Seakeeper Gyro Performance Prediction
Grand Banks 53 Aleutian RP

Objectionable boat roll occurs when the wave encounter period matches or is very close to the boat's natural roll period. This is called natural or resonant rolling. In this condition, a boat will typically roll 3-5 times the slope of the wave and the resulting amplification of the wave slope causes safety concerns, fatigue and motion sickness.

Seakeeper has developed a method of predicting the amount of resonant roll reduction that can be achieved by active gyro stabilization for the case of the vessel operating at zero speed in regular beam waves. The method assumes that the gyro is actively controlled and always maximizes the gimbal or precession motion for a given boat roll period regardless of the boat's roll amplitude.

The resulting roll reduction graphs provide a convenient means of evaluating the performance of the gyro stabilizer without having to perform motion simulations for a large number of sea conditions.

The calculation requires that Seakeeper make estimates of the boat's roll inertia, natural roll period and roll angle/wave slope amplification ratio at resonance. Seakeeper made these estimates for a Grand Banks 53RP using the following data supplied by Grand Banks thru Seakeeper dealer Twin Disc Asia.

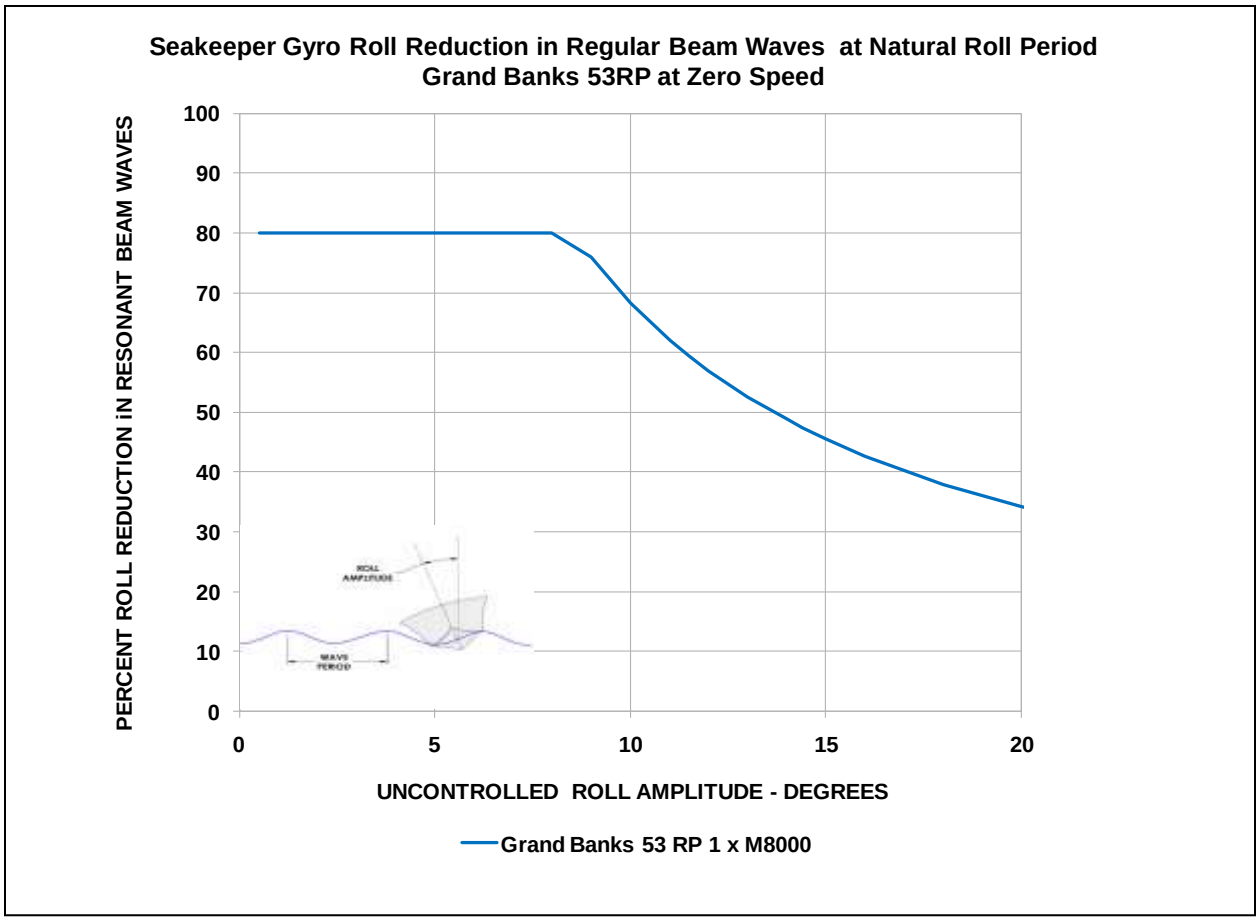
Hull Parameter	Grand Banks 53RP
LOA - M	17.61
BOA - M	5.40
Displacement FLD - MT	34.85
GMT @ FLD – M	1.46
LWL – M	15.02
BWL Max– M	4.90
Deadrise @ BWL Max – Deg	17.7
BWL @ Transom - M	4.90
Deadrise @ Transom - Deg	17.70
Draft Hull Body @ FLD - M	1.45

The results are given as percent roll reduction versus roll angle of the boat without gyros (i.e., the uncontrolled roll) as shown in the graph on the next page. Results are provided for the vessel fitted with one Seakeeper Model 8000 Gyro.

The X-Axis shows the uncontrolled roll amplitude (see the illustration in the graph). The X-Axis is not an average of different amplitudes. Think of the boat as sitting at zero speed in regular beam waves and rolling +/- 5, or +/-10, or +/-15….. or +/-20 degrees at its natural roll period.

The Y-Axis shows the amount that the gyro will reduce the uncontrolled roll amplitude. For example, one Model 8000 Gyro will reduce a +/-10 degree uncontrolled resonant roll by 68%. This reduction would leave a residual roll amplitude of only +/-3.2 degrees.

The performance curves end at approximately 80% resonant roll reduction because Seakeeper believes that percent reductions in excess of this amount are overly optimistic due to simplifications inherent in the method.



On a boat like the Grand Banks 53RP, roll stabilization is required at anchor, at very low speed and while navigating at the cruise speed.

It is Seakeeper's experience that at anchor the maximum, uncontrolled roll angles are typically below 10 degrees and are often below +/- 6 degrees as the sea conditions are usually not very rough.

One Model 8000 will provide an 80% reduction of uncontrolled roll angles up to +/- 8 degrees, a 68% reduction of a +/-10 degree uncontrolled roll and a 45% reduction of a +/- 15 degree uncontrolled roll.

Based on our experience, this should provide excellent stabilization at anchor and at low cruising speeds. As vessels tend to roll about a center that is near the waterline, the roll reductions afforded by the M8000 will also make a huge difference in terms of the reducing the lateral movement on the raised flybridge of the Grand Banks 53.

At high cruising speed, resonant roll still constitutes the largest roll angles. The above graph is strictly applicable to the zero speed case as it does not consider the increase in hull roll damping with forward speed. Underway the gyros will reduce the resonant rolling at the vessel's natural roll period in general accordance with the graph but as the vessel's speed increases the percentage reduction will reduce relative to the graph. The Grand Banks 53RP is a hard chine hull and as speed increases, the hull's dynamic lift should increase the roll stability and the roll damping. The vessel should become very stable at the cruise speed due to the combination of the hull's dynamic lift combined with the action of the Seakeeper gyro.

Please note that the results contained in this report are Seakeeper's estimate of the gyro performance based on the data provided and the tools available to Seakeeper. The method predicts the reduction in resonant or natural rolling in regular beam waves at zero speed when the wave period matches the vessel's natural period. Actual performance will vary depending on the accuracy of the methods and assumptions, the nature of the rolling motion (gyros do not correct static heels or very low frequency roll motions), and variations in actual sea conditions relative to our assumption of regular beam waves. Sea conditions are extremely difficult to quantify due to the random nature of wind generated waves and swell.