

COMPARISON OF TOD, TOT, AND AMERICAP SCORING

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One of the neat things about AMERICAP is that from the two handicap numbers (A and B or TOT and TOD) it is possible to generate the VPP predicted elapsed time-per-mile of a yacht (perfectly sailed) in any wind speed (within about +/- 2 seconds per mile). This also means that it is possible to generate the single-number TOD (like PHRF) handicap numbers, R_d , as the appropriate time allowance per mile at 10 knots wind. Similarly one can generate the pure TOT as the appropriate elapsed time factor at 10 knots wind (like CHS or IR2000)

This makes it easy to generate hypothetical perfectly sailed races to study the error inherent in any single number handicap system, the so-called "wind speed error" over a range of wind speeds. Of course, this is only one of several error components. However, as will be shown the wind-speed error in any single number system can be much greater than any reasonable estimate of the error in the VPP or AMERICAP.

For this comparison we assume

- 1 *all boats are perfectly sailed,*
- 2 *each scoring system handicaps perfectly within the inherent limitations of its scoring format. That means, all three systems agree exactly on the speed of the boats for an average wind (assumed 10 knots) and an average (assumed CCAP) course.*

The elapsed times are thus assumed as given by the VPP and the corrected times according to the VPP or AMERICAP should all be identical (equal to the elapsed time of the scratch yacht under the *nominal* conditions (10 kts, CCAP). Any discrepancy at other than 10 knots measures the handicap *scoring* error inherent in the single-number scoring format, that is the "wind-speed error".

The attached spreadsheet shows this done for the current SCORA AMERICAP fleet. We consider three races, each running a one-mile CCAP course, in steady winds of 10, 6, and 20 knots. using AMERICAP, single number TOD, and single-number TOT scoring.

Columns E and F are the two AMERICAP handicap numbers. G, H, and I are the inferred VPP elapsed time potential of the yacht in 6, 10, and 20 knots wind, W , derived by the formula

$$et(W) = [351.6 + (117.1 / W)^2 + TOD] / TOT$$

(This is derived in the report "AMERICAP PROGRAM DESCRIPTION", 7 December 1998).

Note that the two AMERICAP rating numbers are always defined so as to match the VPP predictions *perfectly* at 6 and 20 knots so columns G and I are

exactly the VPP predictions. Columns J and K are the Time-On-Distance (Rd) and Time-On-Time (Rt) single number handicaps, figured so as to agree exactly with AMERICAP at 10 knots wind.

It can be readily confirmed that for a race at actual wind of 10 knots, with all boats finishing in the elapsed times given in column H, all three scoring systems give identical, perfect results with tied corrected time equal to the elapsed time of the AMERICAP scratch yacht, 488.7 seconds.

The next 6 columns are for a 6 knot actual wind race. The yachts are computed to finish in the elapsed times shown in column G. Columns L, M, and N are the corrected times under AMERICAP, TOD, and TOT scoring and columns O, P, and Q are the scoring errors relative to column L. AMERICAP knows how to handle this situation and the scoring errors are zero, all yachts correcting to 732,5 seconds, the elapsed time of the scratch yacht (by assumption). The TOD and TOT systems on the other hand, show significant scoring errors as much as 50 to 75 seconds per mile. Notice that the spread of scoring errors for TOT (62.3 seconds) is only about half that of TOD at 127 seconds.

The next six columns give the same thing for a 20-knot actual wind race. Here again AMERICAP scores perfectly while TOT and TOD systems have error spreads of 26 and 53 seconds per mile respectively.

Comparing the best heavy wind boat (H) with the best Light wind boat (L) for each case gives the following table:

	Scoring System Comparison, sec/mi		
	TOD	TOT	AMERICAP
At 10 knots, H beats L by	0	0	0
At 6 knots, L beats H by	127.1	62.3	0
At 20 knots, H beats L by	53.6	26.3	0

We cannot emphasize too strongly that these results consider *only* the wind strength component of total scoring system error. They do not in any way imply that the total scoring error of AMERICAP is zero any more than they imply that TOT (CHS) or TOD (PHRF) scoring errors are zero

CONCLUSIONS

1. The scoring errors inherent in any single number handicap system, TOD or TOT, at wind velocities at 6 and 20 knots, are HUGE compared to any observed or claimed VPP errors.
2. The wind errors of a TOT system as preferred by the British (CHS) or PHRF TOT Option are significantly less, generally only about half those of

a TOD system (IOR or PHRF). The TOT system also has the further practical advantage that it is not dependent on Distance, one less parameter to include in the calculation and potentially source of error.

3. Finally, it must be reemphasized that this study considers only one source of scoring error, the wind error, inherent in any single number scoring systems at other than nominal strengths. It would be a gross misinterpretation of these results to infer that AMERICAP (or any other systems) is perfect, or anywhere near perfect in any wind conditions. What is significant though, is this
the wind speed errors of any single number system under light or heavy wind conditions are an order of magnitude greater than the errors of any of the systems under the wind conditions for which each is best.

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