HalSail FAQ

What is the mathematical explanation of ECHO?

ECHO is a progressive handicap scheme, in the sense that it adjusts the handicap given to each boat based on the results of previous races. A boat that does well will be penalised in subsequent races and a boat that does badly will be helped. If crews perform consistently and the conditions are the same, all the boats' results converge after a number of races.

It relies on an algorithm provided by Irish Sailing. This explanation refers to the 2017 version and has been written by Peter Hopford of HAL's Race Results for the benefit of any user of the scheme.

The maths of each race begins as normal. You have:

H_1 The handicap given to a boat before the start of a race. This is used to calculate its corrected time and hence its place.

T_e The elapsed time of a boat in a race (rounded to the nearest second).

T_c The corrected time of a boat (rounded to the nearest second).

- $T_c = T_e H_1$

As in other handicap systems, the positions in a race are given in order of corrected times.

But then the interesting part starts. First we work out:

H_a Handicap achieved by a boat in a race. Also known as the ECHO Index.

- $H_a = \Sigma H_1 / T_e \; \Sigma(1/T_e)$

where Σ indicates the sum over all the boats finishing the race.

If all boats had been given this handicap at the start they would have tied for equal first place.

Then we combine the achieved handicap with the starting handicap to get the handicap to be used for the next race.

α The blend (proportion) of the existing handicap H_1 and the achieved handicap H_a to be combined into the handicap for the next race. The blend is set up for each series at the judgement of the race committee. For the Volvo Dun Laoghaire Regatta 2017 it was set to 0.6. For the O leary Winter League it was 0.25

The finishing handicap from this race that will be used for the next race by **boats that finish this race**.

$H_2 = (1-\alpha)H_1 + \alpha H_a$

The handicap that will be used for the next race by **boats that did not take part in this race or did not finish** is unaltered.

$H_2 = H_1$

And so we move to the next race in the series and start the process again.

At the end of the series we get a set of finishing handicaps from the last race that can be used to start the next series.

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