

# The Rules

What the authorities say should be  
guiding principles of boat design  
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'Science is first in the requisites for consistent success, but it must be blended with natural genius, imagination and much practical handling' **Norman L Skene**

## The Hull

- Simplificate, and add more **lightness**. **Henry Ford** (via [John Welsford](#)) *Comment: John reckons this principle applies generally in boats.*
- The first requisite of any **practical boat** is safety, the second comfort, and the third speed. **Edson B Schock**
- Other things being equal, the **faster boat** is preferable. The hell of it is, other things are *never* equal. **John G Hanna**
- Unless a boat, however small and simple, is **built in a shipshape manner**, it is better not built at all. **William Atkin**
- Cinch up your belt, roll up your sleeves, and go ahead and **build it**, regardless of hell, hurricanes, and high prices. It'll always be worth the cost, as it always was. **John G Hanna**
- A **man** needs a foot of boat waterline for every year of his age. **Traditional, repeated by Uffa Fox** *Comment: Harrumph. What utter bilge. It's a great shame that a man of Fox's genius seems to have been caught saying it, and it's even worse that people keep repeating it. Try telling that to Sir Francis Chichester or Frank Dye, or the entire membership of the Dinghy Cruising Association - for the principle implies that their President should be 12 years of age to match his little Tideway. And don't tell the hundreds of older people sailing Flying Fifteens every weekend in the UK they have got to retire from sailing these boats at 15. And here's the irony: it was Uffa Fox who designed that boat.*
- **'Originality'**, based on one's own study and experimental work, is really the keynote of success **Norman L Skene** *Comment: this is all very well, but let's not forget all the good ideas people have tried and used successfully in the past...*
- The **centre of bouyancy** should be just aft of half way between bows and stern - **John Teale**
- Flat-bottomed vessels need slightly more **centreboard area**; round bottomed ones can get away with slightly less - **John Teale**
- The **beam** of a flat bottomed boat should be no more than half the length; if it is to be rowed or sailed, the length should be two and a half to three times the beam - **HV Sucher**
- In wall-sided boats, making the **curvature** of the sides equal to the curvature of the bottom ensures that the water pressures at each surface are equal, and reduces eddying and wake, and therefore drag. - **Philip C Bolger**
- In a ballasted craft, the weight of **ballast** should be 40 to 50 per cent of the all-up weight - **universal wisdom** *Comment: some people say it should all be below the waterline to be effective.*
- In clinker-on-frame boats, there should be 'three strakes or three frames' of **separation between joints** - **unknown source** *Comment: list members have observed that this rule is often not followed*
- Don't concentrate **ballast** amidships in a ballasted boat, or the craft will move unpleasantly, but don't spread it too far, as that will turn it into a diver. A happy medium is likely to be to distribute it over about the middle third of the distance from stem to stern - **T Harrison Butler**
- In small and medium-sized cruising vessels, make the least **freeboard** about a tenth of the LWL - **T Harrison Butler**
- For an inshore racer in primarily light air conditions it might be wise to go to a **prismatic coefficient** of .525 Cp, while an all around cruising yacht would benefit from a higher Cp, say... .54-.55 and an ocean racer from higher yet, perhaps .56-.57. In any case, it is best if the Cp is a bit on the high side since the penalty for having too high a Cp at low speeds is less detrimental to performance than having too low a Cp at high speeds. As well, the high Cp should be achieved by fullness aft, not forward, as full bows have an adverse effect on performance. **Ted Brewer**
- 'The **curves of areas** for the hull heeled at 25 or 30 degrees for an easy bilged boat should lie roughly parallel to the curve of areas upright, and fairness of diagonals is important. **John Illingworth** *Comment: I wonder what irascible old Sir Francis Chichester would say about this? It was Illingworth's company that designed the boat for his round-the-world trip, and Chichester complained at length about how badly balanced that boat was.*
- **Wineglass sections** throughout the hull will give slack diagonals in a chunky boat - and that's good! *Comment: Chunky here means beamy, blunt ends.* **Pete Culler**
- Suitable **beam** in a round-bottomed cruising boat should be found from the formula square root beam=cube root LWL - **T Harrison Butler**
- To minimise **wave-making**, (i) the length on the waterline should be as great as possible; (ii) there should be no parallel body; (iii) the curve of areas of cross section at the waterline should increase smoothly to a peak just aft of amidships and then decrease similarly smoothly, tailing off at both ends; (iv) there should be no abrupt changes in the shape of the of the cross sections, although planing vessels are an exception to this; (v) in sailing craft, conditions (i) to (iv) should be met also at heeling angles of up to 15 to 20 degrees. **John F Sutton**
- 'It is only when the topsides stand high above the water that your **straight-sectioned boat** looks 'boxy.' **William Atkin**
- To be successful, a self-draining **cockpit** should be at least eight inches above water level... The minimum leg room is held to be 15 inches. **Dennis Sleightholme** *Comment: some sources say the minimum is six inches, while others say that an inch or two less than eight inches is OK, if you're prepared to live with some water in your cockpit from time to time.*
- **Expense:** Never use expensive materials to build a boat designed to be cheap; also it is bad business to design a cheap looking boat that will be expensive to build. **Philip C Bolger** *Comment: Bolger's view is that large sharpie yachts break this rule and rarely fetch a good second-hand price.*
- A straight, nearly **upright stem** with a good depth of forefoot produces a dry bow. **Howard Irving Chappelle** *Comment: This statement, and those from HIC that follow, appeared in a conference paper on fishing boat development held in the late 1950s. Not everyone agreed with this particular view, however...*
- **Issues of form.** To be dry, keep the weight away from the ends of the craft. Also, to be dry a bow should pick up bouyancy smoothly as it submerges and only needs a moderate flare - in fact a straight-sided Vee-section will do. There is no advantage to a hollow entrance and a great width at the sheerline. Carrying flare aft can contribute significantly to dryness, however. Hollow should not be considered in anything but a relatively long craft with a length of no less than four times the beam. In craft with a large square stern, a raked transom with provide lift when hit by a wave. **Howard Irving Chappelle** *Comment: this sounds a lot more familiar, and makes intuitive sense...*
- The most **seakindly boats** have between three to five beams to their length, and a draft of one quarter to one half of the beam. they also had keels that were significantly deeper at the stern than at the bows to prevent any tendency to broach in a following sea. **Howard Irving Chappelle** 'In his experience as a designer, this 'drag' in a keel reduced the tendency to broach even in very square sterns,' he added.
- **Balance** is important - for example a narrow and deep hull combined with a wide and shallow stern is undesirable - but in motorised fishing vessels, at least, this balance of the hull neet not be precise and does not on its own justify a canoe stern. **Howard Irving Chappelle**
- **Full-ended boats** may seem dry, but this is only because they cannot be made to move quickly in a seaway. **Howard Irving Chappelle**
- **Flat-bottomed wave-bridging boats** may be more seakindly than other types due to an air cushioning phenomenon. To be effective they should bridge three or more wave crests. Figure the length between wave crests and build the boat at least three times longer than that. **Philip C Bolger** *Comment: Do you know the distance between your local wave crests?*
- **Length should be at least 6 times beam.** 10 times beam is better... at about 14 times beam the energy saved in smaller immersed cross section begins to be exceeded by increasing surface friction **James Wharram** *Comment: Hence all those multihulls he designs.*
- **For unballasted small craft design, try this** Start the design as a flat-bottomed double-ender, making LOA/beam= 4/1. Other types can be developed along the lines of Matryoshkas (Russian dolls). A dory can be created by taking the double-ender and replacing the stem aft with the triangular 'tombstone'. On this basis, a 16ft double-ender becomes a 15ft 3in dory (LOA). A skiff can be created by removing a quarter of the overall length of the double ender from the stern and plugging the hole with a transom board; this makes the LOA/beam 3/1. The punt can be developed from a skiff by lopping 1/8 LOA fore (again measured from the original double-ender), with the resulting hole plugged by a bow transom. A dinghy is a punt shortened still further from the bows. A pram is a still more shortened dinghy. These figures are not absolute. The trick for each development is to stay in the confines of the same sheerlines of the original double-ender - that is, the beam for the pram is still 4 ft if the original Double-ender is 16 ft. Oh, I nearly forgot. Make sure that sheer line of the original D-E is a NATURAL curve, that is part of a circle arc. For hard-chined hulls, the circle arc segment is set on the LOA as chord. The (maximum) height of the arc is the hypotenuse of a right triangle of which the long leg equals the half-Breadth at Beam (1/8 LOA). The short leg equals the Profile height at Beam. The acute angle between the long leg and the hypotenuse equals the flare angle. (Gardner, John 'The Dory Book' page 43). **Barend Mighelsen** *Comment: This approach derives from Barend's work measuring old boats. Should be easy to draw using CAD software.*
- The Dinghy Cruising Association, a largely British association of people into cruising **small open boats**, has its own set of criteria for boats regarded as suitable for this purpose. The criteria that apply to boat design are as follows: (i) The boat should carry sufficient crew - one stone (14lbs or approximately 6kg) for each foot of waterline length is suggested as a minimum. (ii) The boat should be stable enough to allow the recommended weight of crew to sit on the gunwale without dipping it under or the craft capsizing. A beamy hull is advised, minima to aim for with 12ft, 14ft and 16ft dinghies would be 4ft 4in, 5ft 3in and 5ft 10in respectively. (iii) The boat should carry sufficient positive bouyancy to support itself together with stores and partially immersed crew, plus a reserve of not less than 112lbs. This bouyancy should be so disposed that it is possible for the crew to put the boat back into sailing condition after capsizing or swamping. It should be stressed that capsizing is not an acceptable proposition in a seaway due to the long period of exposure that may ensue and the possible loss of stores and equipment. In rough seas, recovery may even become impossible. (iv) The vessel should have at least a foredeck. (v) Mast, rigging, fittings etc. must be strong enough to withstand capsizing forces. (vi) Consideration should be given to having the mainsail canvas a grade heavier than on a similar-sized racing dinghy; at least this will ensure longer wear. The mainsail should be capable of being reefed while at sea and the possession of a storm jib is desirable on sloops. The **Dinghy Cruising Association**
- A moderate amount of **rocker** helps in waves by getting the center of gravity and the center of the boat down low in relation to where the bow or stern enters the wave. This keeps the bouyancy in the bow and stern up high and it allows the boat to rock fore and aft easily in response to waves. The downside of rocker is in loss of speed, however