



# 2023 Handicapping Synopsis Monday-Night Racing at SPSC

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## Overview

We will carry on with the time-on-time handicapping that we have used at SPSC since 2012 (skipping 2010 and 2011 where we did things a little differently). Your handicap will be a rolling average of the performance of your individual boat in your previous seven finishes. We decided at the planning meetings last year not to carry over performance data from 2022 so all boats will start with a handicap derived from the ECPHRF JOG rating they registered with. Those handicaps will then be refined using the rapid convergence technique as outlined below.

## Competitors New to the Fleet

A new competitor need not have a valid ECPHRF handicapping certificate for their boat. As the Chief Handicapper by Default, I can estimate what your ECPHRF JOG rating would be using the ECPHRF list of rated boats and the North American list of PHRF ratings; however, new competitors are encouraged to do this analysis on their own, or apply for an official ECPHRF rating certificate. The online registration system will accept your entered JOG rating and feed the calculated standard handicap into the online scoring system automatically.

## An Aside on Pace and Corrected Time

### On Pace and Speed

Pace is a measure of how many seconds (s) it takes to complete a nautical mile (mi.) and varies inversely to speed measured in knots. So, for example, an average speed of 6 knots corresponds to a pace of 600 s/mi. and an average speed of 4 knots corresponds to a pace of 900 s/mi.. Pace and speed multiplied together always results in 3600 s/hour

$$600\text{ s/mi.} \times 6\text{ mi./hour} = 3600\text{ s/hour} = 900\text{ s/mi.} \times 4\text{ mi./hour}$$

Note that a slower pace is represented by a greater number of seconds per mile.

Pace is the natural measure of performance prediction and handicapping. A *general purpose handicap* (GPH) is a boat's pace on average and can be used for either time-on-distance or time-on-time handicapping. All existing systems of handicapping for club racing could easily be restated in terms of a *general purpose handicap* without changing their effective handicapping. For the benefit of competitors, we always express the rolling handicaps used on Mondays as a *general purpose handicap*.

## The Universal Corrected Time Formulas

In order to calculate *corrected time* from *elapsed time* we need to single out a *scratch boat* which acts as a reference for other finishers

### For Time-on-Distance

$$\frac{\text{Corrected time}}{\text{Course length}} = \frac{\text{Elapsed time}}{\text{Course length}} + \star\text{GPH} - \text{GPH}$$

### For Time-on-Time

$$\frac{\text{Corrected time}}{\text{Course length}} = \frac{\text{Elapsed time}}{\text{Course length}} \times \frac{\star\text{GPH}}{\text{GPH}}$$

Here *course length* and the scratch boat's *general purpose handicap* ( $\star$ GPH) are common to all — each boat has its own *corrected time*, *elapsed time* and *general purpose handicap* (GPH). Note that while these equations relate *corrected time* with *elapsed time* via *general purpose handicaps* they are better understood as formulas specifying *corrected pace* in terms of *observed pace*. Thinking in terms of pace always gives the most natural form for both the computation of handicaps and the application of handicaps to a race; however these are usually rewritten as time formulas when applied

### For Time-on-Distance

$$\text{Corrected time} = \text{Elapsed time} + (\star\text{GPH} - \text{GPH}) \times \text{Course length}$$

### For Time-on-Time

$$\text{Corrected time} = \text{Elapsed time} \times \frac{\star\text{GPH}}{\text{GPH}}$$

We can be assured that these formulas are universal and apply to all systems of handicapping — with the caveat that *performance curve scoring* (inapplicable to club racing) is neither time-on-distance nor time-on-time.

*Corrected time* can be interpreted as a handicapper's prediction, given its *elapsed time*, of how a boat should have finished were it the same as the *scratch boat*. This provides the basis for ordering boats on *corrected time*. Note that, for the *scratch boat* itself, its *corrected time* and *elapsed time* are always identical. Also note that the particular choice of boat chosen as *scratch* doesn't effect how boats are ordered, making it possible to chose your own boat as *scratch post facto* and referencing other finishers to yourself. Our online results pages makes it easy to do this.

## Differences Between Time-on-Distance and Time-on-Time

The Thursday-Night series has reverted to using time-on-distance handicapping after seven years of using time-on-time; this had been accomplished by an implicit transformation from a PHRF rating to a GPH handicap and for the informed competitor was just as easy to use as time-on-distance — but sailors don't like to read the documentation. We use time-on-time handicapping on Monday-nights. The time-on-distance model predicts the time interval between boats should stay the exactly same in a light air race as it would in a medium or heavy air race; this is unrealistic and would complicate the running computation of handicaps.

While racing it is advantageous to know *time allowances* between yourself and your competitors — a time allowance being the gap in time between two boats that shall correct out the same. With time-on-distance handicapping time allowances are proportional to course length which does not change throughout the race; whereas, with time-on-time, time allowances are proportional to elapsed time which does advance. Note that this explains the naming convention for time-on-distance versus time-on-time. Provided the course is not shortened, time-on-distance can be easier to use. Were you to complete a course where your average pace (i.e. your *elapsed time* divided by *course length*) works out to be the same as your GPH then time allowances with either system will be identical. If you finish faster than your GPH then time allowances will be proportionally less using time-on-time but if you finish slower than your GPH then time allowances will be proportionally more.

With a GPH handicap it is very easy to precompute a table of time allowances usable for either time-on-distance or time-on-time handicapping. With such a table the difference in complexity between time-on-distance and time-on-time pretty much disappears. Even easier for a competitor is when your race committee makes such a table for you. We are, of course, pampered in this way — see the online scratch sheet pages (recomputed every week for Monday racers) and select your boat for your own table of time-allowances. There is linked documentation from these scratch sheet pages. On Mondays the first two races of the year will use a GPH derived from your ECPHRF JOG rating by adding 750  $\$/mi$ . — with average winds, time allowances will be exactly as time-on-distance PHRF would predict.

# On Ratings and Rolling Handicaps for the Monday-Night Series

## Initially Assigned Handicaps (The *Standard Handicap*)

Assigned handicaps are derived from an ECPHRF JOG rating via a formula

$$\text{Standard handicap} = 750\text{s}/\text{mi.} + \text{ECPHRF JOG Rating}$$

This standard handicap is a GPH and can be used to estimate the performance of your own boat.

## Determining Imputed Handicaps for Each Race

For each race we will compute a time-on-time handicap (and call it the *imputed handicap*) that would give every finisher the same *corrected time* (this *imputed handicap* being simply a scaled version of the boat's *elapsed time*). The geometric mean of the *imputed handicaps* of these finishers will equal the geometric mean of the *standard handicaps* for these same boats (this fact determines the scaling factor from *elapsed time* to *imputed handicap* — each race determining its own scaling factor) (this minimizes drift from the initial ECPHRF derived numbers).

## Rapid Convergence to a Rolling-Average Performance Handicap

Since 2018 we have been using a rapid convergence method to assign rolling handicaps for boats that have not yet finished seven races. This will not affect boats that already have an established rolling handicap; rather, it is a way to rapidly phase out the initially assigned handicap with a genuine (if temporarily volatile) performance handicap.

After Joining Fleet	How the Rolling-Average Handicap is Determined
initially	assigned standard handicap based on ECPHRF JOG rating
after first finish	assigned standard handicap again
after second finish	median of previous two imputed handicaps together with assigned handicap
after third finish	median of previous three imputed handicaps
after fourth finish	geometric mean of middle two of previous imputed handicaps
after fifth finish	geometric mean of middle three of previous imputed handicaps
after sixth finish	geometric mean of middle four of previous imputed handicaps

After three races your rolling handicap is no longer dependent on your assigned handicap (mostly — see previous). There are no formal rating certificates; rather, a boat's *standard handicap* together with a list of up-to-seven *imputed handicaps* ordered from oldest to newest serves the same purpose. See the scratch sheet for these.

## Computing the Rolling Handicap After Seven Finishes

Each boat will have its rolling handicap determined by collecting the previous seven *imputed handicaps* discarding the extreme values and averaging the middle five by geometric mean. Older *imputed handicaps* are discarded. All this is shown on the Monday-night scratch sheet available from the main results page of the web site [www.southportsailingclub.com](http://www.southportsailingclub.com).

## Reported Corrected Times

The results page shows abbreviations *Std* for the standard handicap, *Bf* for the rolling handicap from before the race to be used as a GPH to handicap this race and *Af* for the rolling handicap after the race. Corrected times will be calculated from elapsed time and rolling handicap *Bf* by the formula

$$\text{Corrected time} = \text{Elapsed time} \times \frac{\star Bf}{Bf}$$

and reported rounded to the closest second. Here  $\star Bf$  is the handicap of a scratch boat used as a common reference for all boats. Note that the elapsed and corrected time are the same for the scratch boat. The choice of  $\star Bf$  is arbitrary as it has no effect on how a boat will place — using the fastest boat is traditional — the SPSC racing page first loads with the winning boat as scratch but any competitor can be designated the scratch boat by clicking on the table row. The results page will report differences in corrected time for each boat from the scratch boat.

Boats are placed by ordering exact fractions so actual ties on corrected time are far rarer than the (still rare but occasional) apparent ties in the reported but rounded corrected time.

## The Failures of PHRF Numbers and the Derived Standard Handicaps

### Performance Analysis in the Years 2012 Through 2017

In the 2018 analysis of data from Monday-night racing we had determined two alternative linear regressions from PHRF ratings to estimated average performance of ECPHRF JOG Rating + 800s/mi. on one hand or  $2 \times$  (ECPHRF JOG Rating + 300s/mi.) on the other. They agreed on mapping a rating of 200s/mi. to an average pace of 1000s/mi. (a measly 3.6knots). In the years 2012 through 2022, we had effectively used the formula

$$\text{Standard handicap} = 2 \times (\text{ECPHRF JOG Rating} + 300\text{s/mi.})$$

only slightly tweaked at the extremes. This formula, when it was introduced, seemed to have statistical significance. But this significance was illusory and disappeared as the years went on. The failure to pin down the slope of this regression line is owing to how terrible PHRF ratings are at predicting performance. The preferred formula in previous years would have been the simpler

$$\text{Standard handicap} = \text{ECPHRF JOG Rating} + 800\text{s/mi.}$$

but maintaining continuity year-to-year outweighed that simplicity. And the *rapid-convergence* method, which was introduced in 2018, made the selection of a standard handicap formula less of a concern.

### Improvements Over Time

Over time aggregate performance has become pretty clear. With an analysis of all the data up to this year we can refine that average pace to be a more optimistic 3.75knots or 950s/mi. for a boat with a JOG rating of 200s/mi.. This leads to our new formula

$$\text{Standard handicap} = \text{ECPHRF JOG Rating} + 750\text{s/mi.}$$

Arising from a simple shift the standard handicaps could be used as-is for a time-on-distance PHRF race or as a GPH in a time-on-time race. This is not to say the new standard handicaps are a good predictor of performance (they are based on PHRF handicaps after all) but, rather, that they are more than adequate for the fleet as a whole.

### Changing the Gauge Over the Years

When doing time-on-time handicapping it is possible to transform all the standard and rolling-average handicaps by a common scaling factor without effecting corrected times in any way; in the corrected time formula handicaps only appear in the ratio  $\star GPH/GPH$  so a common scaling factor cancels out completely. Such a scaling operation is desirable so that handicaps really are a GPH and truly reflect a boat's pace on average; but, on the other hand, changing handicaps in bulk is disruptive for only a minor gain. We have used the opportunity in not carrying over imputed ratings from last year to change not only the formula for a standard handicap but also, effectively, the gauge for all the time-on-time handicaps.

## Pinning the Gauge

We also changed the gauge in 2018 and this is a furtherance of that effort using the better statistics that the larger data set allows. Note that we have always pinned the gauge in terms of a boat with a JOG rating of 200<sup>s</sup>/mi.

$$\begin{array}{ccccccc} \text{ECPHRF JOG Rating} & & & & & & \\ \underbrace{200^{\text{s}}/\text{mi.}} & \text{pinned to} & \underbrace{700^{\text{s}}/\text{mi.}} & \xrightarrow{\times 10/7} & \underbrace{1000^{\text{s}}/\text{mi.}} & \xrightarrow{\times 19/20} & \underbrace{950^{\text{s}}/\text{mi.}} \\ & & \text{2012--2017} & & \text{2018--2022} & & \text{2023} \end{array}$$

The newest gauge, which maps an ECPHRF rating of 200<sup>s</sup>/mi. to an average pace of 950<sup>s</sup>/mi., is convenient for competitors so that they might estimate the time to complete a course in average conditions.

Because rolling handicapping starts afresh in 2023 the scoring system will not apply this  $\times 19/20$  gauge transformation to imputed handicaps across the 2022/2023 boundary. When referencing results and scratch sheets in the years 2018 through 2022 you will need to take the gauge transformation into account. Likewise for  $\times 10/7$  gauge transformation across the 2022/2023 boundary which is applicable to results in the years 2012 through 2017.

## Plans for the Season

There are good reasons to consider alternate ways to compute rolling handicaps. We will probably run these side-by-side with the existing rolling-average handicaps for comparison purposes. *Note that many of these methods do not compute a rolling-average but we still refer to them as rolling handicaps as they still refine handicaps race-by-race throughout the year.* We will refer to these plans in other documents linked to from the Monday-Night Series page on the web site.