BOOK REVIEWS

PUGH, Philip: *The cost of sea power.* London, Conway Maritime Press. 1986. 423 pp. ISBN 0 85177 419 9. Price £20. (reviewed by D. K. Brown, R.C.N.C.)

The author is an engineer, graded 'scientist' by the Civil Service, who works on the costing of aircraft and has a wide and deep interest in warships. An interesting pointer to his attitude comes in the first paragraph:

> What might be done within present knowledge is applied science. What can be done by a certain date and for a stated cost is engineering.

His book might be subtitled *You get the Navy you can afford* and may be seen as the first economic history of the Royal Navy. Economics is, too often, seen as dull and difficult but Mr Pugh steers the reader carefully through the difficulties and his use throughout of examples from sea will retain the interest of naval readers. In the opening chapter the relationship between material wealth and defence budget is studied for many countries since 1815. Whilst the U.K. achieved a defence budget of 50–60% of GNP in both World Wars such levels cannot be sustained. Without investment in factories, schools, etc., the economic roots of the nation will collapse, taking the Navy with it. Corrected for inflation, it seems that today's spend on the Navy is much greater than it was in 1914 and that the reductions in the 1920–30 era left spending, as a percentage of total GNP, at a normal peacetime level.

Chapter 2 shows how Britain's relative economic (and naval) power has fallen, whilst the next chapter discusses the effects of inflation, the difficulties of cost comparisons over long time scales and the effect of demand on prices. Cost estimating—and the closely related subject of weight estimating—follows, using the battleship *Dreadnought* as an example of estimating procedure. Mr Pugh gets a surprisingly good agreement since his procedure seems to neglect the high productivity of Portsmouth Dockyard and the speed of build which would suggest a lower cost. Over very long periods and from very different classes of ships (battle cruiser *Hood* to ISLAND Class OPV), the annual running cost comes out as one tenth of the Unit Production Cost (UPC), whilst a modernization is about 60% of a new build.

Military equipment of all sizes increases in cost at a greater rate than inflation—typically 8–9% per annum—due, it is suggested, to:

more expensive grades of labour	2·9%
more labour per pound weight	1·9%
increase in size of the equipment	3·5%

This is the 'road to absurdity'; one frigate only in the Navy.

The reasons for growth in cost of battleships and of aircraft carriers are then explored in some detail. There are many interesting points; for example, the effect of constraints in size on increasing cost per unit weight. Just occasionally, there seems to be important omissions in the argument: the effect of aircraft equipment, torpedo protection and anti-aircraft armament on cost of the World War II battleships is not mentioned.

Smaller navies defer or evade the harsher impact of financial problems by moving to a fleet of smaller ships with some reduction in numbers. Attempts to maintain capability by the use of novel technology, e.g. the torpedo boat at the end of the 19th century, are rarely successful.

Chapter 11 is based round a fascinating series of diagrams in which the number of major warships is plotted to a base of total expenditure. There

are three zones, of which the first is the major, all-purpose navy and in which the Royal Navy lies—just. His diagram is very reminiscent of the Hertzsprung-Russell diagram of stellar evolution and I suspect that collapse to a 'dwarf' navy may also be sudden rather than the 50 years which Mr Pugh suggests. The major navy requires strong supporting activities—design teams, research groups as well as specialized industries, collapse of which can bring the Navy down. Lack of political will can also be sudden. However, Pugh's diagrams suggest many hours of discussion—was, for example, the late Victorian navy an overgrown coastal defence force?

A later chapter deals with development cost and the importance of good project definition before order. Even this lengthy review cannot do justice to Mr Pugh's long and fascinating book. No one will agree with all his detail points but it will not be easy to dispute his central themes. It should be read by everyone—politicians, financiers, staff officers and engineers.

MOORE, Captain J. E., and COMPTON-HALL, Commander R.: *Submarine warfare today and tomorrow.* London, Michael Joseph. 1986. 308 pp. ISBN 0 7181 2743 9. Price £15.95
(reviewed by D. K. Brown, R.C.N.C.)

The authors conclude their foreword by saying 'it will be something fresh to argue about' and, judged against this aim, they are successful. Indeed, they are almost too successful since there are so many different points of contention raised that the actual threads are not always clear.

One theme of theirs which has attracted attention in the media is that SSN should carry cruise missiles and that Trident should be abandoned. This is an arguable case but was rejected by those with full access to the effectiveness of Tomahawk and Trident and their relative costs.

Another main theme is that the Soviet Navy has a clear policy for its submarine arm whilst the R.N. has not. This argument seems very hard to sustain when comparing the multitude of different designs in the Soviet fleet with the steady improvements through VALIANT, SWIFTSURE and TRAFALGAR in the U.K.

It is suggested in the book that Operational Requirements staff have concentrated too much on evolutionary development and have paid too little attention to the big leap forward. It would seem in particular that the writers have greater diving depths in mind. They also say that 'Design to Cost' began only with SSN21 in December 1985. This is certainly not correct; both SWIFTSURE and TRAFALGAR were designed to very strict cost limits, excellent but more expensive variants being dropped.

It is rare indeed for opposing navies to adopt such different philosophies of design: deep and fast in the Soviet boats, quiet for NATO SSN. Discussion on these aspects is difficult because of the secrecy in all navies but a fuller treatment should have been possible. The authors seem fascinated with length/beam ratio, a relatively minor aspect of the submarine hydrodynamics. (Moving from an optimum L/B of 6·5 to 10 increases hull resistance by about 5%). The advantage in protection of a full double hull is often mentioned, but the penalty of much increased drag is not. The drag is proportional to the total displacement (including the weight of water between inner and outer hulls) to the power of two thirds.

The authors are on surer ground in emphasizing the importance of the human factor. Some 30% of sinkings by R.N. submarines in World War II were due to 9% of COs, whilst 1040 ships were sunk for the expenditure of 5121 torpedoes. The U.S.N. fired 14748 torpedoes to sink 1314 Japanese ships despite better control gear and, probably, easier targets.

There is an interesting section on midget submarines based on Compton-Hall's command of *Minnow*. Certainly, later British midget designs (not built) had a truly formidable capability.

Those with access to classified data and, particularly, active submariners will indeed find much to argue about.