1 February 2021

RS700 Performance Compensation Trial Proposal - 2021 Season

Introduction

In a motion to encourage younger and lighter sailors into the RS700 class, it was proposed at the 2019 UK Annual General Meeting (AGM) to trial a modified performance compensation system during the 2019/20 season. Unfortunately, due to the impact of the COVID-19, only two UK events were sailed (Brightlingsea and Oxford), which hasn't provided sufficient data to make any decision about its effectiveness or a permanent change to the class rules.

Although the 2019/20 trial appears to have been welcomed by the majority of sailors, it was highlighted that some of the lighter sailors on hole 7 or 8 might have to move in a hole. This was not a deliberate feature, but a mistake made in the generation of the trial table (caused by using an out-of-date compensation table as the baseline).

With the 2019/20 performance compensation trial effectively finished, it is essential that the RS700 Committee provide some clarity on how the class should move forward in the coming season. This paper proposes that a **modified** version of the compensation trial should be used for all RS700 events sailed in the 2021 season. This revised compensation trial, to be known as the '2021 Performance Compensation Trial' is designed to build upon the positive aspects of the 2019 proposal whilst addressing some of its shortcomings.

The 2021 Performance Compensation System Trial Proposal

The first feature of this trial is that there is no requirement for any sailor to carry Lead Corrector Weights (leads) in their boats, and therefore temporarily amends Appendix 7 to class rules - 3.4.3 'Corrector Weights'. This trial therefore doesn't consider boat weight in the performance compensation system, although sailors are free to sail with Intermediate Bars and leads should they wish for stability and handling purposes.

The second feature of the 2021 trial is the amendment of the Rack Setting Table at Annex A to Appendix 7 of the RS700 Class Rules. The revised Rack Setting Table at Enclosure 1 of **this** document is proposed for use. As explained above, this table is different from the 2019/20 Trial settings and doesn't require any 'Hole 7 or 8' sailors to reduce rack width. These revised rack width settings are based around a Compensation Factor of 60% (versus 66% for existing Class Rules). The table at Enclosure 2 shows how the 2021 Performance Compensation Trial Rack Settings compare against the existing rack settings in the Class Rules. As the racks are supplied with pre-drilled holes that correspond to the rack settings 1 – 8, there should be no need to make any physical changes to the racks; but for reference the measured rack widths are at Enclosure 3.

It is proposed that the 2021 Performance Compensation System trial is put to a vote by the UK and International RS700 Class Association members for adoption at all UK and International events during the 2021 sailing season.

Background

The Need to Change

There are several factors that underpin the need to amend the Performance Compensation System:

- **Range Width**. The current Performance Compensation System range is too narrow, which means that the majority of sailors are 'off the scale' and therefore not sailing under the

compensation system. At the 2019 UK National Championships only 24% of sailors were within the compensation range.

- **Sailor Weight**. The current settings do not reflect the average sailor weight, which is why so many sailors are 'off the top' of the scale.

- **Perception of the System**. The Performance Compensation system is often cited as being unfair by lighter sailors who claim that it favours heavier sailors. Many lighter sailors have left the class because of this, which has skewed the composition of the UK fleet towards heavier sailors.

- **Negativity Towards Lead**. In conjunction with the above perception of the system by lighter sailors, a commonly held view is that nobody wants to buy a high-performance skiff and then 'fill it full of lead'. Additionally, many light sailors don't normally sail with leads at their clubs, so having to buy expensive leads that will slow them down discourages them from attending RS700 events.

- **Enthusiasm for Change**. With the exception of Hole 7 and 8 issue mentioned above, there has been wide support for the 2019/20 compensation trial amongst heavy and light sailors, so it makes sense to refine the trial settings to a point where the class can consider voting on a permanent change to the RS700 Class Rules.

Potential Courses of Action (COAs) Considered

To enable sailors to understand some of the main arguments and explain why the committee is proposing the above trial, the following section explains some of the main COAs along with the perceived pros and cons of each.

COA 1 - Do Nothing

The first COA is to do nothing and leave the system as it is, however based on the positive feedback from the 2019/20 trial proposal, the committee deem it necessary to try to complete a trial, so that sailors can judge the merits or otherwise of the proposal over a whole sailing season. As this 2021 Performance Compensation System Trial will be put to a class vote, 'do nothing' may be the outcome.

COA 2 - Move the existing weight range and keep the lead

A proposal that has been recently discussed on Facebook is the idea of keeping the existing 66% compensation factor and lead, but shifting the range up so that the sailors weighing in the region of 80-100Kgs would be compensated. While this would bring more UK sailors onto the compensation range, it wouldn't help encourage lighter sailors into the class. It would essentially be declaring that the RS700 is a heavy weight sailor's boat, which isn't the intention of the committee. In addition, this weight range is not representative of the Czech fleet who would probably see many sailors fall off the bottom of the table. Any amendments made need to be agreed by the UK and International Class associations to ensure that there is no divergence in International Class rules.

COA 3 - Fully Equalise the System

Being able to develop a fully equalised performance system would be the ideal outcome, however there are some significant 'real world' issues that make this unrealistic.

- **Sailor Weight Range**. The weight range of RS700 sailors attending events is routinely70 - 105Kg, with some outliers expanding the range to 65Kg - 120Kg. Noting the unpopularity of carrying up to 12Kgs of lead, the prospect of lighter sailors carrying 40Kg + in order to fully equalise weight would not be supported.

- **Rack Range**. To equalise the leverage of 70Kg - 105Kg sailors would require current Hole 8 sailors to have racks 660mm wider and Hole 1 sailors to reduce width by 610mm. A trial to extend racks beyond the current Hole 8 has been previously trialled, but was deemed to be impractical.

An amendment to the Performance Compensation system was put to a Class Association vote in 2016 that increased lead and reduced rack width; but was comprehensively rejected as lighter sailors didn't want to carry additional lead and heavier sailors weren't prepared to reduce rack width below Hole 1.

COA 4 - Remove Weight (for and against)

Set against the restrictions above of not being able to increase weight or expand the rack width range, the only way to speed up the lightest sailors is to remove the lead.

Arguments for this proposal include:

- **Lighter sailor performance**. Lighter sailors' performance will improve slightly across the wind range.

- **Cost**. Lead corrector weights cost £97.95 each, so 3 correctors for the lightest sailors would cost £293.85. Sailors are generally happy to spend money to speed up their boats, but not to slow them down.

- **Lead for events**. Many club sailors who just sail for fun don't sail with lead in their boats, so the above cost or hassle of trying to beg, steal or borrow lead to 'try' an official event will be a discouraging factor.

- **Hull weight**. There are potentially large variances in boat hull weight, but this has never been factored into the compensation system. Although it has been subjected to several repairs over the years, the all-up-weight of the author's boat is approximately 9Kgs heavier than the 'advertised' hull weight. If a hole 8 sailor raced the boat, they could be potentially sailing with a boat 18Kg heavier than competitors with lighter hulls. Aside from the inconvenience of weighing the boats, lessons from other classes would suggest that the RS700 class should not start doing it as it can have a major impact on the resale value of the boats.

- **Boat appeal**. Without the lead, the RS700 class on the whole will be lighter, faster and have a greater appeal to any prospective new sailors.

- **Downwind handling in waves**. The presence of lead so far forward is frequently cited as being problematic for lighter sailors in waves. Removing the lead will enable them to keep the bow further out of the water to prevent pitchpoling.

- **Off the water handling**. It is slightly ironic that the smaller you are the heavier the boat gets. Removing the lead will enable boat recovery up slipways and beaches more manageable for lighter sailors.

Arguments against removing the lead include:

- **Core to the compensation system**. The use of lead in conjunction with the rack settings is seen by many as a key feature of the class and how performance is moderated across the sailor weight range. The perceived effectiveness of the compensation system is seen by some as a major attraction of the class.

- **Disadvantage to heavier sailors**. Removing the lead will slightly speed up lighter sailors across the wind range, which is likely to be noticed mostly in the lighter winds where the heavier sailors leverage advantage doesn't factor.

There is a widely held view that the boat 'carries weight well' and isn't overly affected by additional weight. To investigate this further the Class Technical Representative conducted some rudimentary experiments using a model hull, to assess how added mass increased sinkage, bow trim and water-plane and wetted surface areas. Appreciating that this was not a 100% accurate experiment due to probable errors in the model, the technique used and salinity of the bathwater(!); the results are at least indicative.

As illustrated in Photo 1 (below) the model was statically ballasted in the tank to the required all up displacement using additional weights placed on the model centreline. Two displacement conditions were used: a Light condition that represented a 70Kg sailor (in addition to a boat with an all-up-weight of 85Kg), and a Deep condition that represented a 100Kg sailor. The respective waterlines of both conditions were then marked on the hull and can be seen in Photo's 2 and 3. It can be seen that while the Deep displacement condition results in an increase in draught at the bow; increasing bow down trim, overall, the upright static hull water-plane and wetted surface areas do not change significantly. This supports the view expressed earlier that the addition of corrector lead ballast forward of the hull's centre of buoyancy isn't ideal from a sailing perspective on boat trim downwind in waves and that in general the hull design carries increased weight/mass rather well.

Photo 1

Photo 2

By measurement and application of Simpson's Rules the increase in wetted surface area was generously estimated to have increased by 2.8%. Noting that this measurement was conducted using a 30Kg variance in sailor weight and in fresh water, it indicates that the effective reduction in wetted surface area of not applying 9Kgs of corrector lead will probably be in less than 1%.

Although a 1% increase in wetted surface area will undoubtedly make a speed difference, for the equivalent trim, it is worth noting that at displacement speeds, wave making and hull friction resistance are roughly proportionate to speed squared (v^2). Therefore, at displacement speeds (where heavier sailors may be concerned that they are giving away too much advantage) this very small reduction in wetted surface, due to the omission of the corrector lead will have a relatively benign effect. Further, any benefit of having increased bow trim on resistance, due to the presence of corrector lead, will no longer be available to the lighter sailor's without corrector leads and trim will solely depend on sailor body position and weight.

Photo 3

The theoretically maximum 'hull speed' in the displacement mode is estimated to be about 5 Knots, beyond which wave-making resistance reduces in proportion as hull lift pressure increases and the hull in effect starts to transition into a planing mode.[1] In a more conventional hull-form, reduced all up weight would typically result in earlier planning, however the combination of the powerful after-body and fine bow of the RS700 means that there is less apparent 'speed hump' to overcome to allow the boat to start planing. As the boat makes a steady transition from displacement to planing mode it should mean there is minimal advantage in being light to 'get on the plane' early. Ultimately, it is the control of the engine; sails, that is the over-riding factor in driving the boat faster as power becomes available through increased wind strength.

While it is probably not affected by the presence of the lead, it is acknowledged that heavier sailors are more likely to sink the transom during light wind tacks, gybes and spinnaker hoists, which kills speed and can take time to recover from.

In summary, the removal of lead from the boats is anticipated to marginally increase the boat speed of the lighter sailors across the wind range, however due to the squared relationship between resistance and speed it will have its greatest effect at higher speeds. Therefore, removing the lead will provide lighter sailors the most benefit in the stronger winds; which is where they need it most to offset their lack of righting moment.

[1] There will be a slight increase in the heavier sailor's theoretical 'hull speed' due to the increased waterline length, but this is considered negligible.

COA 5 - Expand the compensation to 60% and increase the Target Righting Moment

To address the fact that the current range is too narrow[2] and not centred around the average leverage, the rack setting range can be expanded by adjusting the Compensation Factor of 60% (from 66%) and increasing the Target Righting Moment used in the calculation to 188Kgm. Having reviewed data from the international RS700 Sailor Surveys (2015-17) and recent UK Nationals, the average RS700 sailor weight is 85Kg. The revised 2021 Trial Rack Settings at Enclosure 1, will compensate the range 75Kg - 95Kg (i.e. 10Kgs either side of the average). This shift would see 71% of the 2019 UK Nationals sailors brought into the range and 82% of those that attended the 2020 Nationals. Although the table at Enclosure 1 may look as though it compensates sailors heavier than 95Kgs; analysis of sailor data indicates that lighter sailors righting moment is similar to their weight, whilst heavier sailors generally have a higher righting moment to weight ratio (either through increased height or waistline).

The arguments for this COA include:

- **More effective range**. The wider range means that it will bring most sailors onto the compensation range, which will increase the credibility of the system and hopefully reduce the number of complaints.

- **Representative class average**. The effective range will be more representative of sailor weights and leverage.

- **Nobody slows down**. This proposal will see the majority of sailors increase a rack setting, whilst no sailors will have to reduce rack width. Enclosure 2 illustrates the difference between the proposed 2021 Trial Rack Settings and the existing ones in the class rules.

- **Class will speed up**. With many sailors increasing in rack width the overall speed of the class should increase and make the boat more appealing to prospective new members.

Potential arguments against this COA are:

- **Heavier sailors increasing rack width**. Some lighter sailors may complain that it is not fair that some of the heavier sailors (still on the range) will be increasing rack width. While this may be the case, most lighter sailor's complaints are aimed at the 'super-heavies' (who are off the end of the scale), rather than those that are on the range.

- **'Super-Heavies' have nothing to gain**. Heavier sailors who will still be off the end of the revised scale may complain that they have nothing to gain by this proposal. However, they were 'heavily' represented at the 2019 AGM when the initial trial proposal was discussed, and most seemed content with the initial proposal as it would encourage more sailors into the class to race against.

COA 6 - A combination of COA 4 and COA 5

This COA is to adopt COA 4 and COA 5 in their entirety, and is the basis of the 2021 Performance Compensation System trial. This COA addresses the issues relating to the carriage of lead and the narrow unrepresentative compensation range. While the committee strongly support both COA 4 and 5, they are unlikely to be successful if pursued independently. Lighter sailors are unlikely to vote for some heavier sailors increasing rack width, whilst heavier sailors are unlikely to vote for lighter sailors removing lead.

The combination of both measures should mean that both light and heavy sailors have something to gain, while improving the overall appeal and handling of the boat.

[2] At the 2019 UK National Championships only 24% of sailors were within the compensation range.

Conclusion

The adoption of this proposed trial **(based on COA6)** for the 2021 season represents an opportunity for the RS700 class to explore a variation to the existing weight compensation system without committing to a permanent change. This proposal builds upon the positive feedback from the 2019 trial, while addressing some of its negative aspects. It is the committee's belief that by removing the lead weights and modifying the rack settings, the compensation system will be more representative and celebrated, while the boat will become quicker and more enjoyable.

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Enclosures:

1. 2021 Trial Rack Settings.
2. Comparison of 2021 Trial Rack Settings to Current Class Rules.
3. RS700 Rack Setting Widths.

RS700 Rack Position - 2021 Trial Settings

Helm Righting Moment kg

= Weight recorded by scales at head end x Gauge Length

Helm Weight kg	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	###	01	02	03	04	05	06	07	08	09	10	11	12
70	-	-	-	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	4	4	4	4	4	4	3	3	3	3
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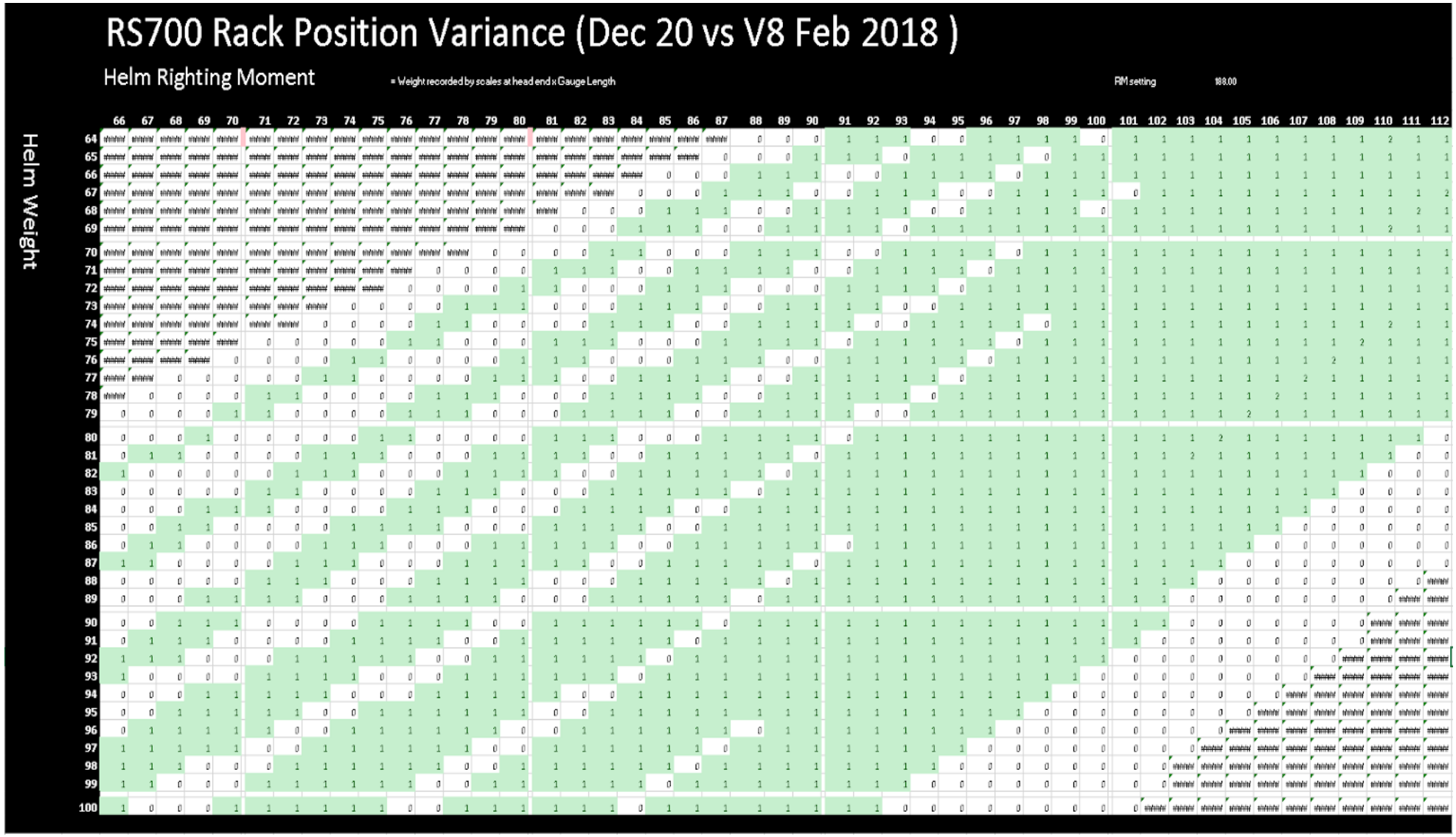
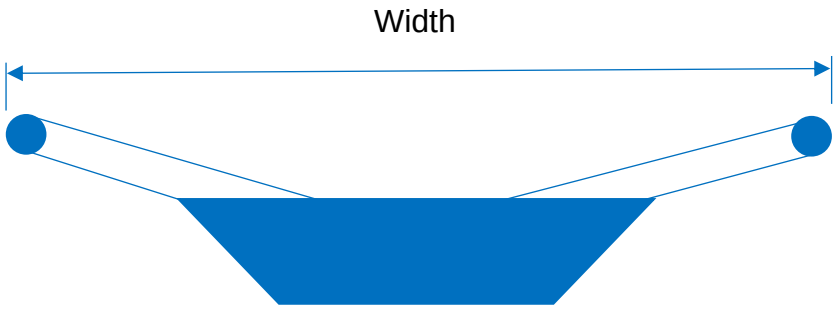


Note: Numbers refer to the change in rack position between the 2021 trial and the current system. i.e. the ‘1s’ in green boxes indicate an increase of one rack position, while a ‘0’ indicates no change. (If there were any, a reduction in rack position would be reflected by a red box and ‘-1’)

RS700 Rack Setting Widths

As the rack setting holes are drilled by the licenced builder, there shouldn't ordinarily be any requirement to check that these hole settings correspond to the correct rack widths; however, for reference they are as follows:



Rack Hole Setting	Rack Width
Hole 1	1.980m
Hole 2	2.090m
Hole 3	2.190m
Hole 4	2.300m
Hole 5	2.400m
Hole 6	2.505m
Hole 7	2.610m
Hole 8	2.710m