



Commercial Shipbuilding Techniques

Can They Be Applied to Warship Production in the United Kingdom?

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Shipbuilders in the United Kingdom should extend their current outsourcing practices as they build new warships for the UK Ministry of Defence (MOD) to include using subcontractors to build and install modular crew cabins, meeting rooms, dining facilities, galleys, and other ship segments. They also should take advantage of outfitting practices used by US, European, and Asian commercial shipbuilders to install a variety of equipment—pipes, electrical gear, and heating and ventilation systems—at the earliest possible ship production phases.

So concludes a recent RAND Europe study led by RAND Corporation researcher John Schank of options open to the MOD to manage the production of the Royal Navy’s two new aircraft carriers. The study suggests that by taking advantage of certain commercial production practices, the MOD will be able to produce the new carriers more effectively and efficiently, preserve the United Kingdom’s military ship industrial base, and maintain the production schedules of other warships being built for the Royal Navy.

The Problem

The MOD is planning to produce two new aircraft carriers to replace the Royal Navy’s three existing *Invincible*-class carriers. These Future Aircraft Carriers (CVFs) are planned to enter the Royal Navy inventory in 2012 and 2015, respectively, and could be the largest warships ever constructed in the United Kingdom. The carriers’ anticipated size makes it unlikely that any single UK shipyard will be able to produce them, given current production capacities. Instead, the MOD’s plans call for major portions, or super blocks, of the carriers to be constructed in several shipyards, which upon completion would be transported to one shipyard for final assembly. Previous RAND research has noted that the near-simultaneous demands from several MOD

Abstract

To produce ships more efficiently and preserve the United Kingdom’s military ship industrial base, shipbuilders producing warships for the UK Ministry of Defence should expand their current outsourcing practices by turning to subcontractors to build and install modular crew cabins, meeting rooms, dining facilities, galleys, and other ship segments. These shipbuilders should also employ outfitting practices used in US, European, and Asian commercial shipyards to install a variety of equipment—pipes, electrical gear, and heating and ventilation systems—at the earliest possible ship production phases.

programmes might seriously strain the available capacity of the UK shipbuilding industrial base.¹

What Was RAND Hired to Do About the Problem?

RAND analysed production options open to the MOD that will allow it to acquire the CVF in the most efficient and effective manner, preserve the United Kingdom’s warship industrial base, and minimise disruptions in the schedules of other Royal Navy warships slated to be produced at the same time. We focused on the costs and utility of using *outsourcing* (i.e., subcontracting certain construction work to other firms or hiring temporary workers to augment in-house labour) to expand the workforce needed for CVF production, and of *advanced outfitting* (i.e., installing equipment foundations, pipes, power distribution systems, heating

¹ *Evaluating Options for the CVF: Workload and Workforce Analysis*, unpublished RAND research, September 2002.

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and ventilation systems, modular cabins, and other components during the early stages of construction) to reduce the total workload demand of the programme.

How Did RAND Study the Problem?

We reviewed past studies and related literature on outsourcing and outfitting and conducted two surveys—one on outsourcing, the other on outfitting—of selected shipbuilders in the United Kingdom, United States, European Union,² and Asia. Additionally, we arranged follow-up interviews with managers of the firms we surveyed and with other industry experts.

The outsourcing survey requested both quantitative and qualitative data on outsourcing of functions associated with constructing the hull and other large structures (sandblasting, priming, painting, or fabricating) and with preparing and installing subsections of ships (e.g., machinery; piping; electrical power distribution systems; heating, ventilation, and air conditioning [HVAC] systems; accommodations; common areas; galleys; or weapon systems).

The outfitting survey was similar. We asked various shipbuilders for data on the level of advanced outfitting they typically use at different stages of construction—how much they perform at each stage and the cost or time such tasks take—and about factors limiting their ability to do more.

What Did RAND Find Out?

Outsourcing Practices

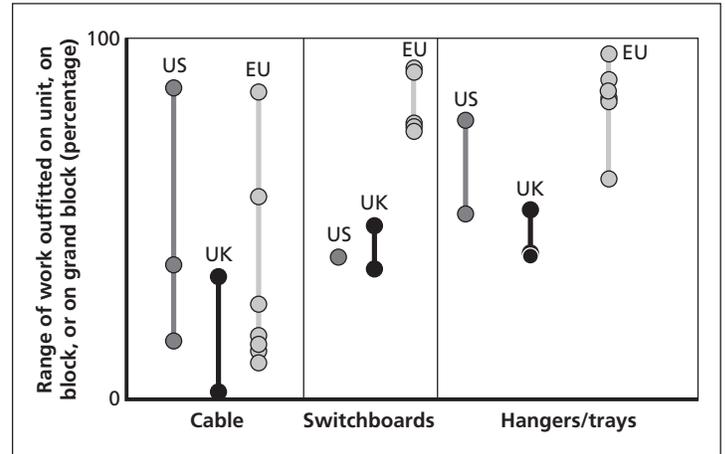
The survey found that shipyards employ two types of outsourcing:

- *Total outsourcing*, in which a shipbuilder subcontracts a complete functional task, such as electrical, HVAC, or painting, to an outside firm. The shipbuilder has no in-house labour capability to perform the function, although it may provide facilities (e.g., painting sheds) or materials and equipment to subcontractors.
- *Peak outsourcing*, in which a shipbuilder uses a subcontractor or temporary labour to augment in-house capabilities during peak demand periods.

UK and US shipbuilders rely on subcontractors very little, either for total functional areas or for meeting peak demands. The majority of the EU shipyards we surveyed use total subcontracting extensively, maintaining in-house capabilities primarily in the structural areas.

The feedback of our survey also suggests that cost savings are not the primary reason shipbuilders use total or peak outsourcing. Although the cost of outsourcing may be slightly less than the cost of maintaining capabilities in-house, shipyards that use outsourcing do so mainly to control their workforce in the face of cyclical demands for certain skills. In addition to better workforce management, shipbuilders that use total outsourcing believe the quality of the end product is better with subcontractors who specialise in certain areas, such as accommodations.

Advanced Outfitting Practices in the United States, United Kingdom, and European Union—Electrical Power Distribution



Outfitting Practices

The accompanying figure depicts the results of our survey of advanced outfitting practices at different UK, US, and EU shipyards. The vertical axis measures the percentage of outfitting accomplished during early phases of construction. The points in the figure represent a specific shipyard's practices, which we have connected to represent ranges. While the figure shows results only for the electrical power distribution tasks of installing cable, switchboards, and hangers, it is generally representative of outfitting practices associated with HVAC, piping, joinery, painting, and insulation.

The data suggest that UK shipbuilders achieve lower levels of advanced outfitting than do most shipbuilders in the United States or European Union, not just for the electrical power distribution tasks depicted but for a variety of other tasks.

What Policy Implications Flow from RAND's Findings?

Outsourcing

With respect to outsourcing, the MOD should allow shipbuilders to follow current practices. But the CVF and other MOD programmes should encourage shipyards to use subcontractors when demands exceed in-house capacity, as is likely to be the case over the next decade for UK shipbuilders. Temporary labourers may also help to meet increased demands but may involve higher costs and lower productivity than qualified subcontractors do.

Concerning total outsourcing, the CVF programme should consider using this practice in accommodation and personnel support functions, such as cabins, meeting/dining facilities, and galleys. These are areas where many UK shipbuilders are already turning to subcontractors, who often can produce higher-quality products at lower costs than a shipyard.

Outfitting

With respect to outfitting, our research suggests that UK shipbuilders could achieve higher levels of advanced outfitting in pipe work,

² That is, surveyed EU shipbuilders outside the United Kingdom.

electrical, and HVAC functions. US and EU shipbuilders typically outfit blocks and grand blocks to higher levels in these areas than UK shipbuilders currently do. Goals of 80 percent outfit at the super block stage are reasonable and achievable.

UK shipbuilders could achieve these higher levels by using more finished products—e.g., packaged machinery units, complex pipe assemblies, and modular cabins and galley—than they typically have in the past.

By using more advanced outfitting, shipbuilders should be able to build the CVF with fewer labour hours. Although our survey suggests the labour savings are highly variable and depend on various factors, it is reasonable to assume that shipbuilders could reduce the number of labour hours for outfitting tasks by 25 percent if they performed them at the block or grand block level rather than after the ships have been completed or are being assembled in dry dock. ■

This research brief describes work done for RAND Europe and the RAND National Security Research Division documented in *Outsourcing and Outfitting Practices: Implications for the Ministry of Defence Shipbuilding Programmes* by John F. Schank, Hans Pung, Gordon T. Lee, Mark V. Arena, and John Birkler, MG-198-MOD, 2004, 104 pages, \$30, ISBN: 0-8330-3635-1, available at www.rand.org/publications/MG/MG198/. Copies of this research brief and the complete report on which it is based are available from RAND Distribution Services (phone: 310-451-7002; toll free: 877-584-8642; or email: order@rand.org). The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. **RAND**® is a registered trademark.

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