Taking the Lines off Historic Vessels

~ a guide for amateurs ~

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A little while ago I received a request to write up an account of the method I use for taking the lines off pearling luggers. I've been pursuing a project of researching and documenting these unique Australian working craft for over a decade now. I should preface what follows by pointing out that there are lots of ways to do this and this is just the way I do it. As I haven't tried any of the other ways so I can't really say whether they are better or worse; but having used this method quite a few times now I'm at least sure that it works reasonably well for vessels with a straight keel (fin-keelers might require a modified method). The method has evolved a bit over the years in the light of experience and I've now got it to a pretty slick process – I can lift a good set of measurements off a ~50 foot hull in a single day.

Of course, modern computerised laser surveying gear (as used by yacht raters and the like) makes manual methods like this redundant, but I can't afford the price and in any case it seems to take a lot of the fun out of the whole thing – a bit like the difference between building a wooden boat or buying a fibreglass one!

The boat has to be out of the water, of course. I've measured luggers on slipways (marine railway type); on tidal slips; on the hardstand (after being lifted out by travel lift); lying abandoned on a mudbank; and even sitting on a cradle in a museum gallery. The method worked OK for all of them, but as a rule the more level and upright the boat is sitting, the easier it will be. The availability of things like a workbench, a covered shelter (to keep your notes dry when it's raining!), bathroom facilities and a not-too-distant source of cold drinks, hot coffee and sticky pastries also help, although they're not essential. When measuring pearling luggers a mixed flock of sandflies and mosquitoes are usually present so insect repellent *is* essential, as is sunblock.

Luggers are usually found in remote parts of Australia so nearly all the tools I use can be carried as checked luggage on an airline. The main ones are clamps (I mostly use quick grips, they're fantastic); a selection of tapes and rulers (including a long, non-stretch tape on a reel); a selection of spirit levels, plumb bobs and bricklayers stringlines; a carpenters square; a selection of marking devices including chalk, tape, marker pens and small nails; a clipboard and notebook; and of course a camera. When I arrive I find a hardware store and buy three long, straight pine battens – 3 metres x 40mm x 15mm works fine for boats the size I work on; larger boats might require longer battens. I also need to borrow a reasonably large ladder, fortunately most boatyards can supply these if you ask nicely. Using a tape and the marker pens I turn the battens into three large rulers, marked in feet and inches.

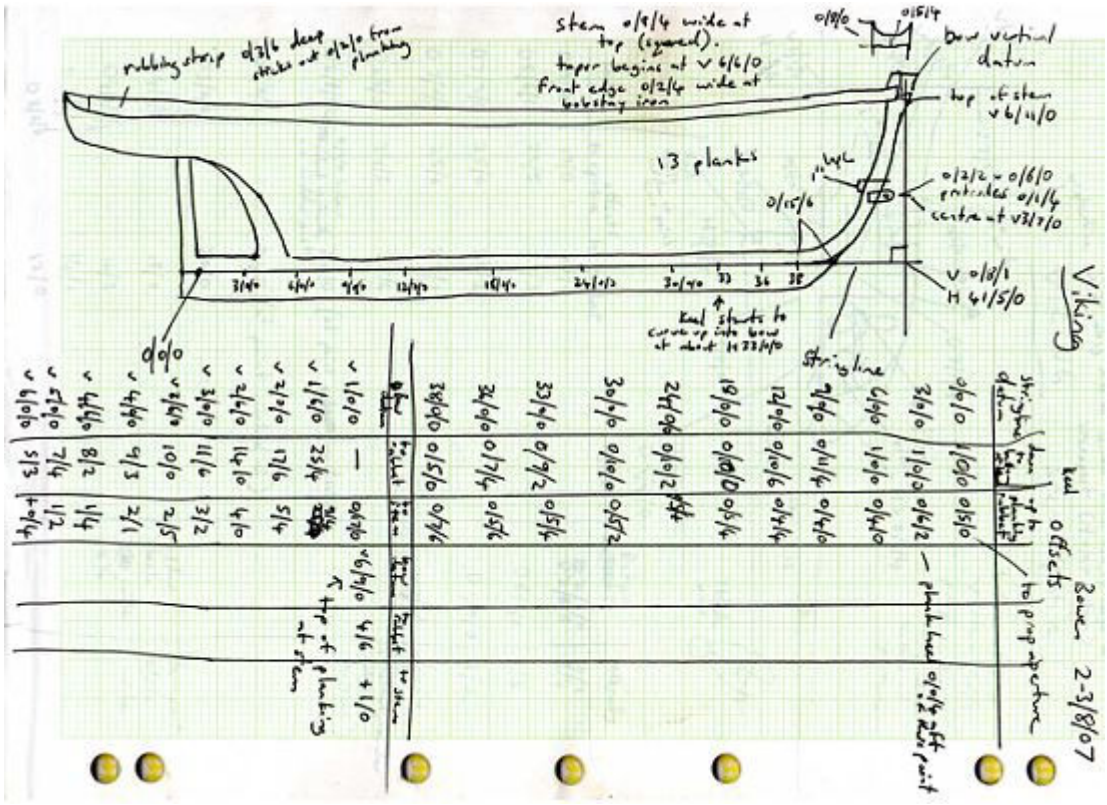
The first step is to establish a zero datum, which is the point on the boat to which all subsequent measurements will be able to be related. I make this at a recognisable point on the top of the stem (usually either the forward or aft edge of the bowsprit gammoning strap where it crosses the stemhead) and mark this with something like a clamp, which should remain in place for the duration of the survey. I next drop a plumbline down the stem from the zero datum, to establish whether the boat is sitting level and to carry a reference line down to the level of the keel. If possible I establish another datum point at this level – a big block of wood with a nail in it seems to work well.

The picture below illustrates the idea. The zero datum for this survey of the 1904 Thursday Island lugger WAITOA is marked by a clamp (just visible) at the top of the aft edge of the bowsprit gammoning strap.

A plumbline at the stern can also be used, to check the alignment between bow and stern. Some old boats have a surprising amount of twist in them! This picture shows the stern of MITCHELL (a 1909 Broome pearling lugger) sitting nice and straight.

Measuring from one or both of these datum points, I then run a long tape the length of the boat and mark off the station intervals. As a rule of thumb, divide the overall length of the hull into ten equal parts, this gives the approximate station spacing. On pearling luggers, which are generally a bit over 50 feet long, I use station intervals of six feet. If the hull has strong curvature at any point (such as the stern quarters) it may pay to put some extra stations in to better define the shape of the hull in that area – this is a matter for judgement and of course experience helps in this regard. If there is an obstacle in the way of a station (such as the arms of a slipway cradle) it doesn't matter, the station can be moved a foot or two without affecting the outcome (as long as you record the new location accurately, of course!).

A side note here about notes and note-taking. You can't take enough notes. Record (and photograph) everything you can – there is a myriad of detail and weeks, months or years later when you're sitting at a desk thousands of miles away drawing it all up, you'll be thankful for every sketch, note and measurement you took. I especially try to record the positions and dimensions of visible hull features (things like deckhouses, chainplates and the like) that can be seen in photographs and used to scale dimensions on them. I use feet, inches and eighths (because pearling luggers were built in the era of imperial measures) and record them using the usual feet-inches-eighths shorthand used by shipwrights, so 20-8-5 is 20 feet eight and five-eighths inches. A similar shorthand works equally well for metric measurements. I end up with field-sketch diagrams like this one:



Once the station intervals have been marked (chalk or tape works well) the bulk of the work begins – establishing the cross-sectional shape of the hull at each station. I do this by using the three batten rulers and clamps to build a triangular frame of known dimensions against the hull at the station, and then measure offsets from it to the hull. The frame should be a right-angled triangle and follow the shape of the hull

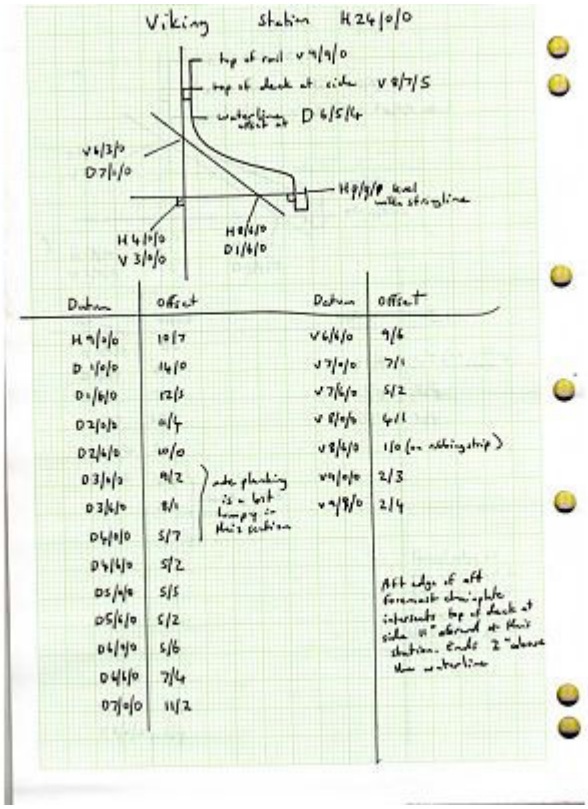
reasonably closely – measuring short offsets is easiest and offsets more than three feet long can get very tricky. If the boat is level and upright the two sides of the triangle that meet at the right angle should be set horizontal and vertical respectively, using spirit level, plumbline and carpenters square. The station can be established perpendicular to the waterline, a stringline or the line of the keel. Of these, the waterline is preferable, firstly because most NAs these days seem to follow the convention of drawing cross sections set at right angles to the waterline, and secondly because the keel isn't always dead straight (due to hogging, for example).

The pictures below show how this looks in practice. The first shot shows a measuring frame set up at a station near the bow of GRAFTON, a 1907 Thursday Island pearling lugger.

The next picture is a detail of the measuring frame made from the batten rulers, showing the right angle where the vertical and horizontal battens meet.

If the boat is lying on its side I set up the stations at right angles to the side face of the keel. This introduces an unwanted source of error and is far from ideal, but sometimes you don't have any choice. The pictures below illustrate what I mean; they show the abandoned hulk of VIKING, looking very forlorn.

The measuring triangle can be accurately defined by recording the points where the battens intersect. I do this by referring to the battens as the vertical, horizontal and diagonal (V, H and D respectively) and so an intersection point of the triangle might be recorded as V 2-6-0, D 8-5-4. In other words, the vertical and diagonal battens intersect at the two foot six inches mark on the vertical batten and the eight feet five-and-a-half inches mark on the diagonal batten. I also record the key points where the triangle intersects the hull. I draw a sketch to record all this, like the one below:



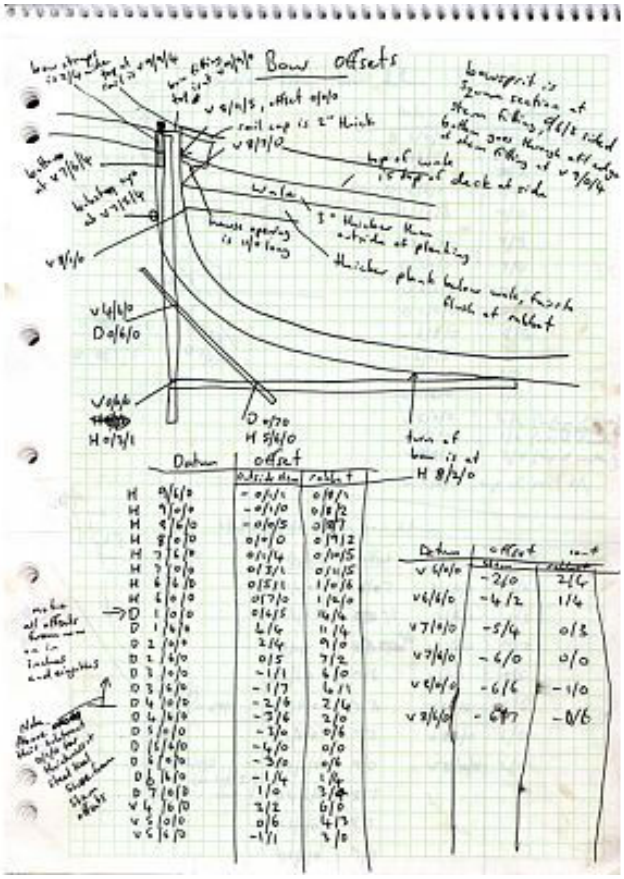
The next step is to record the offsets from the triangle to the hull, to create the table of offsets that appears below the set-up sketch in the notepage above. I take an offset every six inches, which is probably overkill but gives a very sharp set of data. The offsets are recorded at right angles to the measuring triangle (usually most are from the diagonal batten) as shown below.

The offset in this picture would be recorded as 10-0 (ten inches exactly) at datum D2-0-0 (the two foot mark on the diagonal batten). Note that it's *very* important to be consistent about which edge of the batten you measure to! To avoid mistakes I always measure to the edge that's marked with the graduations.

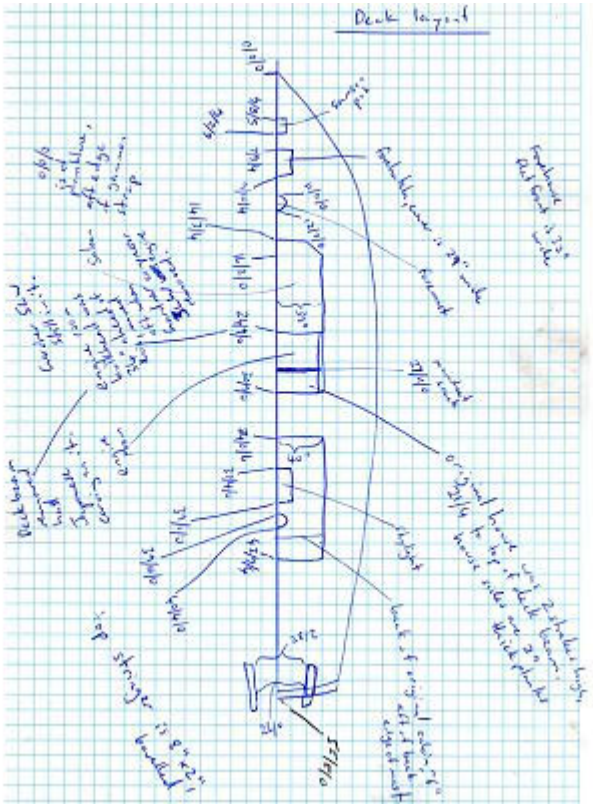
The process can be more difficult toward the stern because of the shape of the hull - the measuring frame can be harder to build and the offsets can get quite long. It may even be necessary to build a four-sided frame. The picture below illustrates the challenge.

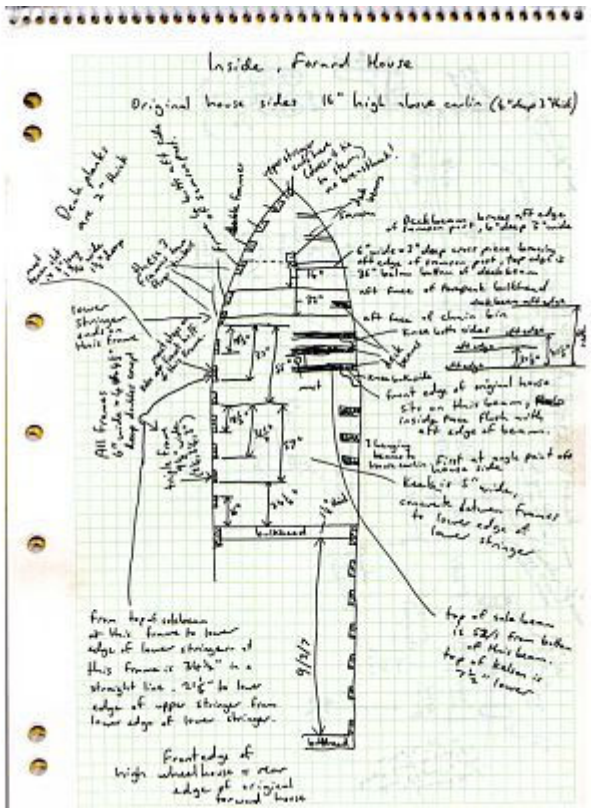
A similar process of measuring off a triangular frame of known dimensions and referenced to known locations on the hull is also used to establish the profile shape of the bow and stern. The pictures below show this being done for the bow of TRIBAL WARRIOR (originally MINA, an 1899 Thursday Island lugger) and the stern of VIKING.

This will create another page of sketches, measurements and notes, like the one below.

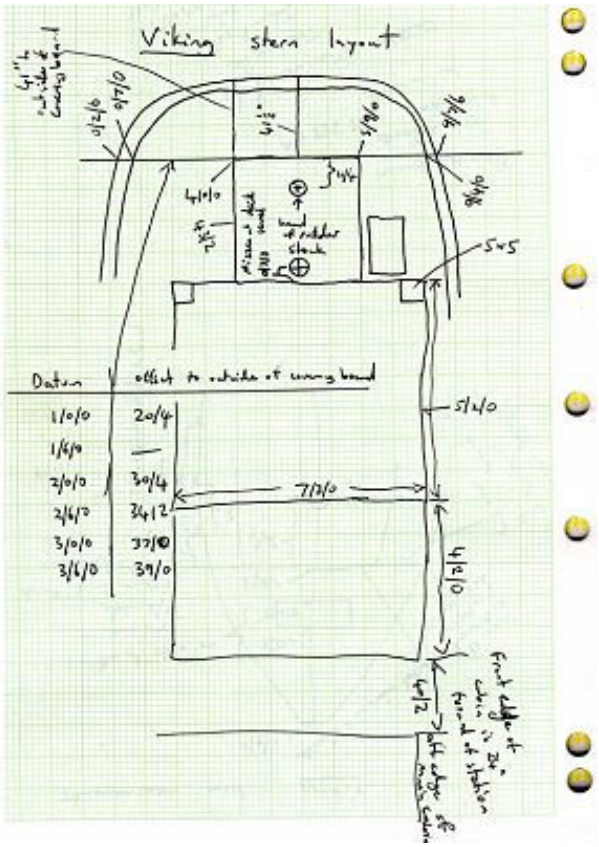


Once the profile and cross-sectional shape of the hull has been established, the next step is to measure up the deck layout and whatever amount of interior / construction detail is either desired or practicable. I usually end up with more pages of notes like these:





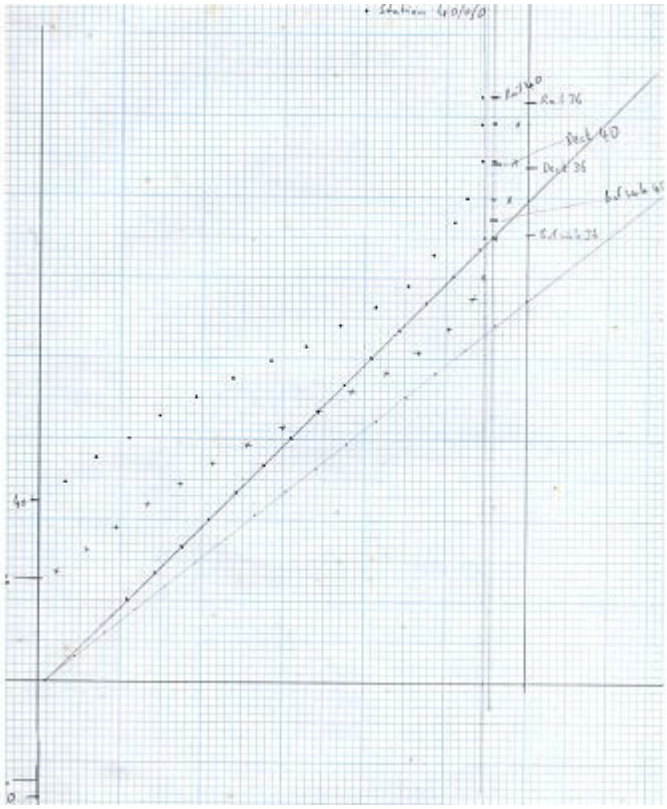
If the boat has a stern with a distinctive shape in plan view (i.e. viewed from above) it may also be a good idea to set up a frame on the deck (configured to suit the circumstances!) and take a series of offsets to establish the shape accurately. The notes below illustrate an example of this – VIKING had a distinctive and rather unusual stern for a lugger.



Finally, the rig also needs to be measured. However, this isn't always practical and so wherever possible I also take a reasonably distant broadside photo. If a the dimensions of a few key visible features in this are known (preferably including dimensions in both the vertical and horizontal planes) then pretty much everything you need can be scaled off such a picture quite accurately. The picture below illustrates the point – if the length of the main boom and height of the wheelhouse are known, the entire rig of the pretty little Broome lugger ROSE F can be re-drawn from this photo.

This is also very useful if historical photos of the boat are available. Details like deck layouts and rig often get changed over the years, and a few key dimensions allow the original layout of the boat to be reconstructed. The picture below shows James Clark's fleet of luggers laid up near Broome in 1916, and there fifth back in line is MINA (i.e. the TRIBAL WARRIOR above), from a very good angle and with lots of interesting detail visible (although I wish she was tipped to port!).

Once you have all this data, the laborious task of drawing it all up into a conventional set of boat plans can begin. I start by plotting out each of the sectional shapes, first drawing up the triangle, then plotting out all the offsets and then “joining the dots”. As the example below shows, the method gives very clear and fair curves.



Once you have these shapes, the usual methods are followed to draw the hull, fairing the waterlines, buttock lines and diagonals etc. There are numerous textbooks describing this process in detail, so I won’t repeat it all here. Suffice to say that the quality of the result from this point will reflect your skills as a draughtsman – I hope yours are better than mine! The end result will (hopefully!) look something like the drawing below, showing the 1929 Broome lugger REDBILL.