MOTOVATED
DESIGN & ANALYSIS

Case Study

SF18 SURFACE PIERCING DRIVE UNIT

BACKGROUND:

Seafury International Ltd produces a range of surface piercing drives and propellers for the marine industry, and have been involved in some extensive development of their drive units.

These units have the top half of the propeller exposed during planing, compared to conventional installations where the entire propeller is submerged. As a result, the propeller and rudder carry significant bending and torsional loads. The advantages of this set up are, however, reduced drag forces, greater efficiencies and higher planing speeds.

Motovated Design & Analysis carried out a range of stress and frequency analyses to check component strengths at 48 knots, and accommodate future upsizing to 70 knots.

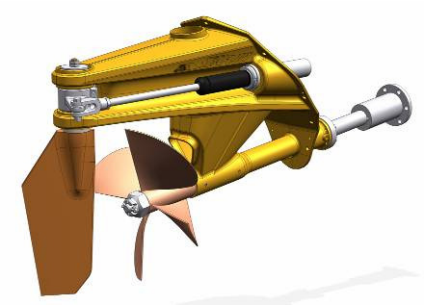

Figure 1: CAD model of SF18 surface piercing drive unit

SOLUTION:

The first step was the development of appropriate propeller and rudder loads (Figure 2). Test data was used to develop a realistic drag coefficient and extrapolate the results to different boat speeds. An analysis of the surface drive assembly was then undertaken, including a portion of the transom to check the transom flange bolt loads. These results were verified by individual analyses of the rudder and main casting, to ensure that the restraints and contacts were working correctly.

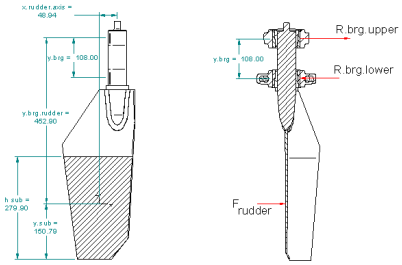

Figure 2: Rudder load development

Rudder Analysis

The rudder design was initially a stainless steel weldment of the rudder stock and blade. As a result of the stress analysis several changes were made, including casting the part in Aluminium Bronze to minimise fatigue issues, thickening the rudder blade and increasing the rudder stock diameter (Figure 3). This was largely due to the higher future speeds required, and as the rudder loads are a function of speed squared, the section sizes also had to increase.

Main Casting Analysis

The main casting analysis highlighted a couple of areas of relatively high stress around radii and section transitions. These were easily modified to improve the stress distribution giving a very sound design (Figure 3).

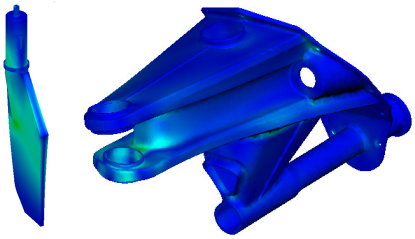

Figure 3: Stress plot of SF18 rudder and main casting

Frequency Analysis

The final analysis performed was a frequency analysis of the surface drive assembly. The natural frequencies of the structure were compared against the driving frequencies of the engine and propeller to highlight where possible resonance issues may occur.

RESULT:

The SF18 unit was considered robust in the 48 knot regime and adequate for prototype testing in the 70 knot regime. The analyses performed before production will undoubtedly pay back dividends, and the results can also be used during the certification process.

"The analysis Motovated has carried out on our surface drives has given us real confidence going into our prototype testing stage. They are a great team to work with!"

Simon Primrose, Principal
Seafury International Ltd

For more information about this product, contact: Seafury International Ltd, www.seafury.com