

February 2019

Executive Summary:
Wolfson Report No. 2698
FISA Para-Rowing – Review of Para-Rowing Equipment

“Currently, FISA one-design para design hulls and pontoons, are adopted for the PR1 Single Scull and PR2 Double Scull (with or without pontoons) classes. Discussions are underway as to whether these are the most appropriate design options, for the longer course length of 2000 metres to be used for the Paralympic course length in the future. This programme of work is aimed at providing evidence with respect to predicted differences of level of safety and speed resulting from different configurations, i.e. FISA standard para hull designs versus Olympic style hull designs with/without pontoons.”

This summary will focus on the aspects determined to be most pertinent to the discussion within FISA concerning the safety and speed of the Para Rowing boats.

The attached report describes the testing protocol, programs used and a general explanation of the science of speed and stability. This, along with other parts of the report concerning inverted stability and pontoon size will not be summarized here and may be read in their entirety in the report.

The boats being tested may be characterized by the table below comparing the waterline beam of the existing para rowing boats vs an Olympic style hull. Waterline beam, meaning “the width at the widest point of the immersed hull measured at the static waterline”, is the strongest determinant of initial stability of a hull.

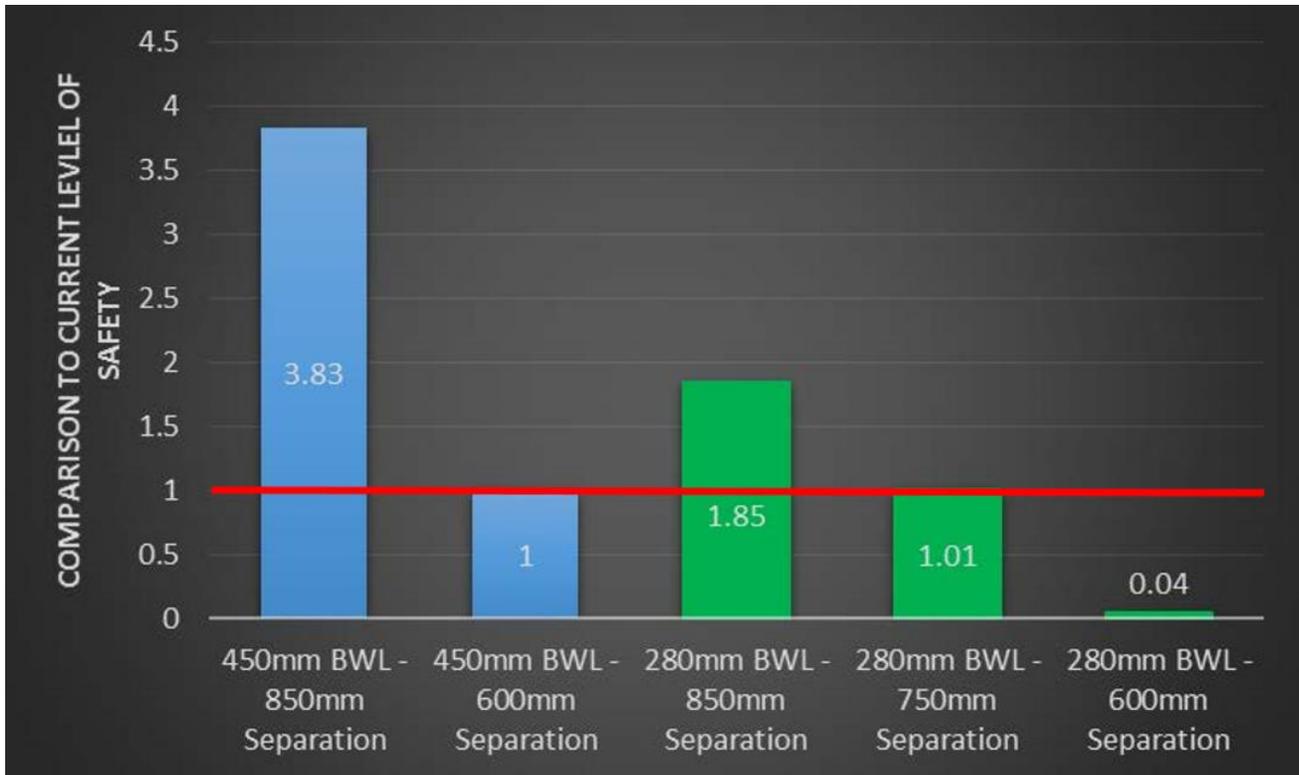
Para Rowing Hull	Olympic Hull (typical)
PR1 450mm	280mm
PR2 490mm	320mm

PR1 Stability

The most important consideration of this study, and FISA’s motivation for initiating the study, is the safety of the rower if the Para Rowing hull were to become deregulated. Computer modeling was used to simulate the stability of the current para hulls with pontoons set at 850mm and 600mm from centerline. The minimum allowable dimension is 600, with few teams having the pontoons set that close in to the hull. Since our experience shows few problems with capsizes at that dimension, we have set the minimum stability criteria to match that configuration.

As the waterline beam of the boat has a significant influence on the stability, when we change to a narrower boat using the same pontoons, they must be attached further from the centerline to affect the same stability. Equal safety is achieved with the existing pontoons 750mm from the centerline with the Olympic type hull.

The graph below shows the stability results reduced to a simplistic form comparing different configurations of Olympic and Para hulls. As discussed above, the existing PR1 boat configured with the pontoons at minimum distance relates to a safety factor of 1. To achieve the same level of safety with the narrow boat the pontoons must be set 750mm from the centerline of the hull.



This study did not take into account the following:

- Any dynamic stability effects, athlete induced control, and impact of the outriggers and blades; factors which are dependent on athlete and the environment and potentially equal in each case.
- Olympic hulls for Para-Rowers who have an asymmetric sitting posture
- Accommodation which may have to be made for athletes with specific disabilities requiring an upward adjustment of seat height and therefore a reduction in stability

PR1 Speed Differential

The speed of the boats was studied to determine the time difference to cover a 2000m racing distance. A time of 9 min for the 2000m course in the PR1 boat with pontoons was used as the baseline. This time, related to the calculated resistance of the boat at that speed, makes it possible to determine the average power output of the rower for the race. The same average power was used to move the Olympic hull with pontoons over the course.

The result was that with the pontoons immersed the same amount for both the PR1 standard hull and the Olympic style hull, the Olympic hull was approximately 13 seconds faster over 2000m. Given that the narrower hull has less inherent stability it could be expected that the pontoon(s) would have greater immersion for stability and therefore greater drag, somewhat eroding or eliminating that differential.

PR2 Stability

This is a much different case from the PR1 as this class does not require pontoons. The standard PR2 design, while quite stable without pontoons, does not have positive stability. This means that the boat would prefer to turn over in the absence of the rower maintaining stability. In this case, the definition of acceptable stability will be more by empirical experimentation.

PR2 Speed Differential

Assuming that both the standard PR2 boat and the Olympic boat are rowed without pontoons the speed difference is 17.8 seconds over 2000m. Assuming that the standard PR2 boat and the Olympic boat are rowed with both pontoons touching, the speed difference is 9.8 seconds over 2000m.

Pontoon Design

The design of the pontoon explored in this paper may not be particularly relevant. This should be explored in more depth to both reduce drag and to reduce the spray from the existing design. There should be a design which maintains the existing stability while improving performance.