OFFSHORE RACING COUNCIL

World Leader in Rating Technology

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MINUTES of a meeting of the International Technical Committee held on 6th-8th November 2003 at Le Meridien Hotel, Barcelona, Spain.

Present:
Manolo Ruiz de Elvira (Chairman)
Friedrich Judel (Technical Director)
David Lyons
Alessandro Nazareth
Jim Schmicker
Jim Taylor
Jim Teeters (ORC Research Director)
Nicola Sironi (ORC Chief Measurer)
Bill Cook (ORC Programmer)
Axel Mohnhaupt (ITC Research Assoc.)

Observers:
Jean-Louis Conti, Measurement Committee, Club Working Group
Never Baran (CSF)
Roberto Biscontini, (Italy)
Luca Brenta, yacht designer, Italy
Alberto Busá (Italy)
Pablo Ferrer (RFEV)
Zoran Grubisa (Croatia)
Juan Meseguer (Spain)
Dan Nowlan, Offshore Director, US Sailing
Peter Reichelsdorfer, US IMS Committee Chairman
Konstadina Sfakianaki, IMS measurer, Greece
Olin Stephens, ORC Member of Honor, USA (ITC Advisor)
Alberto Vidosa (Spain)

Committee members Michael Richelsen and Rob Pallard sent their regrets for being unable to attend.

1. Minutes of September 2003 Meeting

Minutes of the previous meeting in London, UK were reviewed and approved.

2. ORC Chief Measurer's Report

Most of the items that caused action and discussions during the year have been dealt with in the Submissions and are part of the general ITC business.

Some good progress has been achieved during the year in the identification of new equipments able to measure things that are peculiar to the IMS, i.e. the inclining test and the hull measurement, both performed with electronic ñmachinesò.

Alternative equipment to the HMI machines is being tested for the hull measurement, and could be adapted soon for IMS. More testing and a more detailed definition of procedures and software have yet to be finalized.

For the inclining experiment some standard inclinometers have been identified, and some prototypes for new units have been developed and presented. Additional evaluation is needed, but the units and the software have already been tested and proved to be reliable and consistent for the intended use. Once the evaluation is completed, they could be used for valid IMS measurements.

3. Aerodynamic Modeling (FIV 1)

3.1. Upwind aerodynamics: The ITC has concluded that the VPP overestimates the loss of aerodynamic driving force with heel, ultimately encouraging low stability design. Therefore, in the wind triangle solution of the VPP, a heel angle smaller than the actual sailing heel is now used. If the actual heel is less than five degrees, zero heel is assumed. This has the effect of widening the apparent wind angle and accounts for the ability of the trimmers to compensate for the effect of heel by rotating the sail plan. The effect of this proposal is to speed up the whole fleet with more realistic upwind speeds, encouraging to some point boats with more stability.

More detailed analysis is required in this subject as well as a better evaluation of the overlap. The ITC is planning to perform wind tunnel tests and CFD studies in the near future in order to help address this problem.

3.2. Downwind aerodynamics: After a review of the 2003 season and the effect of the change applied in the 2003 VPP related to this matter, the ITC decided to go ahead with one further step in the direction of re-balancing the relative forces between mainsails and spinnakers. For 2003, spinnaker coefficients were decreased approximately 10% and mainsail coefficients increased correspondingly. For 2004, the proposal is to adjust these both by a further 5%. This change was already included in the 2004 Beta VPP.

3.3. Simple Rig Allowances (FIV1): A soft scale has been defined for adjustable backstays in such a way that yachts with a ñfractionalityò of 85% of IG will get 80% of the current credit, 100% credit for configurations with a ñfractionalityò of 70% of IG and none for 100% of IG. After examining test runs it was considered that this is a simple straightforward way to address this problem that should have a very small impact on the current fleet.

The proposed rule changes are in 810.1:

1. Forestay Tension Control.

a) Where forestay tension can be controlled by an adjustable backstay attached to the mast top, this shall be recorded as " forestay adjustable aft " and the yacht will receive a variable increase in the jib lift coefficient depending on fractionality (see IMS 848).

b) Where runners according to 810.2 c) are fitted, the forestay is qualified as "forestay adjustable aft " and the yacht will receive the full increase of the jib lift coefficient (see IMS 848).

810.2 re-titled to:

2. Inner fore and aft stays below the mast top.

810.2.c modified to:

c) Where there are one or more pairs of backstays (runners, checkstays, etc.), these shall be recorded as "runners". A <u>backstay leading</u> to the top of the mast shall not be counted as a pair or runners. The number of pairs, based on the attachment points on the mast, shall also be recorded (see also 724.6). A secondary runner tension adjuster, running to the mast approximately perpendicular to the runner itself, shall not be counted.

848 (with the 2003 numbering) changed to:

848. Forestay Tension Control.

Where a yacht has been recorded as having the means to control forestay tension while racing (see 810.1), the jib lift coefficients are increased in the aerodynamic model varying with fractionality. A masthead rig will get the full increase, while a rig with 70 % fractionality receives no increase. A full increase of the jib lift coefficients is applied, when runners according to 810.2c are fitted.

And 849 (with the 2003 numbering) to:

849. Adjustable inner fore and aft stays below the mast top

Where a yacht has been recorded as having the means to adjust inner stays while racing (see 810.2), the mainsail lift coefficients are increased and the drag coefficients decreased in the aerodynamic model.

3.4. Hull windage drag (FIV10, RFEV1): The Committee discussed the implications of a 2003 yacht designed with radical rocker in the sheerline, evidently intended to misrepresent the rated topside area relative to the actual area in order to take advantage of the hull windage credit which has been based on the weighted average of freeboard height measurements at only the forward and aft freeboard stations. The Committee agreed to implement a full calculation of the actual exposed area of the hull topsides using heights at all measurement stations, while retaining the fore-&-aft weighting implicit in the current averaging formula.

There is also a general perception that the current model slightly overestimates the hull windage drag and therefore the ITC agreed to reduce the drag coefficient by 5%.

A provision was made to avoid unmeasured sail area in extreme cases where the freeboard is intentionally reduced in way of the tack. With following changes proposed to the rule:

812.8 to read:

812.8. No jib shall have a luff length exceeding MXJL. (IM^2+J^2)^0.5.

A new 816 added (note that there is already a 816 rule so the proposal is to renumber and update references for all the numbers in part 8 after this one. The proposed text for the new 816 is:

816. Longest Luff of Jibs (JL).

1. JL shall be the length of the luff of the jib measured along the edge of the sail from head to tack. JL shall be the largest such dimension found on the jibs carried on the yacht.

The current 844.2 (that would become 844.3) would be modified to read:

Jib: The area of the jib is determined as JL(LP)/2.*

Paragraph 847.4 inserted (848.4 after renumbering) that reads as follows:

847.4.1.1 JL: JL shall not be taken as less than 0.95(IM^2+J^2)^0.5*

And the rest of the point of the current 847 renumbered accordingly.

4. Hydrodynamic Research

4.1. Overall Status: Several areas of hydrodynamic performance modeling and testing are being pursued by the committee. Each of these is affected by difficulties that require further time before making recommendations for the VPP. Progress in these is reported below.

4.2. General Residuary Drag: Some discussions and revisions of the residuary drag formulation have been evaluated in the last year, including inclusion of new models, improved data, new parameters and re-formulations of some of them. However no satisfactory results were achieved, becoming one of the main priorities for next yearôs research.

4.3. Resistance Due to Heel (FIV4, RFEV4): A refined model from the initial proposal last May was implemented in the 2004 Beta VPP that provided a substantial improvement over the current heeled drag model.

This new model uses upright beam to draft, length to displacement and length to beam ratios as well as the ratio of heeled to upright lengths. Using this method, the main effect of these parameters is captured. However the ITC believes there is room for improvement but some additional data is required in order to proceed in a safe way.

From the model implemented in September some new test results have been added and the regression improved with some small changes in the performance predictions.

5. Movable ballast - Water ballast and canting keels (AYF 1)

After some discussions during the last meetings the ITC feels that there is a demand to properly rate yachts with these features in a non excessively punitive way, although being sure not to promote them as a required solution to be competitive.

Based on this the following procedures are recommended:

<u>Measurement ï Canting keels</u>

1. Measure boat ashore with keel on centerline (K=0 where K is the angle of keel cant) and any bow rudder or forward dagger board (1 of 1 or 1 of 2), if able to be lifted, in the lowered position. Measure daggerboard manually so as to establish wetted area and append to hull file at rating office, and assumed on yachtôs centreline at same fore/aft location.
   OUTCOME = *.OFF offset file

2. Measure boat afloat with keel on centreline and any daggerboards raised.
   OUTCOME = FFM, FAM, RMC(K = 0°)

3. Measure boat afloat with keel at max. cant (K = Kmax°) and any daggerboards raised.
   OUTCOME = Angle of loll (ū L) at Kmax°
   Record ū L, Kmax°

<u>Measurement ï Water ballast</u>

1. Measure boat ashore in a non ballasted condition.

2. Determine water ballast tank capacity.

3. Determine water ballast lever arm:
   either by direct measurement/estimation.
   or measure freeboards with both tanks full and infer added weight and location.

VPP - Canting keels

1. 2 x RA curves produce 2 VPP matrices.
   The RA curve with keel fully canted is derived by adding the RA at the angle of loll to the zero cant angle value. (RA (K= Kmax) = $RA_0 + RA_{ü L}$)
2. Produce composite certificate using highest predicted speeds from 2 matrices
   ($T_{eff} = T_{max,}$ derived with keel on centerline.)
   (*Note: If too "punitive", try* $T_{eff} = n.T_{max}$ *with* N < 1.0)
   Notes:
   a) For initial introduction of canting keels, ignore wetted area of forward rudder or dagger board to ensure boats with these keels are not favoured.
   b) Asymmetry of canted keel ignored in buoyancy calculations.

VPP - Water ballast

1. Restrict the calculations to 2 conditions, with and without water ballast, run 2 certificates and compute a composite table of time allowances. This is intended to prevent longitudinal trim optimization since at this time the IMS VPP cannot handle the effect of aft trimming tanks, therefore it is proposed to restrict water ballast tanks either to positions forward of say 20% LOA forward of the transom, or outboard of say 35% of local beam from the centreline

Safety starting point ï Canting Keels

1. The IMS Stability Index has been widely used by race organisers and they will expect ORC and ISAF to provide regulations for canting keel boats as well.
2. Recommended treatment in following parts:
   a) Minimum Stability Index requirement to be met with keel fully canted, crew placed on yachtôs centreline, such that ABS.[RA] > some value at 90-95°
   b) ñPanic buttonò to return keel to K = 0° in emergency, accessible from helm and companionway, with manual back-up.
   c) Race Organiser recommended to require evidence that installation was designed and fabricated to a satisfactory standard, which may include independent engineering certification.

Further work -

- *Need to compare knock-down energy (maybe non-dimensionalised), in both directions of heel, of typical canting keel boats (eg. Schock 40, Wild Oats) with "equivalent" fixed keel boats of similar size. Generally compare GZ curve characteristics.*
- *Consider the gust-strike behaviour, effects of hydrodynamic and aerodynamic damping, there is no "over-shoot" etc.*

Safety starting point ï Water ballast

1. The IMS Stability Index has been widely used by race organisers and they will expect ORC and ISAF to provide regulations for canting keel boats as well.
2. Recommended treatment at this stage is to maintain the proposal from 2003 in the sense of complying with the following table. :

ORC Race Category	**Minimum Stability Index (without Water Ballast)**	**Minimum Stability Index (with Water Ballast)**
0	120	125
1	115	120
2	110	115

Safety ï Further work.

The ITC agreed that there was a requirement to explore more fully the stability characteristics of canting keel (CK) and water ballasted (WB) yachts before proposing stability criteria. The requirement is to establish righting arm curves for typical canting keel yachts, and compare these to conventional yachts, for which the stability index has proved to be a reliable criterion.

The process comprises two stages:

1. ***Data preparation***
   a) Preparation of righting arm curves for typical IMS yachts in size bands, 30ô- 90ô.
   b) Develop hull geometryôs for feasible canting keel and water ballast yachts based on existing boats and input from interested designers.
   c) Establish some criteria for selecting ñsimilar boatsò, same LOA, same sec/mile, same sail area.
   d) Prepare a review of existing safety criteria applicable to these types of boat, e.g. ISO standards and Volvo 70 rule, together with extant race entry criteria.

2. ***Criteria Development.***
   Review the data from 1, together with typical operational profiles, to define safety criteria that may be applied to different categories of race

The bulk of the work of Item 1 is engineering calculation using defined geometries and weight distributions which will be determined through consultation with designers.

This process may be carried out by the ITC as part of its voluntary research program, but it would be more speedily accomplished by placing a research contract with a suitably qualified and independent Naval Architectural research organisation. This would provide data for item 2 of the task in the form of a technical report.

To this end the Wolfson Unit will provide a proposal for this work, including liaison with other ITC members and designers, to the ORC . It is anticipated that this would require approximately 20 man days of effort.

Item 2 of the project is most readily accomplished by committee discussion in the ITC, with contributions from other interested parties.

Time scale.
If item 1 is carried out by ITC voluntary effort then it is unlikely that data will be ready for review before September 2004

If item 1 is placed as a research contract then task 2 could be started in January 2004.

6. propeller installation drag (FIV2, RFEV5, RFEV6)

Following the proposed changes in the PIPA calculation last September, three strut units have been tank tested at the ñCanal de Experiencias Hidrodinámicas de El Pardoò (CEHIPAR) strongly supporting the assumption that the current IMS formulation overstates the hub drag for streamlined strut installations as it assumes full separation of flow in the maximum section.

A modified formulation for the strut drive drag calculation was implemented in the 2004 VPP beta and this latest results support including this change in the final 2004 VPP.

A somewhat smaller reduction in drag was applied for exposed shaft installations. A reduction in drag was applied also for solid propellers in order to avoid encouraging racing boats to explore rating optimization through this strategy.

Provisional factor revisions in the last term of the PIPA formulae of IMS Part 6 are:

Out of Aperture	608.1(a), Folding	0.585*(PHD)^2(2003 = 0.65)
	608.1(a), Feathering	0.63*(PHD)^2(2003 = 0.70)
	608.1(b), Solid 2-blade	0.10*(PRD)^2(2003 = 0.15)
	608.1(b), Solid 3-blade+	0.12*(PRD)^2(2003 = 0.17)
Strut Drive	608.3(a), Fold or 2-blade Feather	0.32*(ST4)^2(2003 = 0.40)
	608.3(b), Feathering 3-blade+	0.336*(ST4)^2(2003 = 0.42)
	608.3(c), Solid 2-blade	0.10*(PRD)^2(2003 = 0.15)
	608.3(d), Solid 3-blade+	0.12*(PRD)^2(2003 = 0.17)

In addition to this it became clear that the quality of the finish of the units can make a significant difference beyond the pure dimensions used for PIPA calculations.

Based on this the ITC proposes to allow fairing in the installations provided that the full functionality of the units is preserved and that just the original dimensions of the unmodified unit will be used for the PIPA calculation. These dimensions may not be reduced in the actual unit,

The suggested wording for a 604.2.a rule is:

a) The shape of the strut may be modified, but the full functionality of the standard model has to be retained and ST1-ST4 values may not be reduced below the unmodified standard dimensions. For calculation purposes ST1-ST4 shall not be taken bigger than the unmodified standard dimensions.

In addition 607.2, 607.3, 607.4 and 607.6 will have the following comment added at the end:

(see 604.2 a)

This change was already included in the 2004 Beta VPP.

7. Other Submissions (FIV 3, FIV 5, RFEV 3, RFEV 12, RFEV 13)

7.1. IMS L Sensitivity (FIV 3): The ITC reviewed different residuary drag alternatives, including definitions of L, regressions and tests and no positive results were achieved in time for the 2004 VPP that looked reliable enough. There is work to do in the agenda for the 2004 regarding effective lengths and predictions related to this and it will become one of the main research projects for next year.

7.2. C/R Gyradius adjustment (FIV 5): After some discussion the committee decided that the gyradius adjustment for C/R has a very small effect in ratings and actually some of the C/R requirements imply and increase in the gyradius so the adjustment remains unmodified for the 2004 VPP.

Related to this, using the same gyradius correction for carbon hulls in C/R as for racers was discussed. The committee considered that since this type of yachts do not have to comply with the C/R internal panel weights, the difference in treatment should be preserved since they would get C/R adjustment anyway.

However the committee believes these corrections, especially when combined have a very small effect in rating and should not be a design driver.

7.3. Requirements to comply with Part 4 of the IMS Regulations (RFEV 3): This discussion was postponed as part of a more general one related to C/R-.

7.4. Limit mast dimensions (RFEV 13): It was recognized the need to avoid intentional shape variations in order to get measurement advantages. Rule 105 provides the tool to deal with this and the ITC believes the Measurement Committee is the one to rule on this subject to its satisfaction.

7.5. Allow manual measurement of appendages (RFEV 12): The ITC considers this is a measurement issue and as far as it is concern, any measurement procedure that provides an offsets file with the required accuracy and quality while complying with the rule is valid for performance prediction as far as its provide a fair representation of the yacht. Thus we encourage measurers to consult with the chief measurer and ask for a prompt answer in any measurement issues that can be considered outside of the normal established procedures.

8. Dynamic Allowance (FIV6, RFEV2)

It was agreed to modify the Dynamic Allowance (DA) scheme, with the effect of reducing the maximum allowance and providing DA values which vary by true wind speed and angle.

In fact, it is calculated using individual components over the full matrix of wind speeds and angles before reducing the overall DA to a single number. The internal factors for the DA are greatest in the windward region, lowest in the reaching range, and a little greater running than when reaching. The committee believes that the desired result will occur by reporting the table of handicaps as the individually computed values that already exist, which can then be applied to particular course constructs in the intended proportions. The DA number as presently calculated should remain only as a relative measure of a yachtôs Dynamic Allowance credits

It was proposed as well to remove the stability component (IMS Appendix 8.1(d) from DA since this term proved to be behaving in a different manner than was originally intended.

Inconsistencies with the sail area used for calculating downwind DA credit have been corrected.

As a consequence of the proposed revisions, the global effect of DA will be reduced, especially for those courses with smaller upwind and downwind components, given that in reaching conditions the importance of dynamic effects quickly decreases.

The Committee examined test runs based on these bases and agreed to include the new model for the 2004 VPP.

This change was already included in the 2004 Beta VPP.

9. Summary of Proposed VPP Changes for IMS 2004

- Implementation of a new Heeled Drag model to replace the one that has been in place for 10 years.
- Downwind sail coefficients revised for decreased spinnaker and increased mainsail forces.
- The hard limit for fixed forestay credit has been replaced by a soft scale.
- The upwind aero model has been revised with a correction to apparent wind angle with heel.

- The PIPA formulation has been revised as suggested by some towing tank tests of struts.
- The DA has been modified to better represent the dynamic effects for different wind speeds and directions, correcting some inconsistencies.
- The windage area calculation of the hull has been revised with a more robust method that calculates the real area. The drag coefficient for hull windage has been reduced in 5% from the 2003 VPP one.
- Jib Luff Length will be used for Foresail Area Calculation (no effect in current fleet)

10. Recommendations on GPH limits

The proposed changes to the VPP suppose a significant change in speeds compared to the 2003 version and thus in the GPH values for the whole fleet.

Since this numbers is widely used to define classes both, by the ORC and National Authorities the ITC considers that an indicative number could be 10 seconds per mile for the high speed limits in order not to harm any boats in the fleet. Lower speed limits might be modified according to a different number depending on the class.

However this can be revised depending on the classes and the current yachts in order not to increase ranges beyond the original intentions.

Another note relates to the DA as a warning for NAös that use this number as a reference for some classes. The number displayed in the certificate no longer represents a general multiplier and it will change from 2003 to 2004 so its limits should be revised accordingly.

11. VPP/LPP Documentation

The committee has reviewed the last revision from Andy Claughtonös documentation report of the LPP and VPP. The committee recommends that the ORC include the last changes to the VPP and proceed with publishing the report.

12. ORC Research Fund

The committeeös work this year relied primarily on previous wind tunnel and tank results. For the incoming year a number of projects are being defined that would require funding, including wind tunnel tests for upwind aerodynamics, some new tank tests that might require additional funding and safety studies related to canting keels and water ballasted yachts.

In addition to this, there are some proposals to validate CFD codes and then use them for hydrodynamic projects if those validations are satisfactory.

The intention is trying to get some external funding to cover as much as possible the cost of some of these projects. However in order to schedule this research we anticipate an estimated cost of approximately 50,000 euros.

Besides these projects there is one from 2003 that got funding approval from the AGM last year but other priorities made impossible to accomplish or even initiate. This is the replacement of the twenty-five-year-old Fortran VPP code with a more modern and user friendly program that could a allow a better interaction with potential users, maybe even extending its use from designers to owners that want to evaluate the effect of some changes in their yachts.

The cost of this code update was estimated last year in the order of 50,000 Euro and thus the ITC kindly requests the council to allocate these funds for next year.

13. ITC 2004 Agenda

The ITCôs principal projects for next year are:

- Develop real-time aerodynamic optimizer
- Continue to investigate jib overlap effects
- Investigate effect of re-trimming sails in light air, related to the effect of stability in performance (wind tunnel testing of heeled aerodynamics)
- Investigate mainsail girth effects
- Review performance data from full scale boat tests of various spinnakers sizes to help adjust mainsail and spinnaker coefficients.
- Revise assessment of effective sailing length, including tail effects (IMD tow tank testing of transoms is finished, analysis required)
- Review residuary drag regressions
- Further investigate heeled drag including new parameters and using CFD
- Develop new models for residuary resistance
- Review the assessment of added resistance in waves
- Review the treatment of winged keels
- Study safety treatment for canting keel and water ballasted yachts
- Investigate in general cruiser/racer features and performance differences

Note that the ITC will also be supporting the proposed re-writing of the VPP/LPP code, provided that this project is authorized by Council.

14. Next Meeting

The next meeting of the ITC is planned for end of Jan. or early Feb., 2004 in Düsseldorf (Germany) .