VIKING KNARR.

By Nige Dale.

INTRODUCTION.

Intrigued with the stories of the Vikings since I was a young lad, starting from counting the seconds between Thor striking his anvil, causing the lightening flash, and the sound of the thunder of his hammer striking, (to see how far away he was) to the slim fast boats which took them all over the known world and beyond, has never really left me, and still captivated by it all. Those of us with a sense of fun, and a black sense of humour, can probably blame that on a Norse ancestry. There are some who would blame the Norsemen for a lot of perceived ills of that time, from a comfortable and modern point of view. But what they achieved with the technology of the times was remarkable, and the legacy of their social structure is still with us today.

I have always wanted to build a model boat of the Viking era, and like a lot of things never really had the time to get round to it, with other things getting in the way, for example, life.

Being dragged around the shops (as one does on occasion when adopting the stance of a dutiful husband) we entered a charity shop to see what other people had thrown out, to be passed on to other people willing to pay for someone else's cast offs. Trying to offer the illusion of interest, whilst waiting to go to the next venue of retail, I spotted a venetian blind made of wood, rare these days so I went and had a look. The slats were about an inch (25mm) wide and about 1/8" (3mm) thick, and quite pliable. So for four pounds and a quip of "what are you buying now?" I brought the blind, and put it in the shed, that was three years ago. In all fairness my good lady rarely questions what I buy, but the knowing look as if to say "he is up to something," is accepted as probably being right. A later query, of what are going to do with that blind, was answered by "may build a model boat, it seems good timber, I could give it a go". "haven't you got enough boats?" says the wife, well there is an answer to that, not really.

The next problem was what to build? Also; are there any line drawings from which to develop a model. My book on the Sutton Hoo Burial site was very useful, but surely that was not the only type of vessel around at that time? Then I came across the Skuldelev ships, discovered in the waterway of Peberrenden at Skuldelev, 20Km north of Roskilde, in Denmark, so the reading began. The information on these ships, from Skuldelev is remarkable. The museum has constructed life size replicas, and sailed them to gain a greater understanding.

Books have been written on the results of the research of these boats, and every facet of the vessel design, wood, nails, sails has been investigated, replicated and documented. But, the thirst for knowledge goes on, and so does the research. The information on the usage, and internal detail of three of the ships of Skuldelev, which were deemed "cargo" is

limited, as these three vessel are the only ones to date that have been discovered. I decided to attempt a Knarr, which was the largest of three non-military ships discovered at Skuldelev, and with a good model within the museum to help the ideas of construction, it was time to make a start.

Taking what line drawings I could find, and laying them out using a computer design program, was the starting point. This helped determine the best place to put the shadows for the construction, but very little else. It was also desired to put an extra strake in the hull to give more room for extra ballast, and to also accommodate servos for the sails. The rudder, I have yet to think about.

THE BUILDING OF THE KNARR

The reconstructed excavated ship in the Roskilde Viking Museum is a magnificent sight, and offers a lot of information at glance.

The museum model is equally impressive, and offers a layout for the interior of the ship. The full sized replica is magnificent.

THE KEEL AND SHADOWS.

The construction of a build frame to house the shadows was completed, and the shadow design allowed the removal of the model from the build jig when desired. The construction of the keel, stem, and stern was done with Mahogany, and finished in one piece.

The Build Jig.

The build jig is upside down to the traditional way the Vikings built their vessels, but the practicalities of building a model following the methods used to build the prototypes would add further difficulties that really aren't necessary to achieve the final result. The slots within the shadows that are there to align the keel section with the shadows, and allows another place to hold the vessel the other way up on the initial build, prior to making a stand.

The Keel.

The keel was made of laminated mahogany, and cut to the shape the computer design indicated would most probably work.

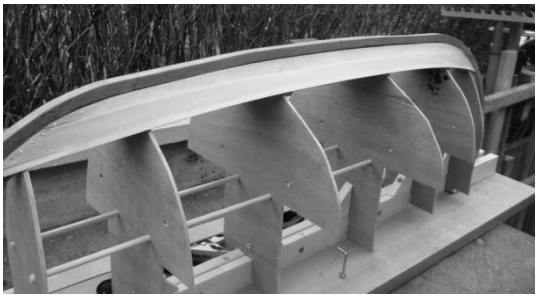
Work in progress is never really that interesting, as usually the builder is the only one who knows what the picture

illustrates. So the picture below will show the finished Keel form within the build jig.

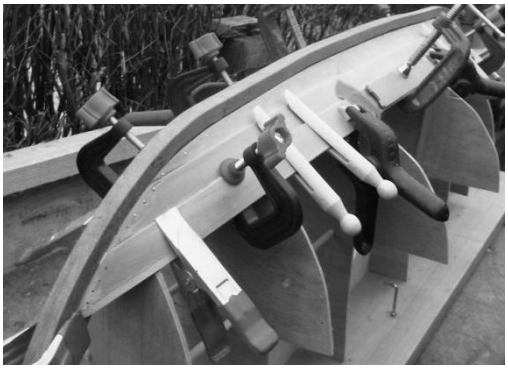
The Rabbet was cut into the keel, (the grove into which the planks fit) and took the gamble that the principle developed within the computer design would be somewhere near. You can only hope.

The Hull.

First fit the Garboard, then the second and third strake. The hood ends of the strakes need to be scarfed so the hood ends of the strakes do not seem to overlap when fitted to the stem, and stern post.



As progress is one strake at a time either side, you have time to contemplate the speed in which they used to build these vessels, using the tools of the time, and waiting for supplies of parts from other trades, nails, rope, clinch plates, etc. The construction time was probably (as indicated by museum reconstruction) about two years, and used for only a dozen years at sea.



The fitting of the strakes continued at a slow rate, but over a few weeks the hull starts to take on the shape that the Vikings are famous for.

On removing the hull from the build jig, and turning it the other way up, it can be inserted into the slots in the shadows for the keel. But, in the not too distant future, will have to build a proper stand for the boat. The holes in the stem, and stern posts are for location dowels to help

hold the hull into the build jig, and will be removed when the need for these holes is no longer required.

This hull is extremely light, so it is very easy to understand how the speed they achieved was done through this hull design. The shape offers a small displacement which assists the speed potential, but limits the carrying capability when compared to the shape of the Cog. I have realized that the length of the keel section in ratio to the plank size will not enable me to introduce a straight section to the middle of the vessel, and will have an elliptical profile when viewed in the plan elevation. Slightly disappointing, but let's see what evolves as a final shape of the hull.

There is no documentation (to and from) as to when these vessels, (the Knarr) were about, but they would most definitely be prevalent within the Norse society as trade and the transport vessels.

Notes of vessels of the period.

The Knarr, were about 15 meters long, and 5 meters wide, with a crew of 6-8 men, propelled by sail and/ or oar, attaining a speed (from trials of the museum replica Ottar) of about 13 knots. The Knarr is estimated as having a carrying capacity of about 24 tons.

The Cog, (from the examples found) were about 15-25 meters long with a beam of 5-8 meters, crew size not determined, and slow at about 4-8 knots, but the carrying capacity increased to about 200 tons. The first record of a Cog is about 948 AD, and spanning the centuries until the fifteenth century. The Cog most probably had a side oar/ rudder in the earlier examples as the first record of a central rudder is about 1240 AD.

The other two cargo/ trade vessels found at Skuldelev, were;

1. The Byrding, of about 14 meters, 3.3 meters beam, with a speed of 10 knots, and a crew of 5-8. The similarity of the vessel dimensions to the Knarr, is obvious, but for the archaeologists and the museum to give the vessel a different name, indicates some constructional variances beyond style.

2. The Ferji, of about 11 meters in length, and 2.5 meters beam, speed unknown and a crew of 5-15 men. Possibly used as an inshore trader or fishing vessel.

I am always aware of the comments offered to me by a boat builder in Yorkshire, when researching the Cobble. "They may look similar, or the same to

some, but they are all made to the needs of the owner and how he wants to use it".

As the planking of the hull was getting near completion, it was apparent that there was too much of a rabbet in the keel section. So it was necessary to add half strakes to the fore and aft sections to fill the rabbet.

Realizing that the vessel is now moving away from what the rivet (or in the case if Viking era vessels clinched nail) counters may deem as a proper representation, the title perhaps should not be a Knarr, but a Nay. Anyway the main task now is to finish the vessel, and see if it willsail.

The Frameworks, & Decking.

Although the information from the Roskilde Viking Museum is excellent, what I am building is not quite to the form they have as an example of a Knarr. This slight deviance is not a worry or a concern, but to make the vessel a more generic style, it was necessary to do some more digging.

Books by, McGrail, and by Bjorn Landstrom, are excellent, and the message of that there is no definitive form to ancient vessels, but the style, or essence, releases the modeller from constraints.

Building the hull deeper in draught than that of the "originals" will offer the room to put the ballast, and add to the stability required to sail the boat with a large square sail. So the first job was to put in some deck bearers that would most probably not be in the prototypes.

Putting the deck bearers in was an interesting job which took time to get nearly right, and at the same time putting some rib parts in that would be difficult to do if left to do at a later date. Drilling holes in the rib parts to insert cut down Hardboard pins to replicate rivets/ clench nails was done, then the ribs fitted.

The above shows the deck bearers and ribs installed. The next job was to put in the timbers that would help support the lower/ cargo deck and offer some support for the mast.

Further rib timbers need to be added, along with timbers that run across the beam, these were made from Oak as were the other timbers, and added to the hull. These timbers will also form the fore and after deck levels.

Easing into some quick fix parts of the boat, it helps to bring it along a bit. So the next jobs are, a mast, sail trial, and the bits that go with that exercise, and back to making saw dust.

The Sail Trials.

Making the sail pattern trials as to the ratios indicated by various reference documents, including the Birlinn as draw my Colin Mudie. The result of the trials was; what I first thought may work; didn't, neither did the second, so the third was a rationalization which looks as though it might just do the job.

Whilst messing with the sail size, came the realisation that the mast height was more akin with present day sizes where the mast is longer than the hull length. In cutting the mast down in size made the third attempt at the sail area look more realistic.

With the sail and mast accepted as a probability, next was the installation of a sail arm servo. Identifying the travel distances of the sail clews, and then working out the multipliers for the arm that would give me the travel required, it turned out to be a bit of a cats cradle. To add to the problem of the clew control, keeping the sail square shape, also became impossible with the loose footed sail.

Missing out the failures that occurred, the final control is (until proven otherwise) is a pair of sail winches for the clews, operating a wind and unwind function that turns the sail to where it may be needed. To remove the problem of the sail foot being loose and having little control, a yard to the foot of the sail was introduced. This may make some

purist balk a bit but the Norse did use a pole called a “Beitass” a long pole which was set up to keep the sail’s forward leech stretched when sailing close to the wind.

Another problem with controlling the square sail with a central lift to the sail yard was the yard swings very easily, to limit this swing the introduction of what would be called “lifts” as on a square rigged mast limited the swing. This also indicated the need for a parrel, so the final fitment will have some form of parrel on the top yard.

Further notes on the sails are within the appendix.

Returning to Frameworks & Decking.

It was good to get the sail control out of the way (for now) and return to making saw dust with a purpose.

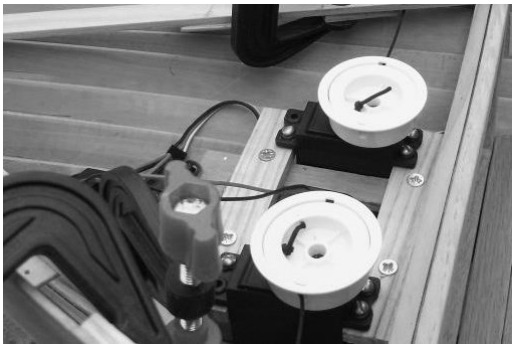
The Norse trading vessels had most probably had an open type deck for the cargo, which would allow for forward and after sections to be raised for working, storing, steering, rowing etc. The fitment of these decks will hold the sail servos, and any potential buoyancy aid.

The above picture, shows the installation of balk heads to the cargo area, and the line at which the raised fore and after decks will be. Also within this picture is the mast foot, which in the prototypes would be on the keel, but this build is raised due to the extra depth needed for ballasting, and also made more of a socket for the mast support.

Putting in more beams, then fitting some deck panels brings the vessel along in its construction.

Back to the Sails.

To check the original sail trial worked, the exercise was repeated.



Using small clamps to hold wood with eyes in to guide the clew lines, the sail control trial was set up again.

The replication worked, so it is now time to continue with the after decking and beams. However, before going too far, the rudder and control need to be addressed. The rudder servo control could be a problem in concealing, so the decision is to hide it under some deck clutter.

The Rudder, Rigging, & Ballast.

The Rudder.

Making the rudder is a relatively easy job. There are numerous examples of rudders, and the set up as used by the Viking Museum on their replicas, are very useful. However, a radio controlled boat under sail needs a rudder that is technically the wrong scale and too large for the boat. With that noted, proceed to make the rudder and fashion a tiller to fit Then mount the servo as applicable and set up accordingly.

Fashioning and fitting the rudder on the right hand side of the boat is widely accepted as the correct position for a rudder of this era and of this style of boat, however there have been examples found through archaeological digs that have the rudder on the left.

Setting up the rudder servo, and to hide it under deck clutter, is a simple affair of putting in the servo, and building a box around it, then make it look as if it is supposed to be there

SERVO FITTED

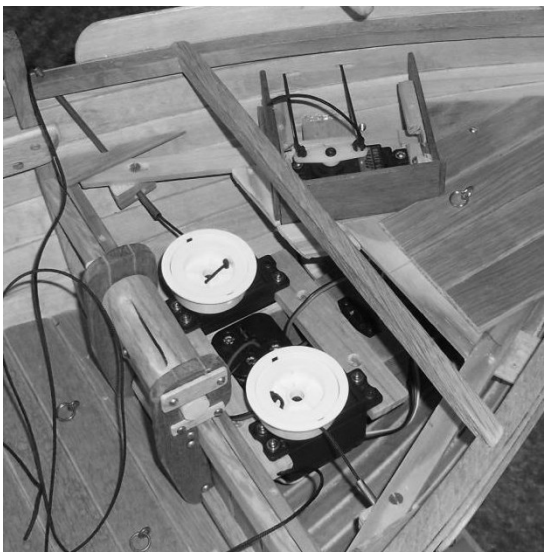
SERVO CONTAINED

SERVO BOXED

The Rigging

On the completion of the rudder servo installation, it was time to make the winch for the sail, then fit. This was done in advance of installing the sail servos as a break is a good as a rest, or alternatively I just wanted to make the winch, so I did.

The winch fitted, and looks OK, so the installation of the sail servo winches was undertaken. The sail winch drums were wound with a cord, one clockwise and the other anticlockwise, the wiring linked through a "Y" adaptor to the receiver. The sheets were then threaded through the tube guides and up to the gunnel.



Standard drum configuration for these servos is a drum with a central segregation to allow two sheets to be run from one servo. In removing this segregation and turning the drum into a single drum operation, allowed the use of a thicker cord for the clew.

With the rudder, and rudder servo fitted, the sail servos installed, it only follows that the standing rigging should be laid and then the running rigging. For the shrouds there are a couple of examples of Viking shroud tensioning devises available, including a fish shaped bowsie. But the style to be used on this boat will be what is sometimes termed to as virgins, which is like a toggle on a line, with the toggle (made of wood) having no holes. Below is a picture from the Skuldelev Museum website.

The standing rigging is a simple affair where the use of fore and after stays, assisted by shrouds, is all that is needed. The running rigging comprised of the lifts and halliard, completes the overall assembly that is not attached to a servo.

The Ballast.

Ballasting a boat is always an interesting time as you are trying to determine how much weight you need, whether your calculations are correct, and the best place to put the loads to offer the best end result for stability, trim, and centre of gravity.

The results of my loading gave me a total load of four kilos. This load is to be made with lead ingots cast to suit the voids below the deck level.

To cast the right shape for the ballast, a pattern, (shape) out of wood to fit the voids under the deck of the boat were made. Measuring the volume of the pattern gave me a finished weight of one Kilo (1Kg), which is helpful as I can use four in the voids around the mast foot.

Using the pattern, four impressions in a tray of compost to mould the lead was made, this was a mistake as the compost was too soft for the outward force of the molten lead. The moulds yielded to the weight of the lead making the final castings a little larger than was planned.

Prior to the pouring the lead, wire loops were suspended into the mould void. These wire loops are to form a handling point that can be gripped, hooked, or tied with a piece of cord, to aid insertion and or removal of these castings from the boat. When the casting are cooled enough to handle, they can be knocked out and finished.

KNOCK OUT

UN WRAP

FINISHED.

All very nice and shiny, but it doesn't last long before oxidisation dulls the casting to the known dull colour that is recognisable as lead. A little dressing was required due to the mould voids yielding as the lead was poured, but the lead castings worked well, and completed the trimming of the boat.

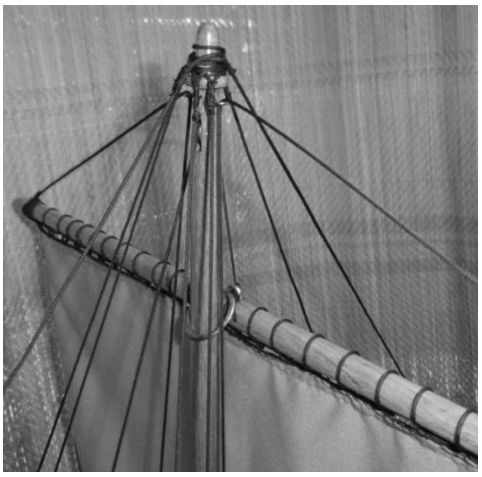
Final assembly.

The final assembly often is a time when you realise that all the work done, parts made, assembled into components, then installed onto the boat, is coming to an end. What has been missed out? What if it doesn't do what it wanted when it's in the water? Possibly a lot more questions, all of which you try to ignore.

The following pictures are of parts of the boat, which are usually seen from afar. The rudder mounted onto the boat. The tiller bar passes through the rudder stock and is captivated by a tiller pin, (1.6mm diameter) attached to a chain.

Using 1/4" x 1/16" Brass Strip, a control arm is formed to drive the rudder from the servo, via a cord link

The standing rigging of stays, and shrouds, are mounted simply, by a soft eye slipped over the top of the mast, and the free end made off as required, by belaying, or at a virgin.



Shrouds, tensioned with virgins.

The virgins and finishing off with a Clove Hitch.

The Main Stays are made off on a cleat.

There is a second fore stay on this boat, which is made off on a pin.

The main sail is hoisted from a halyard attached to a winch. The winch on this boat is functional, and the sail is held up by jamming the winch drum with sprags, doubling up as lever bars.

The deck clutter is always a good thing to have as it enhances the look of the boat. For the deck clutter on this boat Putcher fish traps, a basket, and hurdles were made. The hurdles would have been historically used as a segregation to live stock when carried as a cargo, the fish traps and basket, in this model, are just to add to the clutter. To all this, add a few lengths of rope, and that is about all you can do, apart from putting the boat on water

The above photo is a selective enlargement from a photo taken by Mr. B. Waters. The location is at County Hall, Worcester.

ACKNOWLEDGEMENTS.

For those who like to make models or just read about ships and shipping, books are a wealth of knowledge, but where to look is always a task when you start something that sometimes you wished you had not.

My references were;

The Viking Ship Museum of Roskilde.
The International Journal of Nautical Archaeology.
Sailing Ships , by Bjorn Landstrom.
Ancient Boats in North-West Europe, by Sean McGrail.
The Sutton Hoo Ship Burial,by R.L.S. Bruce-Mitford. The British Museum.

APPENDIX TO THIS WRITE UP.

Sails

As indicated, I attach some additional information on the sails used on this type of vessel. The following, is taken from the Viking Ship Museum Web site, and will give you an idea of the task of deciding the sail plan/ size, and as a result of the no wind Sunday at County Hall, I still do not know if the sail is anywhere near correct. The sail information is a direct copy (not in its entirety) from the museum, and is offered as private reference for information to DSMBC members, and is presented in Italics.

Sail and rigging

The reconstruction of the Skuldelev ship's sails has proved a particular challenge for the Viking Ship Museum, as there are but few traces preserved in the archaeological record. It is therefore necessary to draw on *information from comparable finds and ethnological evidence. Below is a summary of the general questions concerning the reconstruction of sail and rigging:*

The Viking ships' square sail was, in size and shape, developed together with the individual hull size and type of ship. The central crucial factor is the elementary balance between hull, sail and rudder when sailing against the wind, i.e. sailing close-hauled.

If the sail is too broad relative to the hull and the shape of the hull, the ship seeks away from the wind – it has lee helm, and cannot tack against the wind.

If the sail is too narrow, the ship turns into the wind without the rudder being able to prevent this – it has weather helm. If this is not corrected, the ship is dangerous to sail – in fact it is useless as a sailing vessel.

If the sail is too low, the ship will sail too slowly and it will first sail properly when the wind is very strong.

If the sail, and with it the mast, is too high, the load is too great and it is necessary to reef the sail too early.

Further to all this, it is vital that the individual types of ship are ballasted and loaded correctly.

After reading the above, it makes you wonder why you tried to make this type of boat in the first place.