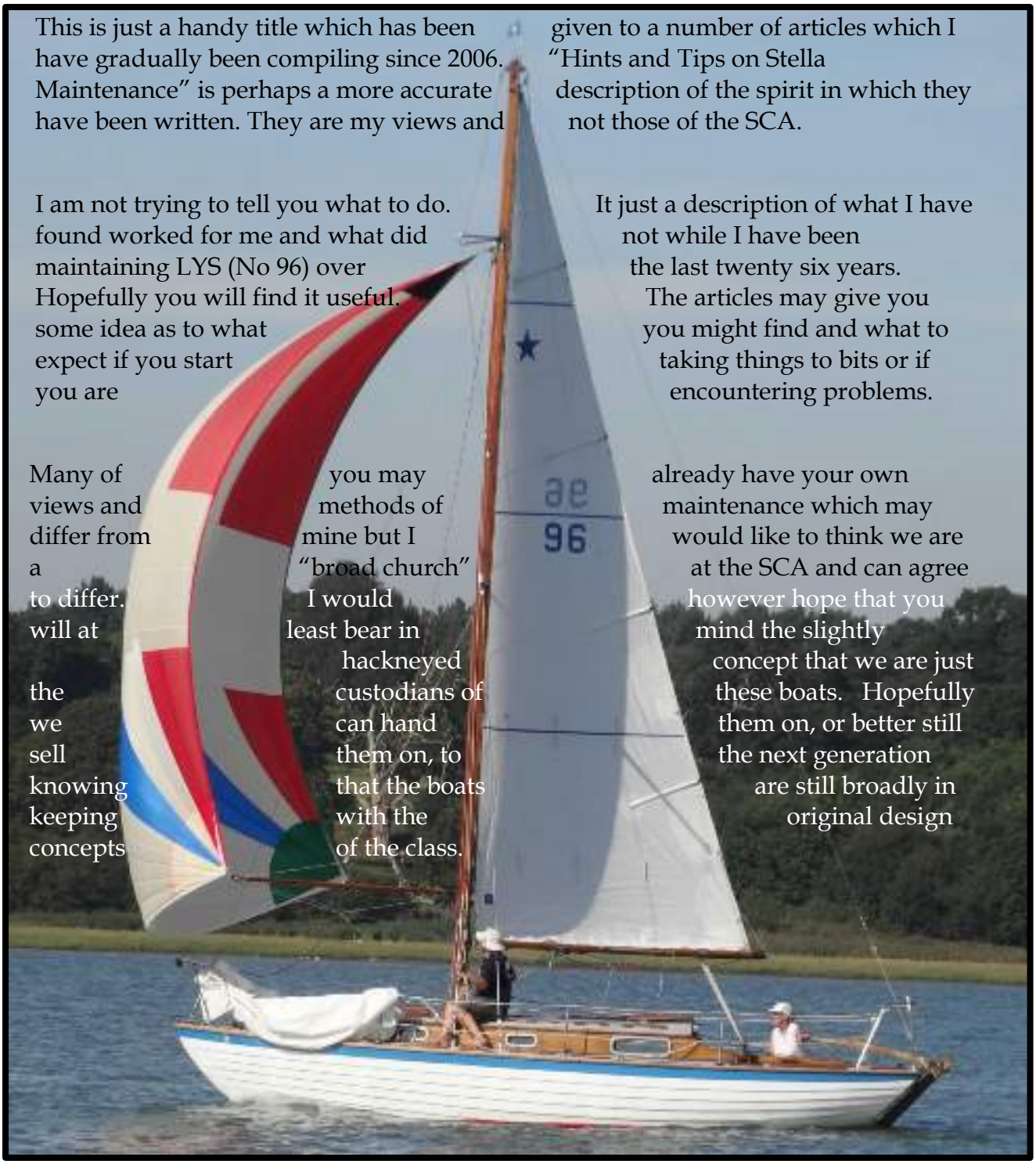
MAINTENACE MANUAL



Ultimately, however, it is down to each individual owner to take responsibility for their decisions about what to do with their own boat.

HINTS AND TIPS ON STELLA MAINTENANCE

Contents

HINTS AND TIPS ON STELLA MAINTENANCE

Part 1

INTRODUCTION

by

John Sparks
01473 788186

Some time ago a request for information about maintenance issues made me realise that after maintaining my own Stella "Lys of Slaughden" (now for the last 26 years) and doing almost all of the work myself, I have accumulated quite a bit of knowledge. This could be usefully passed on. I started to write various bits over a number of winters but it was not until January 2010 that the story so far was published on the Stella Class Association web site. It was however published in one

lump and at 18MB it was felt that it could usefully be broken down into smaller sections which could be downloaded separately. Also even since it was last edited in 2012 I have learnt some new facts and have taken this opportunity to revise some sections slightly.

The manual is not intended to lay down an approved way of doing things. It has been written purely with a view to passing on some information and experiences which others may find helpful when addressing maintenance issues on their boats. You may have your own methods with which you are happy. I am not trying to say my ways are the only proper way to maintain your boat.

When trying to do maintenance work you may have a rough idea about what you want to do but it is often a lack of knowledge about techniques and materials which are available which stops you from doing as good a job as you could.

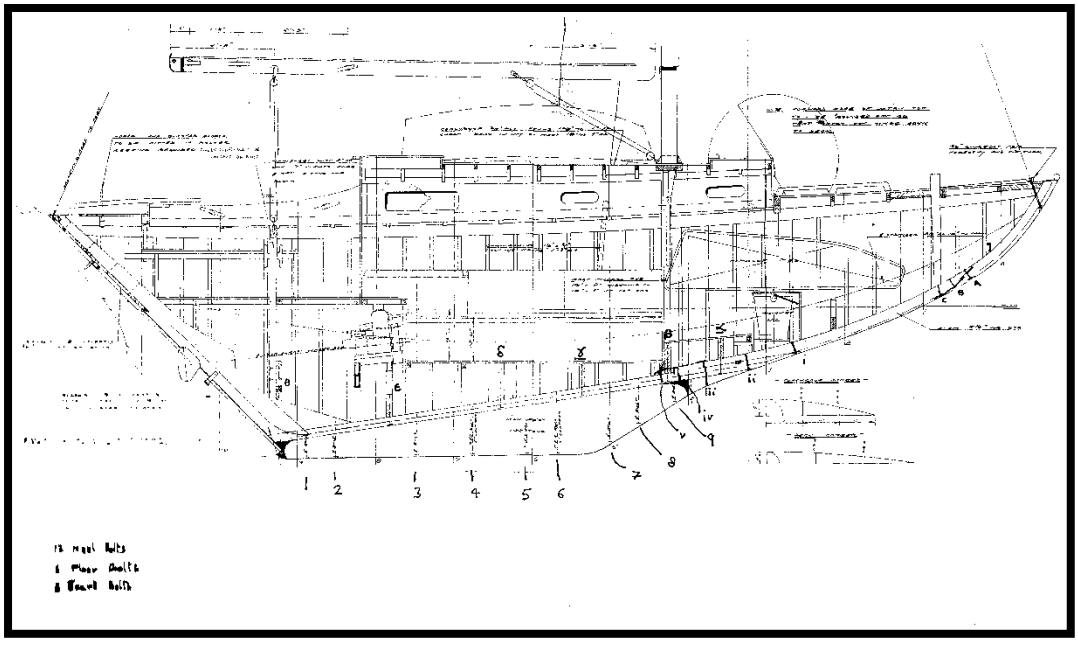
The bulk of my experience is based on my own boat Lys (No 96) which was built by Tucker Brown in 1965. I have seen some photographs at an exhibition in the Burnham museum showing some Stellas under construction. I cannot remember

whether they were built in pairs or three at a time but I was told that heavy use of templates and a certain element of mass production techniques were made.

The Tucker Brown boats have a reputation in some quarters for being lightly built but as they were the original builders of La Vie en Rose No 1 in 1959, one would assume they used the original scantlings set out by Kim Holman. It may be that some of the other licensed builders increased the size of some of the timbers possibly being slightly doubtful about yacht based practices. Whatever the answer is I can only say that if you look after the boat, the original materials have proved perfectly adequate although of course after fifty years some elements have passed their "sell by" date.

I have not made a detailed inspection of any other boats but have broadly found the construction of mine to be consistent with the designer's original drawing, although the stem or apron has been lengthened compared with the original drawing so that it extends into the saloon just beyond the bulkhead with the fo'c'sle.

When I carried out the work to the keel bolts I marked-up any alterations I found and marked the positions of the various keel, scarf and floor bolts on a copy of the plan. This is illustrated below and shows the basic construction and outline of the boat. (A4 version on page 8) **Do Not to Scale**



Copies of the original plans are available for purchase from Holman and Pye in West Mersea. I would strongly advise anyone considering undertaking any serious repair work to purchase a copy. You then should have an understanding of how the boat was put together originally which makes life considerably easier. Unfortunately, you will find the scales are in imperial. Whether it is still possible to get imperial scale rules I do not know but it is not impossible to work it out. It just takes longer.

In common with most Stellas, Lys is made of best-quality rainforest having mahogany planking set on oak timbers. She is largely fastened using copper nails and rivets. Extensive use of mahogany faced plywood was made for the bulkheads and the internal furniture. The ballast keel is of iron and would have originally been attached using wrought-iron bolts. This material is now almost impossible to get hold of and I regret to say that I had to use steel when the bolts were last renewed.

Compared with many Stellas she has led a relatively charmed life in that so far as I know she has never been raced that hard. You will certainly not find her name on that many trophies. She is one of the later ones and I understand that in 1965 there was still a waiting-list for Stellas. I know nothing about the first two years of her history, but she was registered in Maldon in 1967 by a Mr Wrighton. I was told somewhere along the line that he was connected with the high quality kitchens and was responsible for some additional joinery work inside but I was never entirely convinced by this. In 1969 she went down to Kent. While storm bound in Ramsgate one year in another boat I noticed she was on a list of boats "saved" by the Ramsgate lifeboat. In 1972 she was purchased by Keith Canell who kept her at Fambridge and generally looked after her very well until I purchased her in 1990. Since purchase I have refastened her below the waterline, repairing some ribs, renewed the keel and scarf bolts, re-bedded the keel, renewed the deck covering, toe rails etc, renewed the coach roof deck, fitted a new engine and replaced the rudder cheeks and fittings along with replacing the steel drifts in the rudder blade.

Over the years working with both old buildings and old boats I have become increasingly cautious about the use of modern materials in preference to the tried and tested techniques such as those used when the Stellas were built. Undoubtedly modern materials do have good uses in some areas but I would express a degree of caution. This philosophy and the advice given in the manual may not find favour with some but whatever you do bear in mind future owners. Will they be able to undo what you have done should the need arise?

By its very nature articles about technical subjects do require the use of technical terms. Included as part of the manual is a separate pdf file containing a glossary of terms

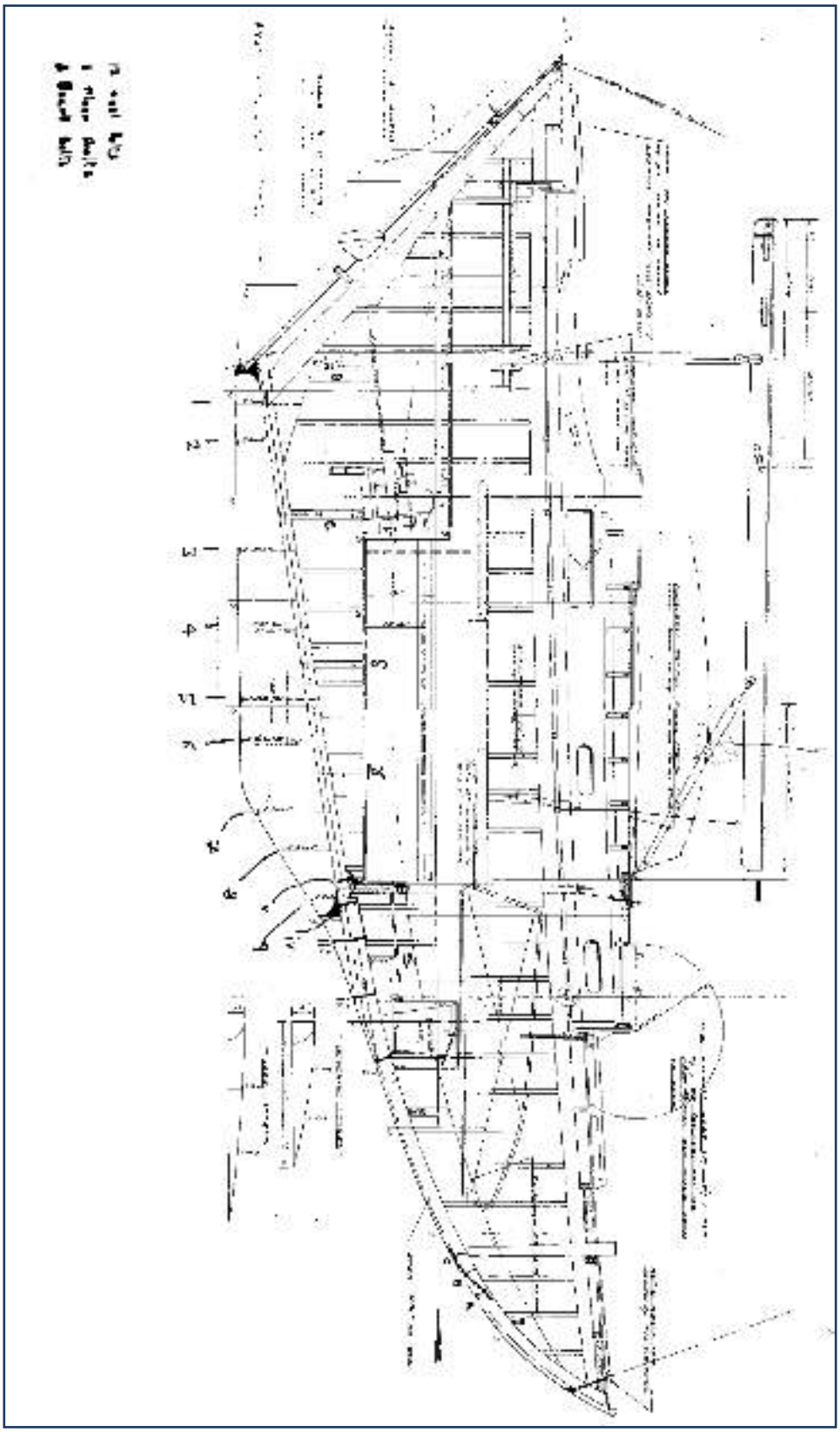
I do not pretend to have all the answers as there are numerous ways of doing things. **I would stress that the following sections which can be downloaded are purely what did or did not work for me. Also any observations made about products are based on my own personal experience and problems experienced could be due to**

failings on my part rather than the product. Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

I am quite happy to answer questions from class association members, initially by telephone but I fully accept that there are other ways of doings things and am not interested in getting into correspondence about how "I did not want to do it like that". If anyone feels there are any factual errors by all means contact me so that they can be corrected.

January 2017 **John Sparks**, Shotley, Suffolk.

DO NOT SCALE printed courtesy of Holman & Pye. This is their copyright and should not be reproduced without their consent. Keel & Scarf bolt markings added by JS.



HINTS AND TIPS ON STELLA MAINTENANCE

Part 2

SKILLS & TOOLS

by

John Sparks
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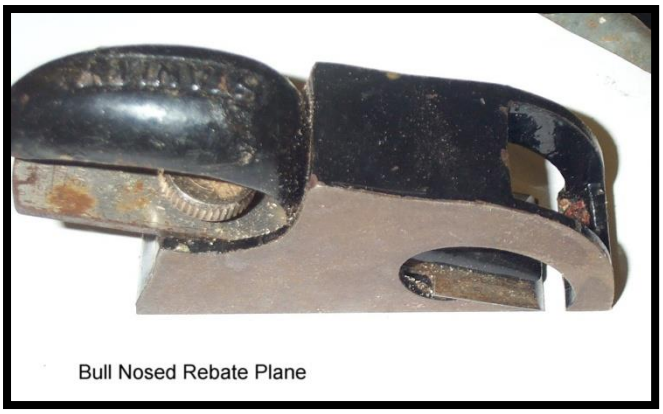
I am a Building Surveyor and so possibly have a head start in that my work involves analysing problems about how materials behave and how to keep moisture out of structures. Even so when I first started boating I did not have wonderful carpentry skills. Over the years I have learnt a lot but my skills are still fairly low compared with the time served professional. For the amateur where time is not an issue, a careful structured approach is probably more important than technical wood working skill. Typical examples being marking things and recording what went where before you take things to bits and the old maxim "measure twice, cut once".

HAND TOOLS

You will find things a lot easier if you use sharp tools. I must confess that sharpening tools is something I have never been that good at. I still use a roller guide for sharpening plane blades and chisels but it gets the required results.

You do need various specialist tools for certain jobs. I will deal with these in other sections but you can get by with a basic carpentry tool kit. My basic hand took kit is as follows.

Saws: Hand saw set relatively course. I get it sharpened periodically. A panel saw will do and some are now so cheap that it is cheaper to buy a new one than get them re-sharpened. Consider having one disposable one which you can use for cutting anything which might have nails in it, in the garden etc. That way your best one never gets wrecked. Tenon saw. Hacksaw (big one and junior). Put the blade in so that it cuts on the forward stroke. Larger blades have an arrow on them which should point forward.



Bull Nosed Rebate Plane

Chisels (various), mallet, marking gauge, square and sliding bevel gauge. Brace and bits. 12”-14” plane, a small bull nosed rebate plane. The blade on this goes right to the edge. Being very small it is useful for getting into small areas and such things as cleaning up the edges of laminated rib repairs. A spoke shave is also a useful tool for planning curved areas but is not essential. A candle is a good thing to have in your tool bag for waxing/lubricating mast tacks etc. Some carpenters use then on the underside of planes but for a boat builder I would express caution. If you are spreading wax albeit indirectly, onto a surface you are intending to glue your chances of getting a good bond will be significantly reduced.

I tend to buy chisels and planes from a second hand tool shop as they are often slightly cheaper and the quality of the old steel is generally better.

A selection of hammers. Claw for general use, ball peen for rounding off the heads to the copper nails when riveting, club when serious clout is required and lastly sledge for knocking out keel bolts. The small tack hammer is used for things like knocking in brass pins to fix the mouldings on the edge of the ply cockpit seats. When hitting things try to make sure the impact is in line with what you are intending to drive. This is not always easy when lying under the boat. Copper nails are very easy to bend. Also try and keep the head of the hammer clean. An occasional wipe with sand paper will help. I find a heavy hammer more useful as the momentum will drive much further and you will have to take fewer strokes.

Trying to drive a keel bolt with a small hammer is a total waste of time and you are more likely to end up damaging the head of the bolt. The same principle applies to most things as you scale it down but be kind to the boat and don't beat the hell out of it. If you are trying to drive something out and need to use a lot of force you should support the area immediately around where you are working to reduce the risk of local damage as much as possible. The use of flat headed punches of various sizes can help in making sure you get the force needed only where it is required.

If you are finding something difficult when driving a nail in, take it out and pre drill the hole to a size slightly smaller than the nail. It is always best to do this anyway as there is less chance of splitting the timber you are driving into.

Screwdrivers of various lengths and sizes. It pays to have a really large one with a hexagonal shape at the top of the shaft. If you fix a wrench onto this you can then use it to turn as you put all your weight onto the top of the driver to stop the blade jumping out of the slot. Always try and use the correct sized blade for the slot and make sure if possible that the shaft is at 90° to the slot. Once you have messed up the slot it is going to be a lot harder to move it so it is probably worth getting out of the boat to find the correct tool first time. Also clean the slot out completely first! Heat applied to a screw which is difficult to remove can help as can initially trying to tighten the screw, especially if you messed up one side of the slot already. Giving the screw a sharp tap with a punch can sometimes also do the trick. If you are dealing with old de zincified screws initially tightening them then easing off and then working to and fro can help to get them out. I think it is to do with the fact that if you just turn them one way there is a tendency for the thread to clog up and bind whereas if you work to and fro it helps to clear this.

A stilson wrench can be useful for unscrewing the fixings on skin fittings etc.

A decent vice and a *workmate* bench come in very handy. You can never have too many cramps although you don't need this many for most work. Ones

which you can work one handed are useful. For smaller work you can improvise using things like the U shaped plywood one at the top combined with wedges.

You do not have to spend large amount of money although if you are in for the long haul you will find them useful for years to come, if you look after them. This applies to the tool kit as a whole. With metal cramps you may need to protect the timber from marking by using small pads made of (ply) off-cuts which can usefully covered in packaging tape if you are gluing.

You would be surprised what you can do with timber wedges. With two pairs of folding wedges you can actually lift part of the boat to adjust blocks in the cradle etc. It just requires a bit of patience and care.

POWER TOOLS:

Power tools can be absolutely wonderful but need to be used with caution and not just from the health a safety point of view. Special caution needs to be used with things like electric planers, circular saws and belt sanders. It is all too easy to take off too much too quickly and I would suggest that these particular tools are only used for roughly cutting timber to size, if at all.

Drills: A good mains power variable speed drill. A pillar drill stand is quite useful if you want to make sure you are drilling vertical holes or if you are using a plug cutter. A cordless screwdriver/drill (Get one with two batteries if you can so you can charge one while using the other). For boat work a small manoeuvrable one is probably better than one of the big 18v ones. Jigsaw. Read the labels about what the best blade is for what you want to do. A baby angle grinder/disc cutter is useful for grinding the heads off old rivets. A wire brush attachment is also very

useful for cleaning up the keel etc. With regard to grinding steel/iron protect any nearby painted/plastic surfaces as well as your eyes. Red hot swarf coming off the disc can melt itself into surrounding paintwork which in a marine environment will then bleed rust spots for years to come. The only way to get rid of it is to strip the paint.

One of the most useful tools I have is a small table saw. This enables me to cut out timber to the dimensions I require making sure everything is at right angles to start with. This makes life so much easier. Mine is a very small one so I am struggling with anything over 3" but I can still do a lot. Rather than buying a purpose built table saw I bought a Makita circular saw and a Wolf multi purpose bench where you can fit the saw to the underside. Technically Makita do not recommend using their saw this way but I have yet to have any problems.

The only use I have yet found for a mechanical sander is when sanding the coach roof deck prior to applying an epoxy scrim. For sanding the planks I always do it by hand with a block of wood.

SAFETY WEAR

Be sensible. **Wear a mask** when sanding. I gave myself a considerable hangover once when grinding off the head of rivets wearing an ill fitting mask. Be careful when working with solvents in confined spaces: for both health and fire reasons. Also wear eye protection when grinding etc. This is something I have not been very good at until recently because the glasses tend to steam up. Reading a tale in Classic Boat about someone who lost the sight in one eye has made me slightly more careful.

When using power tools do not wear loose clothing (open shirts, torn cuffs, scarves etc.) which could get caught in the machine.

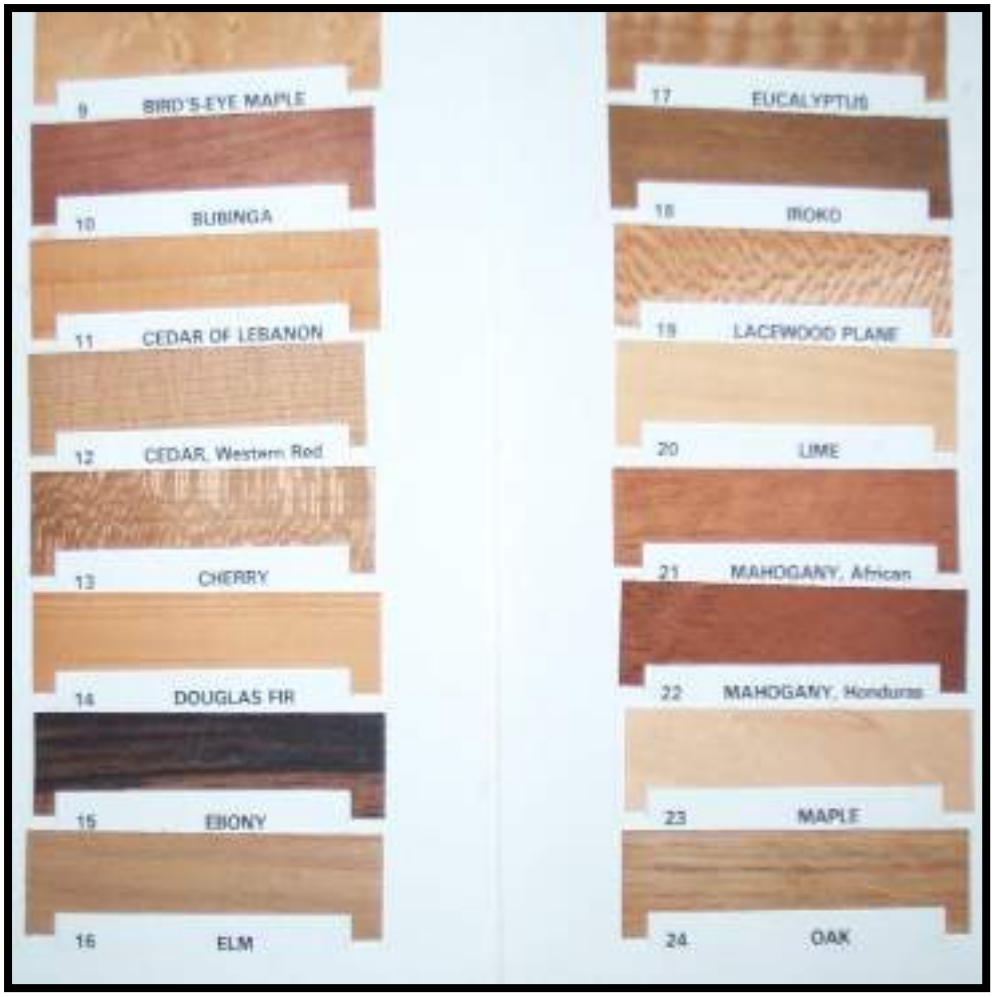
One area where I would fail with the green police is that I use a lot of disposable plastic gloves. If bought by the box they are not that expensive. It is a lot easier than cleaning your hands and if you change them immediately after doing a messy job there is less chance of spreading the muck elsewhere. Finally give your hands and face a good wash before having your lunch! Blowing your nose can also give you a good idea as to how much got past the mask.

Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

All photographs by John Sparks

January 2017 **John Sparks**, Shotley, Suffolk.

HINTS AND TIPS ON STELLA MAINTENANCE



Samples in " What Wood is That? " by Herbert L Edlin

Part 3

WOOD & TIMBER

by

John Sparks

01473 788186

Contents

Trees are plants and as such no one is exactly the same as another. Consequently timber cannot be considered in the same way as manufactured chemical composites such as iron, paint or glue where in theory at least one piece of silica bronze for example should within reason be the same as the next. With timber it is possible, for example with Sitka spruce, to have one tree which would be ideal for making a mast while another one might only be good for making paper. The problem is knowing which is which.

Not only will different trees vary but there are numerous types and species and the wood produced from them may be excellent in one set of conditions but useless in another. It is an absolute minefield. I think that for the amateur perhaps the most important thing is to find a timber merchant who understands what you are trying to do (boatbuilding) and is prepared to listen and match the timber to your requirements. No matter how much you read you are unlikely to gain their hard won knowledge overnight.

I would stress that I am not a timber expert. I am deeply aware of how much I do not know but below is just some of the things I have learnt over the years which some will hopefully find helpful.

Buying Wood

The world of the timber yard has similarities with the mortgage market. There are numerous products some of which have several names and they all have different strengths and weakness. In both cases I sometimes wonder whether there is a deliberate policy to confuse the public.

Some of the complications are caused by different names being used for the same tree or family of trees in America and Europe. Another complication is that different trades sometimes refer to the same timber by different names. A good example of confusion is *Psueudotuga menziesil*. This is perhaps most commonly known in the UK as Douglas Fir. It comes from the pine family (*Pinacea*). Firs are a sub species of pine trees and many given the name "_____ Fir" start with the Latin prefix *Abies.* Douglas Fir is not one of them! The confusing part is many of the trees with the name "_____ Pine" start with the Latin prefix *Pinus* which is a sub species of the pine family (*Pinacea)*. The problem is the loose use of the term Pine Tree. Are we dealing with the family (*Pinacea*) or the species (*Pinus*)?

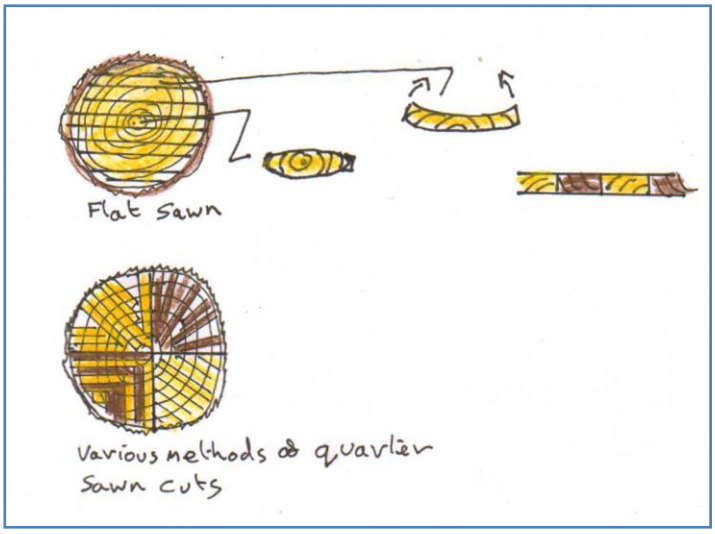
For those not up to speed, all pine trees (P*inus)* are pine trees (*Pinacea)* but fir trees (*Abies*) may or may not be pine trees. That all depends upon the definition the speaker/salesman is using at the time. The result of this sort of loose terminology means that Douglas Fir can also be called; British Columbian (BC) Pine, Columbian Pine, Red Fir, and Oregon Pine. These are all essentially the same tree but for those in the know, the different names may be used to give a better indication of the climate/where the tree was grown. This can have a dramatic effect on its quality and use for boat building.

Another issue relates to the rain forest timbers. Just like the insects there are numerous species; more than the average buyer wants to know about. Consequently there has been a tendency, which is not unreasonable, for the timber merchants to lump similar spices together under a name with which the public are familiar such as mahogany and teak. In his book *Details of Classic Boat Construction* Larry Pardey suggests that there are more than 171 species marketed as mahogany! The problem is that some of these species perform better than others with regard to durability etc.

Unless you are sure you have a timber merchant you can trust implicitly**, do not buy timber unseen.** The only possible exceptions to this are fire wood, even then risky, or high quality plywood such as Bruynzeel or boards from one of the top end plywood suppliers such as Robbins. Hopefully you get what you pay for but even so check the boards carefully before signing for the delivery.

Timber is normally priced by volume i.e. cu ft or m^3.

When going to a timber yard allow plenty of time to go through the racks. There is plenty of warped twisted and damaged timber out there that you do not have to buy. As a general rule the straighter the grain and the less knots the better. Knots create a weakness and may lead to failure if you are bending the timber. Small ones may be perfectly acceptable. Bear in mind what you want the timber to do and look at how the grain of the timber runs. Crooks which are the curved section where a branch springs out and have a curved grain are particularly good for knees as the shape matches the grain. Timber will generally be strong across the grain but can easily split along it.



Also look at how the timber has been sawn. As it seasons/dries out, the outside section of a tree where the cell structure is larger will shrink to a greater degree than the timber in the centre. With timber from a very large tree such as the tropical hardwoods this may not be an issue. With boards taken from smaller trees warping can result particularly that shown on the right. A solution if you are making wide boards for thwarts etc. can be to saw it into strips and glue sections with the grain running in opposing directions as shown at the extreme right. Quarter sawn boards may be affected to a lesser degree.

Take a tape measure and the measurements of what you need. Possibly take the old pattern with you to see how the grain matches up. Can you get what you want out of the plank/log on offer. You can push the pattern round the various timbers looking for the best fit.

Timber generally needs to be seasoned. The one exception is if you are planning to steam timbers (See Part 6) such as new oak ribs. This should be green oak, (directly from the sawmill rather than the timber merchant). The sap in the wood helps it to bend without splitting. The downside is that the timber must not be too large as otherwise it will tend to split twist and warp as excessive internal tensions are created as the timber dries out. (See photo of Log on Page 21)

Most timber you get from the timber yard will be kiln dried but by the time you see it, it should have done most of the splitting it is going to do. Air dried is better as the drying process is slower and so internal tensions and splitting is lower. Due to cost/time issues you are unlikely to find this in a commercial timber yard. If you are storing timber for a long time it may pay to paint the end grain as this is where a large amount of the evaporation/moisture loss takes place. Some of the timber in the yard may have painted ends for this reason. Shrinkage cracks at the end of planks are referred to as checking. Oak is particularly vulnerable.

If you just need small sections such as timber for winch pads or making laminations it may pay you to look in the offcuts section if they have one.

Most of the timber trim, thwarts etc for my tender came from the offcuts pile, saving large amounts of money. In the offcuts pile you may find some sections of tropical hardwoods such as iroko which have been discarded because of small sections affected by woodworm. In most instances this is just a cosmetic issue. The insects will have been in the tree before it was felled and are not an ongoing threat. Therefore if you can use the timber in a low load way where the holes do not show or the damaged area can be cut out for your use, the timber will probably be perfectly adequate for your needs, despite it not being acceptable for a stockbroker's kitchen/floor. (Could be an indicator of sapwood, see next page)

When buying offcuts you can normally only buy the cuts that are there, meaning you may pay for more wood than you need but it is priced at a very much cheaper rate. Keep the bits you do not use as they may come in handy at a later date. When looking at a piece of timber in the pile, can you get two parts of what you want out of one timber where another one which is slightly smaller will only do one? This is why it pays you to have the exact measurements for what you need or the patterns when you go there.

Based near Ipswich I have got most of my hardwoods from Thorogoods www.thorogood.co.uk in Ardleigh just north of Colchester. The offcuts section is excellent but you have to accept what is there on the day and may have to go back a number of times before you find what you want. On the few occasions when I have had to order timber cut to size such as for the rudder cheeks it was quite expensive but I cannot complain about the quality.

For green oak I used the Shrubland sawmill just north of Ipswich. I have bought my plywood from C F Anderson at Marks Tey just off the A12 but they have since gone bust.

When it came to the spars for the dinghy I broke my rule about buying timber unseen and on the recommendation of the local boatyard ordered some Columbian Pine (Douglas Fir) from John Moody in Devon (01548 831075 Advertises in Classic Boat). I was not disappointed. Speaking to him he obviously understood what qualities a boat builder would be looking for which helps. If you go down this route you need to check it before accepting delivery.

One last source of wood is skips. You are unlikely to get anything large but I have found a few boards of teak and Honduras mahogany which have made backing boards for half models and the stern sheets of the tender. Even though it is in the skip it is still the property of the owner so ask before removing!

Softwood purchased from the DIY store/builders' merchant is unlikely to be sufficiently durable for marine use.

Terminology

Sapwood and Heartwood (Do not confuse with hardwood)

I am not a biology expert but my understanding is as follows:

Each year most trees (not bamboo and palms) put on a growth with the trunk getting wider. The new growth is around the outside and it is the young growth at the edge which carries the sap and nutrients around the tree. This is the sapwood. Over the years the older growth in the centre goes through a chemical changes with the starch

in the sapwood converting into lignin and becoming what is know as heartwood. This is very much denser and is what holds the tree up.

Because the sapwood contains high levels of starch it is very attractive to both wood boring insects and fungal decay. Because of its low durability it should be avoided in construction or boatbuilding. It is often but not always a lighter colour and is softer. The colour difference is fairly obvious in the adjacent chestnut log. You sometimes see a lighter strip on the edge of a freshly sawn plank and this is likely to be the sapwood which is softer and should not be used. Ideally you should be using only the heartwood.

Softwoods generally have a greater proportion of sapwood.

Hardwoods and Softwoods

The woods of all trees which have broad leaves are known as hardwood while softwood comes from trees which have narrow needles. Hardwood is generally denser than softwood although there are exceptions such as poplar and balsa which are both very soft despite being hardwoods. Conversely yew is a very hard softwood. As a general rule the hardwood trees tend to be deciduous in that they lose their leaves in winter as opposed to the softwoods which do not. A notable exception is larch which is a softwood but losses its needles in the winter.

It would also be fair to say that, on the whole, hardwoods tend to be more durable than softwood but it is not something I would bank on. When I had some rot in the deck as a result of water seeping through the chain plate, the hardwood plywood together with the mahogany packing piece between the beam shelf and the plank were substantially rotten but the adjacent softwood larch beam shelf was totally unaffected. Good softwood will nearly always be better than a rubbish hardwood.

Notes on common timbers (sometimes found in Stellas)

For Stellas the wood specified in the original drawings is as follows:
Planking/rudder, transom, coamings, hatches and other trim are mahogany. (Larch planking now allowed under class rules) Stem, timber (ribs), floors, hog, sternpost and deadwood are of oak. The stringers, carlins, beam shelves and deck beams are of larch. (See Glossary of Terms)

Rather than taking this as "gospel" bear in mind that some of the builders may have varied this slightly depending on what was available and also other timbers may have been used in repairs. Minor variations for repairs may be acceptable but if you want to be sure your boat remains "in class" check with the SCA committee before making any radical departures from the list given above.

Hardwoods

Oak

Most oak found in the UK is likely to be English Oak. In America there are two groups white and red. White is broadly similar to English oak but the red can have poor decay resistance and should be avoided.

Is hard and strong but heavy. Generally has good decay resistance so makes a good timber for structural members.

The bottom piece is planed kiln dried oak. The upper plank is sawn and was bought

green for making ribs. It has now twisted out of shape. Small sectioned ribs are the only thing you should use an unseasoned timber for otherwise it will twist your boat out of shape. Oak has a high tannin content, especially when green, which stains your fingers black and can damage decorations. The tannins help in making the oak durable but attacks iron shortening the life of scarf and keel bolts. (See Part 7)

It also has a reputation for not gluing very well, possibly relating to the tannin, so not an ideal choice for laminating. The oak ribs I have repaired using the lamination

method described in Part 6 have not shown any problems and it is not the end of the world if they fail. On the other hand I recently saw a relatively new strip planked 40'+ yacht with a laminated stem which is showing signs of delamination after only a few years. A serious problem if it is not just a localised issue!

With regard to gluing all woods, you will probably get a better bond with a sawn finish rather than planed so if you have a smooth finish, sand with coarse paper briefly before gluing to roughen up the surface.

A feature which is far more obvious in some oak is what are known as the medullary rays. I glued a hard bit of oak into the underside of my ash tiller where it slots into the front edge of the rudder. Downward forces on the tiller were crushing the softer ash which discolours easily. The oak puts up with this abuse far better. You can see the yellow medullary rays in this fillet which run across the grain. They have no structural significance but can be used as ornamentation and are a useful tool in identification.

Mahogany

True mahogany comes from central America and was first brought to Europe by the Spanish. Often referred to as Honduras Mahogany. Red brown in colour (See photo on frontispiece), quite durable, slightly soft but comparatively light and does not distort or shrink much once shaped. Only problem is that it is hard to find these days is listed by CITES and hence protected. Various trees of the same family are in greater supply, sometimes referred to as Brazilian Mahogany. All the mahoganies are rain forest timbers so you may wish to ask questions as to how they are sourced but whether you can believe what you are told is another matter.

When true mahogany was running low importers started looking for similar alternative woods from around the globe and started marketing them as African/Philippine mahogany etc.

Most African ones come from West Africa but are only distant relations to true mahogany. Khaya is one of the more common. From South East Asia comes Meranti and it various relatives. I think the mahogany on Lys is one of these two but I am not sure which. (Left in photo) Medium weight, relatively stable but quite soft.

Lighter colour that true mahogany and in my experience bleaches fairly easily in the sun. Essentially which type it is not a critical issue as it has done forty years and is showing no signs of giving up.

Two other fairly commonly found African "mahoganies" are Sapele and Utile. I think the timber on the right is one of these and to my mind it is slightly brash in comparison with other mahogany. The stripes are caused by an interlocking (ribbon) grain which can make planning/machining slightly difficult as it is hard to plane with the grain if it keeps changing direction. Considerably harder than the comparatively soft timber used for planking Lys.

In my experience some of these mahoganies can rot relatively quickly if they become saturated with fresh water. If using them it will pay to make sure the end grain is sealed/painted regardless whether the timber will be exposed or not.

Ash

A white/yellow wood. Early spring growth has relatively open pores which means it is not very durable but darker summer growth is extremely

hard and this combination makes a tough and flexible wood. Moderately heavy. Commonly used for tool handles. Will quickly turn grey/black if water gets in and this poor durability normally means it marine use is restricted to tillers, boathooks and the shells for wooden blocks.

Iroko

A West African teak substitute. Quite hard but workable. Strong but quite heavy and like teak supposedly slightly oily but I have never found this to be the case. Can be almost yellow when cut but turns to golden brown and gradually darkens with age. The top of Lys's rudder which is exposed to sun is starting to bleach slightly after about seven years.

I have used a lot of it. Seems to glue well but grain is slightly irregular which can set up internal tensions within the wood which get released when cut. The effect is that you mark out a rectangular piece of wood but when it comes out of the saw it has a twist in it. I have not found this too much of a problem but some won't touch it for this reason.

The sawdust can have an adverse effect on some peoples' respiratory system. Be careful.

Other hardwoods commonly found (but unlikely on Stellas or new work).

Teak: Good quality (Burma) teak (*Tectona Grandis)* is now quite rare and very expensive to buy in log format if you can find it. Again ethical considerations involved. Is extraordinarily durable but quite heavy and small sections are relatively brittle. Beautiful brown colour when varnished. Oily texture can make it difficult to glue although like Iroko it gets a *Satisfactory* "ease of gluing" rating under Lloyds Register Classification . Dulls tools. Laid teak decks look nice but you are adding weight in the wrong place. When added over plywood is a long term recipe for decay. (Don't do it!) I would go for plywood with an epoxy scrim every time.

Like mahogany some other species with vaguely similar properties are marketed as teak and are found in such things as cheap garden furniture. Some maybe perfectly ok others are not and possibly they are more likely to come from non sustainable sources.

Elm: Not so commonly found now as most of the English Elm trees have succumbed to Dutch Elm Disease, a fungus transported by beetles. A lot of elms propagate by suckers rather than seeds so are essentially all the same plant and hence cannot breed in resistance to the disease. A bit like a slightly red stripy oak to look at. English elm has a slightly wavy grain and does not split easily although can be sawn. Performs very well under water and was used for early water pipes. If air is excluded can last for hundreds of years but does not like a wet dry, wet dry cycle. (Scottish) wych elm has straighter grain.

Softwoods

Larch
Traditionally used as wood for clinker planking but in the Stella makes the framework for the deck and the stringers. In 2012 Class Rules were changed to allow its use for planking as a cheaper and more readily available alternative to mahogany. They have a broadly similar weight. Tough and durable if slow grown boat quality. Can be slightly knotty. It is vital that you look at what you are getting.

Douglas Fir

For a softwood is quite heavy but available in long clear lengths and quite durable. This means it is often used for spars but weight makes it unsuitable for tall masts but excellent for booms etc., providing you do not have a go faster weight fetish. Under Nevins Rules (famous New York yacht builder) it seems to be classed as an all purpose softwood acceptable for planking, ceilings, stringers, beam shelves, deck beams, and decking. I think the big issue for a small boat would be one of weight rather than durability. One big advantage it has is you can still get it!

Spruce (*Picea*)
I think this is what Stella masts are made of. A Tucker Brown price list I have which is strangely dated August 1971 identifies the mast and boom as being of Silver Spruce. Having said this my round boom is quite heavy and has a distinctly different appearance from the mast, possibly some form of pine.

Like a lot of timbers spruce quality can be very variable. Best quality is the slow grown "aircraft quality" Sitka spruce but is expensive. Comparatively light weight with close straight clear grain which makes it ideal for spars, masts oars etc. Sometimes referred to as Silver Spruce. Not that durable and is slightly soft. It is fairly easy to put an impact dent in and crush the surface of my mast if you store it on a sharp point. As the timber is not particularly durable it is important that any damage to the varnish is repaired asap.

The long straight grain and fibres also makes Sitka and some others of the spruces popular for making paper and boxes. Consequently quite a bit of spruce is grown quickly on commercial plantations for this use. The resulting timber is fine for those uses but of no use to the boat builder.

Pine

There are numerous types and like the spruce quality can be very variable. Pitch pine (*Pinus Rigida*) was the best stuff as it is full of resin but I think you will only get this as reclaimed timber now. I understand the trees are out there but it grows very slowly and it is going to take a long time before they become useful lumber. Nevins rules recommend the use of Long Leaf Yellow Pine (*Pinus palustris*) from the SE of the USA for beam shelves, stingers etc. It is classed as a "vulnerable" species but is one of a number of trees that are marketed as Southern Yellow Pine. I have used this for bottom boards in my tender but exactly which pine it was I do not know. It has proved remarkably durable.

White pine (*pinus strobus:* Weymouth Pine in the UK) was said to be good for planking small boats by the likes of Herreshoff in 1927 and Pardey1999 but whether the quality in the UK in 2011 would bear this out I don't know. In any event if plank repairs are required on a Stella stick to Class Rules and use either mahogany or larch.

Cedars

Some of the cedars get quite good press. They have a natural inbuilt resistance to fungal decay and wood boring insect activity making them very durable but the acid within some attacks steel fastening. They are light and available in large boards but are soft and some are not that strong. Also some can absorb large amounts of water and so are not that dimensionally stable. Whether they would have any particular use on a Stella I don't know.

Plywood

There are many types of particle board, such as plywood, OSB, MDF, chipboard etc which are all made by gluing small parts of timber together to form a board. One of the driving forces behind chipboard is economics in that you can use the offcuts, chips etc from other products for that purpose. This is less true of plywood which uses veneers which are peeled off the log with a large sharp blade. For Stellas the only boards which have any place on board are the higher quality plywoods. Plywood can either be of hardwood or softwood.

Plywood is essentially thin veneers (strips) of wood glued together in layers with the grain in each layer running at 90° to the one above/ below. They normally have an odd number of layers or plys so that the grain runs the same way on the outside/inside surface. This sandwich arrangement produces a directionally stable board which should not twist or warp. A 5 ply board may not actually be stronger/weaker than a 3 ply board of the same thickness but it will be more flexible. **Avoid the *core plys***, 3 plys where there is a central thick core with two thin veneers to the surfaces, even if it is specified as a marine ply. Quite a few plywoods have facing veneers that are slightly thinner than in the core. This is not necessarily a problem but bear in mind when sanding plywood with thin surface veneers, over time it may be quite easy to sand through the surface with dramatic cosmetic consequences!

In the UK plywood is generally purchased in 8'x 4' (1220mm x 2440mm) sheets but 10' x 4' sheets are sometimes available. In thickness they are normally available in 4mm, 6mm, 9mm, 12mm sheets and upwards. The original specification for Stellas was ½" (12.7mm) for the deck and much of the internal furniture bulkhead etc. ⅜" (9.52mm) was used for the coach roof. From this you will see the metric equivalents are both smaller. For the deck this is probably not an issue but I think ⅜" was pushing one's luck slightly in the first place although an epoxy (West/SP rather than paint) scrim stiffens the structure considerably.

When replacing the coach roof I chose 9mm Far Eastern WBP plywood. I felt it was going to be protected fairly well by an epoxy scrim so the additional cost of a marine ply would not be justified. For reasons I will come too shortly this was an expensive mistake. Something I later discovered from a friend who is a structural engineer is that the relationship between thickness and resistance to deflection is a cube (x^3) so that extra mm can make a big difference! Also beware of "nominal thickness". If you are trying to replace ⅜" (9.52mm) and chose a plywood that is nominally 9mm, you may actually get a ply which is 8.5mm in places. This is only about 90% of the original thickness, i.e. significantly weaker.

The durability depends not only on the timber used but more importantly the glue used. The minimum acceptable plywood on a Stella should be external grade WBP (Water Boiled Proof) ply which is made using a water proof glue. (Probably Resourcinol) Marine ply (BS1088) has a vital difference in that it is not allowed to have any voids.

On the top is the 7 ply far eastern 9mm board I used but you can see there are some small voids. Below is a section of ½" marine 5 ply board form the original cockpit.

When I first fixed the new plywood down onto the coach roof beams I was alarmed by how flexible it was but as predicted it stiffened up considerably when I added the epoxy scrim. I still felt slightly uneasy but for three years it did not cause any problems.

In the winter of 2009 I noticed some small hairline tears on the underside of the ply at a couple of points. I resolved that I was going to have to strengthen it and that the simplest way was going to be to put another layer of glass and epoxy bonded on to the top of the old one. This still required removal and replacement of the deck paint, hatches etc. A lot of labour. Also the material cost was probably in the region £ 200.00. This extra layer has done what was required but was an expensive lesson.

When I had completed it I took a Stanley knife to the cracked areas and sure enough these had occurred where there were voids in the ply. These had clearly allowed a greater degree of localised deflection sufficient for the bottom ply to tear. The increased stiffness of the extra scrim should now have stopped this occurring. I cut out the area around the voids and filled the holes with an epoxy/colloidal silica paste.
In his book *Clinker Plywood Boatbuilding Manual* Iain Oughtred says "Marine plywood varies greatly in quality and price. Generally you get what you pay for, and considering all the work you'll be putting into your boat a few extra pounds/dollars invested in good quality plywood may be well worthwhile"

My experience would tend to bear this out although when I built my tender I went for a medium priced Gaboon marine ply from C F Anderson. Gaboon is not as durable as some of the other plywoods but is commonly used in dinghy construction because it is light. I still find the £80.00 a sheet for 9mm Gaboon Ply (2/2011) asked by one of the leading suppliers for their cheapest but good quality board a bit hard to justify. When you look at the cost of the epoxy, glass cloth and paints maybe there is a case for going for the best.

One last tip. If you are keeping any offcuts write on them what they are before you store them away. If you don't, you won't have a clue as to whether it is internal or

external grade you are looking at when you go to see what you have got stored in the shed.

Wood Borers

So far as I am aware the incidence of the more common domestic pests such as common furniture beetle and death watch beetle is low in boats. The bulk of the wood boring insects will only attack the cellulose rich sapwood or decayed heartwood. This fact combined with the bulk of the timbers being enclosed by paint/varnish will also help. The insects like moist wood but could well struggle in saturated wood. The fact that most of the boats are in the water when the beetles hatch out and lay their eggs (Approx April- August) must seriously hinder their progress. **Timber is only vulnerable to fresh attack during this time period.**

The greatest risk is probably if you keep the boat in a barn where activity is taking place over the summer.

As outlined earlier some imported timbers may have signs of infestation which was present when the tree was cut but in the majority of cases these do not represent an ongoing problem in the UK climate. Even so it can be an indicator of the presence of sapwood.

I have come across wharf borer beetle in an old wreck but this was just a symptom of rotten wood not a problem in itself.

Teredo also known a shipworm likes warm waters and is therefore unlikely to be a problem to Stella owners unless you are very adventurous. Gribble however is very much alive on the East Coast. This is a crustacean which nibbles away at the surface of exposed timbers which gradually wear down to expose a fresh surface. Providing you keep your bottom paint in good condition it is unlikely to be a problem and even then you would have to leave the boat in the water for a long time before it can be a significant problem. Even so those who keep their boats near old staging in such places as Maldon or amongst the wrecks of Pin Mill would do well to make sure there is no bare wood below the waterline.

Fungal Decay (Rot)

Fungus spores including dry rot are naturally present in the atmosphere all around us. They just need to find a suitable place with sufficient moisture where they can germinate. Once the spores have germinated they create a mycelium felt like growth from which strands appear. These start to chemically break down the cell structure of the wood converting the cellulose (starch) to glucose. The important thing is that they need water to do this. Also the heartwood is far less vulnerable to decay as it is not so digestible. When the fungus gets to a state where it is running out of food or the conditions are turning against it, its reaction is to produce a fruiting body (as in mushrooms) which release spores to repeat the cycle.

While salt does act as a preservative to some degree it does not make boats immune to fungal attack. Probably the greatest source of problems is fresh water getting in from above, through the deck particularly around the chain plates and fixings for stanchions where small amounts of movement are almost bound to be occurring. Taking the boat out and sailing it in salt water may help, but if fresh water is constantly getting in it will dilute the effect of the salt. In many instances the water becomes trapped in the timber by paint and other impervious coatings leading to high water contents over a long period. These produce an ideal breeding ground for wet rots which require a moisture content in excess of 40%. To get rid of these you only need to stop the moisture source and replace the decayed wood. Unfortunately this often involves cutting into good areas and is rarely straight forward.

One type of fungus is different from all the rest. Dry Rot. This requires a much lower moisture content to germinate (min 20%) but requires dark poorly ventilated conditions. We may not be able to do anything about the moisture content and the darkness is not easy when laid up, but we can ensure the boat is adequately ventilated. Fortunately a Stella is fairly simple and does not have areas like counters where ventilation is notoriously difficult. Even so when laying up it is critically important that you pay attention to make sure there is a good flow of air through the boat especially where you have an impervious plastic winter cover. Even though I winterise my engine I wrap it up in blankets and make sure the air is running through the boat. I take anything such as the cushions which can store moisture off the boat, leave all the hatches open, remove all stored items and raise the floorboards so air is free to circulate right around the hull. Only in the coldest weather do I tighten up the flaps at the front and back of my canvas cover.

Where it does germinate, dry rot forms a white fluffy mycelium which turns to a grey leathery sheet with droplets of moisture on the surface and a lilac tinge. In the right conditions it can spread relatively rapidly (4mm per day in laboratory conditions but in domestic conditions the average is considered to be 1m per year. Interestingly they found it very hard to create laboratory conditions in which it would germinate. A very picky fungus.) Once established it can attack timber with a moisture content in excess of 15% but some of its powers have been exaggerated. It cannot survive without moisture and

it does not like draughts. You may have to be slightly more rigorous in your repairs but essentially the method will be the same to cut out the decayed wood and replace it. You need to take the utmost care that any replacement timber does not contain sapwood and that you are scrupulous about ventilation issues in the future. It may also pay to treat surrounding timbers with a preservative. I am aware of problems occurring (not on Stellas) where replacement timbers such as floors have been put in which contain too much sapwood. Oak sapwood is particularly vulnerable but if you ventilate properly it should not be a problem.

Summary

I hope you find the above useful but I would warn against becoming a timber nerd and worrying far too much about exact identification of species. The golden rule if you are doing repair is to chose a timber which is broadly similar to what came out. In practice a balance has to be struck between appearance, availability, durability and cost. Where your choice of timber fits in will to a large extent be dependent on what you are doing. If you are making something up which can easily be replaced you can afford to be a lot more relaxed about matters as if it does not work well you just take it out and do it again. If on the other hand, you are doing major work such as fitting a new deck where failure will have major consequences and costs then you want to far more discerning about your choice.

Good Luck!

Further Reading

What Wood is That? Herbert L. Edlin Stobart Davies ltd

ISBN 0 85442 008 8

Clinker Plywood Boatbuilding Manual Iain Oughtred Iain Oughtred

ISBN 0-9537712-6-1

Details of Classic Boat Construction Larry Pardey L & L Pardey Books
Appendices contains the sections of Nevin's Rules, Herreshoff's Rules and Lloyds Rules and Regulations for the classification of small craft (1979), which relate to timber. These are all good sources of best practice advice.

ISBN-13: 978-0-9646036-8-4

Woodland Crafts of Britain. Herbert L Edlin

Originally published 1949. Not strictly relevant for marine use, but fascinating insight to old forestry and woodland practices. This author published a considerable number of good books relating to trees and timber.

Countryman's England Dorothy Hartley Batsford 1935

Again not strictly relevant to marine issues but has a good section on woodland crafts. (Same Author as for "Food in England")

I would again stress that I am not a timber expert. The text is purely observations and conclusions I have made/come to over the years which others may find helpful.

Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. Before choosing any timber you should satisfy yourself by making your own enquiries with regard to its suitability for its intended use.

All photographs by John Sparks

January 2017 **John Sparks**, Shotley, Suffolk.

HINTS AND TIPS ON STELLA MAINTENANCE

Part 4

MATERIALS & TECHNIQUES

by

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Contents

Philosophy: This is a very pretentious heading but it is important to bear in mind that you are dealing with an old flexible traditionally built boat. Since they were built various new wonder plastic products have been invented some of which if used in the correct place are very useful but sometimes they are used inappropriately and can cause serious long term problems.

Epoxy is a typical example. It is great as a glue for people like me who rarely create perfectly matching wooden joints but if you allow it to get between two planks or bond them together you are likely to create a hard spot and stop the planks closing up when you put the boat in the water.

If in doubt seek advice. Read the product literature and if you are still unsure ring up the technical departments of the manufacturers. They are in my experience very helpful as it is not in their interest to have someone who is dissatisfied with their products.

Another thing which I have been guilty of on a number of occasions is using what I have to hand at the time not what is best for the job. I once bedded a bowsprit down on to a dinghy's plywood deck with Sikaflex as that was what was in the mastic gun at the time. I was not very popular when we had to separate the two with a hack saw blade the next time it needed to come off.

Something I have also come to appreciate in old buildings and boats is that the builders nearly always did something a particular way because of experience handed down over the years had told them that was what worked. In every generation there were always plenty of "Friday afternoon jobs" and you should not treat something with great reverence just because it is old. Even so before deciding to redo something differently it is worth having a think about what is there and why before discarding it. Many of the traditional methods and materials work just as well today as they did forty years ago but it can be a lot harder finding the materials.

Fastenings

So far as I can make out brass screws were originally used in the construction both in the hull and the internal furniture. I expect the quality of the brass used in screws in 1965 was probably much better than it is today. Some of the screws on Lys had lasted reasonably well but I am sure most Stella owners

will have spent considerable time, like me, in trying to extract brass screws which have gone pink. The zinc has wasted away from the alloy through electrolytic action. This causes the brass to become soft and also discolours and damages the surrounding timber. A dab of vinegar on the head of a festering screw will temporarily halt action on the surface.

When I first started doing work on Lys I replaced some damaged screws with brass which is something I now regret. I now have the slightly extreme view that brass screws should not be allowed onto the boat in any position but at the time I was not aware of a source of bronze other than in little very expensive packets in chandlers.

While it is true that silica bronze wood screws are more expensive than brass in the overall scheme of things they are not that expensive. Classic Marine now at Suffolk Yacht harbour www.classicmarine.co.uk stock them and other such items as copper boat nails together with their extensive range of traditional hardware. Their web site and old catalogue was an absolute mine of information about how metals behave in a marine environment, strength issues, gauges and sizes for wood screws and nails etc. I would say essential reading for any Stella owner.

After that commercial, I buy my screws direct from the supplier Anglia Stainless 01359 251414. You can even get things like 6" 20's for the really meaty jobs. They also supply stainless steel screws and coach screws, copper boat nails and roves and other fastenings. Normally items can be sent by post but if you have got a bulk order they will probably do a delivery in East Anglia and they do regular runs to the boatyards in East Anglia so you could always get them dropped off. For those in the south west Seaware Ltd at Penryn in Cornwall also supply the same and a copy of their on line catalogue is well worth having. www.seaware.co.uk. 01326 377998.

Screw gauges work on the bigger the number the bigger the screw. A pair of callipers (digital from Maplin are the easiest) are useful for measuring screws you have taken out to compare against sizes given by the Classic Marine site/catalogue to identify what to reorder.

Just to annoy you nails are classed by wire gauge which works in the opposite direction. The larger the number the smaller the nail.

Stainless steel wood screws are slightly cheaper than bronze but have some drawbacks. Like bronze, stainless steel is an alloy and there are numerous types. The two most common in marine use are 316 (A4) and 304 (A2) If you have a choice

in most cases it is better to opt for the 316 (A4) In order to resist corrosion stainless needs to be initially exposed to oxygen to build up a "passive" corrosion resistant layer. If it is in an underwater situation and there is not an adequate layer you can get crevice corrosion taking place (pitting). A S/S fastening under water may not perform any better than mild steel. This is quite a complicated subject. Find out more on Classic Marine web site. I have a general policy of using bronze or copper fastening below the waterline and use stainless steel above where exposed to air (Cockpit etc.) Somewhere I have had some minor corrosion is in the S/S chain plate bolts where the bolt has been buried in the planking. This has been a problem with rust bleeding rather than a significant structural weakness (or so I thought) Water had been leaking in via the chain plate rotting a section of deck and the packing piece for the chain plate. (Plank/deck repair completed 2009). So if you have some rust staining it could be a warning of a problem but not necessarily so. In my experience stainless steel is best left unpainted. If you cover it with paint it is more likely to bleed rust stains.

For reasons outlined above I would advise against replacing any keel bolts, scarf bolts etc with stainless steel. Stick to galvanised for scarf bolts and iron/steel for keel bolts. (See Part 7)

You will have to get keel bolts made up at a blacksmith. Other galvanised bolts, coach screws etc I got from Seaware Ltd (See their on line catalogue). In connection with this Stellas were built using imperial measurements and most bolts now come in metric. This can cause some problems. If the nearest metric equivalent is larger you just drill a larger hole. In cases when it was the other way round I just sleeved the bolt with caulking cotton bedded in mastic and this has not caused any problems. There is an inch to metric conversion table on the Classic Marine web site/catalogue. I keep a coy of this inside my calliper box.

I will deal with copper nails and roves later when dealing with refastening. (Part 6)

Glues

Before using any glue read the manufacturers' product literature!

Brand names for glues have a habit of changing so the names given below may not be up to date.

PVA: Not suitable for below the waterline or external use. I would only use it for interior work if at all.

Cascamite (*Extramite*)**:** Is a urea-formaldehyde resin. (UF) A dry powder mixed with water which produces a cream coloured glue. Will not withstand total immersion in water for prolonged periods. I think that it is probably what Lys's coach roof and deck were originally fixed down with although I believe the main structural element was the mechanical fixings rather than the glue. When I took the

coach roof plywood off the bond was not particularly strong but the glue had only failed where the fixings had failed, presumably where the water had got in. In retrospect I think this is a good argument for its use. The chances of getting a coach roof deck glued down with epoxy off without destroying the deck beams must be small. I have a feeling that our successors are going to curse the word epoxy.

Aerolite 306: (UF) I have only had direct experience of this glue once. A two part glue. The white powder is mixed with water to form a creamy consistency. It has the advantage that this mix can be kept in a pot to be used as and when required. When you glue up a joint you apply the resin to one side of the joint and an acid hardener to the other and then cramp up. Is classed as being water resistant rather than waterproof. Used by dinghy builders. Not suitable for permanently wet situations.

Semparoc 60 (Balcotan) : (PU) Is a one pot polyurethane glue which cures when exposed to the moisture in the atmosphere. No measuring and mixing required. A great bonus! I believe Rolfe and colleagues with Leonis (27) used it for fixing their new ply deck and I understand it worked well. It has the advantage that the timber does not need to be bone dry. It has a foaming action so has very minor gap filling capacity but if there are any foam filled gaps this is likely to lead to structural weakness.

Unless you can be certain of your carpentry and are sure there are no gaps I would not use it in an important structural location **if you are solely relying on the glue rather than any mechanical fixings**. Things such as winch pads should have mechanical fixings and not just rely on the glue. For things like scarf joints this may not be possible. It is waterproof and I understand from a shipwright can be used below the waterline but I would express some caution. **Any bubbles created if there are any voids could form a conduit for water to the inside**.

One problem I have had with my own experience is that the glue continues to foam out of the edges of the joint until the glue has set. This means than you cannot clean it off immediately after cramping up and before it sets. This is the easiest way with epoxy and other glues. They say that it remains slightly flexible when set and can be cut with a blade which is fine if you are going to plane off the joint afterwards. If however you are fixing down a deck and want to follow the easy option of painting the underside of the deck before you fix it down this could be a significant issue.

R**esorcinol Glues**. (RF) (Cascophen) Two pot system. I have never used it but the two older shipwrights I have used who both did an apprenticeship the old way used it in preference to epoxy. It has a disadvantage to the amateur in that it does not have the gap filling properties that makes epoxy so popular with the bodger. It is a very tough glue and is what they use to glue together exterior grade plywood. I believe it is what was used to glue Stella masts together. It is UV resistant. Unfortunately, it does eventually fail with age but I do not think you can complain when some of our masts are still going strong after 40 years +. I am told that if you

stop the water getting into your mast and keep the varnish in good condition there is much less chance of the glue joints failing. Glue joint shows up as a black line.

Epoxy. Two pot system. Two brand leaders are West and SP. I have always used West but through habit rather than any belief it is superior. Epoxy is comparatively expensive but has the advantage that you can mix up fillers such as colloidal silica into it to get the consistency you require. Use the correct filler/thickener for the job required. There are various but I generally use colloidal silica for structural gluing and micro balloons if using it is a filler. For best results most epoxies should not be used in temperatures below 10°C. This can cause problems for winter projects but if you keep the glues by a radiator in the house before you take them on site this can help. **Look at the literature for the product you want to use.** In cold conditions the mix without any filler can be quite stiff and not very good for being absorbed into the wood. If stored in cold conditions the epoxy can crystallise especially in the pumps. If heated gradually by a radiator will return to liquid eventually but takes time so in the spring/winter check for problems a couple of days before you want to use it.

If you mix it with sawdust you can use it as a filler to repair dings in varnished wood although some experimentation may be required to get the correct colour match as the epoxy makes the wood go darker.

There is a lot of technical literature about doing jobs such as sheathing decks etc.. (See Further Reading and http://www.westsystem.com/ss/assets/HowTo-Publications/British.pdf) Do not mix too much glue at once especially during hot weather. The chemical reaction creates heat which makes it go off quicker. In hot weather the result can be that the mixture boils and will melt any plastic tubs you are using. (Margarine tubs are just as good as the expensive measuring pots the chandlers sell, assuming you are using pumps to ensure the correct proportions.)

Epoxy needs protecting from UV light. If filling (expensive and hard to sand even when using micro balloons) use it sparingly and for all type of work clean up as best you can before it goes off using thinners and a rag. This is a good policy for many materials not just epoxy. For epoxy acetone is much cheaper than epoxy thinners for cleaning up and is also less aggressive. Epoxy can be cut with a chisel when it is "green" but after it has set hard it is very hard to remove. Can be sanded but when it goes off a waxy substance known as an amine blush appears on the surface which clogs sandpaper and must be removed prior to over coating. It can be overcoated with more epoxy in green state without sanding.

I would strongly advise against the use of any form of epoxy coating on the planking as it will restrict movement in the planks and stop the boat taking up. I am aware that there are some clinker boats that have been painted with epoxy paints but this is not a practice I personally am happy with in a boat where the parts were designed to move in relation to each other. If you are working with epoxy near the planks, use cut up supermarket carrier bags to keep the glue away from the planks or to stop any timbers accidentally bonding together. Packaging tape is also good for masking and can save a lot of time cleaning up.

Over the years I have used quite a bit of epoxy and for some things like sheathing decks it is very good. However, looking back there are a number of areas where something else might have been better as well as cheaper. All too often I have fallen into the trap of using epoxy as that is what I had, rather than using what was best.

Oak can cause problems with a number of glues because of the level of tannic acid especially if it is green. Larry Pardey in his very good book "Details of Classic Boat Construction" has quite a lot to say about the failures of glued epoxy joints he has encountered. These mostly seem to be on boats in places such as the southern states and Med where there are a lot higher temperatures and UV levels compared with the more temperate climate here on the East Coast

There are now numerous suppliers of epoxy and other adhesives products on line but if in doubt about a product check the technical literature first before ordering.

Mastics/Sealants

Before applying any mastic or sealant think about what thinners you may need and how you are going to clean up. Also do the joints need priming? Read instructions where given!

For bedding most things down, such as toe rails, all you need is an ordinary **oil based mastic**. (left in photo) It is not expensive and so large amounts can be used and then squeezed out to make sure you do not leave any gaps. You can then scrape off the surplus and apply it to the next section to be bedded down. Then clean off the area with white spirit and large amounts of toilet roll. Over more recent years I have found oil based mastic difficult to find in builders' merchants but found large amounts at a local timber merchant. (Jewsons were stocking it last time I went in also Travis Perkins) I think the reason it is more difficult to get hold of is that more and more builders use the acrylic frame sealants which cannot be cleaned up in the same way. I would not recommend the use of these acrylic based mastics frame sealants or silicone sealants.

Sikaflex is one of these wonderful modern glues/sealants and does have its uses where you want to obtain a really strong bond between two materials. Again for best results read the product literature carefully to make sure that you are using the correct type as there are several. It is comparatively expensive and, like epoxy, someone who wants to take the two-parts which have been glued together apart will not thank you. If you attempt to prize a joint apart it will often fail in the wood not at the joint. If you bed a keel down with it, the next time you want to take the keel off you may well tear a section of the wooden keel off with it!

Some clinker planked boat owners have used Sikaflex along the lands prior to launching to stop leakage. (**Don't do it!)** Often this works for a while but equally if it gets into the lands and you have missed any bits it will stop the plank closing up. To my mind a much better pre launching solution is to mix up a 50:50 mixture of **grease and mastic**. A cake icing set is quite good for applying the mixed up gloop. Push this into any open lands and then clean off the surplus with white spirit. Allow to dry and then over paint. In 2015 I stripped of the antifoul paint with a heat gun and then gave all the underwater lands this treatment after priming and before antifoul. I am happy to report that for the last two years she has leaked very slightly for the first three weeks on going in but thereafter only takes about 1pt a week when on the mooring. The grease stops the mastic from going hard and the mixture will squeeze out as the planks take up. Another soft product called Slick Seam is designed to do exactly the same. The other problems with using Sikaflex for this is it is very hard to remove if you want to do so at a later date.

A one part polysulphide is often much cheaper than Sikaflex. It does have adhesive qualities but these are not as strong. I have used this in preference to Sikaflex for things like bedding in the glass for the windows in the coach roof and bedding the fore hatch down onto the coach roof deck. In both these cases it was important that a slightly flexible waterproof joint was formed. The thinners for cleaning up is quite aggressive and will attack other plastics so use sparingly. It is not a bad idea to wipe the area off with white spirit to remove traces of the thinners after you have finished cleaning up.

One of the disadvantages with oil based mastic is that over time it does eventually go hard and so if flexing, cracks will open up which can draw water in. In connection with this the best things you can do for your boat is take it sailing regularly in salt water. The salt in any water that gets into the inevitable cracks will inhibit **some** fungal decay. Connected with this the two most important issues so far as avoiding fungal decay are 1: Stop water getting in in the first place (keep varnish and paint in good condition) and 2: Provide good ventilation to keep humidity levels low.

If you make sure there is a good seal on the underside of the wood you are bedding down with, say a 50:50 mix of varnish and turpentine, the mastic will take a lot longer to dry out.

Traditional Materials

Tallow: (Boiled down a sheeps' fat) It can be bought in a plastic sausage even at chandlers such as Fox's. What it is used for on a plastic boats I don't know but I use it in as a lubricant for wood screws. It helps the screws to go in easier and in all but the hottest weather stays more rigid than Vaseline and grease so does not mark the wood to the same degree. All you need to do after having pre-drilled and counter sunk the hole, is push the screw into the sausage of tallow and it will come out with the grease in the thread. After the screw has been screwed in there will be a small deposit of tallow at the top which can be wiped away with a rag. If you are subsequently going to coat the wood it is probably best to go round with a rag and methylated spirits afterwards to remove any remaining grease. Using tallow should also help when the time comes to take the screw out. I normally keep my supply in a Tesco's bag in one of the bins beside the bunks in the saloon. I have not noticed any tendency for it to go rancid or smell and this is after four or five years. I also carry a substantial stock of screws on the boat which is just one of the many reasons why she is not at the front of the fleet.

Vaseline Perhaps not a traditional material but if smeared over and worked into any bronze or brass parts, such as seacocks or flagstaff sockets, it stops verdigris forming just in the same way as it stops corrosion to battery terminals. I tend to use a coating of ordinary grease when taking the seacocks to bits at laying up time. I then reassemble with grease in the spring, rub off surplus grease on the outside with a rag and then coat with Vaseline.

Red Lead Powder : This is available in tub format from Classic Marine. (See photo on next page) One tub will last you a lifetime. It is added to putty and gives it a bright orange colour. **This is toxic**. **Wear a mask and gloves when handling and only open tub out of the wind.**

Putty is a mixture of linseed oil and chalk and was traditionally used as a bedding compound and for filling caulked seems below the waterline. (Where planks meets stem, keel and sternpost on Stella) The point of the red lead powder is that it makes the putty toxic to marine borers. I have also known birds to the eat putty in extremely cold weather. Putty which has gone hard can be rejuvenated by adding a small amount of linseed oil. A messy job. I do not think the addition of the red lead to the putty is critical if you stay on the east coast.

Up until about 1990 you used to be able to buy red lead primer paint which was the standard primer used in traditional boat-building presumably for the same reasons. In my experience it was quite tenacious at sticking to wood. Out of curiosity I added some read lead powder to a white wood primer and produced a rather fetching salmon pink primer which has stuck to the boat quite well, although this may have more to do with the paint rather than the addition of the powder. Obviously **the powder is toxic** and appropriate precautions need to be taken when handling . **Make sure it does not become airborne and get inhaled.**

Genuine Turpentine: This was the traditional thinners used for paint and is extracted from pine trees. It should be bought just for the smell alone. Over the last 40 years its role has been replaced by turpentine substitute and white spirit, which by comparison are fairly foul smelling although are very much cheaper. You can buy turpentine at a good decorators' merchant (Kent Blaxhill) and the most economic way is in a gallon can (Bird Brand). Given its price it does not merit use as a standard thinners but something I have noticed is that a varnish brush can be kept in a pot of genuine of turpentine for months and does not clag up in the same way one in white spirit does. Seal the top of your brush pot with a plastic glove to prevent evaporation.

My main use for turpentine is in conjunction with linseed oil. Sometime ago I read an article in Classic Boat (CB64) by a Swedish man who had a waterlogged pine 55 sq m. He used turpentine as a vehicle for displacing the water out of the wood and getting oil back into the planks. While I cannot be absolutely certain about this my limited experience indicates that a mixture of linseed oil and turpentine can put life back into wood which has become fibrous as a result of the oils being displaced. My wife's 15 ft clinker-built day boat with small oak ribs spends most of her time afloat and so the ribs in the bilges had become heavily waterlogged. All the good seemed to have gone out of the oak ribs in the bilges and the wood had become very stringy. We had to replace a number of the ribs as they had split right along the grain of the wood but over the last four years we have taken the boat out over the winter and given the bilges a regular soaking with a mixture of boiled linseed oil and turpentine gradually reducing the quantity of the turpentine. It is quite surprising how some of the timber which was very soft and stringy is now quite hard.

I also use the mixture for touching up the varnished section of exposed ribs

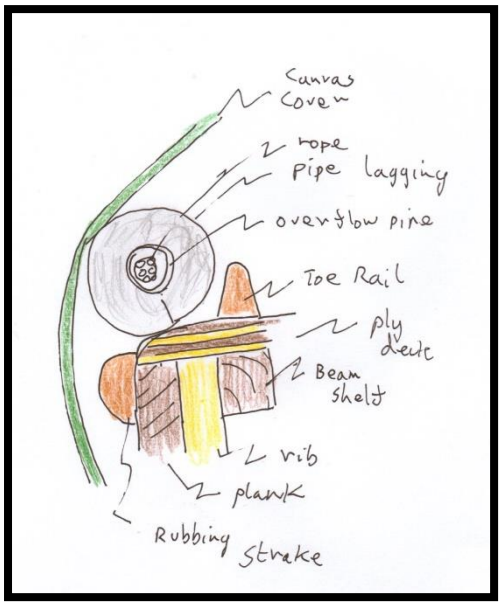
and planking underneath the side decks between the benches and the bulkhead at the front of the cockpit on Lys. The varnish had become slightly damaged in places but I was not that keen on hot air stripping this relatively complicated structure so I just gave it a coat of about 50:50 turpentine and boiled linseed oil. You do not get the same form of high quality gloss as you do with a varnish and the surface is not particularly hard wearing. At the beginning of each season I have just given the area a light sand and then a coat of turpentine and oil and it seems to stay in a reasonable condition.

Linseed oil: This is an oil which comes from pressing the seeds from the flax plant and comes in two types, raw and boiled. I have had relatively little to do with raw. In one of his books Claude Worth talks about soaking a newly made dinghy in the raw linseed oil, but the minor drawback was that you then had to leave it for six months before you could apply any finishes. Also in my experience oily surfaces, if left exposed for long periods of time, attract dirt.

Boiled linseed oil by comparison forms a skin on the surface after a few days. It is important with boiled that it is applied in a thin coats or that the surface is wiped clean after application as otherwise the skin which forms on the surface will be too thick and soft and will easily peel away. I have outlined the use of this material to strengthen dry wood under the previous heading. I use a 50:50 mix to give areas of exposed galvanised metal on the boat a coat, notably the mast step, diamonds, anchor and chain which remains on the deck. It helps to stop rusting, although if the anchor gets hard use like mine the protection does not last that long, but that may not bother many of you.

Traditional varnishes were a mixture of linseed oil turpentine and shellac. Unfortunately modern ones are made from hydro carbons. As an experiment and as I had the boat in a shed a few years ago I coated the bare wood of the coach roof sides and all the mouldings toe rails etc in a 50:50 mix of boiled linseed oil

and turpentine until such time as it would take no more. I then left it for six weeks occasionally cleaning off the surfaces with methylated spirits to get rid of any excess oil. I then varnished the surface with an Epihanes varnish designed for teak. The finish was very good although I have to report that the areas which were subject to slight abrasion from the winter cover did not stand up particularly well. I spoke to an Epihanes rep prior to doing this work and he was quite doubtful so any shortcomings are on my part not on theirs. The mast and the areas which were not subject to abrasion are still in very good condition. The thinking behind this work was that if any water does get in through the varnish because of the oil it will not get sucked in to the same degree.



Something I do to reduce cover abrasion on the toe rails and rubbing strip is placing pipe lagging around the edge. This is set on plastic overflow pipe which has a rope running through it attached to the pulpit and pushpit. Some plastic cable clips are needed to keep it in place. The success of this will depend upon your toe rail/rubbing strip detail.

Paints and Painting

Everyone has their own pet methods but the secret of a good finish is in the preparation. Do not follow that well know male technique "if all else fails read the instructions on the tin"! Here are some general points.

Two pot paints and varnishes (Polyurethane and Epoxy) : They are expensive and can produce a high quality finish. Having said this they are very hard and require a stable substrate. An old flexible clinker boat does not provide this and to my mind the only place these products have on a Stella is for a paint as a coating over an epoxy sheathed deck to protect the Epoxy from UV light or in the case of an epoxy primer as a primer for the metal keel.

Traditional one pot paints

Whilst I would not say you should not have a dark coloured boat, the dark colours absorb more heat from the sun encouraging movement in the planks. This makes it harder to keep the finishes in good condition. Dark colours also tend to make any imperfections more obvious.

The marine paints are, I believe, more hard wearing. This may be of significance if you are in a marina and the fenders are grinding against the side 24hrs a day. This may be of less significance on a swinging mooring. I only have a small pick up buoy

on my mooring attached to a long length of rope which allows the chain to stay in the mud when not in use. The chain is pulled up to deck level over a bow fender. In this way I avoid a large mooring buoy rubbing against the bow planking but you need a bow fender to keep the chain off the planking. This arrangement may be more difficult if your mooring is in very deep water.

I am a cheapskate and for the white paint use B&Q non drip gloss. (Not the "Value" range) I also add about 10% undercoat to the mixture. This removes some of the high gloss so it does not show up the glitches. It does make the paint slightly softer but when it comes to rubbing down it makes the paint chalk rather than clag the sand paper.

When fitting out I start by sanding the antifouling. I know you should not dry sand antifouling but I always find that wet sanding leaves a residue which is hard to clear. (Dry sanding and burning off antifouling paint is not recommend by manufacturers for health and safety reasons as there is a risk of inhaling toxic fumes and particles. This applies not only to you but also your neighbours. If you must do it, wear the relevant protective gear and make sure you have a high quality mask. Do it when other people are not around.) I sand quite aggressively to try and reduce the build up of paint even though I use a self eroding antifouling. (I buy sand paper by the roll from a decorator's merchant.) I then touch up any bare areas with an antifouling primer. Next I sand the topside starting with the top plank and working my way downwards.

Having cleaned off with a brush, vacuum cleaner and tack rag I start painting on the blue top strake. I don't worry that much about getting small bits of paint on the white plank below although you can use masking tape. Providing the bits of blue paint are small they can be over painted with white. Similarly it does not matter if you get small bits of white on the land of the blue plank. Nobody ever sees this when the boat is in the water as it is facing downwards.

With regard to brushes cheap disposable brushes are fine for primer and antifouling and disposing of them is probably cheaper than using lots of thinners. I am not sure what our green colleagues would have to say about this.
For gloss and varnish I have come to the conclusion its worth spending a bit more money on decent brushes and cleaning

them out. It takes a long time but there is nothing worse than picking out bristles from the paint as you go along.

The next thing I do is the first coat of antifouling. This I apply with a gloss roller. I then go along the lands with a brush to make sure they get a coating and make sure any gaps in the lands get filled up. Antifouling paint is relatively soft and should not cause problems when they take up. I do not worry about painting right up to the waterline at this point.

Having white topsides also enables me to cheat with a boot top. I like to have the waterline where it should be with a boot top above. The problem is that a boot top can look awful if is not of a constant height and exactly parallel with the waterline. Visually the best form of boot top is one which is taller at the ends and partially follows the line of the sheer but this is very difficult to do well on a clinker boat. I use quite a tall white boot top which you cannot distinguish from the topsides unless you are within a few feet as the photo shows. Consequently, I do not have to worry that much about a wavy top line to the boot top.

I lightly scribed the waterline into the planks with a hacksaw blade some time ago but the paint needs cleaning out every few years or so. Last of all I apply the final coat of antifouling with a roller. I then paint up to the waterline using a well loaded brush. You should always try and paint up to a line as gravity will help to keep the paint the right side.

As a general point bear in mind that when the boat is in the water very few people are going to get closer than about 10′ from the boat so you do not need to worry about minor imperfections that are obvious when you are right up close in the boatyard.

Varnishes

Again this is one thing we all have our own view about. Personally I have got on best with the International Original varnish although I am sure the Blakes/ Hempel equivalent is probably just as good. One thing I can say with certainty is that if you do not follow the instructions on the tin particularly about the number of coats it is

unlikely to last. Richard Hare has done a number of long term product tests for Classic Boat.

Further Reading

Details of Classic Boat Construction Larry Pardey L & L Pardey Books

Good section at end about the merits of various glues.

ISBN-13: 978-0-9646036-8-4

West System User Manual @ www.westsystem.com How to section.

The Classic Marine web site www.classicmarine.co.uk has a very good section on metals, nails, screws, etc and their relative performance.

Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

All photographs by John Sparks

January 2017 **John Sparks**, Shotley, Suffolk.

HINTS AND TIPS ON STELLA MAINTENANCE

Lodestar over the Deben Bar August 1999

Part 5
MAST & RIGGING

by

John Sparks

01473 788186

In the Summer newsletter for 1999 a copy of the Class Racing Rules (metric) together with an up to date rigging plan were published. The rules with the various max sail measurements etc can be downloaded from the Association Section of the website. A copy of all the plans including the rigging plan can be purchased from Holman & Pye at West Mersea (01206 382478)

The original rigging as specified was 6 x 7 galvanised plough steel 5/8"circumfrence (5.05mm diameter) forestay, back stay, cap shrouds and lowers. The jumpers or diamonds were ½" circumference. (4.04mm diam). In 1964 the lowers which take quite a bit of strain were increased to ¾" circumference (6.06mm)

On Lys I use 6mm for the forestay, backstay and lowers while using 5mm for the cap shrouds. The diamonds are 4mm. I suspect the majority of the racing boys (and girls?) use 1 x 19 wire. This is strong but I find it slightly clunky. I go for the weaker but more flexible 7 x 7. Talurit fittings get a better bight on 7 x 7. There is a lot of useful information about wire and rigging at www.classicmarine.co.uk

The original masts are solid, glued together in two halves with a number of scarf joints. I believe the original specification was for Silver Spruce. Resourcinol glue was used which may be getting toward the end of its life expectancy. If you can keep the water out you are much less likely to have a problem. Silver Spruce is not that durable so it is important to try and keep the varnish in good condition. It is also quite soft so care needs to be taken in storage.

I believe some have failed around the goose neck because of wracking strains. Quite a number, mine included have a tendency for the glue joint to fail at the heel. I had assumed this was due to compression loads but mine opened up for about 3" after a particularly strong gybe when I would have thought the compression loads would not be so severe. The next winter I cut the joint with a hack saw blade put some wedges in, added epoxy and then clamped it up prior to re-varnishing and have not had any problems since.

Some of the galvanised fittings such as the spreader boxes may be getting a bit old and thin. I have had many of mine replaced in stainless but making complicated patterns of this type does not come cheap. Galvanised will be cheaper but not a lot.

With regard to shackles and pins going into these fittings try to make sure that the pin is the right size for the hole. If it is too small it will gradually enlarge and wear an uneven oval hole in the tang.

With regard to racing set up, my boat is very rarely at the front of the fleet so mine is probably not the best advice for racing. Even so, be kind to the boat and **do not tighten things up too much. All you will do is bend the boat.** A number of the go faster boats have large purchases on the backstay and seem to spend quite bit of time pumping. Polaris seemed to go as well to windward as any of these boats when she had no means of adjusting her backstay.

The **spreaders** are designed as struts which take some of the loads on the cap shrouds back to the mast in the form of compression. These loads should pass directly down the spreader.

In order to be efficient the spreader should bisect the angle which the cap shroud forms as it passes over the spreader tip. According to Kim Holman's plans this is about 5° **above** horizontal. All too often I see Stellas with spreaders which are drooping well below the horizontal. This is especially the case where signal halliards are attached to the underside of the spreaders. In this position when the loads come on the spreader tip the tendency will be for the cap shroud to fold the spreader down further. If the spreader breaks the mast will go. Also the drooping in the spreader will allow excessive slack into the rigging which can encourage considerable snatching forces in rough weather. Most seem to get away with it but why take the risk if you do not have to?

My solution to this is to have the spreaders held in their correct position by whipping twine connected to brackets screwed into the mast and top side of the spreader. It also has the advantage of discouraging birds from sitting on the spreaders but for the purists I am sure it must hinder my speed to windward.

The diamonds are also struts under compression. On Lys they are galvanised metal tube although I believe they were originally wood. The difficulty with these is that it is almost inevitable that they will eventually rot through at the sockets on the mast as water will be drawn in due to capillary action.

The principle is that when the forestay pulls this section of mast forward these stresses are resisted by the struts. The struts are prevented from moving forward by the wire stretched over the tips which is connected to the top of the mast and a tang lower down.

Getting the running rigging set up correctly when the mast is on the ground is always difficult at launching and in the photo it looks like the spinnaker halyard has got the wrong side of the cap shroud! I make my pads on the tips of the spreaders out of pipe insulation with small sections cut out to accommodate the tips and then wrap it all round with insulating tape.

Returning to the diamonds I try to set up mine so that the mast is straight at rest. One of the racing boys who had a block and tackle on the back stay set them up so that when the backstay was slacked right off the spreaders actually hung loose. I am not convinced by that but he usually came in well in front of me but was pumping bits of the North Sea through the boat in the process. Whatever the set up the mast should be plumb side to side.

If you are leaving the boat the **rigging screws** should either be wired up or set up with split pins even in the first few weeks of a season when you may still be tuning. Otherwise you risk losing the mast. I do not trust locking nuts. With a rigging screw put two or three turns on one of the threads before you connect the other. If they have an equal number of turns the barrel can come off both threads at the same time and roll off into the drink. Open barrel rigging screws have the advantage that you can see how much thread is left in the barrel.

All rigging screws with the possible exception of the backstay should have a toggle between them and the chain plate as on the adjacent photo. (My old rigging screws were oversized) This allows the bottle screw to articulate in any direction so that it is always parallel with the force which it is being imposed on it. This is particularly important with a forestay as there are considerable sideways forces as well as fore and aft.

Split pins should be the right size for the hole they are going into. According to Rod Stephens (Desirable and Undesirable Characteristics of Offshore Yachts), in length excluding the head they should be about 1½ times the diameter of the object they are going through, no more. As bought in chandlers they are almost certainly too long. When they have been cut to the correct length, round off the sharp edges with a file. Sticking a pin which is too long through and then spreading it through 180° weakens the pin. (as seen at bottom of photo) It creates sharp edges and makes quick removal in an emergency difficult. The shortened arms of the pin only need to be spread though about 20° (10° on each side). You should then put a small gob of silicone sealant between the

arms to prevent the pin from closing accidentally. (Silicone yet to be inserted to those in the barrel in the photo and they need spreading a bit more) Some rigging tape round the pin protects items including your ankles from the pin. In a rigging screw ideally the split should be in a horizontal position so that if the barrel rotates both the arms lock against the barrel at the same time.

All my shackles, blocks etc above gooseneck level are wired and taped up each spring when I put the rigging on after giving the mast two coats of varnish. Stainless steel rigging is supposedly only good for ten years. I have a rolling programme of replacement so that the cost of replacement is spread over several years rather than coming in one big hit. Taking the rigging off the mast enables you to check it over the winter. You would also be amazed how much dirt comes out of the running rigging when you wash it. It is also softer and kinder on the hands if you wash it once a year.

Setting up the rigging, start with the forestay and back stay to get the desired alignment. There should be no weight on the topping lift at this point. Then work on the cap shrouds. You can run a tape measure up on the main halyard assuming it is not blowing too hard or just use the halyard itself to check the distances are equal but this pre supposes that your boat is the same shape both sides and has not pulled up. The distance from deck to block should be approximately the same although there is a 5mm variation between my port and starboard lowers. When you have done this then work on the lowers so that the mast at rest is about straight both fore and aft and side to side. Looking along the aft side of the mast from the fore hatch can give you a good idea. If you are on a mooring, row round the boat and check it from a distance.

When you go for your first sail check the leeward cap shroud when going to windward. It should not be tight but there should not be excessive slack in it. Tighten it half as much as you think it needs. Then go on to the other tack and go through the same process. When you are happy with the set up you can then put the pins in/wire it up on a permanent basis. If you get the boat going well one year and the set up seems right, record the distances between the pins at deck level and the top of the rigging screws so that you can recreate the settings although you should still check whether it looks right. It is pointless setting up the rigging on land as the boat will almost certainly change shape when it goes in the water.

Regardless of whether you set your rigging plumb as I do or with a rake, or with a bend for and aft, one thing I can be sure of; the mast should be straight and plumb side to side. If not you will go better on one tack than the other.

If I can encourage one of the serious racers to add an article for the manual about tuning I am sure other members would be grateful, although this may be giving away trade secrets.

Further Reading

Articles on wire and rigging @ www.classicmarine.co.uk

Desirable and Undesirable Characteristics of Offshore Yachts
Technical Committee of the Cruising Club of America
W.W Norton & Co 1987
ISBN 0-393-03311-2

Chapter 11 *The Sail Plan, Spars and Standing Rigging* by Roderick Stephens Jnr and Mitchell C Gibbons-Neff has some quite strong views about what is good practice and what is not. I know most of us do not go offshore but the views of Rod Stephens merit careful study.

The two books below are ones I have found helpful but many may now consider to be very outdated.

Race Your Boat Right
Arthur Knapp Jnr
Macmillan & Co 1957

Written in the 1950's by an American who was part of Ranger's afterguard and had spent years sailing International One Designs which have a similar rig to Stellas (apart from an extra set of spreaders at diamond level).

Sail Power
Wallace Ross
Granada Publishing 1975
ISBN 0 229 11545 4

Again now slightly dated but to my mind one of the best books on the subject of sails.

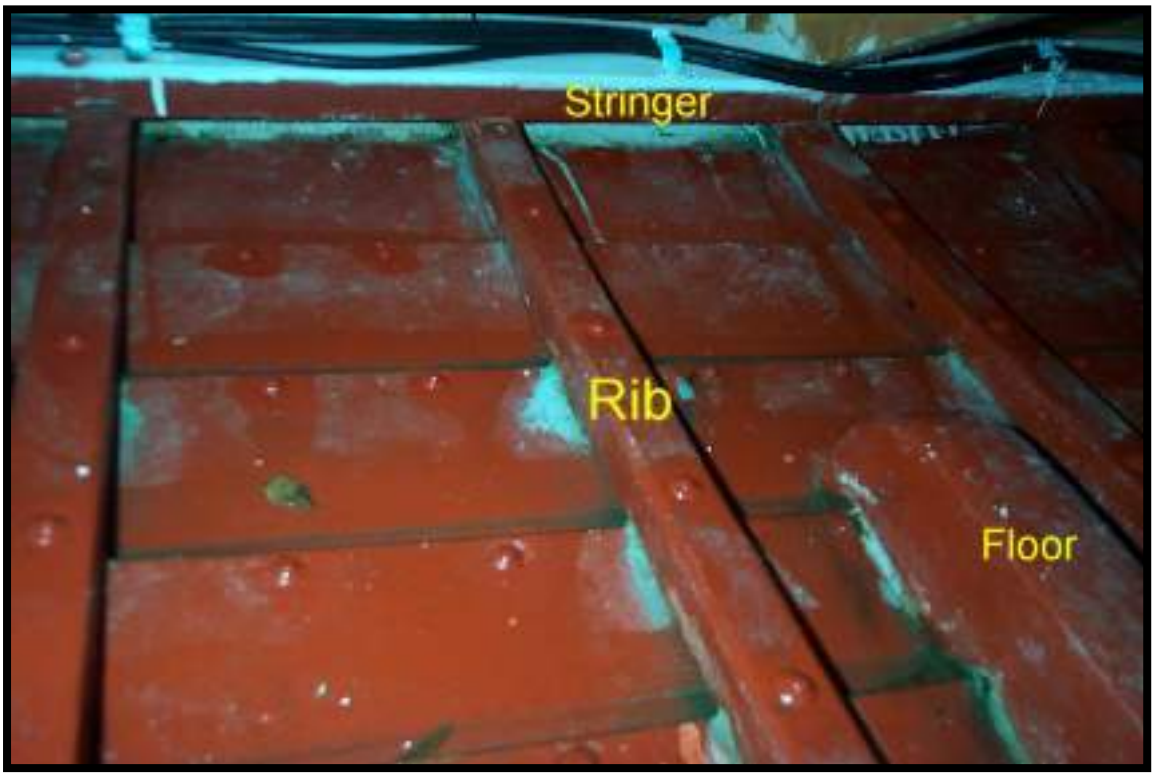
The books outlined above and elsewhere in the manual are probably out of print but can be tracked down by such sites as Abe Books www.abebooks.co.uk and also may be found in some Yacht Club Libraries.

Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

All photographs by John Sparks

February 2017 **John Sparks**, Shotley, Suffolk.

HINTS AND TIPS ON STELLA MAINTENANCE



Part 6

REPAIRING BROKEN RIBS & REFASTENING

by

John Sparks
01473 788186

Contents

Glued: No Ribs, No fastening

Leaking

I would like to think that all Stella owners are aware how clinker (lapstrake: America) planking keeps the water out or not as the case may be and why they leak when they first go back in the water. They rely on the two overlapping parts of the planking known as the "lands" being connected together by rivets. In Viking days these would have been wooden tree nails or trunnels but by the time Stellas came along these had been replaced by copper nails and roves.

The two planks are riveted when the wood is dry. When the boat is placed in the water the planks swell up and close tight against one another. (At least that's the theory!) When the boats come out the planks dry out and open up again. Thin mahogany planking as found on most Stellas dries quite rapidly. Laying up out of the wind and strong sunlight will help prevent over drying and shrinkage. When working inside the boat ashore, try not to let rubbish drop down into the lands as if this is sufficiently hard it could stop the planks closing up. This is unlikely to happen if the interior has been painted and the boat is just out over winter.

The copper nails should last at least 30 years but may waste away over the years. Electrolytic corrosion can takes its toll but this is not usually bad unless something is seriously wrong. The subject of electrolytic corrosion is very complex and will depend to some extent on where you keep the boat. Lys has never had an anode and I have never noted significant problems. My advice would be if you have got one replace it when half of it has gone. It should be bright when the boat goes back in the water and should not be anti-fouled. **If you have not get any problems leave things as they are.** If you start bonding things up you may actually start a problem where there was not one before. You are far more likely to have problems in marinas because of all the stray currents from other boats wired up to the mains. If you change location keep the condition under close review. If you can turn the battery main switches off if you are leaving the boat. Also be careful with automatic bilge pumps that they are not discharging current into the bilge water.

Allowing the boat to dry out seriously does not do the boat any good as once a timber has split or opened up along the grain as a result of shrinkage the two parts may swell back up but they will never bond back together again. Also the shrinkage will place strains on the nails and the timber around the nail holes. Even so don't panic if you have a severely dried out boat. It is probably best to try and get the planks wet before attempting any work. This can be done with a hose from inside and leaving wet sacking inside: but clean it out before you do for reasons explained above as you will be forcing water down through the lands. An alternative and possibly slight extreme solution is to sink the boat, although take the furniture and engine out first! You may also have to wash a considerable amount of silt out of the boat after doing this. An alternative halfway house is leaving it in a cradle where it will only float for a short time at the top of each tide. You will need to pump standing water out when the tide has gone as the hull is designed to hold together with the water on the outside not the inside!

The copper nails are also more likely to be fatigued on a boat which has been subject to hard stresses either through years of general hard racing or by cranking up the rigging which bends the boat. Assuming the nails are OK the boat should be able to stand up to being driven quite hard but it is always wise to be kind to the boat where possible. After launching allow the boat to take up for at least a week before driving it hard and ideally you should allow the topsides to get wet with a few gentle sails before taking her out in a blow.

If she leaks a lot when you launch her, one solution can be to fill a bucket of **fine** sawdust and turn it upside down and push it under the boat with a boathook. Turn it the right way up. This forces the saw dust out which then gets stuck in the lands and swells up. As the sawdust is soft it does not damage the planking. I have had to do this once after burning off the bottom. It was if someone had turned off the tap. Beware that this trick may be only temporary as sometimes the sawdust is just tapped on the outside of the joint and will wash out . You can put a boat in a mud berth to take up but beware mud caulking which washes out under way. **When putting a Stella in a mud berth always make sure you lash the tiller well in a central position.** If you have not and she slides backwards you can easily break the rudder.

After I had burnt the bottom off the first time it took about four years to get the boat back to where it was leakwise before I started. If you are worried before launching and you can see obvious gaps between the planks you can mix up some oil based mastic with some grease and rub it in to the gaps. (See Mastics and Sealants in Part 4) Over the years as paint builds up you are less likely to get problems. Last time I burnt the bottom off I used a hot air gun which is a lot kinder than a propane blow lamp. I gave it the full grease and mastic treatment prior to launch and she hardly leaked a drop. The planks on the turn of the bilges often look like they are open but do not leak because the planks are hard up against each other on the inside edge. **Even so if you can see large gaps between the planks before launching you may well be wasting your time!** Happy pumping.

Although an electric bilge pump may be a necessary for those who do not have the luxury of living near their boat, I have never liked them for two reasons. Firstly if

you are not there you have no idea how badly the boat is leaking and secondly from my Jonah perspective electrical terminals in the bilges connected to a battery is a recipe for problems.

The bulk of normal taking up should take place in the first 12 hours. If it has not taken up within a week it is unlikely to do so although small dribbles can take two or three weeks to completely disappear. My boat in optimum condition normally takes between 1 and 2 pumps a week. After the last burn off I have got it down to about a pint. I have a cockpit cover and I would advise anyone to do the same so as to keep the fresh water out. This is one of the best bits of equipment on the boat.

If you still have a significant leak, trace it back to where it is coming in by drying the lands with a sponge/tissue. Mark where the problem is and then have the boat out or put it on the posts and have a look outside. A further dab of grease and mastic may work in the short term of if a rove head looks suspect try tightening up some of the nails. Serious repair will have to wait for the winter unless it is desperate. Try to avoid having the boat out of the water in the summer heat if you can.

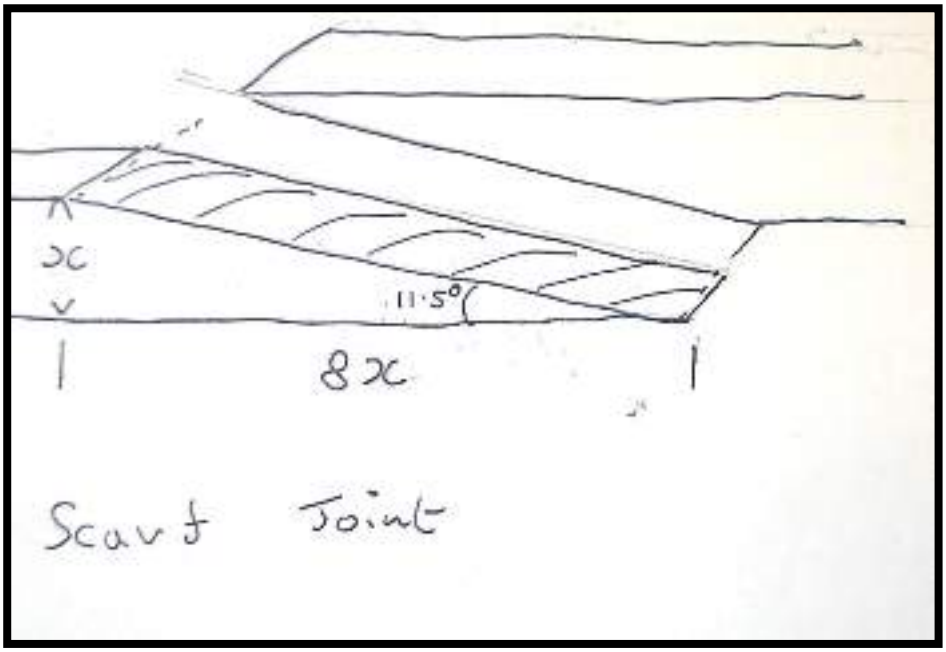
Replacing Ribs

You may find over time that localised stresses placed on the hull have caused some of the oak ribs to crack. The most vulnerable places are on the turn of the bilge and on the reverse tight turn around the engine bearers. When the rib is first steamed and bent into position, the wood structure on outside edge of the turn is placed under tension while the inside edge is under compression. When a crack occurs it will tend to start from the area under tension which gives first and moves towards the area under compression. If you have got just one hairline crack leading from the outside edge toward the middle of the rib it is probably nothing to worry about although you should keep the condition under review. If it goes right through the rib it is of more concern. You basically have four options. One is to do nothing in which case it is likely that the damaged rib will create a weak

spot and put more strain onto the ribs on either side encouraging them to crack which is likely to lead to a leak.

The second option is to "double" by putting a sister rib alongside the damaged one for two or three planks vertically either side of the damaged fastening. This has the attraction that it can often be accomplished without taking too much furniture out. The disadvantages are that you are adding another set of nail holes into an already weak area and aesthetically it looks like a bodge.

The third solution would have been to cut out a large proportion of the damaged rib and steam a new one into place. The difficulty with this is that originally the ribs would have been put in before the deck was added or the stringer put in. This means that with a shape such as a Stella which has as reverse curve or an S shape section it is impossible to get a complete new rib in unless you remove the stringers. Therefore you can only put the lower or upper half in as required making a scarf joint at a point where there is no turn in the rib.



Scarf joints are a means of joining two timbers together using an angled joint. Traditionally they are set at a length of **at least** eight times the height of the joint. Most joints are glued but some are mechanically fixed as well.

The ribs on a Stella should be about 7/8 " deep and so the length of the scarf joint for a rib should be at least 7" long. Scarf joints are quite difficult to cut in situ to give an even matching joint. A tenon saw with a rigid blade should help in keeping the angle of the joint parallel with the base but often there is not sufficient room for a saw of this size. If you mark the ends of the joint top and bottom using a square and then draw a straight line between the top and bottom on both sides of the rib, this should help you to check whether your saw is running true. On a work bench with a mitre saw cutting small scarves is relatively easy but doing so with sheets of ply is more complex and will be covered elsewhere (decks).

Returning to the issue of the long rib repair it will be necessary to steam the timber. You will need to use green oak not seasoned. (See Part 3 Timber) You will probably need to get this direct from a sawmill and you should be looking for relatively

straight grained and **knot free** timber. I use Shrubland near Ipswich. Cut the timber to size and then place it in a steam box. Round off the top edges and do any required finishing with a plane before it goes in.

My **steam box** consists of half of an old large aluminium boom bought from the dump. This is blanked off by the goose neck at one end but a rag would do. The boom is wrapped in old curtains etc to reduce heat loss (partly removed in photo). Steam is provided by an electric steam wall paper stripper where the hose is inserted well into the boom and then the end stopped up with rag. The stripper has the advantage of having safety cut outs etc.

How long you cook your timber for will depend on its size but for a rib I would guess it will be at least 40mins and possibly as much as an hour. I have only done smaller dinghy ribs.

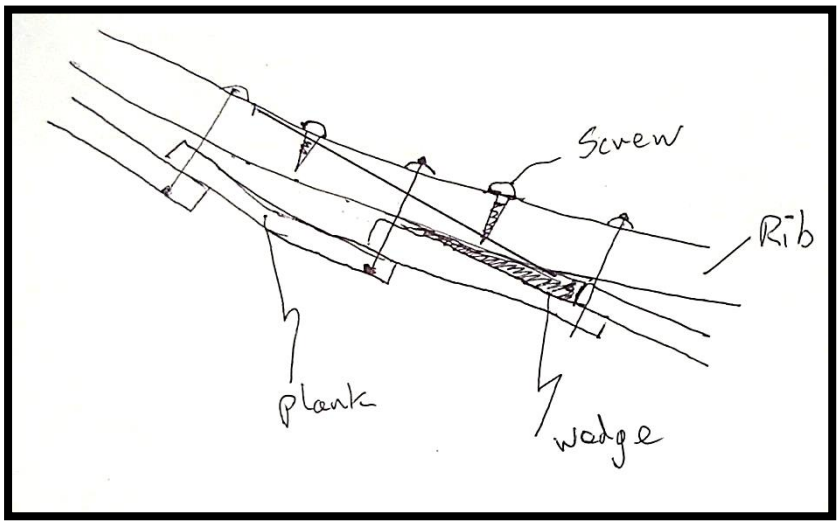
When the timber first comes out of the steam box it is very flexible but cools rapidly losing its flexibility. The timber needs to be worked into place as soon as possible. You should therefore get everything ready and everybody in position before taking the timber out of the box. Wear gloves and if you can get someone who passes the timber up to the person who is going to fit it so much the better. You need at least two people for the nailing. Ideally you should have worked out how you are going to keep the timber in the desired shape using struts under the deck, coach roof or wedges under the stringer etc prior to taking the timber out of the box.

Once you have got the timber into place drill through the existing nail hole in the land up into rib. Use a drill bit just smaller than the copper nail that you are going to put through. This nail should be the next size up (larger) from the one that came out. Once you have put the nail through with someone holding the rib in place on the inside it should keep the rib where you want it in the short term. You can then go onto another part to keep the rib in place as it cools. Probably three of four nails will be adequate to start with. You then rivet up the nails as will be discussed later. You can then put in the other nails at your leisure.

If you are doing a number of ribs choose the one which has the least bend in it first, as this is least likely to crack and will be more tolerant of your slow first attempt. If you have got a difficult one the timbers may crack in which case you have to start again. Reasons for cracking can be the timber is not green enough, you have not cooked it long enough or you have taken too long getting it into position. If your

timber has a knot in it you are wasting your time. Green oak will produce large amount of black tanic acid which will stain your hands and is difficult to remove.

Returning to the issue of a scarf joint in a rib repair, I have only ever done complete rib repairs in a dinghy.



You will not be able to glue a green oak scarf joint (Balcotan might work) so it will need a mechanical joint fix. Logically it would seem sensible to have a nail running through the centre of the scarf so you should plan the centre of the scarf to be over a land The top and bottom of the scarf will also need fixing. Logically this could be done with screws from above. The holes will need to be pre drilled and round or pan headed screws will probably be better than countersunk as the latter would tend to split the thin part of the scarf. The holes for the scarf would probably need to be pre drilled. For a rib the screws will probably be ¾" 6's or 8's. The placement of a small wedge (shown in sketch above) under the rib where there is a gap between the rib and the plank should reduce any tendency for the bottom of the scarf joint to try and open up. This should made up before you start to put the rib in. Ideally the scarf joint should be glued but in practice this may not be that easy especially with green oak. This would be my solution. If someone knows better please let me know

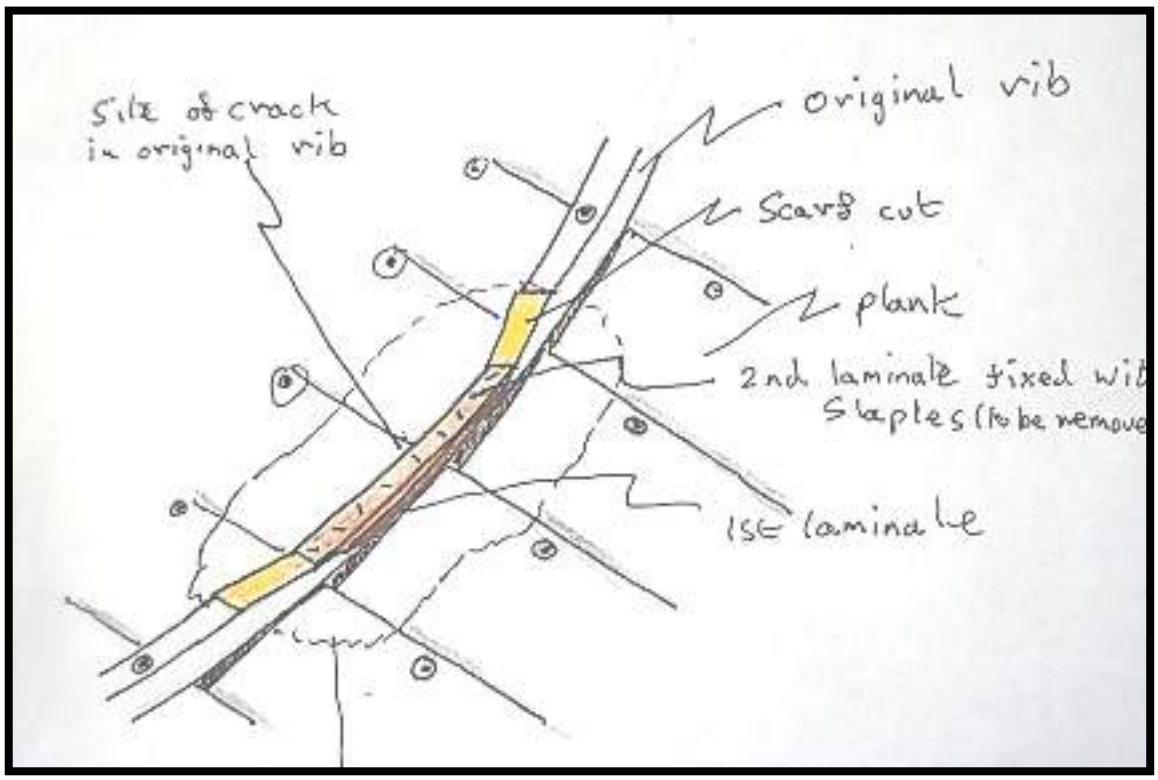
One of the reasons why I do not know, is that with my rib repairs I chose the fourth and to my mind easier option. The laminated rib repair using seasoned oak and glue. Like a sister rib repair it has the advantage of being relatively localised but is not an obvious repair and does not create another set of holes in the plank.

The split in your rib will almost certainly be at a nail hole. I would suggest that you need to cut out the damaged rib back in such a way that the scarf joints at the top and bottom of the repair are centred over the nail holes for the lands immediately above and below the nail hole you are repairing. If there is something like a stringer in the way you will have to cut out a larger area although the stringer can help when it comes to clamping the laminates down later on. From memory I cut the rib at a right angle to start with to "chop it out". I then cut the angled scarf joints afterwards as this gave you more room to work with.

The next thing you will need to do is cut out some laminate strips of oak. A table saw produces nice even strips. I used strips which were 5mm thick, using 5 layers. (See photo on next page) By the time you have added the glue this makes them

slightly larger than the original but once you have cleaned /planed up the rib and finished it the dimension should be about right. With regard to the thickness if they are too thick they will not bend easily and will not take a standard 8mm staple while if they are thinner you will need more laminations.

Measure the distance between the two scarves at the bottom of the original rib following the line of the boat. Assuming you are using a 1:8 ratio for your scarf, for a 5mm thick strip this will give a scarf joint which is 40mm long for each **laminate**. If you added this figure twice to the length between the scarves you have the length of your first laminate. Cut the scarves. Watch out that the second one you cut is a mirror image of the first and not an exact copy. (\ / not \ \) . I know it sounds obvious but it is all too easy to do. Something which may help in this and other situations is if you mark hatches on the timber which is to be cut



away as waste before you get the saw out. That way you are less likely to cut out the wrong piece.

In some ways the first laminate is the most difficult one to fix. Place cut up shopping bags (dotted line on previous page) under the scarves of the cut ribs to stop the glue bonding to the planks. I used epoxy as glue. The timber will need to be dry if using epoxy. Also the glue bonds best to slightly rough timber. Straight off the saw will be fine but if it is planed it may pay to rough it up with some 40 grit sandpaper.

Before getting the glue out place the first laminate in place and check the fit. You will also need to design some form of strut to keep the laminate in place following the curve of the hull while the glue goes off. Wedges covered in packaging tape may help. This all sounds easy and is so when you have not got any glue. When you add the glue it all becomes terribly slippery and will not stay in place so do a dry run first.

Applying a thin neat coat of epoxy to both of the surfaces to be glued. Allowing it to soak in can help to ensure a good bond. I then mixed in coloidal silica to the epoxy to form a mayonnaise consistency to give it a gap filling ability if required. This will only need to be applied to one surface. In the case of the first laminate you only add the glue to the surfaces of the scarves. Place your strut in the desired position to take up the correct curve in the rib. A judicially placed staple in each scarf will help to keep it in place but you cannot do this until it is all set up. Clean up any excess glue so that it does not interfere with the placement of the next laminate. The staples should be removed after the glue has gone off. Then you can add the next laminate.

The process is then repeated except you spread glue on the surfaces of the lamination as well as the scarf and staple it to the laminate below using a staple gun. You will need plenty of force to ensure the glue is pushed out. For the second laminate you may still need a strut to keep the laminate to the correct curve although with 5mm wide strips after two laminations this should not be essential. You will need to remove the staples before laying the next lamination.

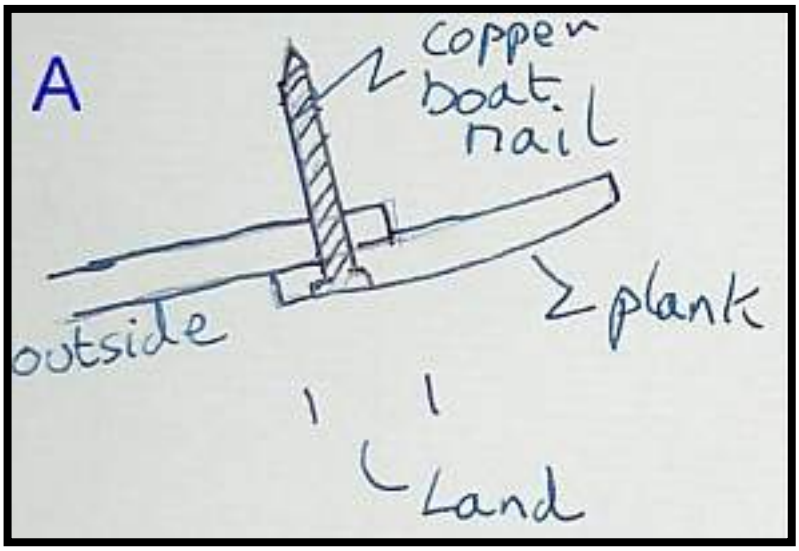
When you have finished with the laminations you can then use a rebate/bull-nose plane to clean the ribs up to the correct size and required finish prior to putting in the fastenings in the normal way. Sand paper will work instead of a plane. It just takes a lot longer.

Refastening

With age electrolytic corrosion can cause the copper nails and other fixings to waste away. Generally the copper is fairly resistant but the combination of ageing nails and excessive drying out placing stresses on the nails can cause planks to leak. Any boat will leak to some degree especially when working to windward. You can try to solve the leaking by methods described earlier or by tightening up the nails. One or two can be done by drying out the boat on the tide but for anything more than a few you will need to take the boat completely out of the water. I would also be careful about just doing a few on the tide as it is just possible that your works might actually make things worse! If your efforts do not have any success you need to take some nails out to assess what condition they are really in.

I refastened Lys below the waterline over four winters. She was not leaking significantly but I have to say that there were a number of rove/rivet heads which were quite corroded and if you had pushed the rove with a screwdriver it would probably have come off without too much effort. In retrospect I do not think that the refastening was strictly essential when I did it as only about 10% of the nails showed significant signs of wastage. Even so, as with keel bolts, it is a lot easier to get the old nails out when they are still in reasonable condition.

The basic fastening process is described briefly in the related drawings A-D shown on the next few pages.



In the case of refastening you will need to remove the old nails. I found the quickest way to do this was to grind the heads off the old nails/roves using a baby grinder fixed with the appropriate disc. Wear a mask as the air in the boat will become laden with copper dust. Wear eye protection. I tended to work on the basis of doing all the fastenings for the ribs on one plank and then on the next plank down only those fastenings between the ribs. After you have refastened these you reverse the process thus making sure that large areas are never completely free of fastenings.

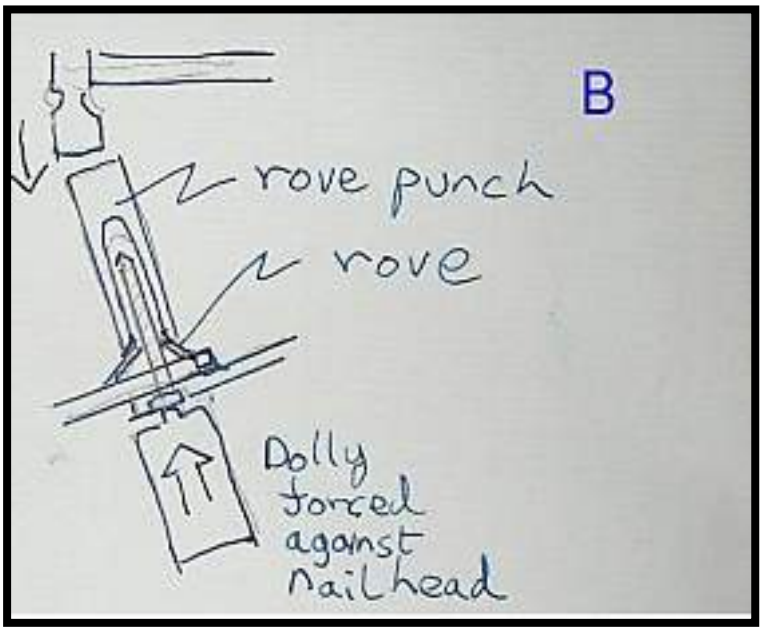
After you have ground off the heads you should be able to see the square section of the nail through the rove. Prise off the roves with a screwdriver without gouging the rib/plank. Sometimes there is not enough space to get the grinder in and you may have to cut the head off with a hacksaw blade. In these cases it is hard not to mark the ribs.

You should then be able to knock the nail out with a punch sufficiently far to be able to draw it out from the outside using a claw hammer. Place a pad under the hammer head as if your planking is as soft as mine you will easily mark it. Increase the size of the pad as the nail gets longer. Mole grips may be useful in drawing the nail out if you lose the head.

The nails which are most difficult to draw are those embed through the stringers and to a lesser degree those running through the ribs as the material they are running through leads to friction. The fixings which just pass through the planks do not normally cause problems.

You will probably need an assortment of thin punches to drive the longer nails out. When you hit them initially try to make sure the force is parallel with the nail. If you hit it and it moves, but there is no sign of movement outside, you have bent the nail! Start drawing it rather than driving it as soon as you can get at it outside as you are less likely to bend the nail in the wood. With Lys there were about three nails where quite a bit of wood came out with the bent nail. In these cases I had to glue a peg in to replace the lost timber. I then cut the peg under the rib and in the land with a hacksaw so that the planks were again free to move. Grain to peg and plank should be parallel to reduce chances of splitting.

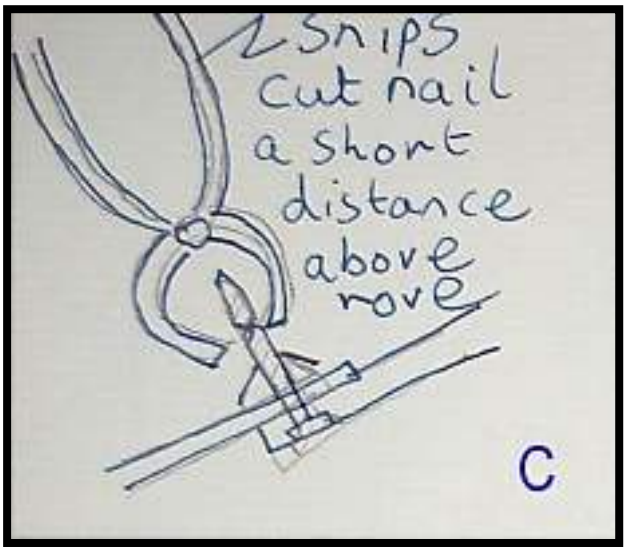
If for any reason you do need to hit something on the inside of the boat exceptionally hard try to have someone on the outside pushing up against the planking say with the head of the hammer (the heavier the better) with a cloth round it to prevent the adjacent planking from flexing unduly.



The new nails going in will need to be the next size up from those that came out. (See materials section). Nails are bought by weight so if you are doing a lot it is cheaper to have a box of each of the three lengths needed; planks, ribs and stringers. Nails going through the stringer will normally be a larger size.

One thing which is difficult when refastening is communication between the person on the outside and the inside. It may help if you number the planks inside and out with chalk. Chalk is also useful for marking things that you are going to come back to etc or which nails are stringers or ribs (as seen from outside).

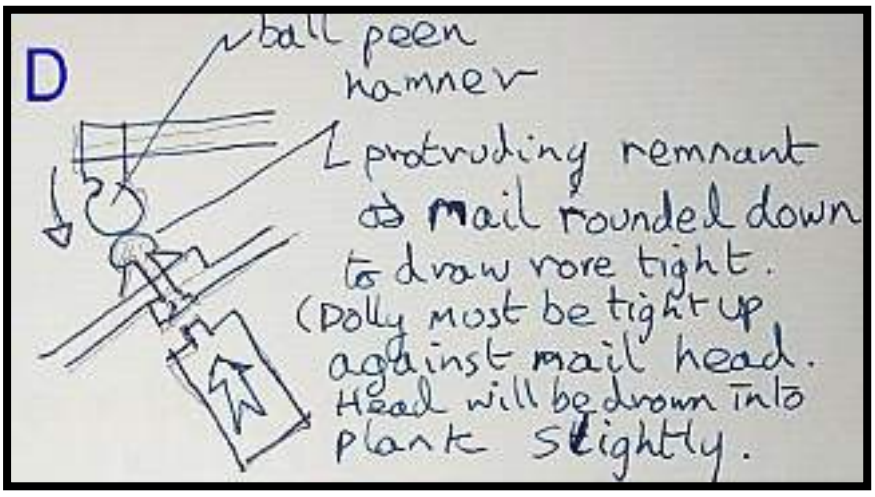
Refastening is a two person job. If you have a long suffering "dolly bird" it will pay you to minimise the time they spend on site by preparing things. There is nothing worse than standing around in a cold boatyard. I split my refastening over four winters, starting in the fore peak, then salon starboard, saloon port and finally the cockpit. Of course all the furniture had to come out. This was quite daunting the first time when dealing with all the old brass screws but once you have replaced them with stainless or bronze the next time it needs to come apart it can be done very quickly. I used to prepare say four planks on a Saturday, grinding the heads off, knocking out the nails and making sure all the equipment was ready. On the Sunday we would refasten that section. Once you get going it does not take that much time but you waste a lot of time initially getting into the swing of things.



Some people put all the nails in first producing a porcupine effect. This is something I would not recommend for two reasons. Firstly, it makes it more difficult to work out which nail you are on when communicating between inside and out and secondly if you scratch yourself on a copper nail, the wound will be sore and slow to heal.

Have a vacuum cleaner on board and try to clear up as you go along so as to reduce the chances of dirt getting into the lands.

If your planking is as soft as mine you do not need to countersink the nail holes. If when you are tightening down the nail with the ball hammer the rove moves sideways you have bent the nail and you will need to take it out and start again. Technically you should use the next



nail size up but I just added a dab of grease and mastic before putting the same size replacement nail in and have not had any problems.

You will reduce the chances of future corrosion to the rove heads if you ensure that they have at least one coat of primer and two coats of (danboline) bilge paint. Each spring before launching I have a look over the roves and if any of them are corroding I clean them off with a wire brush and give them a touch of *Danboline*. The number which need doing should reduce over time.

The tools needed for refastening are slightly specialist but you can improvise to some degree. The blacksmith's punch is not essential but a punch which enables you to accurately place force on the head of a nail is. When putting the nail in initially, tap it with a punch to drive it into the planking. The person on the inside should be pushing down with the head of their hammer against the nearby planking/rib to reduce flexing. The blacksmiths punch can also double as a dolly for light work but does not have enough mass.

I had my dolly made up by a blacksmith but the main function is to be able to place a heavy mass up against the head of a nail so as to provide inertia to resist the impact of the hammer blows at the other end of the nail. The heavier the better but the tip must be no larger than the nail head.

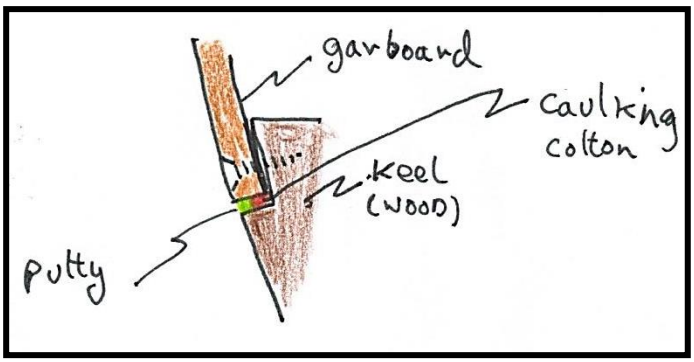
I made the rove punch up out of a cut off coal chisel which I then drilled out. A much simpler method is to use the barrel of a small rigging screw preferably not the open type. The snips I have are a lot easier to work than ordinary pincers but

pincers will do. After you have cut the nail you may need to give the rove another hit with the rove punch prior to tightening up. Tightening up is done with a ball peen hammer, not in the photo. You can get by with an ordinary hammer but it is a lot harder to burr the top of the nail nicely. The person holding the dolly may like a pair of gloves to cushion the impact when they are holding the dolly up against the nail. On the outside they should be able to see the nail head be drawn into the plank as you tighten up on the inside. Don't overdo it.

Sometimes you need to drill a long thin hole which is too long for standard size drill bits. A solution can be a bicycle wheel spoke. The end is hammered flat and then cut with a file to simulate a drill bit. If you use the drill bit for as far as you can go, this will act as a guide for the spoke but do not push too hard otherwise the spoke can bend and veer off course.

The hood ends (where the planks meet the stem and transom) together with the garboards were fixed on my boat using copper (ring shank?) nails. When I bought the boat **brass** screws had been inserted between the copper nails. Whether they were original or a latter addition I am not sure but not surprisingly the brass screws had started to decay although the copper nails were still fine. As is often the case the screws were too far gone to come out without breaking up so on a surveyor's recommendations I sparingly added some additional silica bronze screws to these areas and the floors although there was not a lot of space left in the hood ends to put these fastenings in.

Seams



I tend to refer to the joints between adjacent planks as lands while the seams are the points where the planks ends (hood ends) and garboard meet the rabbet (rebates) in stem, hog(keel) and sternpost. The planks will be fixed to the stem/keel with nails and screws as outlined above. A waterproof joint is created at this rebate by packing it with caulking cotton. I think it is unlikely that you will have to touch the caulking cotton unless it has become dislodged or loose. When the boats were built putty (with red lead?) would have been used as the seam compound to keep the cotton in place and to allow for some degree of movement when the wood "takes up". As already outlined putty dries out with age. As with mastic this tendency can be reduced if you make sure that the wood into which you are putting it has a coat of primer. This reduces the tendency of the oil in the putty to be drawn into the wood.

It is quite common for this putty to crack with age and it may occasionally need replacing especially if you have burnt off the bottom. When it comes out it can

sometimes bring some of the caulking cotton with it. If this is hard and brittle it may need to be replaced.

I am not an expert on caulking and have only replaced small sections but re-caulking the area around the upper stem scarf did solve a persistent slight dribble when replacing the bolts had not done so. I would suggest you do further research before tackling this job but hopefully the information below will point you in the right direction.

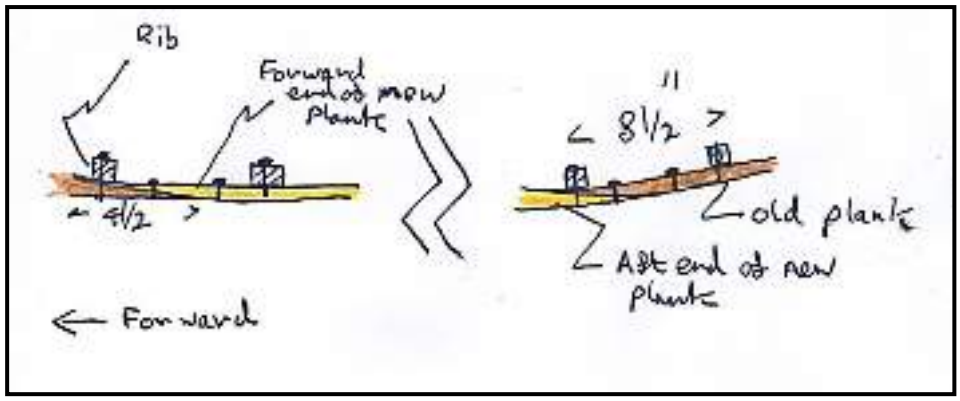
The caulking cotton is forced in, ideally with a caulking iron although any flat metal which is flat enough to force the cotton in rather than divide like a knife will do but it should not damage the edge of the rebate/plank. The cotton comes in strands and you need to twist a number of strands together so that the rope going in is about the same width as the seam. The correct size rope can be created using a hand drill and a bent nail to twist the strands round. The rope is put in at points along the seam leaving small loops hanging out. The loops are then pushed in so that the cotton is compressed longitudinally. Finally it is "firmed up "ideally with a concave or grooved firming iron. Do not overdo it! Bear in mind how dried out the boat is and how much the wood is going to swell up. If the boat is badly dried out you risk damaging the garboard if you pack it too tight. Ideally you should be looking for a nice even pressure along the seam. Too much pressure at one point will leave gaps elsewhere when the boat takes up

Some people use a modern synthetic seam (paying) compounds such as polysulphides to cover the joint rather than putty. They have the advantage that they don't go hard but are a lot more complicated to put in and take out. If you are doing this read the instructions about application before you start paying. You might have to use a special primer on the seams before you start.

I have always used putty. It is cheap, readily to hand, works and is easy to replace.

Plank Repairs

If you have a plank which has split through impact damage or along the nail holes, the only proper way is to take the damaged section out and replace it. This will involve taking the fastenings out where the plank is to be removed and then cutting scarf joints in the planks. These should again be on a ratio of at least 1:8 so with 9/16th" planking will give a scarf about 4½" long.



When making a scarf on the outside of a boat such as on planking or rubbing strakes **make sure <u>the thin edge on the outside is always on the aft end of the scarf.</u>**

The reason for this is that if you did it the other way round, when you graunch alongside something there would be a tendency for the plank to catch and the scarf to open up. Given that you spend more time going forwards rather than backwards the way shown is the sensible way to do it.

Also when you are deciding where to cut, think about where the nail fixings will be in relation to the scarf. Last winter I found some rot in the deck due to water getting in round the port aft chain plate. Interestingly the larch beam shelf was sound but the mahogany packing piece which goes between the plank and the beam shelf was significantly rotten. This was allowing a small degree of play in the chain plate making the leakage worse. There was some very localised rot in the plank but the only way to get at the packing piece was by taking a section of plank out. When doing this repair I positioned the front edge of the scarf just in front of a rib so that I could use the support of the rib to help keep the front part of the scarf together when it came to the gluing up.

The other point you need to consider is are there any scarves close by either in the same plank or adjacent planks. You should avoid having scarves close together as this can cause a localised weakness.

Next you need to think about the issue of how long is the section you are going to replace. Whilst it is tempting to only replace the damaged area, if you put in a short board it won't take up the smooth curve of the planking and will form a flat hard spot. There may be some cases where a short repair can be justified (See below) but for an important highly visible area such as the sheer strake I would say 4' is about the minimum length.

Cutting the scarves in the planks is not easy. The aft one is a lot easier as you can cut away the waste in front. Unfortunately I seem to have lost the photographs for this job but the adjacent photo shows the first trial run scarf I cut in the waste of the plank to be cut out. For a rear scarf the part at the front would be the waste. I used a small fine toothed saw. The mahogany is fairly soft and cuts quite easily but trying to make sure the cut is in a parallel plane across the full width of the plank is far from easy. If you are using an epoxy glue you can get away with minor variations. The

forward scarf is harder still. You also need to make sure that you are not cutting into any ribs or adjacent planks.

With regard to finding replacement timber good mahogany is becoming increasingly hard to find. As a general rule replace like with like if you can. I ended up using sapele which is quite a bit harder. Look for timber without knots. One or two small ones may be acceptable if your plank is not subject to a large amount of twist. Get a section which is slightly longer than the piece you need and then if there are any knots you can make sure they will not coincide with any fixings. Also it needs to be slightly wider than the deepest part of the plank. The top edge of the plank is likely to be curved vertically so you are measuring top of top to bottom of bottom. If you can get the old plank out in one piece it can be used as a template to a limited degree **but do not cut the new plank to exactly that size**. You can cut the top edge of the plank using the old template as this will probably not be visible in the same way as on the outside where a fair line is so much more important. Cut the front scarf first and offer it up. I then temporarily fixed this in place using two wood screws set into pre drilled holes in the planking going through to the rib. It is important to make sure the new plank is in the correct plane before you drill these holes. The screws went through a timber pad to spread the load evenly across the plank. (see photo on next page) The holes can be filled in when you have finished.

Once this is in place you can bend the plank round and accurately mark up where the aft scarf needs to be. Take the plank down and cut the aft scarf and at the same time mark where the bottom edge of the plank should be using the old plank as a template but do not cut it out yet. Fix the plank back up applying the same system of screws and pads at both ends. When you have done this get a long batten probably about ½" x ½" possibly larger. It needs to be sufficiently flexible to bend and hold a curve but not so that it will distort easily. By laying this along the lands of the planks on either side you hopefully should get a fair curve which should be approximately consistent with the line you marked up from the old template.

If you are dealing with a plank below the waterline a fair line is not nearly so critical but if you are working on the sheer strake any unfairness in line will be that much more visible. Ideally you need to be able to stand back and view the batten from a distance but this is not always possible in a boatyard. With a less visible plank you can probably cut along this line but with the sheer strake I would still leave a bit so that you can do the final adjustment with a rebate plane when the plank is fixed and glued in place.

When you are happy with this, mark the top edge of the plank below on the new plank from the inside. Take the plank down and sand and paint the inside surface with primer but do not sand or paint the land or the (faying) surfaces that are to be glued. Glue up the scarves using packaging tape to mask areas or a thin film of plastic such as cut up fertilizer bag between areas that you do not want bonded such as the land and between the plank and the rib. (only necessary in the glued areas) Also between the pad on the outside and the face of the plank. Grease the screws

you are using with the pads to fix the plank in place while the glue goes off. Hopefully the plastic can be pulled out after the glue has gone off and the screws removed. Even so I still went along the land with a junior hacksaw blade to clean it out. If a bit of bag still remains between than plank and rib it really does not matter but it must be removed from the land. **The refastening comes after the gluing, not at the same time.**

You now make your final adjustment with the rebate plane but make sure you leave enough wood for the bottom edge of the nail heads. The holes for the nails in the new plank will be made by drilling from the inside out through the old nail holes in the plank above and below. Make sure that you drill at 90° or on a slope so that the drill comes out through the new plank well above the bottom edge.

You can then nail up the plank in the normal way described earlier. It is then just a matter of sanding. Over the years the hard edge of the plank may have been rounded off by sanding and I would say it would be best to make a similar adjustment to get the plank to blend in. With an important plank such as a sheer strake using a "torture board" for sanding combined with several coats of undercoat will make the new plank blend in that much better. A torture board is a strip of flexible plywood of the same width as the plank which is about 3ft long. Handles are screwed in at either end and a long strip of sandpaper is fixed to the face. You then run this along the face of the plank to achieve a smooth fair finish on the face. The reason for the name is that is very hard work on the arms!

A thin dab of grease and mastic inserted into the lands before the final coat of paint should stop severe leakage while the boat takes up.

In certain cases there may be a justification for putting in a short plank. In 2007 when the boat was being laid up and put in the cradle, unknown to the boatyard one of the metal support pads of the cradle had rotated into a vertical position so that when the boat was lowered this caught one plank which it split and

also made a gouge in the bottom edge of the plank above. Fortunately they realised there was a problem fairly soon and so there were no damaged ribs.

The difficulty was as the internal photograph shows (after repair but before re-fastening) that the top edge of the plank was underneath the stringer. When I re-fastened the boat the only areas I could not do were the nails directly underneath the stringer as you have no access to the roves from above. Unless you take out a section of stringer the only way to replace these fastenings would be by placing blocks between the stringer and the plank which you then screwed into. Given this difficulty I considered it would be better for them to put in a short length rather than having to pack out under the stringer from for a considerable distance. It has created a very slight flat spot in the plank but it is not obviously visible and you have to look hard to find it. You could allow for the curve to some degree by shaping the thickness of the plank very slightly. This is very similar to a process I believe is known as scrubbing which is commonly used when fitting carvel planks although in that case the curve is from top to bottom not from side to side.

The photograph on Page 74 also shows how the damaged bottom edge of the plank above was cut out with chamfered edges and a new piece was later glued in. Whilst this repair may not be considered to be strictly correct, I am happy to report that it has not caused me any problems and has not shown the slightest tendency to leak.

With regard to reading I have yet to come across a really good book which deals with traditional clinker boatbuilding repairs but the two books below both cover the issues to some degree.

Clinker Plywood Boatbuilding Manual Iain Oughtred Iain Oughtred
ISBN 0-9537712-6-1

Details of Classic Boat Construction Larry Pardey L & L Pardey Books
ISBN-13: 978-0-9646036-8-4

Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

All photographs by John Sparks

February 2017 **John Sparks**, Shotley, Suffolk.

HINTS AND TIPS ON STELLA MAINTENANCE

Part 7

IRON/STEEL: KEEL, SCARF & FLOOR BOLTS

by

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Contents

The text given below is purely what did or did not work for me. Any observations made about products are based on my own personal experience and problems experienced could be due to failings on my part rather than the product. Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

Steel and Iron: An Introduction

It would perhaps be useful to Stella owners to give a very basic outline of the differences between steel and the various irons. I am not an expert but there are numerous types of steel and iron and the suitability of the metal for its intended uses can be controlled not only by the ingredients (alloys such as tungsten) but also by how it is heated and handled as it cools.

There are various types of iron ore and the type used will influence the properties of the final product. The iron ore is mixed with a flux, often limestone and coal and heated in a furnace. The flux removes the impurities. The molten iron sinks to the bottom where it is run off into moulds to create lumps of comparatively impure iron know as pig iron. (Supposedly the layout of the casting was thought to be like a sow with piglets) In nautical terms blocks of ballast are often referred to as "pigs". I am not sure this necessarily means they are pig iron but this probably was a cheap means of supplying ballast.

Pig iron has a relatively high carbon content (over 4%) which affects the way the material behaves

Cast Iron

Pig iron is melted and poured into casts (Founded/foundry). There are various types depending on how this is done but many have a high carbon content. You may have seen broken bits which have a grey appearance and a structure a bit like the inside of a *Crunchie* bar. This material **is strong in compression but weak in tension.** Rust forms on the surface but once this has occurred it is very much more resistant to corrosion than mild steel. It c**annot be welded for repair.**

When people talk about iron keels this is what they are talking about. They would have been cast in a foundry local to Burnham or wherever using sand moulds and a timber plug. I understand that some types of cast iron submerged in salt water for long periods will become porous but I have never seen evidence of this in boat keels.

A problem with large castings is that tensions can be set up within the metal if the outside surface cools too quickly in relation to the core. This leads to cracks. (This is a general point about castings of all metals.) You may not be able to see these from the outside. The main point to note for Stella owners is that **the keel is comparatively brittle, so support the keel either side of a keel bolt hole when knocking out.** The risk of fracture is probably low in the middle **but the fragile ends at the front and the back could be vulnerable to damage.** If you break the front edge off or the toe on which the rudder sits, which I have seen on a number of boats, you will probably not be able to weld a bit back on!

Wrought Iron

This is a pure form of iron with the carbon driven off (less than 1%) by a process of reheating (**not melting**) and hammering. It can be reheated and rolled (forged) up to five times to produce a laminar structure which makes it **strong in compression and tension** (ductile). Further heating/hammering will weaken it slightly. If placed under load it will elongate before breaking whereas cast iron will break suddenly without warning. Has superior resistance to corrosion when compared with mild steel but does corrode by delaminating. You may have seen old anchors or anchor chain delaminating. It can be welded by heating it up (red hot) and hammering the two parts together. It can also be shaped, hence fancy wrought iron railings and gates.

Unfortunately the production of wrought iron was a comparatively labour intensive process and this combined with the advent of modern welding techniques and the superior qualities of steel for volume construction has meant that wrought iron has largely become obsolete. I understand it is now only made in a museum reworking old bits of wrought iron.

Its superior resistance to corrosion made wrought iron the favourite for keel bolts. If you can find some fine, use it, but you are likely to be competing for this scarce resource with those repairing the gates of stately homes etc. so I would anticipate it is going to be very **expensive** even if you can get it.

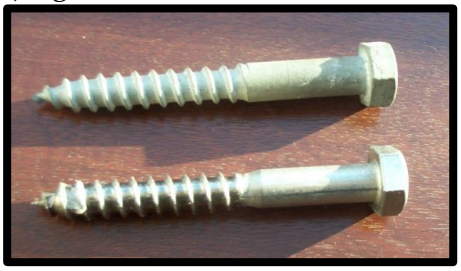
Steel
Steel is essentially a form of wrought iron with a controlled carbon content of between 1% and 2%. The pig iron is melted in a blast furnace to a very high temperature and the spare carbon in the pig iron is either burnt up or distributed more evenly around the metal. The process can be controlled to produce and exact evenly distributed carbon content. Small amounts of other metal such as tungsten are often added to make different types of steel. This material can be cast, rolled etc. The characteristics can be changed by the temperature to which it is heated and the rate at which it cools. Mild steel is stronger in tension, compression and resistance to shear (cutting/sideways) loads. It also can be welded and like iron can be hardened by controlling the rate at which it cools. Unlike iron it can also be tempered. This is a process of reheating and rapid cooling which is vital for producing a metal which will produce a cutting edge on tools. You might think the above would make it a winner all round. Well not quite. Its big weakness is its poor resistance to corrosion. Various methods have been used to combat this.

Stainless steel
Again there are a number of types depending upon which alloys are added in what proportion but chromium and nickel are the more important additives. The two most common types in marine use are 316 (A4) and 304 (A2). If you have a choice in most cases it is better to opt for the 316 (A4). In order to resist corrosion stainless needs to be initially exposed to oxygen to build up a "passive" corrosion resistant layer. If it is in an underwater situation and there is not an adequate layer you can get crevice corrosion taking place (pitting). A S/S fastening under water may not perform any better than mild steel particularly in wet oak. This is quite a complicated subject. Find out more at www.classicmarine.co.uk. From my own experience it will bleed rust stains if you over paint it. It is much happier left bare.

With regard to stainless steel cutting tools (Saws, knives etc) the only use these have is if they are kept on a boat where they can be rust free tools of last resort. Stainless steel is too soft to hold a good edge for cutting wood although OK for carrots, bread etc.

Protective Coatings

Galvanising is just a thin coat of zinc. Once you have hit it with a hammer, that part will probably not be galvanised any longer. With regard to buying galvanised bolts they should be hot dipped. (See Classic Marine web site) I got mine from Seaware Ltd in Cornwall www.seaware.co.uk.



Proper hot dipped products have a dull grey finish. (Top. Bottom A2 Stainless steel) The shiny electro-plated ones you commonly find in DIY stores do not have a sufficiently thick coating of zinc and should not be used in a marine environment.

Touching up with a coat of bitumen paint can protect damaged nail/bolt heads after they have been put in.

Bitumen paint

In my experience a coat of bitumen paint provides comparatively good resistance to corrosion. When fitting out each year I chip any loose paint off the keel bolt heads and then recoat. The only downside is that tar is likely to leach through any paint you apply over the top. Over painting is not recommended but a metal based primer will act as a barrier coating to some degree.

Another method which I have used is what I have heard referred to as Chinese Galvanising. With my new keel bolts I heated them up. (I used the wood stove but don't drop them on the carpet!) I then immediately dunked them in a 5lt pot of bitumen paint outside. Much steam/gas was given off. I was slightly concerned about the flammability of this which was why I did it outside in an open area with appropriate eye protection etc. **When you heat pitch/bitumen there is always a risk of gas becoming trapped in the liquid as it is heated leading to it spitting out.** As the bitumen paint is comparatively viscous and you are likely to be holding the bolt with tongs this should reduce any risks. I did not have any problems but be careful! The paint dries almost instantly and I believe it gets a much better bond to the metal possibly being absorbed into the outer surface to a small degree.

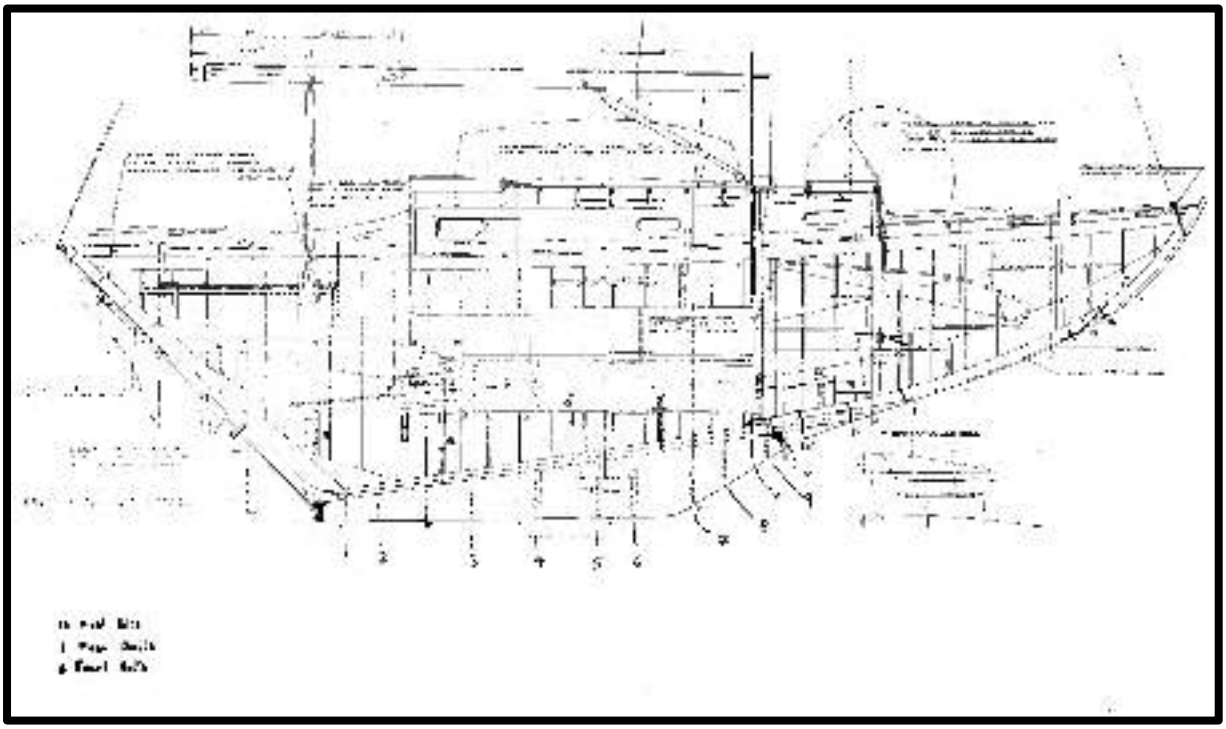
<u>Epoxy and other Paint</u>

Epoxy paint is what the paint manufacturers advise for iron keels. It is expensive. I was always slightly pessimistic about its ability to go off on a cold iron keel during a spring refit as a temperature in excess of 5^{o}C is required. (Check instructions on the tin) When I repainted the keel many years ago I used a traditional one pot system (Primocon) which blistered in places after a number of years. I patched them with epoxy paint which seemed to have been very successful. As the photo shows the antifouling paint has been thrown off very slightly possibly because the epoxy was not 100% cured before the anti foul was applied. The primer itself seems fine.

Subsequently in 2013 I had the keel off and sand blasted. It went straight into a tent and had two coats of epoxy primer within 24hrs. I then filled sanded etc using the complete number of coats as recommended by International. The only issues I have had is where the paint has chipped on the leading edge. This was due to me graunching it on the mooring chain when I have miscalculated when picking up the mooring under sail by myself and have been traveling too fast. You cannot blame the paint for that!

As a general rule follow the instructions on the tin, especially about the number of coats. Bear in mind you should not apply a two pot paint over the top of a one pot although having said this the very small areas at the joint between the old and new paint where I patched it prior to 2013 did not appear to have been adversely affected. Also do not apply epoxy paint to the wooden areas

B) Bolts and the Keel



The drawing above is from the original plans (courtesy of Holman and Pye) which I have marked up to show the various floor bolts, scarf bolts, and keel bolts as I found

them on Lys, which is a late Tucker Brown boat. I am aware there are some minor variations between boats so do your own investigations before attempting to knock something out.

Scarf Bolts

The stem has two scarf joints in it. The upper scarf is just above the waterline on the drawing although on Lys the bottom outside edge of the joint is just below the waterline. I have mentioned earlier how scarfs generally have a minimum depth to length ratio of 1:8 and the scarf as shown on the plan is simply not long enough. I also believe this may well not be a simple scarf joint but the hook scarf joint shown on Page 5 of the 2010 newsletter although I cannot quite make sense of that drawing. Anyway on Lys it has three bolts which I have marked up as A B & C. These are galvanised steel coach bolts. The one in the photograph is bronze and I am not advocating the use of this material but it shows the domed head and the square section of the shank near the head.

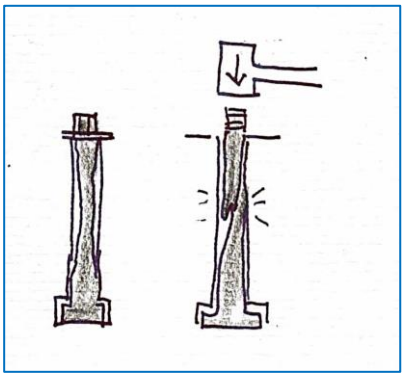
When sailing to windward the loads of the forestay will be trying to open up this joint and it will be the bottom bolt (C) which is under most tension.

First of all locate these bolts internally. They will need to be replaced one at a time. If you take them all out there is a small risk that the joint might move. The next step is to remove the nut inside. One of mine (C) was buried under the base of the sampson post so I had to take this out before starting work.

If you can get a socket to fit the nut fine but it may pay to clean up the head and make sure you have as close a fit as you can with a spanner or socket before you attempt a turn as each time you mangle the corners the less chance you have of getting the nut off. If the nut just turns freely with the bolt rusted solid in the nut there is a strong possibility that the bolt has wasted through in the middle. If so try prizing the top half of the bolt upwards possibly using mole grips but try to make it a vertical pull so you do not enlarge the upper part of the bolt hole in the wood.

If the nut will not come out the only option you have is to saw the nut and bolt off using a hack saw blade. This will probably have to be held by hand as there is not the space to get a saw frame in. Stripped knuckles later, you should then be able to knock the bolt out but before you do so, locate the recess in the stem in which the bolts will have been set. These will be round putty filled holes. Clean out all the putty as well as you can before attempting to move the bolt. The reason for this is that if you do not do so there is a strong possibility that the bolt will catch on the surrounding timber as it comes out prizing off a small bit of the outside edge of the

stem as it comes out. Also with bolt C in particular it is a good idea to have someone with a dolly or at very least a post supporting the bottom edge of the scarf when you first hit the bolt. **The moment you feel it move stop!** If there is someone outside confirm with them whether it has moved on the outside or get out of the boat and check!



Both with scarf and keel bolts which have wasted there is a strong risk that they could fold where wasted. If the top moves but the bottom does not you could just be jamming the bolt further into the hole. If you are not sure mark the outside and it may worth be giving it a further blow but if it does not move outside stop. If you can get the nut back onto the head and there is enough exposed thread you may be able to lever/draw the top section out using folding wedges and a washer. A last resort can be drilling the bolt out but it is very hard to do this without significantly enlarging the hole in the timber.

Initially I always try and hit the bolt with the nut still on so you are trying to hit the nut and the bolt. This makes a larger surface to make contact with. If there is little of the bolt above the nut try and hit it with as much of the thread still on so that it can only move initially about 2mm. When it has done that I wind off another 2 mm and then hit it again. Hopefully you will have done most of the heavy work by this stage and it will not need so much force. Also try and make sure you hammer blow is directly from above with as little sideways element as possible. If you leave the nut on for the heavy work there is less risk of mangling the thread, should you be trying to preserve the bolt. Also as you unthread the nut you clean the thread. Once the bolt has disappeared into the hole use a punch or drift to knock the bolt out. The simplest thing is a coach bolt of the same or fractionally smaller diameter. If you use a small punch there is the risk of similar problems to those shown on the the previous sketch.

For this sort of work I nearly always use a 4lb club hammer. If you use a light weight claw hammer all it will do is bounce off the head damaging the edges. You need the momentum from a club hammer to shift the bolt. There may be occasions when you cannot get a club hammer in the space but you will be much better off with a club hammer and a punch if the space allows. If using a club hammer you should have someone outside or design some support

mechanism for the stem so that all the force is going into the bolt and not moving the stem. Use common sense and be kind to the boat although sometimes some brute force is required.

Having got the bolt out, clean it up and hopefully you should be able to find an un-corroded section which you can measure (with callipers) and with carful measurement even if it has come out in bits you should be able to work out the length and size of bolts to order. I would anticipate that A, B & C will all be the same size.

An issue I have dealt with earlier is that the original bolt would have been in imperial measurements and these days you can only get metric. You will find a metric/ imperial conversion table in the Classic Marine website/catalogue. Use the nearest fit. If there is space you can enlarge the hole slightly if this is necessary when the metric equivalent is bigger. In cases where it is smaller I have sleeved the smaller bolts. Firstly I give the shank of the bolt a thin coating of oil based mastic and then serve it with caulking cotton. In any event when putting a bolt back in, I give it a thin coat of mastic and place some mastic and a couple of turns of caulking cotton just under the head of the bolt. It may also pay to mark the head with a pencil showing a vertical axis so that you can be sure that when the square section of the shank goes in it fits into the square section cut by the old bolt. If it does not and cuts a new square section in the stem you have weakened this area and increase the chances of the whole bolt turning the next time you want to get the nut off. There can be a tendency for the bolt to turn as you knock it in so it may be necessary to keep an eye on your marking and turn the head with mole grips before you knock the last bit in.

You will need a punch to knock in the last bit in but do not hit it too hard. It will be drawn in when you tighten the nut up.

Now that you have got the bolt in, go inside. I normally add a small turn of caulking cotton set in oil based mastic. Then I place a washer over the top, as a general rule the larger the better and tighten the nut up. When you are doing this mastic should be pushed out at both ends. Tighten up until it is firm. Do not overdo it as you will start to draw the end into the wood as you compress the timber. On bolt C it would be easy to draw the bolt head right through the outer part of the scarf making the bolt totally useless.

I then clean up the surplus mastic with white spirit and a rag but I would leave it a day or so before re-stopping the hole in the stem with red lead putty. Some more mastic may be pushed out over the next 48 hours. Prime any exposed surrounding timber before stopping the hole with putty. This prevents the oil in the putty leaching out into the wood.

Now start on the next bolt. These ones are relatively easy to do so I would argue your scarf stem bolts should be checked every five to ten years.

It is a lot easier to do that than be faced with the problem opposite. The bolts have corroded and pushed open the scarf . Once it starts leaking things will only get worse. In this case I think what has happened is that the bottom end of the scarf joint has been snapped off in the process of trying to drive a severely corroded steel bolt out. Moral: support the stem when driving the bolt. Having said this steel and oak are not the greatest of bedfellows in a damp marine environment. A corroding steel fitting can turn the surrounding timber to a mush as a result of electro chemical decay. A big bonus in Stellas is that they do not have any steel floors which have caused so many problems in other boats.

The principles with the lower scarf joint which joins the stem to the wooden keel or hog are the same. On the plan I have marked these up as i-v. The photo shows the joint at the top of the scarf and the round hole covering bolt i. This bolt and possibly ii can be changed relatively easily but again support to top edge of the scarf when knocking bolt i out. With ii be careful as it might just be behind the triangular timber fairing piece in front of the keel. On Lys the fairing pieces was fixed with two quite large bronze screws (14s?)

These were set in recesses which had been plugged. I have already dealt with the issue of getting screws out in Part 2 of the manual. If you are having extreme difficulty getting them out there may be a case for splitting the fairing piece in two. This will expose the screws and then you make a new moulding. With the screws exposed you may stand a better chance of getting them out with mole grips. If they do shear off with small bits left in the stem, it may be

possible to relocate the position of the screws slightly when you make up the new fairing piece. In connection with this, either take a mould beforehand so you can make a copy or make sure you split it out in as few parts as possible so you can use it as a pattern.

On Lys there is an added complication that the transducer for the echo sounder goes through this point. This is an area where I did bed the fillet down using a one part polysulphide and the screws used do need to be fairly meaty. While this piece does not serve a structural function when boatyards put a Stella in slings the front one frequently ends up in this area so the fairing pieces may have considerable sideways forces imposed on it. Get them to place the front strop on the front edge of the keel if you can. The downside of this is that unless the paint is well hardened there may be a tendency for the strop to strip the paint from the smooth metal of the keel. The answer may be to have the strop in front of the fairing piece. It is easy to control where the strop goes when lifting out from the yard. Not so easy when coming out of the water. This is why marinas have those nasty little stickers saying "sling here".

In connection with this, one area which is always difficult is the joint between the front edge of the keel, this block and the wooden keel. You can fair it to wonderful smoothness using filler in the yard. The moment the boat is picked up this joint will move slightly cracking your hard filler, allowing water into the joint behind. My solution is to fair the joint using a one part polysulphide and a putty knife. The brown area in the photograph is where the antifouling has not stuck well to the polysulphide. You don't get a perfectly smooth joint but it seems to survive the transfer into the water although I end up redoing or at very least touching it up when fitting out.

Scarf bolts iv & v are above the keel and so you can only do these when the keel is off. Like the floor bolts if the joint between the wooden and the iron keel is sound they should be far less vulnerable to corrosion.

Keel Bolts

The 12 keel bolts attach the iron keel to the wooden hog or keel and in the case of 1 & 2 the deadwood (small triangular bit of wood joining the hog and sternpost) to the hog as well. The hog (wooden keel) is attached to the rest of the boat by the screw and nail fixings in the bottom plank known as the garboard. This however would not be sufficient to hold onto the 1.22 tons of the keel. The wracking stains on these planks is considerable when the boat is heeled which is why garboards are notorious for leaking on wooden boats.

On the plan there are 9 floors of which 6 are bolted through to the hog using galvanised steel floor bolts. These can only be reached by taking off the keel. The large black plates on the photo above are the keel bolts (with washers) while the small black discs are the nuts on the floor bolts which are recessed into the top of the floors.

The floors attach the wooden hog to the rest of the boat and the hog is in turn bolted to the keel. The shape of the floors is joggled to match the surrounding planking. The joint which should be comparatively close fitting was normally bedded in putty with (bronze) screws fixed through the middle of the planks form the outside into the sides of the floors. In this way the iron keel is fixed to the boat.

The joint between the wood and the iron was originally formed using a white lead paste which helped to create an approximately watertight joint. In my limited experience the vast majority of corrosion to keel bolts takes place either at this joint or where the bolts pass through the wet wood of the keel or deadwood. Unfortunately there is no way of confirming the condition of the keel bolts without knocking one out or using X rays which is likely to be quite expensive and will only tell the condition of the sections in the wood.

Because this is an area they cannot see surveyors regularly ask for a sample keel bolt to be drawn. The difficulty with this is that by the time you have knocked the keel bolt out you have often damaged the head. There is also a tendency to choose the

easily accessible ones. The old chestnut is the one under the engine is never replaced although in most Stella engine installations there is not one at this point. You will certainly have to take the prop shaft out for the rear ones.

If you chose the same keel bolt each time the only person you are fooling is yourself. Much better to make a record of which ones have been checked and when so that you can make sure they are all dealt with one by one.

How do you know if your keel bolts might need doing? Well if you see rust staining of the type on the right this is a fairly obvious indicator all is not well while that on the left is on my own boat with some rust starting to bleed out the bottom of the joint between the wooden keel and the stern post. I replaced the keel bolt 1 but it still continued so in 2013 the keel came off (again!) and I replaced floor bolt θ as well as all the other floor bolts. Just because you see a small amount of rust staining, it does not necessarily mean that the keel is about to drop off. Most wooden boats with iron/steel bolts have some stains.

A downside of doing it bolt by bolt is that the white lead paste bedding never gets replaced. This has a tendency to dry out with age a bit like putty. When it is old if you are knocking seven bells out of the keel bolts to get them out it is highly likely you will disturb the joint in the white lead paste which will then allow small amounts of water in as far as the bolts. This means that your replaced bolts will corrode that much quicker. In 2002 I dropped the keel completely so that I could re-bed the keel and check a sample of the floor bolts at this time. If the keel had never been off these would never have been checked. Those I looked at were fine but I wish I had replaced them all at that time as I would not have had to have the keel off again in 2013.

For most owners major work of this type is probably something which you will need to get the boatyard to do. In my case I was lucky that the boatyard were prepared to work with me in that they did the parts that needed lifting gear and were happy to leave me to deal with the more mundane parts. Before planning any work or deciding where to lay up you need to consult with the proposed boatyard as to how much work they will allow you to do yourself and what their policies are. There is also the issue of timing in that they may not be able to leave something hanging in

the slings while you work on it at weekends. They are more likely to be accommodating if you plan the work for the dead of winter or midsummer when there is less going on. As outlined earlier having the boat out for long period in the summer is best avoided.

Below is a photograph of a complete set of Stella keel bolts set out with the stern at the bottom of the page. Following the numbers on Page 82, keel bolt 2 appears to be positioned upside down. In fact it had corroded away at the base, something which I had not seen before. Presumably this was a fault in the welding of the nut onto the base of the bar. The smaller three set the other way at the top are sample floor bolts extracted. (α, β & ε)

There are 12 keel bolts in total 4, 5 and 6 are in pairs (P&S). When you take them out mark them immediately. I used little bits of paper selotaped to red whipping twine tied round the bolts. You will need the bolts or at least their measurements to take to the blacksmith as patterns when ordering replacements. You will see that with the exception of 9 at the front most of them were in perfectly good condition apart from slight wasting at the top notably one of the ones at 5 presumably where water was getting in at the joint between the keel and the hog (wooden keel). Although most of the bolts were fine if you look at the heads you can see they and the threads have been mangled so unfortunately it was time for a complete new set.

You should measure your own set as they may be different but mine were as follows:

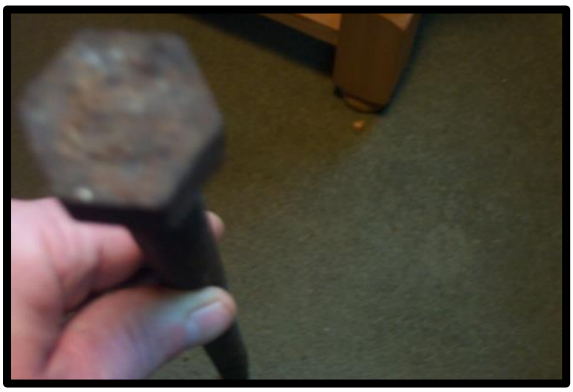
1. 510mm
2. 430mm (probably 20mm more where nut had wasted away).
3. 380mm
4. 430mm P&S
5. 480mm P&S
6. 520mm P&S
7. 500mm
8. 380mm including square head 41mm fore and aft, 32mm deep

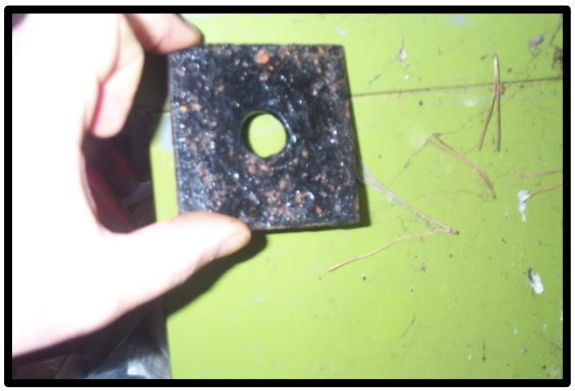
9. 270mm **plus** square head of same dimensions except front edge cut off leaving 18mm fore and 13mm at bottom.

In my experience corrosion tends to worst at the front three (7-9) and the rear one (1). Opposite are what Lyra's bolts looked like after removal. How old they were I do not know but the wasting where they pass through the wood shows why you need to check them.

You will probably only be able to get steel replacements but as Stellas are small sometimes you can get wrought iron bolts made out of the good bits of old bolts reconditioned from larger boats. Although some glass fibre boats with iron keels do use stainless steel bolts, due to its poor performance in wet oak I would recommend you stick with what is known to work i.e. iron/steel. Some may argue there is a case for galvanising the bolts but by the time you have knocked them up through the keel you are likely to have removed much of this. I went for the so called Chinese galvanising option with bitumen paint described earlier. The one exception was for Bolt 1 where over 50% of it is in timber rather than the keel. This is the bolt which wastes quickest in my experience and I felt there was a case for having it galvanised.

The blacksmith takes the correct length of rod and cuts a thread onto both ends.





They will thread a nut on the bottom end and I believe the joint is welded up to prevent these two parts turning. This hexagonal part fits into a shaped recess in the keel casting. (See photo on Page 82) On the upper end there will be the thread and nut. On Lys bolts 3 to 8 have 3″ square steel washers. These distribute the load over a wider area of the hog. Depending on how badly corroded the washers are you may need to order some replacements. Bolts 9 and 1 were of a slightly smaller diameter and together with bolt 2 use standard small round washers.

With regard to a blacksmith I am sure that your local boatyard will be able to advise. I used Jaccobs at Kirton. As a general rule go to someone used to doing this type of work and preferably take the old ones along as patterns. That way there is less chance of mistakes. Ask them to keep the patterns so you can check the new bolts for size when you get them back. It can be both embarrassing and expensive if you are hiring plant/labour only to discover that the replacements do not fit.

Removing the keel bolts is much the same process as for the scarf bolts except everything is more heavy duty. The first thing is to get the nuts off. For this you will probably need a 1¼" socket. While you may be able to do it with a wrench you really need a heavy duty ¾" square drive socket set. Either hire/borrow one or buy a cheap Draper one.

With about 2' of extension bar this enables you to get the 16" T bar up above the level of the floors. With this you can really put a lot of force exactly where it is required. If it won't move scrape all the paint off the head and give it a few coats of diesel, then leave it for a day or so. Diesel works well as a penetrating oil but do not overdo it as wood particularly mahogany does not like being soaked in diesel. Also try tightening it up slightly and then undo.

Once you have got the nut to move wind it up so that the top of the nut is level with the top of the bolt. Place a large punch such as an old keel bolt on the top of the bolt and hit it with a sledge hammer. I have already recommended packing out the underside of the keel but this is particularly the case if the boat is on a trolley. If the base of the keel is not indirectly in contact with the ground some of your impact will be taken up in the springs of the trolley.

For knocking the bolt out you really need a sledge hammer. Ideally you have two people, one to hold the punch/drift the other to swing the hammer but be careful. Wear suitable safety gear and makes sure you hit the drift not your assistant's wrists

thumbs etc. Also do not get too carried away. You do not want a hole in the coach roof. Again check for movement outside once the bolt has moved slightly.
If you do get a bolt which folds you have a problem. You might be able to weld a short bar to the top of the bolts then prise the top part up using folding wedges. Also if you have just got one like that and you are taking the keel right off you may be able to lift the boat off the keel and then knock the parts out separately. If you try this be careful especially if the jammed bolt is at the ends of the keel. If the lift is not absolutely vertical you could crack the casting. What you want to avoid having to do is drill the bolt out as it would be hard to do this without enlarging the hole.

For ones which won't move I am told heating it can help but again you don't want to burn the timber around the bolt where it passes through the hog. I would also have thought that the keel would act as a giant heat sink so the bolt would be quite difficult to heat up. Fortunately I have only had some that have been mildly difficult rather than impossible.

Once all the bolts had been knocked out the yard moved in their trailer and lifted the boat off the keel.

They put the strops in front of the keel and through the propeller aperture in the stern post. This was something which worried me slightly. While the keel makes up a large part of the weight of the boat it also serves a major stiffening function like a girder. I was worried with the strops at the end the boat it might feel the urge to bend up like a banana. The fact they were using a means of lifting, which gave a directly upward pull rather than the strops leading to a central point will have reduced these strains. Also once the keel was moved the boat was put down onto blocks which were carrying the bulk of the load. The strops were just keeping the boat upright.

I think they probably took the keel out using a fore-loader and strops. I was able to move it about to a certain degree on my own using three rollers made up of cut up scaffold pipe. Having said this, be

careful. In 2002 I turned it on its side to clean off the underside. When it went over it almost crushed its way right through the timber bearers I had put out to keep it off the ground. Getting it back required two people using timber leavers and blocks.

The first step in cleaning up the keel was to remove the remains of the white lead paste off the underside of the hog and the top of the keel. This is a toxic material so wear a mask and remove the paste with a scraper so as to minimise dust particles which can be inhaled. If you want to dampen things down it is probably best to use white spirit rather than water as water will start the keel corroding. In 2013 all this got done as part of the sand blasting by the yard.

In 2002 I cleaned off the old paint using a wire brush cup set onto a baby grinder. A metal worker who keeps a boat in the yard rather frowned on this. Apparently this tends to polish the paint into the surface of the keel meaning that any coating will not bond so well. The correct procedure is to have it sand blasted, which is what I did second time round. Worth the extra money and the painting was done in a tent.

One real issue with cleaning up the keel is that you must coat the metal with primer within a few hours of having exposed it. Certainly in the spring you cannot leave it there overnight as condensation will form on the cold metal regardless of whether it rains or not. This is also likely to be in issue in a shed unless it is heated. With the first two coats you also need to make sure you get a good level of coverage. In the past when I have been touching up areas I have applied the first coat on one day only to discover small rust stained areas on the paint surface the next morning. The condensation had reached the metal. You should be trying to get the first two coats on in the minimum amount of time. Knowing what I know now I would definitely go down the epoxy paint route but it is critical that you investigate the product data and recommendations and so far as possible follow these to the letter. This is particularly important with regard to over-coating two pot paints as it is vital that the earlier coat is properly cured before you apply another.

I did not do any filling or fairing until I had applied two coats and then considered the next coat to be the first as it is inevitable that some metal will be laid bare in the process of sanding. It is not necessary that the top of the keel is totally smooth but for the go faster fraternity this will be your best chance of getting a nice smooth finish on the other areas.

The new joint between the hog and the iron keel needs to be soft and slightly flexible. It should fill all the gaps but allow for slight differential movement between the two parts. The hog will expand and contract slightly as the moisture content in the wood changes.

Many boatyards use an adhesive sealant such as *Sikaflex* for this joint. This provides a watertight and flexible joint. The problem is the next time you want to drop the keel, separating the two may not be easy. You run the risk that sections of the oak hog will come off with the keel. Another issue is one of expense. When bedding

something down on sealant, such as toe rails and or the keel you want to be absolutely sure that no voids remain. Any gaps left will suck moisture in through capillary action leading to decay. Sealant should be applied liberally so that when the two parts close up it is squeezed out into all the voids. This can lead to high levels of wastage. If the product is expensive there is a greater risk that gaps will be left.

I went for a traditional but cheap and cheerful option of a layer of reinforced bitumen roofing felt with a bedding of fibre reinforced bitumen mastic trowelled on both above and below the felt. Traditionally barge felt would have been used with bitumen mastic. The fibre reinforcing would not have been necessary as the felt would do this but modern bitumen roofing felt is not absorbent in the same way. I got my mastic at Wickes in 2013. I think it was sold as a roofing repair mastic.

This creates a soft, flexible but watertight joint. As the photograph shows after nine years first time round this was still the case. Over the winter when laid up the weight of the boat comes on the keel and small dribbles of bitumen are squeezed out. These may be slightly unsightly but can easily be cleaned off with a knife, white spirit and a rag come antifouling time.

To put the keel back on I put keel bolts 3 & 7 in while the keel was still upside done making sure the holes they were going into are well filed with the bitumen mastic. The bolts should be coated with a thick grease (details later). A few turns of caulking cotton which were coated in mastic should be added at the joint between the bolt and the welded nut at the base. The keel was then taken out and set up on blocks the right way up. (Photo above).

The next step was to cut out the pattern for the section of roofing felt together with cutting the holes in it for the keel bolts. If anything cut them slightly larger than the hole as overhanging felt could jam the bolt in the hole when you reinsert the bolts. You will probably have to do some further trimming to the edges once the keel has been bedded down. A piece of chalk is probably the best marker for this. It would be handy to mark which side is the top so you don't stick it on to the keel the wrong way round. The two keel bolts help to locate the gasket. Remove gasket.

The next thing was to trowel the fibre reinforced bitumen mastic onto the top of the keel. The purpose of the fibres is to stiffen it slightly making it less likely to run in hot weather. It had the consistency of a soft fudge. I spread this out using a trowel and a plasterers' metal float to a depth of about 3mm. Be generous it does not cost that much. I then put the roofing felt gasket over the top and pressed it down lightly. A further layer of repair mastic was applied over the felt. Then the boat was moved over the keel.

The two keel bolts were used to locate the keel in relation to the boat. This requires quite a bit of skill with tractor driver and trailer to ensure correct alignment so that the boat goes vertically downwards onto the two bolts. These bolts were then done up loosely. The strops were then changed to under the keel avoiding bolt holes and the boat lifted and blocked up underneath so you could get under to insert the other keel bolts. The mastic will squeeze out. (White spirit will clean off bitumen mastic)

Both when putting the keel on and knocking the bolts out, it helps if you mark and number the position of the keel bolts in chalk on the side so that you can arrange the strops/any blocks so that they are not in the way.

When putting the keel bolts into the hole I have, in the past, had access to a thick grease used to protect crane wires which was a bit like treacle. This time I could only find a slightly more viscous grease used for the wires on a travel hoist. The shaft of the bolt was duly slathered with this and a couple of turns of caulking cotton and mastic placed around the base of the shaft. This was then hammered in. When working under a boat in this way you should make sure the keel is blocked up just in case one of the strops fails. You may have to move these blocks periodically.

In most cases the bolts could be hammered in relatively easily. Do not forget the couple of turns of caulking cotton round the base. These could usefully be set in a small fillet of soft bitumen mastic which will squeeze out and fill any gaps between the bolt head and the hole set in the keel as the bolt is tightened up. The bolts going in should not be a loose fit but there was one which I had to put in using a small hydraulic jack after cleaning out the hole. In retrospect I should have cleaned the holes of any residual lead paste when the keel first came off. Be careful if you do resort to this type of force as you might start to lift the boat off its blocks. Also do not mangle the thread on the bolts in the process of putting them in. If you do burr it slightly you may be able to clean it out with a needle file.

Inside I spread a thin film of bitumen mastic on the underside of the washers and also a small fillet around the joint between the bolt and the hog. I then put a couple of turns of caulking cotton around the head put the washer on top and then did up the nut. Initially I only did them up lightly and then went round them giving each half a turn in rotation until they were tight without putting too much force into the socket set.

I then cleaned up the joint outside using a chisel white spirit and a rag. I also used a Stanley knife to trim the roofing felt. As the photograph on Page 95 shows it is not a perfectly smooth joint but I can live with that. I then cleaned up inside and left the joint for 48 hours for the initial stresses in the bedding to balance out. Finally I came back and gave the bolts a further final tighten. You should find that over that time it has all eased up ever so slightly so that you can give it that final turn without undue strain.

Do not do what I did. I could not resist giving bolt 1 that final extra turn and stripped the thread! I then had to have the boat lifted up again to get the bolt back out and take it back to the blacksmith. Since there was not a lot of weight on this one he welded a new section on the top and cut a new thread. I was able to get it back in within a couple of days. Not ideal but it saved the day. Finally the heads and washers were painted with bitumen paint. A stripe of white paint (See photo) was added across the heads as a check against any loosening of the nuts.

Floor Bolts

There are a total of 9 wooden floors on Lys plus one which does not go right down to the keel. This was added to support the end of the tray on which the Stuart Turner engine sat. This is the one just behind my replacement bearers I built for the Yanmar 1GM10. In order to support the new bearers I had to put in a new floor just in front of the Stuart one. I increased the width at the top of floor ε so the engine/bearers would be naturally balanced on the floors. (The front of the engine is well in front of floor ε) It was also necessary to reduce the height of this floor to clear the sump of the Yanmar. I fitted the engine in between the two times I have had the keel off. Fortunately there was enough thread on the bolt to be able to accommodate this. I thought at one point I might have to take the keel off again to get the bolt out to have more thread cut!

As far as I can make out the two front floors and the rear one are not fixed with bolts through the stem/sternpost although the drawing shows dotted lines indicating bolts. I have already described how the keel/floor structure carries the loads and it would make a certain degree of sense that the only bolted floors are those which attach the floors to the hog. I assume the others are only fixed by screws fixed through the planking at the side.

One of the reasons I decide to drop the keel in 2002 was that I realized that while keel bolts had probably been replaced over the years, if the white lead bedding was original, as it appeared to be, the floor bolts would be 37 years old. What condition were they in?

With the exception of floor bolt θ which is set in a pocket in the floor (See Page 82) the nuts to the floor bolts are set in recesses in the floors.

After the keel had been dropped I decided to check some samples. They were relatively easy to knock out. I took out α, β & ε. These are the three bolts at the top in the photo on Page 90. They were originally galvanised and small amounts of this remained. There was some light surface corrosion but they were in perfectly serviceable condition. Even so they were all slightly bent where the floor joins the

hog. I concluded this must be a result of someone running aground extremely hard but just decided to make sure they went back in with the same alignment.

I cleaned up the surface corrosion, painted them with bitumen paint and then put them back in the same manner as the keel bolts with turns of caulking cotton at the top and the bottom. Again make sure the hex at the bottom aligns with the existing recess in the hog as you knock the final bit in. I think I used bitumen mastic to bed the bolts. My conclusions were that providing the bedding between the keel and hog remains watertight they should be in a comparatively dry environment and that significant corrosion will not take place. Having said this, the photo on the left on Page 89 shows a rust stain right at the back behind the keel bolt. I hoped this was keel bolt 1 which I then replaced but the rust still kept coming back so in 2013 I bit the bullet took the keel of for the second time and replaced all the floor bolts barring ε under the engine. I had had this out in 2002 and it was ok then. I could not face taking the engine out.

Getting θ out proved to be extremely hard. The top of the bolt is set in a pocket so that the prop shaft can run through the floor above. After the soaking the nut in diesel and buying a ring spanner for the correct size I manged to get the nut off but then how to drive the bolt out? I thought about using folding wedges but was worried about splitting the floor horizontally with the force. I ended up putting a thick flat metal bar over the bolt so that it projected out either side. I got someone to place a sledge hammer as a dolly against the rear side while I hit the forward side with a club hammer. It worked but once the head of the bolt was down to the bottom of the pocket it had to be drawn out from below with mole grips both turning and placing them just above the bottom nut and then hitting them vertically downward. I then had to dig a pit to get it right out. Eventually when it came out it was quite badly wasted so I was glad I had got it out.

Something which annoys me is that after all that when she is sailing small weeps of water come in through the joint between floor θ and at the base of the stem scarf where it is fixed to the wooden keel at the front of the saloon. These tear drop dribbles stop after about an hour of being on the mooring. Obviously the joints between the members got shaken up in the process of knocking the floor bolts out. Hey ho! That's Stella ownership for you!

Further Reading
On keel bolts there is relatively little in book format that I know of but the Classic Marine web site www.classicmarine.co.uk has quite a bit of useful information on metals.

Hopefully the text will give you a better understanding of the issues and what may be going on in those hidden parts even if you do not want to do the work yourself.

26th January 2017 **John Sparks**, Shotley, Suffolk. 01473 788186

HINTS AND TIPS ON STELLA MAINTENANCE

Part 8

RUDDER, TILLER, PINTLES, Etc.

by

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A Stella rudder is a delicate instrument. Sailing upwind if the boat is correctly set up there is hardly any pressure on it. As the racing helmsman and probably most others will be aware downwind with the spinnaker up and too much wind it can be an absolute brute. One minute the boom end is in the water, the next the spinnaker pole end. The helmsman madly struggles with the tiller trying to control these wild gyrations. (I am told these effects can be reduced but not entirely eliminated by correct sail trim)

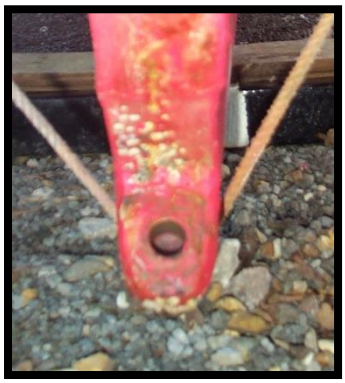
Another area where the rudder may be under strain is if you are moving the boat in reverse so take care especially if near a mud bank. If you reverse into this at speed damage to the rudder is highly likely. Another issue I have already touched on is if you are leaving the boat in a mud berth. Make sure the tiller is securely lashed amidships. If not and the boat moves backwards the rudder will flip over and the large weight of the boat may try and push the rudder beyond the stops probably breaking the blade.

My rudder is essentially made up of four wooden parts. The blade is one piece of mahogany from the toe up to the hole in which the tiller sits. On the Kim Holman's construction drawing (See Glossary of Terms section of Manual) the blade is 1½" (38mm) at the leading edge reducing to ½" (13mm) at the rear. The drawing shows two sizes the main one is for an engineless boat while a hatched line shows the larger outline where a hole has been cut for a propeller. This is an issue which I will come to later but essentially most Stellas these days have engines and mine as shown opposite is the larger format.

From just below the waterline two wooden cheeks are fixed to either side of the blade. On my boat these are 1" (25mm) thick while the

blade has a consistent thickness of 1½" above this point giving a total width of 3½".
These cheeks continue up to the head of the rudder, while the blade stops just above deck/transom level leaving a pocket into which the tiller fits. Above this is a small timber of the same width as the rudder blade. I am not aware of the proper name for this but for the purposes of this article will refer to it as the head piece.

On the photograph on Page 104 you can just about make out how my rudder is fixed to the boat. Keith Cannnell the previous owner replaced most of these fittings in stainless steel prior to my purchase.



The bottom of the rudder fits into a small hole in the toe of the keel casting. In many Stellas I have seen this has been worn to an oval because of corrosion and wear combined with poor support further up the rudder. In my case the hole in the casting has been lined with a nylon bush. I take the rudder off each winter to protect it from the weather but another positive benefit is you can grease the rudder bearings before assembly.

When set up correctly the tiller should automatically move back to a central position when released. The adjacent photo shows the stainless bearing with the vertical straps fitted to the bottom of the rudder. Before putting the tiller back I put grease in the hole in the casting and this then squeezes out when the rudder is put in place.

The next fitting up the rudder is a C shaped stainless strap. This passes through a hole cut in the rudder further up. The arms of the strap are fixed into recesses cut in the sides of the stern post by three screws to either side, staggered in such a way to minimise any weakness in the stern post. This is not a load bearing fitting and there is no metal bearing surface on the hole cut in the rudder to accommodate it. The rudder does not hang from it but it gives lateral support keeping the front edge of the rudder central and reducing wear on the bottom fixing.

My strap fitting is about half way between the keel and the propeller aperture (Photo Page 104) while Kim Holman's drawing shows it much closer to the prop aperture. I

can see arguments for both positions. The drawing also shows one fitting on the transom where mine has two.

The next fitting up is the bottom rudder hanging or gudgeon. This is at about waterline level and is made of two stainless steel parts through which a stainless steel rod or pintle runs (as well as the similar fitting further up).

The lower part of the

bottom fitting is fitted to the rudder and is made up of a solid D section with straps fitted to the rudder blade. These are not recessed as there is a lot of strain on the blade at this point. I have faired up the joint between the blade and the fitting with filler but this fairing needs replacing every couple of years.

A vertical hole is drilled through the D section to accommodate the pintle. The upper part of the fitting is just above the waterline in the boot top region. It is made up of a D shape casting with a large threaded rod attached to the rear which goes through the transom and sternpost and is secured by a large nut on the inside. The D shaped part is slightly recessed into the transom to prevent the mechanism turning as it needs to remain true in relation to the upper bearing.

This is one area where I have some corrosion taking place as by mid season the boot top around this area starts to bleed rust. I believe this is crevice corrosion caused by stainless steel trapped in wet oak without oxygen. (See Materials Part 4) I have tried to knock it out once to check its condition but it did not want to come out easily so it got put on the "to do" list and is something I might address this year. The strap further down also periodically suffers from slight corrosion but strangely the fitting at the heel does not. I can only assume it is the grade of the steel used.

The upper bracket is made in a similar manner except this time the positions are reversed with the upper fitting being of the same D type but connected to straps recessed in the cheeks of the rudder. This fitting was/is connected to the rudder blade by two copper rods which had been domed over in the way you treat a rivet. This joint was concealed by the cheeks. The lower fitting is bolted through the sternpost. Effectively the rudder hangs off this fitting and the rudder heel.

At some points in its life the stainless steel rod or pintle which has a nut fitted to the top has been bent very slightly out of true which makes removal slightly stiff but the distortion is not enough to cause significant problems. There is a split pin at the base which prevents the pintle coming out of the lower fitting.

When taking the rudder blade off, after undoing the fittings, you have to peel it outwards slightly and then upwards to prevent damaging the fitting at the heel. If you tie a rope through the hole at the head and wrap it around the pushpit and back down to hand level it is possible to control the blades outward movement while you lift. Using this method I can do it single handed.

Cheek Repairs

When I bought Lys the rudder and the upper part of the blade and the rudder cheeks had a white painted finish. There was a tendency for faults to occur in the paint work at the junction between the cheeks and the blade. This is not that surprising in that when you are sailing downwind the length of the tiller exerts considerable leverage and it is effectively trying to force the cheeks apart and separates them from the blade.

Fairly soon after purchase I burnt the paint off and then added additional bronze screws but the same fault started to appear.

Upon examination it became clear that a contributory factor was that the upper gudgeon on the rudder was still in mild steel and was corroding thus contributing to forcing the cheeks and the blade apart. (Photo shows replacement)

Part of the reason for this is that when the rudder is hung on the boat it is set at an angle (raked). Although it is reasonably well protected from the weather any water landing on the upper part of the rudder head is likely to run down the forward face and be sucked into any cracks between the rudder blade and the cheeks. It was this water penetration which was leading to the corrosion which was in turn expanding the cracks leading to more water penetration.

I then decided that the old cheeks had to come off to replace the fitting. As is normal the old brass screws did not want to come out easily and I determined that it would be simpler to use new timber for the cheeks and to take the existing ones apart in pieces. In the event this appeared to be the sensible option as the mahogany of the cheeks was significantly decayed where the steel had been corroding.

You can still see on the back of the varnished rudder blade the black marks where the old steel fixings had discoloured the mahogany. The timber of the blade was sound but discoloured. Effectively a cosmetic issue.

I had a new gudgeon fitting made up in stainless steel at considerable expense and ordered up some iroko for the replacement cheeks. The old ones came off in a sufficiently small number of pieces that I was still able to use them as a pattern.

This is one area on the boat where I have used Sikaflex as I wanted a good but slightly flexible bond between the cheeks and the blade. In addition to this the two parts were interconnected using bronze screws which connected the three parts together. The spacing of the screws was staggered on opposite sides to avoid creating any weakness. For cosmetic reasons the screw heads were recessed and the holes plugged.

The area of maximum stress between the cheeks and the blade is going to be at the point where the tiller fits into the slot at the top. To provide maximum resistance at this point rather than using screws I used four copper nails and roves set in a diagonally opposing manner so that each side has two exposed roves. The larger surface area of the roves should be better at resisting the forces. The nail heads have been recessed and plugged.

I still get slight faults occurring in the varnish/paint finishes at the joints and as the photographs above shows there is a small amount of water penetration which has slightly damaged the varnished finish around the base. This needs be burnt off, dried out and re-varnished every five years or so.

The photograph at the bottom of Page 105 shows where I had added some polysulphide sealer at the joints just above the upper fitting to prevent any water getting in at this point. This is not very attractive so a few years ago I let in a small shaped piece scrap of teak just above the fitting designed to shed the water away from this vulnerable joint and this has been quite successful.

Drifts

I suspect that quite a few of the Stella rudders have been rebuilt over the years due to damage and their slender dimensions. I have seen several where the rudder blade is made up of at least two timbers often being much wider aft than the ½" specified.

It is fairly normal practice when constructing rudders out of interconnected sections of timber for them to be fixed together using both glue and metal pins or drifts. Just in the same way as steel stiffens reinforced concrete, the drifts make the timber and the glued joints better able to resist the tension (bending) forces on the surface of the rudder when it is under heavy loading.

I must admit I had never really given much thought to the idea that there might be drifts in my one piece rudder blade. When the boat came out of the water in 2008 I noticed some rust stains and the paint breaking up slightly in two places in the middle of the rudder blade. Upon examining the aft and leading edges of the blade I found small filled circular holes which lined up with the rust stains strongly supporting the presence of two steel drifts.

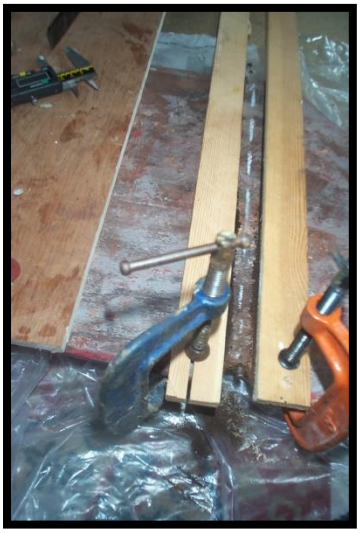
The next step was to strip off the antifouling. I then laid the blade down on a raised board and packed up the area under the cheeks to make sure that the whole of the rudder was evenly supported. It would be very easy to break the rudder blade by placing point sideways loads on it if it is not properly supported.

I then drew a straight chalk lines between the filled holes and tested the areas with a metal detector. Draper makes a cheap one which can detect metal and voltage. Unlike the expensive versions I tend to treat it as a useful pointer that there may be metal or electrical cables present rather a definite finding. Even so it seemed to bear out what I was

expecting except on the upper one for half the length of the blade the meter was bleeping over a wider area than elsewhere.

I initially cut into the aft edge of the upper area as the photograph shows and found the exposed end of the drift. I think this was about 5mm in diameter but I cannot remember now.

I then clamped the rudder blade down to the board and then clamped timbers an appropriate distance to either side of the chalk line to get a square cut but at an even distance to either side of the drift. I took the cut down to just below the level of the crown of the drift. I then chiselled out the waste wood carefully and was then able to pull the drift out. I squared and cleaned out the channel in which the drift had been lying. A friend suggested using a router for this cutting out work but I felt hand tools would give me more control and there was no risk of damaging a router bit on the metal.



The next step was to cut a piece of A4 stainless steel threaded studding to size.

I then removed this and planed the sides of the cut down to a 45° angle to increase the surface area of the glued joint. I then made up a number of pieces of Iroko with sloped sides but importantly with the grain in the same direction as the mahogany. If they were at 90° degrees there is a greater chance of the two timbers expanding at different rates encouraging the rudder to bend in an S shape.

In order to get as strong a joint as possible I first heated the surfaces of the rudder to be glued with a hot air gun quickly to dry out any residual moisture. I then covered all the surfaces to be glued with (warm) runny neat epoxy so that it would stand a better chance of getting a bite into the wood. I then mixed colloidal silica into the mix and put this into the channel and laid the studding in. The thread will help to get a good bond with the epoxy. I then added more of the thickened epoxy on top and then added the wedged shaped fillets to the top so that they pushed out any surplus epoxy. The top of these wedges was well clear of the surface of the rudder blade.

One of these was clamped in place but the others were weighted down. The weights were protected from epoxy by polythene which was also used underneath to make sure that only the required parts were bonded together!

After the glue had gone off the fillets were planed and then sanded to be flush with the surrounding timber.

For the next drift I turned the rudder over and approached the problem in the same way. The point of doing it like this was that if the fillets did expand at a

different rate to the mahogany they would tend to balance each other out rather than creating a bend to one side. In the event there was no evidence of this occurring at all. Another advantage is that if you are creating a weakness in the rudder it will be on different sides and hopefully it will be less likely to fail.

Seven years later there is no obvious evidence as to where the repair was. So far so good.

One thing in relation to this, I was amazed at the skill of the original shipwrights who could drill a 3/16th" 5mm holes through 14" of timber and it had to be dead central as at the trailing edge the rudder was only ½" (12.5mm) wide. I can only assume that they had a large pillar drill with a very long bit and started at the trailing edge before the blade was cut down to shape.

Something which was slightly encouraging was they were not infallible. On one of the cuts I made, the saw hit metal. The metal detector had been right. I had to enlarge the width of the cut out area. Upon removing the waste wood I found the remains of a drill bit which had snapped off in the timber. It was nice to know that this sort of thing happens even in the best boatyards!

Tillers

There is not really a lot to say about these. I would recommend that you have some form of pin to fix it into the rudder so that it can't come out. Normally it is a loose fit in the summer and start of the season but is quite difficult to get out when the wood swells up in the autumn.

It is not a bad idea to have on board a piece of wood or something **which you know** can be used as an emergency tiller although realistically I think the rudder is far more likely to fail than the tiller.

Mine is made of ash. As outlined in Part 3 this has very hard summer growth but has relatively open pores for the early summer growth. This combination makes quite a hard but slightly flexible wood which is why it is used in tillers/ axe handles etc. Its one drawback is that because of the open pores it is not very durable and discolours and decays relatively easily when exposed to moisture.

The photograph above shows the wood discoloured where it enters the rudder cheeks. This is an area of wear and it is

important to keep on top of the varnish as water tends to collect and be retained at this point. Take your rudder home over the winter. It will last a lot longer.

Occasionally when moving around the cockpit there is a tendency to lean on the tiller. Because of the large mechanical advantage quite large crushing loads get placed on the underside where it exits the rudder. After a number of years my ash tiller was starting to show a distinct depression at this point so I cut out the affected area and glued in an oak fillet. This is better at putting up with the loads combined with the slightly wet conditions which may have softened the ash.

Propeller Cut outs

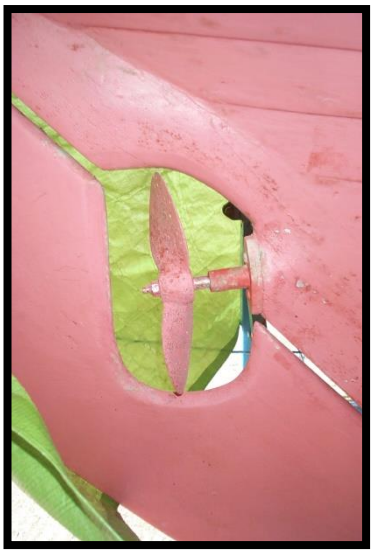
My knowledge of hydrodynamics, keel design and naval architecture is limited but if you are putting a new engine in the boat the size of the propeller and hence the cut out needs to be considered. The photograph to the left shows the original cut out in Lys when she still had the Stuart Turner P5MC petrol engine with a relatively small propeller.

Ballast apart the most important function of a keel is to stop the boat being pushed to leeward. For this function alone the larger the shape below the water the better but large "wetted surface" creates drag. Another significant source of drag is turbulence. Making sure the bottom is clean will help but a good foil shaped keel should allow the boat to move through the water with minimum turbulence **and provide some lift**. This is where it starts to get complicated. To a limited degree the keel acts in the same way as a sail when going to windward in that the water has to travel faster as it is pushed round the foil shape. The pressure drops and so lift is generated. The thing that I do not fully understand is that as the foil shape is the same on both sides why is the pressure not the same on both sides? Anyway I will have to pass on that and just accept that the pressure becomes different with high pressure to leeward and low pressure to windward hence the lift. The objective of the go faster helmsperson is to force this water around the side of the keel to the ruder at the back without it breaking off and creating any turbulence.

At the back of the rudder and the bottom of the keel there is bound to be some turbulence where these high and low pressure areas meet but without changing the rudder or the keel and moving away from the one design principle this is difficult to do anything about. **In a 2013 change to the SCA racing rules any device such as flaps which is designed to stop the flow of water between the keel and rudder was banned. The aft face of the sternpost should be square not concave!**

Returning the issue of propeller cut outs, if you cut a large hole in your rudder/sternpost for your propeller aperture the high pressure water on the leeward side will immediately take the short cut through that hole to the low pressure side creating turbulence. The larger the hole the greater the drag and loss of efficiency in the rudder.

These two cut outs are both for 1GM10's. On the left is Lys and on the right a larger cut out for another Stella which to my way of thinking is on the large side not only from the drag prospective but also you must be weakening the rudder blade. (Compare with amount of blade left in photo on previous page . Also the rudder would appear to be a slightly different shape)



With regard to the stern post if you look at Kim Holman's drawing in the Glossary of Terms you will see there is quite a large amount of stern post above the planks (beyond the rabbet line) so to my mind cutting into this is not as significant as cutting out the rudder but even so do not take any more than you have to.

Putting all this into perspective it does not appear to have caused the other Stella any problems and in the races they normally come in in front of me!

Clearly the propeller needs to be balanced to the engine and the gearbox. The propeller you choose needs sufficient space around it to operate properly and to some extent your propeller choice will be a balance between sailing performance and engine performance. My general advice would be do not take off any more than you have to. You can always take more out later on if you have to.

I do not think there is a lot more to say apart from my standard comment that:

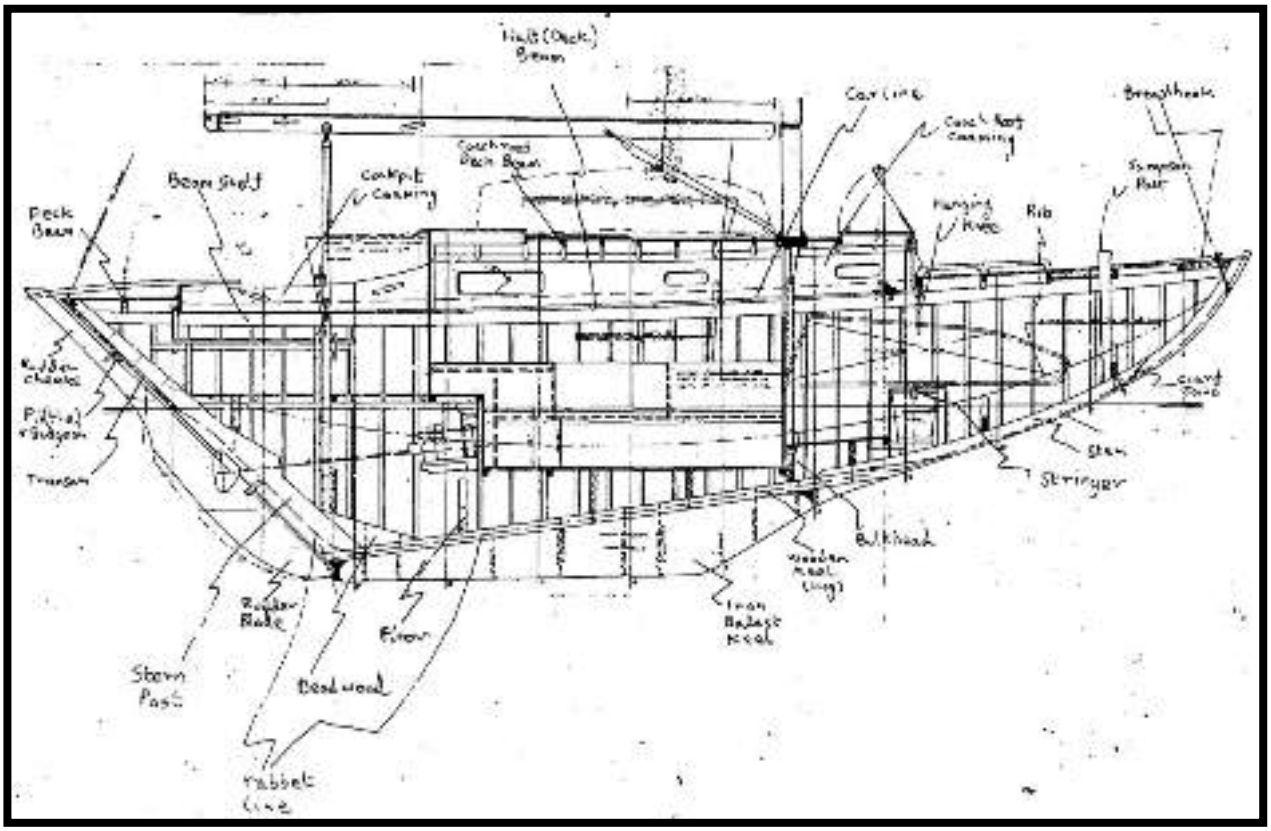
The text given above is purely what did or did not work for me. Any observations made about products are based on my own personal experience and problems experienced could be due to failings on my part rather than the product. Anyone doing work on a boat needs to make up their own mind as to whether what I did would be right for them or their boat. They should also satisfy themselves by making their own enquiries with regard to the suitability/safety of any material or techniques used.

February 2017 **John Sparks**, Shotley, Suffolk. 01473 788186

GLOSSARY OF TERMS

I have set out below a glossary of terms that I may have used in the text of the manual. Sometimes people have different understandings for technical terms or use different names and if mine do not match yours I am sorry.

I would suggest you enlarge this image on the PDF. (Not to scale) *Original reproduced courtesy Holman & Pye, It is their copyright and should not be reproduced without their consent. Additions (labels) John Sparks*



Apron: The inner upper part of the stem rebated to accept the hood ends of the planking.

Back bone: Term used to collectively describe the stem, wooden keel, deadwood and sternpost, to which the planking and floors are subsequently connected.

Ballast keel: The heavy metal bit at the bottom which is fixed to the wooden keel (hog) by keel bolts.

Beams: A side to side timber. (Deck B, Half B, Coach Roof B, Mast B, Cockpit B, Floor Board B etc.)

Beam Shelf: Fore and aft timber running around side of boat under deck just inside ribs. Planking (shear strakes) at ribs and ribs are fixed into it with copper rivets. Outside edge of deck beams are fixed into this. Building plan shows beams being lapped into beam shelf rather dovetailed but as ply deck will be screwed/nailed into both risk of movement between two elements should be slight.
Bevel: The angle cut along an edge made to fit another part. Hence the tool **Bevel Gauge** used to measure/mark angles.

Bilge: Curved area of the hull between top and bottom. Also used to describe the lowest part of interior where bilge water collects.

Breasthook: A horizontal knee fitted into the bow just below the deck which ties the bow together at deck level. Stem, port and starboard planking (shear strakes) likely to be fixed into it together with the stem and probably the beam shelves.

Bulkheads: Transverse separating partitions found between the salon and forepeak under the mast beam, the saloon and cockpit and at the back of the cockpit. They stiffen the structure by connecting the upper part of the structure such as the coach roof to the lower parts. They also tie in some of the principal transverse beams such as the mast beam, the cockpit floor beam, which is notched over two stingers and the principal deck beam at the back of the cockpit. They prevent the hull from twisting when heeled. Made with T & G on some of the early Stellas but later replaced in plywood as this is more rigid.

Butt (Joints): Where two planks or other members touch one another end to end rather than being lapped, halved or scarfed. So far as I am aware there should not be any in the main structural parts of a Stella.

Buttock Lines: See **Sections**

Carvel: Planking laid smooth. Does not apply to Stellas.

Carlin(e): A fore and aft timber which supports the edges of the coach roof and cockpit coamings just below deck level. Half beams to side decks are dovetailed into them and then cockpit and coach roof **coamings** (one piece of timber) are then screwed into the inside face).

Ceiling: An internal lining inside a hull which prevents things coming into contact with the planking. Not normally found on a Stella.

Caulking: In the case of a Stella a soft cotton packing forced into a small gap left between the edge of the rabbet (rebate) in the **backbone** and the planking. Is normally covered with a paying (caulking) compound such as putty to create a waterproof joint which allows for a small degree of movement between the planking and backbone as the timbers take up (absorb water).

Chain Plates: Metal plates for attaching the rigging to the hull. 2 P&S plus 1 or 2 at transom.

Clench: To rivet a nail over a rove to prevent it drawing out.

Clinker: A term used to describe the overlapping planking system used to join planks in Stellas and other boats. **Lapstrake** in USA.

Coaming: A vertical timber fitted to the inside face of the carlins at deck level. Designed to keep the water out. In the case of the Stella is one piece that makes up the sides of the coach roof and cockpit. Also at rear of cockpit and front of coach roof.

Companionway: Entry point between cockpit and saloon.

Crown: The (side to side) curve of an object, typically deck, coach roof or breasthook. Also sometimes referred to as **Camber.**

Deadwood: A triangular piece of timber which attaches the base of the sternpost into the back end of the wooden keel. Is fixed to keel by means of two rear keel bolts and to sternpost by rear floor bolt.

Fastenings: Any device for holding pieces of wood together.

Flare: The increase in beam from the turn in the bilge to the deck.

Faying Surfaces: The prepared surfaces where two parts will meet when they are ready to be glued or fastened together.

Floors: Side to side members which connect the backbone and the planking together. Nothing to do with salon or cockpit floor boards or their supports. Fixed with bolts to the wooden keel and planking screwed into it at the sides.

Garboard: The bottom plank which is screwed/nailed into the rabbet (rebate) set in the hog/wooden keel.

Gripfast Nail: A nail often bronze with barbed rings around the shank which greatly improved holding. Difficult to get out once put in without bringing timber with it. Sometimes referred to as **ringshank nails.**

Gudgeon: A metal rudder fitting fixed to the transom/rudder with a hole in it through which a rod or pin (pintel?) passes to connect the rudder to the transom.

Half beam: A short beam running under the side decks between the carlin and beam shelf. Normally dovetailed into the carlin.

Halve: Join two pieces of timber by cutting out part of each where the **faying surfaces** are parallel to the outside edges.

Hanging Knees: Vertical timbers with two arms and a curved shape which connect the principal beams to the adjacent ribs thus stiffening the structure preventing wracking/twisting between upper and lower parts. Will be found under principal beam at front of coach roof, by forward bulkhead at deck level and possibly at mast beam level (although not on Lys. Because of ply Bulkhead?). Also under principal deck beam at back of cockpit. Lodging knees are set horizontally and I do not think there are any apart from the quarter knees at the joint with the transom and those at the back of the cockpit coamings.

Heel: Bottom of mast or back end of keel.

Hood Ends: The joint where ends of the planks are screwed/ nailed into the rabbet (rebate) in the stem and sternpost fore and aft.

Hog: The wooden keel which is normally rebated to the upper edges to accept the garboard and its fastenings.

Joggle: Notch one part to fit the shape of another. Typical done to make floors, and bulkheads fit stepped shape of planking.

Keel: Main element of **Backbone.** See **Hog** & **Ballast Keel.**

Lands: The area, which is usually bevelled where two planks overlap.

Limber Holes: Holes or recesses at the bottom corner of the floors where they join the keel. Allows bilge water to drain down to (sump) pump. Need cleaning out periodically.

Mast Step: Metal box framed section bolted through coach roof above mast beam to accept heel of mast.

Moulds: Temporary patterns cut to the required section. Often refers to plywood panels set up at each station to establish the shape of the hull when a boat is being built.

Moulded: Particularly used in the USA to refer to the vertical depth of a piece of wood usually perpendicular to the planking or centre line. The opposite width is referred to as siding. Commonly found in specifications.

Plank: The timbers enclosing the outside skin of the hull. Sometimes referred to as **Strakes.**

Profile: Side view.

Quarter Knee: A curved piece of timber found P & S which joins the transom to the back end of the beam shelves just under the deck.

Rabbet (Rebate): A recessed area cut /planed out of a timber to accommodate another. Is often the depth of a plank so as to provide a smooth external surface. Typical in the backbone to accommodate the garboards and hood ends. The **Rabbet Line** is the bottom/ outside edge of the rabbet and will normally be shown as a dotted line on plans. Strangely recessed areas elsewhere are referred to as rebates in the normal manner.

Rake: The angle from the perpendicular at which a mast or transom is set.

Rivet: A copper nail beaten to form a head over a rove.

Rove: A cone shaped copper washer forced over the pointed end of a nail. The head of the nail is then beaten to form a rivet.

Rubbing Strake: A sacrificial D shaped piece of timber fixed to the outside skin (shear strake) of the boat at deck level to prevent damage to the planking when coming along side.

Rudder Cheeks: Pieces of timber glued/screwed/riveted to the section of the rudder blade above the waterline. They extend above the transom so as to form a slot into which the tiller can be fitted.

Sampson Post: Vertical timber post rising through fore deck which provides strong point to fit anchor cable and mooring lines.

Scantlings: Archaic word for the dimensions of the timbers going into a wooden boat.

Scarf: Two pieces of timber joined end to end using a long angled cut parallel to the run of the timber. Typically at least 1:8 or in the case of a mast 1:12. Provides large **faying surface** over which to apply glue. Sometimes has hooked steps in the joint (as upper scarf stem joint) where the two parts may be forced up against each other using folding wedges.

Sections: A cut through an object (the hull) as shown on the plans. Line plans show the hull from various views as if you had put the hull through a bread slicing machine. When referring to sections people are commonly referring to the cuts at the **stations**. i.e. blades of bread slicer set vertically at the stations and hull pushed through sideways. If the blades are still vertical and you push it through front to back you get the **Buttock Lines.** If the blades are set horizontally and it goes in sideways you get the **waterlines**.

Sheer: The line of the upper edge of the hull at deck level. On a Stella should be smooth sloping curve with no humps or bumps. **Absolutely critical to visual appearance of the boat.** Careful attention to detail needs to be paid to this when working on the sheer strake or refitting the rubbing strake.

Sheerstrake: The top plank/strake of the hull which defines the sheer.

Shrouds: Wire rigging attaching chain plates at side of hull to mast. Cap shroud and Lower P & S.

Spiling: Spiling is a method used for making patterns of curved or uneven surfaces such as planks. Particularly for measuring the changing width of planks at given points in relation to the adjacent plank or the keel. These measurements can be transferred onto a pattern or timber to be used for a plank using dividers. A **spiling batten** is fixed to the pattern/plank so that it can be bent to form a smooth line (curve) between the marked points. The batten must be sufficiently rigid but also flexible enough to take a smooth curve. Battens are sometimes referred to as **Ribbands.** The same technique is applied in a different format when cutting/joggling floors to match the planking. A pattern roughly fitting the inside edge of the planking is offered up and then a pencil on a small block of wood is run along the inside face of the planks to mark the shape of the planking on the pattern. albeit the distance of the block of wood above the actual planking.

Spreaders: Struts set out from the side of the mast to spread the angle at which the cap shroud meets the mast.

Stations: Vertical sections set perpendicular to the centreline at regular intervals. (12 on the Stella) Marked on the plan and conventionally numbers rise from right to left (Bow to stern). Normally the points at which moulds are set up when building a boat.

Stays: Wire rigging attaching mast to hull. Forestay & Backstay.

Stringer: A curved fore and aft timber laid in the turn of the bilge on top of the inside face of the ribs and riveted to them with copper nails. Shown as dotted line on plan. Stiffens the turn of the bilge and prevents twisting and wracking in the hull.

Tang: Metal fitting applied to mast to which rigging is attached.

Template: A pattern cut from thin plywood or cardboard which can be offered up before cutting/making the real object.

Tie Rod: A threaded metal (copper) rod used to connect two parts. The Stella's Construction plan shows 5 underneath each side deck connecting the beam shelves

and carlins. No evidence of these on Lys but presumably it was felt that the ply decks made the area sufficiently rigid.

Toe Rail: A timber moulding fixed through the deck to give crew a toe hold.

Transom: The flat upright part of the stern above the waterline.

Construction plan reproduced courtesy Homan & Pye. Additional markings JS.

February 2017 **John Sparks**, Shotley, Suffolk.