THE SHETLAND BOAT – MEASURING AND RECORDING TECHNIQUES

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There has recently been a renewal of interest in the Shetland Boat, an interest given impetus by some excellent Scandinavian work on related boat-types, the National Maritime Museum's experimental archaeology with the Gokstad Faering replica and last, but not least, the present general interest in Shetland history.

However, with one notable exception, it is disappointing to note that much recently published comment on the Shetland Boat has largely been derived from already well-worked secondary sources, sometimes rather uneasily allied to modern theoretical studies. This situation is caused, to a certain extent, by the lack of accurate and widely based descriptive material. The provision of accurate lines (form), construction and rig drawings is an essential first step in any work on boat archaeology and ethnology and, considering the range of boat-types used in Shetland over the past two centuries, published drawings are few and sometimes suspect. Naturally, such descriptive work is not an end in itself but forms an essential data base when discussing overall patterns of usage, building and variation by locality or era.

In the period 1973–75 the author carried out some preliminary field-work in Shetland which, with later modification, recorded parameters especially for the Shetland Boat. Care was taken to ensure that results would be compatible with similar work elsewhere but, at the same time, reflected those factors held to be critical by the Shetland constructor and user. The system can, when fully extended, produce an extremely detailed and accurate description but may also be used in an abbreviated form suitable for those with limited time or technical knowledge. In this latter form useful results could be obtained by field-researchers involved in broader studies.

The first step for the field-researcher to consider is the degree of finished result required. In order of difficulty and time requirement three gradations are suggested:

A) Basic dimensions with limited photographic coverage. Ideally all the parameters listed in the Table below should be recorded; at the minimum including the first eleven items. The nature of items such as steering gear, spars, sails, oars, motor etc. should be noted. From these records a primary description can be compiled which is useful for comparative work.

B) Basic dimensions and hull form with complementary photographic coverage. This involves all the items in A) together with at least four more full sections, profiles of stems and measurement of all gear. From these records an accurate lines (form) plan, general arrangement layout and rig drawing can be made. This is more than adequate for most descriptive purposes.

C) Complete survey and photographic coverage. This involves all the work described for B), plus recording the size, shape, material and detail of all elements of the boat's structure and fittings. The resultant drawings should be to a high standard, sufficient to enable an exact replica boat to be constructed. This grade of work is really only required for a limited number of 'type' examples.

The method of survey applicable for B) is described below: A) and C) are respectively simplified and elaborated from this basic method.

The selected boat must be ashore and preferably chocked fairly level athwartships, lengthwise levelling also makes measurement easier but is often not possible. In the case of a 'hulked' or abandoned boat check for structural deformation, this may make work difficult but not impossible, as will unalterable heeling. The first task is to set up a centreline cord, this must be taut and firmly fastened to the centres of the inner faces of the stems at the level of the sheerstroke's (top planks) upper edge where it meets the stems. It must never be moved during the measuring procedure as it is a major reference line. Take the between stems measurement (b.s.c.). Next, find the two vertical scarphs (joints) where the stems join the keel and, on the keel's top surface, mark with chalk the centre of the keel at the points opposite the forward scarph's forward end and the after scarph's after end. These form the important Fore and Aft datum points; measure between

them (k.l.).

Now decide on the number and position of the stations (transverse sections) you need to measure. The simplest system is to let the boat's own construction determine these, using the positions of the main baands (frames) and the keel ends, so in a normal 'fourern' one gets five stations. Take longitudinal measurements to determine the positions of the frames along the keel length (r.a.k., r.f.k., A.d.m.b., F.d.m.b.). Unfortunately, for practical reasons, your measured transverse sections cannot be on the baand centres, but must be either slightly forward or aft, especially if the thwarts (seats) are not removeable. Always note such displacements carefully and chalk mark the station positions. Make further longitudinal measurements to determine their exact position along the keel (N.B. for convenience on the accompanying diagram the three stations admidships are shown as co-incident with the forward edge of each baand, this is often not achieved in practice; remember you must know the position of the actual frame and its corresponding station, **measure both**). At each station erect a vertical to reach the centreline above and measure (f.s.h., f.b.s.h etc.). Ensure that the vertical stands exactly at right angles to the keel surface fore and aft by using a square or other check, at worst sight its parallelism to the adjacent baand by eye; any error here leads to endless trouble later and these heights should be taken to one eighth of an inch accuracy. Mark the position where each vertical crosses the centreline cord with adhesive tape, then take longitudinal measurements **along** the centreline (m.b.s.a.c., m.b.s.f.c., a.s.l.a.c., f.s.f.c.).

Sets of vertical and horizontal co-ordinates must now be measured to define the boat's transverse section at each station. The horizontal widths are taken between the top **inside** edges of opposing (port and starboard) pairs of strakes (planks), as shown in the transverse section diagram, normally working from the pair nearest the keel upwards to the topmost pair. The height at which each horizontal crosses the already established vertical is accurately measured (VI,w.; VI,h etc.). If an extending rule or tape-measure is used to measure the horizontals it is important to ensure that it does not sag since a small error of vertical reading will produce a

significantly distorted planking angle, especially in the lower strakes. Note also the change in level along the top of a Shetland boat's keel, the ends are usually one half to one inch higher than the centre section, k.f. (ends) and k.f. (mid) on the diagram.

Owing to the influence of keel shape on the entire boat its dimensions must be carefully monitored at each station (measurements pre-fixed k. on diagram inset). The change in level of the keel's top surface must of course be allowed for in the field or when drawing-up.

An alternative method for establishing the transverse sections can be carried out by simply measuring the plank angles and internal widths of the planks with clinometer and carpenters rule. This method is quick and simple, but subject to cumulative error, so the co-ordinate method is much to be preferred. When combined with an overall beam measurement the clinometer method is however often adequate for recording to grade A) standards. It may, incidentally, be carried out on a heeled boat providing corresponding port and starboard measurements are taken; but this is a wise precaution anyway. Both with this and the preceding method always measure the mid-section first, since it is the most critical section in determining the overall characteristics of the boat.

Defining the shape of the boat's stem is probably the hardest part of the measuring task to complete successfully. Always work on the forestem initially, since in Shetland practice the afterstem is usually only a slightly truncated version of the same profile. Re-erect the vertical at the fore-station, taking great care that it is upright in both planes; this cannot be overstressed. Now take a diagonal measurement from the Fore datum to the fore end of the centreline (f.s.d.VI.). The resultant triangle (f.s.d.VI., f.s.f.c., f.s.h.) is critical in the drawing-up process, so get it right! Now take similar diagonals upwards to the top of each strake/stem join in turn (to avoid confusion only one set is shown on the diagram, those for strake III on the afterstem) together with complementary diagonals downwards from the top of the fore-station vertical. When drawing-up the crossing arcs of these diagonals they will rarely fall perfectly on a fair stem curve, so any additional measurements which can be made are always useful; for example, by

using variant of the transverse section method (a.s.h.III, a.s.l.III), though keeping the 'horizontals' parallel to the keel is difficult in practice. Usually the stammeron (angled end frame) obstructs some measurement, but with persistence reasonable accuracy can be obtained in defining both stem profiles. The stem-cross-sections should also be recorded in a manner similar to that employed for the keel.

This really completes the measurements which are needed to draw-up the form of the boat and it should be noted that they are largely internal measurements There are good reasons for this: the boatbuilder 'sees' and measures this way during construction; drawing-up will largely relate to interior structure and fittings; and it is conventional to draw lines, body sections etc. to the inside of planking. Most external measurements will relate to the depth and width of the keel and stems, and the position of fittings. The sail angle between the tack(s) and sheet position can be measured either as a direct angle at the boat's centreline (sketch a line across and measure with protractor t—s^{o}), or graphically from appropriate length and beam measurements. If a general arrangement drawing is planned then the basic dimensions of such items as frames, stammerons, thwarts, bottom-boards, stretchers etc, must be noted and additional measurements made to define their positions, using wherever possible the existing datum points and stations as reference positions.

An essential requisite is the individual boat history, this should contain at least the following: the original builder or locality of build, date of build, original usage, changes in owner, usage and/or modifications made to the boat's structure and mode of propulsion, naming or registration if used, notes on any stores associated with that particular boat, oral evidence as to the boat's performance direct from a user (treat with caution!). If relying on oral evidence make especial note of any points susceptible to documentary confirmation e.g. number for fisheries registration purposes.

The final drawing-up cannot of course be carried out in the field, although it should be done as soon as possible afterwards.

When working to grade A) a final neat tabulation is sufficient, though an accompanying line-drawing of the mid-section, scaled at one inch to one foot, is also desirable. For grade B) the aim should be to produce an internal elevation (profile), plan and all station sections, scaled at one inch to one foot, and showing if possible the main structural layout separately or in conjunction; hull lines, curves of areas etc. can be derived from these drawings. It is good practice to work up the field-measurements on graph paper at a scale of half an inch to one foot before commencing any final drawing-up. In fact, if this can be done in the field it will immediately reveal discrepancies or mis-measurements which can cause trouble later on. If you do not feel technically capable of the draughting work involved there is no need to be deterred, as from clear and well tabulated measurements, plus graph paper sketches, someone else may still be able to benefit. Anyone intending to work grade C) should need little further advice since they will already be familiar with standard Naval Architecture practice and the work of small boat speicalists such as Faeroyvik, Chapelle and McKee.

Little mention has been made of field-measuring equipment and in fact this need be little more than standard handyman's material plus a few cheaply purchased (or 'acquired') items. However, it would be difficult to cope without the basic items listed below and for prolonged serious work many of the items listed as "desirable" increase speed and convenience, though at the expense of portability:—

Basic equipment: Carpenter's chalk line or 30 feet of heavy braided or stranded fishing line; assorted lengths of line, from 3 – 10 feet; staples or broad-headed nails; 8 – 10 foot extending rule with thumb-lock (6 feet will do at a pinch); coloured chalks; carpenter's folding rule; clipboard, pencils, rubber, paper; sharp penknife; two rolls of insulation tape (different colours); plumb bob*; simple square (the clipboard may do); stiff but not heavy 4½ foot pole, preferably graduated; two people, patience and ingenuity; clinometer*.

'Desirable' equipment: 25 – 30 foot surveyors cased tape-measure; pocket level; geologists clinometer; 2 graduated poles,

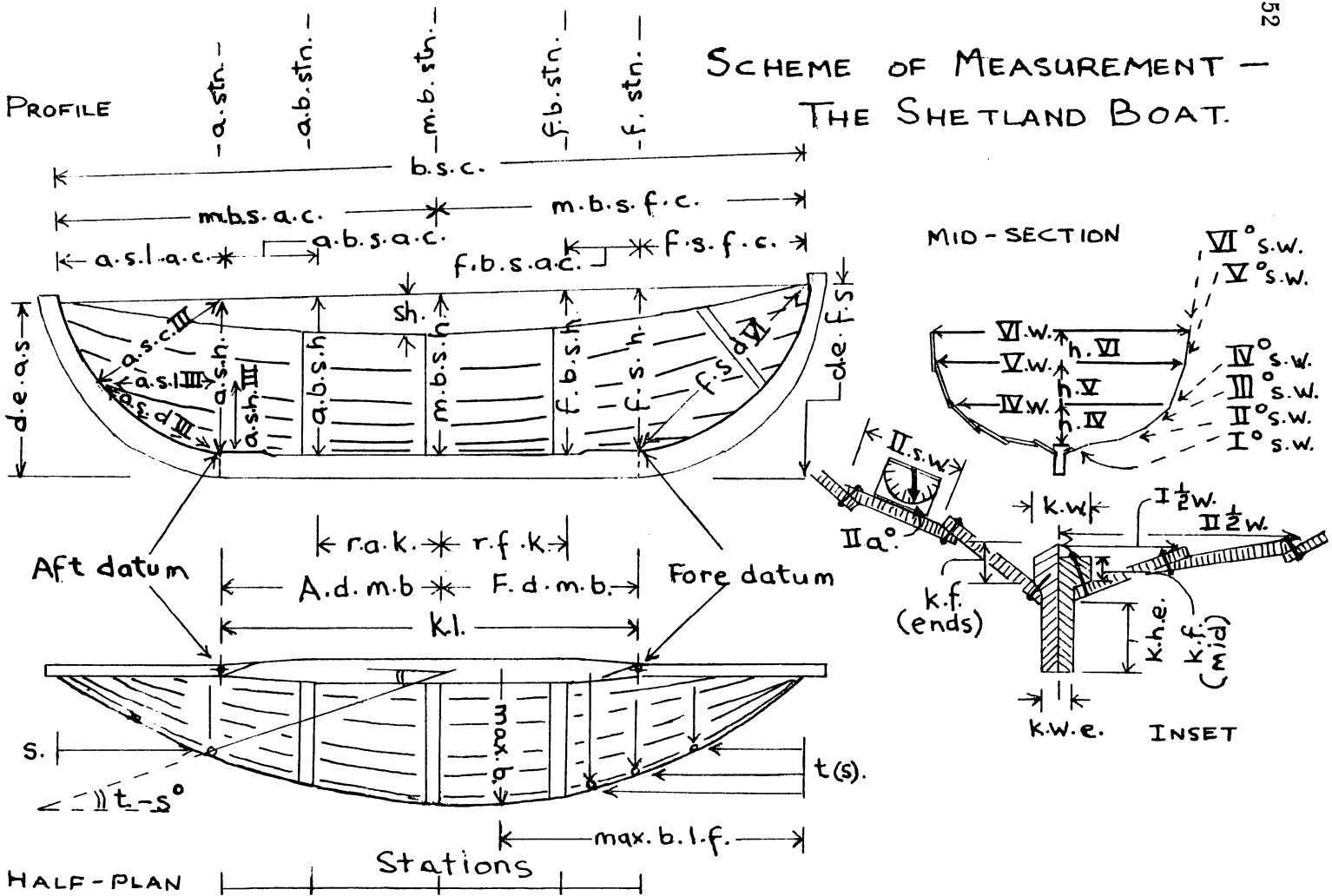
8 - 10 feet, demountable*; folding skeleton square*; various one-draw telescopic measuring rods and square mount*; pre-printed recording forms*; more patience and ingenuity.

*Descriptions for cheaply making items marked * can be supplied.

A final most important note is that regarding ethics and courtesy. The owner's permission **must** be obtained before commencing measuring, explanation will require tact and clarity. Remember that the lines of a boat may justifiably be considered a builder's or owner's copyright, especially if the boat is new or used for regatta racing. Never damage a boat, at the most you should leave two small filled nail-holes in the stems (these can be avoided sometimes by tiers round the 'horns'). Always replace loose gear removed for access or inspection. Send the owner/builder drawings or photographs at a later date, don't promise them however, you never know what may happen (watch that cliff-edge!).

Over the next three years the author hopes to continue his study of The Shetland Boat, particularly into those aspects which are susceptible to understanding by field-research. A selected series of boat measurements is essential for this, and a register is being built up of 'old' or 'type' boats which require measurement, re-measurement or description. Information about boats in obscurer parts of Shetland would be particularly welcomed and fully acknowledged. The author would certainly be happy to encourage and assist anyone who would seriously like to attempt any of the measurement and recording work outlined above; such contact would at least avoid the confusion of duplicate measurement (possibly to the annoyance of an owner/builder) and hopefully could lead to positive exchanges of information. If it all sounds a bit daunting then remember, it is much more difficult to describe in words than carry out in practice.

Scheme of Measurement — The Shetland Boat.



TABLE

Code on Diagram	Measurement	Burra Isle 'fourern', built 1910 J. Goodlad
b.s.c	Length between stems	21 ft. 0 ins.
k.l.	Length of keel	13 ft. 3 ins.
max. b.	Maximum beam	6 ft. 4 ins.
max. b.l.f.	Position of maximum beam from forestem	9 ft. 9 ins
Forestem to forward rowing position	Length of forehead	6 ft. 3 ins.
Afterstem to after rowing position	Length behind after rowing position	8 ft. 9 ins.
d.e.f.s.	Depth, external, at forestem	3 ft. 10 ins.
d.e.a.s.	Depth, external, at afterstem	3 ft. 4 ins.
	Depth, external, at mid-section	2 ft. 7 ins
Sheerstroke (VI) h.	Depth, internal, at mid-section	2 ft. 2 ins.
VI°, s.w. V°, s.w. IV°, s.w. III°, s.w. II°, s.w. I°, s.w.	Mid-section strake angles and strake widths	76 deg. 7 ins. 67 deg. 9 ins. 40 deg. 9½ ins. 25 deg. 8 ins. 13 deg. 9 ins. 20 deg. 6 ins.
r.a.k., r.f.k.	Room spacing (for rowing positions)	2 ft. 11 ins
sh.	Depth of sheer at lowest point	11 ins.
t — s°	Tack-sheet angle	17 deg.
	Mast position aft of forestem	c. 9 ft. 6 ins.