Stern Flaps

At a Glance

What is it?

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

How does it work?

Stern flaps modify the flow field 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.

What will it accomplish?

Stern flaps have been proven, at sea, to reduce propulsive power and exhaust emissions, and to foster significant fuel cost savings, while increasing both ship speed and range. They have been used to provide for 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. Flaps also reduce propeller loading, cavitation, vibration, and noise tendencies.

Metrics:

- Potential DDG fuel savings of 10%
- Combined $413 Million in fuel savings

Applications:

- 166 USN and USCG ships

Point of Contact:

Dominic S. Cusanelli
301.227-7008
dominic.cusanelli@navy.mil

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, which 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, or is equally viable for new design & 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 with simple techniques (similar to bilge keels), using mostly flat plates and an internal structure using 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 research, design, and at-sea experience, now makes stern flap technology ripe for a 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.