

# SIGHTING THE LINE



## ISAF IRO Newsletter Issue 2, February 2007

Dear Friends

As the Race Management Sub-committee we know we must follow new technologies very closely. They will eventually make our sport much more accessible and potentially more fair. Costs are always an inhibitive factor but as with the very expensive computers in the early days, as quantity rises, costs will decrease and more will be possible. As this subject is crucial to the future of our sport we decided to ask Patrick Bergmans, Chairman of the Race Officials Technology in Sailing Working Party, to look specifically into this matter and we are very impressed with his input.

With special thanks to Patrick and I trust you will find his article of great interest.

Kind regards

A handwritten signature in black ink, appearing to read 'HGC van der Aat'.

Henri G C van der Aat  
Chairman, Race Management Sub-committee

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### OCS

For a long time, the determination and fair handling of OCS situations (“On the Course Side”) at the start of sailing races have been considered major problems, by the race committee, as well as by the sailors. Some have even argued that OCS issues at the start of a race were the biggest problems in the sport.

#### **Why is OCS a problem for race committees?**

This is fairly obvious, even though seasoned race officers may disagree on the extent of the problem. In some cases, it is just not easy to accurately detect whether boats are “over the line” in large fleets or on long starting lines (determination of OCS), and which boats need to be recalled or penalized (identification of OCS). The problem is often compounded by the legitimate eagerness of sailors to start in a favorable position. In recent years, many classes have recommended to split large fleets into several groups, starting at close intervals. Race officers definitely agree that fewer starters, resulting in shorter lines, very much alleviate the problem. Nevertheless, many race officers believe that the problem does not completely go away with small fleets, and would welcome the introduction of new methods to make OCS determination and identification more accurate and rigorous.

### **What is the OCS problem for sailors?**

There are, in fact, two OCS problems for sailors. First of all, a fraction of the sailors believe that OCS calls are not always fair. They are aware of the difficulty, for race committees, to accurately identify all OCS boats, and they believe that many unfair decisions are made in OCS calls. They don't necessarily question the competence of race committees, but they believe too many errors are made, in good faith, because of the inherent nature of the starting procedure.

The second issue for sailors is the notification of OCS to individual sailors. With a single exception (after a general recall under black flag), the RRS do not require to inform sailors individually of infringements of the starting rules. Yet, many Sailing Instructions provide for one or another method to notify early starters. Sailors also claim, with reason, that collective signaling can be misleading (for example, in some cases, the individual recall under I-flag), and result in the making of wrong decisions.

### **Can technology help solving the OCS problem?**

Satellite-based determination of position has recently become ubiquitous in sailing, for navigation purposes, but also for the management of sailing races, for example in the laying of the course. It takes very little creativity to envision sailing races in which all boats automatically transmit their position periodically to the race management. In fact, experiments in Olympic classes races have been run for more than ten years. Most experiments were done for tracking purposes, i.e. to collect the position of all boats in the regatta, and to publish these positions in some form (large screen display on the venue, broadcast TV feed, web site, etc).

It doesn't take a stretch of the imagination to attempt to use these tracking systems to monitor the position of the boats in the starting area, and to use that position during the starting procedure to determine infringements of the starting rules, under the various preparatory signals. However, as soon as the conceptual step is made, a score of questions arise about the practicality of the approach.

### **Precision requirements**

The first issue is the precision of the position, and the frequency of transmission to the race management (on the starting vessel or ashore). Most race officers will agree that the determination of the position should be performed within a margin of error 30-50 cm. At a reference speed of 6 knots, or 3 m/sec, this requires at least 10 transmissions per second, from every boat. The transmitted message itself is of average complexity, including the identification of the boat, and its position, with a precision exceeding the acceptable error of 30cm. Without going into detailed calculations, for a fleet of 100 to 200 boats, this represents a steady "stream" of information that is not trivial to transmit wirelessly to the starting vessel. On the other hand, the range is limited, restricted as it is to the starting area. It is not trivial, but technology is available, and it can be done.

It should be noted that tracking systems, used to track the position of the boats on the course, for transmission to the shore and use on large display screens or broadcast media (Television or Internet), operate with fundamentally different parameters: a position precision of 3m, and a transmission rate of once per second (or even significantly less) are probably sufficient, but the range is on the order of a mile for dinghy sailing, and much longer for seagoing yachts.

Again, this is quite possible, and has been done with experimental systems on many occasions.

Combining the two requirements in a single unit is a bit of a challenge, but that too, can be done. So the technology is available, today.

### **Notification of Race Signals and OCS conditions**

In the above analysis, the boats are equipped with “black boxes” communicating data (in one direction) to the race management. However, it is quite conceivable to design the wireless communication system as a bidirectional transmit/receive system. In fact, the receiver subsystem of the “black boxes” would be much simpler than its transmitter subsystem. Bidirectional communication between the boats and the race management would allow the transmission of information from the race management to the boats, either in broadcast mode to all boats, or in individual mode by specifying the identity of the boat in the transmitted message. This would make it possible to make all race signals electronically, and to display them on the boat: recall conditions (general or individual, with or without identification), postponement or abandonment of races (with or without further signaling ashore), with colored lights or small displays.

One (big) step further would consist in continuously displaying the OCS condition during the whole start procedure, perhaps with three lights (green, yellow – if less than 1m away, red – if over the line), or even the distance to the line. Such an implementation of starting control would unquestionably change the game, and sailors wouldn't need the skill to locate or estimate the position of the starting line on the water any longer, by using bearings on the shore or other techniques. But other systems for start control, such as the materialization of the starting line with wires or ribbons, used in other sports, have the same effect, and have been experimented with.

### **When to use EDOCS (Electronic Detection of OCS)?**

This is a major policy issue. There are two extreme positions on this: only at the Olympic regatta (and perhaps the world championships of the Olympic classes), or in *all* sailing races. Of course, all intermediate positions are also conceivable.

Obviously, the cost of the system has a major impact on its applicability. But cost considerations only do not exclude either extreme. Indeed, EDOCS at the Olympic regatta only would require the building of a few hundred “black boxes” for boats, and 10 or so systems for starting vessels or race offices ashore. The systems would be provided to the competitors. Even a rough estimate of the cost of the whole operation cannot be made at this time, before some of the basic options are decided. On the other hand, the design of a system to be used at all events (except perhaps the smallest club races), would be quite different, because such a system would have to be mass-produced. Incremental production cost for such a system, *in quantities of tens of thousands*, could very well be as low as 100-200€, or a fraction of the cost of most any boat that races. The substantial cost of initial design of such a system could be recovered as a small license fee to be applied on each production unit. ISAF would have to decide whether imposing the purchase of such systems, and their use in almost all races, is acceptable for sailors and the sport in general.

## **EDOCS, the Racing Rules of Sailing and the Class Rules**

Quite obviously the definition of *Start* would have to be modified. EDOCS, as described above, can only report on the relative position of a reference point, with respect to the starting line. Hence, the notion of “any part of her hull, crew or equipment” loses its meaning, and will have to be replaced by the notion of “reference point” in the boat (to be defined in the modified Class Rules). It would be conceivable to measure and transmit other boat variable, such as compass course and heel, to minimize the difference between the two definitions, but this would make things immensely more complicated.

Depending on the flavor of EDOCS adopted, the following rules will need inspection and possible modification:

- 20 Starting Errors
- 25 Notice of Race, Sailing Instructions and Signals
- 26 Starting races
- 27 Other Race Committee Actions before the Starting Signal
- 28 Sailing the Course
- 29 Recalls
- 30 Starting Penalties

Signaling course changes (RRS 33) could possibly also be affected, as well as Mark Missing (RRS 34).

The concept of General Recall could conceivably be disposed of, since all OCS boats will always be identified, and, in some versions of EDOCS, individually notified.

Obviously, serious consideration would have to be given to the course of action to be taken when EDOCS equipment is malfunctioning, either on individual boats, or as a whole system, before or during the start procedure. If the EDOCS “black boxes” are supplied, requests for redress are likely to be filed for equipment malfunction.

Evidence-taking would be quite different. Visual observation of the starting line, with note-taking, should be continued, as a backup in protest hearings. But the race committee PC would have to log events carefully, to provide evidence in protest hearings, in a simple and user-friendly way.

The main impact on Class Rules will be the specification of the EDOCS “black box”, and the determination of its location. The most obvious location would be at or near the bow of the boat, because that’s the part of the boat that typically crosses the line first. But that position is bad, if one wants to verify compliance with RRS 20.1 (“... completely on the pre-start side”) or RRS 29.1 (same).

The bow is also the most exposed part of the boat, and it might be safer to locate the “black box” at the mast, especially if it also has a notification function. If the unit has no notification function, it could be located inside the hull, for protection.

Class rules might also have to specify who is responsible for testing the equipment before the start of the regatta (pushing on a knob, for example, and monitoring the reaction).

## **Conclusion**

The technology is available, *today*, to design and implement an EDOCS system, in one of many flavors. But it will require a lot of hard thinking, foresight and imagination, to predict the impact that an EDOCS system will have on the sport. Likewise, it will take a long time to digest the introduction of such technologies in sail racing. It took 5 years to “simplify the rules”. But if it really takes so long to experiment with EDOCS, why not start quickly?

**Patrick Bergmans (BEL)**  
**RMSC**

<p>We invite you all to submit articles concerning Race Management matters to: Nino Shmueli : <a href="mailto:ninos@netvision.net.il">ninos@netvision.net.il</a></p>
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