high performance rule

KWRW 2013 Post Race Analysis

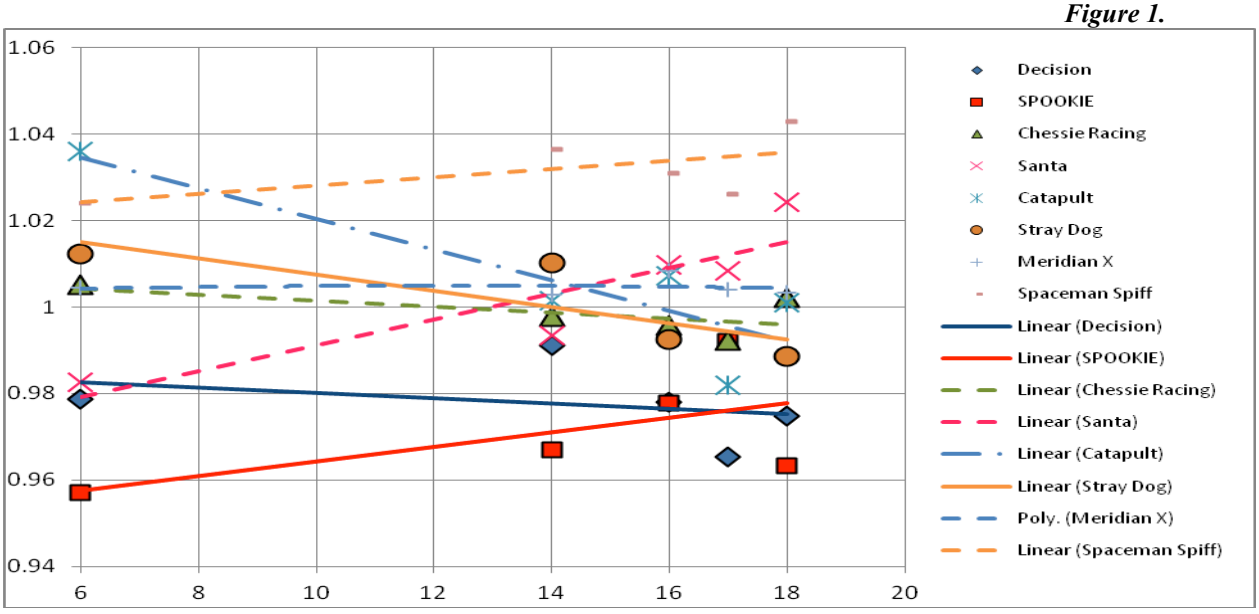
The following is a graphical display with commentary that illustrates the relative performance of all the boats competing in the HPR class. *Team Premier* has not been included since she had no results for 6 of the 10 races.

The methodology used was to:

1. Calculate, for each boat and for each race, the corrected sec/mile (CSPM) equal to corrected time divided by the race distance. Each boat's worst race was discarded, except for Races 1 & 2, which were the only two sailed in light air;
2. Take the average of the CSPMs for the fleet;
3. Divide each boat's CSPM by the average CSPM to create a performance index. Those values will be scattered above and below a value of 1 (a value of 1 implies finishing in the middle of the fleet.) A value below 1 is the result of sailing fast and having a low corrected time. The lowest value of this index in a given race is obviously the winner.
4. The performance indices were then plotted across true wind speed in the following figures to look for wind speed-related trends.

In Figure 1 are shown the 5 races that were windward/leeward with 4 legs. They were at nominal wind speeds of 6, 14, 16, 17 and 18 knots. The graph shows scattered points for each boat along with a line that is the linear fit to those points. *Spookie*, in red squares, has generally the lowest index, indicating the best performance. Her index ranges from about .96 to .98 (4 to 2 percent better than the fleet.)

Figure 1.



Spaceman Spiff had the worst performance. (I have included all the boats just for the sake of completeness - we can always ignore a boat if we believe she was not sailed to her potential.)

Observations on the WL 4-leg races of Figure 1:

1. The two Carkeek 40s performed consistently better than the average by 2 to 4 percent.
2. The best of the Farr 400s, *Santa* and *Chessie Racing*, performed close to the average which means they were 2 to 4 percent slower, on corrected time, than the Carkeek 40's. This can be interpreted to mean that if their HPR ratings were reduced by 2 to 4 percent they would have essentially tied the 40s, ignoring other factors such as boat interactions.
3. *Stray Dog* was perhaps 1 percent higher than the average in light air, 1 percent lower in strong winds.
4. *Catapult* really struggled on the light air race, Day 1. On the heavy air races she had an index close to 1, and appears to be 2-3% off from the Carkeek 40's.

Figure 2.

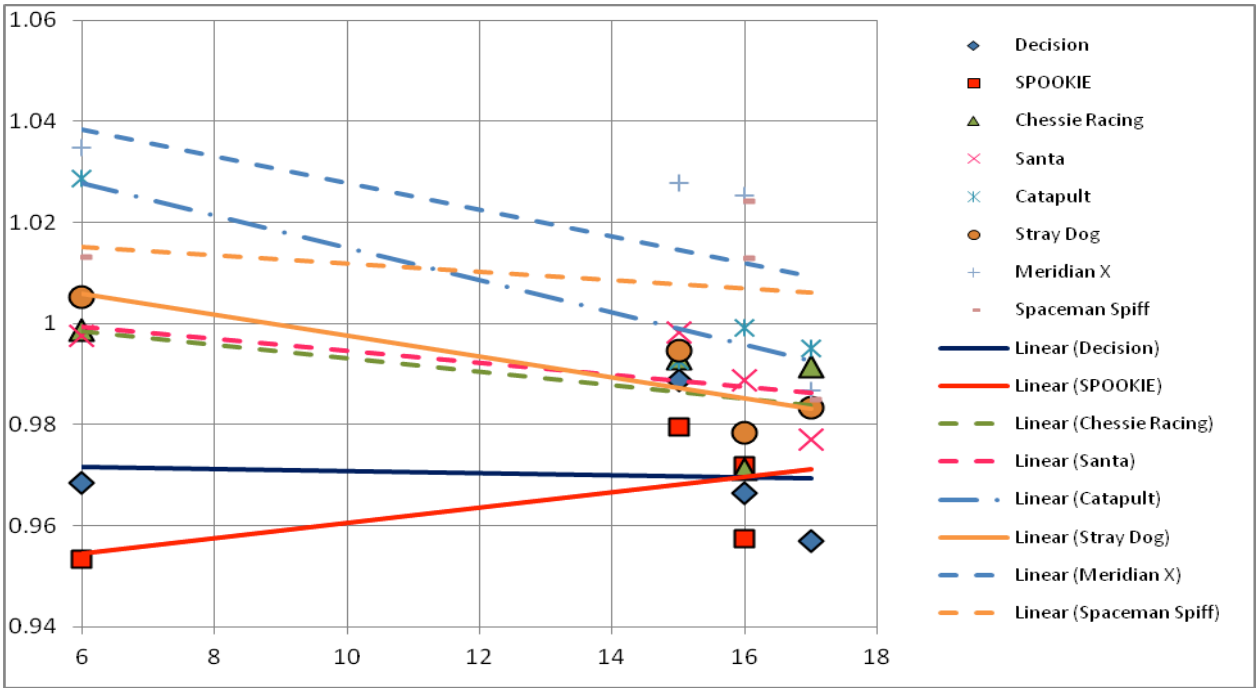
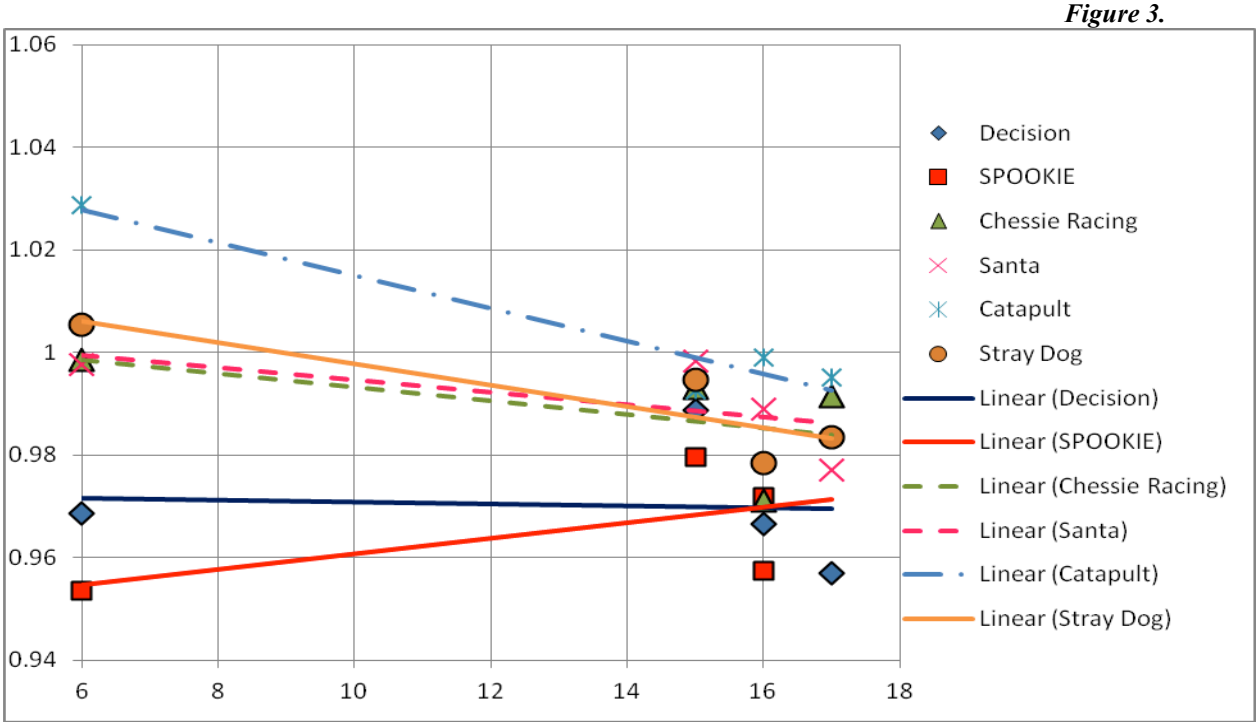


Figure 2 shows the 5 races that were W/L with 5 legs, meaning an extra upwind leg. The winds were clustered between 15 and 17 knots with one race at 6 knots. (Note that the formulas for HPR were calibrated using performances predicted in 10-12 knots so the results are really showing how well HPR deals with extremes in winds.)

Figure 3 shows the same analysis as Figure 2, except that to help clarify the observed trends only the best-sailed Farr 400's are included:

Figure 3.



Observations for Figures 2 and 3:

1. *Spookie* again has the best CSPM. Although for the whole week there were only two races in light air she certainly dominated those.
2. The scatter of the fleet is about the same as in the 4 leg races so, at least in this sample, I don't see anything that indicates the extra beat made anyone more or less competitive.
3. *Catapult* still does better in heavy air than light.
4. *Santa, Chessie Racing,* and *Stray Dog* were firmly in the middle of the fleet.
5. The best of the Farr 400's were about 2-3% off the pace relative to the Carkeek 40s. That stretches to 3-4% in light air.

Conclusion:

- A small rating adjustment of the older pre-HPR designs is justified based on observations and race results.

Changes embodied in HPR Calculator V4e:

1. Adjustments have been made in factors that relate to design differences including:
    a. Freeboard (removal of penalty for low freeboard on existing boats)
    b. Displacement (broadening the range of displacement used to calibrate HPR)
    c. Propellers (full benefit of the estimated reduction in sailing performance)
    d. Construction (newly introduced)
    e. Age allowance
    f. The conversion from rated length to TCF.
2. When applied, these result in the following changes in V4e for the Key West fleet and other designs recently scored in HPR events:

OOAH	Flying Jenny	Interlodge	Spookie	Stray Dog	Catapult	Santa
MC 38	TP 52	IRC 52	Carkeek 40	GP 42	Ker 40	Farr 400
-2.1% TCF	+1.6% TCF	+1.7% TCF	0.0%	-0.2% TCF	-1.1% TCF	-1.4% TCF
+12.5 sec/mi	-7.7 sec/mi	-7.6 sec/mi	0.0	+1.1 sec/mi	+6.2 sec/mi	+8.1 sec/mi

The first row gives % change in TCF, the second row shows the change in sec/mile, with all results expressed as changes relative to *Spookie*. So, for example, the 52's are losing 7.7 sec/mile or about 1.65%. Catapult is gaining 6.2 sec/mile, 1.1%. The Farr 400 gains 8.1 sec/mile or 1.4%.

The Farr 400 and the Ker 40 (in heavy winds) are gaining more than half the apparent performance deficit imputed from the above analysis of KWRW.

The MC38 gets the largest adjustment, much of that coming from eliminating the penalty for low freeboard for pre-HPR designs.

Jim Teeters, US Sailing Feb 19, 2013

Additional comments from Bill Lee:

This process of adjusting ratings is a tricky one. It is a delicate balancing act between the need to use empirical data from race results to assess the ability of the Rule to perform correctly, against the need to have some stability to allow designers to optimize to the intended typeform, which in turn has been open to input.

But it's important to also keep in mind a few key points in this process:

- This is the first HPR regatta where yachts have had valid HPR certificates and is a relatively small sampling of both boats and races. Future races could show the need for more or less correction. It is important not to risk over-correcting this so early in HPR development;
- Some of the entries may be less optimized to HPR than Spookie and therefore they may have more potential for improvement;
- HPR is type-forming and this is an effort to make boats designed prior to HPR more competitive.

Bill Lee, Santa Cruz Feb 21, 2013