drumbeat” between first-of-class design efforts, but offered no guidance on how this would be achieved within the capability management regime now driving defence acquisition planning in the United Kingdom.

To summarize, the Defence Industrial Strategy focuses on working with industry to tackle the sustainability issues by

- identifying the likely timing and volume of future business;
- defining in greater detail how the required sovereign capabilities would be maintained, including defining the core workload;
- restructuring industry around the emerging core workload;
- improving efficiency and quality to achieve an affordable program; and
- exploring alternative commercial arrangements.

This paper will now examine the strategies applied to the acquisition of three types of surface warships and compare progress to the way ahead proposed by the Defence Industrial Strategy.

River Class Offshore Patrol Vessel

During the 1980s and 1990s the tasks of fishery protection in UK waters and protection of oil and gas fields in the North Sea were carried out by a fleet of seven Island Class Offshore Patrol Vessels (OPVs). These ships, built by Hall Russell in Aberdeen largely to commercial standards, were commissioned between 1976 and 1979. Based on a trawler design, the ships rolled heavily in rough seas and were criticized for their small size, slow speed, and lack of a flight deck. By the late 1990s additional roles for these ships had been identified (including assisting HM Customs and Excise, conducting scientific and environmental duties, and assisting vessels in distress). However, the aging fleet did not have the capabilities to perform this wider range of tasks and was proving increasingly costly to maintain and support.

Following the introduction of the Smart Procurement initiative in 1998, the MoD produced a user requirement for a replacement OPV capability that was issued in the form of an invitation to tender to eight UK shipbuilders in December 2000. These included commercial shipbuilders as well as the traditional warship yards. The MoD was particularly keen on controlling and reducing through-life costs and therefore specifically stated it was looking

for new and innovative ways of delivering the required capability. It was hoped that the involvement of a range of commercial shipbuilders would encourage the development of innovative solutions.

In the event, the MoD announced in March 2001 that Vosper Thornycroft had been selected as the preferred bidder, and the contract was placed in May 2001. As the requirement had been developed and agreed within six months, this meant that the complete process from project inception to contract placement had taken under 12 months; subsequently the ships entered service between January and December 2003.

This total procurement cycle time of less than three years looks impressive, but it is worth examining further the factors that led to this apparent success. As already indicated, the existing Island Class OPVs were becoming difficult and expensive to support. Although originally envisaged to stay in service until 2007, pressure was building to reduce short-term support costs. Gapping the capability was not an option. The requirement to patrol the UK's economic exclusion zone was ongoing and it was unacceptable to curtail this activity.¹⁵ Therefore, there was significant pressure to cut costs in the short term to relieve pressure on the defence budget.

The need to demonstrate the success of the Smart Procurement/Acquisition initiative was another factor. The procurement program was littered with a range of expensive legacy projects that had been initiated before Smart Acquisition came about. It was proving very difficult to transition these projects, with their legacy commercial arrangements, to the Smart Acquisition regime and demonstrate time, cost, and performance savings. Some major new programs were in the pipeline, including T45 and CVF, but these were unlikely to deliver Smart Acquisition savings in the short term. There was therefore a desire within senior management in the UK's Defence Procurement Agency to introduce an innovative program that could deliver clear savings in the short term and demonstrate to politicians and taxpayers the success of Smart Acquisition.

The final contributing factor was political. In December 2000, Vosper Thornycroft had issued redundancy notices to half of its 11,000 workforce because of a gap in its order book before potential T45 Destroyer work came on stream. The loss of significant numbers from the workforce would mean that it would be very difficult to regenerate a major shipbuilding capability on the south coast and so meet the government's strategy of maintaining a healthy UK defence industry and a continuous commitment to competitive procurement.¹⁶ Although this move by Vosper Thornycroft could be construed as posturing, considerable political pressure was exerted to ensure that the company won the contract with an order for at least three ships to

maintain jobs and keep its shipyard open. In the event, Vosper Thornycroft had to cut only 120 jobs.

Taken together, the combination of a clear requirement, an urgent need to reduce costs and demonstrate a quick and significant win for Smart Acquisition, and political pressure to place contracts quickly meant that the total procurement cycle time was surprisingly short.

The commercial arrangement for delivery of the offshore patrol capability also warrants a closer look. The MoD was looking for innovative ways of delivering the required service in a cost-effective and responsive manner, and the invitation to tender provided significant flexibility in how this requirement could be met. In addition to construction of new vessels, the MoD was also expecting to see proposals that included the update of older vessels or conversion of commercial ships. In the end, the successful proposal from Vosper Thornycroft went considerably further.

The VT proposal included the leasing of three ships to the Royal Navy with support and maintenance provided through a Contractor Logistics Support (CLS) arrangement. Vosper Thornycroft retains ownership of the vessels and charters them for a period of five years, with a daily charge for full CLS. Under this arrangement, the company guarantees 960 days' availability per year across the fleet to the Royal Navy, and only when those ships are available for operational tasking is the MoD liable for CLS costs. Thus Vosper Thornycroft is incentivized to provide maximum availability of the ships. This has proved very successful. In the first year of operation the three River Class OPVs achieved 97.5 percent availability, compared with a maximum of 82 percent for the five Island Class vessels they replaced. Additionally, these vessels are more capable, some 30 percent larger, more fuel efficient, and have a crew of 30 (from a pool of 45) compared with 35 on each of the previous Island Class ships, thus providing further operational cost savings.

As a result of this success, the initial charter period has been extended five years until 2013. Similar lease and support arrangements are also in place for the Falkland Island Patrol Vessel, HMS Clyde, and the two Echo Class Oceanographic Hydrographic Survey Vessels, although in these cases the support arrangements extend to 25 years and include worldwide support.

Although the improved availability figures and cost savings through efficiencies in design and manning provide the headlines, the acquisition strategy for these vessels has a number of less obvious benefits. Leasing, in the absence of improvements in support arrangements and other efficiencies, does not necessarily result in reduced costs. However, it does have the benefit of smoothing out total acquisition costs over a number of years,

removing the bow-wave effect inherent in traditional acquisition strategies, and easing budget planning problems. Although the MoD through the Royal Navy will always retain the ultimate operational risk, significant elements of risk are transferred to the contractor who is incentivized to fully quantify the risks associated with delivering the required levels of availability and to put in place appropriate mitigation measures. If responsibility for delivering the support was retained by the Ministry of Defence, it would be difficult to incentivize effective risk management with the result that availability levels would, in all probability, be degraded. The opposite effect (i.e., an improvement in availability) has consistently been seen in legacy systems that have transitioned from traditional support arrangements to Contracting for Availability.¹⁷ This is a result of the difficulty in incentivizing MoD-managed support in a peacetime scenario where there are no significant consequences or financial penalties if, for example, a routine patrol is not carried out due to non-availability of the ship.

In addition to more effective management of the availability risk, planning and technical risk is also significantly reduced through leasing. If the long-term requirement for the capability is uncertain (unlikely for an Offshore Patrol Vessel in the UK, but possible for many other defence capabilities in today's environment), leasing provides a means of sharing the risk with the commercial provider. Although the provider will factor the cost of the risk into the leasing charge, the MoD has the option of walking away at the end of the five-year lease period with no additional financial penalty. Conversely, and this was seriously considered in the case of the OPV (and taken up by the MoD in other leasing arrangements), the MoD could have the option to purchase the ships outright at their commercial value. This is colloquially known as "try before you buy." The same principle applies to the sharing of technical risk, particularly in the case of novel or innovative technical solutions where there is uncertainty about their operational effectiveness.

Overall then, the River Class Offshore Patrol Vessel is a good news story. Its acquisition times were impressively short, it provides improved availability at lower cost compared with its predecessor class, and it delivers budgetary stability and improved risk management. The partnering approach also incentivizes a culture of continuous improvement.

Type 45 Daring Class Destroyer

The Type 45 is designed as the successor to the Royal Navy's Type 42 destroyers, which were designed in the 1960s and came into service

between the mid-1970s and mid-1980s. These ships are now going out of service as they reach the end of their useful lives and are in urgent need of replacement in order to fill a capability gap in UK maritime-area air defence. The procurement history of the replacement capability is a catalogue of procurement delays, presenting a stark contrast to the accelerated time scales of the River Class OPV.

Originally a national procurement strategy was the preferred procurement route, with consideration being given to Type 43 and Type 44 programs in the 1970s and 1980s, but these did not progress. However, it was realized that a number of European states had similar requirements over similar time scales. This led to the establishment of the NATO Frigate Replacement (NFR 90) program in the 1980s involving the United States, Canada, the United Kingdom, France, Germany, Italy, Spain, and the Netherlands; Greece, Turkey, and Belgium also expressed interest in joining. Feasibility studies were completed at the end of 1985, with numerous points of disharmony subsequently becoming apparent. The consortium did not last long, with the UK being the first to pull out in late 1989 in favour of a national replacement for the Type 42. The NFR 90 program collapsed shortly afterwards.

Project Horizon was one of two projects spawned from the NFR 90 (the other involving the Netherlands, Germany, and Spain led to the F100, F124, and LCF classes of warships). It initially involved France and the United Kingdom, joined by Italy in December 1992 with the signing of a tri-national staff requirement for a Common New Generation Frigate (CNGF) deploying the Principal Anti-Air Missile System (PAAMS). The procurement strategy for Horizon, as the combined project was named, had four key principles: maximum competition, effort to benefit from existing solutions, determined measures to reduce costs, and minimum national variants.

Unlike the other project to come out of NFR 90, national variations were discouraged for it was deemed that the more “common” the frigate, the more money could be saved on development and production. It was intended that this would be managed through an International Joint Venture Company (IJVC) composed of prime contractors from each nation. A primary reason for the failure of Project Horizon can be attributed to the UK’s objection to the work shares allocated to France and Italy—justified given that in July 1998 they were willing to commit to two ships each compared with the UK’s 12 and its 75 percent contribution to the funding. This could be seen as an example of the UK attempting to pursue a multinational procurement strategy in order to share costs whilst protecting its own industrial base. Work share was always going to be a delicate issue as all three nations had the ability to build a nationally designed frigate, and there was no natural

division of labour because no single company excelled over another in any area. The UK also objected to perceived French domination of the project's management. Further disagreement resulted from differences over the role of the ships and therefore the radar array to be used (EMPAR or MESAR/SAMPSON variants), leading to delays in the probable in-service date and ultimately contributing to the demise of the program.¹⁸

The UK finally pulled out of Project Horizon in April 1999, citing continuing dissatisfaction with the industrial and management structure of the project, and writing off somewhere between £75 and £200 million of investment, depending on how much was assessed as being reused in the Type 45. France and Italy continued to cooperate on a smaller, cheaper version. The three countries also continued to cooperate over the procurement of PAAMS.

Work quickly began on the Type 45 program with a ten-week study to examine the design parameters for an anti-air warfare destroyer and the nomination of a prime contractor (Marconi Electronic Systems). In accordance with then current government policy, the Type 45 was to be built in UK shipyards. The requirement for Type 45 was based on an anticipated service life of 25 years, which would provide the Royal Navy's anti-air warfare capability until at least 2035. It was originally planned that there would be 12 ships and all would be in service by 2014.

The Type 45 Integrated Project Team was formally established in September 1999 and consisted of the MoD Project Team at Abbey Wood, Bristol, and the single Prime Contracting Office a short distance away at Filton, Bristol. A charter was created that set out the working ethos between the Defence Procurement Agency and the Prime Contracting Office, establishing an environment where joint work could effectively take place following the intent of the Smart Acquisition initiative.

Originally, Marconi Electronic Systems was nominated as the prime contractor with the contract to complete the Preparation for Demonstration (because the company had been the UK partner on the IJVC Horizon Project and so had the best chance of pulling work through from that project, thus reducing losses and future costs). BAE Systems took over the contract when British Aerospace merged with Marconi Electronic Systems, and was subsequently awarded the Demonstration and First of Class Manufacture contract in December 2000. The key related contracts are shown in Table 1.

Main Gate approval was obtained in July 2000. The original procurement strategy, announced by the Secretary of State, was for HMS Daring, the first ship, to be assembled by BAE Systems Marine, with Vosper Thornycroft

Table 1. Key Type 45 Contracts

<i>Contractors</i>	<i>Contract Scope</i>	<i>Contract Type</i>	<i>Procurement Route</i>
BAE Systems Electronics Ltd.	Full development and production	Fixed-price incentive fee with a maximum price	Single source
EUROPAAMS	Full-scale engineering development and initial production, including missiles for initial use	Fixed price	Collaborative with France and Italy
EUROPAAMS	Follow-on ships production	Fixed price for five follow-on equipments	Collaborative with France and Italy
EUROSAM & UKAMS (MBDA)	Production of missiles	Fixed price	Collaborative with France and Italy through OCCAR

Note: OCCAR = Organisation for Joint Armament Cooperation.

being contracted to make a significant contribution. HMS Dauntless, the second ship, would be assembled by VT, and the third by BAE Systems Marine. This strategy would allow for both companies to assemble one ship, thereby gaining the experience necessary to compete effectively for the second batch of Type 45s. This strategy was preferred as it was seen as fostering competition and encouraging the development of the UK industrial base (particularly through the new VT facility in Portsmouth); these shipbuilding industries, as well as competing for further batches of T45s, could also contribute to the forthcoming CVF program. It was intended that the prime contractor would manage (with MoD oversight) competitions for the manufacture and assembly of subsequent batches, and it was expected that all UK shipyards would have the opportunity to bid for the manufacture of blocks for the second batch of ships (with only assembly competition being restricted). In line with government policy, this competition would not be extended overseas.

This strategy fell apart following the failure of BAE Systems Marine and Vosper Thornycroft to agree on a risk-sharing partnership in time for the subcontracts to be let at the same time as the main contract. There then followed an unsolicited bid by BAE Systems Marine for the full class of Type 45 ships, as well as MoD commitment to the company on other naval construction programs. The bid was given consideration for its potential cost savings, but eventually rejected given concerns over the damage it would do to future potential competition within the UK shipbuilding industry.

Before its rejection, however, as part of the process of consideration, the Chief of Defence Procurement commissioned a study to be conducted by RAND Europe into the advantages and disadvantages of alternative procurement strategies for future warship programs, focusing primarily on the Type 45.¹⁹ As well as influencing Type 45 and, subsequently, CVF procurement decisions, this report heavily influenced the UK Defence Industrial Strategy published in 2005.

The RAND report developed a new analytical model of the UK shipbuilding industrial base that considered all current and future warship programs at the BAE Systems Marine and VT shipyards. Using this model (which took into account aspects such as workforce overheads and investment costs), Birkler and colleagues conducted a quantitative and qualitative comparison of the advantages and disadvantages of having either company or both companies produce the Type 45. They considered whether there should be one or two producers, competitive or directed allocation of work if two producers, and whole-ship or block-ship construction.

The authors had difficulty assessing the savings that would be derived from competitive processes in one procurement approach compared to the savings that would result from experiential learning through the program if all the work was allocated to a single shipbuilder. The RAND study concluded that there was “roughly an even chance that competitive production of the Type 45 at the two shipyards would yield about the same overall cost as sole-source production at one shipyard,”²⁰ and recommended that factors other than cost should be given significant consideration. These factors included

- incentivization to innovate,
- risk reduction through multiple sourcing,
- increased customer leverage with multiple sourcing,
- commonality of ships with sole source or block construction,
- increased complexity associated with the coordination and integration of multiple shipbuilders, and

- co-location of production and support in Portsmouth with VT involvement in the program.

There were also knock-on effects to other shipbuilding programs as well as long-term impacts on the UK shipbuilding industrial base to consider. On balance, taking into account all factors, block construction involving both BAE Systems Marine and Vosper Thornycroft was seen to be an effective compromise. However, RAND offered the caveat that once directed buy of blocks had been chosen for the Type 45, it could be difficult to choose another paradigm for future programs.

The Secretary of State for Defence, Geoff Hoon, announced in July 2001 that the Type 45 would adopt a batch production strategy, with different blocks of the ships being constructed by different shipbuilders (BAE Systems Marine and VT) and assembled in one. Such a strategy was chosen as it was perceived to allow each yard to increase efficiency and produce better value for money for the taxpayer, and offered the best prospect of maintaining the in-service date, although it was not without its risks. Block construction needed to have enough rigidity and weatherproofing to permit movement and transportation, and would therefore carry additional costs. Structural tolerances also needed to be managed carefully since misalignment of blocks would bring substantial rework costs. There were block transportation costs to consider as well as the management overhead of coordinating and scheduling block delivery.

The blocks would be constructed by VT in Portsmouth and BAE Systems Marine at yards on the Clyde in Scotland and Barrow-in-Furness in Northern England. The first ship would be assembled and launched by BAE Systems at the Clyde yard with subsequent ships at Barrow. Design support for the whole class would be based at the Clyde yard with continuing participation by both shipbuilders. The MoD also committed to six ships at this time, with the promise of subsequent batches to deliver a class of 12. Subsequently, potential conflicts with Astute submarine construction led to the transfer of all final assembly work to the Clyde yard.

In July 2004 the planned build of ships was reduced from 12 to 8, although there was no contractual commitment to the two additional ships. Although BAE Systems bid for the additional ships, the MoD finally announced in 2008 that only six Type 45 destroyers would be built, something long suspected by observers. Since 2000 when Main Gate approval was obtained, the program had slipped a total of 36 months owing to a combination of delays from design issues, a reassessment of program risk, and difficulties agreeing on the industrial strategy. Total forecast costs, including

PAAMS, had increased by £989 million to an estimated total of £6,464 million from the approved maximum Main Gate figure of £5,475 million.²¹ This was primarily due to increased PAAMS and shipbuilding costs. A further £199 million was incurred through having to run on the old Type 42 ships because of delays to the Type 45.

HMS Daring, the first of class, is now undergoing trials and is due to enter service in November 2010. The sixth and final ship should enter service in 2013.

The first phases of the program to provide an area maritime air-defence capability to the Royal Navy illustrate all the issues associated with large defence collaborative programs. Difficulties in aligning objectives led to the failure of the first attempt (NFR 90) whilst work-share problems led to the demise of CNGF/Project Horizon. However, the PAAMS program has continued under a collaborative basis and is a technical success, although the cost overruns have dominated the Type 45 program. A highly complex program consisting of a major warship platform and one of the most complex weapon systems yet devised was probably, therefore, a step too far. A less ambitious program, with aligned requirements and less contentious industrial issues, could have succeeded. An earlier in-service date might also have resulted in full delivery of all 12 ships before budgetary pressures hit, without the need to run on the older ships at additional cost.

Once established as a national program, Type 45 suffered further significant cost increases and schedule delays but nothing abnormal compared with many other defence programs of this magnitude. Much of the delay, and resulting cost increases, can be attributed to the difficulties in establishing a clear industrial and procurement strategy for the program. An earlier decision may not have provided the optimal solution but would have allowed the program to proceed to an earlier in-service date with its associated benefits.

The industrial considerations for Type 45 strongly influenced the development of the Defence Industrial Strategy, which was published in December 2005. If the strategy had been published a few years earlier with a clear direction, then it is likely that the Type 45 could have progressed with fewer delays. As it is, the program has resulted in further rationalization of UK warship-building capability, albeit under the ownership of one company, BAE Systems. If CVF and, subsequently, the Future Surface Combatant (FSC) proceed as planned, then in the short to medium term the present capacity and structure of the industry will probably be appropriate. If either or both of these programs are cut as a result of the forthcoming UK Strategic Defence Review, then further rationalization will be inevitable. Delays to

either program, which are almost inevitable in the present financial environment, will lead to a gap in workload in the warship yards, with an inevitable loss of skilled staff and capability that will be difficult to regenerate. BVT Surface Fleet, now wholly part of BAE Systems, has therefore signed an agreement with the MoD proposing long-term savings in warship build costs to the MoD in return for a guaranteed work flow. Under the legally binding agreement, BVT has committed to find at least £350 million in cost savings over 15 years in return for a guaranteed minimum workload from the MoD estimated at £235 a year. BVT will also have “exclusive” rights to design, build, integrate, and support shipbuilding programs, such as the Future Surface Combatant to replace the Type 23 frigates. This clear strategy, based on a partnering approach underpinned by a legally binding framework, should smooth the development of future warship procurement strategies in the United Kingdom.

Future Carrier – CVF

The two proposed Future Aircraft Carriers (CVF), HMS Queen Elizabeth and HMS Prince of Wales, are designed to replace and expand the capability of the three Invincible Class ships that have been in service since the late 1970s. The UK’s 1998 Strategic Defence Review delineated the requirements for the CVFs. The existing ships were coming to the end of their expected lives and would be decommissioned between 2010 and 2015 after some 30 years of service. Furthermore, the current ships had been designed with the primary role of anti-submarine warfare (ASW) operations in the North Atlantic, carrying ASW helicopters, with Sea Harrier aircraft providing a limited air defence capability, subsequently replaced by Harrier aircraft in the ground attack role. However, following the end of the Cold War it was deemed that the ships were too small for the new environment. This was confirmed in the Strategic Defence Review where the aircraft carrier was identified as being a pivotal asset in power projection and rapid operational deployment. The MoD therefore announced plans to build two larger vessels that could operate more powerful air groups.

Preliminary studies had started in 1994, with several alternatives being considered. These included constructing three new, small 20,000 tonne carriers; converting merchant ships; refitting the current aircraft carriers to fly a new generation of Sea Harriers; large-scale lengthening and rebuilding of the current carriers to fly a new generation of aircraft; building new aircraft carriers, but to merchant standards; and purchasing of old US Navy ships. The most promising options appeared to be constructing new ships or

extending the life of existing ships; however, detailed study into a possible 30-year Ship Life Extension Program combined with a stretched hull was shown to have a high degree of risk and costs that were disproportionate to the potential improvement in capability.

The Strategic Defence Review therefore announced that the three Invincible Class ships would be replaced by two Future Aircraft Carriers by 2015. The larger ships were determined to be the preferable option largely due to the uncertainty of the strategic environment, which had started to evolve through the 1990s. Successive operations in the Gulf, Bosnia, and Kosovo had demonstrated the flexible nature of aircraft carriers as providing an effective alternative to the use of fixed front-line airbases, with the ability to quickly deliver power projection and cohesive forces to previously undetermined operational areas around the world. The primary component of the air wing would be the Joint Strike Fighter, development of which was underway in the United States.

The MoD initiated procurement of the CVF through the award of parallel competitive Assessment Phase Stage 1 (Analysis of Options) to potential contractors. Only two industrial teams responded to the invitation to tender: BAE Systems and France's Thompson CSF (later to become Thales), teamed with Raytheon Systems and BMT. Both teams were awarded contracts worth £5.9 million by the Defence Procurement Agency in November 1999. At the same time, and in line with the new Smart Procurement initiative, an Integrated Project Team was established under the leadership of Ali Baghaie, who brought considerable commercial offshore and shipbuilding experience from his previous role at the Kvaerner Govan Shipyard in Glasgow.

Some mandatory criteria were imposed on the contractors. The ship would be a single hull design, capable of embarking up to 48 aircraft, and it would be designed and built in the United Kingdom. Other key functional requirements imposed by the MoD related to sortie generation profile, battle space integration, and ship speed sufficient to ensure both rapid deployability and the conduct of air operations. Non-functional requirements related to availability, survivability, adaptability, and sustainability.

In accordance with Smart Acquisition principles, both teams were given considerable latitude to examine innovative processes and technologies in order to deliver the required capability on schedule. Although affordability was a critical issue for the CVF, during the assessment phase the procurement was driven by the statement of need and documented key requirements, with the designers given freedom to determine how these were to be technically met. As a result, many of the cost estimates coming

back from the contractors during the assessment phase did not accurately reflect the available budget. The teams were encouraged to maximize cost/capability trade-offs through the use of off-the-shelf technological solutions and best practice from other maritime sectors. However, the freedom to look at these was curtailed by the need to maintain the schedule in order to meet the Main Gate review target date.

Both industry teams developed six indicative-cost design studies for large (40 aircraft) and small (30 aircraft) carriers, designed to accommodate one of three aircraft variants: short take-off vertical landing (STOVL), short take-off but arrested recovery (STOBAR), and conventional take-off and landing (CTOL). BAE Systems added an unsolicited seventh design (using private-venture funds) in the form of a STOVL-variant ship with the capability of operating fixed-wing aircraft, but this was dismissed as being outside the concept outline and suboptimal to the three variants.

It was necessary to investigate options suited to all aircraft variants as the configuration of the proposed Joint Combat Aircraft had not been decided by May 2000, when the Assessment Phase 1 design studies were submitted to the Defence Procurement Agency. In June 2001 the Joint Strike Fighter was chosen to fulfil the joint combat aircraft role, and the variants were then reduced to STOVL and CTOL options. The contract to develop the F35B STOVL version of the Joint Strike Fighter was awarded to Lockheed Martin in September 2002. The delay in aircraft selection had significant impact on the CVF program.

At about this time the relationship between the Defence Procurement Agency and the two major contractor teams started to become more adversarial, with the contractors expressing fears that the value assigned to the Assessment Phase 2 contract did not reflect either the scale of work or the risks involved. As a result, the Phase 2 contract award was delayed until November 2001. All parties admitted that, during Phase 2, efforts would need to be made to develop a more positive and productive partnership ethos.

Competing contracts of 12-months' duration were awarded to Thales and BAE Systems to the value of around £25 million each for Assessment Phase 2. The outputs of Phase 2 were intended to form the basis of the subsequent prime contractor selection process and focused on risk reduction and cost-capability trade-offs that had not been given primary consideration in Phase 1.

As the Lockheed Martin F35B was not selected until September 2002, Phase 2 work initially had to consider both STOVL and CTOL designs. However, after selection of the STOVL variant, given the intended service

life of the carriers (up to 50 years), it was decided that the carriers should have the adaptability to deploy CTOL aircraft in the future if required. This also provided risk mitigation of potential problems with the development of the STOVL aircraft. Phase 2 was completed in November 2002.

Selection of the prime contractor for the CVF became a highly politicized issue, reflecting the scale of the project, the transparency of the issues involved, and the level of its potential impact on the UK's shipbuilding industry. In December 2002, the MoD CVF Integrated Project Team produced a report showing that Thales's CVF proposal was technically superior to that of BAE Systems in a number of areas, although both proposals were relatively similar in cost. Furthermore, as well as producing a preferable technical design, award of the contract to Thales had the added benefit of increasing the likelihood that the French Navy would order a third ship, thus providing cost benefits to both countries. After a number of meetings, the MoD's Investment Approval Board therefore concluded that the contract should go to Thales. Their decision may also have been influenced by the poor performance of BAE Systems on the Astute submarine and Nimrod aircraft contracts at that time. This decision was leaked to the press in January 2003, leading to considerable condemnation from trade unions and BAE Systems due to Thales being partly owned by a French company. BAE Systems played on the notion that awarding the contract to Thales would result in a loss of British jobs to French companies, and fanned the flames by announcing plans to cut 1,045 jobs in its UK shipbuilding business.

A cabinet subcommittee chaired by Prime Minister Tony Blair convened to discuss the CVF on 23 January 2003, where it was decided that it was politically impossible to award the contract outright to Thales (at the time the Prime Minister had other disagreements with the French, including the Iraq issue, which may have influenced the decision). The MoD subsequently announced on 30 January 2003 that it had failed to decide who to award the CVF prime contract to. Instead, it proposed an alliance approach, through a partnership that was later to become known as the Aircraft Carrier Alliance. It was announced that the Alliance would be led by BAE Systems as the prime (and politically acceptable) contractor responsible for management of the project, with Thales UK as the key supplier responsible for the CVF design. The MoD would be an active participant in the Alliance, providing leadership and therefore acting as both partner and customer.

This decision was not without controversy, with much of the media skeptical as to the ability of BAE Systems to lead a project based on the design of a competitor company. Industry generally was unimpressed, as

the MoD had spent two years and several million pounds encouraging and funding a competition only to ignore the end result. Government officials countered that the skills demonstrated by both teams were complementary.

The Assessment Phase 3 contract, initially worth £23.4 million for six-months' duration, was awarded to the Carrier Alliance on its formation. The CVF Integrated Project Team and the Alliance were to refine costs, reduce risks, and decide on the key cost/capability trade-offs, leading to submission of a Main Gate business case by December 2003. It was intended that the build contract would be awarded in 2004. However, these time scales were unreasonably optimistic, given that two previously competing companies had to form an effective working alliance as well as take two relatively immature designs and amalgamate them into a single design of sufficient maturity to place a build contract. The Phase 3 contract was therefore extended to 12 months from a start date of September 2003.

The BAE Systems and Thales teams merged to form a 350-strong Alliance under a unified management structure to begin immediate work on Phase 3. Despite the establishment a single team, problems between Thales and BAE Systems persisted, particularly in regard to lack of ownership of the design and work-share issues. These disputes contributed to the delay of the first of a two-part Main Gate approval until December 2005 and a doubling of Phase 3 costs to £50 million.

At the outset of Assessment Phase 3, BAE Systems had warned the MoD that it could not build the 65,000 tonne adaptable CVFs (at 295 m length and an aircraft complement of 50) within the allocated budget, arguing that the demonstration and manufacture phases of the procurement would cost an extra £1 billion at £3.8 billion. BAE Systems blamed cost escalation on additional requirements consistently being added by the MoD, whilst some industry experts blamed the government for forcing BAE Systems to work off the Thales design. The Chief of Defence Procurement therefore called for an urgent review and tasked the Carrier Alliance to look for cost reduction options by examining smaller, less sophisticated designs without sacrificing future adaptability.

The result was an array of design options, all of which suffered from unacceptable reductions in capability or adaptability. In December 2003 BAE Systems chief executive Mike Turner and head of Thales UK Alex Dorrian told the MoD's Chief of Defence Procurement, Sir Peter Spencer, that the requirements for the ships could not be met within the £2.9 billion budget, with defence officials rejecting savings measures at the expense of adaptability or operational performance. As a result the Carrier Alliance failed to provide the Defence Procurement Agency with a firm price for the

development and manufacturing phase by the deadline of January 2004. It also indicated that it would not take on the role of prime contractor under the current terms. Smarting at the time from problems with the Astute and Nimrod projects, BAE Systems also indicated that it would refuse to accept a fixed-price contract for the demonstration and manufacturing phase of the CVF project.

Rear Admiral Nigel Guild, senior responsible owner for the Carrier Strike Program,²² conducted an audit of the CVF in early 2004. The audit identified improvements in the CVF Alliance arrangements but determined that a Main Gate of April 2004 was not achievable. The roadmap was revised, with all three members of the Alliance agreeing that further work was required to complete Phase 3 and the MoD making additional funding available for further assessment-phase de-risking. Phase 3 was therefore extended until November 2004, with Main Gate set for December 2004. A total of £153 million had been spent by the MoD on studies with further substantial costs incurred by the contractors.

In March 2004, the Defence Procurement Agency proposed a new procurement strategy. Key elements included extending the assessment phase; moving away from a traditional prime contractor agreement; reducing the role of BAE Systems; bringing project management of the development and manufacture phase in-house; adopting an enhanced “best practices” alliance approach for the development and manufacture phase; and appointing a new company as an “integrator” to provide specialist advice and consultancy support to the Defence Procurement Agency about managing the build process.

Tensions continued to mount. In April 2004, BAE Systems leaked to the newspapers that it might put its shipyards up for sale, a move that was interpreted by some as an attempt by BAE Systems to pressure the MoD to place the CVF contract on its preferred terms. Assessment Phase 3 was further extended and Main Gate was now set for mid-2005.

By February 2005, Kellogg, Brown & Root UK (KBR) had been appointed as the preferred physical integrator for the project, with responsibility for developing the optimum manufacturing strategy. Once again this resulted in dispute within the Aircraft Carrier Alliance, with BAE Systems threatening to pull out on KBR’s appointment. Several concessions were made by the MoD in relation to KBR’s direct ability to oversee the design and manufacture of the ships, or the ability to allocate such work.

In December 2005 a further £300 million was committed to the demonstration phase. At the same time it was announced that the Aircraft Carrier Alliance would be expanded from its original members—BAE Systems,

KBR, MoD, and Thales UK —to include the shipyards Babcock and Vosper Thornycroft. It was subsequently agreed that KBR would leave the Alliance on completion of the demonstration phase.

The RAND Corporation maintained its involvement in the program and in early 2005 proposed several options to reduce CVF costs.²³ These included using more advanced outfitting; setting the start of the second ship to minimize labour costs; centralizing the procurement of material and equipment; giving greater consideration to the use of commercial systems and equipment in place of standard military equipment; ensuring the completion of comprehensive design reviews by all stakeholders; and minimizing changes during ship construction and resolving quickly those that need to be made. The study also recommended that a radical approach to manning the ships be considered.

The net result of all this was that by mid-2005 the Integrated Project Team concluded that the budget would need to be increased from £2.9 billion to £3.6 billion in order to meet the key user requirements, a figure that was seen by many as very challenging.

Throughout this period there had been regular reports of possible cooperation between the United Kingdom and France to develop ships to meet both the UK's CVF requirement and the French *Porte Avion 2* requirement. Studies completed in 2005 concluded that there was potentially 80–90 percent commonality between the two requirements and that the CVF Delta design could, with only limited tailoring, be adapted to meet the needs of the French. This led to formal involvement of the French in the program (a memorandum of understanding was signed in January 2006), and funding contributions from France toward costs already incurred by the UK in the assessment phase and for future development costs. Difficulties soon emerged regarding proposed French changes to the baseline design and work-share issues. However, the situation was overtaken by events when the new French president, Nicolas Sarkozy, announced in May 2008 that a decision on ordering *Porte Avion 2* would not be taken until 2011–2012. This meant that any savings resulting from joint construction of the ships could not be realized, and the UK decided to proceed on block construction and final assembly of the ships in the UK. France would, however, continue to benefit from the ongoing design effort.

In October 2005 the CVF Integrated Project Team admitted that Main Gate could not be met, eliciting anger from the House of Commons Defence Select Committee whose members were concerned that the first ship would not meet its 2012 in-service date and that additional costs would be incurred in running on the current ships. However, the team reaffirmed that the first

CVF would meet the required in-service date. Despite departing from Smart Acquisition policy, a two-part Main Gate approval was agreed and the Secretary of State for Defence announced in December 2005 that the first Main Gate had been approved, with the second part set for December 2006.

Focus was now set on achieving Main Gate 2. CVF design specifications were confirmed in October 2006, although at £3.8 billion, they were still some £200 million over budget. There was still indecision surrounding the F35 variant, as well as the problem of cutting costs without reducing capability below an acceptable level (essentially the same problems that had plagued the project throughout its life). Main Gate 2 was again pushed back, although elements of the manufacturing phase were progressed as part of the demonstration phase with orders for long-lead items, such as the Converteam for its advanced induction motor and the VDM2500 converter for the main propulsion.

In March 2007 the Treasury approved the MoD's proposal for two ships at a target cost of £3.74 billion, with incentives to lower cost. Any savings were to be shared between the MoD and the shipbuilders. Maximum cost was now set at £3.9 billion, excluding the £599 million that had been spent in the assessment and demonstration phases. In July 2007 Main Gate approval was obtained and Defence Secretary Des Browne announced to the House of Commons that "we can confirm that we will now place orders for two 65,000 tonne aircraft carriers."

Various reviews of the project were completed at about this time and all were largely positive. The "superblock" build strategy was reaffirmed. The hull stern section (block 4) was to be built at BAE Systems Govan, block 3 at BAE Systems Barrow, block 2 at VT Portsmouth, and block 1 (the bow section) at Babcock Rosyth where final assembly would take place, aided by investment in a Goliath Crane to lift the superstructure blocks. Substantial elements of the CVF were competed for, pushing overall competition to over 60 percent, in line with the MoD's acquisition strategy.

At this time BAE Systems and the VT Group announced the creation of a joint venture for the design, manufacture, and support of UK surface warships. The joint venture company, called BVT Surface Fleet Ltd., began operations for the carrier with other members of the Alliance. However, in December 2008 the MoD announced that the planned in-service dates of the ships (2014 and 2016, respectively) would be put back about two years to 2016 and 2018. This was presented as a change in schedule to match the service entry of the Joint Combat Aircraft (the Lockheed Martin F35B), although many commentators saw this as a solution to short-term funding problems that would lead to increased costs in the longer term.

More encouragingly, the first steel was cut at a ceremony at the BVT Govan Shipyard on the Clyde in Scotland in July 2009.

Since then BAE Systems has bought out Vosper Thornycroft's share in BVT. The MoD and BVT have also signed a 15-year terms of business agreement, with the following key features:

- a minimum of 15-years' exclusivity to BVT to design, build, integrate, and support specified MoD shipbuilding programs, including the Future Surface Combatant;
- measures to ensure the maintenance of key industrial capabilities, as outlined by the government's Defence Industrial Strategy; and
- guaranteed savings to the MoD of at least £350 million over the 15-year period (against baseline material, overhead, and labour costs).

The build of the ships is now proceeding rapidly, and many subcontracts for materials and equipment have been placed. However, the long-term future of the program remains uncertain. Current financial problems have intensified the focus on the requirements for a number of major defence programs in the United Kingdom. Any decisions on the CVF will be delayed until the outcome of the Strategic Defence Review is known sometime in late 2010, following the recent general election. A comprehensive Strategic Defence Review is considered inevitable irrespective of which party wins the election. Therefore, uncertainty will continue to hang over the program for the next year despite the large sunk costs that are being incurred.

The CVF is a long and complex story, dominated throughout its life by affordability and political and industrial issues. The sheer scale of the project—further complicated when the linkage to the Carrier Strike program, including the Joint Strike Fighter, is taken into account—has ensured that its affordability has been continually questioned. Current operations, and the focus on equipment issues in Afghanistan, have prompted many commentators to question the “value for money” of the Carrier Strike capability when balanced against other operational needs.

As the current biggest warship-building program outside of the United States, the industrial impact of the CVF in the short to medium term cannot be underestimated. The Defence Industrial Strategy looked for rationalization in UK shipbuilding as a means of ensuring that national sovereignty in this industrial capability would continue. The extended build programs for Type 45 and the CVF, to be followed by the Future Surface Combatant (yet to be approved), have resulted in the long-term establishment

of a partnering arrangement as the only viable means of maintaining the necessary shipbuilding capability. The success of the agreed partnering arrangement has yet to be demonstrated, but only through a process of innovation and learning enabled by effective partnering behaviours will the savings target be achieved. However, the whole industrial situation will have to be readdressed if the Strategic Defence Review affects both the CVF and Future Surface Combatant programs.

The impact on jobs of the CVF program has ensured that it is never out of the political limelight. Political interference has been a constant theme throughout the program, highlighted particularly after the MoD announced Thales UK (a predominantly French-owned company) as the preferred bidder, only for the decision to be heavily revised by a senior cabinet committee. Political considerations and the need for jobs to be shared across the United Kingdom also had an influence on the block build construction process that was finally selected. There was also a dalliance with international cooperation with France, but ultimately this had little impact on the program.

At this stage, the success or otherwise of the CVF project is not a relevant consideration. The fact that it has managed to survive at all is surprising. This is perhaps due to the political influence resulting from the industrial impact its cancellation would have. An approach that assessed affordability against the capability delivered may well have resulted in its cancellation many years ago, and this is still a possibility.

Conclusions

This paper has reviewed the evolution of the UK warship-building industry from the Second World War until the present day and then looked at three very different case studies of recent warship acquisition programs and examined how their procurement has been influenced by industrial and political considerations.

The Offshore Patrol Vessel program was a procurement success and is an operational success, but there are dangers in applying this solution to more complex platforms and systems. Firstly, the procurement strategy for the OPV was ideal for the prevailing political situation at the time of its approval. It provided an early quick win for the Smart Acquisition initiative and enabled politicians to demonstrate the success of what was considered to be a radical new approach to defence procurement. Furthermore, the OPV, as a ship and weapon system, was relatively simple and cheap. It met a clearly defined operational requirement, which included a consistent time at sea, a routine operating profile, and a known environment (the UK

economic zone). Thus Vosper Thornycroft, as the contractor, was able to provide a leased, availability-based solution against a known set of risks. The design itself required little development and could be built quickly using existing facilities, and the construction also solved the problem of filling the gap until T45 work started to come on stream.

Such an approach is not practicable for more complex platforms that are required to operate worldwide against an unpredictable operating profile. In these circumstances the risk is difficult to quantify and therefore difficult to transfer to industry under a lease and availability-based contract—and that is before industrial, political, and international issues are taken into account.

Acquisition of the Type 45 has been dominated throughout by international considerations. The problems of aligning requirements and work share on international programs are well known and there is no better case study of these than T45's predecessor programs, the NFR90 and the Common New Generation Frigate. However, the fact that there were two attempts to progress the program on an international basis suggests that collaborative programs have potential benefits that are highly attractive. But, the difficulties in delivering these benefits in highly costly and complex military systems where there are big issues of national industrial sovereignty at stake show that the associated risks were either poorly assessed or deliberately hidden.

Earlier pursuit of a national solution by the United Kingdom may have had other benefits. Primarily, earlier decisions may well have resulted in the number of ships procured approaching the 12 originally required rather than the 6 that were finally purchased. It could also have resulted in an earlier entry into service, removing the need to run on the obsolete Type 42 destroyers at significant additional cost and severely degraded capability. Luckily, to date, the prevailing threat has not required utilization of a maritime area air-defence system.

Progress as a national program, although not without its problems, has gone as well as could be expected for this level of complexity, although there is still room for significant improvement.

The most significant point about the Type 45 program has been its influence on the maritime element of the UK's Defence Industrial Strategy and the resulting rationalization of the industry, the introduction of the block-construction philosophy, and the agreement of a 15-year partnering relationship between the MoD and the BVT. The success or otherwise of this partnership will be assessed as the CVF program continues and the Future Surface Combatant requirement matures and progresses.

The CVF project demonstrates the requirement for outstanding program management of the wider aspects of complex acquisitions of this sort. Although this paper has focused on the platform elements (the CVF project), the capability is nothing without its air group, and the parallel Joint Strike Fighter project continues to interact with and add complexity to the CVF project (and vice versa). Strong program management is required to recognize and manage the dependencies and the inevitable trade-offs, as well as deal with stakeholders.

The concept, in line with Smart Acquisition, of two approval points—Initial Gate and Main Gate—is irrelevant for major programs like the T45 and CVF where there are so many political, industrial, and international considerations. Achievement of the Main Gate for the CVF, for example, was delayed by two years. That is not to say that these decision points are without utility. They provide a major milestone review where progress can be ascertained, risks assessed, and future procurement options discussed and developed. However, any hope that objective options will simply be approved or rejected is unrealistic in these complex programs. The Gates are simply starting points for the development of acceptable compromise solutions.

None of the ship projects reviewed have been immune from political interference. Indeed, political interference is a fact of life. Project and program teams need to recognize this, making sure that they have the skills to manage their political stakeholders rather than complain about the level of interference.

The procurement strategies described are neither accident nor design. They are pragmatic responses, based on clear strategic frameworks (through the Strategic Defence Review, the introduction of Smart Acquisition, and the publication of the Defence Industrial Strategy), to an evolving environment. In two cases, T45 and CVF, this approach has resulted in inordinately long acquisition time scales and increased program delivery costs, compounded by the additional costs of running on older ships. However, more focused decision points may well have resulted in earlier termination of these programs, which would have had a significant impact on the UK's military capability. Reducing acquisition cycle times, an aim of many politicians, will require tough decisions to be made. Furthermore, some of these decisions may be politically unacceptable. In a democracy, political interference is a fact of life and its handling should not be ignored but should be factored into the overall management of any large and costly defence program.

The final conclusion is that there is no single, preferred procurement strategy. It needs to be tailored to reflect the platform being purchased and the

prevailing industrial circumstances, and the strategy will almost inevitably need to be further adapted to reflect political developments and imperatives. Unfortunately for these politically sensitive and highly complex and costly programs, these factors will add time and cost to the acquisition cycle unless program management teams can develop options that are acceptable to powerful political and industrial stakeholders who are then willing to make brave decisions.

NOTES

¹ Public Record Office, Cabinet CAB 128/2 CM (45) 56 minute (London: Public Record Office, 1945).

² R. Geddes, *Shipbuilding Inquiry Committee Report 1965–66*, Cmnd. 2937 (London: Her Majesty's Stationery Office, 1966).

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⁴ Secretary of State for Defence, *Statement of the Defence Estimates, 1991: Britain's Defence for the 1990s*, Cm 1559 (London: Her Majesty's Stationery Office, July 1991).

⁵ Secretary of State for Defence, *Defence Industrial Strategy – Defence White Paper* (London: Ministry of Defence, 2005).

⁶ K. Hartley, "The Economics of UK Procurement Policy" (Centre for Defence Economics, University of York, UK, October 2002).

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⁸ Ministry of Defence Private Finance Unit, *Review of MoD PFI Projects in Construction and Operation* (London: Ministry of Defence, 2005).

⁹ Confederation of British Industry, *Building on Success: The Way Forward for PFI* (London: Confederation of British Industry, 2007).

¹⁰ L. Johnman and H. Murphy, "The Rationalisation of Warship Building in the United Kingdom, 1945–2000," *Journal of Strategic Studies* 24, no. 3 (2001): 107.

¹¹ Secretary of State for Defence, *Defence Industrial Strategy*.

¹² T. Webb, "Abandon Ships and Sail On: As VT Group and BAE Systems Merge Shipbuilding Arms, the US Army and the BBC Will Occupy Paul Lester," *The Observer*, 16 December 2007, <http://www.guardian.co.uk/business/2007/dec/16/vtgroup.armstrade> (accessed 10 May 2010).

¹³ M. Arena, J. Birkler, J. Schank, J. Riposo, and C. Grammich, *Monitoring the Progress of Shipbuilding Programmes: How Can the Defence Procurement*

Agency More Accurately Monitor Progress? (Santa Monica, CA: RAND Corporation, 2005).

¹⁴ Secretary of State for Defence, *Defence Industrial Strategy*.

¹⁵ For “hot” warfighting capabilities, the military is more likely to take a calculated risk that a particular capability will not be required for a period of time—for instance, the lack of fleet air defence for the Royal Navy, resulting from retirement of the Sea Harrier force some years before the F-35 Lightning comes into service, and the retirement of elderly T42 Air Defence Destroyers before the T45 Destroyer becomes fully operational. In such circumstances, decisions can be made on deployment of forces without air defence depending on the threat levels, coalition contributions, and so on. This leeway is not an option for routine patrolling of territorial waters and the constant threats that are being countered.

¹⁶ Ministry of Defence, *Strategic Defence Review* (London: Secretary of State for Defence, 1998).

¹⁷ National Audit Office, *Transforming Logistics Support for Fast Jets*, HC 825 Session 2006–2007 (London: Her Majesty’s Stationery Office, 2007).

¹⁸ P. Antill, “Horizon: The Common New Generation Frigate,” *Military History Encyclopedia on the Web* (2001), http://www.historyofwar.org/articles/weapons_horizonlong (accessed 23 October 2009).

¹⁹ J. Birkler, J. Schank, M. Arena, G. Smith, and G. Lee, *The Royal Navy’s New-Generation Type 45 Destroyer: Acquisition Options and Implications* (Santa Monica, CA: RAND Research, 2001).

²⁰ *Ibid.*, xviii.

²¹ National Audit Office, *Providing Anti-Air Warfare Capability: The Type 45 Destroyer*, HC 295 Session 2008–2009 (London: Her Majesty’s Stationery Office, 2009).

²² The Carrier Strike program is the overarching program into which the CVF project delivers. Carrier Strike also includes the Joint Strike Fighter and the other Defence Lines of Development (including infrastructure, training, and support) that are required to deliver, through life, the Carrier Strike capability. The senior responsible owner is a role defined by the UK Office of Government Commerce’s “Managing Successful Programmes” framework.

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CHAPTER 2

Naval Shipbuilding in the Netherlands

Wim A. Smit

Naval/Maritime Industrial-Technological Cluster

The Royal Netherlands Navy (RNLN) has been a blue water navy for centuries. Its ships include frigates, submarines, minehunters and minesweepers, supply ships, and amphibian vessels. All these ships have been built on Dutch shipyards. The Navy has maintained long-lasting ties with a limited number of Dutch shipyards for building its surface vessels. Though officially the Ministry of Defence and Parliament decide on defence acquisitions, the Royal Netherlands Navy has managed to keep a relative autonomy on naval ship procurement through the years. As concerns shipbuilding, the RNLN differs in at least one respect from other navies: it has its own design department that designs new ships for the Navy, which are then built in Dutch shipyards. The Navy also designs the required Sensor, Weapon, and Control Systems (SEWACO). Much expertise on naval technology is therefore located within the Navy's own design office. Whereas the Netherlands has been self-sufficient in naval shipbuilding, this is not the case for the weaponry aboard the ships, most of which has been imported.

A tight naval/maritime industrial-technological cluster of companies is connected to the Royal Netherlands Navy. The heart of this cluster currently comprises the Navy; Damen Schelde Naval Shipbuilding; the naval defence electronics company Thales Netherlands, which has traditionally supplied the Navy with military radar and electronics; and Imtech Marine and Offshore,¹ which has supplied almost all Dutch naval ships with "civil" electrical installations and electronic systems for platform control and monitoring. The two R&D institutes, MARIN and TNO Defence Research,

provide a supporting research infrastructure for maritime research and naval technology development. Traditional second-tier suppliers in the cluster are Wärtsilä Nederland² for engines, Wärtsilä Propulsion Netherlands³ for screw propellers, and Rolls Royce for gas turbines. Additional second-tier companies are Rohde & Schwarz (telecommunication), Hertel Machine Services (firewall and accommodation), Rexroth Hydraudine (hydraulic cylinders), Exendis (energy conversion), and Loggers (shock and vibration protection).

The RNLN, being at the centre of this cluster, acts as the *orchestrator* of virtually all naval shipbuilding in the Netherlands. In order to keep this cluster alive in hard times, the Navy (or, formally, the Ministries of Defence and of Economic Affairs) has supported the shipyards financially, or has allowed shipyards to sell naval ships already under construction for the RNLN to a foreign navy—the Dutch ships then being delivered at a later stage.

Short History of the Dutch Naval Shipbuilding Industry

The Netherlands has a long-standing tradition, of several centuries, in building its own warships. It belongs to a handful of traditional European naval shipbuilding countries, including the United Kingdom, France, Germany, and Russia. Until the beginning of the twentieth century the Dutch State itself operated several shipyards (*Rijkswerven*) that built large warships. Nowadays, the Dutch Navy owns one shipyard, at its naval base in Den Helder, which is mainly involved in ship maintenance but has also built a number of small landing craft. The Dutch shipyards that built naval vessels after World War II were also strongly involved in commercial shipbuilding, until the 1970s.

In the 1960s hard times set in for the Dutch and, more generally, for the European (civil) shipbuilding industry due to heavy international competition, in particular from countries in the Far East. Countries such as Japan and South Korea became the centres of gravity for building large oil tankers and bulk carriers. Employment at the large Dutch shipyards and at the yards involved in naval shipbuilding, including De Schelde, Rotterdamse Droogdok Maatschappij (RDM), and Wilton Fijenoord, decreased.⁴ The decline in orders, combined with the high investments in large docks required to stay in business, forced the large shipyards to cooperate in order to reduce costs. In 1966 the shipyards RDM and De Schelde merged into the Rijn-Schelde organization with 11,000 personnel, and in 1968 Rijn-Schelde took over the Wilton Fijenoord shipyard.

From the 1950s through the 1980s, the main shipyards active in naval shipbuilding were

- De Schelde in Vlissingen, building most of the Dutch frigates;
- Rotterdamse Droogdok Maatschappij (RDM), building most of the Dutch submarines;
- Wilton Fijenoord in Schiedam and Rotterdam, which built two frigates and four submarines (of which two were exported to Taiwan in the 1980s);
- Van der Giessen de Noord in Rotterdam, building minesweepers and minehunters; and
- the Nederlandse Scheepsbouw Maatschappij in Amsterdam, which was involved in building three frigates (until the mid-1960s).

In the 1980s, Damen Shipyards, which specialized in smaller ships, started building fast patrol and attack craft, mainly for the export market.

A further decline in large merchant ship orders to the Dutch shipyards caused the yards that were traditionally involved in both commercial and naval shipbuilding, such as De Schelde and RDM, to increasingly specialize in naval shipbuilding in their struggle for survival. Moreover, their lack of success in the naval export market meant that these shipyards became even more dependent upon orders from the Dutch Navy. For example, between 1975 and the 1990s, De Schelde shipyard built only warships and no commercial ships. Attempts by the yard to re-enter the commercial market in the 1990s were not very successful.

The Rijn-Schelde-Verolme (RSV) organization, a mega-merger in 1971 resulting from governmental intervention and involving all large shipyards (except Van der Giessen de Noord), turned into a real disaster. RSV went bankrupt and was dissolved in 1983, after more than ten years during which the Dutch government had pumped €1 billion into the concern to keep large shipbuilding in the Netherlands alive. The only shipbuilding activity within RSV that remained profitable was naval shipbuilding by the shipyards De Schelde, Wilton Fijenoord, and RDM. This profit was the result of support from the Dutch Navy. Not only did the naval contracts contain “cost-plus” in terms of a fixed profit percentage but the Navy and Ministry of Defence sometimes brought orders forward, commissioning the building of new ships earlier than originally planned. This was the case, for instance, with some S-Frigates in the mid-1970s (De Schelde) and, in the mid-1980s, with some M-Frigates (De Schelde) and the Walrus submarines (RDM).

Moreover, in 1980 the Dutch Navy permitted De Schelde to sell two S-Frigates under construction for the Navy to Greece, at a loss to the Navy of several hundred million euro.

After the breakup of RSV in 1983, the two shipyards De Schelde and RDM, both involved in building new ships for the Dutch Navy at the time, were saved and received considerable governmental support.⁵ Both yards acquired a privileged position in naval shipbuilding. De Schelde became the Navy's partner for building frigates and RDM for submarines. Wilton Fijenoord, at the time still involved in building two submarines for Taiwan, was left to fend for itself. By the mid-1990s Wilton Fijenoord had limited its activities to ship repair and maintenance. RDM fell into decline in the early 1990s, after the completion of the four Walrus-class submarines for the RNLN, and no new orders were received. It went bankrupt in 2004.

The other shipyard that had traditionally been involved in naval shipbuilding, especially minesweepers, was Van der Giessen de Noord. The yard was awarded the order for building 15 Alkmaar-class minehunters between 1979 and 1989, and an additional two for Indonesia. In contrast to De Schelde, Van der Giessen de Noord successfully shifted its emphasis to the civilian market for technologically advanced ships for some years. At the same time, the yard tried to retain its naval expertise, hoping to receive the order for the Troika minesweeper system. However, the Dutch Ministry of Defence endlessly postponed and finally abandoned the project. After having been taken over by IHC-Caland in 1997, Van der Giessen de Noord shipyard was closed down in 2003 due to lack of orders.

In the late 1990s, De Schelde, while still building the four Air Defence and Command frigates for the RNLN, nearly went bankrupt. It was saved through a takeover by Damen Shipyards in 2000, with substantial financial support from the Dutch government. Since then all new naval ships for the RNLN have been built by Damen Schelde Naval Shipbuilding.⁶

Dutch Naval Exports in Recent Decades

In the second half of the twentieth century, the Dutch yards involved in naval shipbuilding were not very successful in their export attempts. NATO countries usually protect their own domestic naval shipbuilding capacity. On the highly political international naval ship market, shipyards are strongly dependent upon promotional activities by their own government and navy. In many cases the Dutch yards involved in naval shipbuilding did not receive the level of support that competing foreign (European) shipyards received from their respective governments.⁷ Moreover, the technologically

advanced Dutch frigates and submarines were in the high-price class and therefore often not affordable to emerging or less advanced naval countries. Still, as the Royal Netherlands Navy has a clear interest in securing a strong financial position for the yards, it has on several occasions delayed its own procurement schedule on behalf of quick deliveries to foreign navies.⁸

Because the level of domestic naval orders has been limited, exports were necessary for Dutch naval shipyards to maintain the existing capacity. However, the lack of success for substantial exports made the yards even more dependent upon the (limited) Royal Netherlands Navy's orders, implying a rather precarious position.

The Netherlands was more successful at selling *used* frigates and mine-sweepers. One route for gaining access to potential foreign markets is to start by offering used (cheap) warships to establish relations. Unfortunately for the Dutch shipyards, follow-on contracts for supplying new warships were realized only occasionally. More often, the transfer of used ships has been accompanied or followed by refitting programs. Next to the shipyards, the Dutch naval electronic company Thales Netherlands has often been involved in modernizing the radar and fire control equipment. However, only two countries, Peru and Indonesia, have been outstanding customers of second-hand Dutch warships. Of these, only Indonesia has also bought newly built naval vessels from Dutch shipyards: two minehunters at the end of the 1980s, and more recently four SIGMA-class corvettes for the Indonesian Navy (TNI-AL), built by Damen Schelde Naval Shipbuilding between 2005 and 2009.

Export opportunities have also been plagued by political factors, either at home or in the customer country. In the mid-1960s, the weapons embargo against South Africa prevented the delivery of submarines to South Africa. The Iranian revolution blocked a possible order for eight frigates at the end of the 1970s. A follow-on contract to build two or more submarines for Taiwan in the 1980s was refused by the Dutch government after a political crisis between the Netherlands and the People's Republic of China.

Rumours in 1999 about RDM Submarines hoping to conclude a contract with Egypt to build two submarines of a new type—the Moray submarine, which existed only on the drawing board—did not substantiate. Another glimmer of hope was Malaysia's reported interest in buying two second-hand submarines from RDM Submarines, possibly followed by the construction of two new Moray submarines. Because export orders were vital to RDM Submarines and none of these projects materialized, the business of building submarines in the Netherlands has now disappeared.

By contrast, Damen Shipyards has been successful in exporting fast attack craft and patrol vessels for navy or customs and coast guard, for example to Malaysia, Sudan, Hong Kong, and Guernsey.

The Netherlands has been successful in the export of radar and fire control equipment for naval combat systems. The Dutch company Thales Netherlands (part of the French defence-electronic giant Thales, since 1990) is a world player, having supplied equipment for more than 80 fast patrol boats, 40 corvettes, 120 frigates, and 45 other major vessels in either new or refitting programs.

Exports of Naval Vessels Since 2000

Since De Schelde was taken over by Damen Shipyards in 2000, export prospects have increased. Damen's policy is to build less costly warships, such as patrol vessels and corvettes; moreover, its ship designs are more flexible and thus more adaptable to the customer's specific wishes. In particular, Damen's SIGMA concept uses a modular design in many areas, which offers the user greater flexibility at reduced costs.⁹ Between 2005 and 2009, four corvettes using the SIGMA design were built for the Indonesian Navy. In 2009 Damen Schelde Naval Shipbuilding started the construction of three SIGMA "multi-mission frigates" (corvettes) for the Royal Moroccan Navy, to be delivered in 2012. Their design was based on the corvettes built for Indonesia, but enlarged using the modular-hull design. Damen Schelde has also built a hydrographic survey vessel for the Royal Thai Navy (delivered in 2008)¹⁰ and has received a Swedish order for three multi-purpose coast guard vessels, the first being delivered in 2009.¹¹

Related to the reduction in size of the RNLN's fleet in the past decade, a number of used warships have been sold. Five frigates were sold to Chile between 2005 and 2007, two frigates to Belgium in 2007 and 2008, and two frigates to Portugal in 2009. Five minehunters were sold to Latvia in 2005 (and delivered between 2007 and 2009).

Dutch International Collaboration

Dutch shipyards have been involved in some international collaborative naval projects. These include the Trilateral Frigate Program, a rather loose collaboration from the mid-1990s to 2004 between Germany, Spain, and the Netherlands (each designing and building its own frigates); a Landing Platform Dock (Amphibious Transport Ship), a collaboration with Spain in the mid-1990s; on the Tripartite coastal minehunter (Eridan), a collaboration

between France, Belgium, and the Netherlands (1974–1985); and the Troika minesweeper system in cooperation with Germany.¹² In 1990 the shipyard Van der Giessen de Noord signed a memorandum of understanding with the Belgian shipyard Beliard Polyship—its partner in the successful Tripartite minehunter project of the 1980s—to design and build 14 new inshore minesweepers for the Dutch (8 vessels) and Belgian navies (6 vessels). In 1991 Portugal joined the project. However, following the collapse of the Warsaw Pact, the Dutch Ministry of Defence cancelled this minesweeper project.

Prospects for Dutch Naval Shipbuilding

The size of the traditional Dutch naval shipbuilding industry has been reduced substantially. In fact, Damen Schelde Shipyards, having a privileged position, is currently the only shipyard that builds naval vessels for the Royal Netherlands Navy. Damen Schelde has a close working relationship with the Damen-owned Galati shipyard in Galatz, Romania. For instance, the aft and forward sections of the Landing Platform Dock Johan de Witt were built in Galatz, while the mid-section including the engine room was built at the Schelde yard. Likewise, whereas the first two Ocean Patrol Vessels for the RNLN are being built at the Schelde yard, the other two will be built at the Galati shipyard in Romania, thus lowering the price. Engineering and installation of the SEWACO systems occurs in the Netherlands. As mentioned, Damen Shipyards also has good export prospects for its small civilian and naval ships (fast attack craft, corvettes, and patrol vessels).

The Dutch capacity for building the RNLN's advanced submarines has disappeared, probably forever. There is only one Dutch shipbuilding company left that still wants to compete with Damen Shipyards to build naval ships—IHC Merwede. Next to its commercial shipbuilding activities, it focuses on design and construction of auxiliary and support vessels for the Navy, such as Amphibious Transport Vessels, Landing Platform Docks, and Auxiliary Oil Replenishment vessels. IHC Merwede was engaged by the Australian defence and technology contractor Tenix Defence Pty Ltd. to construct the multi-role ship HMNZS Canterbury for the New Zealand Navy.¹³ However, it lacks broad experience in naval shipbuilding. Therefore, its chances for receiving a contract for the RNLN's new Joint Supply Ship (JSS) were poor. The contract for the construction of the JSS went to Damen Shipyards and was signed in December 2009. About 60 percent (work hours) of the JSS's construction will be carried out at Damen's shipyard in Romania.¹⁴

The long relationship of mutual trust that has existed between the Royal Netherlands Navy and its traditional prime contractors in shipbuilding (three

to four shipyards in the past decades—now reduced to one, Damen Schelde), in radar and fire control (Thales Netherlands), and in platform control and monitor systems (Imtech) implies a comfortable position for the Navy. The RNLN has always preferred relationships of mutual trust with its suppliers rather than putting them in competition with other potential suppliers.

The Navy's role as designer of naval ships was accepted as a matter of course by the shipyards. This situation will change if and when the Navy has to turn to foreign shipyards to build its ships—a rather unattractive prospect to the Navy compared with its present position. In this sense the Navy is, in turn, dependent upon the Dutch shipyards and it is in the Navy's interest to sustain at least a minimum domestic naval shipbuilding capacity. This explains why the Navy has been so supportive of the shipyards, both through financial and other arrangements and by promoting and supporting the shipyards' export efforts. It also explains the RNLN's commitment to Damen Shipyards when it took over the yard De Schelde in 2000, and the Navy's recent willingness for an early procurement of four Ocean Patrol Vessels to prevent a large time gap between Damen's finishing the construction of four Air Defence and Command frigates in 2005 and receiving the commission of new frigates or patrol vessels.

The dominant position of the RNLN as a "leader firm" within the Dutch naval industrial-technological cluster may also have its drawbacks when it comes to exports. Whereas in naval exports the Navy plays a crucial role as a *launch customer*, the RNLN, by designing its own ships tailored to its own specific wishes, may "force" the shipyards to build ships of a less flexible design—ships that are less adaptable to the specific wishes of other navies, and thus harder to export. The RNLN's wish list may result not only in technologically advanced but also in expensive warships, which makes them attractive to other navies only as second-hand vessels after having been used by the RNLN for a number of years, as is evident from past experience. Thus, the challenge for Damen Schelde Naval Shipbuilding is how to serve both the RNLN and foreign navies. As for patrol vessels, the RNLN's specific requirements may turn out to be favourable to Damen Schelde, because the company can now offer two types of patrol vessels on the international market—the SIGMA-design and the RNLN-design patrol vessels.

International Context in Naval Shipbuilding

In contrast to the defence aerospace and electronics industries, which have strong transnational links, naval shipbuilding is still nationally

oriented. One factor accounting for this difference is that the defence aerospace and electronics industries have a large overlap with the transnational civil aerospace and electronics industries. A second factor is the traditional close relationship between navies and shipyards, which caused navies to procure primarily from domestic shipyards. A third factor is that in contrast to the large number of orders placed for fighter aircraft, warships (cruisers, carriers, frigates, submarines) are built in relatively small numbers.

Most naval shipyards are strongly dependent upon orders from their national navy.

Only a few yards are successful in exporting naval ships. This is certainly true for Dutch naval shipbuilding, though the position of the yard De Schelde has improved since it was taken over in 2000 by Damen Shipyards, which is successful in exporting patrol vessels.

In Europe, the main exception is Germany, where naval shipyards are also involved in civil shipbuilding, allowing them to fill naval gaps with civil orders. The German yards also have a strong export position, for instance as to frigates, corvettes, and submarines.

Consolidation of European naval shipbuilding is occurring on a national scale.

The steady increase in unit costs of naval ships, against a background in the 1990s of decreasing naval budgets, caused difficulties for traditional naval shipyards. Financial pressures led to rationalization of the industry, as a number of (national) mergers and acquisitions took place and some shipyards closed. The consolidation process was not a new phenomenon in shipbuilding: in Western countries, national-level rationalization and consolidation in the naval shipbuilding industry has been underway since 1945. This process accelerated during the 1960s and 1970s when civil shipbuilding faced fierce competition from the Far East. In the United States, for instance, the number of private suppliers to the US Navy decreased from 175 (operating 200 yards) in World War II to basically 6 naval shipbuilding yards today. Similarly, in the United Kingdom, the number of naval shipbuilding companies fell from 42 (46 yards) during World War II to 2 companies running 4 yards in 2000.

In the Netherlands, Damen Schelde Naval Shipbuilding is currently the only supplier to the RNLN, though IHC Merwede is trying to re-enter the market. To date only two transnational mergers have occurred: the takeover

by the German yard HDW of the Swedish naval shipyard Kockums in 1999, and of the Greece Hellenic Shipyards in 2002. Today, while transnational mergers are less likely, intensified transnational cooperation is more likely. Thus, further collaboration may occur between the German ThyssenKrupp Marine Systems (including Blohm + Voss, Thyssen Nordseewerke, and HDW) and the Italian yard Fincantieri, which are already collaborating on the building of submarines for the Italian navy.

Emerging naval countries seek their own domestic naval shipbuilding capabilities.

The total number of countries throughout the world capable of building large warships has increased from 10 in the early 1950s to about 40 today. Although initially importing and building under licence, the emerging naval countries have emulated the traditional ones in building up their domestic naval shipbuilding capability. The current export pattern of traditional European naval shipbuilding countries is one of *export of lead ships plus technology transfer*; that is, one or two lead ships are built in the exporting countries, with the follow-on ships being built, under licence, in the yards of the recipient country (e.g., French submarines to Pakistan and frigates to Singapore, German corvettes to Singapore and frigates to Turkey and Greece, and Spanish frigates to Norway). This is a policy that the Dutch Damen Shipyards will also follow when appropriate. Currently, however, Damen is focusing on cooperating with shipyards and building new yards in low-wage countries, for instance in the Far East and Eastern Europe.

A shift in predominance may occur from naval yards to system integrators.

The most valuable parts of naval ships are the weapons and electronics systems. Weapons and defence electronics companies may increasingly take a predominant role as system integrators in naval shipbuilding. This is already the case in the United Kingdom, where BAE Systems now owns the major naval shipbuilding yards. In the United States, the “Big Six” shipyards are now owned by only two (defence) companies, General Dynamics and Northrop Grumman. In France, the prime naval shipyard for the French Navy, DCNS, has a close relationship with the defence electronics company Thales. In such cases, a system integrator could eventually own yards in a number of different countries; that is, a virtual transnational merger of such yards might occur.

NOTES

¹ Formerly Rietschoten & Houwens (R&H), supplier to the RNLN since 1890.

² Formerly Stork Dieselmotoren.

³ Formerly Lips Scheepsschroeven.

⁴ For instance, employment at Wilton Fijenoord dropped dramatically from 8,400 in 1967 to 4,100 in 1971, 3,300 in 1977, and 700 in 1988. Employment at the yard De Schelde had dropped to about 700 by 2004.

⁵ De Schelde had only two shareholders: the Dutch State (90 percent) and the Province of Zeeland (10 percent).

⁶ According to the director of the yard IHC Merwede, it was agreed that, for a period of five years, other shipyards would not compete with Damen Schelde. This arrangement resulted, *inter alia*, in the Navy commissioning two hydrographical survey vessels with the Damen Schelde yard in 2000, followed by the RNLN's second Landing Platform Dock (LPD), Johan de Witt, in 2002. The LPD was completed in 2006.

⁷ For instance, in 1984, after ten years of negotiations, perspectives for building S-Frigates for Portugal were nullified by a German offer.

⁸ For instance, the export of two S-Frigates to Greece in 1981–1982, and of two minehunters to Indonesia in 1985.

⁹ The SIGMA design (Ship Integrated Geometric Modular Design Approach) uses standard, 7.2-meter-long (24-foot) sections separated by bulkheads with watertight doors throughout the ship. By varying the number of sections, a ship can be stretched or shortened. The Indonesian corvettes, for example, have 12 sections, two of the Moroccan ships have 13, and the third Moroccan ship has 14 sections.

¹⁰ The project was carried out by a joint venture of Damen and Unithai Shipyard, in which design and engineering, purchasing, and project management were handled through Damen Schelde Naval Shipbuilding and the building of the vessel itself was carried out by Unithai Shipyard in Thailand.

¹¹ Design and engineering, purchasing, and project management were handled through Damen Schelde Naval Shipbuilding, while the building of the first vessel was carried out at Damen Shipyards Galati in Romania.

¹² The Troika minesweeper system included a guidance ship that remotely controls the minesweeping Troika-drones. The Dutch Troika project was postponed several times and eventually never substantiated.

¹³ The vessel was delivered to Tenix Defence Pty in 2006, after which Tenix completed the military outfitting at its facilities in Australia.

¹⁴ The total costs for the Dutch JSS project are about €365 million.

CHAPTER 3

Shaping Future Procurement Strategies through Canadian Defence Procurement Reform

Lieutenant-Colonel Ross Fetterly

One thing is clear: the larger acquisition process was designed and optimized to respond to a security environment dominated by a single strategic threat, the former Soviet Union. The security environment is very different today; therefore, the processes need to change to meet the demands of this new environment. We must have the flexibility and agility to respond to dynamic security challenges and rapidly changing needs.¹

— Assessment Panel of the Defense Acquisition
Performance Assessment Project, 2006

The subject of replacing the naval fleet of today with the naval fleet of tomorrow has been a recurring theme in Canadian defence ever since Lord Jellicoe issued his report at the end of 1919 on alternative model fleets for the post–First World War Canadian Navy.² Although modern defence management includes an in-depth planning and budgeting regime, the requirement to develop and implement capital equipment replacement strategies within a defined budget remains a constant challenge for all national military organizations.³ While replacing aging military fleets is a recurring investment decision, identification of optimal replacement strategies in a defence environment with a high level of uncertainty is a significant task. The subject of defence procurement is significant to a nation, as “the process of procuring weapons and the vehicles which carry them is complex, expensive and of great national importance since it strongly influences and may even govern the ability of a country to preserve its way of life and its integrity.”⁴

The intense use of our military equipment on deployed operations today gives defence procurement issues increased prominence in Canada. Furthermore, the current international strategic environment makes timeliness a predominant criterion under which defence department procurement processes can be judged. Whereas the “differentiator in military operations could previously be measured in terms of scale and potency, today it is more about agility and the ability to create an appropriate military effect rapidly and in response to changes in the operational environment.”⁵ Consequently, the departmental capital equipment program is central to the defence strategy articulated by government policy. Indeed, “while defence policy is important, the reality is that, without equipment, one cannot even begin to implement that policy.”⁶ The projects approved, as well as the manner and speed in which they are implemented, are fundamental to the success of that strategy. In the absence of a procurement process capable of providing a timely response to changes in capabilities needed by equipment in use in deployed operations, the ability of military forces to achieve the goals and objectives of government policies is severely constrained.

One of the most prominent characteristics of defence is that it is a capital-intensive activity. From a very basic perspective, if Armies, Navies, and Air Forces do not have the quantities and capabilities of equipment required, their ability to do their assigned tasks will be severely restricted.⁷ As the Auditor General wrote in a 1998 report, “defence capital acquisition decisions affect how well the Canadian Forces can implement defence policy. The amount and type of equipment they purchase directly affects their ability to carry out their roles, which in turn determines how and where the government can deploy them.”⁸

The ability of the defence procurement system to meet the operational demands of military forces has been a concern for governments across Western nations for several decades. The solution frequently proposed to improve the acquisition process is defence procurement reform. Indeed, “during the past 50 years, defense acquisition reform panels, studies, reviews, and commissions occurred with such frequency that they could virtually provide lifetime employment.”⁹ The large dollar value of acquisition contracts, the positive employment return from major defence contracts, the advanced technology inherent in weapons systems that benefits the national economy, the spinoff of political pressure on politicians in ridings with a high concentration of defence employment, and the power of defence industry advocates have all combined to pressure national governments to create jobs through defence procurement spending. Indeed, the sophisticated, leading-edge technology necessary for the development and manufacture

of advanced weapons systems produces the high-value employment that national governments want to foster, in large part for the “multiplier effects” it provides within the domestic economy. The significant demand for defence-procurement funding stems from the rapidly evolving nature of modern warfare and the so-called revolution in military affairs.

This paper examines the subject of defence procurement reform and considers how this information can be applied to the capital equipment procurement process. The paper begins by outlining six major trends affecting the Canadian defence procurement environment. That is followed by an examination of the differences between the private and defence sector maritime markets. Defence procurement reform is then discussed, the need for effective knowledge management raised, and optimal equipment sequencing literature reviewed. The importance of a disciplined approach to capital project decision-making is emphasized next, and the potential for greater international collaboration is highlighted. The paper concludes with observations on how the transition to accrual accounting practices in the Department of National Defence is affecting capital equipment procurement.

Major Trends Affecting the Defence Procurement Environment

The Canadian Forces, as with other allied military establishments, has undergone a significant and rapid transformation since the end of the Cold War in 1989. Currently, change in the Canadian naval procurement environment is dominated by six major trends. The primary factor driving this change is the elevated level of sustained Canadian participation in high-intensity international deployed coalition operations. This dominates all aspects of military operations and support. Second is the prolonged substantive involvement in international deployed operations. This is facilitating an ongoing shift in the Canadian Forces to an expeditionary military both in practice and in culture. In this capacity, the Navy is a leader. Third is the procurement of capital equipment fleets not currently in the Canadian Forces’ inventory for use directly on international deployed operations. This is a development not observed in Canada since the early stages of World War II and brings the particular challenge of integrating new capabilities into operational units while deployed. Fourth is the long-term challenge facing both the Department of National Defence and the Canadian Forces in advancing an ambitious capital equipment program while simultaneously integrating numerous replacement-generation fleets into operational units. The prolonged demands placed on large numbers of military and departmental personnel by the increase in capital project offices, while

also training personnel to operate and maintain new equipment, are substantial. Fifth is the rapidly growing demand for replacement equipment parts, as well as capital equipment repair and overhaul contracts. This is the result of the sustained high equipment activity rate and the difficult environment in which the Canadian Forces operates. These expenditures are funded from the departmental National Procurement budget.¹⁰ Sixth is the emerging, and not yet clearly recognized, shift in the capital equipment budget from its historical residual status within the overall defence budget to that of a primary and sustained focus of decision-making about defence resource allocation. This will significantly affect how defence operations and maintenance expenditure resources, previously the main targets of in-year capital program slippage, are managed. These trends will all influence what equipment the department will purchase, when it will be required, and how current equipment fleets will be managed. Prior to examining defence procurement reform, a review of the differences between capital equipment procurement in the private sector and in the defence sector is provided as a foundation for later discussion.

Differences between the Private Sector Market and the Defence Market

New opportunities rarely fit the way an industry has always approached the market, defined it, or organized to serve it.¹¹

—Peter Drucker, “The Discipline of Innovation,” 1985

Leading firms in the corporate sector are, out of necessity, proactive in undertaking fundamental changes to their business models and processes; otherwise, demands for change become overwhelming and organizational failure occurs. Corporations manage change by pursuing multiple rather than single strategies, remaining flexible in approaches taken, and implementing solutions in a timely manner. This proactive approach inherent in exceptional corporations stresses the necessity for organizational strategic resilience.¹² Although operating in this manner can come at a cost of increasing complexity, it is balanced against the benefit of greater responsiveness to market conditions.

The private sector market for major capital equipment is significantly different from that of defence fleets in terms of system requirements. Therefore, it can be expected that the characteristics of the private sector capital procurement market will be distinct from those of the defence capital procurement market, as the assets within each market are designed and

built for a specific purpose.¹³ However, these differences do not mean that enhancements or advances in the private sector market could not be adapted to benefit the defence sector. For example, improvements in technology can benefit customers in both sectors. Advantages in defence technology do not win wars by themselves, but in the hands of able commanders and troops, superior defence technologies have time and again altered the way battles are fought and won.¹⁴

Commercial shipbuilding and military shipbuilding are significantly different. Commercial vessels are several times the size of warships yet much less complex. The distinct set of requirements for both types of vessels leads to differences in design; naval ships are filled with advanced equipment and technology that require a much more rigorous testing and evaluation regime. Furthermore, the differences in ship dimensions and sophistication require naval vessels to have a more skilled construction and maintenance workforce, and a greater level of engineering support. To be sure, “given the complexity of ... [warship] design and construction, warship procurement is arguably the most complex procurement activity our government undertakes.”¹⁵ The ship procurement process in defence, as compared to the private sector, is more detailed, complex, and lengthy.

Incentives for manufacturers in filling military or commercial orders for ships can be quite dissimilar. Contracts for commercial shipbuilding focus incentives toward ensuring on-time delivery of the ships, whereas for military contracts, payments are made to the manufacturer following specific milestones.¹⁶ Although commercial shipbuilders generally build their ships from established designs, the design of naval vessels by both class and nation tends to vary. The importance of this distinctive feature of the two markets cannot be overstated. The requirements for naval vessels of developed countries are largely similar, as are their requirements for commercial vessels. Yet while commercial vessels of various size and specialization are produced in large quantities from essentially standard designs, naval vessels are generally designed independently and produced in small numbers.

The naval shipbuilding industry is quite specific on its concerns regarding the naval shipbuilding market.¹⁷ First, industry reliance on government shipbuilding contracts is not a stable business model. From the perspective of industry, the regularity of naval shipbuilding contracts is not steady, and future plans for naval contracts are uncertain and often subject to change. The uncertainty of future naval shipbuilding contracts acts as a constraint on the willingness of firms in the industry to invest in modernization of shipyards and to increase skills in their labour force. In a capital-intensive

industry, such as shipbuilding, this is a significant handicap and acts as a disincentive to further investment. Second, the significant differences between the two markets, and the products they produce, make it difficult for naval shipbuilders to diversify into the commercial market. Third, as a consequence of the dwindling supplier base for military shipyards in the post–Cold War era, specialized spare parts built to meet specifications of naval vessels take longer to acquire and, with limited quantities procured, can result in significant price escalation over time. Fourth, industry perceives contractual requirements of governments, together with regulatory regimes and statutory requirements, as an ever-increasing burden. Complying with government processes increases private sector costs and further limits the pool of companies willing to undertake this work due to the particular institutional expertise required to prepare project bid submissions. The considerable quantity of change orders in military shipbuilding programs throughout that process, as well as late product definition, are leading causes of project delays.¹⁸

In military shipbuilding, national governments are the sole purchaser from competing firms, whereas in the private sector there are multiple buyers and sellers. Key challenges in the defence market come from increased complexity, differences in incentives, greater uncertainty, and the extraordinary demands imposed by government that drive greater asset specificity and more detailed process specificity.

Despite the marked differences between the defence and commercial sectors, the process of designing, building, and maintaining equipment fleets is reasonably similar. In addition, both sectors are significantly influenced and shaped by advances in science and technology.¹⁹ Given these grounds for comparison, the naval shipbuilding industry could adopt the proactive strategies of the corporate sector to better manage change. As the “lead for developing many critical technologies has shifted from the defense industry to commercial industry,”²⁰ the dynamics between defence departments and the corporate sector have changed. It is just as important—or even more important—for defence departments to maintain and improve capabilities in addition to meeting the objectives of policy, yet it is corporations that are leading and defence departments learning the lessons of industry.²¹ Defence procurement reform is a largely ongoing process that updates and adapts acquisition methodologies to leading-edge processes.

Defence Procurement Reform

While DOD maintains military forces with unparalleled capabilities, it continues to confront pervasive, decades-old management problems related to its

business operations—which include outdated systems and processes—that support these forces.²²

—United States Government Accountability Office, 2009

The need for change in defence procurement was evident over four decades ago. The influential 1968 Packard Commission report in the United States set the foundation for a generation of subsequent reforms in defence procurement.²³ However, the need for further defence procurement reform in Western nations is driven by the dramatic unleashing of ethnic, regional, and religious tensions previously held in check by the bipolar world, and the uncertainty that the shifting international security environment has brought to the United States and other nations over the past decade.

Critics of defence procurement reforms over the past several decades have complained that these reforms “focused on making incremental improvements to a narrowly defined acquisition process.”²⁴ This view minimizes the impact of measures taken since the late 1980s to maximize declining procurement funding. Falling budgets and the failure of incrementalism have forced an in-depth institutional examination over a number of years as to how equipment is procured and, out of necessity, how costs could be reduced.

In the early 1990s the changed and unsettled international strategic environment brought shifts in what had previously been the relatively stable operational demands on front-line military personnel. The predominance of asymmetrical conflicts and the multiplication of unconventional threats have resulted in more frequent changes to operational requirements of weapon systems. Linked to these phenomena was a marked difference in government and business procurement cycles; sluggish military procurement cycles took “as much as 2.5 times longer than commercial cycles” to complete an acquisition project.²⁵ Finally, regulatory barriers and the intense bureaucracy of defence procurement organizations were seen everywhere as barriers to firms considering entry into the defence sector.²⁶

More recently, advances in commercial products combined with a shrinking gap between capabilities of commercial and military products have highlighted the inefficiency of certain products produced according to relatively inflexible military specifications. The apparent compatibility of some public and military requirements and material makes a compelling case for defence departments to look to the private sector for solutions, particularly in view of the speed with which commercial products having a high level of technology are advancing.

Despite the plethora of defence procurement reforms in Western countries in recent decades, reform in this area may never be complete. From this perspective, procurement reform in defence establishments “is perhaps better viewed as something that will always be a work in progress.”²⁷ This dynamic should not overshadow efforts to better understand how the procurement process functions or the desire to shift to a more appropriate and focused defence acquisition system. Perhaps the most important observation in recent decades is the transition from the emphasis in the 1990s on process reform to the prominence now given to the achievement of effective outcomes. The practical effect is that today departmental program managers are dedicating less attention to how weapons systems are produced and more to what the program is intended to deliver.²⁸

Assessments of the success of defence procurement reforms in Western nations are mixed, partly due to changing visions and criteria for success in defence procurement over time. Changes in governments invariably bring shifts in policy approaches, often challenging or reversing momentum that may have been achieved earlier. Specifically, “changing visions also create potential for less than full realization of change consequences, as change agents become overly focused on achieving some measure of change during their term in power.”²⁹

Successful, innovative firms are constantly examined for the lessons that they can provide other businesses, or even public sector organizations. Innovative organizations merit study because they have succeeded well beyond their peers. In the RAND publication *Implementing Best Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*,³⁰ the authors examine innovative commercial procurement practices and convey how these practices can be applied in a Department of Defence context. The report emphasizes that supply-chain best practices can be applied in any organization, with military establishments being no exception. The authors found that innovative corporations are transitioning from a transactional to a goal-oriented approach. In addition, due to the significant change required to implement new procurement practices, experience has demonstrated that formal implementation processes are required. A considerable percentage of the defence budget is spent on capital equipment, as well as goods and services. Thus the authors observed that the level of effectiveness achieved in the procurement process is becoming increasingly important to organizational performance, thereby making procurement processes a key strategic management concern. One of the most common issues in both private sector and defence procurement is management of capital project costs.

A combination of significant and persistent cost growth in defence acquisition programs and “a systematic bias toward underestimating the costs”³¹ of procuring weapons systems makes national military capital procurement programs a lightning rod for the media, opposition parties, and interest groups opposed to defence spending. For these reasons defence procurement processes are constantly under review by governments seeking to increase efficiency, effectiveness, and timeliness in the acquisition process. According to the recently published United Kingdom report entitled *Review of Acquisition for the Secretary of State for Defence*,³² the procurement process can be improved through greater autonomy, better skills, financial discipline, and improved accountability.

The cost of military equipment is increasing more rapidly on a sustained basis than the rate of general inflation, and this is a perennial obstacle to maintaining the purchasing power for defence capital equipment. In *A Macroscopic Examination of the Trends in U.S. Naval Ship Costs over the Past Several Decades*, RAND Corporation examines four decades of data and analyzes the magnitude of growth in ship costs, and compares this cost growth to other sectors of the economy and even to other types of weapon systems.³³ In the case of the United States Navy, “the real growth in Navy ship costs means that ships are becoming more expensive and outstripping the Navy’s ability to pay for them.”³⁴

In a 1986 interim report for the US President’s Blue Ribbon Commission on Defense Management, the commissioners viewed the following as common characteristics of successful commercial and government projects:

Short, unambiguous lines of communication among levels of management, small staffs of highly competent professional personnel, an emphasis on innovation and productivity, smart buying practices, and, most importantly, a stable environment of planning and funding—all are characteristic of efficient and successful management.³⁵

Although the above characteristics are widespread in leading companies, it remains a challenge to meet these criteria within defence departments, given the differences in organizational structures and control over their environments. As a result of this fundamental finding in an influential American defence procurement reform report, the applicability of private sector acquisition techniques in defence procurement has been the subject of significant discussion in the literature. In 1999, the United States Government Accountability Office determined that the use of private sector

best practices in defence acquisition can improve procurement outcomes, despite the significant differences between the sectors and their market incentives.³⁶

The 2009 report by the Business Executives for National Security entitled *Getting to Best: Reforming the Defense Acquisition Enterprise* articulates quite succinctly the application of the current private sector procurement model to defence procurement.³⁷ The contribution of this report is that it demonstrates the broad range of similarities in the procurement process of capital equipment between defence and the private sector. The report puts forward comprehensive arguments for greater use of business processes in defence procurement, ensuring its reference on further discussion of this subject. The authors observe that “the acquisition process, unlike most government pursuits, is a business function. It demands the skills and talents that are far more common to the business world than to governance, military operations, or policy-setting.”³⁸ Too often the defence procurement literature emphasizes the distinctiveness of that market—rather than its similarities with the private sector. This publication, written by prominent American corporate executives and politicians, takes the opposite approach and underscores the commonalities in the procurement process, notwithstanding sectoral differences.

Similar approaches to defence procurement reform are evident among Canadian allies with troops and equipment deployed in the same international strategic environment. Although the responses to defence procurement reform have been distinctly national, a number of common themes have emerged. In fact, it is not the differences but the commonalities in structural, legal, and procedural changes that have defined defence procurement reform in recent decades. In effect, each nation has taken a unique path to arrive at similar, desired objectives.³⁹

Yet the strategic, business, and procurement environments were also changing at a rapid pace, leaving the defence establishment continually struggling to keep pace.⁴⁰ This reality broadened the scope of needed reform and ushered in a series of further studies aimed at better aligning acquisition processes with the needs of operational military units. What is noteworthy is that the pace of change does not appear to be abating. Consequently, a series of further defence acquisition reforms can be expected on the horizon as defence departments continue to strive toward a closer alignment of military operational requirements and delivery of timely new operational capability through the acquisition system. These themes are illustrated in Table 1.

Table 1. Enduring International Themes in Defence Acquisition Reform

<p>Policy</p> <ul style="list-style-type: none"> • Establishment of a defence industrial strategy • Parliamentary oversight of the defence acquisition system • International collaboration • Close links between government and industry • Use of an Advisory Board for defence acquisition <p>Management</p> <ul style="list-style-type: none"> • Clear responsibility and accountability • Effective project governance regimes and decision-making processes • Configuration of technology to meet military needs • Stable acquisition leadership <p>Private Sector Practices</p> <ul style="list-style-type: none"> • Use of best-in-class private sector practices • Use of commercial products and processes • Improved cost-estimating practices • Consideration of both acquisition and in-service costs in decision-making • Responsiveness of the acquisition system
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Source: R. Fetterly, “Summary of Defence Acquisition Reform in Other Nations,” in *Defence Procurement Reform in Other Nations*, Claxton Papers 10 (Kingston: Queen’s University School of Policy Studies, 2009), 36, Table 4.1.

Knowledge Management

Weapon systems purchased for military organizations include a high—and increasing—level of technology. As a consequence, defence departments “will require an anticipatory approach based on formulating new concepts, incorporating emerging technologies, and adopting new business practices.”⁴¹ In addition, the introduction of new concepts in operations and support, as well as ongoing measures taken by potential opponents to improve current capabilities, will require defence departments to keep up-to-date in a number of diverse knowledge areas. This is a relatively labour-intensive activity, as “taking advantage of external knowledge requires internal experts to monitor, access, and understand new technologies and information.”⁴² Indeed, broad awareness of developments and advancements in technology, academia, the defence industrial sector, and allied military organizations is

central to keeping institutional knowledge current. In their seminal paper on absorptive capability, Cohen and Levinthal demonstrated that “prior knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends.”⁴³ Military organizations must maintain a high level of related knowledge in order to have the capability of assessing and then effectively utilizing external knowledge.

Although the necessity to remain aware of substantive industry developments and technology capabilities is not new, the demands of the international strategic environment have changed, reinforcing the importance of this institutional capability. Western military establishments are now heavily involved in deployed operations and will likely continue with the present forms of operations for the foreseeable future. Hence, what is new is accountability within the organization. It is therefore essential that defence departments monitor technology developments and adapt to changing circumstances in deployed operations that are assisting failed or failing states: lives of military personnel on those operations could be affected. Although technology that facilitates the dissemination of knowledge throughout military organizations has improved in recent years, the delivery of this information remains somewhat ad hoc, and internal processes of knowledge transfer have yet to become sufficiently institutionalized.

The pace in advancement of knowledge internationally is accelerating and, as a consequence, the ability to interpret, understand, and apply that knowledge needs to dramatically improve in large organizations. Indeed, “knowledge acquisition, knowledge dissemination, and knowledge utilization”⁴⁴ are all significant contributors to organizational innovation. But because technology is developing in a non-linear manner, in-depth knowledge management is difficult to achieve. For example, the continuous pace of change within digital infrastructure is astonishing: under the long-standing “Moore’s Law” computing capacity doubles every 18 months; under the “Fiber Law” communication capacity doubles every 9 months; and under the “Disk Law” storage capacity doubles every 12 months.⁴⁵ This relentless and rapid capacity growth in information technology is a key enabler in supporting advances in a broad range of industry and defence products. In order to benefit from both the incremental and transformational changes that are occurring in computing and communications, continuous monitoring of these fields and of the dissemination of information needs to be an integral part of information management in defence departments. This example of information technology is applicable in a number of other areas in defence and highlights the importance of remaining current in a broad range of essential knowledge areas.

Optimal Equipment Replacement Sequencing

Canada's Department of National Defence, as with other Western military establishments, needs to analyze more rigorously the optimal time to replace equipment. This requires a proactive cost-benefit analysis of all fleets at regular intervals throughout their expected in-service use. This in-depth analysis takes specific expertise, a thorough understanding of management principles, regular development and analysis of business cases, and the staff capacity to undertake this work.⁴⁶ Current research in this field is having a positive impact on how defence departments are planning to manage their fleets on a long-term basis.

Determining the most important time frame to replace aging defence capital fleets is essential to minimize the long-term cost of maintaining that particular capability. In "How Old Is Too Old? An Economic Approach to Replacing Military Aircraft,"⁴⁷ Greenfield and Persselin develop an economic framework to identify optimal replacement strategies for aging aircraft fleets. They employ cost trade-offs and incorporate age effects in their methodology. Their article provides a theoretical foundation that can be applied in decisions on when to replace aging military equipment fleets. As these recurring investment decisions are common to any industry that maintains large capital equipment fleets, the authors also survey the literature in this field that has an impact on military equipment.⁴⁸ This literature makes an important contribution to the defence procurement literature because it advocates an optimal replacement strategy that in the long term is more cost-effective than current suboptimal strategies generally pursued by defence departments.

The recognition of the economic principles behind the need to replace defence equipment in a timely manner is beginning to generate this type of important analysis. One example of this emerging analysis in the Department of National Defence is a 2007 study that examined the optimal time that the Canadian Forces should have used the CP-140 Aurora aircraft fleet prior to replacing it with a newer aircraft.⁴⁹ The objective of the study was to identify the optimal replacement strategy for a fleet of aircraft, holding technology constant. The study determined that the optimal time to replace the aircraft was after 15 years. The CP-140 Aurora aircraft began to enter into service in 1980; 30 years later, this aircraft is still in service.

A more recent Department of Defence study entitled *Optimal Fleet Replacement and Forecasting under Uncertainty* utilizes data from the CP-140A Arcturus maritime surveillance aircraft and develops a model that "signals replacement, modernization, or a 'reset-the-clock' overhaul

to decision makers.”⁵⁰ This model acknowledges the value of delaying replacement decisions in order to increase the information available to decision-makers. The approach taken recognizes that defence departments will make a range of decisions on different equipment fleets. These can include variants of replacement, modernization, or major overhauls. This publication indicates that researchers are now taking a broader perspective on options available to defence planners to address the impacts of aging equipment fleets by examining not only economic considerations but also cost alternatives, equipment availability, and the effects of uncertainty.

A Disciplined Approach to Project Decision-Making

At the program level, the key cause of poor outcomes is the consistent lack of disciplined analysis that would provide an understanding of what it would take to field a weapon system before system development.⁵¹

—Katherine Schinasi, *Defense Acquisitions*, 2008

The use of business cases is common in the private sector, and is increasingly becoming an essential tool in government decision-making. In industry, “the business case analysis underlying an opportunity is usually the most important element considered.”⁵² A well-written, thorough, and referenced business case is a concise document that provides both senior management and external organizations with evidence that project staff have made a detailed and logical analysis of the subject and on that basis have come to the appropriate conclusions. In the public sector environment where a high level of accountability is being demanded of both government officials and public servants, business cases document and support the decision-making process. Frequently, the challenge is not persuading individuals on the necessity of aligning organizational strategy with goals and objectives; it is documenting project facts, arguments, and recommendations in a systematic manner.

The United States Department of Defense is working toward a knowledge-based approach to defence acquisition; however, the US Government Accountability Office stated in a 2008 report that “our most recent assessment of major weapon systems found that the vast majority of programs began development with unexecutable business cases.”⁵³ The Government Accountability Office supports a knowledge-based approach in business cases that uses knowledge thresholds at three key points in

product development, in advance of significant financial commitments. This is important as, in the case of defence, “separating technology development from product development has been a critical determinant for successful program outcomes.”⁵⁴ Similarly, “having clearly established controls to capture and use appropriate knowledge to make decisions at critical junctures is crucial for delivering affordable products as planned.”⁵⁵ Table 2 identifies the benchmarks at each of the three knowledge-based decision points. A 2008 RAND study of cost growth in 35 major defence acquisition programs over three decades found that “most of the cost growth occurred early in the acquisition phase,”⁵⁶ and that this cost growth had remained relatively steady over three decades. The US Government Accountability Office’s emphasis on knowledge-oriented business cases is a significant contributor to improving project decision-making and managing project costs.⁵⁷

Table 2. Congressional Budget Office – Defence Business-Case Knowledge Points

<ul style="list-style-type: none"> • Program start – customer needs match available resources of developer <ul style="list-style-type: none"> ◦ Mature technologies ◦ Time ◦ Funding • Midway through development – design review is critical at this point as prototype development begins <ul style="list-style-type: none"> ◦ Product design is stable ◦ Demonstration that the product is capable of meeting performance requirements • Production decision point <ul style="list-style-type: none"> ◦ Production can be undertaken within budget and schedule ◦ Quality targets met and product reliability demonstrated ◦ System-level testing completed
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Source: M.J. Sullivan, *Defense Acquisitions: Measuring the Value of DOD’s Weapon Programs Requires Starting with Realistic Baselines* (Washington: Government Accountability Office, 2009), attachment 1, <http://www.gao.gov/new.items/d09543t.pdf>.

International Collaboration as a Preferred Acquisition Strategy

Collaborative programmes involving the UK have been regarded by many analysts as having had mixed success to date; mainly due to a lack of funding, a divergence of national interests and requirements, and disputes over industrial participation.⁵⁸

—Claire Taylor, “UK Defence Procurement Policy,” 2003

International collaboration in defence procurement is frequently recommended,⁵⁹ yet in practice has been adopted infrequently by governments. The above quotation summarizes the predominant factors hindering greater use of international collaboration in defence capital projects. Nevertheless, this section will outline how a number of other influential factors that are now converging should lead to increased international collaboration in multi-million dollar defence projects in the future.

Nations that independently develop and produce advanced weapon systems are increasingly facing high costs and low production. Globalization of the defence market is another key factor that amplifies the cost of unilateral national action.

The prevalence of extremely high costs and low scales of production in the development and production of complex RMA weapon systems means that increasing numbers of countries are unable to afford self-sufficiency. Thus, defence globalization is forcing a reverse process, whereby self-reliance is no longer the goal, with acquisition instead geared toward international collaboration, and increasingly, outright purchase.⁶⁰

Consequently, when viewed from a broad perspective, it is the economics of defence globalization that has “become the main lever for securing cost reductions. Indeed, economics appears to have become more important than defence-industrial sovereignty.”⁶¹ The real unit cost of a broad range of weapon systems has increased significantly with each new generation since World War II, and smaller nations are struggling to re-equip all elements of their armed forces.⁶² Even the United States, which has been investing in arms procurement at a rate of approximately 3:1 compared with the combined European total,⁶³ is finding it difficult to unilaterally develop and field a broad range of weapon systems.

Although the arguments in favour of international collaboration are persuasive, a globalized defence market may mean that many countries will see their defence industrial base shrink with a resulting loss of skilled,

well-paying jobs. Consequently, there will be interventions by the national defence industrial sectors to their respective governments to keep existing defence employment, and there will also be political pressure in certain regions with existing high levels of defence-related industrial production. In order to minimize the impact of this globalized defence market on individual nations and to demonstrate to citizens that Defence is being proactive in this changing market, middle powers such as Canada should adopt an approach that centres on international cooperation in weapon system research and development, as well as in design, testing, and production. An additional benefit is that “multinational procurement encourages greater convergence of thinking about international security”⁶⁴ among North American and European governments, fostering a common Western strategic culture and enhanced interoperability.

Impact of Accrual Budgeting on Capital Procurement

The historical practice in Canada has been to support current operations (the present force) at the expense of investing in capital equipment (the future force). This practice resulted in capital equipment expenditure in the defence budget being treated as a residual. In effect, once personnel costs were covered and the required operations and maintenance resources were funded, the remainder of the budget was allocated to equipment procurement. The in-year capital slippage was used to fund operations and maintenance overprogramming at the end of the fiscal year. This policy had a detrimental effect on the long-term capital investment program.

The adoption of accrual accounting by the Department of National Defence is dramatically changing this entrenched suboptimal dynamic.⁶⁵ The explicit decision to rebalance defence resource allocation—in contrast to past precedent—to address the chronic underfunding of capital procurement is perhaps one of the most consequential decisions since the decision to integrate the Canadian Forces during the Hellyer era. Managing the capital program under full accrual accounting is changing long-standing patterns of institutional behaviour. The effect that this will have on activities supported by operations and maintenance budgets is not yet fully apparent, because the Department of National Defence is in a period of transition. But with new capital projects funded under accrual budgeting, any slippage in capital programs will be moved to the capital budget for the next fiscal year; this money will not be reallocated to cover operations and maintenance expenditures. Consequently, operations and maintenance overprogramming

by the Army, Navy, and Air Force will have to be significantly reduced, and these organizations might be obliged to reduce or eliminate support to lower priority activities.

Slippage in the planned capital program is now being re-profiled; funds are moved to the next fiscal year and remain within the capital investment envelope.⁶⁶ This is a major contribution to the long-term ability of the Canadian Forces to maintain modern and capable equipment fleets. The shift to a higher absorption rate of capital expenditure underscores the necessity of transforming the capital equipment procurement process to make it more responsive and timely. This will allow for more effective long-term planning and will also reduce the historical swings in funding for new equipment.

Conclusion

The enduring themes in defence acquisition reform throughout the past two decades are perhaps not evident to the casual observer, or even to those working within defence department procurement organizations. In a period of constant change, it is imperative that all parties in this field understand the shifting landscape and be capable of responding appropriately. Defence acquisition reform consists of three distinct, yet interrelated, themes. First, in the current procurement environment, policy can and does make a difference. Policy plays an integral role in setting the appropriate conditions to facilitate success. An active policy regime engages Parliament and intensifies the relationship between the defence department and government. Policy also establishes the parameters for departmental management of the defence acquisition process. Second, effective management through clear lines of communication, accountability, and authority can make a difference, as can stability in project management leadership. Finally, knowing, understanding, and applying emerging leading-edge private sector practices are vital to improving performance metrics.

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CHAPTER 4

Australian Naval Shipbuilding Strategy 2009

Stefan Markowski and Robert Wylie

Introduction

In this paper we examine defence procurement for naval vessels and support services in Australia, which has long had domestic warship building facilities and maintenance capabilities.¹ Naval shipbuilding has a special significance in Australia, where the sector is sometimes referred to as “the jewel in the defence industry crown. Naval vessels are the only major platforms built in Australia, and firms that build them are the highest profile and most prestigious element of defence industry.”² Despite the considerable achievements of naval shipbuilding in Australia, particularly during World War II and over the past 20 years, this sector has also attracted much adverse publicity—from the troubled government shipyards of the 1950s and 1960s through to the highly publicized difficulties encountered in acquisition of the Collins Class submarines in the 1990s and again in the late 2000s. Lessons learned from the latter program have had a profound impact on how the government goes about the acquisition of major strategic capabilities and on the mechanics of the defence acquisition process. As *The Australian* reported,

The navy’s [Aus]\$6 billion Collins-class submarines face serious operational restrictions after being hit by a run of crippling mechanical problems and troubling maintenance issues.... So serious are the problems that the Defence Materiel Organisation has put the Collins boats at the top of its list of “projects of concern”—the key equipment issues troubling Australia’s Defence leaders.³

Naval shipbuilding has a high public profile in Australia, partly because the procurement of naval assets and the location of naval shipyards and support industries are highly politicized, with the federal government balancing the competing interests of the Australian states, the armed services, and local industry. As a result, the Australian naval shipbuilding and repair sector has consistently presented governments of the day “with a series of interwoven challenges,”⁴ and governments’ responses to these challenges have been a key driver of economic and institutional reforms of the Australian defence industry in general and the naval shipbuilding sector in particular.

The latest Defence White Paper reaffirms “the important role that defence industry plays in support of the Australian Defence Force capability, from the provision and maintenance of military equipment to the delivery of a wide range of support services.”⁵ And although the 2009 White Paper devotes only about three pages to defence industry policy, including naval shipbuilding, the paper was released by the Prime Minister from the deck of a warship in Sydney—thereby emphasizing the Navy’s role in defence of Australia.⁶

This paper is structured as follows. First, we briefly review the history of naval shipbuilding and repair in Australia and discuss the three post-1945 ship acquisition cycles, which are critical to the understanding of how successive Australian governments have responded to naval shipbuilding and procurement challenges. We draw lessons from these three cycles for future procurements, as the 2009 White Paper foreshadows the start of the fourth shipbuilding cycle in the decade beginning in 2010. Second, we consider the Australian maritime industry—that is, shipbuilders and maintainers, facilities and industry locations, and the changing division of labour. We draw attention to renewed public investment in capital-intensive common user facilities which, because they reduce barriers to entry and increase competition in shipbuilding and in-service support, may be of international interest. Third, we focus on maritime industry supply chains, competition, and predominant contracting arrangements between parties. Finally, we draw lessons from recent developments in naval shipbuilding, the procurement of naval assets, and fleet sustainment that, in our view, should inform those responsible for naval shipbuilding and procurement strategies in Australia over the next five years.⁷

Post-War Shipbuilding Cycles

During World War II, Australia became a significant builder and repairer of naval vessels.⁸ The scale of activity declined significantly during

the post-war period. Since 1945, Australia has experienced two major naval building cycles separated by a 15-year period of low activity, and a third building cycle has been underway since 2007.

The First Cycle: The Bad Old Days

In the 1950s and 1960s, nine Daring and River Class destroyers were built at the government-owned shipyards. The first cycle also included an afloat-support ship, hydro vessels, and patrol boats. The construction of these ships was notorious for cost overruns, schedule slippages, and industrial disputes. In response, the government resorted to imports, and no major surface combatants were launched in Australia for over 20 years.

The Troubled Pause

By the end of the 1970s, it was apparent that the naval shipbuilding sector was suffering from deeply ingrained systemic problems. In the 1970s and early 1980s, no warships were built in Australia although four large naval support and hydrographic vessels were completed as well as eight heavy-landing craft and 14 Fremantle Class patrol boats. This preference for imports left Australian naval shipyards with mostly repair and (limited) refit work.⁹ But systemic problems persisted:

Industrial relations were particularly bad as naval shipyards were seen by both the unions and the shipyard management as Defence-funded sheltered workshops. The Department of Defence lacked the ability to specify its needs precisely enough to prevent endemic requirements creep. It also lacked effective contracting skills. This was an important limitation as changing technologies, especially the growing use of electronics and information technology, made naval vessels increasingly complex and knowledge-intensive. Project management skills were also lacking in Defence and there were shortages of critical shipbuilding skills at naval yards.¹⁰

The 1976 Defence White Paper envisaged the development of local defence industry capabilities to enhance Australia's defence self-reliance. To further this aim, the Australian Frigate Project was initiated in 1978 with an FFG-7 Class frigate to be built in-country to an imported design. In 1980, the government authorized the construction of two FFG-7 frigates at its Williamstown dockyard providing that the shipyard "demonstrated its capacity to build the ships to the RAN's [Royal Australian Navy's] requirements."¹¹ The FFG contract was to facilitate extensive local industry involvement, including a cost premium for the local build of about 30 percent.¹²

The election of a Labor government in 1983 brought with it the reaffirmation of the self-reliance objectives and a commitment to economy-wide reforms aimed at increasing the competitiveness of Australian manufacturing industry. The new government was keen to secure significant improvements in shipyard productivity. In accordance with the prevailing New Public Management doctrine and associated efforts to wind back government ownership of the means of production, such improvements were to be achieved through the transfer of ownership to the private sector. In 1987, the government sold the Williamstown naval dockyard, with the FFG contract, to the Australian Marine Engineering Corporation (AMECON). The privatization of the yard turned out to be a very successful initiative. Both ships were launched by AMECON ahead of their initially agreed schedule and within the original cost estimates (in real terms).

The Second Cycle: Revival

The second naval shipbuilding cycle unfolded in the 1980s. The cycle got under way following the government's decision to build six Collins Class submarines and to award the contract to the Australian Submarine Corporation in 1987, and ten ANZAC Class frigates (based on the MEKO 200 design), with the contract going to the AMECON-Blohm+Voss consortium in 1989. In 1994 Australian Defence Industries (ADI, now Thales) was contracted to build, to an Italian design, six Huon Class coastal minehunters. The final contract in the second cycle was signed in 2003 with Defence Maritime Services Pty (DMS), a joint venture between P&O Maritime Services and Serco Australia for the delivery of 14 Armidale Class patrol boats. The patrol boats were built by Austal Ships Ltd., Australia's largest commercial shipbuilder, and in-service support is provided by DMS.¹³ The second cycle also included some minor naval construction (e.g., Freedom Class patrol boats and hydrographic ships). Nearly all ships required by the Royal Australian Navy during the second cycle were built in country. The cycle ended in 2008 with the commissioning into service of the last Armidale Class patrol boats. The main shipbuilding projects are briefly discussed below.

The Australian Submarine Corporation and the Collins Submarine Project

To build submarines in Australia, the Australian Submarine Corporation (ASC) was established in 1985 as a joint venture between Sweden's Kockums (as shipbuilder and designer holding 49 percent of the company's

shares), the government-owned Australian Industry Development Corporation (49 percent), and Wormalds International and Chicago Bridge and Iron (holding the 2 percent balance of shares). In 1987, ASC was made the prime contractor for the project, which had a fixed cost of Aus\$3.9 billion (1986 prices) to deliver and support, through life, six submarines. With over 73 percent local content for the six platforms—involving at least 3,500 suppliers and 1,600 individual contracts¹⁴—the project was “Australia’s most ambitious and technically advanced defence project ever.”¹⁵

The project was hampered from the outset by a decision to acquire a sophisticated combat data system (CDS) independently of the platform design when the most straightforward approach would have been to select a design with the CDS fitted as standard.¹⁶ This was compounded by the Navy’s preference for the CDS to be developed to order to meet its unique requirements rather than purchased as a military-off-the-shelf (MOTS) system.¹⁷ “By including the combat system with the platform in the single prime contract, with a unique military specification, Defence left itself wide open to technological problems¹⁸ and, we would add, to major contracting challenges.

By 1993, it had become apparent that Rockwell, the CDS subcontractor and designer, was not able to meet the Navy’s specifications (the first submarine was provisionally accepted into service in 1996 with the combat system incomplete). By the late 1990s, the project had become a major embarrassment for Defence and the government. In 1999, the government terminated the failed CDS subcontract and, in 2001, it contracted Raytheon, who supplied combat systems for US Navy nuclear submarines, to supply a variant for the Collins Class.¹⁹ Also, later that year, the RAN and the US Navy signed an agreement to cooperate in equipment-sourcing and logistic support and to enhance Collins Class interoperability with US ships. The German STN Atlas was also awarded a contract for sonar and navigation equipment.²⁰

The way Defence established and managed the project has also been criticized. The single-batch construction of the six hulls allowed for little learning by doing. While economies of scale and scope are unavoidably lost through the fragmentation of ship construction into smaller batches, there is more opportunity to alter the specifications of successor ships by learning from the in-service performance of their predecessors. This principle of “spiral” or incremental new capability formation was well understood and practised in Sweden where the Collins Class design originated.²¹

A fixed-price contract was used in an attempt to avoid cost overruns associated with traditional cost-plus contracts, and to shift most product- and

(construction) process-related risks from the Commonwealth to the contractor. As we have argued elsewhere,²² the use of a fixed-price contract was flawed for the following reasons:

- The magnitude of the technological challenge inherent in this project was grossly underestimated both by the ASC as the contractor and by Defence as the customer. The country lacked experience in building modern, sophisticated submarines, and both parties misunderstood the technological challenges posed by the bespoke CDS. Consequently, there was too much reliance on Kockums's expertise as a builder of submarine platforms. In such circumstances, the Commonwealth (Defence) might have realized the limitations of risk-shifting between the parties and, instead, relied on risk-sharing mechanisms (such as those provided by incentive contracts) and risk mitigation through more collaborative management of the project.
- Contract variations are inevitable in developmental projects of this kind, so that the use of a fixed-price contract provided little effective protection for the buyer (Defence). An *ex ante* fixed-price contract may, in reality, become an *ex post* cost-plus arrangement. If contract variations are routinely approved, there is no incentive for the contractor to seek cost efficiencies. It would have been preferable to use a flexible form of contract to allow for learning, and to provide incentives to improve and share risks, rather than to end up with the de facto cost-plus arrangement dressed up as a fixed-price contract.
- A belief that project risk could be shifted to the contractor to reduce the Commonwealth's exposure was naïve, given the ASC equity structure. With its 49 percent share of equity, the Commonwealth was both the sole buyer of the ships and a key shareholder on the supply side. In 2000, when Kockums was acquired by the German submarine builder HDW, the Australian government stepped in to buy Kockums's share of ASC equity.

Another criticism concerned the acquisition and management of intellectual property (IP), initially retained by Kockums.²³ The subsequent insertion of sensitive US technology into the vessels and the involvement of a US firm, Electric Boat, as a capability partner with ASC exacerbated existing IP-related complexities. The apparent failures of the Collins Class technology management highlight the importance of access to proprietary technological know-how and IP in all knowledge-intensive defence projects.

These IP-related challenges are often underestimated in the early phases of acquisitions of large, technologically complex, developmental projects where detailed product and process specifications are not fully understood when the contract is signed. As we observed elsewhere,

Thus, a classic “hold-up” relationship may emerge between the parties as the buyer belatedly realises that its ownership of an asset is incomplete without the transfer of all IP. The incompleteness of ownership rights imposes severe limitations on who is allowed to maintain the asset and who has the right to modify it. By the time the buyer becomes aware of such problems, the cost of contract re-negotiation may be prohibitive and opportunities for switching suppliers very limited. This problem is compounded when the product design incorporates “black boxes,” which can only be accessed by the original supplier or its agent and which are subject to technology restrictions imposed by the supplier’s home government.²⁴

Despite its ostensible commitment to privatization of naval shipbuilding and ship repair, the government of the day attempted to cut through these and other complexities by nationalizing the Australian Submarine Corporation: “There was more than a touch of irony in the fact that after decades of effort to transfer all defence production capability to commercial industry, the Government finds itself the owner of ASC.”²⁵

Ever since their launch, the submarines have been plagued by mechanical problems. For example, the Hedemora diesel engines did not function well from the start, and there are growing concerns that they are not robust enough to last the rest of the expected life of the Collins fleet. *The Australian* reported on 21 October 2009 that “other mechanical issues include the performance of electric motors, batteries and generators but ASC sources are confident that these glitches are being satisfactorily resolved.”²⁶ But the CEO of Defence Materiel Organisation (semi-autonomous Australian defence procurement agency) was less sanguine: “We are concerned with the amount of availability of the boats and the cost of doing the maintenance as well as some of the technical outcomes being achieved.”²⁷

In sum, the Collins Class project “exposed serious flaws in Defence’s procurement processes.”²⁸ As one well-informed commentator observed, “the most compelling lesson that can be learnt from the Collins submarine program is the importance of selecting the procurement strategy to suit the nature of the project.”²⁹

The Collins Class saga suggests the need for an approach tailored to address gaps in technical know-how at the outset of an ambitious

developmental project. It suggests that contracts should be designed to facilitate the synergistic relationship between the buyer (Defence) and the prime contractor rather than attempt to shift all product- and process-related procurement risks from the buyer to the contractor.

Tenix and the ANZAC Frigate Project

When the contract for the ANZAC frigate (worth Aus\$7 billion in 2006 prices) was placed in 1989, it was the largest *single* defence design and construction contract ever awarded in Australia. It was also the only European-style naval “workshare” contract, with two customers—the navies of Australia (eight ships) and New Zealand (two ships)—and with the industry workload shared between the two countries. It was stipulated that neither country would cross-subsidize the shipbuilding costs of the other; subcontractors were to be selected competitively; and the achieved workshare between the two countries was to reflect the overall cost shares.

Two consortia were shortlisted for the work and, in 1989, AMECON-Blohm+Voss was declared the winner of the 15-year design-construct-test project. The frigates were to be assembled at the newly acquired AMECON shipyard at Williamstown with modules to be built in Australia and in New Zealand. As the shipbuilder, AMECON assumed prime responsibility for the project, subsequently changing its name to the Tenix Marine Division of Tenix Defence Pty Ltd. By the early 2000s, Tenix Defence, incorporating the marine division, had become one of Australia’s largest defence contractors. Despite its initially limited experience as a shipbuilder, Tenix completed the project on schedule and on budget. This outcome was helped by the modular ship construction and by highly synergistic business arrangements with SAAB, the combat system supplier, which facilitated the testing of the combat system prior to installation.³⁰

The shipbuilder was required to achieve high levels of local content in the project. This was partly accomplished through an effective search for subcontractors to meet the local content targets—sometimes described as “reverse garage sales”; that is, components were put on display and potential subcontractors were invited to decide which of these products could be made locally.³¹ This approach to subcontracting has been acclaimed as a factor contributing to the project’s cost and schedule discipline.

In 2001, Tenix, SAAB, and the Defence Materiel Organisation signed a tripartite, long-term alliance agreement—the first of its kind in Australia—to support the frigates in service and to collaborate in future modifications and capability enhancements of the class. This agreement followed on from

the success of the ANZAC frigate project and was a tribute to the strong business focus of Tenix in its various incarnations and to the strategic business leadership provided by its management. It also positioned the company favourably as a bidder for construction work in the next shipbuilding cycle.

ADI-Thales Australia and the Minehunter Project

In 1989, Australian Defence Industries was formed as a government-owned corporation to consolidate major defence industry facilities still in government ownership. ADI was awarded the prime contract for the Huon Class minehunters. The Huon Class was based on an Italian design, but the contract designated ADI as the design authority to adapt the original design for Australian conditions. The project (worth Aus\$917 million in 1994 prices) was the first Australian-sourced naval project in which the local prime contractor was awarded design authority.³² The first composite hull was made in Italy and the remaining five in Australia. The six ships were built at a greenfield facility employing a “new” labour force. Deliveries were made on schedule expedited by provision of an onshore facility that integrated and tested the combat system prior to its installation.³³ Like the ANZAC frigates, the Huon Class contract stipulated a high local content target of nearly 70 percent.

In 1999, the French Thales and the Australian Transfield companies bought ADI from the federal government as a 50-50 venture. In 2006, Thales Australia acquired Transfield’s share and consolidated it with its other Australian assets to become one of Australia’s largest defence contractors and a key naval repair, maintenance, and upgrade contractor.

ADI-Thales Australia and the FFG Upgrade Project

In contrast with the very successful minehunter project, ADI’s Aus\$1 billion upgrade of four FFGs was plagued with problems. This project, commissioned in 1999, involved the upgrade of ships’ combat systems that required advanced design and engineering work, including the ADI-designed and developed Australian Distributed Architecture Combat System.³⁴ Initially, the project was to cover six ships, but when the first ship was delivered three years late (in 2006) and over budget, the project scope was reduced to four vessels. For a while, the project topped the government’s list of “troubled projects,” and this has effectively constrained Thales’s ability to bid for prime contracting work in the next shipbuilding cycle, even though, in 2007, it was Australia’s largest defence contractor.³⁵

On the one hand, Thales's involvement in the second shipbuilding cycle reaffirmed Australia's success in building modern, medium-sized naval vessels. This was a quantum leap into quality and cost-effectiveness and a far cry from the dismal record of the first cycle. However, it also demonstrated how difficult it is for a small country like Australia to engage in the cost-effective and timely development of sophisticated combat systems.

Patrol Boats and Multi-Hull Builders

In Australia, there are two small but internationally competitive commercial builders of aluminium multi-hulls: Austal Ships Ltd. (Austal) and Incat. Both companies have established market niches in wave-piercing multi-hulls, fast multi-hull ferries, and luxury motor yachts. Both companies have also been successful exporters based on their innovative designs.

In 2003, Austal won the last major contract of the second shipbuilding cycle—an Aus\$553 million project to build 14 Armidale Class patrol boats. This contract broke new ground for Australia in that Defence framed its requirements in terms of operational performance specifications (e.g., operational availability) rather than setting detailed technical guidelines for ship designers. Two years earlier, in 2001, Austal had established a foothold in the US shipbuilding market by opening a construction facility in Mobile, Alabama.³⁶ Austal is the only Australian naval shipbuilder to be involved in foreign direct investment in an offshore construction facility while retaining its core design team in Australia.

In the early 2000s, Incat sold and/or leased out high-speed catamarans to naval users, including Australian Defence and the US Department of Defense. The adaptability of these civil ship designs to military uses exemplifies the dual-technology opportunities inherent in many civilian designs. Nevertheless, the company has shown no intention to expand its operations into naval shipbuilding.³⁷

The Third Cycle: Continuity and Refinement

The third cycle began in 2007 with tenders for the construction of three air warfare destroyers (AWDs), two large landing helicopter dock ships (LHDs), afloat support ships, and the watercraft element of the amphibious deployment and sustainment project. This cycle of naval shipbuilding is expected to end around 2016–17.

On the basis of the 2006 Defence Capability Plan and anticipated upgrades and maintenance, Defence intends to spend about Aus\$30.5 billion

(2006 prices) on naval construction and sustainment programs between 2006 and 2025.³⁸ While the proportion of local content differs from project to project, about Aus\$19 billion (63 percent) could be spent in Australia.

Much demand for naval construction and through-life support work during the third cycle has been committed under supply arrangements that originated during the second cycle. This has meant much greater continuity of shipbuilding and maintenance work between the cycles compared to previous years. These arrangements include

- the sustainment contracts for ANZAC frigates (Tenix Marine with SAAB as the combat systems integrator), Collins Class submarines (ASC with Raytheon as the combat systems integrator), and Armidale Class patrol boats (Defence Maritime Services);
- a construction contract for three air warfare destroyers awarded to ASC and a contract with Raytheon for the AWD combat system, which is likely to be followed by a future contract for through-life support with the two companies; and
- another construction contract for two landing helicopter dock ships awarded to Tenix Marine (recently acquired by BAE Systems), which is also well positioned to win a future contract for the LHD sustainment support.

As we observed elsewhere, this continuous commitment of such a large proportion of the 2006–2018 expenditure is limiting the opportunity to attract new competition into the domestically located market before the onset of the fourth shipbuilding cycle around 2018.³⁹ And, although support arrangements have yet to be decided for the AWDs and LHDs once their construction phase draws to a close (the first ships are expected to be delivered in 2012–13), the logic of Defence sustainment policy favours the existing supplier consortia.

Over the past 20 years, this preference for imported designs has produced competition among design-based consortia of shipbuilders, integrators, and original equipment manufacturers (OEMs), fronted by domestic prime contractors. Defence has benefited from the greater market rivalry and performance benchmarking resulting from this form of for-the-market competition, and the increased market contestability resulting from the threat of foreign entry. In the third cycle, Defence continues to source overseas designs for its major platforms (e.g., AWDs and LHDs). However, past experience has reduced its appetite for extensive Australianization. As the success of the Spanish Navantia in winning the AWD and LHD contracts

has demonstrated, overseas shipbuilders with successful designs adopted by a foreign parent navy are well placed to compete for work in Australia by teaming with Australian prime contractors.

Finally, the resource export boom in the late 2000s led to tight labour markets and an appreciation of the Australian dollar. This created a strong incentive to build non-combatant vessels overseas or to buy second-hand civil ships that could be adapted locally or overseas for Australian naval use. For example, HMAS Sirius, one of the RAN's two replenishment ships under way, was originally built in South Korea as a double-hulled commercial product tanker. After buying it in 2004, the Commonwealth contracted Tenix to modify it for RAN purposes.

The Fourth Cycle: Force 2030

The 2009 White Paper sets forth the government's plans to build new classes of ships in Australia, starting in the late 2010s. These plans include the new class of 12 conventional submarines (the "Future Submarine," with a long-range strike capability) to replace the Collins Class fleet. The new design will inevitably be based on the Collins Class, which is the only conventional submarine in the world capable of meeting Australia's blue water requirements.⁴⁰ To ensure continuity of work at the existing naval shipbuilding and maintenance facilities, these boats are to be built and maintained in South Australia.

The fourth cycle may include another AWD (currently under review), but there are more definite plans for eight "Future Frigates" optimized for anti-submarine warfare. There are also plans to build about 20 largish, modular, multi-role "Offshore Combatants" to replace and/or complement the current fleet of patrol boats, minehunters, and hydro- and oceanographic vessels.⁴¹ A new sea lift ship and six heavy-landing crafts are to be acquired during the fourth cycle to complement the LHDs that will enter service within ten years. The fleet's current afloat support capability will also be replaced.⁴²

Naval Maritime Industry

Shipbuilding and Ship Repair

The traditional concept of "naval maritime industry" is largely focused on shipyard-based shipbuilding and ship repair/maintenance activities. Second-tier suppliers of major maritime equipment (OEMs) and maritime

service providers such as naval architects and surveyors are also included. However, most third-tier subcontractors, such as jobbing firms supplying components made to order, tend to be excluded. Thus, the conventional description of this industrial sector underrepresents the number of firms that depend for business on shipbuilding and repair work.

Shipbuilding, including capability upgrades, has also been traditionally distinguished from *ship sustainment* (maintenance and repair, including battle damage rectification). Both shipbuilding and sustainment are essentially shipyard-based, using specialized infrastructure such as dry docks and ship lifts. In Australia, the two sectors have tended to operate in parallel, with different facilities involved in ship sustainment and shipbuilding. Under such parallel arrangements, platforms constructed by specialized and often overseas-based shipbuilders have been maintained and repaired by local repair yards, with on-board equipment supported by OEMs and jobbing contractors. However, this division of labour has often required long supply chains linking upstream suppliers, often based overseas, to local repair yards and has led to delays in the availability of parts and long repair turnaround times.

Increasingly, modern warships such as submarines and AWDs are maintained by their builders, who retain the IP they have created in platform design and/or work closely with the design authority to protect and support the integrity of ship design. As we observed elsewhere,

The retention of (or access to) design IP, the use of dedicated facilities, and the tacitness of ship-specific knowledge gained during the construction phase underpin the shipbuilders' competitive advantage in through-life upgrades and maintenance work. Thus, strong synergies (economies of scope) arise between the construction and sustainment phases of naval capability. Also, when ships are built in small batches with long gaps between shipbuilding cycles, resources used in construction (e.g., specialized labour, docking facilities) may subsequently be redeployed in fleet sustainment.⁴³

In Australia, this synergistic relationship between the ship construction and sustainment phases was first exploited in the Collins Class submarine project, with the construction facility dedicated to the production and deep maintenance (full docking) cycles of the class. On the other hand, routine maintenance is performed where the submarines are home-ported. This model of "construction-enabled" ship maintenance has now been adopted in the sustainment of other vessels (e.g., the ANZACs). The model is also likely to be used in support of future additions to the fleet (e.g., AWDs and LHDs).⁴⁴

Australia's naval shipbuilding activity is largely confined to four main shipbuilders: Australian Submarine Corporation, BAE Systems (which took over Tenix Marine), Thales, and Austal. Of these, ASC and Austal are currently Australian-owned while BAE Systems and Thales are fully owned subsidiaries of their British and French parent companies. Small-scale module building, consolidation work, and maintenance activity have also been undertaken by other maritime suppliers such as Forgacs, with facilities in Newcastle and Brisbane, and by NQEA in Cairns. The four major shipbuilders and Defence Maritime Services, responsible for the maintenance of Armidale Class patrol boats built by Austal, are also the main providers of naval sustainment support for the submarine fleet, ANZAC and FFG frigates, minehunters, and minor vessels.

In addition to shipbuilders and maintainers, the naval maritime industry also includes a myriad of second- and third-tier subcontractors and upstream suppliers.⁴⁵ According to the Australian Defence Organisation, these suppliers contribute "70% by value of a project."⁴⁶ As noted in the Defence submission to the 2006 Senate Inquiry, a "typical" frigate comprises some 170,000 parts and components provided by 600 suppliers and subcontractors. A large conventional submarine may consist of some 500,000 parts provided by 1,600 suppliers.⁴⁷

With the notable exception of CEA Technologies, Australian combat systems integrators (e.g., Raytheon, Thales, BAE Systems) and OEMs (e.g., STN Atlas) are either subsidiaries or agents of major overseas companies. In the early 2000s, the Australian industrial footprint of these multinational companies varied from significant (Raytheon, Thales, BAE Systems) to small (Lockheed Martin). In most cases, this Australian footprint could be flexibly expanded or shrunk, depending on the quantity of in-country work available. These subsidiaries have made much of their direct access to the parent company's global network and technology as a key element of their competitive advantage. However, according to Defence, "experience indicates that they have difficulty obtaining suitable licensing and intellectual property rights which in turn may have time and cost implications particularly in providing sustainment."⁴⁸ To provide better access to overseas technology, the Commonwealth often helps to facilitate technology transfers using government-to-government arrangements, such as the US FMS framework, to gain direct access to sensitive military technologies or to import foreign equipment that embodies state-of-the-art technologies (e.g., the direct purchase of the US Aegis combat system for the AWDs by Defence from the US Navy under the FMS arrangement).

Increasingly, the provision of through-life sustainment of modern ships depends on access to the IP behind the *ship design*. Traditionally, Australia has imported designs for larger and more complex ships needed by the RAN. But, the Australian Navy's unique requirements and political pressures to increase local content have resulted in considerable Australianization of imported designs. For example, in the Collins Class case, it was only when the Commonwealth negotiated the full access to the Kockums-owned IP that ASC became the de facto design authority for the class of which the RAN is the parent navy. At the smaller-vessel end of the naval design spectrum, Austal is, arguably, the only Australian shipbuilder offering world-competitive naval design expertise for multi-hull aluminium vessels.⁴⁹

Facilities

The pattern of industry location reflects the RAN's fleet-basing strategy, which envisages the maintenance and home-porting of major surface ships on the east coast of Australia (Sydney) at Fleet Base East and on the west coast (near Perth) at Fleet Base West. The submarines are home-ported and maintained at Fleet Base West, but all deep maintenance (full cycle docking) is undertaken in South Australia. Minor war vessels are mostly home-ported and maintained in Darwin and Cairns.

The home-porting of naval vessels at Fleet Base West has induced many navy-oriented suppliers and subcontractors to cluster around major ship maintenance facilities. Thus, in addition to major shipbuilders and repairers, small designers and builders of aluminium boats and minor ships, and engineering firms supporting resource projects have located in Western Australia, in particular at the Australian Marine Complex in Henderson. These firms are attracted by strong *agglomeration economies* as there is more scope for forging direct business links between businesses that operate in close proximity at the Maritime Complex (lower transaction costs). Co-location also facilitates the formation of agile (just-in-time) supply chains.

Ownership of capital-intensive facilities (e.g., ship lifts and dry docks) has long been a key characteristic of naval shipbuilders. The high cost of establishing and maintaining such facilities has been a formidable barrier to entry into the naval shipbuilding and repair sector. Investment in such facilities requires high fixed costs that can only be recouped over the long term. Even the largest companies have difficulty absorbing such costs in the relatively small Australian market. On the other hand, possession of such specialized facilities provides the incumbent shipbuilder with a degree of

monopoly power as new entrants are deterred by the high and risky upfront investment. An example of such a local monopoly was the ship lift/transfer system operated by the then Tenix Marine in Henderson near Fleet Base West in the late 1990s.

To make ship repair more competitive, the state government of Western Australia developed, adjacent to the Tenix facility, a protected deepwater harbour, a 15,000 tonne service and heavy lift wharf, a 3,000 tonne load out wharf, a 4,800 square metre mobile assembly hall with a 200 tonne mobile portal crane, 39 hectares of paved laydown area, and offices, workshops, and other amenities. The new facility, completed in 2003, is owned by the state government but operated by a private management company as a common user facility (CUF). The Western Australian CUF is designed for multiple users including the oil and gas, resources, marine, and defence industries and is sufficiently large to accommodate a number of parallel projects. This allows co-locating firms to benefit from economies of scope and agglomeration. Facility users provide their own management and workforce and accept normal project accountabilities. They use the CUF only when required and are charged for the specific facilities they use. This arrangement greatly reduces project set-up costs and company overheads.

The South Australian state government followed suit with investment in Techport Australia, including a CUF adjacent to the Australian Submarine Corporation's maintenance facility in Osborne.⁵⁰ The South Australian CUF is scheduled for completion in 2010 and, like its Western Australian counterpart, is intended to support multiple projects in parallel.⁵¹ The nearest equivalent to such infrastructure on the east coast is the Captain Cook Dock (leased by the Commonwealth to Thales at Garden Island, Sydney). As we observed elsewhere,

The introduction of CUFs funded by state governments and, subject to leasing arrangements, ongoing Commonwealth ownership of the Captain Cook Dock combine to reduce the significance of facility ownership as a barrier to entry, particularly in the market for naval ship repair. As an indicator of policy trends, the development of these facilities also suggests a reappraisal of the value of public ownership of assets that governments were so determined to privatize in the 1980s and 1990s.⁵²

Cost Structure

For naval combatant capability, the combat systems component is the most important element of the overall system, in both cost and functional terms. This is reversed in the case of naval support capability.

Table 1 shows typical warship production costs in a stylized breakdown that includes all on-board combat systems but excludes shore- rather than ship-based capability elements. In the table, the platform element of capability accounts for 33 percent of the total production cost for a more technologically complex combat ship (e.g., a 3,500 tonne frigate that takes about 1.2 million person-hours, spread over 22 months, to build and costs Aus\$600 million).⁵³ On-board combat systems account for 41 percent of the ship's total cost. The other two cost items are largely platform-related and represent the cost of logistic support acquired during the construction phase and the cost of project management. For a typical combatant ship, imported combat systems and other major equipment account for 50 percent of the construction cost.⁵⁴ (For technologically complex vessels such as the submarines and the AWDs, the proportion is likely to be much higher.) In contrast, for a large naval support ship constructed closer to commercial standards, the platform accounts for 47 percent of the total cost and on-board combat systems for only 15 percent (see the table).

Table 1. Percentage Cost Breakdown in Warship Production

<i>Production Cost Element</i>	<i>Surface Combatant Ship %</i>	<i>Support Ship %</i>
Platform design, hull, machinery, and equipment	33	47
Combat systems	41	15
Logistics support and training (mostly platform-related)	17	25
Project management	9	13
Total	100	100

Source: Based on the Australian Defence Organisation, "Defence Submission to the Senate Inquiry into Naval Shipbuilding" (Canberra, 2006), para. 2.2, Table 1.

Table 2 provides another perspective on the stylized shipbuilding cost structure. Three stylized projects are compared in the table. In each case, the prime contractor engages a platform designer, a system integrator, and OEMs as well as a large number of small second- and third-tier subcontractors to produce the end product: a naval vessel with all systems

and equipment integrated into it or on it. For a more technologically complex combat ship (say, a 3,500 tonne frigate), the prime contractor, as the project's manager, accounts for about 9 percent of the total project cost. The combat system integrator accounts for 42 percent and the shipyard and OEMs for 45 percent. For a large naval support ship, as described above, the prime contractor accounts for 13 percent of the total cost, the platform designer for 7 percent, and the shipyard and OEMs for 65 percent, but the combat system integrator for only 15 percent. By way of comparison, for the stylized weapons upgrade project, much greater weight (and cost share) is assigned to combat system integration (50 percent); the shipyard and OEMs account for 35 percent and the prime contractor for about 12 percent of the total project cost.

The overall cost of local construction and the cost structure also depend on the extent to which the imported design is modified. To reduce the cost and risk inherent in acquisition of major defence capital equipment,

Table 2. Project Cost Breakdown in Warship Production by Supplier Category

<i>Supplier Category</i>	<i>Frigate-Type Combat Ship %</i>	<i>Support Ship %</i>	<i>Weapons System Upgrade %</i>
Prime contractor	9	13	12
Platform designer	4	7	3
Combat system integrator	42	15	50
Shipyard and OEMs	45	65	35
Total	100	100	100

Note: The table presents a stylized breakdown of total project cost by supplier category. Thus, the cost of platform design is imputed to "platform designer," the cost of combat systems is imputed to "combat system integrator," and the cost of project management to "prime contractor." The cost of hull, machinery, equipment, and logistics support (including training) is attributed to "shipyard (operator) and OEMs." Other second- and third-tier suppliers are included in the OEM, shipyard, and combat integration cost elements.

Source: Based on the Australian Defence Organisation, "Defence Submission to the Senate Inquiry into Naval Shipbuilding" (Canberra, 2006), 8, Table 1.

Defence is seeking to avoid excessive “Australianization” in ship design in the next generation of vessels to be constructed in-country: the AWDs, LHDs, and afloat support ships. For example, in the case of AWDs, the government overruled the Navy’s reported preference for the unproven Gibbs & Cox adaptation of the Arleigh Burke destroyer in favour of the already operational Spanish design based on the Navantia-built F100 destroyer.⁵⁵ Subsequently, the Australian government reaffirmed its preference for the “off-the-shelf” procurement of complex military materiel, if possible from existing production lines. In doing so, the government has expressly recognized that “in many cases, an off-the-shelf defence capability acquisition also entails acquisition from overseas.”⁵⁶

Supply Chains, Contracting Arrangements, and Competition

Supply Chain Models

The functional focus on naval platforms is helpful in identifying firms largely dedicated to shipbuilding and fleet sustainment, that is, shipbuilders, OEMs, and ship repairers. The supply chain framework sheds more light on the competitive dynamics of the naval construction and support industry as it also includes combat systems integrators and the plethora of second- and third-tier suppliers, many straddling traditional sectoral divisions and serving different customers in different sectors. The model also shifts the functional emphasis from “platform-centred” shipbuilding to more broadly defined “capability-centred” naval construction and support industry.

Two types of prime contractor arrangements, and thus two supply chain management structures, dominate the interface between Defence and naval shipbuilders in Australia:

- a *conventional single channel model* under which a single prime contractor is engaged by Defence to manage the supply chain and orchestrate all the back-to-back contracts with upstream suppliers of platform design, systems, equipment, components, and services; and
- a *complex multi-channel model*, where two or more prime contractors are engaged by Defence to manage parallel supply channels that jointly produce the required capability element.

These two models are used both in shipbuilding and in through-life fleet sustainment.

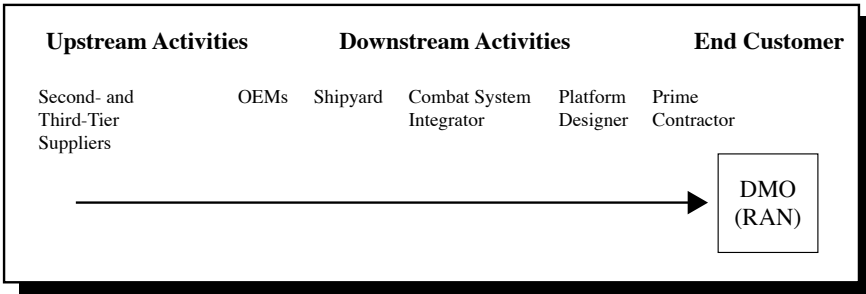
Figure 1 shows the stylized traditional supply chain management model, which is a sequence of back-to-back contracts between suppliers

with the prime contractor responsible for the end product: a platform with all systems and equipment integrated into it or on it. In the model, a single prime contractor engages a platform designer, a system integrator, and OEMs as well as a large number of small second- and third-tier subcontractors. Further upstream are OEMs that provide equipment and subsystems for downstream platform and systems integrators, and other second- and third-tier subcontractors that provide inputs for OEMs and downstream integration activities.

Some of these smaller second- and third-tier contractors are specialized naval suppliers, but most tend to be broadly based manufacturers and service providers. Also, some apparently small subcontractors (in terms of quantities and dollar value of supplies) are subsidiaries or agents of large producers of generic products. As we move from right to left along each supply channel, from downstream to upstream activities, suppliers are less likely to be dedicated to the production of naval systems. This conventional prime contracting model has long been used by Defence as a risk-mitigation arrangement under which the prime contractor is expected to manage and absorb risks associated with the operation of the supply chain.

The conventional model was used by Defence during the second building cycle in all major shipbuilding projects including, initially, the Collins Class submarines. However, the conventional model failed when the Collins Class project ran into problems with combat system integration,

Figure 1. Conventional, Single-Channel Supply Chain for a Naval Combatant



Note: OEMs = original equipment manufacturers. DMO = Defence Materiel Organisation. RAN = Royal Australian Navy.

Source: Broadly based on the Australian Defence Organisation, “Defence Submission to the Senate Inquiry into Naval Shipbuilding” (Canberra, 2006), 8, Table 1.

activities along its particular supply *channel*.⁵⁸ This at once raises a higher-level coordination problem: Defence, through its procurement agency DMO (“capability prime”), is now responsible for coordinating the activities of two prime contractors. This necessarily implies that Defence cannot (as it has traditionally sought to) adopt and maintain an arm’s-length relationship with its suppliers. Effectively, Defence is a partner in the prime contracting arrangement. The effectiveness of such partnering arrangements remains to be tested under stress, that is, when a major project failure causes erstwhile partners to contest the sharing of resultant liabilities.

Contracting Arrangements

The multi-channel prime contracting model has already been applied in the acquisition of the AWDs via an *alliance-based contracting* strategy.⁵⁹ This strategy is given practical effect through an Alliance-Based Target Incentive Agreement signed by the Defence Materiel Organisation, ASC as the designated builder and prime contractor for the Navantia-designed AWD platform, and Raytheon Australia as the combat system integrator.⁶⁰ Defence is also directly involved in the supply chain management as it purchased directly from the US Navy for Aus\$1 billion the US Lockheed Martin Aegis combat system, which Raytheon is to integrate with the platform and other on-board systems.

Competition

The competitive conduct of defence procurement, including naval supplies, has long been a mantra of defence procurement. For-the-market competition among shipbuilders to take on the role of prime contractor for larger naval projects normally takes the form of rival offers by consortia composed of Australian shipbuilders, overseas designers, and Australian subsidiaries of overseas systems houses. Traditionally, the competitive selection process has ended with the award of contracts to successful consortia using the conventional (arm’s-length relationship) model of engagement between the prime contractor and Defence. This model of engagement has worked reasonably well for projects involving less complex deliverables, such as the ANZAC ships.

As noted earlier, the experience of the Collins project demonstrated that the conventional model based on the arm’s-length relationship between Defence and the prime contractor was not suitable for procuring capabilities

with high developmental content such as submarines or technologically challenging systems upgrades (e.g., the troubled FFG upgrade). A key reason for the difficulty lies in elements of mutual dependence (hold-up) present in the relationship between the incumbent prime contractor and Defence. While competition *for-the-market* is normally used to engage prime contractors fronting competing consortia, competitive pressure on prime contractors, combat systems integrators, and often key OEMs tends to fall away once the prime contract is signed. That is, there is subsequently little *in-the-market* competition between primes and OEMs.⁶¹ Thus, if the prime contractor fails to deliver contracted performance, slips behind schedule, or runs over the budget, Defence is heavily constrained in its options for remedial action. Switching prime contractors and/or main subcontractors is often technologically unfeasible, financially prohibitive, or politically too embarrassing. Even for a medium-sized naval project, such as the aforementioned FFG upgrade, the prime contractor was allowed to continue with the project despite public expressions of dissatisfaction from the client and an adverse national audit report. The limitations of this model were even more apparent in the case of Rockwell's failure to deliver the CDS system for the Collins Class submarines, when Defence decided against re-competing the requirement and, instead, *chose* a substitute, Raytheon, to take over as system integrator. This highlights the limitations of Defence's traditional arms-length business model in bringing a large contractor into line in these circumstances.

In the third naval procurement cycle, much of the competitive process for major naval projects was concluded early on, with alliance-style contracting arrangements used for the construction of AWDs and LHDs, and for through-life support of ANZACs and Collins submarines. The complex, multi-channel procurement model described above can be viewed as an evolutionary adaptation: Defence has recognized that, to maximize the likelihood of success for its projects, it has to embrace fully its ultimate responsibility as "prime contractor of the last resort." While it seems unlikely that any non-performing prime contractor would be replaced by another contractor, there is a key difference between these and earlier prime contracting arrangements. Defence has become aware that lack of effective competitive pressure following the initial contract award deprives it of effective market power vis-à-vis its larger prime contractors. It has been obliged to accept that the prospects for shifting project risk to primes in large, strategically important projects are at best limited and, realistically, often unachievable. For successful outcomes, Defence has to manage projects more proactively

and build close, synergistic relationships with primes rather than rely on tight contract specifications, impracticable penalties for non-performance, and arm's-length dealings with contractors.

That said, alliance-style contracting arrangements work much better at the systems acquisition stage, when the buyer may orchestrate limited competition between supplier consortia, than at the fleet sustainment stage dominated by bilateral monopoly arrangements between the parties.

Conclusion

This paper has highlighted a number of issues that will continue to demand attention from those responsible for the formation and implementation of naval procurement and sustainment strategies in Australia. These include, *inter alia*, demand management to smooth stop-go investment cycles, local production versus imports, political and economic versus strategic aspects of in-country sourcing of materiel, the role of competition, the management of procurement risks, and business models used to engage suppliers and mitigate the risks of inadequate supplier performance. We conclude this paper by highlighting what we consider to be key challenges for naval shipbuilding and sustainment in most countries, but in particular for smaller maritime powers such as Australia.

Demand Lumpiness

Most defence equipment, including that embedded in naval systems, tends to be replaced at widely spaced intervals rather than continuously. This applies to simple weapons systems, such as small arms, but particularly to large and “lumpy” elements of capability such as naval ships. Industry advocates frequently urge Defence to smooth this batching of demand by staggering fleet replacements (e.g., while the Collins Class submarines were all built as a single batch of six boats, the 12 Future Submarines foreshadowed in the 2009 White Paper are likely to be built in three batches of four boats). But some lumpiness of demand seems unavoidable.

Long-term forward plans, such as the Australian Defence Capability Plan, make it easier for industry to anticipate forthcoming (lumpy) acquisitions and ramp up for future tenders. But in small countries like Australia, staggering fleet replacements may mean disrupting finely balanced plans for development of a portfolio of defence capabilities. Australia's record suggests that, for the foreseeable future, the wider cost inherent in such disruption will tend to outweigh the more parochial benefits accruing to the naval industry.

Asset Ownership

Most sovereign nations insist on the complete control of “use rights” for key combat assets such as warships. This can be achieved through the conventional full ownership of naval assets, or through leases, particularly the leasing of vessels from major powers. Increasingly though, more business-like arrangements are used to procure the services of auxiliary assets such as patrol boats, which tend to operate in peacetime in more predictable circumstances. As demonstrated by the Australian Armidale patrol boat arrangement, the procurement of ship “availability” from a private consortium of maritime service providers is more cost-effective than the full ownership of these vessels. And, in the event of war, the nature of the relationship between the parties can be changed by placing the vessels under complete naval control.

Local Content Requirements

In Australia, as in many other small countries, building ships in-country is politically as much as strategically driven: central governments routinely find themselves under pressure from industry and state governments to favour domestic sources of supply by mandating local content requirements or by “Australianizing” system specifications to advantage local suppliers. But, as the depth and breadth of expertise and capabilities in local defence industry tend to be limited in most small countries, governments find it hard to strike the right balance between national security objectives and other socioeconomic considerations. Political pressures are likely to support ongoing high levels of local content in platform construction, but national security considerations may be more important in influencing levels of local content in combat systems’ maintenance and modification.

High local content requirements are often justified on the grounds that the challenges of modern warfare necessitate the formation and sustainment of domestic industry capability to undertake urgent ship modifications and repairs, particularly battle damage rectification. It is more problematic, however, to justify actually building the vessels in-country. If local through-life support is more efficient when ships are also built locally in the first place, the sustainment argument is reinforced. But substantial cost premiums paid for local content suggest that a critical eye should always be applied to promises of large, expected net benefits from locally produced weapons systems that are normally available “off-the-shelf” from overseas suppliers.

Australia continues to import naval ship designs, but the recent tendency is to reduce design customization to mitigate risks of “design

parentage.”⁶² Defence is also keen to mitigate the risk of relying on local supply for developmental components. The current approach is to incorporate military-off-the-shelf (MOTS) components in imported designs and make use of overseas contractors’ established supply chains. For example, the LHDs project, incorporating hull construction at Navantia’s Ferrol shipyard in Spain and superstructure by Tenix (now BAE Systems) in Australia, departs from the past approach of building ships in-country to an imported design. Another example is the procurement of the AWDs. It follows the conventional path, with expectations that substantial premiums will be paid for the political decision to construct them in South Australia.⁶³ However, the locally designed CEAFAR active-phased array radar for the AWDs was not included in the system baseline specification as it was still under development by its maker, the small but high-profile Australian firm CEA. To reduce the risk of schedule slippages and cost overruns, the new technology will only be incorporated in the AWD system when it matures.⁶⁴

Business Models

A range of new business models has been used by Defence to engage suppliers in the most effective way. These models tend to be tailored to the nature of the product procured and the characteristics of the supplier. Where mature products are sourced from established contractors, and the inherent risks of performance degradation and schedule slippages are low, traditional fixed/firm-price contracts tend to be used. An evolved model of this kind has been used to acquire the services of the Armidale Class patrol boats. However, when the developmental content of the system increases, or if the supplier’s track record inspires less confidence, various forms of incentives and incremental contracts are likely to be used (e.g., the acquisition of the electronic warfare system for the AWDs).⁶⁵

For technologically sophisticated, complex, and politically high-profile acquisitions, it is now accepted that the Commonwealth cannot divest itself of its ultimate responsibility for strategic capability formation and, thus, must manage its relationships with suppliers rather than rely on detailed but hard-to-enforce contracts. For example, under the aforementioned multi-prime contractor model, the DMO is a member of a “prime alliance” with the shipbuilder and systems supplier. This reflects the growing recognition that the Commonwealth, as the system’s buyer and future user, cannot shift all development and procurement risks to commercial prime contractors.

Facility Ownership

It was widely claimed in the 1980s and 1990s that privatizing government shipyards and factories was a necessary precondition for their improved productivity and supply reliability. In the 2000s, however, it has become increasingly apparent that the private sector will invest in new shipbuilding facilities only if companies' order books justify the heavy capital commitment. This, in turn, depends on owners' confidence in a continuing flow of potentially profitable orders—hard to create in the face of a history of long intermissions in demand and the competitive processes for allocating work.

One way to boost order books and induce private investment is to abandon competitive tendering and award a particular contractor the status of a sole source supplier to Defence. However, this would likely lead to many problems previously experienced with government-owned monopolies. A more robust approach is the CUF model pioneered by Western Australia and adopted by South Australia. Under this arrangement, governments attract and sustain private naval investment by investing in complementary infrastructure and engaging in a form of quasi-vertical integration under which the publicly owned asset is then leased back to a private contractor for the period it requires to supply goods and services to Defence.

Another way is to attract direct foreign investment by multinational firms. The 1990s and 2000s have witnessed increased penetration of the Australian shipbuilding sector by overseas capital. Of the three largest naval shipbuilders, two (ADI and Tenix) have become subsidiaries of foreign companies (Thales and BAE Systems, respectively). The third, ASC, has been nationalized but may yet end up in overseas ownership. All systems integrators and nearly all major OEMs (except CEA) are subsidiaries of overseas companies. And P&O Maritime Services and Serco Australia have pioneered the provision of fully supported services for the Armadales. This trend is very much in keeping with global developments in defence industry. Few small countries can support indigenous systems integrators and OEMs, while the exporting of defence materiel from small countries poses well-known difficulties.

Industry Structure and Conduct

The 1990s and 2000s have also seen the increased consolidation of ship assembly in fewer hands and, in a clear break with the past, a growing integration between shipbuilding and repair. In part, the latter trend reflects the changing global division of labour as systems houses and OEMs are

increasingly more involved in the provision of through-life support for their products. In part, it also reflects the shift of emphasis in Australian industry policy from a focus on platform construction to through-life capability support.

As we noted elsewhere, in the 1990s and 2000s, firms have increasingly made efforts to collaborate along the supply chain rather than to do business with each other at arm's length. On the other hand, firms also appear to have been competing with increasing frequency and intensity for markets opening up for all segments of the naval supply chain. Firms' awareness of their mutual dependence in the network of supply arrangements appears to be driving a tendency to greater collaboration once the principal contract has been awarded.⁶⁶

Competition for and in the Market

Arguably the most striking development since the end of the second shipbuilding cycle, particularly in the aftermath of the Collins project, has been the growing maturity of Defence as an investor in new capability elements and as a buyer of military materiel. This reflects a much better understanding by Defence of competitive processes, especially the difference between for- and in-the-market competition. For example, to create a competitive environment in a downstream segment of the chain, the market needs to be opened to overseas participants—the range of competing designs and combat systems is broadened as overseas consortia of platform builders, system integrators, and OEMs (sometimes combining with local firms) come to contest the market (for-the-market competition). However, once a preferred package has been selected, competition in the market follows, with subcontractors vying for various elements of the package. In particular, local subcontractors can be assured a major role in this part of the process if local content requirements are applied.

Defence has also become more aware of the difference between the pre- and post-contract opportunities open to it in sourcing supplies—the contestability of supply at various phases of the procurement process. It now appears to better understand that as a project progresses through the tendering process, the scope for product and supplier substitution decreases and, for major projects, there may be no way, realistically, of returning to *status quo ante*; once the contract is signed, switching suppliers and supplies may be impossible for technological, budgetary, or political reasons. Thus, applying a “one-size-fits-all” business model can often be a recipe for failure in defence procurement. However, to tailor different models

to different acquisitions, it is necessary to acquire good understanding of supply conditions and commercial business processes. The Defence Materiel Organisation, since its designation as a semi-detached and partially independent (prescribed) defence procurement agency, has become increasingly professionalized and involved as a hands-on equity partner in major acquisition projects.

To Sum Up

Faced with the challenge of efficiently procuring naval vessels of increasing technological sophistication, the Australian government has learned over recent decades that contract arrangements alone are often insufficient to allow it to address and remedy problems, especially where developmental issues are at stake. As we observed elsewhere,

A warship is a sea-borne platform carrying weapons. But the business of designing and building sea-worthy and battle-ready vessels is altogether different from the enterprise of designing and producing the highly sophisticated, often network-integrated weapons systems that the warship must support.... Despite past rhetoric to the contrary, innovation and complexity in design and production thus appear to create conditions in which governments find themselves obliged to form close and durable relationships with suppliers if they wish to maximise the likelihood of project success. It may neither be realistic, given the industry structure, nor wise, given the alternatives available to suppliers, for governments to threaten competitive recontracting as their sole, or even principal, means of discipline and performance control.⁶⁷

NOTES

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¹ Although by the standards of older maritime nations, the industry may not have a long history.

² Australian Strategic Policy Institute, *Setting a Course for Australia's Naval Shipbuilding and Repair Industry* (Canberra: Australian Strategic Policy Institute, 2002), 8.

³ "Faulkner Orders Review into Collins Class Submarine Fleet," *The Australian*, 21 October 2009.

⁴ Australian Strategic Policy Institute, *Setting a Course*, 1.

⁵ Department of Defence, *Defending Australia in the Asia Pacific Century: Force 2030* (Canberra: Commonwealth of Australia, 2009), 127.

⁶ C. Barrie, "The Defence White Paper 2009 and Australia's Maritime Capabilities," *Security Challenges* 5, no. 2 (2009): 51-59.

⁷ As the government has now adopted a quinquennial approach for writing Defence White Papers, the next White Paper is expected to be published in 2014.

⁸ Senate Standing Committee on Foreign Affairs, Defence and Trade, *Blue Water Ships: Consolidating Past Achievements* (Canberra: Commonwealth of Australia, 2006).

⁹ *Ibid.*, 42.

¹⁰ S. Markowski and R. Wylie, "Industry Case Study: Australian Naval Shipbuilding," in *Defence Procurement and Industry Policy: A Small Country Perspective*, ed. S. Markowski, P. Hall, and R. Wylie (London and New York: Routledge, 2009), 327-28.

¹¹ Senate Standing Committee, *Blue Water Ships*, 46-47.

¹² *Ibid.*, 48.

¹³ J. Kerr, "Armadales Back at Work," *Australian Defence Magazine* 16, no. 1 (Pacific Insert, 2008): 30-31.

¹⁴ Senate Standing Committee, *Blue Water Ships*, 56.

¹⁵ M. McIntosh and J. Prescott, *Report to the Minister for Defence on the Collins Class Submarine and Related Matters* (Canberra: Commonwealth of Australia, 1999), 5, <http://www.minister.defence.gov.au/1999/collins.html> (accessed 10 Dec 2007).

¹⁶ D. Woolner, "The Air-Warfare Destroyer: Managing Defence Procurement," in *The Business of Defence: Sustaining Capability*, CEDA Growth No. 57 (Melbourne: Committee for Economic Development of Australia, 2006), 72.

¹⁷ D. Woolner, "Getting In Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement" (Research Paper No. 3 2001-02, Parliamentary Library, Canberra), 9.

¹⁸ McIntosh and Prescott, *Report to the Minister*, 5.

¹⁹ P. Yule and D. Woolner, *The Collins Class Submarine Story: Steel, Spies and Spin* (Melbourne: Cambridge University Press, 2008), 306-9.

²⁰ Senate Standing Committee, *Blue Water Ships*, 59-60.

²¹ See B. Hagelin, "From Certainty to Uncertainty: Sweden's Armament Policy in Transition," in *Defence Procurement and Industry Policy*, ed. S. Markowski, P. Hall, and R. Wylie (London and New York: Routledge, 2009), 286-302.

²² Markowski and Wylie, "Industry Case Study," 330-31.

²³ The nationalization of ASC also exposed a more serious flaw in the procurement philosophy that was inherent in the Collins Class acquisition. Under the original contract, Kockums retained much IP in the vessel's design and the ASC shareholding arrangement made it difficult to determine the ownership of various IP changes to the original design, new IP elements, and the associated body of design data that were critical to access if ASC was to carry on as the ship's maintainer and modifier. The resultant legal dispute took until 2004 to resolve. Under the new arrangement, Kockums owns the legacy IP but ASC has full access to it (Senate Standing Committee, *Blue Water Ships*, 55).

²⁴ Markowski and Wylie, "Industry Case Study," 331-32.

²⁵ Australian Strategic Policy Institute, *Setting a Course*, 24.

²⁶ P. Walters, "Engine Problems Cripple Subs," *The Australian*, 21 October 2009.

²⁷ *Ibid.*

²⁸ Senate Standing Committee, *Blue Water Ships*, 57.

²⁹ Woolner, "Getting In Early," 47.

³⁰ Tasman Asia Pacific, *Impact of Major Defence Projects: A Case Study of the ANZAC Ship Project*, Final Report (Canberra: Tasman Asia Pacific, Economic, Management and Policy Consultants, 2000), 9.

³¹ Markowski and Wylie, "Industry Case Study."

³² Senate Standing Committee, *Blue Water Ships*, 67.

³³ Tasman Economics, *Impact of Major Defence Projects: A Case Study of the Minehunter Coastal Project*, Final Report (Canberra: Tasman Economics, 2002), 9.

³⁴ Senate Standing Committee, *Blue Water Ships*, 69.

³⁵ J. Hinz and K. Ziesing, "ADM's Top 40: Thales Takes Top Spot in Growing Australian Defence Business Sector," *Australian Defence Magazine* 16, no. 1 (2007-08): 34-35.

³⁶ From this facility, Austal operates as part of the General Dynamics team, building prototype littoral combat ships (LCS) for the US Navy. Austal's role is to design and build the LCS platform. If the LCS program proceeds, the US LCS trimaran project may involve the building of 60 vessels at a cost of US\$15 billion (Senate Standing Committee, *Blue Water Ships*, 72).

³⁷ *Ibid.*, 74.

³⁸ Australian Defence Organisation, "Defence Demand for Naval Shipbuilding and In-service Support" (Defence submission to the Senate Inquiry into Naval Shipbuilding, Section 3 Update, Canberra, 18 August 2006), para. 3.4.

³⁹ Markowski and Wylie, "Industry Case Study."

⁴⁰ Barrie, "Defence White Paper 2009," 54.

⁴¹ Ibid.

⁴² Ibid.

⁴³ Markowski and Wylie, "Industry Case Study," 337.

⁴⁴ Under this model of construction-enabled ship maintenance, two major contracts were let. In 2001, Defence signed a long-term alliance agreement, underpinned by a through-life support contract, with Tenix Marine (shipbuilder) and SAAB (system integrator) covering the development of all future capability change packages for the ANZAC ships. In 2003, it signed another long-term contract with ASC for the 25-year through-life support for the Collins Class submarines.

⁴⁵ Australian Defence Organisation, "Defence Submission to the Senate Inquiry into Naval Shipbuilding" (Canberra, 2006), para. 1.18–1.20, http://www.aph.gov.au/Senate/committee/fadt_ctte/shipping/submissions/sub20.pdf (accessed 10 December 2007).

⁴⁶ Ibid., para. 1.18. However, the third-tier contractors as well as other tiers of suppliers should not be seen as a reflection of a hierarchical industry structure. These relationships are project specific. Thus, a large firm that is engaged as a prime contractor in one project may be a third-tier subcontractor in another.

⁴⁷ Ibid., Figure 1.

⁴⁸ Ibid., para. 2.9.

⁴⁹ This is reflected in its aforementioned involvement as a ship designer and potential builder in the General Dynamics–led bid for the US Navy Littoral Combat Ship.

⁵⁰ J. Kerr, "Mobilising the Naval Industry," *Australian Defence Magazine* 16, no. 1 (Pacific Insert, 2008), 2.

⁵¹ Markowski and Wylie, "Industry Case Study." In response to these developments, the West Australian government invested further in a floating dock to launch and dock large ships; a rail transfer system to allow construction and repair within the CUF's undercover facilities; an extension and upgrade of the existing wharves to accommodate all types of naval and commercial vessels; and the installation of marine services such as power, seawater fire main, wharf communications, and sewerage off-take.

⁵² Ibid., 339.

⁵³ Australian Defence Organisation, "Defence Submission to the Senate Inquiry into Naval Shipbuilding," para. 1.18–1.20.

⁵⁴ Ibid., para. 2.5.

⁵⁵ P. Walters, "Targeting the Armada," *The Australian*, 19 June 2007.

⁵⁶ Department of Defence, *The Response to the Report of the Defence Procurement and Sustainment Review* (Canberra: Commonwealth of Australia, 2009), 22.

⁵⁷ Senate Standing Committee, *Blue Water Ships*, para. 4.20.

⁵⁸ Markowski and Wylie, "Industry Case Study."

⁵⁹ See Air Warfare Destroyer Alliance, "Why an Alliance," <http://www.ausawd.com/content.aspx?p=98> (accessed 29 May 2010).

⁶⁰ The arrangement takes the form of an Alliance-Based Target Incentive Agreement between the Commonwealth (represented by the Defence Materiel Organisation), ASC as the shipbuilder, and Raytheon Australia as the mission systems integrator. "The broad AWD procurement principles articulated by the Alliance comprise value for money, efficient and effective process, ethics and probity, accountability and transparency, good faith and fair dealing and *competition*" (italics added; Kerr, "Mobilising the Naval Industry," 2-3). Under this arrangement, major equipment is already specified by Navantia SA, the Spanish designer, and the Alliance is to utilize Navantia's established supply chain. Navantia will perform all the required design modifications and will maintain design configuration control. Raytheon will undertake the Australianization of the combat system around the fully imported Aegis core sourced by the Commonwealth via the US FMS (ibid.).

⁶¹ However, lower tier contractors are more likely to compete for and in the market as they are often easier to replace if they fail to perform.

⁶² Kerr, "Armadales Back at Work"; and Kerr, "Mobilising the Naval Industry."

⁶³ M. Dodd, "Downsized Fleet 'the Way to Go': Navy Cost Sinking Budget," *The Australian*, 7 January 2008.

⁶⁴ Kerr, "Mobilising the Naval Industry."

⁶⁵ Ibid., 6.

⁶⁶ Markowski and Wylie, "Industry Case Study."

⁶⁷ Ibid., 351.

CHAPTER 5

Shipbuilding Centres of Excellence: The Road Map to a Sustainable Industry

Steve Durrell

Introduction

Irving Shipbuilding Inc. (ISI) is pleased to provide this Claxton Paper to Queen's University outlining a logical, value-added method that ISI proposed to the Government of Canada for the implementation of a National Shipbuilding Procurement Strategy through the establishment of two Shipbuilding Centres of Excellence. The proposal responds to the questions posed by Canada at its recent Shipbuilding Forum and provides a cost-effective solution for an integrated approach to a viable, long-term, sustainable shipbuilding strategy that will respond to Canada's needs and encourage shipyards to make the incremental investments that will allow them to remain sustainable for the foreseeable future.

In this paper, ISI proposes that its Halifax Shipyard facility be the Centre of Excellence for Major Crown Projects for the construction of medium-sized vessels such as the Arctic Offshore Patrol Ships and Canadian Surface Combatant. Halifax Shipyard has the people, place, partners, and proven performance to be a strategic partner with Canada and help deliver the government's current 30-year, 30-ship fleet renewal commitments. ISI and Davie Yard Inc. have signed a memorandum of understanding providing us with a complementary way to work together on future ship construction projects. As Canada's Centre of Excellence (COEx) for combat ship construction program delivery, production, and integrated logistic support,

the Halifax Shipyard will provide Canada with a world class capability to build and manage ships. The four pillars of our value proposition are capability, experience, proven performance, and commitment to deliver value for money to Canada.

Irving Shipbuilding Inc. proposes that Canada qualify shipyard facilities based on their existing capability. The medium and large COEx shipyards would be pre-qualified for the new government ship construction projects. Contracts for large- and medium-sized Centres of Excellence would be allocated based on the facility's specific expertise and capability, while smaller, less complex projects would be competed among the many small shipyards in Canada, as per the current marine procurement practice. Alternatively, a third Centre of Excellence for smaller vessels could be established.

COEx shipyards would be designated via a competitive contracting process such as the Solicitation of Interest and Qualification, and shipyards would be pre-qualified as either large or medium COEx facilities. Essentially, Canada would be competing capability as opposed to individual contracts. The contracts for individual projects would then be negotiated via Shipbuilding Supply Arrangements (SSAs) that would include all standard terms and conditions covering ship construction work, particularized for the individual project requirements. These SSAs would include all contracting mechanisms to ensure that Canada received the benefits of competitive tenders without the long and costly process to government and industry of having to continually tender each individual requirement. Consequently, Canada will have in place long-term, cost-effective contract management processes embodied within a Shipbuilding Supply Arrangement to ensure that best value is achieved in every shipbuilding project.

These SSAs would also include the following cost-controlling mechanisms: Public Works and Government Services Canada contract cost principles (1031-2), annual rate negotiations, contract audits for profit limitation, earned value performance measurements, continuous improvement incentives through shared risk, and integrated project teams. These mechanisms will provide the effective program management tools to ensure that Canada will receive value for money in all upcoming shipbuilding Major Crown Projects. Halifax Shipyard has the capability and experienced personnel needed to be a Centre of Excellence, and ISI is willing to work with the Government of Canada to negotiate the terms and conditions required to ensure value for money for taxpayers, while building Canada's naval surface fleet of the future.

Brief History and Impact of Shipyard Rationalization

In the mid-1980s the Government of Canada acknowledged that there was an over capacity in the shipbuilding and repair industry and decided to rationalize the industry. The government paid owners to close shipyards across Canada. The following list summarizes the payouts provided by Industry Canada:

<i>Province</i>	<i>Assistance (\$M)</i>
Ontario	23.1
Quebec	144.0
British Columbia	30.8
Atlantic	50.4
Total	248.3

The industry was rationalized primarily because there was insufficient work to sustain all the shipyards given that Canadian shipyards are primarily reliant on government contracts. Canada had no long-term marine industrial strategy in place to sustain industry and consequently decided to rationalize the shipyards.

Even today, the shipbuilding industry is sustainable only if we have a continuous federal build program. In addition, Canada cannot afford any further reductions in capacity if we are to meet the pent-up demands represented by the rusting federal fleet. The industry needs to sustain current capacity and cannot afford a gap in production that leaves the shipyards without construction on a continuing basis. Consequently, contracts are required immediately not only to maintain current capacity but also to build capability for investment and growth in order to have the potential to compete globally.

Procurement Overview

The reality of federal fleet renewal is that contracting with the Government of Canada contains many high-risk elements and is very complex, time consuming, and expensive for both government and industry. It demands that a bidder be very diligent, patient, and financially secure in order to withstand the rigours and continuous change that is the nature of government tenders and projects. Notwithstanding these facts, stakeholders recognize that there is a need to change the way we procure the new federal fleet given Canada's significant shipbuilding requirements and the need to ensure that capable and qualified Canadian shipyards, which have a demonstrated and

existing capability, obtain continuous work in order to maintain a strategic shipbuilding asset base. Consequently, ISI has proposed a National Shipbuilding Procurement Strategy based on shipbuilding Centres of Excellence, which is in line with what most Western nations have already implemented.

It is acknowledged by most in the marine industry that much of the Canadian shipbuilding work in the short and medium term will be related to the federal fleet. There will be some commercial work in booming markets or for small boats; however, these markets are not predictable. In addition, there may be niche markets for lake vessels, provincial ferries, and tugs.

Overall, the history of Canadian shipbuilding during the last three decades has suffered from a “boom and bust” cycle, meaning that we make a very costly investment in human and capital resources to meet a demand, only to watch it fall apart (or pay to break it apart) after the demand is met and the cycle moves to bust for another prolonged period. For example, the Canadian Patrol Frigate contract was signed in 1983 (boom) and the Maritime Coastal Defence Vessel in 1992 (maintain), but a Navy major new build has not been implemented in over a decade (1997–2009, a long bust).

Without a continuous build strategy, a cost-effective tendering process, and an immediate allocation of contracts, this bust cycle may continue for a considerable period of time. For example, the Canadian Patrol Frigate contract took seven years to implement from the expression of interest to contract award, and the cost to ISI for the bid was over \$20 million. It would be difficult for the company to justify repeating such a process when extrapolating this into 2010 dollars. Likewise, the Maritime Coastal Defence Vessel took four years and \$8 million to bid, while the Joint Support Ship solicitation was suspended after more than ten years and many millions of dollars spent by the industry and by taxpayers to sustain an ineffective program management office. Meanwhile, we have been waiting for progress on the Arctic Offshore Patrol ships since 2007 when the project management office was established. We estimate that the project may have already cost the government over \$100 million in preliminary design costs, program management costs, and price escalations. Any further delay on this project will only prolong the industry bust cycle.

The National Shipbuilding Procurement Strategy (NSPS)

Consultation

On 27–28 July 2009, the Government of Canada conducted an unprecedented consultation with industry in order to establish a positive direction

on the procurement process for the renewal of the federal fleet. Canada had concluded that failed procurements were no longer acceptable and an effective procurement strategy was needed. The consultation received full support and active participation from all stakeholders at the Forum.

The NSPS consultation proceeded with a number of key assumptions:

- federal ships will be constructed in Canada, as per the Shipbuilding Policy;
- the finite federal demand will be over a 30-year horizon;
- there will be a limited number of shipyards involved; and
- government ship-operating departments will load-level the requirements to eliminate the boom/bust cycle.

Irving Shipbuilding Inc. and the NSPS Road Map to Success

ISI believes that the best way to maintain a viable Canadian shipbuilding industry and rebuild the federal fleet is to implement a long-term strategy that will establish a large- and a medium-sized Shipbuilding Centre of Excellence (COEx). These Centres will be shipyard facilities that are pre-qualified to bid for work based on their ability to implement projects in relation to their size, scope, and capability. ISI has proposed to Canada that Major Crown Projects pertaining to fleet renewal be allocated to facilities based on their capability to manage and implement the programs planned by Canada. Further we proposed that one COEx be qualified for medium-scale, complex combatant vessel capability and a second COEx be qualified for large-scale, complex, non-combatant vessel capability.

Centres of Excellence

Competitive Process

ISI believes that Canada has a successful competitive procurement strategy to emulate for fleet renewal, that being the Frigate Life Extension Project (FELEX), which was prepared in full collaboration with industry. The FELEX used a competitive Solicitation of Interest and Qualification Process (SOI-Q) to compete capability among pre-qualified bidders for the two main FELEX program components, the Multi-Ship and the Combat Systems Integration contracts. The key to this strategy was the pre-qualification process, which must be considered as a risk mitigation exercise employing strong filters to ensure that only capable suppliers are

qualified to bid. Thus criteria that reflect true shipbuilding requirements must be used when selecting bidders. We suggest, as a minimum, that the following risk-reducing criteria be utilized:

- adequate existing facilities
- qualified resources—skilled labour
- management strength and experience
- financial strength
- recent proven experience in ship construction
- past performance on complex Major Crown Projects

Without strong and realistic qualification criteria, the Crown will expose itself to its greatest contract risk, that of having a contractor incapable of performing or delivering a compliant product—one that meets quality requirements—on time and within budget. No amount of contract clausling can protect Canada from a risk such as this.

Contracting Procedures

The SOI-Q process will result in the award of a long-term contract to a large COEx and a long-term contract to a medium COEx. These contracts should follow the format of a Shipbuilding Supply Arrangement (SSA) to ensure that Canada receives the best value. Each fleet renewal Major Crown Project will be separately negotiated to reflect that particular project; however, the basis of payments and terms and conditions will be the same for all contracts issued under an SSA. Incentives will be built into each contract to reward performance and share cost-savings with Canada. This win/win situation will ensure that Canada's shipbuilding industry will be sustained and the federal fleet rebuilt, and that value for money will be obtained on all contracts issued under an SSA.

What do other Western nations do? The Centre of Excellence model of contracting is similar to that used in other countries such as the United States, the United Kingdom, France, and Australia. This proven model should also be adopted by another NATO ally, Canada.

Value for Money

These Shipbuilding Supply Arrangements would include all contracting mechanisms to ensure that Canada received the benefits of competitive tenders without the long and costly process for government and industry of

having to continually tender each individual requirement. Consequently, Canada will have in place long-term, cost-effective contract management processes embodied within a Shipbuilding Supply Arrangement to ensure that best value is achieved in every shipbuilding project. Tools such as contract cost principles of Public Works and Government Services Canada (1031-2), annual rate negotiations, contract audits for profit limitation, earned value performance measurement, and continuous improvement incentives through shared risks and integrated project management teams will provide the effective mechanisms to ensure that Canada will receive value for money. We elaborate as follows:

Contract Cost Principles

- These cost principles are reflected in Public Works and Government Services Canada's contract supplemental clause 1031-2. The principles define what contractor direct and indirect costs are acceptable to Canada and ensure that only reasonable and properly incurred costs are allocated to the performance of the contract.

Rate Negotiations

- Rate negotiations are conducted annually utilizing approved Treasury Board financial cost-accounting procedures that review and audit shipyards' direct and indirect costs. Only allowable costs are permitted, and mark-ups are limited to reflect a fair margin for the risk assumed by the contractor. These negotiations have been successfully conducted for over a decade on marine sole-source contracts and ensure that the hourly rates charged by shipyards are fair and reasonable, and represent value to Canada. Rate negotiations are conducted regularly by Public Works and Government Services Canada, and the department has a cost analyst section dedicated to such negotiations with large defence contractors.

Contract Audits for Profit Limitation

- For Major Crown Projects, Public Works and Government Services Canada employs the services of independent auditors to audit the conduct of contracts periodically and upon completion. These audits are conducted to ensure that terms and conditions are being followed and to determine whether or not profits are excessive in

relation to the costs being incurred by the contractor and level of risk associated with that work. Any such excesses are “rolled-back” so that Canada is ensured fair value for services provided.

Earned Value Performance Measurement (EVPM)

- EVPM has the ability to combine measurements of scope, schedule, and cost in a single integrated system. EVPM will provide an early warning of performance problems as well as measure contractor performance. EVPM will also improve the definition of project scope, prevent scope creep, communicate objective progress to stakeholders, and keep the integrated project team focused on achieving progress.

Continuous Improvement Incentives through Shared Risk

- Sharing the risks in the projects, particularly for new designs, will eliminate the application of contingencies and risk mitigation budgets required by the contractor. To avoid the inherent risk and contingency costs associated with a Major Crown Project involving ship construction, we suggest that Canada consider paying for the first three ships under a time and material basis to allow for the learning curve and establishment of a steady state production level. For the remaining ships, Canada would pay the steady state value established after ship three, mitigating the risk costs to the actual construction level. This would represent a true shared-risk scenario and ensure Canada does not pay a risk premium.
- Application of targets, ceilings, and incentives on the basis of payment after the build of the third ship will provide a baseline from which to establish shared incentives and productivity improvements, and thus reduce overall ship costs.
- Canada will benefit from this economy of scale, improvement in learning curves, production efficiencies, and long-term sustainability of a viable shipyard.

Integrated Project Teams

- An integrated project team made up of involved government departments, key suppliers, and stakeholders will be established to create a long-term collaborative relationship to promote better value

for money by encouraging all to work together. These teams will improve design, operational efficiency, and performance; minimize the need for costly design changes; identify ways of driving out inefficiency; share best practices from previous projects; minimize the risk of costly disputes; and identify incentives to deliver tangible improvements in quality and reductions in time and whole-life cost in the operational phase of the project.

The employment of such contractual controls and project procedures will ensure that the benefits of the competitive process are maintained when contracts are allocated to Centre of Excellence shipyards. Canada will be assured value for money spent, and contractors will be rewarded for performing in the fleet renewal contracts. Continual or regular reporting of contractor performance (i.e., targets achieved and money saved) will also go a long way to assuring the public that the perception of non-competitiveness has been replaced by cooperative contracting and a best value approach as the basis of payment for work conducted by Shipbuilding Centres of Excellence.

Long-Term and Strategic Benefits

Implementing a Centre of Excellence approach will have huge long-term and strategic benefits to industry and Canada. Primarily, Canada will preserve a “Sovereign Capability” and maintain shipbuilding as a strategic asset for at least the next 30 years. There will be an ongoing economic benefit in that Centres of Excellence will provide steady workload and career opportunities for thousands of Canadians during the fleet renewal period. This workload will be characterized by high-value jobs requiring technical, management, and trade skills that will be valuable to all Canadian industries. In addition, there will be stable facilities for the cost-effective delivery of all Major Crown Projects, thus allowing for incremental investment to keep pace with a worldwide industry. Another direct benefit to industry will be the reduced cost of producing proposals, leaving more money for facility investment and human resource development.

The COEx model will also provide Industry Canada with the basis for a long-term shipbuilding industrial strategy. It will provide Public Works and Government Services with an expedited procurement process that will reduce costs, and that has the potential to deliver ships to clients in a timely manner, all the while fully respecting contract policy and safeguards. Another important cost benefit will be the reduced effort needed by Canada’s project management office, leaving more funding available for shipbuilding

and project deliverables. Overall, Centres of Excellence will reduce risk to the program, the contractor, and the Government of Canada.

Impact on Small Shipyards and Small/Medium Enterprises

Small shipyards and small- and medium-sized enterprises will also have strong potential to thrive under Centres of Excellence.

In order to provide significant opportunities to small shipyards, a facility designated as a COEx would not be allowed to bid on non-Major Crown Projects (< \$100 million). A COEx will be encouraged or incentivized to subcontract work to small shipyards, where geographically feasible. The federal small fleet (less than 1,000 tonnes) represents a significant number of ships and over \$120 million in renewal or repair contracts available to the smaller sector of the industry. In addition, there will be significant in-service and maintenance work required on the larger vessels once they are commissioned into their respective fleets. Overall, the small shipyards and small- and medium-sized enterprises also stand to benefit from implementing Centres of Excellence.

Industrial and Regional Benefits (IRB)

It is certain that companies designated as Centres of Excellence will create immediate high-value jobs. Irving Shipbuilding Inc. is prepared to commit to direct IRBs exceeding 60 percent of the contract value and will guarantee to achieve indirect benefits through offsets so that the total industrial benefits to Canada meet or exceed the contract value. This is a huge positive incentive to Canada to renew the federal fleet today, as every dollar spent building a ship in Canada will benefit Canadians. Not building ships will ensure that there will be no benefits for anyone!

Through Canada's current IRB policy, Centre of Excellence contracts will result in the distribution of work across Canada to the maximum extent possible. In addition, we strongly encourage that Canada continue to establish an Aboriginal set-aside (similar to the Mid-shore Patrol Project) so that all sectors of the industry can grow under federal fleet renewal.

Summary of Benefits

Implementing Centres of Excellence today will guarantee that the future federal fleet will be built in Canada in the most cost-effective and expeditious manner. The Government of Canada will be able to reduce the

time and cost of procuring ships while ensuring that taxpayers receive value for money when delivering these ships into service. The government will also ensure that our shipbuilding industry will have work to sustain growth over the next 30 years, ensure a strategic capability within our country, and provide industry with a long-term capability for growth during the fleet renewal period.

The Centre of Excellence road map to success represents a huge opportunity for Canada and the marine industry that occurs only once in a generation. It is time for Canada to show the leadership needed to rebuild its fleet, and to establish shipyards and an industry capable of building and maintaining that fleet. Furthermore, this leadership will solidify the future capability of shipbuilding in Canada and plant a seed for the next generation of excellence.

About the Authors

Douglas L. Bland is Professor and Chair of the Defence Management Studies Program in the School of Policy Studies at Queen's University. His research is concentrated in the fields of defence policy-making and management at national and University of New South Wales international levels, the organization and functioning of defence ministries, and civil-military relations. He has published books, articles, and reports and has lectured in these fields in Canada, the United States, Europe, and South Africa.

Jonathan Davies graduated from the University of Wales, Swansea, with a first-class honours BA in War and Society. Since moving to Cranfield University, he has worked as a researcher in the Centre for Defence Acquisition, part of the United Kingdom's Defence Academy. His role includes investigating procurement strategies for a range of major defence programs and helping to build a body of knowledge for defence acquisition.

Steve Durrell, President of Irving Shipbuilding Inc., graduated in 1984 from Maine Maritime Academy with a Bachelor of Science in Marine Engineering. Steve has enjoyed a successful career with the shipbuilding group for over 24 years. He joined Irving as an engineer at Saint John Shipbuilding in the Canadian Patrol Frigate Program. In 1994 he moved to Halifax and took on the role of ship manager and, more recently, leader of Irving's Commercial Group. He became president in August 2008 and is currently responsible for all operations at Irving Shipbuilding Inc. He and his wife Karen have two sons.

Lieutenant-Colonel Ross Fetterly is the 8 Wing Trenton Administration Officer. He was posted to Trenton from the Air Force staff where he was the section head in Director Air Comptrollership and Business Management responsible for financial management of the Air Force budget and cost analysis. He was previously the section head in Director Strategic Finance and Costing within the Ministry of Defence. Ross completed a seven-month

tour in Afghanistan in February 2009 as the Chief CJ8 at the NATO base headquarters at Kandahar Airfield, where he was responsible for finance, procurement, and contracting. He is a PhD candidate at the Royal Military College (War Studies) and is completing his dissertation on transforming defence procurement to meet the demands of government policy.

Stefan Markowski completed a master's degree in mathematical economics at the University of Warsaw in 1966, and a doctorate at the London School of Economics in 1974. He joined the Centre for Environmental Studies, working in senior positions. In 1980 he became a senior lecturer at South Bank Polytechnic (now University) and also began his long-standing association with a firm of land and urban economists, Roger Tym and Partners. As an academic researcher and professional consultant, Stefan completed several land, housing, transport, and employment studies in the United Kingdom. Following a two-year sabbatical at the Bureau of Industry Economics in Canberra, he moved to Australia in 1988 to take up a position at the University of New South Wales, Australian Defence Force Academy. Since 1989, he has also worked as a consultant with ACIL (Australia) and Unisearch. His current teaching and research interests at the School of Business include strategic procurement, logistics engineering and operations management, defence technology management, small arms proliferation, private military companies, and international mobility of factors of production. He has published widely in these and related areas.

Wim A. Smit is Associate Professor of Science, Technology and Society at the School of Management and Governance at the University of Twente, the Netherlands. He completed a PhD in Physics in 1973. Wim has published on such issues as the assessment and dynamics of military technological developments, nuclear technology and proliferation, and societal risk. His current research focuses on co-evolutionary patterns in the relation between naval technological change and developments in war fighting.

Robert Wylie has been a lecturer at the School of Business, University of New South Wales at the Australian Defence Force Academy, Canberra, since 2007. He was a senior policy advisor for 25 years to successive Australian governments, primarily on defence policy and procurement, and Defence Force access to civil infrastructure. After leaving the public service in 2000, Robert joined ACIL Tasman, an economics and strategy consultancy, where he specialized in analysis of Australian industry involvement in defence capability. His current research focuses on how Australia, as a small open trading economy, balances indigenous development and

overseas procurement in supplying and supporting the materiel needed to achieve its strategic objectives. He helps edit *Security Challenges*, Australia's leading scholarly journal on defence policy, military strategy, and national security affairs.

Stuart Young joined the UK Royal Navy in 1977 as a marine engineer officer, and completed a master's degree at the Royal Naval Engineering College in Plymouth. In addition to range of operational appointments at sea, he has held a number of acquisition-related posts in the Ministry of Defence. He served at the British Embassy in Washington, where he was responsible for liaison with the US Department of Defence on a number of key warship programs. Later, as Electric Ship Programme Manager at the Defence Procurement Agency, he had direct responsibility for a major UK-French technology development program that led to the selection of innovative propulsion systems in the new Type 45 Destroyer and the Future Carrier. More recently, he helped develop the Defence Logistics Organisation's strategic plan, worked as business manager for the Defence Electronic Commerce Service, and then as a senior manager at the Defence Management and Leadership Centre at Shrivenham. Following his retirement from the Royal Navy in April 2008, Stuart joined Cranfield University as the Deputy Director of the Centre for Defence Acquisition. He has a particular interest in the relationship between the MoD and industry across the supply chain and the application of through-life capability management to major acquisition programs.

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