Stern Flaps

What is it?

A stern flap is an extension of the hull bottom surface which extends the rearmost part of the vessel. It is a relatively small appendage, built of plate steel and welded to the transom.

Description:

Many concepts are available for ships to save fuel or increase speed, but these improvements are frequently high-cost, high-risk, or require new vessel builds. On the other hand, a stern flap is a clever manipulation of flow around the hull that produces tangible performance benefits, but is small, unobtrusive, easy to install, inexpensive, and can be back-fit to a ship with little change to the hull, and is equally viable for new design and construction. The U.S. Navy and U.S. Coast Guard have installed stern flaps on destroyers, cruisers, frigates, cutters and patrol craft, all of which have exhibited significant fuel savings and increases in maximum speed during at-sea trials.

Current stern flap evaluations under the Fleet Readiness R&D Program (FRR&DP) include prototype installations on two amphibious ship classes. For these applications, a new stern flap concept was developed, one which combines the flap's hydrodynamic surface and the stern gate support structure.

Stern flaps are constructed in a manner similar to bilge keels, using mostly flat plates and an internal structure with triangular 'A' frames. Attachment to the transom is with conventional welding on the ship's exterior. Pay-back period to recoup fabrication and installation cost is on the order of 1-2 years.

Challenges and Opportunities

- The breadth of Navy research, design, and at-sea experience with stern flaps now makes this technology ripe for transition to a variety of commercial and recreational craft.
- Fully develop an active stern flap system consisting of two half-span flaps, where hydraulic systems could be used to vary the angle of attack on the flap sides independently.

What Will it Accomplish?

Stern flaps have been proven to reduce propulsive power requirements and exhaust emissions, and foster significant fuel cost savings while increasing both ship speed and range. They have been providing a better balance between the ship's power requirements and engine operating envelope, increasing the interval between engine overhauls, and extending the service life of the propulsion machinery. Stern flaps also reduce propeller loading, cavitation, vibration, and noise tendencies.

At a Glance

How Does it Work?

Stern flaps modify the water flow under the hull afterbody, decreasing flow velocity and increasing pressure, resulting in reduced form drag and thus reduced hull resistance. Wave heights in the near field stern wave system, and far field wave energy, are both reduced by the flap. Localized flow around the transom, which represents lost energy through eddy-making, wave breaking, and turbulence, is also significantly modified.

Metrics

- Potential DDG fuel savings of 7.5%
- Cumulated $655 million in fuel savings

Applications

- 173 USN and USCG ships

For More Information

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