World Leader in Rating Technology

OFFSHORE RACING CONGRESS

ORC Race Management Guide 2024
USA-CAN edition

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1. INTRODUCTION

The Offshore Racing Congress (ORC) was born in 1969 when a need was identified by the Cruising Club of America and the Royal Ocean Racing Club to have a single rating rule system that could service the needs of offshore racing boats competing on both sides of the Atlantic. This was called the International Offshore Rule (IOR) and was the prevailing system used worldwide for decades, followed by the VPP-based IMS system in the mid-1980's and then since 2007 the current ORC rating system in use today.

ORC thus has over 50 years of experience with measurement, rating and scoring in handicap racing.

Being an International Rating System recognized by World Sailing, there has also been a long association of the rating rule system with Grand Prix-level regattas, where the high levels of competitiveness push the rules and standards to their limits. Defining and developing the formats and standards for annual World and Continental ORC Championship events has been the ongoing work of the ORC's Offshore Classes and Events Committee, where they are published yearly in the ORC 'Green Book' of championship rules (www.orc.org/rules).

In more recent years the ORC rating system has grown rapidly to now provide fair racing at all levels of competition, from Grand Prix to club racers, and it issues over 10,000 certificates to boats of all types in more than 40 countries. These include not only monohull offshore-capable racers and cruiser/racers but also Sportboats (light fast keelboats 6.00 – 9.15 m in length), Superyachts (>30 m in length) and now Multihulls as well. With this increased popularity and widespread use, often by race organizers and managers new to the system, the need has arisen for a coherent set of guidelines on how they can make the most of this accurate and versatile rating system.

This USA-CAN edition of the ORC Race Management Guidebook is intended to provide this advice for monohull yachts that have current and valid ORC Club, ORC International, ORC Double Handed and ORC Non-Spinnaker certificates. As more ORC Multihull certificates come available these methods and principles should apply as well. We urge experienced race organizers and managers to review this guide and use it as a reference, while those that are new to use of ORC should study it carefully and also keep as a reference, especially the flow chart shown at the end of Section 3.

Racing styles evolve with time, and new ideas and innovations arise as the sport changes. Therefore, we intend to improve this book with regular updates as new features are generated by the ORC system, and as new ideas come from the racing community itself.

Regardless, ORC is pledged to help grow, improve and sustain the sport, and our staff is available to offer support for new and existing users of this system. Please contact the ORC USA liaison for any questions or clarifications: dobbs.davis@orc.org.

ORC rule resources: (all are available for download at www.orc.org/rules)

- International Measurement System (IMS): IMS is the platform that defines the procedures and methods for measuring a boat's hull, appendages, propeller, stability, rig, sails and accommodation.
- ORC Rating Systems: Uses the IMS as a measurement platform and the ORC Velocity Prediction Program (VPP) to provide fair ratings of boats with different characteristics. ORC Rating Rules includes the limits and defaults for the hull, rig, sails and crew, the rules applying while racing, certificate layouts and description and a complete explanation of different ORC scoring options.
- ORC Sportboat Rules combine the power of the ORC VPP with an application specified to small, light and fast keelboats in a fair and transparent handicap solution for these style boats.
- ORC Championship Regulations (aka the Green Book) contains ORC Championship Regulations that apply at the World and Continental Championships recognized by the ORC and World Sailing. ORC Championship Rules are also recommended for regional and national championships, and a Standard Notice of Race and Sailing Instructions may be used for any event using ORC Rating systems.

- ORC Velocity Prediction Program gives the formulations used in the Aerodynamic and Hydrodynamic modelling of a boat's performance in 6-24 knots of wind and all wind angles. The VPP is improved and updated yearly.

2. EVENT STRUCTURE

2.1 Basics – overview

The popularity and effectiveness of a rating system will very much depend on how it is implemented by event organizers and race managers. ORC offers many possible solutions for fleets ranging from local club races to World Championships, but to be effective the appropriate choices should be made among these options, starting with the structure of the event.

Consider, for example, the type of race: is it a Windward/Leeward course race, a short-day race around an island, an overnight race, or a long oceanic race? Each will have its own set of appropriate rules and standards.

2.2 Committee structure

a) ***Race Committee*** – Composition of the Race Committee (RC) will vary with the type of racing. Inshore course races require more members to handle setting and moving buoys, compared to distance races where a starting and finishing line is only needed. This is no different than any other type of racing.

However, one common element is having accuracy in recording elapsed time data for each boat's finish, and additional information such as course distance data, wind direction and wind speed depending on the scoring type used. Therefore, make sure there are suitable personnel on the RC assigned to take on these important tasks.

b) ***Technical Committee*** - Note that RRS 92 specifies the appointment of a Technical Committee to be a resource to resolve issues related to measurement, inspection, and other issues. Whether or not your event intends to conduct measurements and inspections, it is nonetheless important to have someone available to fill this role who is available and familiar with ORC rules so they can be consulted on these and other ORC-related technical matters both before and during the event.

c) ***Protest Committee*** – Ideally the members of the Protest Committee or Jury should be experienced with keelboat and/or offshore boat fleet racing and have some familiarity with both safety and ORC rules. On matters related to ORC rules, they should be prepared to work with the Technical Committee or refer the matter to ORC (see RRS 64.4(b)).

2.3 Notice of Race

The Notice of Race (NoR) is a basic document for every regatta defined as a "contract" between the organizer and competitors. ORC provides a convenient Standard Notice of Race template available for download in PDF and Word formats at this link: www.orc.org/rules. Even though it is designed primarily to be used for World and continental championships, it may be edited to be used for any race or regatta where ORC scoring is used.

Regardless of NOR style, there are some specific items that needs to be included such as:

a) ***Rules*** – applicable rules shall include the **IMS Rule** as a measurement rule and **ORC Rating Systems** as a rating rule. Even though both documents may be considered under the RRS definition of "*rule*" it is always worth mentioning this in the NoR so competitors may know where to look for any technical explanation of the rules. This reference can also just be generalized as **ORC Rules**. **ORC Sportboat Class Rules** should also be included for any class that is organized for ORC Sportboats only.

b) ***Safety rules*** – It is important to define safety rules and apply the appropriate category to the type of the race. This may be through the World Sailing **Offshore Special Regulations** (OSR) or US Sailing's **Safety and Equipment Regulations** (SER). SER Race Categories are defined as:

- Nearshore Monohull & Multihull - Races primarily sailed during the day, close to shore, in relatively protected waters: http://www.ussailing.org/wp-content/uploads/2022/01/Monohull-SER-2022.0-Nearshore.pdf and www.ussailing.org/wp-content/uploads/2022/01/Multihull-SER-2022.0-Nearshore.pdf.

- Coastal Monohull & Multihull - Races not far removed from shorelines, where rescue is likely to be quickly available: www.ussailing.org/wp-content/uploads/2022/01/Monohull-SER-2022.0-Coastal.pdf and www.ussailing.org/wp-content/uploads/2022/01/Multihull-SER-2022.0-Coastal.pdf.

- Ocean Monohull & Multihull - Long distance races, well offshore, where rescue may be delayed: www.ussailing.org/wp-content/uploads/2022/01/Monohull-SER-2022.0-Ocean.pdf and www.ussailing.org/wp-content/uploads/2022/01/Multihull-SER-2022.0-Ocean.pdf.

Both OSR and SER set minimum stability requirement for the races of Categories 0, 1, 2 and 3 through Stability Index (SI) or the equivalent ISO standards.

Stability Index (SI) is shown on the lower right corner of the first page of ORC International and ORC Club certificates when stability is measured – it is not shown on an ORC Club certificate when the stability is not measured for that boat.

Please note that it is responsibility of the entry to meet the stability criteria established by the organizing authority.

c) ***Changes to the ORC rules*** – several ORC rules may be changed by the NoR in accordance with RRS 87 as follows:

- Minimum crew weight - ORC certificates define a Maximum crew weight where the weight of all crew members weighed in light street clothes shall not be greater than the number recorded on the certificate. This shall always apply, and therefore shall not be amended by the NoR. There is also a Minimum crew weight that is recorded on the certificate, but this shall be applied only when specified by the NoR and Sailing Instructions. See ORC Rules 102.3 and 200.1(b) for more details.

- Allowed amount of liquids on board – Unwarranted quantities of stores shall be considered as ballast because their weight may have a measurable effect on performance. Any liquid carried on board in excess of 2.5 litres of drinkable fluid per person per day of racing, in the tanks or in other containers exclusive of emergency water required by safety rules, and any fuel in excess of the quantity needed to motor for 12 hours, is therefore not permitted. Race organizers of long offshore races may waive this requirement by specifying so in the Notice of Race. See ORC Rule 201.2 for more details.

- Moving sails or equipment - Moving sails or equipment with the intention of improving performance (i.e. "stacking") is prohibited and shall be considered as a breach of RRS 51, although organizers of long offshore races may change this in the Notice of Race. See ORC Rule 201.3 for more details.

- Number of sails aboard while racing – The maximum number of sails allowed on board while racing is defined as follows: exclusive of storm & heavy weather sails required by the safety rules, a boat shall not carry aboard while racing more sails of each type than the numbers defined as follows:

CDL*	**Above 13.550**	**13.550 – 11.271**	**11.270 – 9.631**	**Below 9.631**
Mainsail	2	2	2	2
Headsails	8	7	6	5
Spinnakers	6	5	5	4
Mizzen Staysail	1	1	1	1
Mizzen	1	1	1	1

** CDL is explained in Section 2.5 below*

Note that if there is a single headsail furler recorded on the certificate then only one headsail shall be aboard while racing (except storm or heavy weather sails required for safety).

Since these limits may change yearly but are shown on the certificate, this table is not needed in the Notice of Race or Sailing Instructions unless these limitations are modified according to the appropriate character of the race. For example, the organizer may want to ensure all boats in a class have the same number of sail types allowed on board, or in defining cruising classes the limits may want to be reduced to suit the intentions of the organizer. See ORC Rule 206 for more details.

d) ***Eligibility and Classes*** – The NoR shall define how entries will be divided in classes and divisions with the criteria explained later in Section 2.5. The options may be, for example, to set up fixed class limits defined by CDL or APH where boats will enter a defined class or to set up a deadline after which the organizer will define classes based on the entries received.

It is strongly recommended to make reference to where participants can apply for their certificates with US Sailing at this link: www.ussailing.org/competition/offshore/orc/#application. For Canadian boats apply with ORC Canada at this link: https://www.orc-canada.org. Any race with ORC rules and scoring may use valid certificates issued by any ORC rating office.

Since the ORC VPP is usually issued in the first few weeks of the new year, for races and regattas held in the winter season after January 1st it should be specified in the NoR that only certificates from the previous year will be used. This is why US Sailing's default expiry date on certificates is Jan 31st. However, for events held in February, March or even later in some Florida and northern frostbite fleets, US Sailing may at no charge re-issue valid certificates with a later expiry date to accommodate the entries in these events. Inquire with the Offshore office at offshore@ussailing.org.

e) ***Registration process*** – Entry to an event should be made available through an online system whenever possible with following items considered:

- There should be a deadline until when a valid ORC certificate should be issued. ORC certificates are available in digital format and are valid as soon as uploaded by the rating office to the ORC Database. There is no need for a printed copy and organizers can easily check for the existence of a valid ORC certificate using https://orc.org/sailors/active-certificates-database. This deadline may vary but should not be later than up to one week before the start of the event. This will help rating offices with certificate processing and organizers to prepare an entry list and scratch sheet. When defined, this rule will need to specify that it changes RRS 78.2.
- No changes shall be made on an ORC certificate after this deadline except with the permission and approval of the Technical Committee or the Race Committee either as a result of a pre-race measurement check, an unintended delay in certificate processing or an error discovered. It is important to correct any error on the certificate before the start of the first race. Corrections are allowed by ORC Rules and explained further in Section 2.4 about certificate handling.
- If crew lists are needed, there should be a deadline for amending these lists. The entry form presented as part of the registration process should include a list of crew members that will be onboard at the first day of the race. For subsequent changes in the crew there should be a request made on an appropriate form.
- If a Corinthian Division is desired, then World Sailing's Sailors Categorization Code shall be applied. More details that relate to the use of this **code** are on the WS website.

f) ***Schedule of races and Scoring*** – The Schedule of races should give the time for the warning signals for each race and describe the type of race (windward/leeward or a distance race). The Scoring section should explain which scoring method will be used as explained later in Section 3. There are many options for scoring, as shown on Page 2 or USA-CAN certificates.

For example, if Polar Curve Scoring (PCS) is intended this should be specified, just as if a custom course model is planned for a single scoring option as explained later in Section 3.5, then the wind matrix and method used for the calculation of the single number rating should be specified.

2.4 Handling ORC rating certificates

ORC certificates are issued as HTML files in A4 page format…there is no need to convert to PDF or print in hard copy. Doing so may require manual adjustment in sizing to convert to US Letter to format correctly.

2.4.1 US Sailing and ORC Canada issue the following certificate types:

a) ***ORC International*** – for a completely measured boat with an ORC-approved offset file

b) ***ORC Club*** – where measurement data may be measured, declared by the owner, or obtained from any other source, including photos, drawings, designs, data from identical or similar boats. *(*In the USA a category called "ORC Club+" is used when there are all the criteria met for an ORC International certificate except for an offset file approved for ORCi use.)*

c) ***ORC Double Handed certificate –*** may be issued from the data needed for ORC International or ORC Club certificate and shall apply for crews made of two persons.

d) ***ORC Non-spinnaker certificate –*** may be issued from the data needed for an ORC International or ORC Club certificate and shall apply for boats not using any spinnaker nor headsail set flying.

e) ***ORC One Design certificate*** – ORC International or ORC Club certificates where all data affecting a boat's rating are standardized based on the set of measurements for classes having One Design class rules or having all the measurements within close tolerances. A list of these can be found at this **link**.

All certificate types are fully compatible and may be used on same event. However, Double Handed and Non-Spinnaker are usually separated in different classes or divisions as described later in Section 2.5.

ORC Superyacht and ORC Multihull certificates are issued directly from ORC by applying at https://orc.org/organization/superyachts and https://orc.org/organization/multihulls.

2.4.2 For race managers the following items should be considered when handling rating certificates:

a) ***VPP year*** – ORC Rating Systems use science and technology to develop its handicap system through the Velocity Prediction Program (VPP). This VPP is updated yearly and therefore it is **imperative** to have all boats in the same race with certificates using same VPP year. The VPP year is shown on the upper box of each rating certificate.

b) ***Expiration date*** - The certificate is valid until the date printed on the certificate. For example, in the USA the default expiration date is 31 January of the following year to accommodate winter season racing, and may be extended by the rating office for boats racing in a regatta or series later than this date (see 2.3(c) above on NoR Eligibility) The expiration date is printed in the lower margin of each rating certificate.

Note: all dates on ORC certificates follow the dd/mm/year convention.

c) ***Valid certificate & Reference number*** - Because the ORC system is updated yearly based on the latest science and analysis of the fleet's performance to improve the VPP, it's important to score races based only on ratings from the latest valid certificate for each boat in the fleet.

A boat may have more than one certificate issued during the same VPP year period, but only the last one issued will be valid. Double Handed and Non-Spinnaker certificates may co-exist at the same time with the regular ORC International or ORC Club certificates.

Copies of all latest valid certificates are available for free viewing and download on the ORC website at this link: https://orc.org/sailors/active-certificates-database. Click on the link to the country and certificate type and a new page will load that

lists valid certificates alphabetically by boat type. Clicking on the ORC Reference number loads another page with the valid certificate in HTML format.

Rating data is also available in RMS, JSON and CSV format files at https://orc.org/race-managment/rms-files. These may be used by **ORC Scorer** and any other scoring software as explained later in the Scoring section.

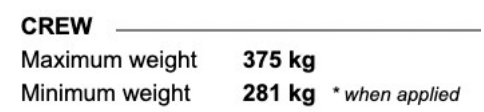
d) ***Compliance with the certificate*** – is defined as:

i) All measured, declared or recorded values shall be as close as possible to those on the certificate. Differences are allowed only if the values on the certificate give a worse (i.e. faster) rating with a lower All Purpose Handicap (APH).

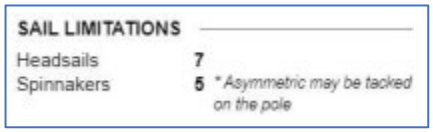
ii) The sail area should be smaller or equal to what is printed on the certificate. The sail inventory shall include the largest of each when applicable: mainsail, mizzen, quadrilateral sail or sail set on the wishbone boom, headsail set on the forestay, symmetric spinnaker, asymmetric spinnaker, mizzen staysail and *all* Headsails set Flying and all asymmetric spinnakers having SHW/SFL < 0.85.

e) ***Owner's declared values***

i) Crew weight is an important factor affecting the boat's performance and is considered in the VPP rating calculations. The crew shall not be heavier than the Maximum value recorded on the certificate. The maximum value may be declared by the owner. If not declared, it will be calculated as default according to the size of the boat. And if the NoR or Sailing Instructions specify, then the crew weight shall not be less than the Minimum shown on the certificate.



ii) When there are symmetric and asymmetric spinnakers in the sail inventory together with a spinnaker pole and bowsprit, an owner may declare that the asymmetric spinnaker will be used only when tacked on centerline. Appropriate message explaining how an asymmetric spinnaker may be used in relation to the pole is shown at the Sail Limitation section.



f) ***Correcting errors in the certificate*** – ORC Rule 303.6 allows correction of any certificate when the Rating Office has reasonable evidence that not by her own fault a boat does not comply with her certificate. Whenever there is such an error found on the certificate, by any party, the Rating Office shall be contacted immediately explaining the error and the need for correction. Correction may be done at any time before, during or after an event, and all races shall be rescored using the new rating data. This underscores the importance to have all certificates being reviewed prior to the start of the first race.

2.5 Entry organization

One of the most difficult tasks for race organizers is to define racing groups. The definitions can be applied at all levels – local, regional and national, and even international such as at the ORC World and continental Championships. Entries are divided into groups variously called Classes, Divisions, Sections, Fleets, etc., with the goal of having boats of similar characteristics racing against each other whenever possible.

There are several ways to help define appropriate racing groups. Application of these criteria should be made after careful consideration of the expected fleet of competitors and can be made singly or in combination of multiple criteria. These groups can be described in the Notice of Race of the event or delayed until the close of entries when organizers have a full picture of the composition of the fleet.

Here are some tools and examples of their application:

All-Purpose Handicap (APH) is an average representation of all time allowances in all wind speeds and wind directions. It is used for simple comparisons between boats and possible class divisions and should replace GPH for this purpose. It can also be used as the simplest of single number Time on Distance Rating options as described later in Section 3.3.2.

Class Division Length (CDL) is the main parameter that is used for dividing boats in classes for windward/leeward inshore racing at ORC World and continental championship events. Since most inshore races have an upwind start, CDL is a parameter defined by the average of the effective sailing length (IMS L) and the rated length (RL) that is calculated from the upwind speed of the boat in a True Wind Speed of 12 knots. CDL is also used to define sail limitations (shown in 2.3c above). A boat's CDL rating is shown in a separate box on its certificate.

Special divisions: Fleets may also be divided in separate divisions like Double Handed or Non-Spinnaker using relevant ***Double Handed*** or ***Non-Spinnaker*** certificates. Additionally, boats that comply with ***Sportboat*** Rules may be grouped in a separate division. Whenever possible it is better to have these fleets racing separately but if the number of boats cannot justify this, such boats may be added to the other classes as well.

Performance and Cruiser/Racer categories: Additionally, boats may also be categorized as Performance or Cruiser/Racer as defined by IMS Rules in Appendix 1 where ***Cruiser/Racers*** are boats designed primarily for cruising and are equipped with accommodation and cockpit layouts comparable to the standards of series production boats. Those boats not meeting these requirements are categorized in the ***Performance*** division. ORC races may be run with boats from both categories, or organizers may wish to use these categories in fleet organization to define separate classes.

Dynamic Allowance (DA) is a parameter that applies to Cruiser/Racers that describes the boat's behavior in unsteady conditions and is related to sail area, volume and wetted surface of the boat. Boats of both categories older than 30 years in design will also get a DA.

For example, there are some fleets that define a Cruiser division for boats with a DA of ≥ 0.230 %.

Sail Area/DSPL ratios: New for 2024 is SA/DSPL Upwind and SA/DSPL Downwind ratios appearing on Page 2 of USA-CAN certificates in the Scoring options section of this page. At the discretion of the OA, these parameters may be used to group boats of like type to promote closer racing. The Rolex Big Boat Series at St Francis YC has done this for the separation of their two ORC classes at their recent events.

An example of using this parameter is that the APH for a typical Farr 30 is 524 sec/mile, not far from the APH rating of a much larger and heavier Beneteau First 40.7 at 521 sec/mile. Yet these boats will have very different performances on the race course depending on wind speed and angles. So a method to separate these boats into classes of boats with similar performance is to look at the SA/DSPL ratios. While for the Farr 30 it is 32.81 Upwind, which is not too far off from the First 40.7 Upwind ratio of 28.82, the Downwind ratios quite different: 82.86 for the Farr 30 compared to 42.23 for the First 40.7.

Numerous other examples abound, so OA's and RC's may consider use of this SA/DSPL tool.

2.6 Sailing Instructions

ORC provides a convenient Standard Sailing Instructions template available for download in PDF and Word formats at this link: www.orc.org/rules. Even though it is designed primarily to be used for World and continental championships, it may be edited to be used for any race or regatta where ORC scoring is used.

In addition to the items already described in the Notice of Race sections, there are some specific items that needs to be included in the Sailing Instructions for ORC events as follows:

a) ***Communication of the Race Committee with competitors*** – It is highly recommended to have frequent and clear communications from the Race Committee to competitors, such as explained in RRS 90.2. The Sailing Instructions, for example, should include limitations of possible requests for redress based on OCS calls with wording such as:

> *"If any part of a boat's hull is on the course side of the starting line at her starting signal and she is identified, the race committee will attempt to broadcast on VHF her sail number, bow number or name of boat. Delay in the radio broadcast of these calls, or the order in which they are made, or*

any omission or failure in the transmission or reception of these, will not be grounds for a request for redress by the boat. This changes RRS 60.1(b).”

Another example is this wording:

“The following communications may be made by the race committee on VHF: time checks and starting times, starting order and designation of race areas, confirmation of any visual signal displayed, courses including bearing and distance to the first mark, change of course, shortening, postponement, abandonment and other information explaining the intentions of the race committee.

Delay in the broadcast of these calls, or the order in which they are made, or any omission or failure in the transmission or reception of these, will not be grounds for a request for redress by the boat. This changes RRS 60.1(b).

b) ***Scoring*** – Scoring options shall be defined by the SI’s, but it is important that selection of the scoring options shall not be grounds for a request for redress by the boat, and the following wording should be included:

“*The decision on the scoring method and scoring parameters used for a race will be at the sole discretion of the Race Committee. This includes the length of the course, directions of the legs and the wind details such as strength and direction. These will not be grounds for a request for redress by the boat. This changes RRS 60.1(b).”*

c) ***OCS Penalty*** – For safety reasons it is common practice in long offshore races to have a time penalty for OCS instead of disqualification. If this is the case World Sailing Development Rule DR 21-01 should be used as explained at this **link**.

d) ***Discretionary penalties –*** The Sailing Instructions should define for which breaches of the rules that discretionary penalties, with the notation ‘[DP]’, may be imposed by the Protest Committee that may be less than disqualification. These may include items such as the following:

- number of sails on board
- placement of the bow numbers
- some breaches of the safety rules
- not reporting the use of the engine for rescuing people or giving help
- failing to request the change of crew or equipment
- use of support boats
- communications with the Race Committee
- haul out restriction

A Discretionary Penalty Imposed (DPI) document may be created and published as an appendix to the Sailing Instructions.

2.7 Measurement protests

Occasionally an issue may arise where there is an irregularity of a boat with its ORC certificate prior to the start or during racing. This may be, for example, a boat having a sail which is larger than that shown on her certificate, or a question about displacement, or having crew that exceeds the limit shown on the certificate. A Technical Committee appointed by the organizers should handle these matters related to measurement and certificate compliance.

The ORC Rating Systems rules have a clear definition of the procedures for measurement protests defined in ORC rule 305.

The first step for the Technical Committee should be to determine what is not in compliance on the boat with its certificate. If it is determined that this is not the fault of the owner or the crew, then the issue should be immediately reported to the relevant rating office that issued the certificate. They shall withdraw this certificate, correct the error, and issue a new certificate. Note that this may be done before the start or even during the event and should not hinder the boat from racing. In either case once the corrected certificate data is available then results should be re-calculated and updated.

However, if the owner or the crew are responsible for the non-compliance, the procedure should be as follows:

a) ***Prior to the start of first race*** – if the non-compliance is considered to be minor and can be easily corrected, the boat should be brought into compliance with her certificate, and, when necessary, a new certificate should be issued. The Technical Committee shall approve the issue of a new certificate.
When the non-compliance is major (even if it can be corrected) or if it cannot be corrected without requiring significant re-measurement, a boat shall not be eligible to enter a regatta. The Technical Committee shall inform the Rating Authority that the boat is not in compliance with its certificate.

b) ***During races as a result of measurement protest or post-race measurement check*** – A test certificate should be generated with the new measurements taken by the Technical Committee. The resulting APH on the test certificate shall then be compared with the APH on the original certificate used to enter the regatta.
The ORC Championship Rules may be then used to prescribe time penalties assessed in the races sailed in proportion to the change in APH.
Test certificates needed for APH comparison shall be run by the relevant rating office. However, if the rating office is not available during the regatta, the Technical Committee may use **ORC Sailor Services** to generate a new test certificate. Any costs involved shall be covered by the unsuccessful party as defined by the RRS 64.4(e).

c) ***Declared value non-compliance (Crew weight & Asymmetric spinnaker on centerline)*** - Please note that values recorded on the certificate by the owner's declaration such as Crew weight and use of an asymmetric spinnaker tacked only on the centerline are not eligible for the APH comparison procedures defined above. Infringement of these rules will result in Disqualification unless any other penalty is defined by the Sailing Instructions.

2.8 Redress

In addition to the options available in RRS A9, if there is a decision by the Protest Committee to grant redress to a competitor in the form of time sailed on the course, this should be expressed in elapsed time rather than corrected time.

3. RATINGS AND SCORING

3.1 Ratings and Scoring

Scoring races to get acceptable race results is an important function of race management. Competitors expect races to be run competently, and the results to reflect their abilities on the race course in a fair and unbiased way. With ORC's use of scientific modelling of boat performance to calculate ratings, this is possible with the correct selection of scoring type that best reflects the race type, the wind conditions and the expectations of the competitors.

3.2 Scoring options and the factors of choice

Since the ORC VPP produces a complete matrix of predicted boat speeds at various wind strengths and directions, ORC rating systems can therefore provide a wide variety of methods to calculate corrected time. This variety may look complex, but it is actually one of the strengths of the ORC rating systems to offer race managers choices that best suit their fleet, their race type and their race conditions. Choosing the best scoring option is therefore finding the right balance between accuracy and simplicity appropriate for the fleet.

The very simplest of options shown on ORC certificates include use of a single-number Time on Distance or Time on Time rating given for basic course types such as:

- **Windward/Leeward course** - has 50% upwind and 50% downwind race legs
- **All Purpose course** - includes equal distribution of all wind directions.

However, when boat types are widely varied, their rated performance will vary widely as well, making a single number rating approach inherently unfair. Race managers should therefore use a more sophisticated scoring method to use the full power of the VPP to create more accurate and fair corrected time results.

Selecting the appropriate scoring option should be based on several other factors besides wind geometries, such as:

a) ***Level of competition*** – For the most casual racing in club-level events with limited race committee resources, the simpler scoring options may be the appropriate choice. As the level of competition increases, then more sophisticated systems may be appropriate depending on the expectations of the sailors. For example, major races and regattas in the US with inshore racing use either constructed course models (eg, Rolex Big Boat Series) or the 5-band system (eg, Block Island Race Week), and offshore races such as those at the SORC use one of the Predominant Upwind, Reaching or Downwind models where this level of scoring is accepted and understood.

b) ***Class composition*** – Regardless of the scoring method selected it is important to have the fleet organized into racing groups (e.g. classes, divisions, sections, etc) of similar type as explained in Section 2.5). The scoring system works best when like-type and sized boats race each other, particularly when using the most accurate scoring options.
Yet for coastal or offshore races there may be a desire to list overall results that include all entered boats in addition to the results from separate classes. For overall results it's important to consider use of the same scoring model for all those eligible for an overall prize, except when using Weather Routing Scoring (see Appendix 3).

c) ***Time on Distance vs Time on Time*** – Simple scoring options offer either Time on Distance (ToD) or Time on Time (ToT) ratings. The two are equivalent, and the choice can be based on what the local fleet is accustomed to using…in the USA and CAN the prevalent choice is ToT, especially in regions that have current.

3.3 Single Number scoring options

The simplest single number scoring options shown on every ORC certificate do not use the full power of the ORC rating system but may be a preferred choice when simplicity matches the expectations of the fleet or when race weather conditions cannot be predicted. These are options include Time on Distance (ToD) and Time on Time (ToT) ratings for Windward/Leeward and All-purpose course types:

Single Number Scoring Options		
Course	Time On Distance	Time On Time
Windward / Leeward	601.8	0.9971
All purpose	486.3	1.2338

ToD coefficients are calculated for the respective course models (Windward/Leeward or All-purpose) with the following wind strength distribution:

TWS (kt)	***6***	***8***	***10***	***12***	***14***	***16***	***20***
Time Allowance percentage	5%	10%	20%	30%	20%	10%	5%

Equivalent ToT ratings are calculated for the respective course model (Windward/Leeward or All-purpose) as ToT rating = 600 / ToD rating.

Corrected times are calculated accordingly:

a) ***Time on Distance*** - With ToD scoring, the coefficient of time allowance of one boat will not change with wind velocity, but will change with the length of the course. One boat will always give to another the same handicap in seconds/nautical mile (sec/mile), and if the distance sailed is known then it is easy to calculate the difference in elapsed time between two boats needed to determine a winner in corrected time. Corrected time is calculated as follows:

*Corrected time = Elapsed time – (ToD_{Delta} * Distance)*

Where $ToD_{Delta} = ToD_{\text{the boat}} - ToD_{\text{the lowest (fastest boat) in the fleet}}$ and therefore the corrected time of the boat having the fastest ToD in the fleet will be equal to her elapsed time (this is often termed the "Scratch boat").

b) ***Time on Time*** - With ToT scoring, the time allowance will increase progressively through the duration of the race. Course distance has no effect on the results and need not be measured. Corrected time will depend only on the elapsed time, and the difference between boats may be seen in seconds depending on the duration of the races. The longer the race is in time, the larger the handicap. Corrected time is calculated as follows:

*Corrected time = ToT rating * Elapsed time*

Pursuit racing – For casual races, race managers may consider use of the Pursuit start, where for a known and measured distance of the course and the selected ToD ratings of the entries, a unique start time is calculated. In this format the boat starts the race at their designated time, with the slowest-rated entries starting first followed by others in progressive order of rating. Results are then determined by the order of boats crossing the finishing line. To calculate the start times on the scratch sheet, this formulation is used:

*Starting time = Starting time of the slowest boat + ($ToD_{slowest\ boat}$ – ToD) * course length*

3.4 Polar Curve Scoring (PCS)

PCS is used at ORC World, European and some national championship events, and is regarded as the most accurate and objective scoring method for inshore racing. It requires specialized software (eg, ORC Scorer, a Window-based program downloadable at www.orc.org/software) and race management personnel trained on its use - it is not actively used in the US at this time. For more information about PCS see its description in the general ORC Race Management Guidebook at www.orc.org/rules.

3.5 Custom-made Single Number scoring

Use of Single-number options will be accurate if the actual wind conditions are close to the wind matrix used for its calculation.

However, there is also an option to define a different wind matrix that is custom-made for a single number time allowance. This may be done using a weather forecast on the day prior to the start of the race (*see Appendix 3) or historical wind data for the course area.

Below is an example of this approach, the Upwind course model option used in the Chicago-Mackinac Race:

TWS (kt)	***6***	***8***	***10***	***12***	***16***	***20***	
Beat VMG	*1.75%*	*5.25%*	*10.50%*	*10.50%*	*5.10%*	*1.60%*	**34.70%**
52° reach	*1.40%*	*4.35%*	*9.00%*	*9.30%*	*5.10%*	*1.80%*	**30.95%**
90° reach	*0.75%*	*2.25%*	*4.50%*	*4.50%*	*2.40%*	*0.90%*	**15.30%**
135° reach	*0.60%*	*1.80%*	*3.30%*	*3.30%*	*1.50%*	*0.45%*	**10.95%**
Run VMG	*0.50%*	*1.35%*	*2.70%*	*2.40%*	*0.90%*	*0.25%*	**8.10%**
Sum	**5.00%**	**15.00%**	**30.00%**	**30.00%**	**15.00%**	**5.00%**	**100.00%**

The choice of course model should be specified in the Notice of Race and/or Sailing Instructions. If the course model is not known until the Sailing Instructions are published, then a generic reference can be made, such as "Scoring will be using Time on Time ORC ratings."

A custom-made Single number rating can also be calculated using the Time Allowance tables at the top of Page 2 on ORC certificates, and if the course length and wind angles are known this can be expressed as a ToD rating, convertible to ToT ratings using conversion factor of ToT = 600/ToD.

This custom approach will also be available soon online at ORC's Sailor Services portal – www.orc.org/sailorservices - where all valid certificates issued since 2009 can be found in an online library. When this is available an announcement will be made through ORC media channels and US Sailing.

Weather Routing Scoring (WRS) is also being offered by ORC – see the Addendum to Appendix 3.

3.6 USA-CAN standard scoring model options

US Sailing and ORC Canada publishes multiple scoring options on Page 2 of all their valid ORC certificates. This may include ToD and/or ToT coefficients using different course models as well as multiple ToD and/or ToT coefficients for different wind ranges. The reason for these multiple options is to help produce the most fair race results among boats of widely varied sizes and types since there can be significant differences in rated performance as a function of wind speed and wind direction on the race course. The closer the actual conditions are to the race models, the more fair the results. Formulations for the models that produce these ratings are found in Appendix 4.

The course type used to calculate these ratings and the methods of how they will be applied should be specified in the Notice of Race and/or Sailing Instructions of the races and events that use them.

For guidance on scoring choices, see the flow charts in Appendices 2 and 3.

a) ***Triple Number*** – When wind speed can be bracketed within a range of values – Low, Medium or High – for the duration of the race, then the Triple Number system should be considered. The range of these values is a blended mix of true wind speeds and is shown below:

TWS (kt)	6	8	10	12	14	16	20
Low	50%	50%					
Medium		8.4%	33.3%	33.3%	25%		
High					25%	37.5	37.5%

Note the average wind speeds for Low, Medium and High are 7, 11.5 and 17 knots, respectively, and that not every option among non-custom models has a Triple Number option – eg, Predominant Upwind, Downwind and Reaching – but these are available for Windward/Leeward and APH course models.

b) ***5-Band*** – For W/L, W/L 60-40, APH, Predominant and SF Bay courses, there is even further refinement in wind speed ranges to include 5 choices: Low, Low/Medium, Medium, Medium/High and High. Note the average wind speed figures for each. If the wind conditions can be constrained to be within one of these bands, race results will likely be closer and more accurate than with use of other options.

TWS	6	8	10	12	14	16	20	24	TWS Avg
Low	77.3	22.7	0	0	0	0	0	0	6.5
Low/Med	14.7	35.3	35.3	14.7	0	0	0	0	9
Med	0	7.7	19.2	46.2	19.2	7.7	0	0	12
Med/High	0	0	0	7.7	19.2	55.8	17.3	0	16
High	0	0	0	0	0	17.3	65.4	17.3	20

c) ***Predominant Upwind, Downwind and Reaching*** – These options are often useful for destination races where the wind may be constant from start to finish and conforming (mostly) to their model descriptions - these models are offered in 5-band format and described in detail in Appendix 4.

3.7 Scoring software

There are numerous methods of scoring available, and their suitability should match the scoring methods desired. For simple single-number methods, for example, there are a wide variety of software options available, ranging from simple spreadsheets to web-based tools with HTML outputs.

If, however, more complex rating options are desired, then there are fewer scoring software options available to handle the task. Several of these are listed on the **ORC website**.

Yacht Scoring is perhaps the most widely-used web-based scoring and regatta management system in the USA for ORC races and events. One reason for this is convenient handling of an entry's ratings based on the numerous options found on Page 2 of ORC certificates. For each entry the input of the boat's certificate reference number allows the program to retrieve these ratings from the ORC's database of RMS files, making these then available on the administration side of the program for scoring use by race managers.
All ORC certificate scoring options are available from the ORC database by retrieval at www.orc.org/scoring in RMS, JSON or CSV formats. Note that these are organized by certificate type: Standard (ie, full-crewed), Double Handed and Non-Spinnaker.

3.8 Time allowance sheets

It is a best-practice to list entries on a scratch sheet organized by class and each entry's APH rating. It is also a best-practice to provide rating and time allowance information to competitors so they can anticipate how they are performing in corrected time relative to their competitors.

This is a simple task when using a single number scoring option, but this becomes more complex when race managers may opt to use different scoring options within an event, necessitating a time allowance sheet produced for each option.

ORC provides a web-based utility for this within ORC Sailor Services called **Scratch Sheet**. Using the *Search for certificates* tool, find the certificate for each class entry, click the box highlighted in orange to add its measurement record to the online Scratch Sheet file within the user's Sailor Services account, then use the drop-down menus to select USA (or CAN) for national rating options, then the other drop down menu to select the scoring model desired.

A time allowance sheet is then generated with that scoring option's ratings and the course distance (for ToD ratings) or elapsed time sailed (for ToT ratings) in columns on this sheet. This can then be saved as an HTML file, which when opened can be edited for length of time (in minutes) or distance (in miles) at the top of each column and a button available for each entry to use as a reference scratch boat to calculate time allowances for every other entry in the class. An example is shown below:

ORC

Scratch Sheet

ToT - 5-Band AP Med/High

	Yacht Name	Sail No	Type	APH	TOT	1 min	5 min	10 min	20 min	30 min	60 min	90 min	120 min
○	AIRBORNE	USA 238	J 109	540.6	1.2106	4.8 00:00:05	24.1 00:00:24	48.1 00:00:48	96.2 00:01:36	144.4 00:02:24	288.7 00:04:49	433.1 00:07:13	577.5 00:09:38
○	OUTRAGEOUS2	USA 12039	J 120	510.8	1.2902	0.8 00:00:01	4.1 00:00:04	8.1 00:00:08	16.3 00:00:16	24.4 00:00:24	48.8 00:00:49	73.2 00:01:13	97.7 00:01:38
○	MicroDarcy	USA 56443	J 124	506.1	1.2940	0.6 00:00:01	3.2 00:00:03	6.4 00:00:06	12.7 00:00:13	19.1 00:00:19	38.1 00:00:38	57.2 00:00:57	76.2 00:01:16
◉	ENCHANTED	USA 61704	Solaris 44 SD2.4	510.0	1.3077	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00	0.0 00:00:00
○	MicroDarcy	USA 56443	J 124	497.2	1.3272	-0.9 00:00:01	-4.4 00:00:04	-8.8 00:00:09	-17.6 00:00:18	-26.4 00:00:26	-52.9 00:00:53	-79.3 00:01:19	-105.8 00:01:46
○	SECOND WIND	USA 51316	J 130 SD	493.3	1.3357	-1.3 00:00:01	-6.3 00:00:06	-12.6 00:00:13	-25.2 00:00:25	-37.7 00:00:38	-75.5 00:01:16	-113.2 00:01:53	-150.9 00:02:31
○	MYSTIC	USA 2615	SYDNEY 41	487.0	1.3498	-1.9 00:00:02	-9.4 00:00:09	-18.7 00:00:19	-37.4 00:00:37	-56.1 00:00:56	-112.3 00:01:52	-168.4 00:02:48	-224.6 00:03:45
○	FREJA	USA 2	AERODYNE 43	484.0	1.3768	-3.0 00:00:03	-15.1 00:00:15	-30.1 00:00:30	-60.2 00:01:00	-90.3 00:01:30	-180.7 00:03:01	-271.0 00:04:31	-361.4 00:06:01

*Numbers in Red indicates time owed by the Scratch boat, and in Black time owed to the scratch boat.

It is recommended to make this scratch sheet of time allowances available to all entries for all possible scoring options by posting on the Notice Board and/or emailing to all entries in advance of racing.

4. RACE MANAGEMENT BEST PRACTICES

4.1 Race Management Best Practices

Running an ORC event is not significantly different from running any other sailing race. However, there are some aspects that needs to be addressed specifically while using the ORC system. For this ORC offers tools that can make race management tasks even easier. This guidebook is not intended to give an overview of the basics of proper race management because there are many other resources available for acquiring these skills.

4.2 Setting a Windward/Leeward course

a) ***Course distance*** **-** Regardless the scoring method used (as explained in Section 3) setting up the course includes gathering basic information of the position of the marks, length and compass bearings of each leg as well as wind over the course. The polar diagram data available on ORC Certificates makes it easy to calculate the distance of the course needed to achieve the target elapsed time for the race. ORC International and ORC Club certificates with an optional second page show time allowances for pre-selected course types as follows:

Time Allowances in secs/NM							
Wind Velocity	**6 kt**	**8 kt**	**10 kt**	**12 kt**	**14 kt**	**16 kt**	**20 kt**
Beat VMG	886.1	737.6	668.8	638.7	624.4	613.1	601.9
52°	580.2	491.6	457.4	445.4	439.6	436.4	428.8
60°	547.3	471.5	444.5	433.2	427.6	424.2	417.6
75°	520.8	457.5	434.5	421.0	411.5	405.4	398.8
90°	506.5	446.2	423.6	409.0	396.6	387.9	373.3
110°	524.0	452.6	425.6	405.9	386.0	368.1	341.2
120°	553.7	465.9	430.7	409.0	387.5	369.2	335.7
135°	623.5	508.0	450.3	424.7	403.8	381.5	336.9
150°	742.8	598.6	507.4	453.6	427.5	407.6	365.5
Run VMG	857.7	691.2	585.9	518.5	474.9	440.9	400.2
Selected Courses							
Windward / Leeward	871.9	714.4	627.3	578.6	549.7	527.0	501.1
All purpose	663.6	554.7	501.3	472.7	454.4	438.9	416.9

Time allowances are shown in sec/NM that allows easy calculation of length of the course needed to achieve target time for finishing. For example, if there is a windward/leeward race planned with a target time of 01:15:00 hours, the length of course is calculated as:

Target time = 01:15:00 = 4500 sec
Observed wind speed: 10 kts, Time allowance at TWS of 10 kts = 627.3 sec /NM
Length of the course: Target time / Time allowance = 4500 / 627.4 = 7.17 NM

Using the same calculation method for wind of 12 kts and same target time length of the course would yield a result of 7.77 NM. Using this approach, it is easy to build a table of length of the course as a function of wind strength as shown in the example below for a Target time of 01:15:00.

Wind speed (kts)	***6***	***8***	***10***	***12***	***14***	***16***	***20***
Time Allowance (s/NM)	871.9	714.4	627.3	578.6	549.7	527.0	501.1
Length of the course (NM)	5.16	6.30	7.17	7.77	8.19	8.54	8.98
*Length of the 1st leg (NM)**	1.34	1.63	1.84	1.99	2.10	2.19	2.30

* *Assuming 2 laps course with 2 windward and 2 leeward legs and the leeward gate at about 0.1 NM windward of the starting line*

Once the total course length is calculated it is easy to divide it by the number of leg/laps and give this information to the mark set boat on where to set up a windward mark.

Obviously the figures used for this calculation may be from the fastest, mid-fleet or slowest boat in the fleet depending how the target time is set. Please also note that the **Scratch Sheet** tool at **ORC Sailor Services** can be used to select the class entries from the Search criteria, add them to the Scratch Sheet folder, then select the PCS –Windward Leeward option to create a table of rated speed values as shown above.

The same approach may be made for All-Purpose courses, where the length of the course should be calculated as the shortest distance between marks. Using the online Scratch Sheet tool, the time it takes for an entry to sail the course can be shown by entering the leg or course distance in the columns of the HTML file. An example is shown here:

ORC

Scratch Sheet

ToD - All Purpose

	Yacht Name	Sail No	Type	APH	TOD	2 NM	3 NM	5 NM	10 NM	20 NM	30 NM	40 NM	50 NM
○	POLLY ESTHER	USA 7	XP-44	484.1	484.1	968.2 00:16:08	1452.3 00:24:12	2420.5 00:40:21	4841.0 01:20:41	9682.0 02:41:22	14523.0 04:02:03	19364.0 05:22:44	24205.0 06:43:25
○	Cheep N Deep II	USA 25580	J 44	493.5	493.5	987.0 00:16:27	1480.5 00:24:41	2467.5 00:41:08	4935.0 01:22:15	9870.0 02:44:30	14805.0 04:06:45	19740.0 05:29:00	24675.0 06:51:15
○	Ace	USA 39506	FARR 395	500.4	500.4	1000.8 00:16:41	1501.2 00:25:01	2502.0 00:41:42	5004.0 01:23:24	10008.0 02:46:48	15012.0 04:10:12	20016.0 05:33:36	25020.0 06:57:00
○	VARIANCE	USA 100	J 111	503.8	503.8	1007.6 00:16:48	1511.4 00:25:11	2519.0 00:41:59	5038.0 01:23:58	10076.0 02:47:56	15114.0 04:11:54	20152.0 05:35:52	25190.0 06:59:50
○	VIVA LA VIDA	USA 46722	J 120	510.7	510.7	1021.4 00:17:01	1532.1 00:25:32	2553.5 00:42:34	5107.0 01:25:07	10214.0 02:50:14	15321.0 04:15:21	20428.0 05:40:28	25535.0 07:05:35
○	ENZO	USA 8975	Hobie 33 Mod	517.2	517.2	1034.4 00:17:14	1551.6 00:25:52	2586.0 00:43:06	5172.0 01:26:12	10344.0 02:52:24	15516.0 04:18:36	20688.0 05:44:48	25860.0 07:11:00
○	SPANKER	USA 51196	FIRST 40.7	519.2	519.2	1038.4 00:17:18	1557.6 00:25:58	2596.0 00:43:16	5192.0 01:26:32	10384.0 02:53:04	15576.0 04:19:36	20768.0 05:46:08	25960.0 07:12:40

b) ***Course data*** - Once the course is set it is always good to have clear communications between the RC signal boat and mark set boats in monitoring the wind speed and direction. This assists the RC to decide if there is needed a possible change or shortening of the course. Data on the length of the course, wind direction and wind strength also need to be collected for scoring purposes.

Note that length of the course is not needed when Time-on-Time scoring method is used. However, it is always good to have this information which is easily obtained using GPS technology. It may be calculated from the Lat-Lon positions of starting, rounding, and finishing marks along the course or directly from the GPS instrument on the distance to the mark set boat. Regardless, the length of the course shall be recorded to a precision of 0.01 NM.

4.3 Communication from the Race Committee

a) Race Committee communications through VHF should be clear and frequent, explaining their intentions but also giving information about the race course. This information can include, for example, the length and compass bearing of the first leg of the course and the intended time for the warning signal. Each visual signal should be announced on the VHF with a countdown broadcast in advance and into the last few seconds prior to its display.

b) It is always desirable to announce boats that are OCS by VHF. Such announcements shall be clear, concise, and uniform using either bow number, sail number or boat names for all boats that are called over the line at the start. Any changes of the course or shortening of the course should also be announced

on the VHF. Radio communication from the Race Committee shall not be ground for redress as described in Section 2.6 with appropriate wording to be included in the Sailing Instructions.

c) Scoring options: When not pre-determined by a specific race course model, the NOR and Sailing Instructions should have a general description of the intended scoring to be used, such as Time on Time. In the SI's it should then be stated that the intended choice for scoring will be announced prior to the Warning signal, and this choice **may be changed by the RC if conditions change** if they decide another scoring model may be more accurate and thus produce more fair results. *If this protocol is used it should be announced on VHF prior to the finish of the first boat in the class and described in the Sailing Instructions.*

Wind shear influence on wind speed choices: The aerodynamic model in the ORC Velocity Prediction Program (VPP) assumes wind speeds at 10 m off the water surface. Since there is friction in the boundary layer of air close to the water surface, wind speed will typically increase with height. An instrument reading taken at a few meters off the water on a RC vessel is therefore unlikely to have the same figure assumed at 10 m or read by wind instruments at the top of a spar 20 m high. Therefore it is useful to know how this effect may influence the decision on what wind speed range to choose among the scoring options available in the Triple Number or 5-Band wind ranges.

The equation to describe this wind shear effect is:

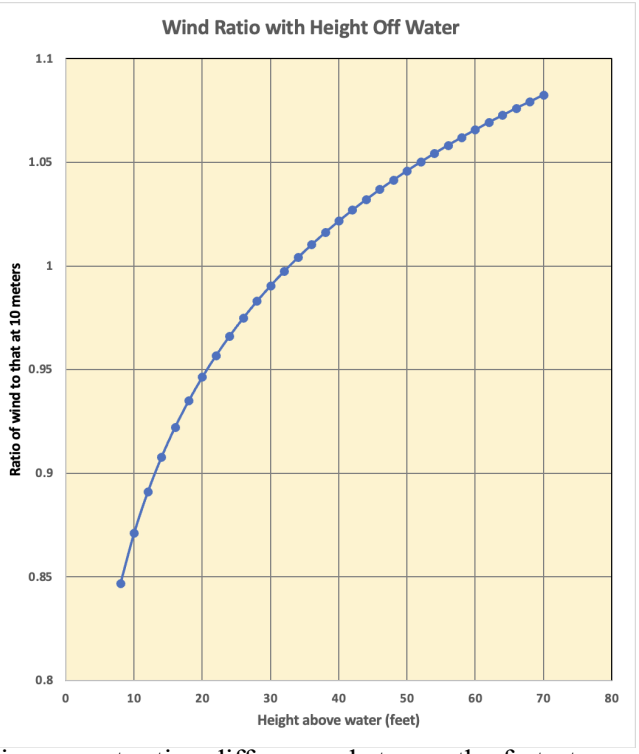
$WS_{10m} = WS_{measured}/[0.1086 * log(304.8 * H_{measured})]$

where
WS_{10m} is the wind speed at 10 m
$WS_{measured}$ is the wind speed at measurement height
$H_{measured}$ (in ft)

A graphic depiction of this is shown to the right and indicates the shear effect reduces with greater height.

An example is that 11 knots of wind measured at an 8 foot (2.4 m) height is 13 knots at 10 m.

Likewise a 10 knot wind at 10 m would be measured as 10.8 knots by a masthead wind instrument located at a height of 65 feet (19.8 m).
(*Thanks to Jim Teeters for providing this formulation)*



4.4 Race Time Limits

Setting up a time limit in handicap racing needs to take in account rating differences between the fastest and slowest boat in the fleet. As explained in Section 4.2, having a complete set of predicted boat speeds for different wind conditions make this process much easier. There are several ways to define a time limit in the Sailing Instructions:

a) ***Fixed time limit for all boats in the fleet*** – if this option is selected it should be calculated based on the slowest rated boat in the fleet. Whatever method being used to score the race, the appropriate Time on Distance time allowance should be used. For example, if a Time-on-Time scoring method is used, then the relevant Time-on-Distance conversion factor should be used as described in Section 3. If time allowances are given for more than just one wind condition, the one for the lightest wind should be used. Once an appropriate ToD time allowance in sec/NM is selected, the estimated time need to sail the course may be calculated as:

Estimated time to sail the course = ToD x Length of course

The final time limit can then be determined by adding some margin based not only on the weather but competitive quality of the fleet: in general, smaller margins may be used for experienced competitors. For others the margin may be up to a 50% increase to the estimated elapsed time.

b) Fixed time limit for the first boat with finishing window for the rest of the fleet – Time limits for the first boat to finish may be calculated as described in a) above while the finishing window for the rest of the fleet may be calculated from the difference in ratings between the fastest and the slowest-rated boats in the fleet using the same method for selecting appropriate ToD factors:

$$\textit{Estimated time difference to sails the course} = (ToD_{\textit{fastest boat}} - ToD_{\textit{slowest boat}}) \times \textit{Length of course}$$

The final finishing window time limit shall then be determined by adding some margin increase to the estimated time difference to sail the course up to a 50% increase of estimated time difference between the fastest and the slowest boat.

c) Individual time limit for each boat – may be calculated from an appropriate ToD rating and length of the course, such as:

$$\textit{Time limit} = ToD \times 2.0 \times \textit{Length of course}$$

where a factor of 2.0 may be adjusted to the type of race. This option is better to be used for Coastal/long distance races where the list of time limits may be printed and given to competitors prior to the start of the race. This option is available in the ORC Scorer Software. Please note that this option requires more attention from the Race Committee when recording finishing times to check that each boat has individually finished within her time limit.

4.5 Distance Races

Except for the Start line and possibly a short upwind leg to a windmark mark to spread the fleet, courses for distance races are usually defined in the Sailing Instructions with fixed government marks. These should be described in full with Lat-Lon coordinates, color, buoy type, number and any light characteristics. Check the local Notice to Mariners to ensure the marks are on location.

Scoring for distance races follows the same guidance for informing competitors in the NOR and Sailing Instructions on the intended scoring model. For distance races that have a pre-defined course model we recommend this be mentioned in Scoring section of each document, with reference to this model being defined as an Appendix or referenced to the list of USA-CAN scoring models published on the US Sailing website link at: www.ussailing.org/wp-content/uploads/2024/02/2024-USA-CAN-Scoring-options.pdf.

Examples include the Chicago Mac Race All-Purpose model shown here:

Chicago Mac Race All-Purpose - avg TWS 11.5 kts

Wind Spd (kts)	6	8	10	12	16	20	TWA
Optimum Beat	1.5%	3.9%	6.9%	6.0%	2.4%	0.6%	21.3%
52° Reach	0.7%	2.4%	5.4%	6.0%	3.2%	1.1%	18.8%
90° Reach	0.7%	2.4%	5.4%	6.0%	3.9%	1.6%	20.0%
135° Reach	0.7%	2.4%	5.4%	6.0%	3.2%	1.1%	18.8%
Optimum run	1.5%	3.9%	6.9%	6.0%	2.4%	0.6%	21.3%
TWS	5.0%	15.0%	30.0%	30.0%	15.0%	5.0%	100%

As mentioned in 3.6 above, there are also several other generic options used mostly for destination races…these include All Purpose (APH), Predominant Upwind, Predominant Downwind, and Predominant Reaching models, both for single-number options and for 5-band options of Low, Low-Medium, Medium, Medium-High and High wind bands, with average wind speeds for each described in the course model descriptions (but not shown on certificates). In addition, APH is also available for the Triple Number range of wind speeds.

Because it is often difficult to describe in advance which model is appropriate for any distance race without a pre-determined course model, we recommend NOR's contain only generic reference to how scoring will be handled, such as "Scoring shall be using Time on Time ratings." Sailing Instructions may follow the same convention so that the scoring model chosen before the race may take advantage of the most recent weather forecasts.

An example is here:
ORC scoring will use either Time-on-Time simple scoring ratings or Time-on-Time ratings based on an appropriate custom course model announced at the Skipper's Meeting. The RC may also post a Time Allowance sheet based on these ratings on the Official Notice Board before the start of the race. Use of this Time Allowance sheet is for guidance only and does not replace the official results."

Once chosen, the scoring option and time allowance sheets should be communicated with competitors through the appropriate channels (eg, email) as well as posting on the Notice Board. There may even be circumstances when the forecast is too uncertain in advance to make a decision, and the All-Purpose options seems too generic. In the SORC the RC has recently addressed this issue by using an amendment to the SI's stating:

"Large uncertainty regarding the forecasted conditions have caused the Race Committee to delay announcement of the course model until it can review actual observed weather conditions during the race."

Weather Routing Scoring: This is a new scoring method that relies on weather Grib files, routing software and each entry's ORC polars to determine a Predicted Elapsed Time (PET) for that entry to complete the course. The method has tremendous promise for races in helping equalize results for moderate to long races where slow and fast boats may experience different predicted weather during the race. It is not intended for use with shorter day races.

This method is still under development by the ORC team, but is now available for races that want to give it a try...see Appendix 3 for more details. Here are some considerations:

(1) this language should be used in the Notice of Race:
Offshore race results will be determined by corrected times calculated by the single ToT calculated by the Weather Routing as provided by the ORC. List of ratings will be published not later than (insert number) hours before the start.

(2) and this in the Sailing Instructions:

The decision on the scoring method and scoring parameters used will be at the sole discretion of the race committee. The length of the course, compass headings of legs of the course, wind directions and wind speeds will not be grounds for requests for redress by a boat. This changes RRS 60.1(b).

More information on WRS can be found in Appendix 3 and at: **https://orc.org/race-managment/qa-wrs**.

The application to order WRS ratings for your event is at: **https://orc.org/sailors/news-archive/apply-for-weather-routing-scoring-wrs**.

4.6 Recording finishes and publishing results

Finishing times should be recorded to the nearest second in the format of HH:MM:SS of the actual local time when boat crosses the finishing line. With the starting time entered in the same format, scoring software will then do the calculations needed to determine elapsed and then corrected times.

For offshore races lasting longer than 24 hours the finishing day may also need to be recorded. If the race is going through more time zones, be sure to have all starting and finishing times recorded within same time zone, whether UTC or the starting venue time standard.

Results using ORC scoring are often very close. It is perfectly OK if two or more boats are finishing so close to be recorded as having finished within the same second in elapsed time, because their corrected times will likely calculate to be different. If their corrected times are the same, then ties are resolved according to RRS rule A7 with the points for the place for which boats have tied and for the place(s) immediately below added together and divided equally. Therefore, it is important to give the maximum possible accuracy on recording finishing times.

The best practice is to have one RC member monitoring the line identifying the boat finishing, and then give the sound signal when they cross the finishing line. Another RC member is then recording the time of the sound signal by writing on a finishing log sheet. Finishing times should also be recorded by a sound recorder.

The results should be published as soon as possible so that competitors may get results quickly. To facilitate this the scorer should be present on the race committee boat or at the race office with finishing times and course information sent from the race area, such as in photos taken of the log sheets. In either case, the race committee should double check all input data and resulting output with special attention paid to: Are all finishing times entered correctly?

- If the race lasts for more than a day, are all finishing days entered correctly?
- Is the starting time entered correctly and elapsed times calculated correctly?
- Are all time limits considered correctly?
- Are all OCS, UFD or BFD penalties entered properly?
- If PCS is used, is the scoring wind of the winning boat within range of the observed wind during the race? If not, double check the course configuration.

Once the RC is satisfied with the results, they may be published on the event web page and announced to the competitors by VHF if appropriate. The **ORC Scorer software** has an option to publish results with single click as described in its user guide. Likewise, scoring software such as Yacht Scoring can display results online quickly upon entry of elapsed times.

After the results have been published, they should not be changed unless there is an error discovered. RRS 90.3(c) requires the Race Committee to correct any error that may be found from its own records or observations. If there is any request for correction of results from the competitors, the Race Committee should first check its own record and if the error is found it may proceed in accordance with RRS 90.3(c). If not, the boat may request redress according to RRS 60.1(b).

4.7 Measurement protests

Occasionally an issue may arise where there is an irregularity of a boat with its ORC certificate prior to the start or during racing. This may be, for example, a boat having a sail which is larger than that shown on her certificate, or a question about displacement, or having crew that exceeds the limit shown on the certificate. A Technical Committee appointed by the organizers should handle these matters related to measurement and certificate compliance.

The ORC Rating Systems rules have a clear definition of the procedures for measurement protests defined in ORC rule 305.

The first step for the Technical Committee should be to determine what is not in compliance on the boat with its certificate. If it is determined that this is not the fault of the owner or the crew, then the issue should be immediately reported to the relevant rating office that issued the certificate. They shall withdraw this certificate, correct the error, and issue a new certificate. Note that this may be done before the start or even during the race, if necessary, and should not hinder the boat from racing. In either case once the corrected certificate data is available then results should be re-calculated and updated.

However, if the owner or the crew are responsible for the non-compliance, the procedure should be as follows:

a) Prior to the start of first race – if the non-compliance is considered to be minor and can be easily corrected, the boat should be brought into compliance with her certificate, and, when necessary, a new certificate should be issued. The Technical Committee shall approve the issue of a new certificate.

When the non-compliance is major (even if it can be corrected) or if it cannot be corrected without requiring significant re-measurement, a boat shall not be eligible to enter a regatta. The Technical Committee shall inform the Rating Authority that the boat is not in compliance with its certificate.

b) During races as a result of measurement protest or post-race measurement check – A test certificate should be generated with the new measurements taken by the Technical Committee. The resulting APH on the test certificate shall then be compared with the APH on the original certificate used to enter the regatta:

- If the difference is less than or equal to 0.1%, the original certificate will be maintained, the protest will be dismissed, and the protestor will have to cover any cost involved. RRS 64.4(e) will apply but no corrections are needed.
- If the difference is more than 0.1% but less than 0.25%, no penalty shall apply, but a new certificate shall be issued by the Rating Authority based on the new measurement data and all races of the series shall be rescored using the new certificate data. The protest will be considered accepted and the protestee will have to cover any cost involved.
- If the difference is more than 0.25% but less than 0.40%, a boat shall receive a scoring penalty that shall be 50% of the score for Did not Finish, rounded to the nearest whole number (0.5 rounded upward) in any race in which her rating was incorrect. New certificate shall be issuedbased on the new measurement data and all races of the series shall be rescored using the new certificate data. The Protest will be considered accepted and the protestee will have to cover any cost involved.
- If the difference is 0.40% or more, a boat shall be disqualified (DSQ) in any race in which her rating was incorrect. The Protest will be considered accepted and the protestee will have to cover any cost involved and the yacht shall not race again until all non-compliance issues are corrected to the limit defined above (less than 0.1%). Further actions may be taken by the Protest Committee if it may be considered that non-compliance is result of misconduct following procedures defined in the RRS 69.

Test certificates needed for APH comparison shall be run by the relevant rating office. However, if the rating office is not available during the regatta, the Technical Committee may use ORC Sailor Services to generate a new test certificate. Any costs involved shall be covered by the unsuccessful party as defined by the RRS 64.4(e).

c) Declared value non-compliance (Crew weight & Asymmetric spinnaker on centerline) - Please note that values recorded on the certificate by the owner's declaration such as Crew weight and use of an asymmetric spinnaker tacked only on the centerline are not eligible for the APH comparison procedures defined above. Infringement of these rules will result in Disqualification unless any other penalty is defined by the Sailing Instructions.

4.8 Redress

In addition to the options available in RRS A9, if there is a decision by the Protest Committee to grant redress to a competitor in the form of time sailed on the course, this should be expressed in elapsed time rather than corrected time.

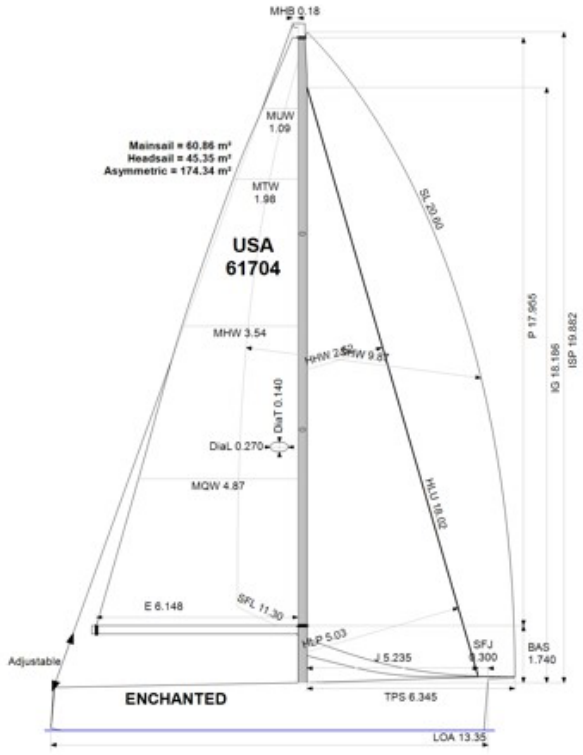
APPENDIX 1

Example ORC USA-CAN certificate Pages 1 & 2

International Certificate 2024

Boat
ENCHANTED
USA 61704

US SAILING
1 ROGER WILLIAMS UNI WAY
BRISTOL, RI 02809
USA



Rated boat velocities in knots								
Wind Velocity	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt	24 kt
Beat Angles	44.2°	41.8°	40.4°	39.9°	39.7°	39.6°	39.5°	40.3°
Beat VMG	3.59	4.41	4.97	5.31	5.48	5.57	5.66	5.60
52°	5.52	6.59	7.32	7.74	7.95	8.06	8.18	8.17
60°	5.84	6.89	7.60	8.01	8.23	8.34	8.47	8.48
75°	6.08	7.13	7.83	8.24	8.51	8.70	8.90	9.00
90°	6.21	7.38	8.09	8.46	8.67	8.86	9.30	9.58
110°	6.27	7.53	8.28	8.71	9.07	9.44	10.02	10.41
120°	6.13	7.42	8.22	8.73	9.18	9.59	10.38	11.21
135°	5.51	6.86	7.85	8.46	8.94	9.43	10.49	11.83
150°	4.64	5.89	6.96	7.78	8.29	8.65	9.34	10.13
Run VMG	4.02	5.10	6.03	6.74	7.18	7.52	8.47	9.18
Gybe Angles	142.9°	146.2°	148.4°	149.4°	150.1°	168.5°	175.9°	175.5°

APH ToD: **510.0** CDL: **11.304**
APH ToT: **1.1764** CertNo: **US6170**

BOAT

Class	**Solaris 44 SD2.4**
Designer	**Acebal**
Builder	**Solaris Yachts**
Age date	**02/2023**
Series date	**06/2018**
Offset file	**SOLARIS442-240.off**
Data file	**USA 61704**

HULL

Length Overall	**13.350 m**
Maximum Beam	**4.178 m**
Draft	**2.449 m**
Displacement	**12,251 kg**
DLR	**5.6135**
IMS Division	**Cruiser/Racer**
Dynamic Allowance	**0.250%**
Age Allowance	**0.195%**

PROPELLER

Installation	**Strut**
Type	**Feathering 3 blades**
Diameter	**0.485m**

CREW

Maximum weight	**595 kg** (declared)
Minimum weight	**465 kg** ** when applied*
Non Manual Power	**Yes**
Crew Arm Extension	

SAIL AREAS (m²)

	Measured	Rated
Mainsail	**60.86**	**61.52**
Headsail Luffed	**45.35**	**45.35**
Headsail Flying		
Symmetric		
Asymmetric	**174.34**	**174.34**

(1 asymmetric(s) with SHW/SFL < 85%)

STORM SAIL AREAS (m²)

Trysail	**19.32**
Storm Jib	**16.65**
Heavy Weather Jib	**44.94**

SAIL LIMITS

Headsails	**7**
Spinnakers	**5**

STABILITY

Righting Moment	**298.0 kg·m**
Stability Index	**120.9**

The owner and any other person in charge is responsible that boat is complying with her certificate in accordance with RRS 78.1 and ORC Rule 304.

ORC Ref **045600030JJ** Issued on **29/02/2024** Valid until **31/01/2025**

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ORC International Certificate 2024

Boat
ENCHANTED
USA 61704

US SAILING
1 ROGER WILLIAMS UNI WAY
BRISTOL, RI 02809
USA

Time Allowances in secs/NM								
Wind Velocity	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt	24 kt
Beat VMG	1003.8	817.2	724.2	678.0	657.5	645.9	636.0	642.7
52°	652.4	546.3	491.7	465.1	452.8	446.6	440.3	440.6
60°	616.1	522.2	473.4	449.3	437.2	431.5	425.3	424.4
75°	591.8	504.8	460.0	436.7	423.1	414.0	404.4	400.2
90°	580.1	487.7	445.1	425.4	415.3	406.2	387.1	376.0
110°	574.1	478.0	434.9	413.1	396.8	381.4	359.4	345.8
120°	587.1	485.2	437.7	412.4	392.2	375.3	346.8	321.1
135°	653.0	525.1	458.9	425.5	402.7	381.7	343.3	304.2
150°	775.1	610.9	517.2	462.6	434.2	416.3	385.3	355.3
Run VMG	895.1	705.4	597.2	534.2	501.3	478.6	425.1	392.0
Selected Courses								
Windward / Leeward	949.4	761.3	660.7	606.1	579.4	562.2	530.6	517.4
All purpose	728.4	595.0	526.3	490.3	471.1	457.3	436.0	423.3

Single Number Scoring Options		
Course	Time On Distance	Time On Time
Windward / Leeward	636.2	0.9431
All purpose	510.0	1.1764

Custom scoring options for United States of America

Scoring Option	TOD	TOT
Triple Number AP Low	661.7	0.9067
Triple Number AP Medium	506.3	1.1851
Triple Number AP High	452.8	1.3251
Triple Number Windward/Leeward Low	855.3	0.7015
Triple Number Windward/Leeward Medium	630.6	0.9515
Triple Number Windward/Leeward High	554.7	1.0817
Predominant Upwind	556.1	1.0789
Predominant Reaching	491.4	1.2211
Predominant Downwind	491.4	1.2211
Predominant Upwind - Low	741.9	0.8087
Predominant Upwind - Low/Med	614.5	0.9765
Predominant Upwind - Medium	537.9	1.1155
Predominant Upwind - Med/High	501.2	1.1971
Predominant Upwind - High	484.8	1.2375
Predominant Downwind Low	645.3	0.9297
Predominant Downwind Low/Med	579.6	1.0352
Predominant Downwind Medium	494.3	1.2137
Predominant Downwind Med/High	445.1	1.3480
Predominant Downwind High	411.8	1.4571
Predominant Reaching Low	645.3	0.9297
Predominant Reaching Low/Med	535.4	1.1207
Predominant Reaching Medium	468.8	1.2798
Predominant Reaching Med/High	432.2	1.3882
Predominant Reaching High	408.6	1.4686

Scoring Option	TOD	TOT
5-Band Windward/Leeward Low	906.7	0.6617
5-Band Windward/Leeward Low/Med	730.6	0.8212
5-Band Windward/Leeward Medium	620.0	0.9677
5-Band Windward/Leeward Med/High	563.4	1.0649
5-Band Windward/Leeward High	533.8	1.1241
Windward/Leeward 60-40 Low	917.7	0.6538
Windward/Leeward 60-40 Low/Med	742.8	0.8078
Windward/Leeward 60-40 Medium	634.3	0.9460
Windward/Leeward 60-40 Med/High	580.5	1.0335
Windward/Leeward 60-40 High	554.8	1.0815
5-Band AP Low	698.1	0.8594
5-Band AP Low/Med	575.0	1.0436
5-Band AP Medium	499.1	1.2023
5-Band AP Med/High	458.8	1.3077
5-Band AP High	437.5	1.3714
5-Band SF Bay Tour - Low	863.0	0.6952
5-Band SF Bay Tour - Low/Med	699.0	0.8583
5-Band SF Bay Tour - Medium	597.0	1.0050
5-Band SF Bay Tour - Med/High	545.2	1.1006
5-Band SF Bay Tour - High	519.1	1.1559
Chicago-Mac Upwind		1.0567
Chicago-Mac All Purpose		1.0992
Chicago-Mac Downwind		1.1490
Bayview-Mac Shore		1.0235
Harvest Moon Regatta	438.5	1.3682

SA/DSPL Upwind	19.82	SA/DSPL Downwind	43.89

AUS AUT BRA BUL CAN CYP DEN ESP EST FIN FRA GER GRE HUN ISR JPN KOR LTU NED NOR POR RSA RUS SLO SUI SWE UKR USA

ORC Ref **045600030JJ** Issued on **29/02/2024** Valid until **31/01/2025**

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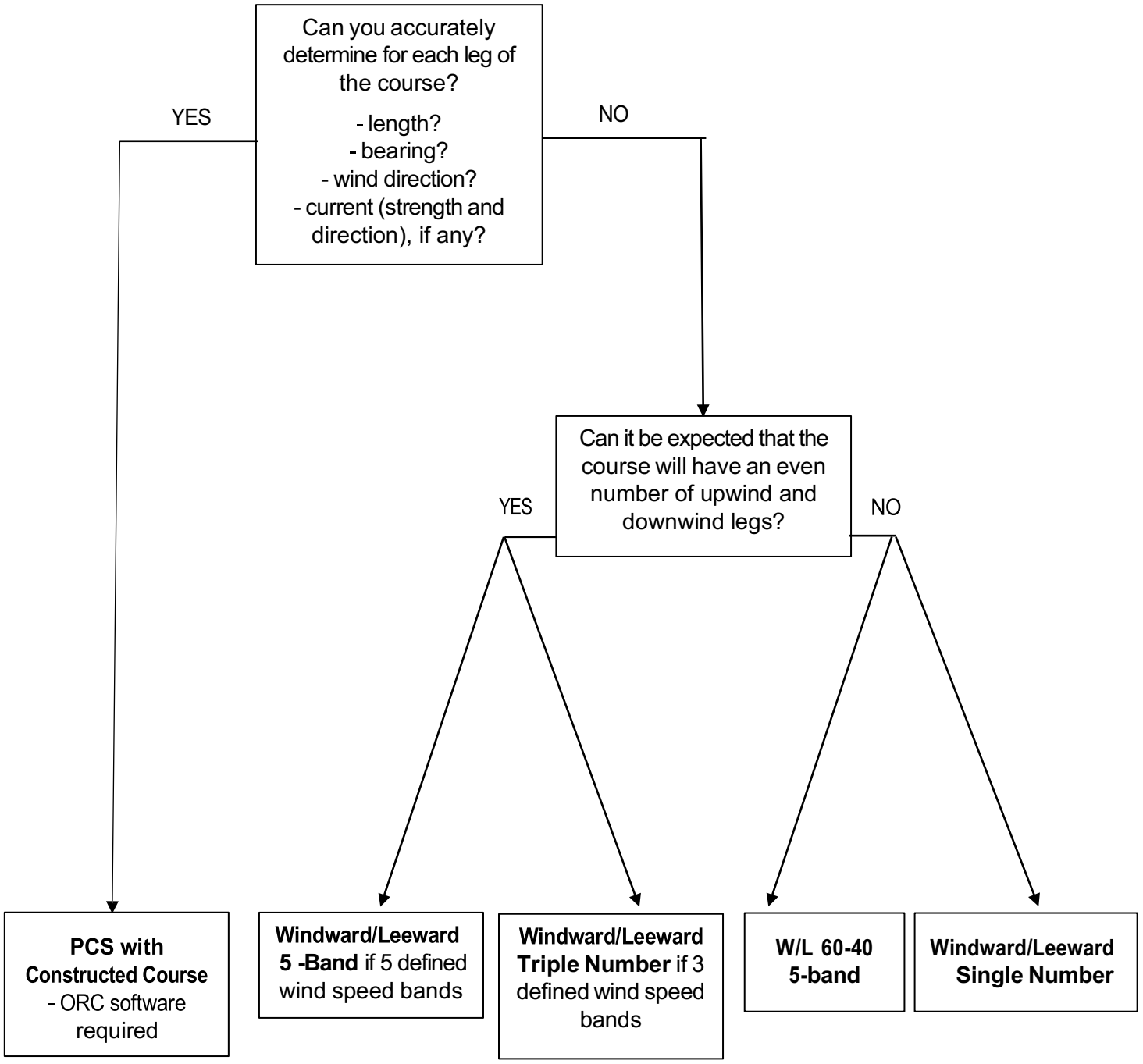
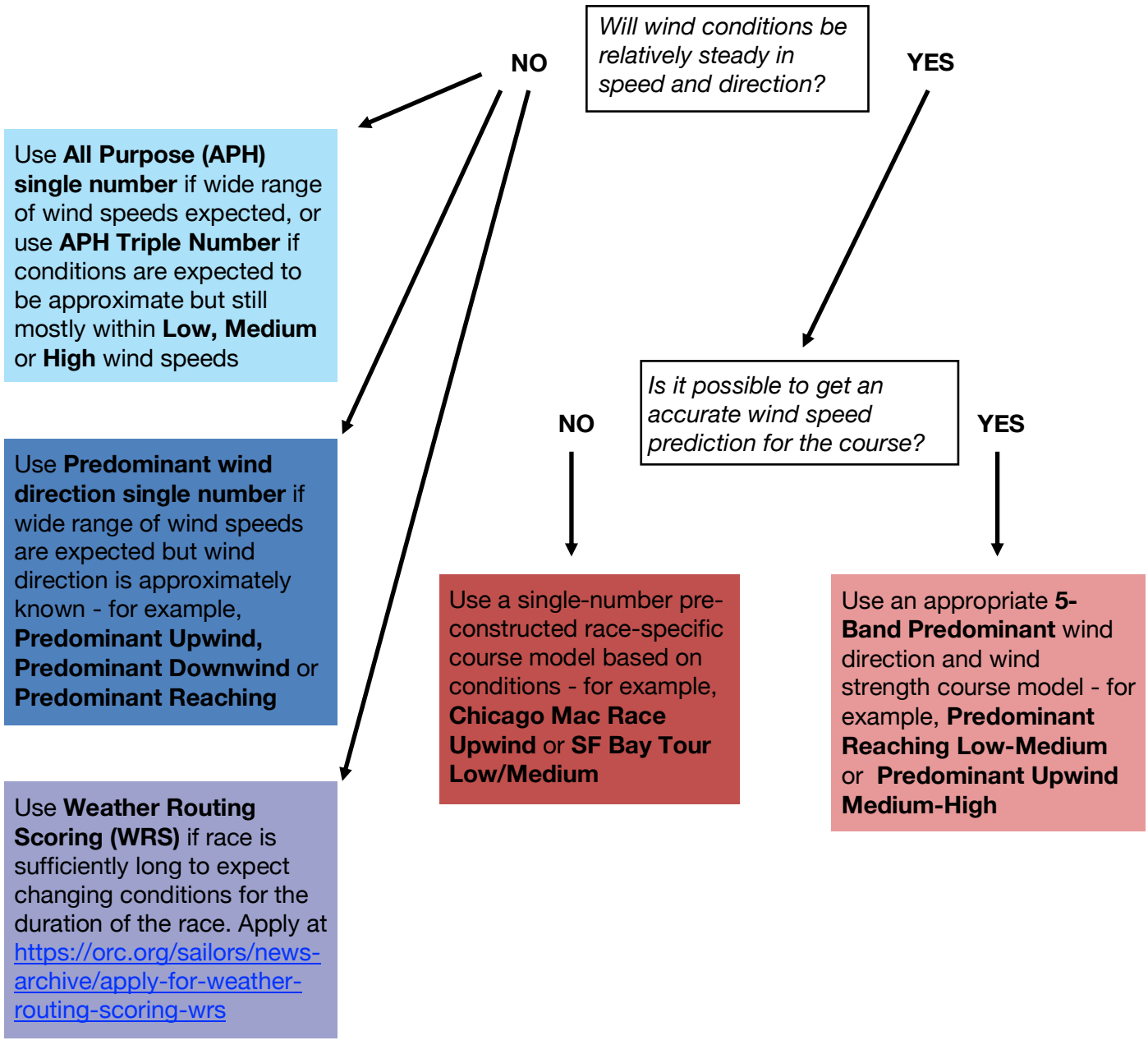
APPENDIX 2

USA - CAN Windward / Leeward race scoring options flow chart



APPENDIX 3

Coastal and Long Distance race scoring options flow chart



ORC Weather Routing Scoring (WRS)

Weather Routing Scoring (WRS) promises to be the most accurate and objective scoring method available today. It merges modern weather routing and polar performance from the ORC VPP to achieve results that help filter out the luck factor from offshore racing. This is done by rating each boat according to its predicted weather during the race and not a global average of wind speed and angle found in the APH or other generalized scoring models.

The WRS method is simple: with the race course coordinates and start times provided by organizers, polar performance of each entry determined from their ORC certificate, and updated Grib files of predicted conditions of wind and current, routing software can be used to determine an optimal route and Predicted Elapsed Time (PET) for that entry on that course. From PET data a Scratch boat is chosen in the fleet and Time Correction Factor (TCF) ratings are calculated where Boat A's TCF = Boat A PET/ Scratch boat PET.

Corrected time results are then simply TCF x Elapsed time = Corrected time.

The ORC supports race organizers who wish to have their race scored with weather routing by providing a time correction factor (TCF) for each entry. These TCF's are calculated by ORC staff using fleet and course data provided by the organizer. The TCF's are then used in the scoring software to calculate race results by time-on-distance or time-on-time methods.

There are two options available from ORC during 2024:

1. If you want to score your race with WRS, this must be clearly prescribed in the Sailing Instructions.

Prior to the race, you need to provide ORC with the following:

- Notice of Race and/or Sailing Instructions.
- Sailing Instructions must include the starting time and the course of the race, including any constraints, such as marks or islands to be left to port or starboard, exclusion zones, etc.
- The entry list of the competitors. This list must include the reference number of each boat's certificate.

The above must be provided by the organizer at least two weeks prior to the start of the race. The entry list may be amended, but not later than two days prior to the start of the race.

The ORC staff will deliver TCF's to organizers 24 hours prior to the start, and these should be distributed to competitors, along with a Time Allowance sheet.

2. The organizer may choose to have the race shadow-scored in order to compare weather routing results with actual ones used in their published scoring method (eg, APH, Predominant Reaching, etc).

The information needed by the ORC staff is the same as above, and for shadow-scored races the ORC staff will deliver TCF's to organizers after the actual results have been posted.

Organizers of races interested in using WRS are referred to the description of the method at https://orc.org/race-managment/scoring and complete the application form.

APPENDIX 4: 2024 USA-CAN Standard Scoring Models

These appear on Page 2 of all ORC certificates issued in the USA and CAN and test certificates run in the ORC Sailor Services system. The ratings are also available for use by scoring software systems by downloading in RMS, JSON or CSV format from the ORC server at https://orc.org/race-managment/rms-files.

In general, the closer a race manager can describe the wind conditions of a race and choose an appropriate scoring option that matches that description, the more accurate and fair will be the ratings and race results.

1. Single Number rating options are used when conditions are too variable to select a specific wind range for scoring a race. These include 2 simple models: **Windward/Leeward** (50% VMG beat + 50% VMG run) and **All Purpose** (APH - an equal mix of all wind angles).

Single Number Scoring Options		
Course	Time On Distance	Time On Time
Windward / Leeward	698.1	0.8595
All purpose	577.5	1.0390

The wind speed distribution for these single number ratings is as follows:

TWS (kt)	*6*	*8*	*10*	*12*	*14*	*16*	*20*
Time Allowance percentage	5%	10%	20%	30%	20%	10%	5%

2. When the wind speed during a race can be confined within a specified range, another scoring option to consider is the **Triple Number** for APH and Windward/Leeward courses. This is the wind speed distribution for **Low**, **Medium** and **High** wind ranges. Note the average for each:

TWS	6	8	10	12	14	16	20	Average
Low	50%	50%						7.0
Medium		8.40%	33.3%	33.3%	25%			11.5
High					25%	37.5%	37.5%	17.0

3. When the race course has a wind direction that is mostly beating, reaching or running, especially for longer races, the **Predominant course models** should be considered. When wind speed is undefined then the AP mix of wind speeds shown above and is used with the following mix of wind angles for **Upwind, Reaching** and **Downwind** single number scoring options:

True Wind Angle	Upwind	Downwind	Reaching
Beat VMG	32%	8%	8%
52 deg	34%	11%	18%
90 deg	15%	15%	38%
135 deg	11%	34%	28%
Run VMG	8%	32%	8%

4. When the wind speed during any course type can be further refined into a more specific range of wind speeds, the **5-Band system** should be considered to yield even more accurate results. This system identifies ratings for **Low, Low-Medium, Medium, Medium-High** and **High** ranges.

The formulations for each depend on the course type and are summarized here:

For **Windward-Leeward** courses with equal numbers of upwind and downwind legs, the 5-Band **Low, Low-Medium, Medium, Medium-High** and **High** range formulations are summarized here:

TWS	6	8	10	12	14	16	20	24	TWS Avg
Low	77.3	22.7	0	0	0	0	0	0	6.5
Low/Med	14.7	35.3	35.3	14.7	0	0	0	0	9
Med	0	7.7	19.2	46.2	19.2	7.7	0	0	12
Med/High	0	0	0	7.7	19.2	55.8	17.3	0	16
High	0	0	0	0	0	17.3	65.4	17.3	20

For **Windward-Leeward** courses with 3 upwind and 2 downwind legs, the 5-Band **Low, Low-Medium, Medium, Medium-High** and **High** range formulations are summarized here:

60/40 WL. 5-Band Low: avg TWS 6.5 kts			
TWS	6	8	TWA %
Beat VMG	46.4	13.6	60
Run VMG	30.9	9.1	40
TWS %	77.3	22.7	100

60/40 WL 5- Band Low-Med: avg TWS 9 kts					
TWS	6	8	10	12	TWA %
Beat VMG	8.8	21.2	21.2	8.8	60
Run VMG	5.9	14.1	14.1	5.9	40
TWS %	14.7	35.3	35.3	14.7	100

60/40 WL 5-Band Medium: avg TWS 12 kts						
TWS	8	10	12	14	16	TWA %
Beat VMG	4.6	11.5	27.7	11.5	4.6	60
Run VMG	3.1	7.7	18.5	7.7	3.1	40
TWS %	7.7	19.2	46.2	19.2	7.7	100

60/40 WL 5-Band Med-High: avg TWS 16 kts					
TWS	12	14	16	20	TWA %
Beat VMG	4.6	11.5	33.5	10.4	60
Run VMG	3.1	7.7	22.3	6.9	40
TWS %	7.7	19.2	55.8	17.3	100

60/40 WL 5-Band High: avg TWS 20 kts				
TWS	16	20	24	TWA %
Beat VMG	10.4	39.2	10.4	60
Run VMG	6.9	26.2	6.9	40
TWS %	17.3	65.4	17.3	100

For **All Purpose** courses, wind angles are equally distributed across all wind angles from VMG upwind to VMG downwind, and wind speeds described in the 5-Band **Low, Low-Medium, Medium, Medium-High**

All Purpose 5-Band TWS for all TWA's

Linked from Basis Tab

TWS	6	8	10	12	14	16	20	24	TWS Avg	Sum %
Low	77.3	22.7	0	0	0	0	0	0	6.5	100
Low-Med	14.7	35.3	35.3	14.7	0	0	0	0	9	100
Medium	0	7.7	19.2	46.2	19.2	7.7	0	0	12	100
Med-High	0	0	0	7.7	19.2	55.8	17.3	0	16	100
High	0	0	0	0	0	17.3	65.4	17.3	20	100

For **Predominant** courses when the wind speed cannot be defined, there are **Upwind**, **Reaching** and **Downwind single number** rating options that are summarized here:

Predominantly Upwind Single Number - average TWS 11.6 kts

	8	12	16
Beat VMG	10.24	14.72	7.04
52 deg	10.88	15.64	7.48
90 deg	4.8	6.9	3.3
135 deg	3.52	5.06	2.42
Run VMG	2.56	3.68	1.76

Predominantly Downwind Single Number - Average TWS 11.6 kt

TWS	8	12	16
Beat VMG	2.56	3.68	1.76
52 deg	3.52	5.06	2.42
90 deg	4.8	6.9	3.3
135 deg	10.88	15.64	7.48
Run VMG	10.24	14.72	7.04

Predominantly Reaching Single Number - average TWS 11.6 kts

TWS	8	12	16
Beat VMG	2.56	3.68	1.76
52 deg	5.76	8.28	3.96
90 deg	12.16	17.48	8.36
135 deg	8.96	12.88	6.16
Run VMG	2.56	3.68	1.76

For **Predominant Upwind** courses when the wind speed can be described, the 5-Band **Low, Low-Medium, Medium, Medium-High** and **High** wind angle percentage formulations vary and are summarized here:

Predom. Upwind 5-Band Low: avg TWS 6.5 kts

TWS	6	8
Beat VMG	24.736	7.264
52 deg	26.282	7.718
90 deg	11.595	3.405
135 deg	8.503	2.497
Run VMG	6.184	1.816

Predom Upwind 5-Band Low-Med: avg TWS 9 kts

TWS	6	8	10	12
Beat VMG	4.704	11.296	11.296	4.704
52 deg	4.998	12.002	12.002	4.998
90 deg	2.205	5.295	5.295	2.205
135 deg	1.617	3.883	3.883	1.617
Run VMG	1.176	2.824	2.824	1.176

Predom Upwind 5-Band Medium: avg TWS 12 kts

TWS	8	10	12	14	16
Beat VMG	2.464	6.144	14.784	6.144	2.464
52 deg	2.618	6.528	15.708	6.528	2.618
90 deg	1.155	2.88	6.93	2.88	1.155
135 deg	0.847	2.112	5.082	2.112	0.847
Run VMG	0.616	1.536	3.696	1.536	0.616

Predom Upwind 5-Band Med-High: avg TWS 16 kts

TWS	12	14	16	20
Beat VMG	2.464	6.144	17.856	5.536
52 deg	2.618	6.528	18.972	5.882
90 deg	1.155	2.88	8.37	2.595
135 deg	0.847	2.112	6.138	1.903
Run VMG	0.616	1.536	4.464	1.384

Predom. Upwind 5-Band High: avg TWS 20 kts

TWS	16	20	24
Beat VMG	5.536	20.928	5.536
52 deg	5.882	22.236	5.882
90 deg	2.595	9.81	2.595
135 deg	1.903	7.194	1.903
Run VMG	1.384	5.232	1.384

For **Predominant Reaching** courses when the wind speed can be described, the 5-Band **Low, Low-Medium, Medium, Medium-High** and **High** wind angle percentage formulations vary and are summarized here:

Predom. Reaching 5-Band Low: avg TWS 6.5 kts

TWS	6	8
Beat VMG	6.184	1.816
52 deg	13.914	4.086
90 deg	29.374	8.626
135 deg	21.644	6.356
Run VMG	6.184	1.816

Predom. Reaching 5-Band Low-Med: avg TWS 9 kts

TWS	6	8	10	12
Beat VMG	1.176	2.824	2.824	1.176
52 deg	2.646	6.354	6.354	2.646
90 deg	5.586	13.414	13.414	5.586
135 deg	4.116	9.884	9.884	4.116
Run VMG	1.176	2.824	2.824	1.176

Predom. Reaching 5-Band Med - avg TWS 12 kts

TWS	8	10	12	14	16
Beat VMG	0.616	1.536	3.696	1.536	0.616
52 deg	1.386	3.456	8.316	3.456	1.386
90 deg	2.926	7.296	17.556	7.296	2.926
135 deg	2.156	5.376	12.936	5.376	2.156
Run VMG	0.616	1.536	3.696	1.536	0.616

Predom. Reaching 5-Band Med-High: avg TWS 16 kts

TWS	12	14	16	20
Beat VMG	0.616	1.536	4.464	1.384
52 deg	1.386	3.456	10.044	3.114
90 deg	2.926	7.296	21.204	6.574
135 deg	2.156	5.376	15.624	4.844
Run VMG	0.616	1.536	4.464	1.384

Predom. Reaching 5-Band High: TWS 20 kts

TWS	16	20	24
Beat VMG	1.384	5.232	1.384
52 deg	3.114	11.772	3.114
90 deg	6.574	24.852	6.574
135 deg	4.844	18.312	4.844
Run VMG	1.384	5.232	1.384

For **Predominant Downwind** courses when the wind speed can be described, the 5-Band **Low, Low-Medium, Medium, Medium-High** and **High** wind angle percentage formulations vary and are summarized here:

Predom. Downwind 5-Band Low: avg TWS 6.5 kts

TWS	6	8	10
Beat VMG	6.184	1.816	0
52 deg	8.503	2.497	0
90 deg	11.595	3.405	0
135 deg	26.282	7.718	0
Run VMG	24.736	7.264	0

Predom. Downwind 5-Band Low-Med: avg TWS 9 kts

TWS	6	8	10	12
Beat VMG	1.176	2.824	2.824	1.176
52 deg	1.617	3.883	3.883	1.617
90 deg	2.205	5.295	5.295	2.205
135 deg	4.998	12.002	12.002	4.998
Run VMG	4.704	11.296	11.296	4.704

Predom. Downwind 5-Band Medium: avg TWS 12 kts

TWS	8	10	12	14	16
Beat VMG	0.616	1.536	3.696	1.536	0.616
52 deg	0.847	2.112	5.082	2.112	0.847
90 deg	1.155	2.88	6.93	2.88	1.155
135 deg	2.618	6.528	15.708	6.528	2.618
Run VMG	2.464	6.144	14.784	6.144	2.464

Predom. Downwind 5-Band Med-High: avg TWS 16 kts

TWS	12	14	16	20
Beat VMG	0.616	1.536	4.464	1.384
52 deg	0.847	2.112	6.138	1.903
90 deg	1.155	2.88	8.37	2.595
135 deg	2.618	6.528	18.972	5.882
Run VMG	2.464	6.144	17.856	5.536

Predom. Downwind 5-Band High: avg TWS 20 kts

TWS	16	20	24
Beat VMG	1.384	5.232	1.384
52 deg	1.903	7.194	1.903
90 deg	2.595	9.81	2.595
135 deg	5.882	22.236	5.882
Run VMG	5.536	20.928	5.536

5. For 2024 there are also several scoring models that are specific to races held around the USA: these include the **Bayview Mackinac Race**, the **Chicago to Mackinac Race**, the **Harvest Moon Regatta** and the **St Francis YC's Rolex Big Boat Series**. Here is a summary of these models:

Harvest Moon Regatta - single number Time on Time, avg TWS 14.1 kts

Wind Spd (kts)	6	8	10	12	14	16	20	Sum
Optimum Beat	0.5%	1.0%	1.0%	0.5%	0.5%	0.0%	0.0%	3.5%
60° Reach	1.0%	2.0%	2.0%	4.0%	4.0%	1.0%	0.0%	14.0%
90° Reach	0.0%	0.0%	5.0%	6.5%	6.5%	8.0%	5.0%	31.0%
120° Reach	0.0%	0.0%	1.0%	5.5%	8.0%	8.0%	4.0%	26.5%
150° Reach	0.0%	0.0%	1.0%	3.0%	5.0%	5.0%	4.0%	18.0%
Optimum run	0.5%	0.5%	0.5%	0.5%	2.0%	2.0%	1.0%	7.0%
	2.0%	3.5%	10.5%	20.0%	26.0%	24.0%	14.0%	100.0%

Bayview Mac Shore Course - single number Time on Time, avg TWS 9.7 kts

Wind Spd (kts)	6	8	10	12	16	Sum%
VMG Upwind	5.0	5.3	5.0	3.0	1.0	19.3
60° reach	5.0	5.3	5.0	3.0	1.0	19.3
90° reach	3.0	4.8	5.0	5.0	3.0	20.8
120° reach	2.0	4.1	5.0	5.5	3.5	20.1
VMG Down	5.0	5.6	5.0	3.5	1.5	20.6
	20.0	25.0	25.0	20.0	10.0	100.0

Courses used in the **Chicago to Mackinac Race**. Each model yields a single number Time on Time rating:

Chicago Mac Race Upwind - avg TWS 11.5 kts

Wind Spd (kts)	6	8	10	12	16	20	TWA
Optimum Beat	1.8%	5.3%	10.5%	10.5%	5.1%	1.6%	34.7%
52° Reach	1.4%	4.4%	9.0%	9.3%	5.1%	1.8%	31.0%
90° Reach	0.8%	2.3%	4.5%	4.5%	2.4%	0.9%	15.3%
135° Reach	0.6%	1.8%	3.3%	3.3%	1.5%	0.5%	11.0%
Optimum run	0.5%	1.4%	2.7%	2.4%	0.9%	0.3%	8.1%
TWS	5.0%	15.0%	30.0%	30.0%	15.0%	5.0%	100%

Chicago Mac Race Offwind - avg TWS 11.5 kts

Wind Spd (kts)	6	8	10	12	16	20	TWA
Optimum Beat	0.5%	1.4%	2.7%	2.4%	0.9%	0.3%	8.1%
52° Reach	0.6%	1.8%	3.3%	3.3%	1.5%	0.5%	11.0%
90° Reach	0.8%	2.3%	4.5%	4.5%	2.4%	0.9%	15.3%
135° Reach	1.4%	4.4%	9.0%	9.3%	5.1%	1.8%	31.0%
Optimum run	1.8%	5.3%	10.5%	10.5%	5.1%	1.6%	34.7%
TWS	5.0%	15.0%	30.0%	30.0%	15.0%	5.0%	100%

Chicago Mac Race All-Purpose - avg TWS 11.5 kts

Wind Spd (kts)	6	8	10	12	16	20	TWA
Optimum Beat	1.5%	3.9%	6.9%	6.0%	2.4%	0.6%	21.3%
52° Reach	0.7%	2.4%	5.4%	6.0%	3.2%	1.1%	18.8%
90° Reach	0.7%	2.4%	5.4%	6.0%	3.9%	1.6%	20.0%
135° Reach	0.7%	2.4%	5.4%	6.0%	3.2%	1.1%	18.8%
Optimum run	1.5%	3.9%	6.9%	6.0%	2.4%	0.6%	21.3%
TWS	5.0%	15.0%	30.0%	30.0%	15.0%	5.0%	100%

Courses used in the **StFYC's Rolex Big Boat Series Bay Tour**. Each model yields a single number Time on Time rating:

Bay Tour 5-Band Low: avg TWS 6.5 kts

TWS	6	8	TWA %
Beat VMG	38.19	11.22	49.41
52°	1.24	0.36	1.6
60°	0.00	0.00	0
75°	0.00	0.00	0
90°	0.00	0.00	0
110°	0.80	0.23	1.03
120°	2.14	0.63	2.77
135°	6.18	1.82	8
150°	6.88	2.02	8.9
Run VMG	21.87	6.42	28.29
TWS %	77.3	22.7	100

Bay Tour 5-Band Low/Med: avg TWS 9 kts

TWS	6	8	10	12	TWA %
Beat VMG	7.26	17.44	17.44	7.26	49.41
52°	0.24	0.56	0.56	0.24	1.6
60°	0.00	0.00	0.00	0.00	0
75°	0.00	0.00	0.00	0.00	0
90°	0.00	0.00	0.00	0.00	0
110°	0.15	0.36	0.36	0.15	1.03
120°	0.41	0.98	0.98	0.41	2.77
135°	1.18	2.82	2.82	1.18	8
150°	1.31	3.14	3.14	1.31	8.9
Run VMG	4.16	9.99	9.99	4.16	28.29
TWS %	14.7	35.3	35.3	14.7	100

Bay Tour 5-Band Medium: avg TWS 12 kts

TWS	8	10	12	14	16	TWA %
Beat VMG	3.80	9.49	22.83	9.49	3.80	49.41
52°	0.12	0.31	0.74	0.31	0.12	1.60
60°	0.00	0.00	0.00	0.00	0.00	0.00
75°	0.00	0.00	0.00	0.00	0.00	0.00
90°	0.00	0.00	0.00	0.00	0.00	0.00
110°	0.08	0.20	0.48	0.20	0.08	1.03
120°	0.21	0.53	1.28	0.53	0.21	2.77
135°	0.62	1.54	3.70	1.54	0.62	8.00
150°	0.69	1.71	4.11	1.71	0.69	8.90
Run VMG	2.18	5.43	13.07	5.43	2.18	28.29
TWS %	7.7	19.2	46.2	19.2	7.7	100

Bay Tour 5-Band Med/High: avg TWS 16 kts

TWS	12	14	16	20	TWA %
Beat VMG	3.80	9.49	27.57	8.55	49.41
52°	0.12	0.31	0.89	0.28	1.60
60°	0.00	0.00	0.00	0.00	0.00
75°	0.00	0.00	0.00	0.00	0.00
90°	0.00	0.00	0.00	0.00	0.00
110°	0.08	0.20	0.57	0.18	1.03
120°	0.21	0.53	1.55	0.48	2.77
135°	0.62	1.54	4.46	1.38	8.00
150°	0.69	1.71	4.97	1.54	8.90
Run VMG	2.18	5.43	15.79	4.89	28.29
TWS %	7.7	19.2	55.8	17.3	100

Bay Tour 5-Band High: avg TWS 20 kts

TWS	16	20	24	TWA %
Beat VMG	8.55	32.31	8.55	49.41
52°	0.28	1.05	0.28	1.6
60°	0.00	0.00	0.00	0
75°	0.00	0.00	0.00	0
90°	0.00	0.00	0.00	0
110°	0.18	0.67	0.18	1.03
120°	0.48	1.81	0.48	2.77
135°	1.38	5.23	1.38	8
150°	1.54	5.82	1.54	8.9
Run VMG	4.89	18.50	4.89	28.29
TWS %	17.3	65.4	17.3	100