

# For our next trick...

## 'Weather routing scoring'

The ORC rating system provides handicap time allowances that are sensitive to the performance differences in the fleet with changes in wind strength and points of sail. If you want to race on handicap in a diverse fleet this ability offers a more equitable approach than a single number. Yet there is a big 'but': how to unequivocally work out what conditions the fleet experienced during the race.

The traditional method was to use Polar Curve Scoring where the wind strength and points of sail were calculated from the course geometry and the boats' elapsed times scored accordingly. This method determines a Scoring Wind representing the average theoretical wind speed the boat would have encountered in that race.

In 2023 there were several submissions to the ORC Congress asking why the Scoring Wind for coastal and offshore races was often very different from the actual wind experienced. And the answer... because offshore/coastal races are typically scored using the All-Purpose Handicap (APH), which is based on a mix of wind speeds and true wind angles from the polars on your certificate.

Whatever the conditions you experience in the race, the race is always scored on the same APH mix. The Scoring Wind does not match what you experienced because the APH (default) mix of conditions was not the same as the real weather. Surprise, surprise, the APH is like a broken clock, it is exactly right twice a day.

This situation can only be improved by finding a mix of wind speeds and points of sailing that match what you see in the race. Yet attempts to score races based on 'observed' conditions have never been successful because accurate data from the boats is very hard to collect and the race can only be scored after the finish – a deeply ungratifying situation for those competing.

Prompted by these submissions ORC has developed a new approach called 'Weather Routing Scoring' as an alternative to the APH. The procedure is as follows:

- A few hours before the race start the Race Committee will use the ORC Weather Routing Scoring system to simulate the race for every boat in the fleet.
- Each boat will sail its best route and point of sail around the course using the forecast grib files and the boats' Polar Curves.
- The simulation will deliver the track of the optimised route and a Predicted Elapsed Time (PET) for each boat.
- The Time Correction Factor (TCF) for each boat to use in the race will be calculated from the differences in the PET.

Each boat now leaves the startline knowing the TCFs of all her competitors based on the forecast. A few hours before the race start the ORC scoring software will also simulate the race using:

- the best relevant weather and current forecasts available
- the polar curves from each boat's certificate
- the course geometry input by the race organiser
- commercially available weather routing software.

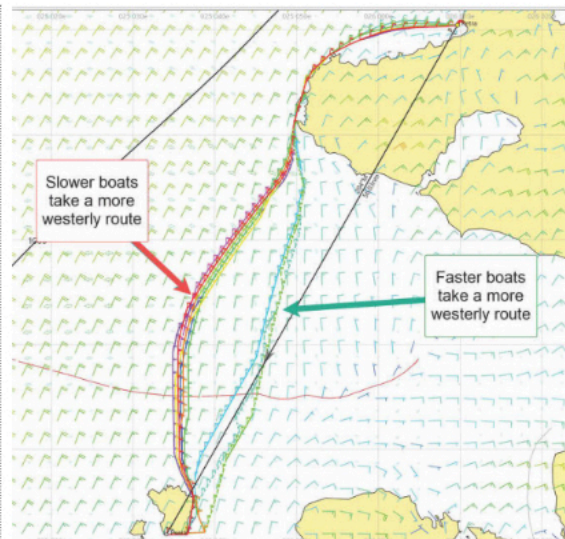
This process delivers a predicted optimum route and a PET for every boat in the race. The graphic above shows a typical race simulation using Expedition routing for a day race in the Aegean Sea. As you'd expect the different routes predicted for the race are different for the faster and slower boats.

Still before the race start this list of elapsed times is then used to generate a scratch sheet giving the time allowances for each boat. Taking the fastest, the slowest and the chosen 'Scratch Boat' the race-specific TCF can be calculated.

## This process has two benefits

- The results are more equitable because the wind conditions used to score the race are not tied to the one size fits all All Purpose Handicap (APH).
- The time allowances are available pre-start.

During the 2023 season the ORC has shadow-scored championship races using Weather Routing Scoring. When comparing to the All-Purpose Handicap the first instinct is to look at the difference in corrected times and finishing position – yet these show only a modest change in the finishing order.



This should not be a surprise, the best-sailed boats often outpace their rivals by large percentages on corrected time. The more significant takeaway from the shadow-scoring is that predicted elapsed time using the APH for a race (course length x APH) is on average 30% too short, whereas predicted elapsed times using the Weather Routing process are on average within 5% of the real result.

Also, if the predicted elapsed time using weather routing scoring is closer to the actual time, there is confidence that the race has been scored in the appropriate segment of the polar speed table. This won't propel a badly sailed boat onto the podium, but it will level the playing field for different hull and rig types racing offshore.

The ORC's analysis of previous races shows that Weather Routing Scoring can deliver a robust method of determining TCFs. This includes an algorithm to prevent anomalies due to wind holes where some of the fleet might be stopped. And crucially a fleet of 30 boats can be processed in just a few minutes. The following will be defined in the Sailing Instructions:

- The source of the wind and current forecast.
- The date and time of the forecast used for scoring.
- The procedure for dealing with delayed starts.

Naysayers justifiably say weather forecasts are never right, but they are better than the APH or even most predefined course matrix models that are based on historical data – as commonly used in offshore races in the USA. Whether the race is sailed in a gale or light winds the predicted elapsed time for the race never changes.

A simple thought experiment makes things clearer: you are racing offshore tomorrow; you must decide by 5pm what to wear in the race. No ifs or buts, pick an outfit, shorts or thermals, windcheater or foulies. What you choose today is what you will wear tomorrow.

There are three options, which will you use?

1. Base your choice on the average daily temperature for the last 10 years.

This is All Purpose Handicapping (APH).

2. Base your choice on the average temperature for tomorrow's date over the last 10 years.

This is a predefined course matrix.

3. Look at the weather forecast.

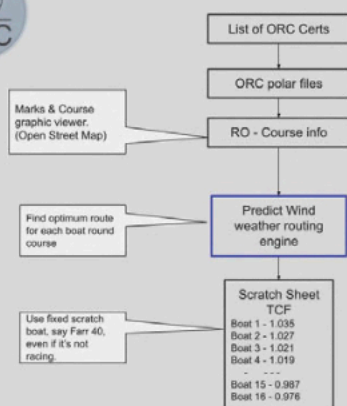
This is Weather Routing Scoring.

It's not complicated, it's common sense! The weather forecast may let you down, but on average it will be better than the first two options at predicting how the race is sailed.

The sceptics also worry that the system is too complicated for reliable use. But take Google Maps as an example: this is a complex



## 2024 Weather Routing Scoring



Boat name	Predicted elapsed time (hh:mm:ss)	Predicted elapsed time (seconds)	Time correction factor (TCF)
Liberte	05:15:06	18906	1.523 (28799+18906)
Vorras	07:59:59	28799	1.000 (28799+27899)
Anatolousa	08:27:04	30424	0.947 (28799+30424)

system, but it's not complicated for the driver. It predicts an optimum route and elapsed time by combining maps, vehicle type, traffic conditions, road closures and so on. Most of us are happy Google is routing us in a sensible way, at least until we see grass between the wheel tracks. Users don't worry that the algorithm for routing a bus is different from routing a Mini, they just get on with it.

The Weather Routing Scoring process is similarly complex, but it delivers an easily accessible, robust and fair way to provide Time Correction Factors based on a boat's polars.

If they wish race organisers can devolve all their scoring decisions to the Weather Routing Scoring system. Their task is to:

- gather the entries and start times
- define the racecourse
- submit this data to the Weather Routing Scorer
- distribute the Time Correction factors to the fleet.

Prompted by Stan Honey, the USA's submission to the ORC in 2022 set this ball rolling and ORC followed his vision. Stan says, 'Weather Routing Scoring uses three highly complex technologies, sailboat performance prediction, weather forecasting and optimal routing, to make racing simpler.

'With TCFs for each boat issued prior to the start, time allowances are easy to figure so sailors can race tactically, knowing who to cover and when to split. ORC should be commended for the best possible use of technology to make racing simpler and more fun.'

For the 2024 season ORC will use Weather Routing Scoring to score offshore races at the World and European Championships. Other races are also planning to use the system with ORC support.

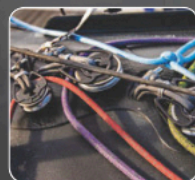
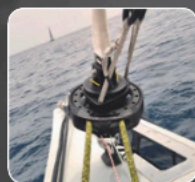
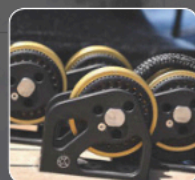
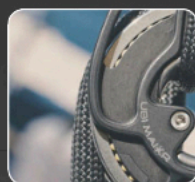
During 2024 the ORC will develop, in collaboration with Predict-Wind, the standalone software needed to make Weather Routing Scoring an accessible option for organisers who want to use it.

Organisers happy enough with the scoring options already on the certificate do not need to stop using them, but for coastal and offshore courses Weather Routing Scoring could do a better job.

● Offshore Special Regulations will no longer permit SSS to be used for Cat 0 and Cat 1 races – but the committee were told that the removal of SSS for races below Cat 1 would lead to the decimation of some offshore fleets. World Sailing has set up a Working Party to review the stability screening process.

Andy Claughton, ITC Chair

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