CORRESPONDENCE

WARSHIP PROPULSION SYSTEM SELECTION

SIR,

I was most interested to read the article on 'Warship Propulsion System Selection' in the December 1989 issue[1].

In particular, I was sufficiently intrigued to apply a few of their statistics to TABLES I and II contained in Mr Palmer's article 'The Impact of the Gas Turbine on the design of major surface warships' in the December 1973 issue[2]. These explained the reasons why the R.N. changed from steam to gas turbines in 1967.

In Mr Palmer's article, TABLE I reads:

TABLE I—*Breakdown of the through life cost of a gas turbine ship showing the difference in cost of items expressed as a percentage of the cost of production and installation of one complete steam plant and auxiliaries*

Item	*Difference in cost as percentage of cost of one steam plant*
Producing and installing the complete propulsion plant plus trunking, gearing, machinery controls, electric generators, air conditioning plant, distilling plant, and air compressors	+10%
Other ship procurement costs, the displacement and accommodation being reduced as described earlier	−7%
Extra engines to implement the 'upkeep by exchange' policy	+10%
Saving in fuel consumption over 20 years	−5%
Saving due to reduction of ship's complement over 20 years	−40%
Saving in upkeep costs over 20 years	−5%

From this he concludes that:

> This shows a net reduction equal to 37% of the procurement and installation cost of a steam plant. This would normally mean a reduction of about two per cent. of the through life cost of a destroyer or frigate.

Without considering any of the other percentages, the engineering complement of any ship, regardless of the machinery plant, is virtually the same (TABLE IV, page 30 of the 1989 article[1]). We can therefore discount the minus 40% due to savings in ship's complements

Summing the remainder of the figures in Palmer's TABLE I then shows an increase of 3% in favour of steam for unit production cost, and presumably the through-life cost is affected similarly.

Palmer, in 1973, summarized the advantages of gas and steam turbines as follows:

> It is not easy to assess the relative merits of these two propulsion plants when not all the advantages or disadvantages lie with either one and different features have different values. For example, how does one compare the advantage of the steam turbine in discharging comparatively little heat from the funnel with the better working conditions for engine-room personnel in gas turbine ships?
>
> However, by giving merit and worth factors to each of the several features discussed, the total impact of the gas turbine on the design of major warships may be weighted and assessed.
>
> Referring to TABLE II, in the first column are the main features which, in the author's view, affect the comparison of warships with gas turbines and with steam turbines, omitting all those features for which there is little to choose between the two forms of propulsion machinery. In the second column, advantage factors of 3, 2, or 1 are awarded if the gas turbine ship has a distinct, a moderate, or a slight advantage, and −3, −2, or −1 are awarded if the steam turbine ship has a distinct, a moderate, or a slight advantage. In the third column, worth factors of 1, 2, or 3 are allocated depending on what is judged to be the relative worth of these features to the Navy.
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> In column four, the figures in two and three are multiplied and then added to give an overall assessment. Rough justice indeed, and many would argue with the details although none, it is hoped, would argue with the positive sign of the overall assessment which indicates that the move to gas turbines really has affected an improvement in the Navy.

TABLE II—*Comparison of gas turbine and steam turbine ships*

Feature	*Advantage factor*	*Worth factor*	*Product*
Downtakes, uptakes, superstructure	−3	2	−6
Auxiliary power	−1	1	−1
Arrangements for going astern	−1	1	−1
E.R. complement and conditions	2	1	2
Through life cost	1	2	2
Ship availability	2	3	6
Ship operation and control	2	3	6
Industrial base	3	1	3
Overall assessment			POSITIVE

With the proven facts as demonstrated in merchant ships, a steam plant can be fully automated and unmanned in the same way as a gas turbine plant, so E.R. complement and conditions can be eliminated from the list.

Through-life cost is very similar. TABLE I of the 1989 article[1] shows that this item can be eliminated also.

By using membrane boilers and electric auxiliaries, the maintenance in a modern steam plant is negligible. As a result the ship's availability is certainly equal to that of gas, and if anything is better.

Ship operation and control are possibly still in favour of the gas turbine as regards changes in speed of operation only, so I suggest this should read Advantage Factor 1, Worth Factor 3, and so Product is 3.

As a result of the improvements made over the past twenty years, TABLE II when drawn up today reads:

TABLE II (*revised* 1990)—*Comparison of gas turbine and steam turbine ships*

Feature	*Product*
Space	−6
Auxiliary power	−1
Astern arrangements	−1
E.R. complement and conditions	0
Through life cost	0
Ship availability	0
Operation and control	3
Industrial base	3
Overall assessment	NEGATIVE

Steam has certainly been vindicated in the secondary plant of nuclear submarines. Should not the position be reassessed for the surface fleet?

Apart from the above, as the quality and availability of high grade fuel deteriorates, will gas turbines be able to operate satisfactorily over the life cycle—say up to the year 2040—for future classes of ships? A steam plant can burn any fuel and will most certainly remain operational when this predictable situation occurs.

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References

1. Westwood, S. P. C., Spencer, J. and Simpson, R. R.: Warship propulsion system selection; *Journal of Naval Engineering*, vol. 32, no. 1, Dec. 1989, pp. 20–32.
2. Palmer, S. J.: The impact of the gas turbine on the design of major surface warships; *Journal of Naval Engineering*, vol. 21, no. 2, Dec. 1973, pp. 156–175.

'WHERE THE HELL'S MY RELIEF?': A JUNIOR OFFICER'S VIEWPOINT

SIR,

Having received the *Journal of Naval Engineering* for the first time in December 1989, I was most interested to read Captain A. P. Masterton-Smith's letter. As one of the youngest and most junior officers in the Royal Navy I decided to examine the problem with reference to my recent experience as a Potential Officer Candidate (POC).

As a POC I studied A levels at an independent day school only two years ago. The sixth form comprised over 100 pupils, all of whom planned to move on into further education. The school was, therefore, a natural target for future employers. In addition to the Armed Forces the school was visited regularly by both manufacturing and service industries. The R.N. area schools liaison Officer made regular visits and the R.N. Presentation Team (RNPT) spoke to the sixth form once every two years.

There was a significant contrast between the presentations given by civilian organizations and those given by the R.N. In particular:

(*a*) The R.N. lecturers were members of a full-time presentation team. The civilian lecturers were employees of a particular company's local branch.

(*b*) The R.N. presentation was professionally written, structured, and timed to perfection. Many civilians arrived without any preparation.

(*c*) The R.N. presentation was supported by extensive visual aids ranging from slides to a Lynx helicopter. The civilians were rarely supported by any visual aids.

Surprisingly, the RNPT was the least effective of all the presentations. The civilian organizations were bombarded with questions whereas the RNPT was met with silence; a debate was in fact initiated by the skill of the speaker. The reasons for such negative feedback were voiced both before and after the R.N. presentation in the sixth form common room. Pupils clearly believed:

(*a*) The RNPT was merely a recruitment ploy as opposed to the public information unit it claimed to be.

(*b*) The majority of the information presented was propaganda. For example the Head of Studies could not believe the facts concerning the efficiency of the Seawolf system, his reason being that the R.N. had actually lost a number of ships in 1982 through poor air defence.

(*c*) The speakers were too professional and not individuals. Uniforms and shoes were immaculate, as were facial expressions. On political issues the team demonstrated impartiality to an unbelievable extent.

(*d*) Finally a career in the armed forces was considered less challenging and rewarding than a civilian career.

Having briefly described the situation at a fairly standard independent school I would like to make a suggestion to the Department of Naval Recruiting. If the R.N. is to become more readily accepted in schools and colleges the presentations must become more personal. It is vital that R.N. personnel are seen as individuals and not as robots. The material discussed at presentations could be more directly relevant to the audience. For example daily life as a junior officer could be substituted for the finer points of flexible response.

The recruitment of future Naval personnel may present one of the greatest challenges in the future. Success depends on judging the exact situation in schools and colleges.

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