Optimising Fuel Usage – Hull Review

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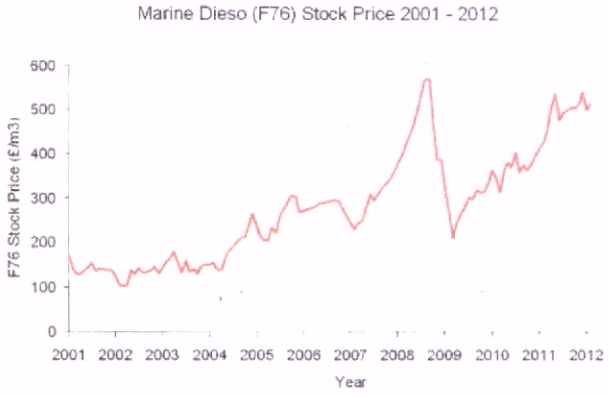
Introduction

The initiative to Optimise Fleet Fuel Usage to Maximise Effectiveness [OFFU] was created in 2006, triggered by activity cuts. The need was strengthened in 2007 by the dramatic increase in the cost of fuel at the time. The programme addressed an array of fuel efficiency measures including operation & ship handling, training, machinery configuration, hull fouling, use of shore supply & changes to hull design (e.g. transom flaps). This article provides a review of the performance of the hull aspects introduced and the associated increases in availability. Whilst the cost of fuel is fairly stable at the moment, it is likely to increase again as the global economy starts to expand once more, as it does the extant gains from optimising fleet fuel usage will become more significant.

Background

In 2007 Fleets' activity was being cut and prioritisations of activity over capability led to the approach of Optimising Fleet Fuel Usage to buy back previously imposed "activity" cuts and further develop the existing culture among the operators to use fuel more efficiently. It was Fleet's intention to recover the loss of 20% Fleet activity as far as possible and not reduce fuel allocations in order to sustain current reduced activity levels.

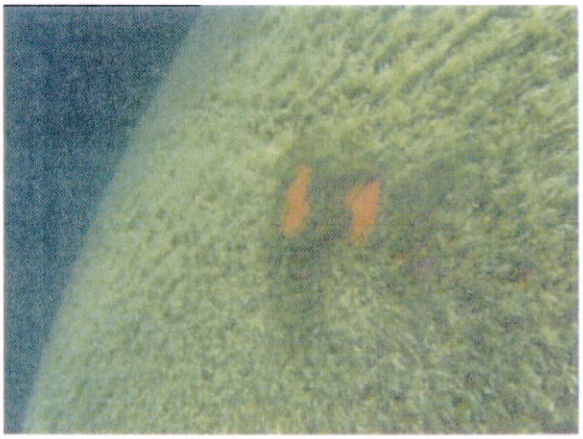


The success of this programme was dependent upon a wide range of naval organisations doing their bit to achieve the common goal, it also lead to a change in behaviours e.g. spending resource for no individual direct benefit. The edict "costs fall where they lie" was decreed and waterfront organisations now had to find budget to perform unscheduled hull cleans. As part of this initiative it was felt that the greatest savings could be gained from improving the efficiency of the hull and reducing the effects of fouling. Other areas would also contribute and every percentage would make a difference. The hydrodynamic aspects of the initiative were:

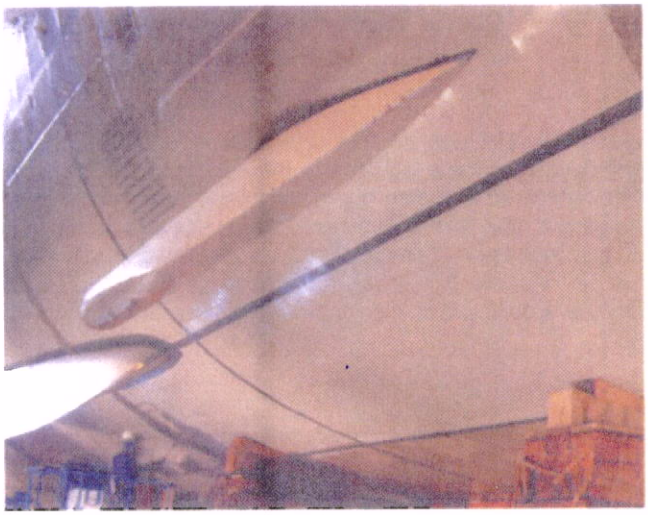
- Hull fouling & cleaning
- Anti-foul paints
- Propeller polishing
- Stern flaps
- Displacement and trim

At cruising speeds the majority of ship resistance is due to friction, it being mainly influenced by the area of wetted surface and its associated roughness. The influence of fouling increases the roughness, requiring more power which in turn increases fuel consumption.

Anti-foul paints and hull fouling



In 2006 self polishing anti-fouling paints on RN warships had an effective life of approximately 3 years. This did not tie in with the change in docking cycles from 2.5 years to 5-6 years. As a result the paint wore out midway between dockings and the hull became fouled. It was evident this needing managing and the fouling trigger system was launched. This compared in-service resistance with clean hull values, immediately four ships reported between high increases in resistance and thus fuel consumption. It was evident a change was needed when a T22 OpDef'd a 2kt reduction in top speed…the ship had a 70% increase in skin friction. The photograph from a T22 is now a thing of the past. Monitoring shaft power once a month led to informed timing on cleaning decisions and a 20% increase in availability during the 2.5 years prior to a docking period without the need to uplift fuel allocations.



At the same time the hull fouling management system was being introduced two ships were trialled with the new foul release silicone based anti-foul paint being used by the merchant navy. This works by providing an ultra smooth surface which prevents fouling from adhering strongly to the hull. If ships are alongside for an extended period fouling will attach itself, however once the ships exceed a threshold speed, typically 10-15kts (depending on coating specification) the fouling will wash-off. This foul release coating does not damage the environment (unlike conventional anti-fouling paints which kill fouling life with toxins), is easier to maintain as well as lasting for the period between docking. Some confidence in this paint system had been gained from the operation of the trimaran demonstrator RV Triton. During a docking (now with a commercial owner) the hull was inspected and "one was able to move the barnacles around with your hand". The coating was 7 years old. However there were risks for RN ships which regularly experience extended periods alongside, unlike their merchant counterparts, that foul release may not be as effective. The trials were however a success as illustrated in the image above showing HMS Northumberland with minor slime after 6 years in the water without any cleans.

Nearly all RN ships are now coated with foul release coatings with projected benefits in the order of £600k to £1m of fuel over ten years of operation for each DD/FF platform. This does not include any allowance for manufacturers stated claims that the lower skin friction of the coating can reduce the frictional resistance by up to 4%. In general the move to the new coatings has been an overriding success; there of course have been the odd occurrences of application issues and on one occasion an MCM with one engine down was unable to steam above the paint threshold speed thus entering an ever worsening spiral of fouling. These issues are rare however and are compensated by the overall cost savings achieved through application of the new coatings.

The regime of detecting fouling and managing hull cleaning needed to adapt with the implementation of foul release, the key concern being the extended period of inactivity. Another navy had trialled this coating and found it to be ineffective, but the ship on which the trial was conducted had spent 9 months inactive in a tropical climate and the calcareous growth had taken a stronghold going through the coating and would not wash off. The Standard Manoeuvre and RN operational doctrine in high risk fouling areas has adequate to avoid the imposition of any new condition monitoring processes such as a routine "full ahead".

The monthly shaft power "trigger" returns used to inform the hull fouling management system (identifying ships with 18% increase in resistance) will continue in order to detect any coating damage or fouling accumulation, and where fouling is suspected the ship advised to steam at full power for an hour to remove the growth. The E-Flubcon system has simplified the return system for these trigger results however the number and quality of returns made is below par and the practice not yet completely embedded. The graph below containing actual data shows how the monitoring is used to inform decision making for each individual ship.