Technical Comments

Comment on "U. S. Navy Hydrofoil Craft"

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AFTER seeing Table 1 of Ref. 1, one may naturally desire to compare performance of the listed craft. Available data on displacement, shaft horsepower, and maximum speed are related as follows: by definition,

$$\eta_p = T \cdot V / 550 \text{ shp} \tag{1}$$

where

$$
\begin{aligned}
\eta_p &= \text{net propulsive efficiency} \\
T &= \text{thrust, lb} \\
V &= \text{velocity, fps} \\
\text{shp} &= \text{shaft horsepower}
\end{aligned}
$$

At maximum speed, where thrust is equal to drag, Eq. (1) becomes

$$\eta_p = R \cdot V_{\max} / 550 \text{ shp} \tag{1a}$$

where R is the total air and water resistance in pounds. Multiplying Eq. (1a) by the (Δ/R) factor, which is a measure of hydroaerodynamic efficiency,

$$\eta_p(\Delta/R) = \Delta \cdot \Delta_{\max} / 550 \text{ shp} \tag{2}$$

Converting speed into knots and displacement into long tons

Table 1   Results of substitution of Ref. 1 data into Eq. (2a)

	1 PCH-1	2 AGEH-1	3 FRESH-1	4 PGH-1	5 PGH-2
Δ_T	120	320	16.7	57	58
shp	6200	28,000	5000^a	3150	3100
V_K	40+	45+	100	40+	40+
$\eta_p(\Delta/R)$	5.34+	3.54+	2.30	5.00+	5.16+

^{a} Estimated.

gives

$$\eta_p(\Delta/R) = 6.89 \Delta_T \cdot V_K / \text{shp} \tag{2a}$$

where $\Delta_T =$ displacement in long tons and $V_K =$ maximum speed in knots. Substitution of data from Ellsworth's Table 1 on displacement, shaft horsepower, and maximum speed into Eq. (2a) gives the results shown in Table 1 of the present Comment.

More meaningful results would ensue if (Δ/R) and (η_p) were presented separately. In order to do so, R must be known explicitly. Unfortunately, R is not listed in Table 1 of Ref. 1. Otherwise, separating the performance of the hydrofoils from the performance of the propulsive systems would help to explain the disappointingly low product of efficiencies shown in columns 2 and 3 of the present table.

It is granted that an experimental craft in a process of development is not expected to attain a high degree of efficiency. Nevertheless, relative or comparative figures, however crude, are of some interest and value as an indication of the potential of the fully developed craft.

Reference

[1] Ellsworth, W. M., "U.S. Navy Hydrofoil Craft," *Journal of Hydronautics*, Vol. 1, No. 2, Oct. 1967, pp. 66–73.