WATER-FREE IOM MEASUREMENT
IOMICA, 2005 March 4

The IOM has grown to become the most broadly accepted radio sailing class worldwide. To a large degree that success can be attributed to a strong set of class rules. However, as the class continues to grow the practicality using of a flotation tank to measure draft has come under increased discussion. The IOMICA has been investigating the possibility of a simplified "water free" measurement method to determine hull depth, keel depth and total length at event measurement.

The objectives are to:

1. eliminate the need for flotation tanks at event measurement
2. avoid the construction, transportation and storage problems associated with the current tank
3. make hull depth, keel depth and total length controls easier and quicker to do
4. address the growing perception that the IOM is difficult to measure
5. encourage measurement of all IOM yachts at all events
6. minimize any advantage or disadvantage to existing and future designs (this is probably the most important point as it is vital that any new measurement procedure doesn't prejudice the current IOM global fleet).
7. Produce a method of measuring hull and total depth, which has minimum influence on the design concept of the hull.

Currently the IOM is governed by class rule C.4.1 which specifies minimum and maximum *draft*, maximum depth of the hull from the waterline and maximum hull length, all with the boat floating in fresh water. This effectively places minimum restrictions on hull form, as can be seen by the range of designs that have been built over the last decade. And this is considered to be an important feature of the IOM class, the development of hull forms. It is of prime importance that with any new measurement criteria we do not restrict hull design/form significantly more than it is with the current rules which allow a great deal of freedom when designing an IOM hull. Unlike other radio sailing classes, we do not need to actually measure waterline length (which is very complicated to do accurately) and there are no limits on hull width etc and no formula based on hull length or waterline length etc to determine other factors.

Obviously, '*draft*' (which is measured from the waterline) cannot be measured without water, so the new measurements are simply referred to as 'hull depth' and 'total depth'. The baseline for such measurements is not designed to exactly replace the real waterline but simply to provide a common point from which to measure these new parameters.

As a first step a simple transverse keel depth gauge was considered and designed (Figs.1 and 2 below show two versions) being modelled after a similar gauge used for the Marblehead class along with the possible elimination of the hull depth restriction and with a simple length gauge to measure total length. A study of more than 30 current designs showed a maximum variation of 4mm (+/-2mm) in keel depth measurements using this type of gauge (v.3) vs. a tank. That amounts to less than 1% of the maximum permitted total draft allowed by the current rules. In both designs a stepped or double jaw ensures that both narrow and wide beamed designs are catered for.

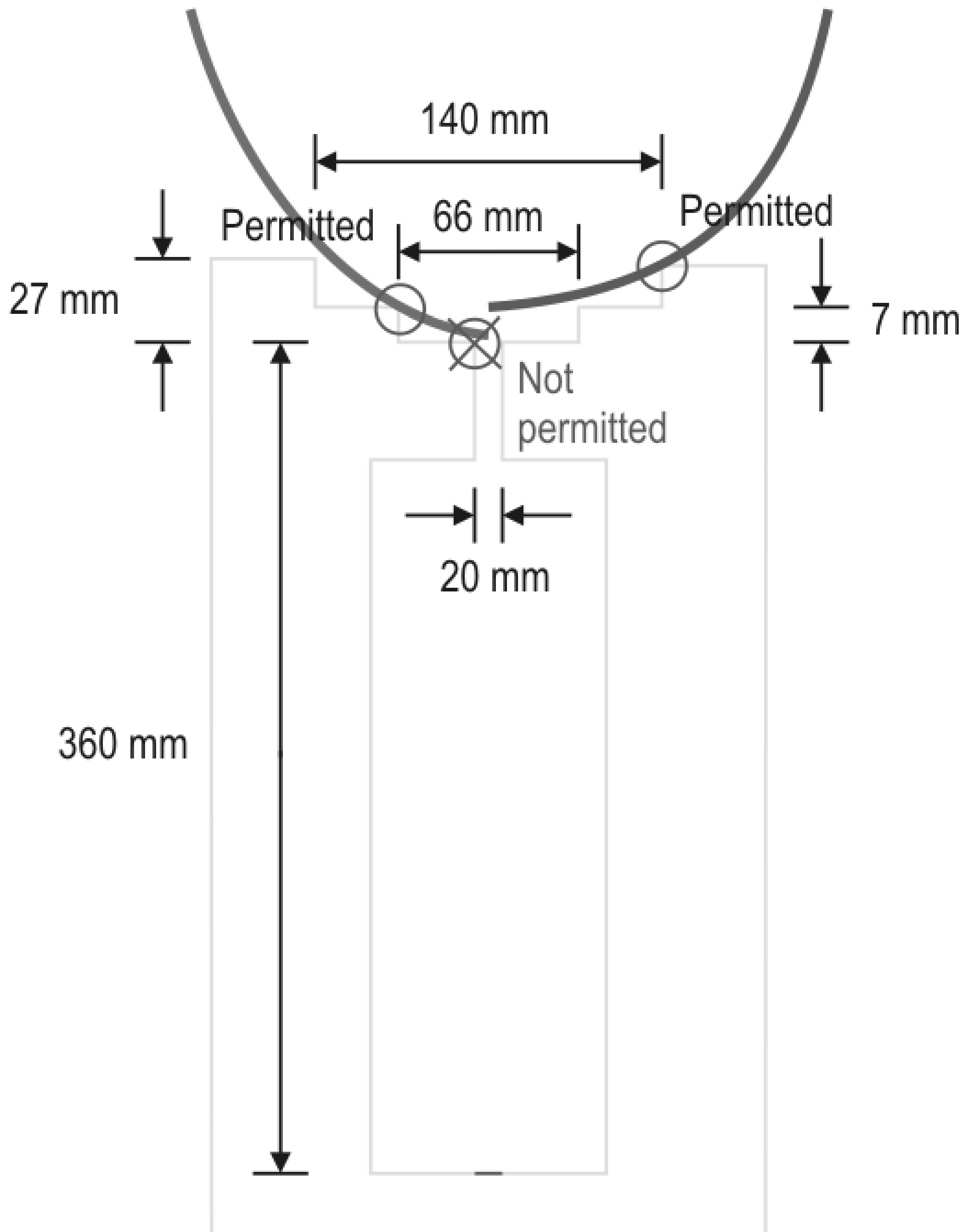

Figure 1. Transverse gauge v5.

It can be seen that the double jaws of the designs catch both shallow draft wide beam designs and narrower beamed deeper draft designs. Although it may be possible that an extreme design would be slightly more advantaged or disadvantaged we cannot foresee a large danger of odd shaped hulls being successful considering other factors such as drag, wetted area and form stability. For example, a hull would need to be less than 66mm beam at the mid sections to fall through the gauge in Fig 2 – whilst not impossible, taking into account the displacement of an IOM, it is highly unlikely.

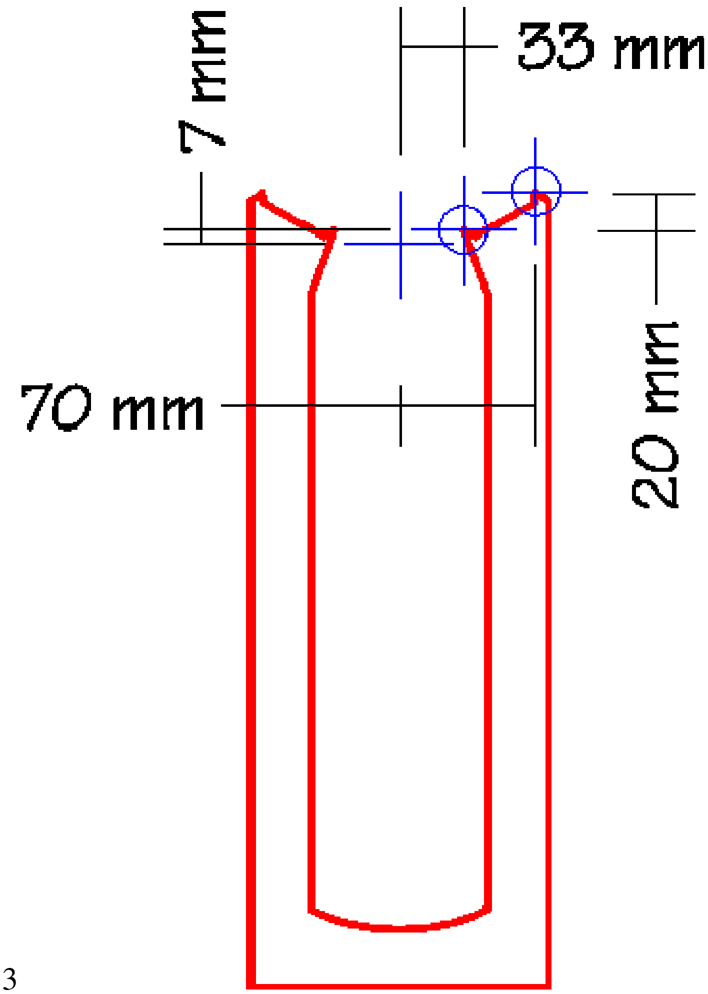

Fig.2. Transverse gauge v.3

The gauge can be made of any stable rigid material, (sheet metal, polycarbonate/Perspex, Formica etc) and its use is as simple as offering it up below the hull with the keel and bulb mounted to see if it passes cleanly without the bulb touching the base of the gauge.

A longitudinal gauge was then considered and it was decided that with this approach a hull depth restriction could remain. The current versions of longitudinal gauges for measurement of hull depth and total depth/total length are shown below (Figs 3 and 4) and are the result of the work of the IOMICA Measurements and Technical Sub Committees (MSC and TSC) along with input from other IOMICA officials, designers, measurers as well as comments gathered from the various IOMICA forum threads on this topic.

These diagrams are only designed to show the concept of the measurement, the details of construction are less important since the gauges could be made of any stable material (metal, plastic etc…). Indeed, to date a number of prototypes have been made using Formica, polycarbonate and even wood (probably not suitable in terms of long term stability). The critical points to note (on both gauges) are the size of the bow and stern supports at 30mm and 10mm in from their respective ends. Tests have shown that the bow support could be shorter without having a large effect on the measurement but the bow bumper interferes if it makes contact with the bow support.

Extreme scow designs with the bows well above the real waterline may be disadvantaged by this type of measurement gauge and there may be an advantage gained by designing a hull with both the bows and stern immersed to maximise total draft although the effects of increased drag and the other factors mentioned earlier may counteract this benefit.

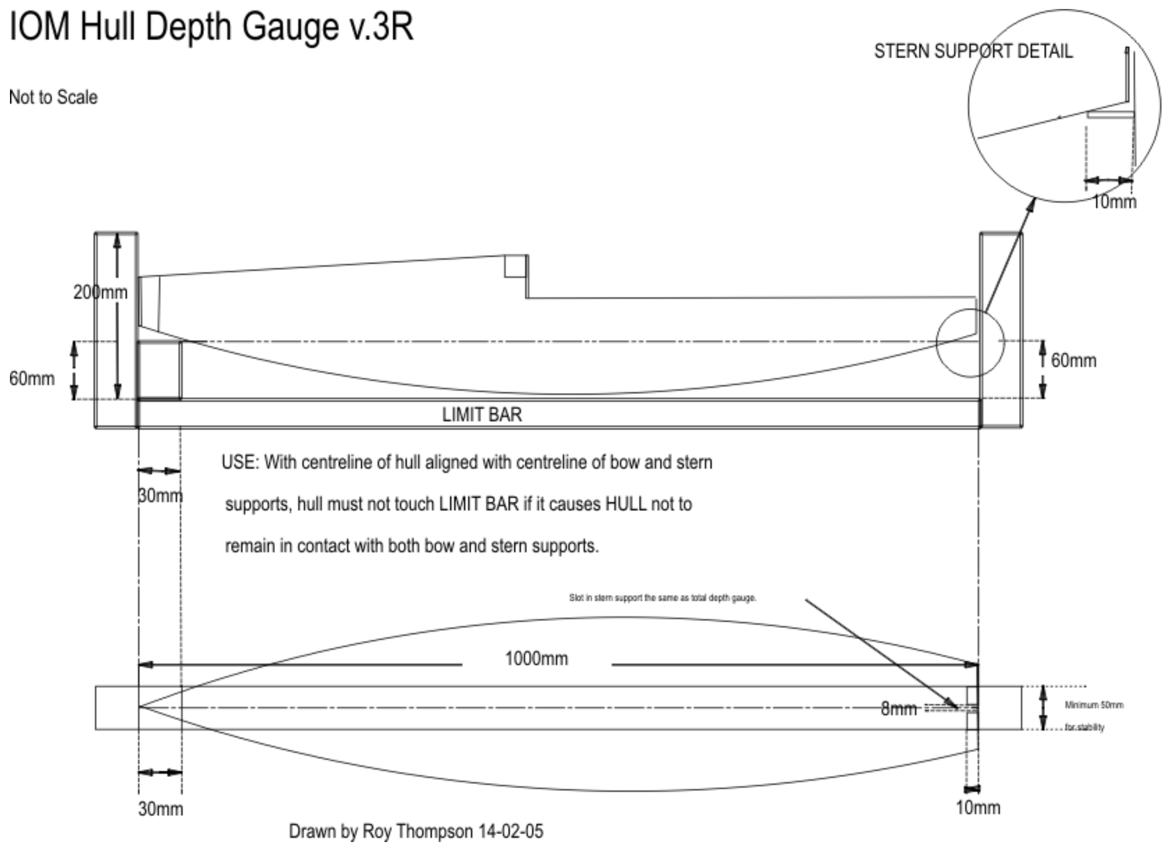

Figure 3. Longitudinal Hull Depth Gauge v3R

Whilst some small scale trials have been carried out with these types of longitudinal gauges and in the Australian Nationals a similar method to determine hull and keel depth was employed, large scale testing of these gauges with the collection of empirical data is necessary to fully test the feasibility of the idea and adjust the critical factors of the gauges design to minimise as far as possible any negative effects of using this type of measurement.

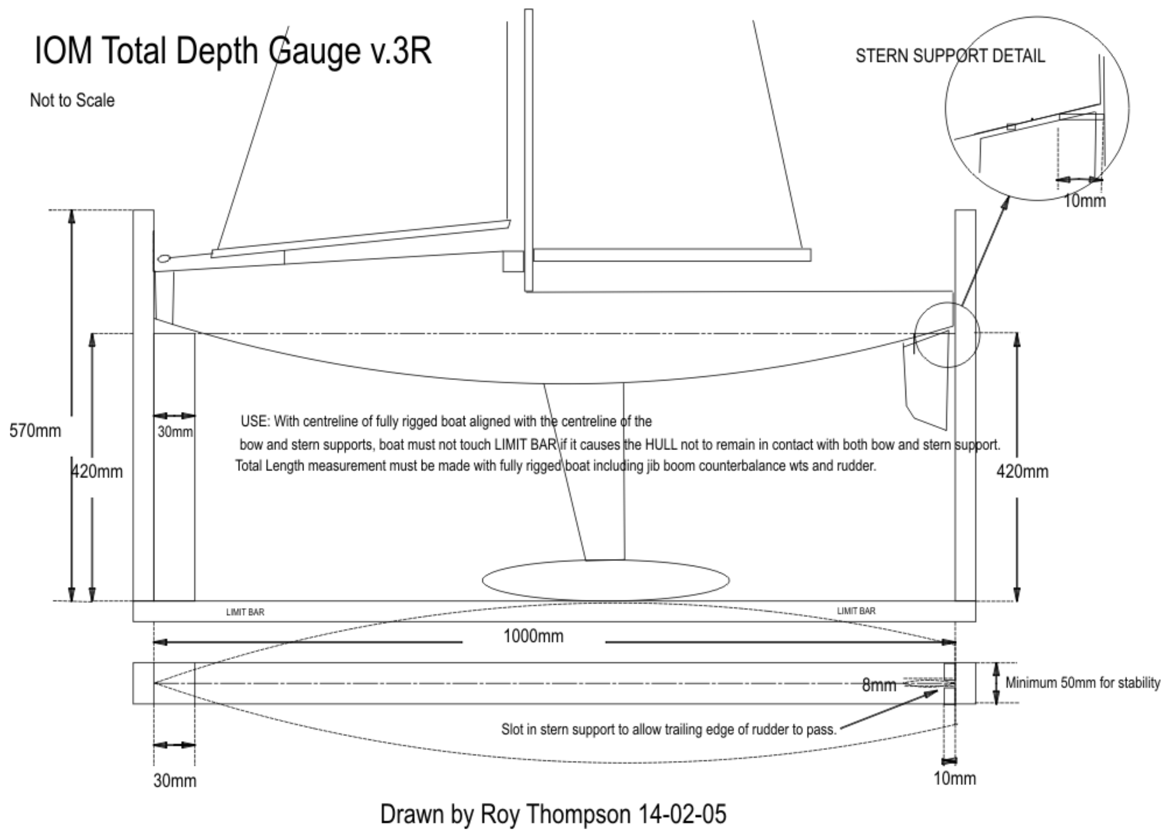

Figure 4. Longitudinal Total Depth Gauge v3R.

It may be necessary to have a period where both tank and gauge measurements are made at events to fully appreciate the true impact of changing over to the use of a gauge. It may also be wise to use a transverse gauge for the keel depth and a longitudinal gauge to measure total length and/or hull depth. It may be that some of these measurements can be incorporated into the certification (fundamental measurement) process and hence alleviate some of the work, time and stress for both competitors and organisers at events.

The question is, can we do away with the tank and water without significantly changing the design of IOM hulls?
With the studies we have conducted so far it is not believed that any of the gauges will allow the design and construction of a new superior IOM when straight line speed, manoeuvrability, drag, wetted area and form stability are taken into account, especially if a wide range of wind speed and water conditions are considered. This of course needs to be proved on the water and on the racecourse.

Comments from the IOM class owners, measurers, designers and event organisers are welcome via the IOMICA forum Topic 'Water Free Measurements' within the 'Measurements' area of the forum.