Gear for Gaffers - a series of articles appraising traditional rigs and rigging

Part 1 - Introduction and Bowsprit Arrangements

There are a number of good reasons for bringing traditional rigs and their associated fittings up to date, and for continuing to develop them. To start with, we use our boats differently from our predecessors in the sense that our sailing is constrained by the need to turn up to work at regular intervals, and the cost of marina berths or moorings. Secondly, the skills we deploy in using our boats tend to be different given the number of other boats, the ubiquitous auxiliary engine, the time we are able to devote to developing our skills and the restrictions naturally imposed by a family crew sailing for recreation. Thirdly, there is available to us a much better range of materials to consistent specifications, together with production and design techniques which allow new approaches to old problems to be tried. Finally, there is a developing aesthetic of what a "proper" boat should look like. All of this impacts on the design, usability, reliability and longevity of the equipment fitted to boats with traditional rigs.

Not that I'm proposing a revolution, you understand; rather the idea that it is more sensible to evolve traditional rigs on a continual basis than it is to preserve more or less quaint notions of traditional equipment and skills for their own sake. That is for museums and tourists. In embarking on this venture, it is vital to realise that the elemental forces which we encounter in a boat - the wind and waves - are the same now as they have ever been, and demand our respect. Also, please bear in mind that our predecessors were not fools. We discard their accumulated experience, as it appears in the design and construction of rigs, at our peril. Perhaps a little example will help to illuminate the approach. Some while back a colleague and myself spent some time looking at the design of mastbands, from the point of view of checking the way in which rigging loads are transmitted from the mast into the wire. So the kind of things of concern were the strength of the materials used, dimensions to suit standard fork or eye terminals, stress concentrations around holes, strengths of welds, the kind of frictional forces coming into play between the band and the mast, how cross-bolting could be used and a whole lot of similarly clever stuff. The results came out "about right"; in other words, the clever analysis had not shown that existing solutions are hopelessly over- or under-engineered, but generally adequate for the job in hand. If you think about it, that is how it should be, since the solutions have evolved on an empirical basis over decades. So the benefits of the analysis , other than re-inforcing a healthy respect for evolution, lay not in a fundamental re-design of existing equipment, but in the ability to gauge the adequacy of particular fittings (even if certification isn't here yet, it soon will be, and besides we live in an increasingly litigious world), the ability to transfer the approach to new materials (for example, carbon spars or titanium mastbands (!)), and the ability to help fill in some of the gaps in knowledge where accumulated knowledge has been lost (how would you rig a caravel?).

I'll also just mention a couple of self-imposed restrictions on this series of articles. I will be considering rigs for boats to which ordinary mortals can aspire, i.e. between 4m and 10m length on deck (say,13 to 33 feet), and be making the assumption that the main use of these boats is for cruising with a family or friends type crew. I'm not trying to put you off the occasional race - OGA style - but serious racers will tend to make a different set of assumptions in sorting out

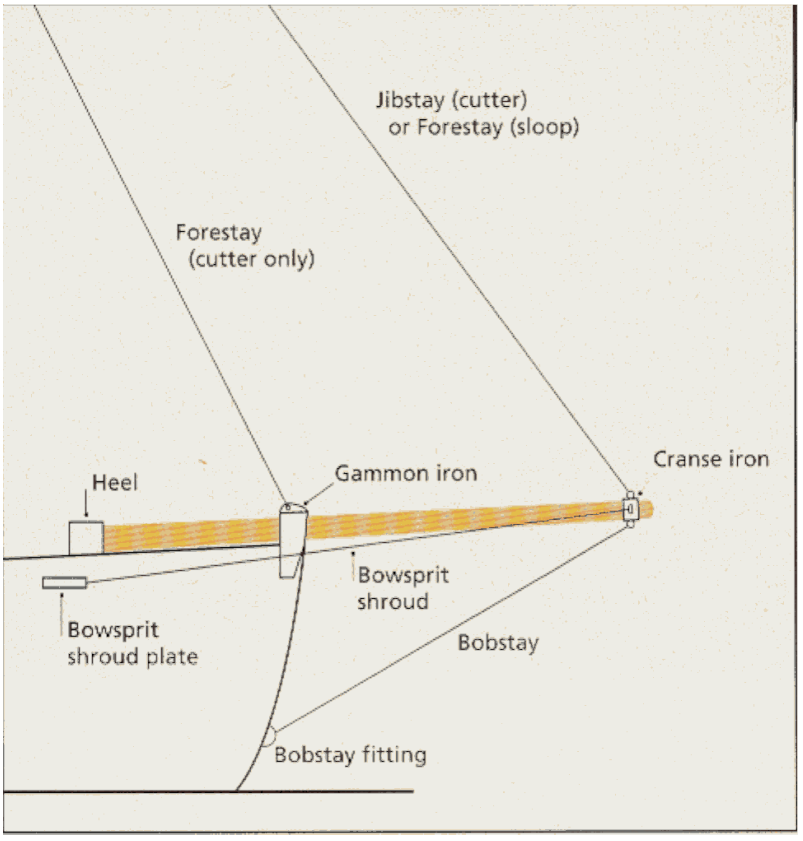
their rig.

Being a logical chap, I'll start at the bows and work around from there, so let's consider bowsprits.

Bowsprits

Bowsprits exist for a number of reasons. On a gaff cutter or sloop, there is a need to balance the large area of the main by a corresponding area forward. Generally, this cannot be accommodated within the confines of the hull, so the base for the sailplan is extended forward by means of a bowsprit. In the case of a cutter, the foresail area is divided between a staysail, usually set between the stemhead and the hounds, and a jib set between the bowsprit end and either the hounds or a point further up the mast. As conditions become more epic, the rig is brought inboard, the staysail balancing a reefed main. For yawls or ketches, the arguments alter a little, since two reefing options emerge; one is to balance a reefed main with a staysail as in a cutter, the other to balance the mizzen with the jib, having furled the main and staysail. For working boats this latter was a useful arrangement. Fishing boats could clear a large area amidships for working nets, and barges could load voluminous cargoes such as haystacks and still sail, even though seeing where they were going must have been fun. With the introduction of the Bermudan rig, the use of bowsprits reduced, not because they somehow fell from grace, but simply because they are not essential. This is because the centre of effort of a triangular mainsail necessarily moves forward - by dint of the geometry of the thing - thus allowing the foresail area to move aft to balance it. So bowsprits weren't a necessary feature.

Bowsprits, like masts, are structural members in compression, the sail loads on the cranse iron being transmitted to the bowsprit heel, where they are then taken into the hull. A principal feature of pole bowsprits - as opposed to plank bowsprits - is that they should not be subject to bending under normal conditions. Indeed, they should "float" within the gammon iron once the sail(s) are pulling. As in the case of a mast, this state of affairs is achieved by the use of stays: the bobstay running from cranse iron to a point on the stem somewhere around the water-line, and bowsprit shrouds from cranse iron to plates mounted at around deck level. Where the staying angles are small, usually when the bowsprit is long relative to the beam or the forward freeboard, then the equivalent of spreaders are fitted, referred to as the dolphin striker for the bobstay, and whiskers for the bowsprit shrouds. The picture shows the various bits.



Picture reproduced courtesy of Watercraft magazine

A bowsprit, then is a fine and necessary piece of kit for gaff-rigged craft. It is, however, a complete pain when it comes to mooring or berthing, since it causes either needless expense or congestion, and in extreme weather it is possible for a large wave to break the thing. Many brain cells have therefore been expended over many years in the quest for an easily reefed bowsprit. Two main options have emerged; raising the bowsprit by pivoting it about the heel, and bringing it inboard when not required. I've tried to summarise below the impact of both these options on the

Components affected by Different Bowsprit Reefing Methods		
	Lifting Bowsprit	**Reefing Bowsprit**
Gammon Iron - bowsprit off centre-line	Open topped or removable upper section	Can be enclosed, but needs enough clearance to allow withdrawal.
Gammon Iron - bowsprit on centre-line	Removable upper section incorporating forestay tang if forestay on centre-line, open topped if forestay off centreline	Can be enclosed incorporating forestay tang as necessary, but needs enough clearance to allow withdrawal.
Heel Fitting	Bitts or heel fitting incorporating pivot	Any fitting but if tenoned into samson post, all stays must be extendable to allow forward movement
Bowsprit shroud plate position	If athwart or aft of pivot point, shrouds will be self-tensioning once set up	To suit
Bobstay	Must be extendable	Must be extendable if heel tenoned into samson post; if not, can be fixed.
Bowsprit shrouds	Depending on position of bowsprit shroud plates, can be fixed	Must be extendable if heel tenoned into samson post; if not, can be fixed.
Reefing or Furling Gear?	Furling gear only	Furling gear only

arrangements of the various fittings.

What comes from all this lot?

The first point is that if you want to reef your bowsprit, you can't use reefing gear on your jib because of the rigidity of the extrusion, unless you have some means of disconnecting the jibstay. So you use furling gear, a jib set flying or a jib hanked to the jibstay. For a quick note on reefing gears versus furling gears, see the box.

Secondly, the forestay - i.e. the stay running from the stemhead to the hounds on a cutter - is a vital part of the rig. I think that it is unsatisfactory, from an engineering viewpoint, to attach it to the top of a gammon iron through which a bowsprit passes. Arches are great in compression, but not so good in tension. So if you must have your bowsprit on the centreline, you would be better off to mount the forestay tang off centre - it really won't make much difference to your performance, and if you want upwind performance, use a Bermudan rig - so it can pick up a stronger mounting beside the stemhead. Alternatively, you could use two forestays or a bridle attached to both sides of the stemhead.

And why are so many gammon irons closed over the bowsprit? As we've already mentioned, the bowsprit should

float in the gammon iron when under load. If you have the misfortune to have the bobstay slacken or part, the rig will still be powered up while the bowsprit is subject to bending - fixed at the heel and gammon iron, with a hefty pull upwards at the cranse iron. Exit one bowsprit. If, on the other hand, the bowsprit is free to rise, it will be stabilised athwartships by the bowsprit shrouds, and the rig will be de-powered almost instantly by the release of tension on the jibstay,peak halyards and mainsheet. The upper part of the mast, or topmast, may bend alarmingly, but there is a much better chance of saving the spars.

Finally, there is the question of the bowsprit stays. One of the themes that will run through this series of articles is the contention that simpler is better for today's style of sailing, so long as function is retained. This applies in spades to bowsprit stays, where having them all extendable leads to significant complications of ropes and tackles, with associated scope for stretch and/or failure - not to mention expense. I think it is well worth striving for an arrangement with the maximum number of stays "fixed", i.e. adjustable only over a short length.

So far, then, we have established the grounds for a detailed look at the loads on the various fittings associated with bowsprits, which I'll address in the next part. In the meantime, I'll re-iterate below a note on the difference between reefing and furling gears, which is the source of occasional confusion.

Reefing versus Furling Gears

Just in case you get confused, it is probably worth rehearsing the two generic approaches open to you for reducing headsail area. The first, and currently more common on modern rigs, is to use **reefing gear**, which allows you to vary the amount of sail set from the full sail to nothing depending on conditions. Almost all systems use an aluminium extrusion through which the forestay passes and into which the headsail boltrope is fed. The sail is reefed by turning the extrusion by means of a drum at its lower end. This arrangement means that whatever disaster befalls the reefing mechanism itself - and sometimes they jam or snarl up, there is still a stay supporting the mast.

Furling gears , on the other hand, adopt a different approach. They work on the basis of a top and bottom swivel attached directly to the head and tack (respectively) of the sail. Transmission of the torque from the lower swivel to the upper is done by means of the luff wire in the headsail. This has three implications. Firstly, if you are fitting a furling gear to a sail for the first time, it is not simply a question of removing the hanks and fitting the gear. Please check with a sailmaker that the luff wire is going to be stiff enough to work, because if it is not, the lower part of the sail will furl leaving a baggy mess higher up. In “demanding” conditions, this upper part will at best send you sideways, and at worst shred, so wrecking the sail. Which leads to the second implication, namely that you cannot - unless the luff wire is unmanageably stiff - obtain a consistent sail shape in a part-furled condition. So with furling gears, you get all the sail or none at all. Occasionally you will hear of a cunning scheme to allow furling gears to act as reefing gears by using a double luff wire or an extrusion or some such device. Don’t bother. Why not? Because with furling gears you don’t have a continuous stay supporting the mast as part of the gear itself. Instead you rely of the strength in tension of two bearings. Other than a simple snarl up of the furling line, the most common failure is in these bearings. If you use a furling gear you **must** have an independent stay to support the mast.