Interpreting The Results Page for PHRF Time-on-Time Handicapping

South Port's race results are published on the web in a form that makes it easy to interpret the corrected times, but a little explanation is called for. For each boat its corrected time $\check{t}$ is calculated using the formula

$$\check{t} = t \times \frac{{}^{\star}\text{PHRF} + 557\,\text{s/mi}}{\text{PHRF} + 557\,\text{s/mi}}$$

where t is its elapsed time, PHRF is its handicap and *PHRF is the handicap of a scratch boat. The scratch boat (or rather its rating) needs to be same for all the boats in a single start but the actual choice of the scratch makes no difference in how finishers are ordered.

The Yacht Club uses a common ${}^{\star}\text{PHRF} = 93\,\text{s/mi}$ scratch for all classes in all races. We do things just a little bit smarter.

An Example

Imagine a boat Slomo with $\text{PHRF} = 223\,\text{s/mi}$ where the scratch ${}^{\star}\text{PHRF} = 93\,\text{s/mi}$. Then

$$\check{t} = t \times \frac{{}^{\star}\text{PHRF} + 557\,\text{s/mi}}{\text{PHRF} + 557\,\text{s/mi}} = t \times \frac{93\,\text{s/mi} + 557\,\text{s/mi}}{223\,\text{s/mi} + 557\,\text{s/mi}} = t \times \frac{650\,\text{s/mi}}{780\,\text{s/mi}} = t \times \frac{5}{6}$$

Every 6 s of elapsed time for Slomo evaluates to 5 s of corrected time. Let's see Slomo race. The complications of converting between hours:minutes:seconds and plain seconds are handled by the computer.

Boat	PHRF	Elapsed t	Corrected $\check{t}$
Scratchy	93	1:20:10	1:20:10
Slomo	223	1:37:00	1:20:50

Slomo looks at race results where it is 40 s behind a competitor Scratchy in corrected time. To have avoided being beaten by this boat it would have needed to have finished 48 s sooner — $8 \times 6\,\text{s} = 48\,\text{s}$ of elapsed time for Slomo evaluates to $8 \times 5\,\text{s} = 40\,\text{s}$ of corrected time.

By the magic of a rigged example the arithmetic worked out easily but in general there would be messy fractions.

The Scratch Boat

The scratch boat itself is in an enviable position that its corrected time and elapsed times are the same

$$\check{t} = t$$

and all other competitors have corrected times that are directly comparable to its own elapsed time. Using an example from our race results with Spitfire as the scratch boat. We apply the formula

$$\check{t} = t \times \frac{{}^{\star}\text{PHRF} + 557\,\text{s/mi}}{\text{PHRF} + 557\,\text{s/mi}} = t \times \frac{99\,\text{s/mi} + 557\,\text{s/mi}}{\text{PHRF} + 557\,\text{s/mi}} = t \times \frac{656\,\text{s/mi}}{\text{PHRF} + 557\,\text{s/mi}}$$

for each boat in turn and order the results by corrected times.

Boat	PHRF	Elapsed t	Corrected $\check{t}$	Corr. Δ
★ **Spitfire**	**99**	**1:17:13**	**1:17:13**	★
Wave Equation	165	1:27:01	1:19:04	+1:51
Dynamo Hummm	180	1:29:29	1:19:39	+2:26
Shenanigans	183	1:29:59	1:19:46	+2:33
Mai Toi	150	1:31:45	1:25:08	+7:55

The columns show elapsed times t, corrected times $\check{t}$ and how much later than the scratch boat each boat finished in corrected time (*delta* Δ being an abbreviation for *difference*). It happened in this race that the scratch boat won so all the deltas are positive.

Spitfire can now see, directly, how well it would have placed had it finished between +1:51 and +2:26 later, between +2:26 and +2:33 later and so on (and had all the other boats finished as before).

Another Competitor's Point of View of the Same Race

Let's look at the same results from Wave Equation's point of view. Its corrected time is calculated by

$$\check{t} = t \times \frac{{}^\star\text{PHRF}+557\,\text{s}/\text{mi}}{\text{PHRF}+557\,\text{s}/\text{mi}} = t \times \frac{99\,\text{s}/\text{mi}+557\,\text{s}/\text{mi}}{165\,\text{s}/\text{mi}+557\,\text{s}/\text{mi}} = t \times \frac{656\,\text{s}/\text{mi}}{722\,\text{s}/\text{mi}} \approx t \times \frac{1}{1.10}$$

Remember that corrected times for Spitfire are identical to its elapsed times. So 1.10 s of elapsed time for Wave Equation is comparable to 1 s of elapsed time for Spitfire. Wave equation can spend 10% more time on the race course and correct out besides Spitfire.

A Cheap Metaphor

Think of a second of elapsed time for the scratch boat Spitfire (or, equivalently, a second of corrected time) as the international currency of exchange US$1.

Boat	PHRF	Conversion	Common Currency Δ
★ **Spitfire**	**99**		
Wave Equation	165	US$1 = WE$1.10	+1:51 $\leftrightarrow$ +US$111
Dynamo Hummm	180	US$1 = HM$1.12	+2:26 $\leftrightarrow$ +US$146

Wave Equation's currency doesn't quite measure up at a fixed exchange rate of US$1 = WE$1.10. Wave Equation spent an additional US$111 in the currency of exchange more than Spitfire. From Wave Equation's point of view, had it spent US$111 = WE$122 less it would have beaten Spitfire. Abandoning the metaphor for a moment, 2:02 = 122 s of elapsed time for Wave Equations is comparable to 1:51 = 111 s of corrected time or 1:51 of elapsed time for the scratch boat Spitfire. From Dynamo Hummm's point of view had it spent US$146 = DH$164 less it would have beaten Spitfire or US$35 = DH$39 less and it would have beaten Wave Equation.

The message to take is that elapsed times are not directly comparable across boats (unless they have same handicap). Like currency, seconds of elapsed time need to be tagged with the context in which they can be spent without conversion. Converting to a common currency (corrected time which is elapsed time for the scratch boat) allows for comparison across many boats.

Small Change

Even though converting between elapsed times for one boat to elapsed times for another boat is as is conceptually simple as converting currencies, for boats other than the scratch boat such conversions quickly become tiresome. For classes with a small range of handicaps using a boat within the class as scratch would allow competitors to approximate small intervals of elapsed time with the same interval of corrected time. If the difference between handicaps is too large, as it is at SPSC, this wont work well.

The Ideal

It would be best for any boat to be able to see the results with itself as the scratch boat. Let's reexamine our race with Wave Equation as the scratch boat and $^\star\mathrm{PHRF} = 165\,\mathrm{s/mi}$. We apply the formula

$$\check{t} = t \times \frac{^\star\mathrm{PHRF} + 557\,\mathrm{s/mi}}{\mathrm{PHRF} + 557\,\mathrm{s/mi}} = t \times \frac{165\,\mathrm{s/mi} + 557\,\mathrm{s/mi}}{\mathrm{PHRF} + 557\,\mathrm{s/mi}} = t \times \frac{722\,\mathrm{s/mi}}{\mathrm{PHRF} + 557\,\mathrm{s/mi}}$$

for each boat in turn and order the results by corrected times.

Boat	PHRF	Elapsed t	Corrected $\check{t}$	Corr. Δ
Spitfire	99	1:17:13	1:24:59	-2:02
★ **Wave Equation**	**165**	**1:27:01**	**1:27:01**	★
Dynamo Hummm	180	1:29:29	1:27:40	+0:39
Shenanigans	183	1:29:59	1:27:48	+0:47
Mai Toi	150	1:31:45	1:33:42	+6:41

The ordering of finishes is unchanged from when Spitfire was used as the scratch boat but for Wave Equation conversion between elapsed times is no longer necessary as corrected times and elapsed times for Wave Equation are now identical.

On the Web

It would be impractical on paper to show a new table for each boat but is easily achieved on the web. In SPSC results page clicking on a table row will recalculate corrected times and deltas using the selected boat as scratch. Initially the page will load with the winning boat as scratch.