



Royal Ocean Racing Club Rating Office

Manual and Stored Power

Sail Handling, Moveable and Variable Ballast

1. Introduction

The following is offered for consideration by the IRC Congress.

It was originally drafted following comment on the subject matter in the wake of the CYCA's 2005 Sydney to Hobart Race. Subsequently, the CYCA hosted a forum on 21st February this year to consider banning canting keels and boats fitted with powered winch systems. While this forum voted against both of these proposals, the subject matter is nevertheless worthy of wider debate.

2. Current Position

IRC Rules:

- 14.1 *RRS 52, Manual Power, shall not apply. This Rule may be amended by notice of race.*
- 27.3.1 *..... RRS 51, Moving Ballast, and 52, Manual Power, are modified in respect of movable and/or variable ballast systems to the extent required by this*
- 27.3.4 *Stored power may be used for the operation of movable and/or variable ballast systems.*

Rule 14.1 permits the use of stored power (ie powered winches etc) for trimming sails. It also permits autopilots. Rules 27.3.1 and 27.3.4 permit powered systems for moving water in water ballasted boats and moving the keel in canting keel boats.

Should any consideration be given to amending these rules, to changing the way in which IRC rates them, or to imposing any other restrictions?

3. Background

There are suggestions from overseas that boats using stored power for either sail handling or moveable ballast (but notably not variable ballast, ie water) should be barred from competing in open events.

Historically, under all relevant rules, water ballasted boats have been permitted to use stored power to pump in/out/transfer water. When then canting keels appeared, this logic was extended to also include them.

NSR, the Nautor Swan Rule introduced the concept of permitting stored power for sail handling some 10 years ago. Initially, boats had to apply individually to permit monitoring of any powered equipment developments. This reporting requirement was subsequently dropped some 5 years ago. IRC introduced the concept some 7 years ago, with initially a minimum qualifying LOA limit of 24m. This



limit was reviewed two years ago with the initial proposal that the minimum qualifying LOA be reduced to 18m. After discussion at the IRC Congress, it was concluded that RRS 52 should be removed entirely, but that an Organising Authority should have the right to amend the IRC Rule in this respect.

No rating penalty has ever been applied on the logic that mechanically powered equipment was slow and heavy and was therefore of no advantage. Now, new high powered systems with also high line speeds have appeared and are being used by some large boats.

Some boats now run their engines continuously while racing.

Detail issues considered in the discussion below and with the RORC Technical Committee are contained in the Appendix. Technical Committee concluded that:

- Wider discussion was needed
- The issue was as much philosophical as technical
- There were two separate issues:
 - The use of stored power for the control of rig and sails
 - The use of stored power for control and adjustment of moveable and variable ballast.
- A rating effect for the use of stored power for the control of rig and sails might be considered

It is accepted, as concluded by Technical Committee, that there are two separate issues. While it may be desirable to address the two discretely, there is inevitably some overlap in that in a number of cases both issues apply to the same boats.

I consider also that there is a third issue to explore, that being the general desirability of racing boats with moveable and/or variable ballast alongside more conventional boats.

4. Discussion

4.1 General

A strength of IRC over the years is that it has been and remains today generally permissive. As developments have happened (bowsprits, asymmetric spinnakers, carbon spars, composite rigging, water ballast, etc) they have been permitted by IRC. This, together with a proactive and progressive general attitude to the development of the rule has allowed boats of all types, shapes, sizes, and ages to compete together. It has contributed significantly to the growth and development of the rule worldwide and to its use at such a range of events and event types from local racing through regional and national regattas, to the original classic ocean races.

The downside is that the range of boat types competing under IRC has become very wide. From elderly classic designs through RORC and CCA rule types to IOR and IMS to modern cruisers, cruiser/racers and racers to sportsboats. IRC is effectively open to all. All of these types however have their own 'performance profiles'. Some excel upwind, some down. Some in light airs, some in heavy. A majority are reasonable all rounders. The effect is that courses and conditions inevitably have an increasingly significant effect on race results. A windward/leeward with beats against the current in moderate airs will tend to favour heavier moderately canvassed designs. Reverse the current and increase the wind speed and sportsboats and lighter designs generally will be favoured. Add reaches instead of runs, and the sprit boats come to the fore.

The issues now under discussion are simply an extension of this. They are thus not new. They have simply been highlighted by recent race results. Add to this that modern maxis are very substantially faster than their predecessors. A typical IOR/IMS maxi would today rate c1.450. A new modern supermaxi rates c1.775, ie close to 25% faster. Apart then from courses and conditions, the chances of different sections of a fleet seeing different conditions are also exacerbated. A prime example is the



recent Sydney/Hobart Race. For the two leading boats on the water, this was a wholly downwind race in generally good breeze. For the rest of the fleet, this was not the case.

The Rating Office regularly receives comment concerning the performance of particular designs or design types. In recent years, it is accepted that a significant part of this has been directed towards modern supermaxis, particularly those with canting keels. It must however be clearly noted that in addition to these, a less publicly obvious but nevertheless noticeable trend in this sort of comment has been towards modern moderate production cruiser/racers. My underlying point is that we must be very careful about drawing conclusions based on short term or localised observations or generally insufficient data.

4.1 Powered Sailing Handling Systems

As noted above, large boats have been permitted under IRC to use powered sail handling systems for a number of years. This original permission was based on the fact that essentially *all* boats above c25m have some powered sail handling capability. The removal of the minimum qualifying length limit was based on the logic that:

- Powered winches were becoming increasingly available off the shelf at smaller sizes
- An increasing proportion of boats, both production and one-off, were and are fitting powered systems to ease sail handling when cruising
- There is a trend towards short handed sailing, increasing the utility of powered systems
- A common complaint among owners is the difficulty of finding crew. Powered systems potentially reduce the number of crew required on boats, particularly large boats

Some of the boats using powered systems today are high profile and obvious; the modern supermaxis for example. The great majority however are not at all obvious. Most Swans, Baltics, Oysters, etc over c45' for instance have one or more powered winches and often a powered headsail furling system. The Dehler 35 CWS has been on the market for many years. None of these poses any threat to the status quo. While most if not all have manual systems they could equally use, I consider however that to ban them from using their powered systems would be retrograde and would be counterproductive to the growth and spread of IRC.

Until very recently, apart from the marginal benefit of being able to adjust a sheet without leaving the weather rail, there was no direct performance advantage whatsoever to be gained from powered systems. In many, if not most cases, it was actually a disadvantage. Winches and associated systems added weight high up in the boat; they were slow, certainly slower than crew manually winding winches; without adding substantial battery banks, the power available was very limited. There was thus no logic in applying any rating tax for their use. Permitting the free use of powered systems simply made IRC more open to all.

More recently, we have seen the development on a few large modern boats of novel high line speed/power systems. Anecdotally, lines speeds of up to 9m/s are now possible, ie faster than a man could tail a sheet. In the case of very large boats, particularly those of high performance when very rapid sail trimming against very high loads becomes of increasing importance, these systems can and do have a real and marked performance benefit. This is currently unrated.

It is also very noteworthy that boats fitted with these systems are almost exclusively also fitted with moveable ballast, ie a canting keel. It is thus probable that the performance benefits of the canting keel are being confused with the gains from the powered winch systems.

Such systems also consume large amounts of power, encouraging the trend, particularly when allied to a canting keel, towards running the engine/generator continuously while racing. They are also expensive.

A potential solution would be the introduction within IRC rating maths of a powered sail handling function. This could potentially be implemented in such a way that for boats which did not see any real benefit, the tax would be small or zero. But for boats which could see significant benefit, the tax would



increase to be significant. Without going into detail, it is readily possible to parametrically identify the relevant boats from existing IRC data. There would thus be no additional complexity or cost to owners generally apart from the simple question 'Does your boat use stored power for the adjustment or operation of running rigging and/or spars?'. Notably, this approach would leave as separate issues stored power for the operation of moveable and/or variable ballast and also autopilots.

4.3 Moveable Ballast

Moveable ballast, ie a canting keel, was first used some 20 years ago. It started to become more widely used during the early 1990's on designs such as Open 50s and 60s for short handed sailing. Initially however, the full benefits were not clearly seen because of the very specific nature of the design of the Open Class boats. Designs such as the Schock 40 also appeared during the 1990's. With the opening up of rating rules some 5 – 7 years ago, particularly those to which large boats were being built, interest grew among designers and owners leading to the position now when the majority of high performance maxis are fitted with moveable ballast.

Initially therefore, designers had little or no knowledge of the design features of these boats. There has therefore, from a relatively low base, been a dramatic improvement in the actual performance of the boats. In parallel, IRC rating maths have been modified to reflect theoretical predictions, experimental research data, and actual observed performance.

The number of boats fitted with moveable ballast is small. At 40' and under, it is limited to a few sportsboats, one-offs, and the Schock 40. There are now 7 Cookson 50s. Additionally there are a number of larger one-offs: c6 in the 60' to 70' range including Open 60s, 7 Volvo 70s, 2 maxi Z86s, and 7 at 90' or over. A few more are likely to be in build. In other words a total of c33 boats in a worldwide IRC fleet of c6500, some 0.5%. Of these boats, none of the small designs has ever proven to be competitive. The Cookson 50 was competitive in 2005, but to my knowledge has not won many, if any, major races. In the 60' to 70' bracket, the two WILD OATS are both reasonably competitive, but now far from dominant. The Volvo 70s are something of an unknown quantity in mixed fleet racing, but being designed primarily for downwind performance, it is considered unlikely that they would excel. The maxi Z86s were competitive in 2004, but have not raced under IRC since then and would now be rated significantly higher.

At 90' and over, two boats, both new supermaxis, are competitive. Changes for 2006 have reduced this significantly. Analysis of the 2005 Rolex Trophy Series under 2006 TCCs shows a conventional boat winning the series. It must also be clearly noted that both of these boats are fitted with high powered sail handling systems and are potentially gaining significant unrated advantage from this. It must be clearly noted that this is completely separate from moveable ballast issues and would be equally applicable to any other similar concept large high performance boat, whether fitted with moveable ballast or not. None of the other boats of over 90' are considered to be fully competitive.

From the above, it can be clearly noted that the number of competitive boats in the IRC fleet fitted with moveable ballast is very small. I would therefore be averse to banning them from racing under IRC.

While we can never be certain, and while there may still be significant development to come, it is considered that in broad terms 2006 IRC maths deal reasonably well with moveable ballast. This of course ignores any performance gain resulting from the high power sail handling systems now fitted to the larger of these boats.

As noted above, the right to use stored power for the operation of moveable ballast stems originally from the same position for variable, ie water, ballast. At small boat sizes, up to c35', it is entirely practical to use wholly manual systems. Noting however that the keel canting loads increase approximately cubically with increase in length, at sizes over this, manually powered systems become increasingly impractical for racing purposes. If therefore powered keel control systems were to be banned, this would be to all intents and purposes a ban on canting keels generally for boats over c35' LOA. This is not considered a sensible or practical option.



4.4 Moveable Ballast and Powered Sail Handling in Mixed Fleets

It is generally accepted that the closer the design types and the speeds of boats competing, the better the racing that will result. The RORC Rating Office for instance receives regular comment about race results for fleets including very mixed boat types; heavy cruisers and sportsboats for instance. Our response is to direct clubs towards the guidance in the IRC Yearbook, but to also acknowledge that when fleets are small splitting them into classes defined by boat type is often impractical. We then usually suggest that all entries are accepted, but that the club tries as far as possible to vary the conditions, primarily course types, for a series of races. The alternative, barring some boats from competing is not seen as generally desirable.

When fleets are larger, many Organising Authorities define classes based on the physical parameters of boats. 'Cruising' or 'Performance Cruising' classes for instance defined by a minimum displacement/length ratio. 'High Performance' classes defined by a maximum displacement/length ratio and other factors. The Notice of Race for this year's Rolex Commodore's Cup does exactly this and also bars any boat fitted with either moveable or variable ballast.

Boats fitted with moveable and/or variable ballast are simply an extension of this.

This approach works well for events with large fleets which can be split into defined classes and when it is not necessary to define an overall winner for a major trophy. The classes are separate and boats race only against other boats in their class. This approach has long been supported and encouraged in the published comment and advice in the annual IRC Yearbook.

For major one off (ie not a series of races) fleet races in which it is necessary to define an overall winner, this plainly will not work. An Organising Authority may then be faced with pressure from some boats to ban other different boat types, specifically in this instance boats fitted with moveable ballast and using powered sail handling systems. If this was to be accepted, what then might be the next step? Suppose a small, heavy, old boat wins the next race. The pressure might then be directed towards banning boats of that type. And so on.

It must also be clearly recognised that conditions on the race course in many instances have far more effect on race results than anything else. The 2005 Sydney/Hobart has already been mentioned above. A further example, demonstrating the opposite effect is the 2005 Fastnet Race. At the Fastnet, the corrected time order as boats rounded showed a one-off 52' boat clearly leading. She finally finished 181st overall, not through any lack of speed on her part but because conditions were markedly in favour of smaller boats for the second half of the race.

Decisions of this nature are of course entirely within the remit of each Organising Authority. The IRC Rating Authority has no brief or authority in this area. As already noted above, some Organising Authorities already follow the practice of defining the boat types for their events. This is however not always possible. In these latter cases, serious consideration should be given before boats of any particular style are barred from competing.

4.5 Use of Engines While Racing

It has long been accepted that a boat may run its engine while racing to charge batteries. Historically however, batteries have only been used to power such as navigation lights, instrumentation, radios, domestic services, etc. The use of batteries to either directly drive electric motors on winches or a hydraulic pump is relatively new and not only increases the power demand but also changes the nature of power use from essentially safety and none racing purposes to directly racing purposes.

The desirability or otherwise of running an engine continuously while racing is largely philosophical. There are however real practical issues to consider:

- Pollution. Sailing is regarded as a 'green' sport. Exhaust fumes and noise would be detrimental to this.



- Safety. It is paramount that failure of an engine, or any other power source, should not hazard the boat. Plainly, the efficiency and/or ease of handling will almost certainly be compromised. But it is fundamental that a boat must be capable of safe and seamanlike handling in the event of a power failure.

It is considered impractical to differentiate between stored power in the form of electricity in batteries and in the form of chemical/thermal energy in fuel for an internal combustion engine. It is also considered impractical to impose restrictions on the amount of time that an engine may be run while racing. Would this be a percentage of an (unknown) race time? A fixed period defined before a race? What would happen in the event of partial or total battery failure requiring the engine to be run continuously for navigation lights? Etc.

It is also noteworthy that even ignoring powered sail handling systems, the power demand on modern boats is increasing. Radio, radar, communications generally, etc, all consume significant power. Notably, the communications systems on a Volvo Ocean 70 consume more energy typically than the keel systems.

Short therefore of a complete ban on the use of an engine for any purpose while racing, it is considered difficult if not impossible to legislate on how and when an engine may be run while racing. It is therefore considered that if it is thought to be undesirable for boats to run their engines for lengthy periods when racing, then this must be achieved by other measures.

5. Conclusions and Recommendations

No conclusions have been drawn nor recommendations made at this stage.



Appendix

Issues Considered

In no particular order:

- 1 Volvo 70s have manually powered sail handling, but electro mechanical keel operation. They can 'tack' the keel 2-3 times on battery power, but then need to re-charge the batteries. Inshore, they therefore run the generator continuously.
- 2 WILD OATS, ALFA ROMEO, both have all have high speed and power mechanically operated sail handling systems. It is unclear whether the same applies also to SKANDIA WILD THING and NICORETTE. It is understood that at least the first three of these run their engines continually while racing.
- 3 Many other boats of all sizes have powered winch systems. Few of these are a real advantage except in so far as convenience of operation by a smaller weaker crew and/or from the rail.
- 4 The World Speed Sailing Record Council (WSSRC) permits stored power for the operation of moveable and variable ballast, but requires manual power only for the rig and sails. This approach appears to be widely accepted.
- 5 The sheet loads on modern large boats are very high indeed. c8 tonnes on the mainsheet would not be atypical.
- 6 Powered sail handling potentially reduces the number and required strength/physical fitness of a crew.
- 7 Rig sizes for very large boats tend to be limited by the availability of suitable deck gear.
- 8 To race to the same degree of efficiency as small boats, large boats need stored power systems.
- 9 When eg LEOPARD OF LONDON (Reichel/Pugh 90, 2002) was commissioned, powered deck gear was less efficient than a pedestal. The same is not true today.
- 10 Modern powered winch systems offer the potential of both very high line speeds and very high pulling power.
- 11 Modern systems tend towards a hydraulic pump direct driven off the engine, rather than electro mechanical systems.
- 12 On such as the VO70s, which still use electro mechanical systems, the charge interval offshore varies typically between 40 minutes and 6 hours. Notably, the media and communications system on a VO70 consumes more energy than the canting keel.
- 13 Indicatively, both sheet loads and canting keel loads increase at more than the square of increase in LOA.
- 14 The loads on both canting keels and sails on large modern boats are practically beyond human capability. It can be done, but only very slowly. It would thus be possible to build a 100' boat to be wholly manually powered. By comparison with a boat with powered systems, it would be markedly less efficient and slower.
- 15 This debate is analogous in some senses to the debate 25 years ago about the use of Decca, Loran and more recently GPS. Similarly, external assistance by way of weather forecasts, both radio and web based is now the norm.



- 16 The mini transat class does not permit GPS.
- 17 Moveable and variable ballast are perhaps different and separate issues from rig and sail handling.
- 18 IRC, WSSRC, Notices of Race generally and other rules, undoubtedly influence the design of boats.
- 19 Should all the major 'classic' races (Fastnet, Bermuda, Sydney/Hobart, Middle Sea) adopt similar policies? What about other events? Inshore events? The Maxi Cup? Etc.
- 20 The current noise in Australia suggests that in some quarters at least the focus has switched from line honours to handicap results.
- 21 What is undesirable about running an engine when racing? Noise? Pollution? Perception? Purity? Safety (ie can the boat get home without the engine?)? Other?
- 22 It is considered OK to run an engine to charge batteries for safety related issues (eg lights) and communications.
- 23 IRC is a permissive rule. There are many boats who would at the least be inconvenienced, and in some cases disenfranchised if powered rig and sail handling was banned.
- 24 The cost of powered winches is undoubtedly more than manually powered systems. High speed/power systems are expensive.
- 25 What are the safety/seamanship issues?
- 26 The RORC has already decided that canting keel boats will not be permitted in this year's Rolex Commodore's Cup.
- 27 Is the issue *really* canting keels? Is it really that owners are unhappy about sailing against such design but are expressing it in this way?
- 28 Modern high power/high line speed winch systems are a very significant technical advance over systems available a few years ago.
29. All modern winch systems are expensive. Modern high power/high line speed winch systems are very expensive.
30. Modern high power/high line speed winch systems allow large modern boats to be sailed at the same or greater efficiency as small boats. The winch systems are much more efficient than man powered pedestal winch systems. This in effect gives the boats an apparent unrated speed advantage when compared with their predecessors on which rating maths have been based.
31. An outright ban on either moveable ballast or powered winch systems would not sit comfortably with IRC's generally permissive philosophy.