



World Leader in Rating Technology

OFFSHORE RACING CONGRESS



**Guide to Race Management and Scoring
of IMS and ORC Club**

OFFSHORE RACING CONGRESS
IMS GUIDE for Race Committees & Owners
The International Measurement System
&
ORC Club
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1. INTRODUCTION

IMS was introduced as International system in 1985, after being developed in the USA by the Massachusetts Institute of Technology and used in several races since 1978. The initial development was relatively slow, due to the necessity of measuring a large number of hulls, but by 1987 it was widely adopted as the default and main handicapping system in Germany, Holland, England and other nations of Northern Europe.

In the Mediterranean the system has been introduced in 1990, and in the following years it has quickly replaced the IOR also at the top level of racing. The IOR had been used for two decades as the main system for handicap races and to set the "level classes" racing in the International "ton cups".

The transition from IOR to IMS has been made easier by the fact that only the hull needs to be specially measured for the IMS; all other data, including freeboards and stability which are a prerogative of IMS were already part of the IOR set of measurements.

Being quickly exposed to the top level of racing, IMS has been put under increasing pressure by designers owners and professional sailors in general, who were able year after year to build and race ever faster boats, with a better rating. Production boats, when sailed at the same professional level of the custom one offs have been able to be very competitive, and often win important trophies. In 1999 the first IMS World Championship was held.

This guide is designed to provide race organisers with the necessary information to manage races held under the ORC's International Measurement System (IMS) and its companion ORC Club. Competitors may find this guide helpful to understand how IMS works. ORC Club certificates display a reduced set of handicaps, but their "RMS" files can be used exactly as IMS data.

IMS is a sophisticated system for measuring yachts, predicting their speed under various sailing conditions, producing handicaps and calculating race results. This document will briefly explain the theoretical background of the speed predictions and how to translate this in practice through the many scoring methods available. Once a basic understanding of the principles of IMS is achieved, these methods are easily grasped so that they can be further explained to more sailors, in whatever language.

Specific explanation of the operation of the official ORC-computer programs can be found in the software manuals, delivered together with the programs.

Both manuals are downloadable for free from the ORC homepage at www.ORB.org. There are in existence other programs which are not fully covering the IMS scoring methods, but can read and import data from the same database files (RMS) and deliver the same results, limited to the options available by the individual software.

2. MEASUREMENT

In order to enable the optimization algorithms of the VPP, able to calculate the fastest boat speed for any given wind speed and angle, there must be available a good deal of information about the size and shape of the different parts of the boat such as hull, keel, rudder, other appendages, in addition to the spars and sails and crew weight quantities.

A sophisticated method for measuring the shape of the hull was developed at the initial stages of IMS designing and building an electronically controlled measurement machine, interfaced and wired to a computer.

The other measurements have been inherited by the IOR, and developed afterwards to account for evolving features as asymmetric spinnakers and stability enhancing devices. Measurements are performed by official measurers for IMS, but can be assumed from sistership data and/or based on Owners provided data for ORC Club.

Hull measurement:

The measurement of the hull and its appendages is performed with a special measurement machine, that was designed and built for the purpose in the early 80s in two models, one American and the other German, which were manufactured in about 50 units each, and are still in use in several parts of the world. The yacht has to be out of the water and placed on the ground, where the machine can be positioned and displaced along a straight line on both sides, moving the equipment and re-levelling it in sequence at each station to be digitized along the full length of the hull.

The machine is operated through a wand which is connected with strings wound on rotating drums, and connected to a digital board placed in the machine "head", which is connected by wire to a computer.

A number of points along a vertical transverse section are sampled on the hull from the bottom up to the sheer, locating and touching the hull surface with the wand tip, then pressing a button. Each time the button is pressed the information about the wand's head hence the string elongation and angle are sent to the computer.

To follow the vertical line on each station of the hull to be measured, a strain gauge connected to the wand's string follower arm to verify the correct longitudinal position in the case of the US HMI, or the spot of a laser beam in case of the German Hullscanner.

When all the stations on both sides of the hull and its appendages are measured the data are processed by a conversion software to produce an "OFF" file. The OFF file is read by the LPP to be able to calculate all parameters contemplated by IMS LPP and VPP, using the points acquired on a given number of stations (typically between 20 and 50). IMS differs fundamentally from all other systems, which all depend on an extremely limited number of measurement points. Several experimental hull measurements have been performed with reflectorless laser equipments known as "total stations" and with "3d scanners". Both methods have been used to obtain OFF files without using the old machines, and several people around the world are working at further experiments and tests to make the procedure more streamlined and effective.

In-water measurement:

The yacht rests in the water in "measurement trim". See IMS Rule 402.2 for the rules about what should or should not be on board for this measurement. Freeboards are measured on stations identified by their distance from the extreme hull bow (SFFP and SAFFP) and their measured values will result in a calculated displacement following Archimede's principle.

Freeboard checks have an important meaning in IMS to precisely determine the boat displacement, but not as much in ORC Club when the hull used for certification is not a measured one.

The inclining test is executed to determine the height of the center of gravity (VCG) through the measurement of the righting moment (RM), moving weights from side to side on spinnaker poles rigged athwartships. A Stability Curve plot can be obtained by IMS and ORC Club data, but it only makes sense when hull and afloat measurement are complete.

Measurement of rig and sails and propeller installation.

IMS takes the actual size of the biggest headsail, spinnaker and/or gennaker and mainsail. Miscellaneous data are also taken such as propeller installation, boom and mast dimensions, forestay, spin-pole length, running backstays, etc.

3. SPEED PREDICTION

The Line Processing Program (LPP) calculates hydrostatic data such as wetted surface, displacement and stability at various heel angles. It provides the necessary input data for another computer module called: Velocity Prediction Program (VPP). This is a computer simulation model, whose formulae and coefficients are based on experiments with a fleet of yacht models performed in the past in towing tanks. The VPP takes into account many variables. It calculates the resistance of the hull in the water in racing trim i.e. with full

crew weight and all the equipment on board, under different angles of heel. It calculates the forces from the rig driving the yacht forward and pushing it sideways with all possible sail configurations, and finally selects the optimum configuration (the one giving the maximum speed) for any of the many calculated points. The effect of crew weight distribution on stability, and thus sail carrying capacity is calculated, as well as added resistance in waves for various sea conditions.

All the calculations performed by LPP and VPP are used to obtain results that will be printed on certificates in a table of speed predictions for different wind speeds and wind angles. These speed predictions are presented on the Rating Certificate, but can also be presented in a different form of calculation and graphically in a polar diagram (Appendix 3).

4. HANDICAPPING AND SCORING

Now we come to the part of the IMS where the race committee steps into the picture: SCORING. Using IMS the race managers have some role in making decisions that may have an impact on the final results, and has no precedent in the traditional and current single-number systems. Until the introduction of IMS, the measurement Rules were producing a single “rating” value, typically a length, from which a handicap was derived in the form of a coefficient to be used with the time-on-time method, or a seconds per mile time allowance to be used with the time-on-distance method. This single handicap was used irrespective of the sailing conditions, so giving one or another boat some advantage depending on the sailing conditions encountered. IMS can give variable handicaps depending on the conditions during the race, but provides also a range of simplified options to be used to adjust to local practices, weather situations and degree of understanding. Race managers must therefore be prepared to provide the correct and adequate information about the methods used and how the handicaps can vary within the fleet when they want to use IMS at its full potential, using the constructed course/PCS scoring option.

Several alternatives to the fully constructed methods of scoring are described and explained in the paragraphs that follow.

4.1 Software

There are several scoring software packages available for yacht races, but only 2 allow the use of the full set of options provided by the IMS, “Altura” and “Velum NG”.

Other available scoring software packages can handle simplified options, as the Dutch “ZW” and the French “Freg”. Some of them can import the certificate data from the “RMS” files, which are generated collecting and arranging the certificate data in a standard format.

With the simplified options it is possible to calculate results by hand, although nobody would do it these days. This is convenient however for the competitors in order to convince themselves that the results are correct.

In case the constructed course is used, it is very important to produce the “scratch sheets” which show to the competitors how their handicaps vary as a function of wind speed for any given course.

4.2 Single Number Scoring

It is the baseline system, which can be used in the two options of time-on-time or time-on-distance. The recommended single scoring options are GPH for offshore or coastal races where the wind direction cannot be determined and the ILC for round the buoys races, with approximately half of the course sailed upwind. Apart from these two recommended single number options, in fact any value printed on the certificate, or derived through a custom course construction could be used as a single number handicap. The GPH is printed on a special box and represents the most “general” number used also to set class limits.

4.2.1 General Purpose Handicap GPH – offshore

This single handicap number is used for offshore races and is the average of Circular Random handicaps for 8 knots and 12 knots of wind speed taken from the IMS certificate. GPH is printed separately on top the Rating Certificate. Basically, GPH is not different from any other single number handicap system. The

difference lies in the more sophisticated way of measuring the yachts and the more scientific basis of speed prediction of IMS.

GPH is often used in offshore races where a simplified method (single value) of scoring is required.

Using Time-on-Distance GPH is expressed in seconds per nautical mile – to be understood as time allowance. Therefore

$$\text{Corrected time} = \text{Elapsed time} - (\text{GPH} \times \text{Distance})$$

Note: using the formula above when the race is fast there is the risk of obtaining negative corrected times. Therefore it is a standard practice to identify a “scratch” boat (usually the fastest in the fleet) and replace GPH in the formula by (GPH-GPH_scratch). This will result in a corrected time identical to the elapsed time for the scratch boat, and a corrected time less than the elapsed for the rest of the fleet. The selection of the “scratch” boat has no influence on the results, just on the numerical values of the corrected times.

To use the Time-on-Time a time multiplying factor is derived as:

$$TMF = 600 / GPH$$

This produces a Time Multiplying Factor (TMF) with 4 decimals.

In this case

$$\text{Corrected time} = TMF \times \text{Elapsed time}.$$

The advantages of one method over the other has been discussed among sailors and race experts since the beginning of handicap racing, and remains unresolved. At a certain speed of the race the two methods produce the same result. When the race is slow the smaller (slower) boats have an advantage over faster ones using time-on-time, and the opposite happens when the race is fast. An advantage of the time-on-time is that the course distance does not need to be measured (or corrected in presence of strong tide).

4.2.2 Inshore Handicap ILC – inshore

This single handicap number is used for inshore races at sheltered areas, and is based on the following matrix:

Course (Weight) Wind (Weight)	VMG Beat (50%)	110° Reach (20%)	VMG Run Downwind (30%)
6 kts (24%)	12,00% * TA	4,80% * TA	7,20% * TA
10 kts (34%)	17,00% * TA	6,80% * TA	10,20% * TA
20 kts (42%)	21,00% * TA	8,40% * TA	12,60% * TA

TA = Time Allowance as found in the IMS certificate as ILC

The calculated ILC handicap is defined as the average of its time allowances (TA) in the nine conditions above multiplied by their respective weights. To arrive at the combined weight factor we multiply the wind speed weight factor with the course weight factor, As an example, the contribution to ILC of VMG Beat at 6kts is 12% (24% * 50%).

The ILC number is printed in the “simplified scoring options” field at the bottom of the certificate.

The corrected time is calculated exactly as described above for GPH, except that a different coefficient is used to calculate the Time Multiplying Factor:

$$TMF = 675 / ILC$$

This produces a Time Multiplying Factor (TMF) with 4 decimals.

4.3 Variable Handicap Scoring

The unique feature of IMS, making it fundamentally different from any other handicap system and much more precise, is its capacity to give and rate different handicaps for different race conditions because yachts do not have the same performance in different conditions.

This means that yachts will have a different time allowance in each race depending on the weather conditions and the course configuration for that particular race. This gives consideration to the fact that yachts can behave very differently according to their characteristics. For example, heavy under canvassed boats are slow in light airs but fast in strong winds. Boats with deep keels go well to windward and light boats with small keels go fast downwind.

4.3.1 Tri-Number scoring

This method of scoring originates from the Netherlands and is the simplest option that combines the easiness of use of the single number scoring with the variability allowed by IMS. The Triple-Number system provides a set of three TMFs for each of two course types:

- a) Windward/Leeward
- b) Circular Random.

Within each of these two course types TMFs are given for three wind ranges:

- 1) Low range (less than 9 knots)
- 2) Medium range (equal or more than 9 but less than 14 knots)
- 3) High range (14 or more knots)

In practice, the course selection for a race is pre-specified and the race committee signals at the start which number will be used for scoring. The TMFs displayed on the certificate are derived as follows. The three wind velocity ranges (Hi, Medium, Low) are each comprised of weighted averages of several Time Allowances (sec/mi) selected from the familiar seven IMS wind speeds. The "cookbook" recipe for proportions in each of the three wind ranges is given in the table below. The result is a form of wind-averaging for each of the three Triple Number wind ranges.

Wind Speed:	6 kt	8 kt	10 kt	12 kt	14 kt	16 kt	20 kt
Low Range	1 part	1 part					
Med Range		1 part	4 parts	4 parts	3 parts		
Hi Range					2 parts	3 parts	3 parts

Once a single weighted average sec/mi Time Allowance has been calculated for each of the three wind ranges, these are converted to a TMF by the formula $TMF = 675/TA$.

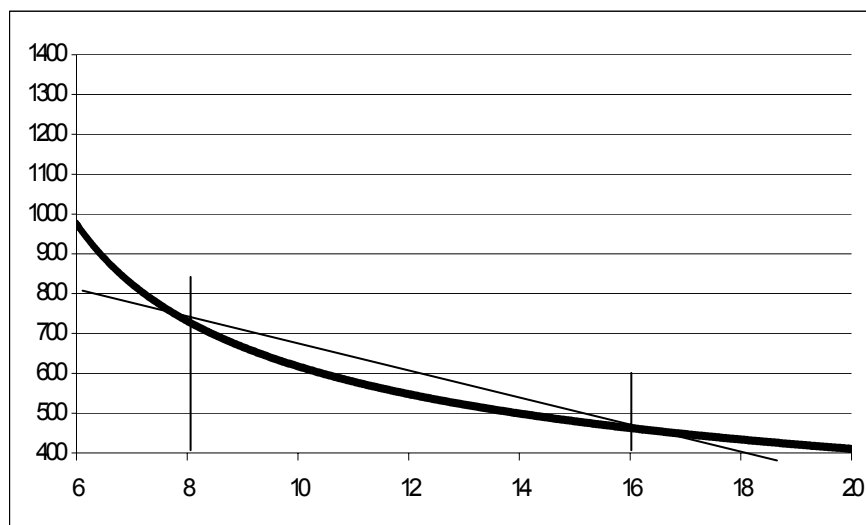
The 3 numbers at the base of the system can be calculated also on different courses or using a different "cookbook", as it is allowed by some scoring softwares.

The system relies on the Race Committee decision for the choice of the handicap, and may become controversial when the wind during a race increases (or decreases) above (or below) the one announced prior to the start.

4.3.2 Performance Line Scoring

Performance Line Scoring is a simplified variation of Performance Curve Scoring, explained further down in 4.3.3. As the name tells it works with lines instead of curves and can easily be used with a pocket calculator or simple computer program/spread-sheet as Excel, and can be checked on board racing boats when times and distances sailed are known.

The performance line is established calculating the coefficients of a straight line intercepting the performance points of 8 and 16 knots of wind for a given course. The base points can be based on different wind speeds, obtaining different coefficients.



There are two options of PLS, PL-Offshore and PL-Inshore.

- PL-Offshore bases on the Ocean Course Type and therefore is best suited for long distance/ offshore races with a relatively high content of reach and downwind angles.
- PL-Inshore is based on Olympic triangle type of course, with approx. 55% beat and 45% reach- and downwind angles, so is best suited for inshore round the bouys races.

It is not necessary for the race committee to obtain wind speed prediction or measure actual wind speeds when PLS is used. The corrected time will be calculated by means of sailed distance and elapsed time as follows:

$$cT = (TMF * eT) - (DMF * sD)$$

cT = corrected Time in seconds

eT = elapsed Time in seconds

sD = sailed Distance in nautical miles

TMF = Time Multiplying Factor printed as PLT on the IMS certificate

DMF = Distance Multiplying Factor printed as PLD on the IMS certificate

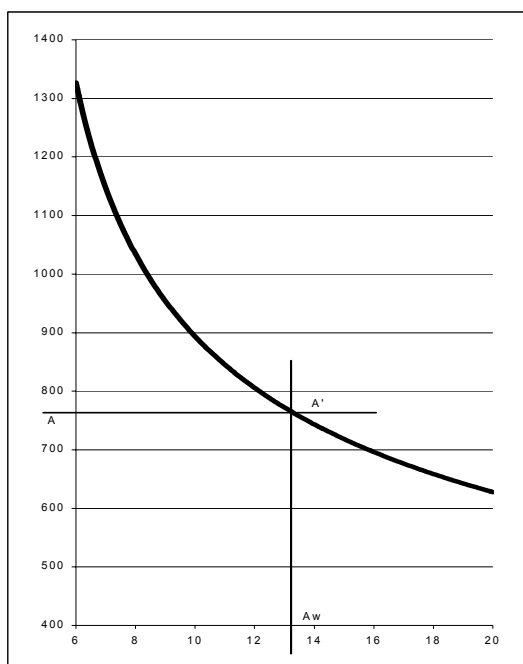
The two coefficients vary considerably among the fleet, and it is not obvious without performing any calculation to determine which boat is faster and which is slower.

There is no limit to the range of application of the performance line, so in cases of extremely slow, or extremely fast races the relative handicaps may considerably diverge from what they are in the typical range as calculated by IMS.

4.3.3 Performance Curve Scoring

The method known as "PCS" works as follows:

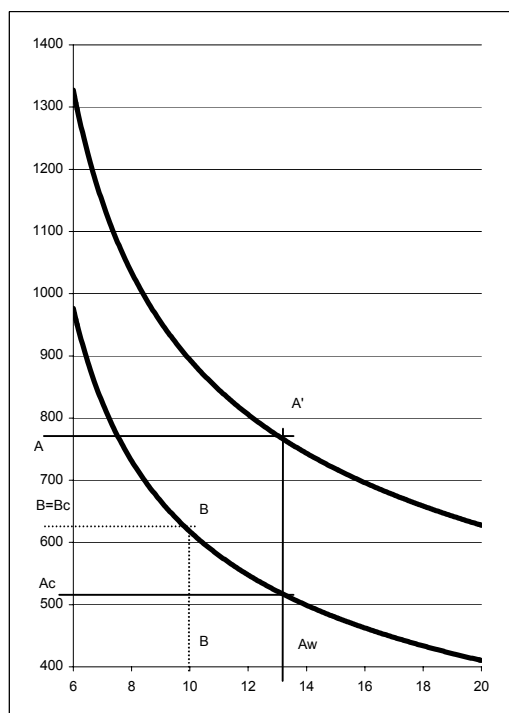
For any type of course for a given race a set of 7 values is derived by the computer program constructing each of them as a function of length, bearing and wind direction for each leg of the course. The points so obtained are linked by a curve which represents the predicted optimum performance along a scale of wind speeds (page 9). This curve is called the Performance Curve, and for each yacht this curve is different for any different course sailed.



PERFORMANCE CURVE

The vertical axis represents the speed achieved in the race, expressed in seconds per mile. The horizontal axis represents the wind speed in knots. When the finishing time of Yacht A is known, its elapsed time is divided by the distance of the course to determine the average speed in seconds per mile. This number is represented by point A on the vertical axis. The computer then finds the point on the curve that corresponds for that course to the average speed obtained. This results in point Aw, the so called "Implied Wind". This means that the yacht has completed the course "as if" it has encountered that wind speed. The faster the boat has sailed, the higher the Implied Wind, which is the primary index for scoring. The yacht with the highest Implied Wind wins the race. The Implied Wind is then transformed into a corrected time.

The Implied Wind is intended as an interpolation between time allowances, not an extrapolation. This means that when the Implied Wind drops below 6 knots or raises above 20 knots, the time allowances used for calculating the corrected times will be those of 6 knots and 20 knots respectively. This does not mean that IMS races need to be stopped (or not started) with wind below 6 knots or above 20. When the "implied wind" results to be less than 6 knots or more than 20, the respective values are used, as using a "fixed wind" option.



PERFORMANCE CURVE SCORING (with Scratch Boat)

In order to present the result of the race in a comprehensive format we use a "Scratch Boat". In most cases this is the potentially fastest boat of the fleet, yacht B. Her Performance Curve is the lowest in the drawing. From the point where the vertical line yacht A intersects with the curve of the Scratch Boat, a horizontal line is drawn to the left towards the vertical axis. This point, Ac, produces the corrected time when the seconds per mile are multiplied by the distance of the course in miles. The corrected time of the Scratch Boat is, by definition, the same as its elapsed time. This exercise produces corrected times, expressed in hours, minutes and seconds, a format most sailors are familiar with.

4.4 Course Selection

4.4.1 Constructed Course

The best method to determine the correct wind angles over the course is to construct it leg by leg. A provision for this is incorporated in the ORC Scoring software programs. To be able to use constructed course, the race committee must gather the course information, and determine the wind direction and the length of each leg of the race.

The computer operator enters data about the bearing and the length of each leg of the race, the direction of the wind on each leg and, optionally, the direction and rate of the current on each leg. Any leg can be split in sub-legs in case there is a marked shift.

Once all data are entered, the computer calculates the mix of wind angles and distance through the water for each yacht for 7 wind speeds, corrected for the tide in it is also entered. The constructed course method is usually associated with the performance curve system, but in particular cases or for special reasons it can also be used with fixed wind speed as described in the following paragraph.

4.4.2 Constructed Course with fixed windspeed

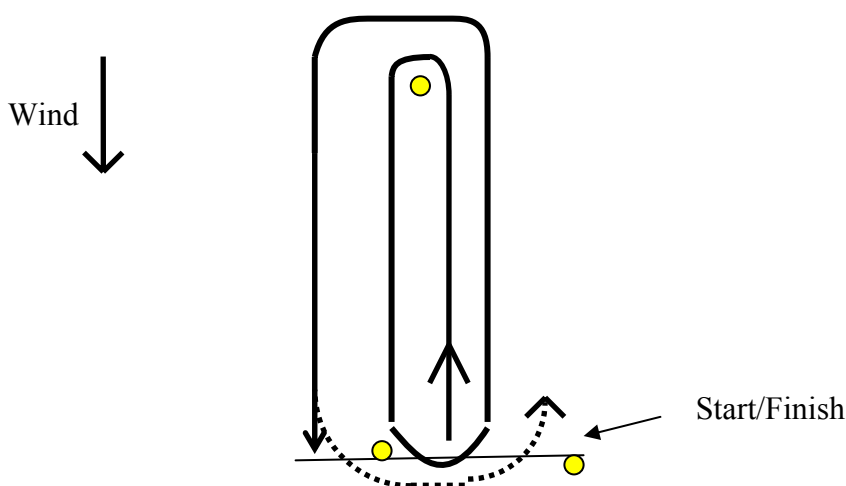
The course constructed table of time allowances provided by the scoring software can also be used with a fixed windspeed. This can be a single windspeed for the whole race, or split in a windspeed for each leg of the constructed course.

4.4.3 Selected Courses

As an alternative to the constructed course method on the IMS certificate there are a number of “selected” courses based on different types of courses described in the following paragraphs. All the time allowances are “wind averaged”, which means that their values are not just the results of the VPP calculations for each wind speed considered, but are “smoothed” through a complex algorithm that takes into account also the values of higher and lower wind speeds.

They can be used with the Performance Curve method, setting a Performance Line passing through any couple of calculated points or picking any one of the numbers.

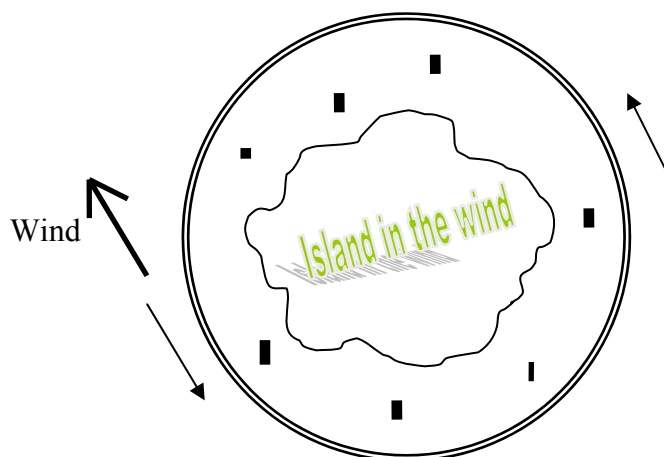
A: Wnd/Lwd (Windward/Leeward)



This is the conventional Windward–Leeward Course (up and down) around Windward and Leeward marks. Usually the race course shall consist of 50% up- and downwind legs. If any other combination is used, the

course setup should be made from the “constructed course”. Note that the handicap values (TA) for the Wnd/Lwd - course printed on the certificate show VMG datas (velocity made good), not actual boat speed.

B: CircularRandom



This handicap is calculated simply averaging the boat speeds around the circle, from VMG downwind to VMG upwind in 2 degrees intervals. It can be represented by a hypothetical course sailing on a perfectly circular course (for instance around an island) in a steady wind.

C: Non-Spinnaker

The same procedure used to calculate Circular Random is performed on the polars calculated by the VPP without setting a spinnaker on the rig. In case of mizzen mast rigs, the calculation will include a mizzen staysail if the yacht was measured with one.

D: Ocean for PCS

This course type was especially designed for the Bermuda Race, but can be used in other offshore races of long distances where the fleet will be widely spread, a wide range of wind and sea conditions can be expected and which cannot be accurately predicted. It is a composite course, the content of which varies progressively from 30% Windward/Leeward and 70% Circular Random at 6 knots of wind speed to 100% Circular Random at 12 knots of wind speed and then to 20% Circular Random and 80% reaching at 20 knots of wind speed.

These Fixed Course Types are presented on the Rating Certificate with handicaps for different wind speeds, expressed in seconds per mile. The race committee can either try to lay the course as precisely as possible to match a course configuration on which the handicaps are based on, or choose the handicap which is closest to the actual course. Most important for this choice is to take into account the beat content of the course!

For example, when the actual course has a beat content of app. 50%, the w/l course should be chosen. If the beat content is much less, the circular random or the ocean course are more appropriate.

APPENDIX 1: IMS certificate

ORC

SAIL LIMITATIONS
REGULATION 205

Genoa's	:	3
Jibs	:	2
Spinnakers	:	3

MAXIMUM STORM SAILS AREAS FOR SPECIAL REGS	
Heavy Weather Jib	28.9
Storm Jib JL=31.19	10.7
Storm Trysail	15.3

Default Crew Weight	688
Default Spinn. Luff	14.42
Default Spinn. Foot	7.65

HEAVY ITEMS	NO
Bow Thruster	NO
Anchor Windlass	NO
Heavy Deck	NO
Deck Int. Headliners	NO
High Superstructures	NO
Electric Generator	NO
Air C.+Diss.+Water H	NO
Liferafts on Deck	NO
Radar on Stern/*Mast	NO
Jib Furler	NO
*Main Furler	NO

* (if not included in MWT)

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This section can be
customized with Rating
Office info & graphics

IMS AMENDED TO JANUARY 2007 VPP: 24/JAN/07 11:07:33
Cert No 12345 4 PARAIMS.DAT 18/MAR/05 15:34:38
OFF Meas'd: 22/MAY/91 PARAVIRT.OFF 05/JUN/92 14:08:30

ECM	0.000	CBRC	0.000	CBMC	0.000	CBTC	0.000
WCBA	0.0	CBDA	0.000	KCDA	0.000	ECE	0.000
WCBB	0.0	CBDB	0.000	ENDPLATE ADJ (KEDA)	0.000		
PRD	0.434	PBW	0.120	PHD	0.044	PHL	0.153
ST1	0.026	ST2	0.105	ST3	0.105	ST4	0.057
PSA	18.000	PSD	0.028	PIPA	0.0036		

FFPS	1.372	AFPS	1.029	FFPV	0.614	SAFP	11.190
FFM	1.228	FAM	1.009	FFPV	0.000	AFPV	0.000
FF	1.229	FA	1.010			SG	1.023

STABILITY DATA

W1	17.000	PD1	39.000	PLM	1516.000	PL	1502.792
W2	34.000	PD2	75.000	GSA	28.274	RSA	3216.9
W3	51.000	PD3	119.000	SMB	7.327	WD	12.025
W4	68.000	PD4	156.000	RM	137.1	RMC	137.1
RM2	141.5	RM20	132.2	RM40	112.6	RM60	79.2
RM90	35.6	WBV	0.0	CREW ARM (CRA)	1.757		

CALCULATED LIMIT OF POSITIVE STABILITY: 121.5 DEGREES

RATIO STABILITY CURVE AREAS, POSITIVE/NEGATIVE: 3.286

KEEL DRAFT	(DHKO)	2.305	(DHKA)	2.353
2ND MOMENT LENGTH	(LSMO)	10.013	(LSM1)	10.383
DISPLACEMENT (WEIGHT)	(DSPM)	5747	(DSPS)	6679
WETTED SURFACE	(WSM)	26.41	(WSS)	28.04
VCG FROM OFFSETS DATUM (FOR CLUB RM)	(VCGD)	-0.014		
VCG FROM MEASUREMENT TRIM WATERLINE	(VCGM)	-0.091		
INTEGRATED BEAM ATTENUATED WITH DEPTH (B)		2.942		
MAXIMUM SECTION AREA	(AMS1)	1.345		
BEAM/DEPTH RATIO	(BTR)	4.344		
EFFECTIVE DRAFT	(D)	2.057		
2° HEEL (LSM2)	10.387	25° HEEL (LSM3)	10.304	
SUNK (LSM4)	11.997	AVG LENGTH (L)	10.466	
TRIM: 1mm/9.251m-kG		SINK:	1mm/19.584kg	

SAIL AREAS:

MAIN+FORE+MIZ'N:	83.49	MAIN:	52.41	MIZ'N:	0.00
GENOA:	48.70	SYM:	103.69	ASYM:	0.00

FORETRIANGLE

J	4.250	FSP	0.066	HB	0.220	TH	NO
IG	14.521	LPG	6.33	MG	1.24	TL	2.500
MW	0.189	LP	6.40	MGT	2.13	MDT1	0.103
GO	0.219	JL	0.00	MGM	3.65	MDL1	0.165
ISP	14.571	JGT	0.00	MGL	4.78	MDT2	0.075
IM	14.624	JGU	0.00	MSW	24.0	MDL2	0.089
HBI	1.085	JGM	0.00	F	15.505	MGT	0.0
SFJ	4.232	JGL	0.00	E	5.627	MCG	0.000
SPL	4.232	TPS	0.000	EC	5.636	ED	0.182
SL	14.39	ASL		BAS	1.886	CPW	2.900
SW	7.64	AMG		SPS	2.456	BAL	0.153
SF		ASF					

MIZZEN

IY	0.000	PY	0.000	HBV	0.000	TLV	0.000
EB	0.000	EY	0.000	MGY	0.000	MDT1Y	0.000
YSD	0.00	ECY	0.000	MGUY	0.000	MDL1Y	0.000
YSF	0.00	BASY	0.000	MGY	0.000	MDT2Y	0.000
YSMG	0.00	BALY	0.000	MGLY	0.000	MDL2Y	0.000
		HBIV	0.000	BDY	0.000		

IMS AMENDED TO JANUARY 2007
Offshore Racing Congress
Chelmsford, England
Copyright 2007

GPH
587.9

RATING OFFICE: IMS 2007

Issued: 24/JAN/07
Measured: 22/MAY/91

Revalidation Authority: US SAILING

Measurer: STIMSON

"I CERTIFY THAT I UNDERSTAND MY RESPONSIBILITIES UNDER THE IMS."

OWNER:.....

MR JOHN B SAILOR

123 SPINNAKER LANE

PORTSMOUTH, RHODE ISLAND 02871

LIMITS AND REGULATIONS

Limit of Positive Stability: MEETS REQ

Minimum Displacement: 3238kg: MEETS REQ

Maximum Crew Weight: 815 kg.

Stability Index: 122.0

C/R HeavyItems Pitch Adjustm't 0.00000

Applied Age Allowance: 1.04%

Anchor(s) Weight: 0 Dist: 0.00

NOTE TO OWNER: The range available to revise crew weight is 448- 826 kg.

TIME ALLOWANCES IN SEC/MI BY TRUE WIND VELOCITY & ANGLE

(NOT WIND-AVERAGED)

Wind Velocity: 6kt 8kt 10kt 12kt 14kt 16kt 20kt

BEAT ANGLES: 44.3° 42.0° 39.4° 37.9° 37.2° 36.8° 36.7°

BEAT VMG: 929.2 783.2 722.2 688.6 668.2 656.1 648.0

R 60°: 598.8 524.1 498.0 483.6 474.6 469.0 463.9

E 75°: 538.1 486.0 460.8 447.3 438.5 432.4 424.5

A 90°: 541.1 483.8 454.4 438.7 424.5 415.9 405.6

C 110°: 561.5 493.1 458.8 433.9 414.6 400.6 383.5

H 120°: 596.5 511.4 471.0 442.7 419.6 399.9 368.6

150°: 854.1 668.1 562.1 504.7 470.3 444.5 401.9

RUN VMG: 986.2 771.4 648.5 571.5 518.0 481.8 432.8

GYBE ANGLES: 140.8° 144.4° 151.7° 162.1° 169.8° 174.1° 175.2°

NOTE: To convert any time allowance above to speed in knots: Kt = 3600/TA

TIME ALLOWANCES FOR SELECTED COURSES (AFTER WIND-AVERAGING)

Wnd/Lwd VMG 977.1 791.6 695.2 637.8 600.2 575.3 545.4

Circular/Random 797.2 649.5 571.4 526.3 498.2 479.4 454.9

Ocean for PCS 906.5 715.2 607.7 541.1 495.7 465.3 422.1

Non-Spinnaker 847.5 683.9 596.0 544.6 512.6 491.5 464.9

SIMPLIFIED SCORING OPTIONS

Time-on-Distance Time-on-Time

(sec/mi) TMF PLT PLD

OFFSHORE 587.9 (=GPH) 1.0206 (=600/GPH) 0.840 91.0 (Ocean)

INSHORE 652.4 (=ILC) 1.0346 (=675/ILC) 1.226 395.8 (Olympic)

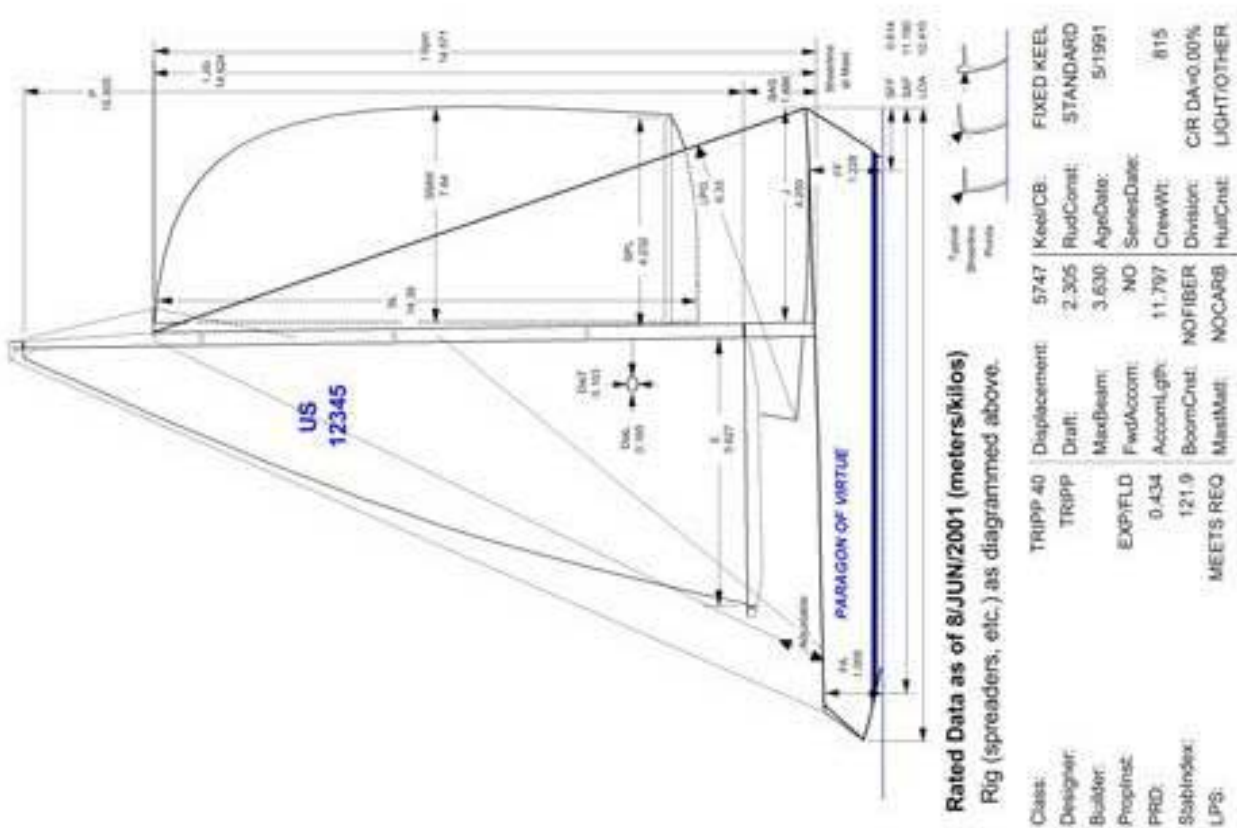
Performance Line Corrected Time = (PLT x Elapsed Time) - (PLD x Distance)

TRI-NUMBER TMS BY WIND RANGE

WINDWARD Low Medium High CIRCULAR Low Medium High

/LEEWARD 0.7781 1.0361 1.1962 RANDOM 1.0225 1.2849 1.4339

APPENDIX 2: ORC Club certificate



Rating Certificate -- 2001

Offshore Racing Council
Southampton SO14 2AQ, UK
Copyright © 2001

Not Valid Beyond 12/31/2001

"PARAGON OF VIRTUE"

Sail No.: US-12345

Certificate No.: 12345

Scoring Selections

A. Performance Line OFFSHORE:



Corrected Time = (0.826 x Elapsed Time) - (87.1 x Distance)

B. Time-on-distance (GPH):



Corrected Time = Elapsed Time - (588.9 x Distance)

C. Time-on-Time: (ILC)



Corrected Time = 1.0329 x Elapsed Time

ORC Rating Authority		Owner	
Issued	2/NOV/2001, 09:50:26 by:	"I certify that I understand my responsibilities under the Club Rule"	
ORC		Signed	
Tel: +44 1473 785 091		MR JOHN Q SAILOR	
Tel: +44 1473 785 092		123 SPINNAKER LANE	
ORCclub@compuserve.com		PORTSMOUTH, RHODE ISLAND 02871	
Ref: PARAVIRT/SA/PARAVIRT			

APPENDIX 3: Polar diagram

