OFFSHORE RACING CONGRESS

IMS GUIDE

For Race Committees & Owners

The International Measurement System
&
ORC Club

V2

2004

IMS RATING CERTIFICATE No. 12345
Based on: FULL MEASUREMENT (Metric)

NOT VALID AFTER 12/2004

IMS AMENDED TO JANUARY 2004
Offshore Racing Congress
Chelmsford, England

GPH
590.4

YACHT DESCRIPTION

Name:	PARAGON OF VIRTUE		
Sail No:	US-12345		
Class:	TRIPP 40		
LOA:	12.410m	Beam(MB)	3.630m
Designer:	TRIPP		
Builder:			
Rig:	FRACTIONAL SLOOP 150% Jib		
Keel/CB:	FIXED KEEL		
PropInst:	EXPOSED FOLDING		
FwdAccom:	NO	SPIN:	SYMMETRIC
HullCnst:	LIGHT	RudCnst:	STNDRD
Forestay:	FIXED	BoomMtl:	HEAVY
Spreadrs:	3 Sets	InrFsty:	NONE
Runners:	NONE	Jumpers:	YES
Dates:	AGE:5/1991		

COMMENTS

RATING OFFICE:
Issued: OFFSHORE RACING CONGRESS
09/APR/04 Tel: +44 1473 785 091
Measured: Fax: +44 1473 785 092
22/MAY/91 ORCclub@CompuServe.com

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 Displacem't 3238kg: MEETS REQ
Maximum Crew Weight: 815 kg.
Stability Index: 121.9
C/R HeavyItems Pitch Adjustm't 0.00000

Measurement Inventory: 18/MAY/91
Accommodation Length: 11.797m
Accom Certificate: C/R DA= 0.00%
Plan Approval: YES
Anchor(s) Weight: 0 Dist: 0.00
Applied Age Allowance: 0.65%

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	CHECKSUM
BEAT ANGLES:	44.3°	42.0°	39.5°	38.0°	37.0°	36.5°	36.5°	(273.8)
BEAT VMG:	934.5	790.0	725.9	692.1	672.5	661.2	654.5	(5130.7)
52°:	602.5	528.5	502.3	488.2	479.3	473.8	468.7	(3543.3)
R 60°:	565.3	506.9	484.7	471.9	463.6	458.2	452.2	(3402.8)
E 75°:	539.0	489.7	464.8	451.3	442.4	435.9	427.8	(3250.9)
A 90°:	541.4	486.9	458.2	441.9	428.1	419.0	408.0	(3183.5)
C 110°:	561.9	495.1	460.9	436.1	417.4	403.6	385.8	(3160.8)
H 120°:	597.7	512.5	472.7	443.9	420.7	401.4	372.4	(3221.3)
135°:	706.2	564.4	503.4	468.2	440.9	417.2	375.6	(3475.9)
150°:	854.8	667.7	561.5	505.5	471.1	444.6	400.1	(3905.3)
RUN VMG:	987.0	771.0	648.0	570.4	518.0	482.4	432.2	(4409.0)
GYBE ANGLES:	140.9°	144.6°	151.5°	162.2°	170.9°	174.1°	174.9°	(1119.1)

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

TIME ALLOWANCES FOR SELECTED COURSES (AFTER WIND-AVERAGING)

	6kt	8kt	10kt	12kt	14kt	16kt	20kt	CHECKSUM
Wnd/Lwd VMG	980.2	794.5	696.9	639.2	602.4	578.0	548.3	(4839.5)
CircularRandom	799.9	652.0	573.9	528.8	500.8	482.1	457.6	(3995.1)
Ocean for PCS	910.0	718.1	610.4	543.7	499.3	467.8	424.5	(4173.8)
Non-Spinnaker	850.0	686.3	598.4	547.0	515.1	494.1	467.5	(4158.4)

SIMPLIFIED SCORING OPTIONS

	Time-on-Distance (sec/mi)	Time-on-Time TMF	Performance Line PLT	PLD	
OFFSHORE	590.4 (=GPH)	1.0163 (=600/GPH)	0.839	92.5	(Ocean)
INSHORE	655.3 (=ILC)	1.0301 (=675/ILC)	1.222	396.8	(Olympic)

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

IMS AMENDED TO JANUARY 2004 VPP: 09/APR/04 15:12:36
Cert No 12345 PARAIMS.DAT 04/FEB/04 22:25:08
OFF Meas'd: 22/MAY/91 PARAVIRT.OFF 05/JUN/92 15:08:30

CENTERBOARD AND DRAFT

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

PROPELLER AND INSTALLATION

PRD	0.434	PBW	0.120	PHD	0.044	PHL	0.153	ESL	0.979
ST1	0.026	ST2	0.105	ST3	0.105	ST4	0.057	ST5	0.183
PSA	18.000	PSD	0.028	PIPA	0.0036				

FLOTATION DATA

FFPS	1.372	AFPS	1.029	SFFP	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

INCLINING TESTS

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	142.5	RM20	133.2	RM40	113.3	RM60	79.5
RM90	35.6	WBV	0.0	CREW ARM (CRA)			1.443

CALCULATED LIMIT OF POSITIVE STABILITY: 121.3 DEGREES
RATIO STABILITY CURVE AREAS, POSITIVE/NEGATIVE 3.265

HYDROSTATICS — MEASUREMENT TRIM — SAILING TRIM

KEEL DRAFT	(DHK0)	2.305	(DHKA)	2.354
2ND MOMENT LENGTH	(LSM0)	10.013	(LSM1)	10.374
DISPLACEMENT (WEIGHT)	(DSPM)	5747	(DSPS)	6679
WETTED SURFACE	(WSM)	26.41	(WSS)	28.16
VCG FROM OFFSETS DATUM (For CLUB RM)			(VCGD)	-0.014
VCG FROM MEASUREMENT TRIM WATERLINE			(VCGM)	-0.091
INTEGRATED BEAM ATTENUATED WITH DEPTH			(B)	2.948
MAXIMUM SECTION AREA			(AMS1)	1.340
BEAM/DEPTH RATIO			(BTR)	4.373
EFFECTIVE DRAFT			(D)	2.058
2° HEEL (LSM2) 10.374		25° HEEL	(LSM3)	10.231
SUNK (LSM4) 12.000		AVG LENGTH	(L)	10.460
TRIM: 1mm/9.251m-kg			SINK:	1mm/19.584kg

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

FORETRIANGLE — MAIN & SPARS

IG	14.521	J	4.250	HB	0.220	TH	NO
MW	0.189	FSP	0.066	MGT	1.24	TL	2.500
GO	0.219	LPG	6.33	MGU	2.13	MDT1	0.103
ISP	14.571	LP	6.40	MGM	3.65	MDL1	0.165
IM	14.624	JL	0.00	MGL	4.78	MDT2	0.075
HBI	1.093	JR	0.00	MSW	24.0	MDL2	0.089
SFJ	0.000			P	15.505	MWT	0.0
SPL	4.232	TPS	0.000	E	5.627	MCG	0.000
SL	14.39	ASL		EC	5.636	BD	0.182
SMW	7.64	AMG		BAS	1.886	CPW	2.900
SF		ASF		SPS	2.456	BAL	0.153

MIZZEN

IY	0.000	PY	0.000	HBY	0.000	TLY	0.000
EB	0.000	EY	0.000	MGTY	0.000	MDT1Y	0.000
YSD	0.00	ECY	0.000	MGUY	0.000	MDL1Y	0.000
YSF	0.00	BASY	0.000	MGMY	0.000	MDT2Y	0.000
YSMG	0.00	BALY	0.000	MGLY	0.000	MDL2Y	0.000
		HBIY	0.000	BDY	0.000		

CONTENTS

1. Introduction

This guide is designed to provide race organisers with the necessary tools to manage races held under the ORC's International Measurement System (IMS). Competitors may find this guide helpful to understand how IMS works.

The easier version of IMS named ORC Club will be explained in its appropriate appendix at the end of this guide. ORC Club uses the same speed prediction engine as IMS does, but with fewer rating options and easier to understand handicap figures.

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 deal mainly with race scoring methods. Once a basic understanding of the principles of IMS is achieved, these methods are easily used.

This guide assumes little prior knowledge of IMS. To make this guide easier to read, only the basic essentials of the system are explained.

Specific explanation of the operation of the official ORC-computer program, can be found in the software manual, delivered together with the program. Both are downloadable for free on the ORC homepage at **www.ORC.org**.
There might be more programs on a national orientated base, which are not fully ORC approved but work on the same modules and deliver the same results.

For world - and continental championships, the scoring program used has to be of fully ORC approved type.

The programs will be referred to as **SCP** (Scoring Programs) in the following text.

2. Measurement

In order to give handicaps to yachts, there must be information about the size and shape of the different parts such as hull, keel, rudder, spars and sails. IMS has a sophisticated method of measuring the shape of the hull by means of an electronically controlled measurement machine.

Hull measurement:
The measurement of the hull and its appendages (keel and rudder) is performed with a **measurement machine**. The yacht has to be out of the water and placed on an even and level surface where the machine can be positioned on both sides and moved along the full length of the hull. The machine consists of a wand which is connected with strings wound on rotating drums, connected to a computer. A number of points along a vertical section on the hull are located with the wand. Each point is touched and its exact position is fed into a computer. By following the vertical line the whole cross section of the hull (station) is measured. When all the stations on both sides of the hull and its appendages are measured the computer generates a drawing of the lines of the yacht. IMS differs fundamentally from all previous systems, such as IOR, which depend on an extremely limited number of measurement points.

In-water measurement:
The yacht rests in the water in "measurement trim". Freeboards are measured on definite stations and an inclination test is executed. This provides information on how deep the hull is immersed in the water and thus, the exact shape of the hull being known, the displacement or weight of the yacht. The inclination test gives information about the stability of the yacht in measurement trim and the location of the yachts centre of gravity.

Measurement of propeller installation, rig and sails.
IMS takes the actual size of the biggest foresail, headsail (spinnaker and/or genaker) and mainsail. Miscellaneous data are 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. The LPP provides the necessary input data for another computer program called: **Velocity Prediction Program (VPP).** This is a computer simulation model, based on experiments with a fleet of yacht models in towing tanks. The VPP takes into account many variables. For example, 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 selects the optimum one for the given circumstances. The effect of crew weight distribution on stability, and thus sail carrying capacity is calculated, as well as resistance in various sea conditions.

Rating Certificate. (Appendix 6). All this eventually results in a set of speed predictions for different wind speeds and wind angles, the so called points of sail. These speed predictions are presented on the Rating Certificate. They can also be presented graphically in a polar diagram (Appendix 7).

4. Handicapping and Scoring

Now we come to the part of the IMS where the race committee steps into the picture: **SCORING**. Nowadays the role of the race committee is different and more sophisticated because IMS differs fundamentally from earlier handicap systems.

What is the difference from other systems? Until the introduction of IMS, handicaps could only be single value figures. In other words, each yacht had a fixed handicap, irrespective of the sailing conditions. IMS gives variable handicaps depending on the conditions during the race. The race committee must therefore provide the correct information about those conditions so that IMS can be used to its full potential. This will be achieved by using the PCS scoring option. Using the Performance Curve Scoring (PCS) will provide the best results with the highest precision.

If IMS is used to its full potential (e.g. with the PCS option) a PC-type computer is necessary for scoring. Conventional Windows based PCs will do the job.

It is, however, possible to score IMS races without a computer, although the full potential of IMS will thus be limited. A simple hand-held calculator can be used for a limited number of options of the system. See Appendix 2.

4.1 Simplified Scoring Options

The simplified scoring options are printed on the bottom of each IMS certificate and provide information for single value scoring when required.
They are divided into the following methods:

- **Time-on-Distance ToD**
- **Time-on-Time ToT**
- **Performance Line PLS (explained further down, see 4.2.3)**

Each of the above methods is additionally divided into figures for offshore or inshore use.

4.1.1 General Purpose Handicap GPH - offshore

NOTE:
The main purpose of the General Purpose Handicap (GPH) is to provide a tool for rough comparison of certificates and for the division of a fleet into classes.

This single handicap number is the average of Circular Random handicaps for 8 knots and 12 knots of wind speed (explained later). It is printed separately on top the Rating Certificate. Basically, General Purpose 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.

<u>Time-on-Distance scoring:</u>

The General Purpose Handicap can be useful where a simplified method (single value) of scoring is required on offshore races. The GPH is a single value handicap in seconds per nautical mile – to be understood as time allowance.

<u>Time-on-Time scoring:</u>

The **SCP** has the facility to calculate a race result with a time on time handicap, based on General Handicap.

$TMF = {}^{600}\!/_{GPH}$ This produces a **T**ime **M**ultiplying **F**actor (TMF) with 4 decimals.

The time on time scoring should only be used at a fleet of yachts with very close sailing performance figures at different wind speeds.

For tidal areas the Time on Time scoring is usually the better choice, while in areas with variable winds and calms the Time on Distance scoring gives the better results.

4.1.2 Inshore Handicap ILC – inshore

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

Wind / Course	VMG Beat	110° Reach	VMG Run (downwind)
6 kts	TA	TA	TA
10 kts	TA	TA	TA
20 kts	TA	TA	TA

TA = Time Allowance as found in the IMS certificate

The calculated ILC rating is defined as the average of its non-wind-averaged time allowances (TA) in the nine conditions above, weighted as follows:

6 kts	24%		Beat	50%
10 kts	34%		110°	20%
20 kts	42%		Run	30%

It is **NOT** printed separately on top the Rating Certificate as the GPH but shown in the "simplified scoring options" field.

Time-on-Distance scoring:

The ILC Handicap can be useful where a simplified method (single value) of scoring is required on inshore and sheltered areas races. The ILC Handicap is a single value in seconds per nautical mile – to be understood as time allowance.

Time-on-Time scoring:

The **SCP** has the facility to calculate a race result with a time on time handicap, based on General Handicap.

$TMF = {}^{675}\!/_{ILC}$ This produces a **T**ime **M**ultiplying **F**actor (TMF) with 4 decimals.

The time on time scoring should only be used at a fleet of yachts with very close sailing performance figures at different wind speeds.

For tidal areas the Time on Time scoring is usually the better choice, while in areas with variable winds and calms the Time on Distance scoring gives the better results.

4.2 Variable Handicapping

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.

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.

To be able to use variable handicaps, the race committee must determine two separate pieces of information for each race:

1. The wind direction and the length of each leg of the race.
2. The average wind speed (except if using the recommended PCS method).

4.2.1 Wind Direction and Length of each Leg

In order to get the right mix of beat, reach and run for a given race course there are two methods: The “**Constructed Course**” or the “**Fixed Course**” Types.

4.2.1.1 Constructed Course

The best method to determine the correct wind angles is the Type “Constructed Course”.
A provision for this is incorporated in the ORC Scoring software program.
The Race Committee must determine the bearing and distance of each leg.

Because IMS is a time-on-distance system, it is of vital importance to assess the correct distance sailed through the water!

In the case of strong tide or current it may be appropriate to make corrections for current on the sailed distance. The computer operator must input the direction of the wind and, optionally, the direction and rate of the current on each leg. When these data are entered, the computer calculates the mix of wind angles and distance through the water for each yacht.

4.2.1.2 Fixed Course Types

If, for some reason, it is not possible to use the “Constructed Course” there is a simplified method, using the table of Time Allowances for Selected Courses, printed on each Rating Certificate. This system consists of a few standard courses with a fixed percentage of wind angles.

A: Windward – Leeward (Up `n Down)

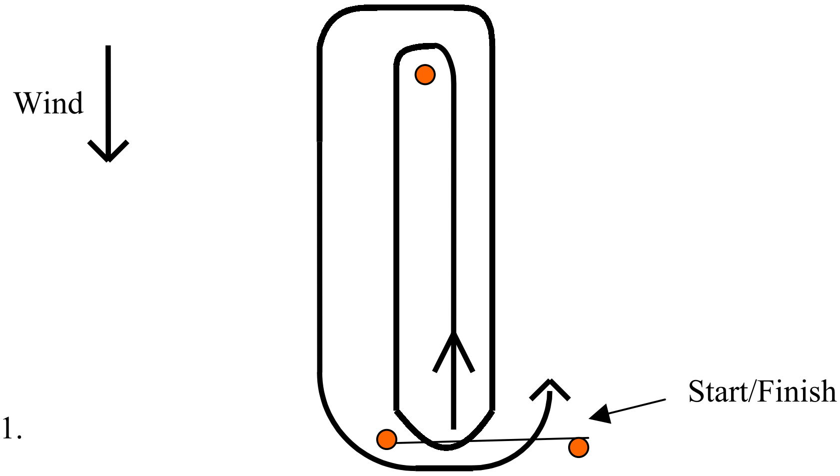


Fig. 1.

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 shall be made from the “variable course option”. The handicap values (TA) for the Wnd/Lwd - course printed on the certificate show VMG datas, not actual boat speed.

B: Circular Random Course

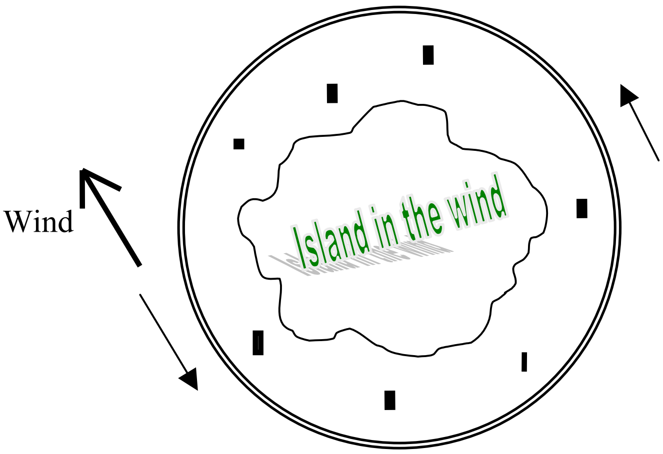


Fig 2.

This is a hypothetical course based on sailing a perfectly circular course (for instance around an island) in a steady wind with equal distances of the course at each possible angle to the wind. It might, for example, approximate a closed course "round the buoys" typical for an afternoon race. The course content includes beating for approximately 25% of the total distance. This course is only used for calculation of the GPH. It is not shown separately in the simplified scoring options and on the certificate.

C: Non-Spinnaker Course

The time allowances in this course type are based on Circular Random but are calculated without 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.

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 most close to the actual course.
Most important for this choose is the beat contend of the course!

For example, when the actual course has a beat content of app. 50%, the inshore course should be chosen. If the beat content is much less, the offshore course is the appropriate one.

D: Ocean Course (computer generated) for PCS

The Ocean Course handicaps printed on the Certificate are for general information only and are not appropriate for "manual" scoring.

This course type is especially designed for 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. It is intended for use only with Performance Curve or Performance Line Scoring (see 4.2.2 and 4.2.3).

Internal to the computer program, PCS works as follows:

For any type of course specified (by the Race Committee) the computer can construct a curve for each yacht which represents the predicted optimum performance along a scale of wind speeds (fig.3.1). This curve is called the Performance Curve. For each yacht this curve is different for any race course sailed.

The scoring works as follows:

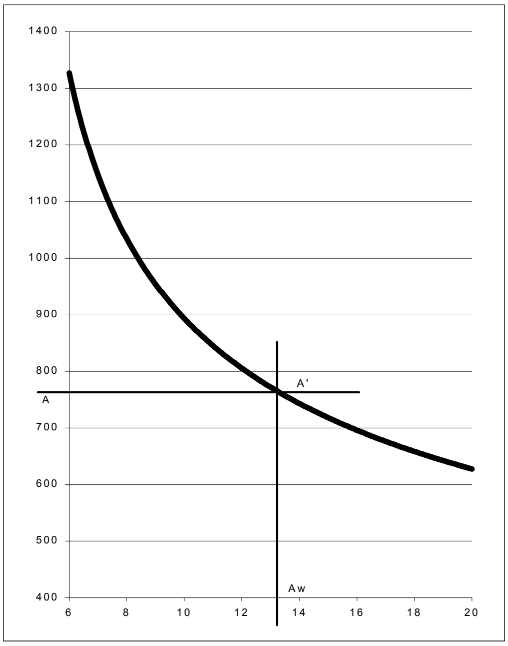
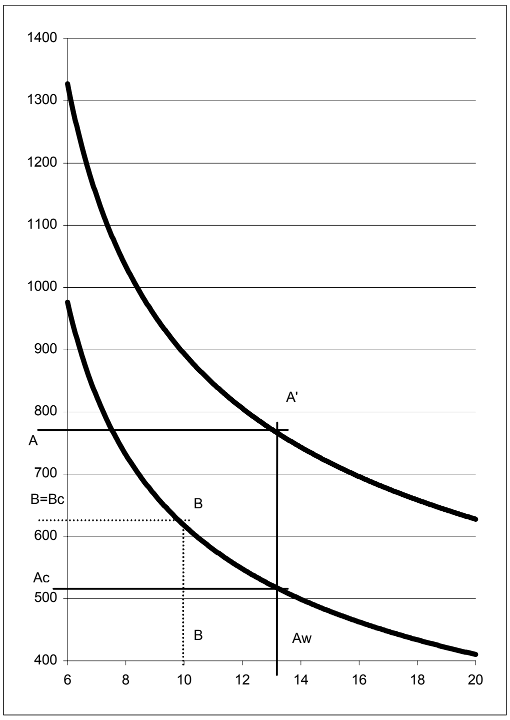


Fig 3. 1. Performance Scoring Implied Wind from VPP Yacht A

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 achieved speed in seconds per mile. This number is represented by point A on the vertical axis. The computer draws a horizontal line to the performance curve of yacht A. From the intersection A' a vertical line is drawn to the horizontal axis. 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. The yacht with the highest Implied Wind wins the race.



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, same as its elapsed time. This exercise produces corrected times, expressed in hours, minutes and seconds, a format most sailors are familiar with.

Fig 3. 2. Performance Scoring Implied Wind from VPP, Yacht A, Yacht B (Scratch Yacht)

4.2.3. Performance Line scoring (Computer not essential)

Performance Line Scoring is a simplified variation to performance Curve Scoring, without the need to have a computer doing the calculation of results.
As the name says it works with lines instead of curves and can easily be used with a pocket calculator or simple computer program/spread-sheet analysis (Excel).

The performance line is established as a straight line between 8 and 16 knots of wind. In comparison to the performance curve system, the performance line cannot be as accurate, but gives satisfying results in handicapping light- and strong wind performances.

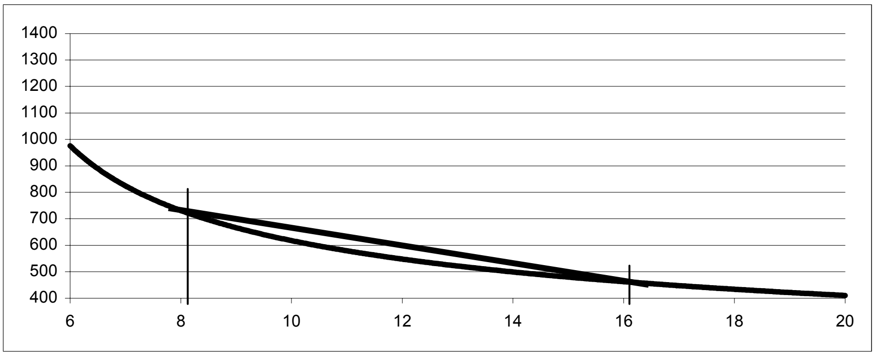


Fig 3.3 Performance Line

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

a. PL-Offshore bases on the Ocean Course Type and therefore gives best results at long distance offshore races with a relatively high content of reach and downwind angles at higher wind speeds.
b. PL-Inshore provides useful aids for inshore races on covered areas like lakes. The course behind PL-Inshore is constructed from 55% beat and 45% reach- and downwind angles, very much like the Olympic course.

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

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

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

This is an easy-to-use option for both race committees and sailors and can be done with a pocket calculator on board. This will provide maximum transparency to both sailors and race officials.

4.2.4. Fixed Wind Speed (no Computer necessary)

When it is impossible to use PCS or PLS, IMS offers a method to handicap the race with a fixed wind speed. The Rating Certificate has a list of speed predictions at fixed wind speeds: 6, 8, 10, 12, 14, 16 and 20 knots. The committee can estimate the average wind speed during the race and use the fixed wind speed time allowances (Note: except the Ocean Course!).

This method is hazardous in many circumstances, especially when the wind speed varies locally, as it often does. The selected wind speed may be arbitrary. The differences in predicted performance of dissimilar designs between two wind speeds can be considerable.
As a consequence the choice made by the committee can influence the race results substantially.

However, in some cases the use of a fixed wind speed can be a better option than PCS.
Example: If a race is sailed in a constant wind of 12 knots but comes to a standstill during a substantial period without wind, the use of PCS will result in an implied wind of, for example, 8 knots. This will give a result which benefits the heavy weather boats unfairly. In such a case it is better to use a fixed wind speed in which the greater part of the race is sailed, in this example 12 knots. It will be necessary to gain experience with these matters as to when and how to make such a decision.

5.1. General

IMS is used throughout the world. Circumstances differ greatly from place to place. This guide can not choose solutions for every situation. It is the responsibility of each race committee to use its local insight to select the appropriate method for their unique circumstances.

5.2. Stick to a fixed routine

Regardless of the method used, it is very important for a race committee to stick to the same standardised routine. It is very confusing if a committee is constantly changing its scoring methods.

5.3. Level of Sophistication

Generally, the more sophistication that is used, the more accurate the race result will be. This applies more strongly when the fleet contains more variation in design of boats.
But it should be noted, that as higher the sophistication of the scoring is, the higher a level of sophistication at the scorers will be required!

The **STATE OF THE ART** is:

CONSTRUCTED COURSE with PERFORMANCE CURVE SCORING

5.4. Tidal Correction

Input of the correct tidal information can be very important in areas with strong tidal current. The distance sailed on the different legs of the course will strongly depend on tidal current. For example, if a beat to windward is against the tide, the percentage of beat in that race is considerably greater than if there was no current. The **SCP** automatically takes this into account when using the Constructed Course. With the "Fixed Course" Types from the certificate this is not the case!

If a leg against the tide leads along a shallow bank or shore the competitors will try to avoid the adverse current by sailing along the shallow part. The estimated current rate on the shallow part of the course is the correct choice to use, not the rhumb line current where nobody is sailing!

If yachts should choose to stay in the strong tide on the rhumb line they could be forced to kedge or move backward. The computer will assume this if the rhumb line current speed is entered. In the **SCP** RMS96 or later the computer will show a warning if this is the case:

[- current might be too strong for "name of yacht". Reconsider input data! -]

It needs a lot of experience to establish the correct amount of tidal correction. If it is not possible to establish the tidal correction close to reality, it has been proven better to use one of the time on time simplified scoring options. (offshore or inshore)

5.5. Division into classes

The fleet can be divided into classes when necessary. It is possible to give the different classes each its own course, wind and tidal data. This gives a better basis for comparison between the classes. See appendix 1.

5.6. Fixed wind speed, fixed course type

If there is no computer available, the fixed course types with fixed wind speeds can be used. A hand-held calculator is sufficient to calculate results easily.

In areas with predictable constant winds and without strong currents, fixed wind speed and fixed course types may provide reasonably correct results, but this can always give cause for complaints about the choice of the inputs by the committee!

Again: If determination of wind speed or wind direction is difficult, either the offshore or inshore simplified handicaps are a realistic alternative.

5.7. Practise before you score your first race

Inexperienced race committees should give ample attention to sufficient practice and exercise with the scoring of IMS races. Nothing is more frustrating than a stressed computer operator who has crashed the program and does not know how to solve the problem. The best way to prevent this is to practise with test races during the winter months. More than one person must be familiar with the system.

5.8. Make certain your results are correct

Only when the Principal Race Officer is 100% sure that the result is correct should it be made public. Never publish a revised race result calculated with a different method unless it is clear that the original method was completely wrong or if mistakes were clearly made. If so, please explain it to the competitors.

5.9. Publish as much data as possible

When presenting a race result it is important to publish as much input data as possible: wind direction, tidal data and the course mix (distance and bearing of the different legs of the course). This will give the competitors confidence. Competitors may discover simple mistakes such as input errors, which can be easily corrected. When those errors are discovered it is necessary to correct them (preferably before the prize-giving ceremony!).

5.10. No discussion about decisions of the race committee

On the other hand, there should be no discussion about the race committee's partly subjective (but considered) course and wind determination. It is strongly recommended to include a paragraph in the sailing instructions, stating that decisions made by the race committee concerning the scoring are not subject to protest.

6. IMS Scoring and Practice in daily use

6.1. Before the start of the season

Practice.
As soon as the new race management software is available the race committee should appoint a group of people who will be responsible for the scoring during that season. A training program must be started, using old race results. During practice people will discover their limitations. Every new version of any computer program will have difficulties, some of them have to be corrected, and others have to be accepted. National Authorities may organise training sessions for race committees. It is important that, when the first race is held, the race committee feels confident that calculating the race results will cause no problems.

Select your methods.

In most circumstances, a race committee should select a method of handicapping for the whole season. If possible all the races in an area should use the same system. Competitors like to know what they can expect.

6.2. The week before race

The rating data from the National Authority has to be provided in time so that when the list of entries is known, the fleet can be put into a race file. Preferably all entries are known some days before the race. Division into classes can be decided and scratch sheets can be produced. If entries are only known on the evening before the race, all this has to be done in the late hours of that night. Yachts not included in the data provided (e.g., foreign yachts, new certificates) have to be entered manually, which can be very time consuming and prone to error.

6.3. The day before the race

The race committee should produce scratch sheets for competitors. On the committee vessel the members of the committee must have a working list for all the necessary data: Positions of marks (or distance and course of each leg), wind direction sheets with tidal information, actual starting times of each class, finishing times, etc. Somebody should be appointed to record the meteorological data such as wind and current, combined with rough positions of each class along the race course.

There are several practical methods for collecting the wind and current data. One should be pragmatic and not go into too much detail. In inshore races the easiest method is to make observations from the committee vessel. The average wind direction taken every 15 or 30 minutes is sufficient in most cases. This has to be combined with a recording of the position of the fleet along the course. Tidal information can be taken from charts or from direct measurement of the current at certain key points.

For offshore races, a wind log given to competitors, to be completed during the race, usually gives excellent information (Appendix 3). Remember that you need **TRUE** and not relative wind directions! Many yachts nowadays have a true wind indication on their instruments. On longer offshore races, tides can often be ignored because the ebb and flood compensate each other on the long run or it is impossible to predict their differential influence over a fleet spread across many miles.

If the race committee operates ashore there may be an observation vessel along the course or another method to obtain the course data might be chosen.

If available, a portable computer on board the committee vessel is very handy. All you need is a separate cabin and, if possible, electric power. Battery power always lasts a shorter time than expected! An extra charged battery is very practical. A small portable inkjet printer makes it possible to produce the provisional results coming ashore. They can be checked by the Principal Race Officer when still on the water.

If the computer is positioned ashore be sure that communications are reliable and that reports are executed according to a strict protocol.

The computer room should always be free from interference. Distractions lead to errors! Errors will lead to endless discussions!

As soon as all the data are collected they should be entered into the computer according to the software program (SCP). Often it is possible to start with the input of finishing times long before the entire fleet is finished.

The necessary data are:

1. Course data:
   - Course and distance of each leg.
   - Wind direction and rate and course of current.
   - Fixed course type (if applicable).
   - Wind speed (if applicable).

2. Yacht data:
- Class division (General Purpose Handicaps).
- Start times.
- Finish times.
-DNC, DNS, OCS, ZFP, BFD, DNF, RAF, SCP, DSQ, DNE, RDG informations according to ISAF-RRS Appendix A 11 (“Scoring”)

6.4. After the race

The first provisional results can now be produced. They must be checked immediately. Look carefully for odd results, in most cases they are caused by simple input errors. When applicable, results of protests and the application of penalties should be entered. Often it is possible to post the provisional results before protests, provided the scoring is thoroughly checked by the Principal Race Officer and declared to be correct.

It must be clearly indicated: "**Provisional results, pending protests**".

Each race result must be published together with a list of data, such as course configuration and percentage of different wind angles. It is also possible to publish a list with the precise handicaps for that particular race (mostly the computer program offers this option, at least it should). If a fixed wind speed is chosen it should be made public.

A complete set of race results, together with all the available data, can then be handed out to all competitors.

After the race series is finished, a set of all results and the race data shall be send to the National Authority’s IMS representative for further use and comparison work.

APPENDIX 1: Division into Classes / Different course length

Division into classes.

In order to provide fair racing in a fleet with a wide variety of size of boats it is necessary to divide the fleet into classes. In many races however there is a necessity to proclaim an overall winner and produce a fleet ranking for every competitor. In most cases boats sail the same course and the overall results are often depending on weather conditions and tidal gates. IMS offers another solution to this problem.

Different course length for each class.

A feasible option, offered by **most SCP's,** is the possibility to give the smaller boats a shorter course. For example on a Wnd/Lwd race the smaller boats can be given one up-and-down less than the bigger boats. In practice this means that the bigger boats will overtake the small boats by the time they approach the finish. Both classes finish the race at (almost) the same time and subsequently sail under the same wind and tidal conditions on the same stretch of water. The program can calculate an overall result, based on a performance in seconds per mile, for all classes. This often gives a fairer comparison for the overall trophy than when all the boats sail the same distance but the small boats arrive much later in a dying breeze or after the turning of the tide.

APPENDIX 2: Example fixed course and fixed wind speed

Calculation of a fixed course with fixed wind speed

Course type: Windward/Leeward
Wind speed: 10 knots.

Let us assume a Wnd/Lwd race with a distance of 10 miles There are 4 competitors: Yacht A, B, C and D. Yacht A is the fastest yacht with a Wnd/Lwd Handicap Time Allowance of 482.8 sec/mile. We call her the Scratch Boat.

In the first column we see the Wnd/Lwd Allowances of the competitors in seconds per mile (s/nm). In the second column we see the differences with the Scratch Boat (s/nm). In the third column we see the differences multiplied by the distance of the course in miles (10 nm). It is called the Race Handicap, expressed in minutes and seconds. In the fourth column we see the Elapsed Times of the yachts given in hours, minutes and seconds. The Corrected Times are in the fifth column. They are calculated by subtracting the Race Handicap (third column) from the elapsed time (fourth column). Quite simple isn't it?

RACE RESULT

YACHT	TIME ALLOWANCE Wnd/Lwd –10 sec/nm	DIFFERENCE sec/nm	RACE HANDICAP min:sec	ELAPSED TIMES hrs:min:sec	CORRECTED TIMES hrs:min:sec
A	482.8	0.0	0.00	1 : 43 : 41	1 : 43 : 41
B	485.6	2.8	0.28	1 : 53 : 59	1 : 53 : 31
C	500.0	17.2	2.52	1 : 44 : 28	1 : 41 : 36
D	502.1	19.3	3.13	1 : 45 : 52	1 : 42 : 39

APPENDIX 3: Example of Wind log for competitors

RACE: **DATE:** **COURSE NR:**
YACHT NAME: **SAIL NR:**

Mark	Date and Time	Yacht ahead	Yacht astern	True wind direction	True wind speed	Current set	Current drift	Sea state	Remarks

General navigational or meteorological remarks and observations:

Signed: ....

Skipper/Navigator:............................

NOTE:
Most yachts with modern navigational and/or tactical electronic equipment will be able to produce print-outs or printable files from their automatic wind logs.

APPENDIX 4: Different options of scoring a race

With computer:

1. CONSTRUCTED COURSE with PCS
2. FIXED COURSE with PCS/PLS

with computer and/or pocket calculator

3. FIXED COURSE with FIXED WIND SPEED.
4. simplified handicaps either single number (ToT, ToD, inshore, offshore) or PLS.

WIND AVERAGING:

The SCP has the option of Wind Averaging when fixed wind speeds are chosen. This is a possibility to take into account the effect of natural variations of wind velocity on the performance of the boats with acceleration and deceleration. When PCS is chosen Wind Averaging is not used.

APPENDIX 5: Scoring Options for ORC-Club Races

The scoring options given by the ORC-Club certificate are printed in the left side box of each ORC-Club certificate and provide information for single value scoring.
They are divided into the following methods:

- **Time-on-Distance ToD**
- **Time-on-Time ToT**
- **Performance Line PLS**

The ToT values are better suited to calculate inshore (e.g. short round the buoy) races, whereas the ToD values are recommended to be used in offshore (rather longer distances) races.

Note: It is strongly recommended to use Time on Time (ToT) in Tidal Areas!

ToD and ToT are simple singer number scoring options in fom of time allowance and time multiplying factor (see 4.1.1 in the main text of this guide)

Performance Line scoring (Computer not essential)

Performance Line Scoring (PLS) is a simplified variation to performance Curve Scoring (which is explained in the main text of this guide), without the need to have a computer doing the calculation of results.
As the name says it works with lines instead of curves and can easily be used with a pocket calculator or simple computer program/spread-sheet analysis (Excel).

The performance line is established as a straight line between 8 and 16 knots of wind. In comparison to the performance curve system, the performance line cannot be as accurate, but gives satisfying results in handicapping light- and strong wind performances.

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

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

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 ORC-Club certificate
DMF = Distance Multiplying Factor printed as PLD on the ORC-Club certificate

This is an easy-to-use option for both race committees and sailors and can be done with a pocket calculator on board. This will provide maximum transparency to both sailors and race officials.

ORC Club

"VPP Inside"

Offshore Racing Congress
Ipswich IP6 9HG, UK

Rating Certificate -- 2004

Not Valid Beyond 12/31/2004

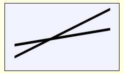
Sail No.: **US-12345**

Certificate No.: **12345**

"PARAGON OF VIRTUE"

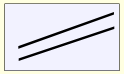
Scoring Selections (GPH= 592.2)

A. Performance Line OFFSHORE:



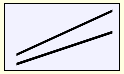
Corrected Time = (0.836 x Elapsed Time) - (92.3 x Distance)

B. Time-on-distance (GPH):



Corrected Time = Elapsed Time - (592.2 x Distance)

C. Time-on-Time: (GPH)



Corrected Time = 1.0132 x Elapsed Time

ORC Rating Authority

Issued 9/SEP/2004, 16:01:17 by:

OFFSHORE RACING CONGRESS
Tel: +44 1473 785 091
Fax: +44 1473 785 092
ORCclub@CompuServe.com

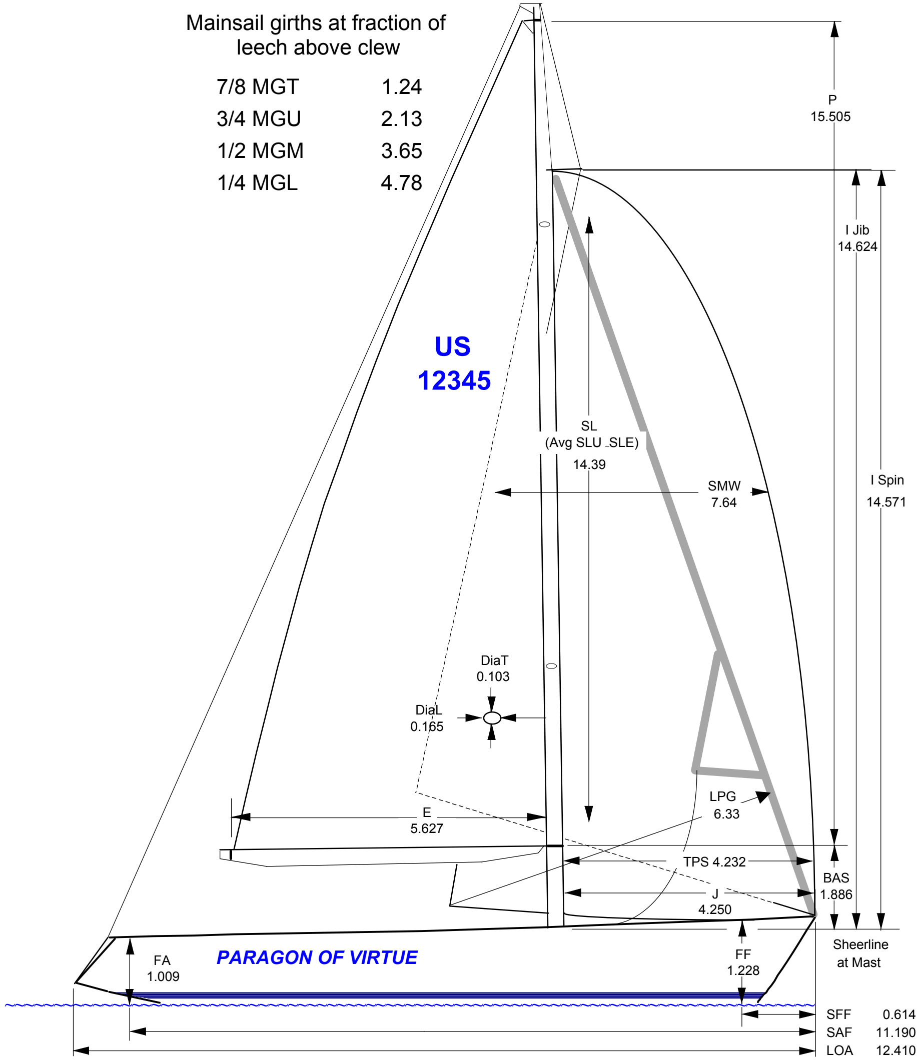
Ref: PARACLUB/SA/PARAVIRT

Owner

"I certify that I understand my responsibilities under the Club Rule"

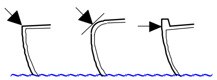
Signed________________________________

MR JOHN B SAILOR
123 SPINNAKER LANE
PORTSMOUTH, RHODE ISLAND 02871

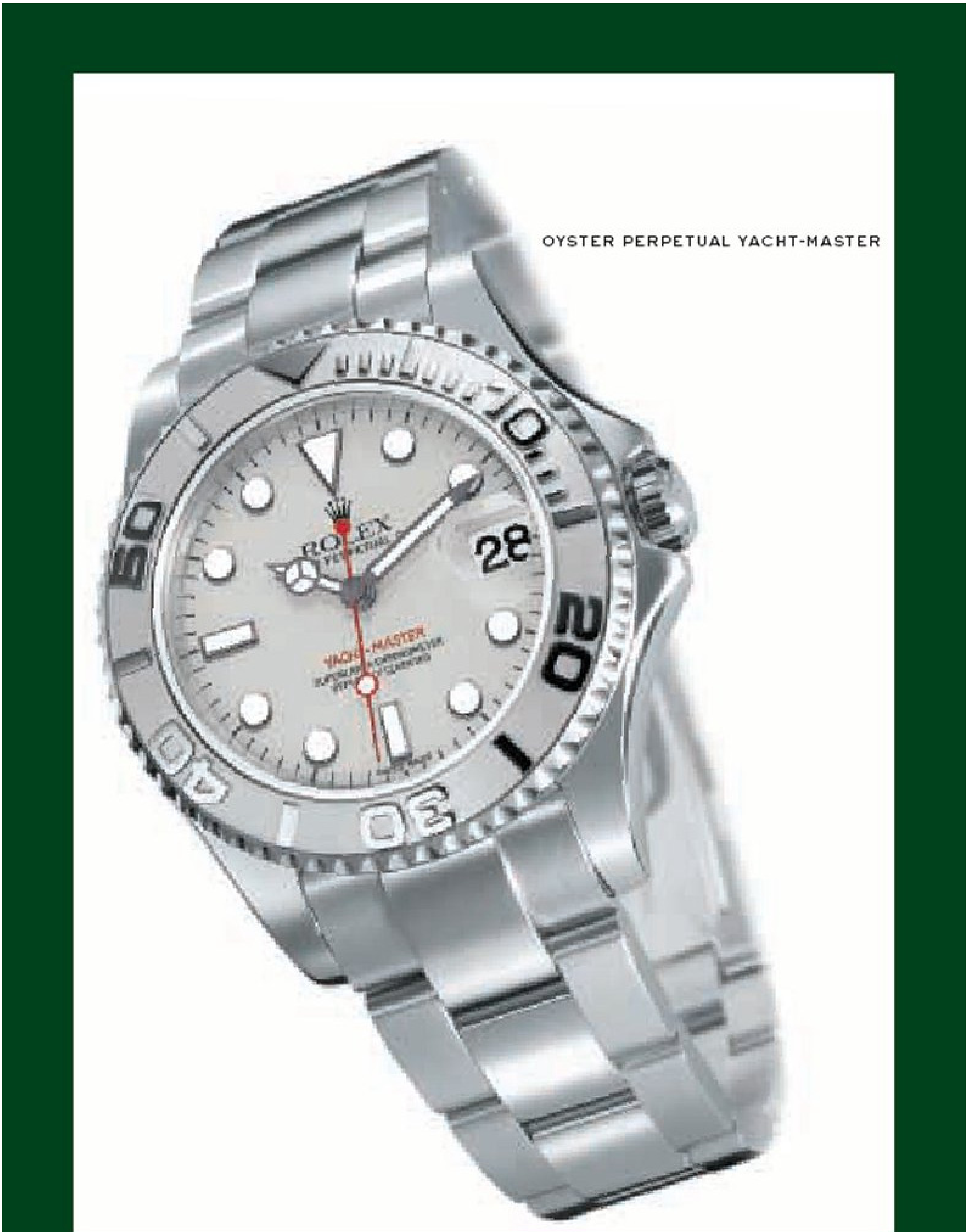


Rated Data as of 25/JAN/2004 (meters/kilos)

Rig (spreaders, etc.) as diagrammed above.



Class:	TRIPP 40	Displacement:	5747	Keel/CB:	FIXED KEEL
Designer:	TRIPP	Draft:	2.305	RudConst:	STANDARD
Builder:		MaxBeam:	3.630	AgeDate:	5/1991
PropInst:	EXP/FLD	FwdAccom:	NO	SeriesDate:	
PRD:	0.434	AccomLgth:	11.797	CrewWt:	815
StabIndex:	121.9	BoomCnst:	NOFIBER	Division:	C/R DA=0.00%
LPS:	MEETS REQ	MastMatl:	NOCARB	HullCnst:	LIGHT/OTHER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