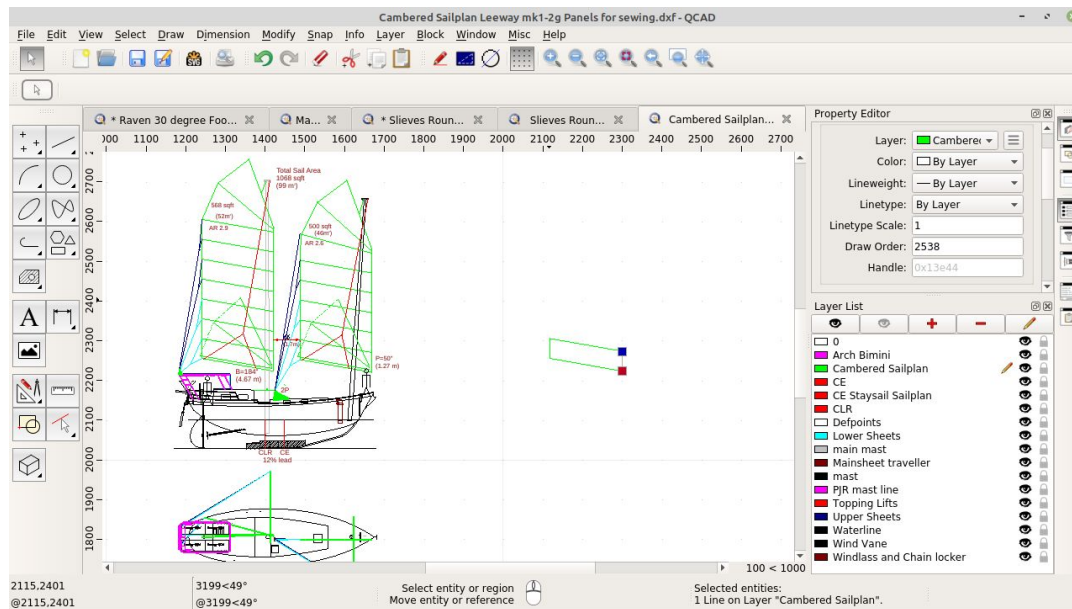
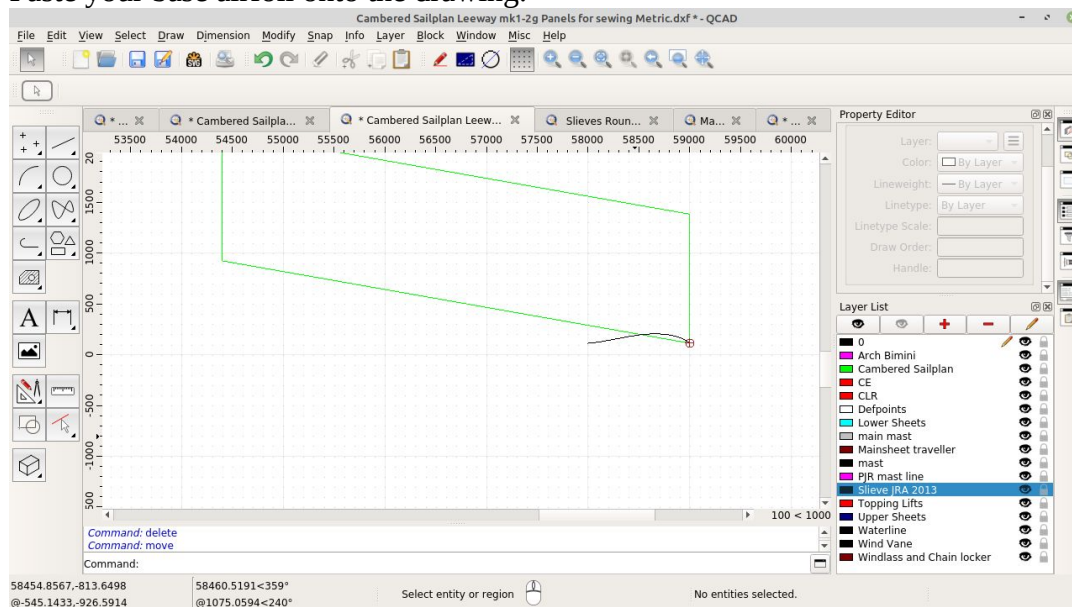


An idea for graphically making 30° shelf foot sails

Draw out your sailplan, either following PJR, Arne's instructions or something else. Decide what maximum camber you want in the lower panels. Arne uses the same camber for all the lower panels, some folks taper them. The upper panels have so little camber it makes sense to make them with just rounding as Arne does. Select one panel from the plan view (lowest front panel shown here). Slide it over using Move/Copy command.



Paste your base airfoil onto the drawing.



I used the airfoil Slieve provided in the JRA magazine (Feb 2013 JRA Issue 61). There, he provided it to calculate how much rounding you add to a barrel rounded panel, but if you use the maximum camber you want for your airfoil it plots an airfoil that seems as good as any without a wind tunnel to test with. It also has shape that thinks about how the actual sail will set when made with cloth that will stretch a

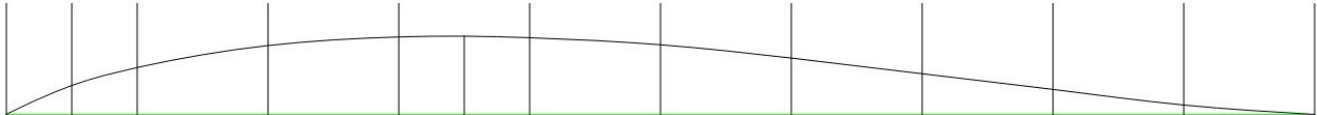
bit (notably it has a bit of reflex in the aft 40%). It is the same airfoil he describes in his book (Page 18, C and SJ P1-22 12-03-17c.pdf) found in his public folder on the JRA.

Slieve's percent of Camber figures

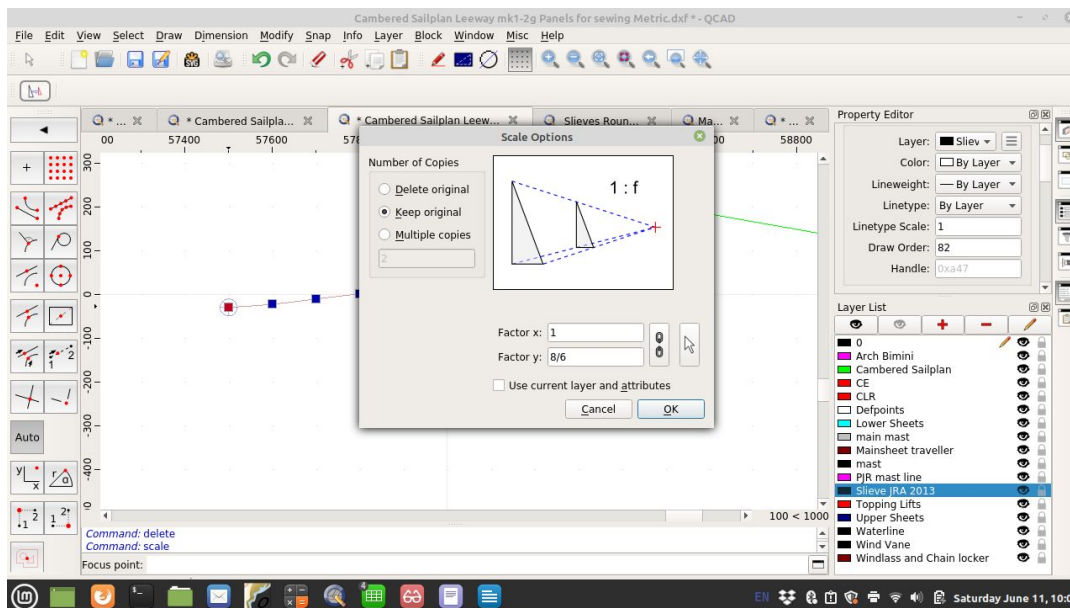
From Feb 2013 JRA Issue 61

X = % of Chord Y = % of Maximum round added to parallelogram

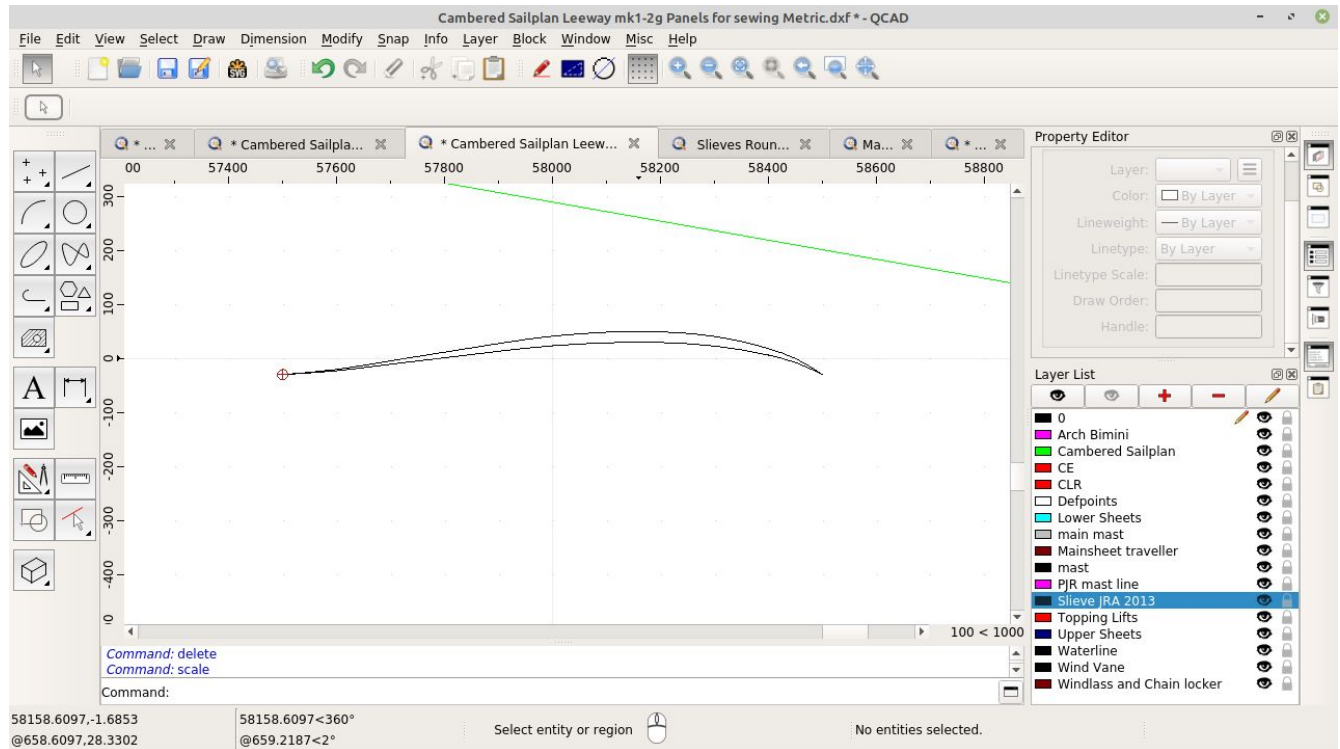
X %	Total Round	0	5	10	20	30	35	40	50	60	70	80	90	95	100
Y %		0	0.37	0.6	0.88	0.99	1	0.98	0.89	0.72	0.52	0.32	0.12	0.05	0



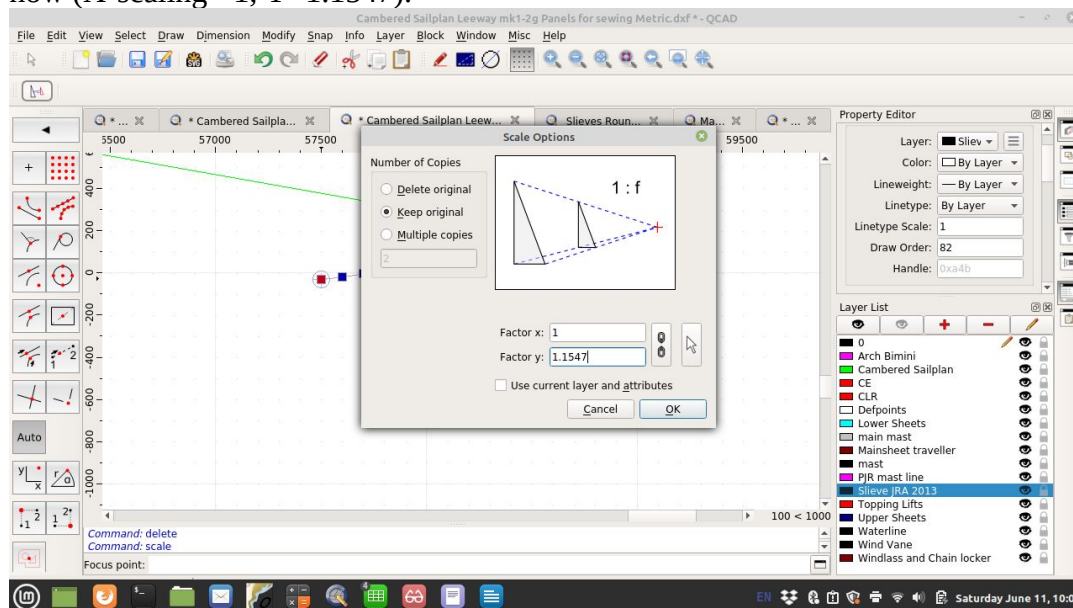
I have one base airfoil I'm using and I drew it to 6% camber (it's maximum thickness is 6% of its length from luff to leach). So, the first thing I needed to do for the lower panel was increase this to 8% camber. To do this use the Scale tool and scale only the y-axis by 8/6 (1.333).



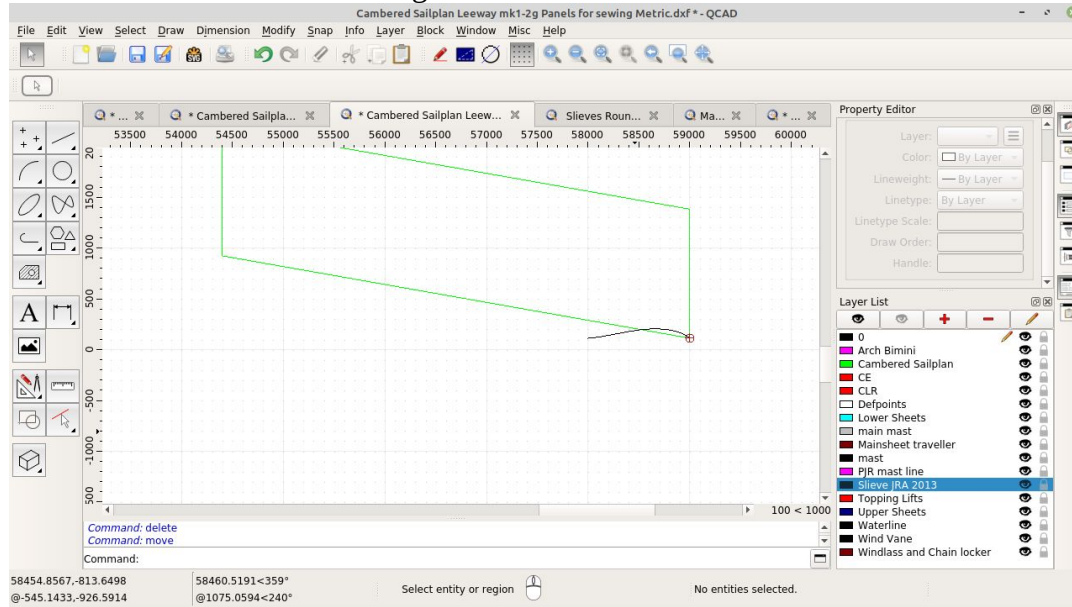
New 8% airfoil shown over the 6% below. Delete the 6% airfoil.



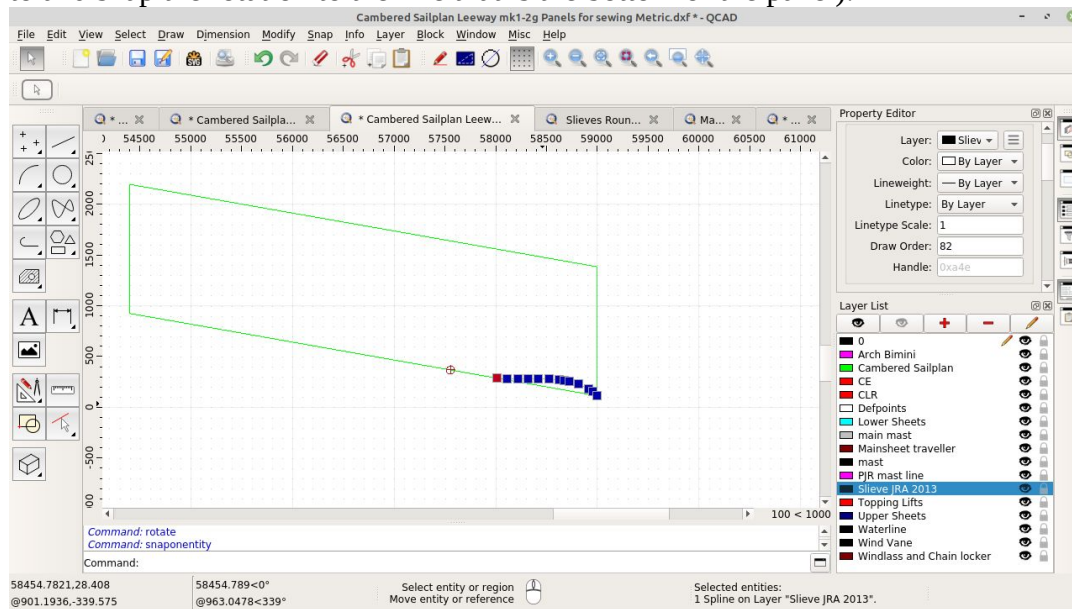
If you were using a horizontal (0°) foot shelf-foot, you could just use the above airfoil. However, since we're using a 30° shelf-foot the airfoil needs to be taller, as running at 30° it has to cover a longer distance than a straight line. You can work through the trigonometry if you like (given you know your camber height you can calculate the 30° shelf (hypotenuse) with $b/\cos a$), but I was really pleased to find out that it all reduces to just scaling the airfoil vertically by 1.1547 for a 30° shelf foot. So, do that now (X-scaling =1, Y=1.1547).



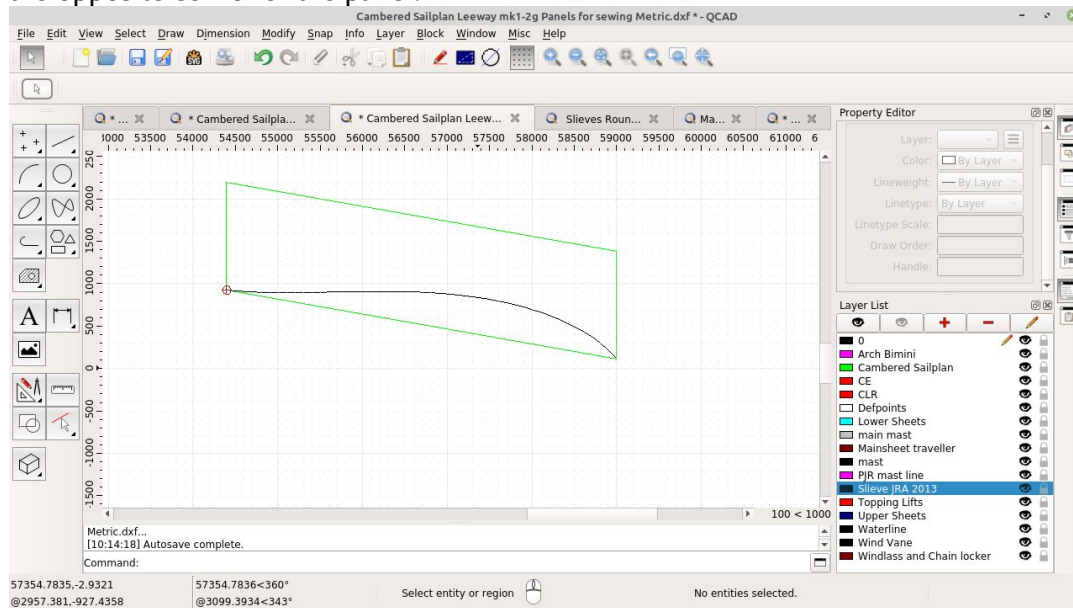
Use the move command to bring the forward end of the airfoil to the forward end of the panel.



Use the rotate command to align the bottom of the airfoil with the panel edge (use the arrow selection to and snap the rotation to the line that is the bottom of the panel).

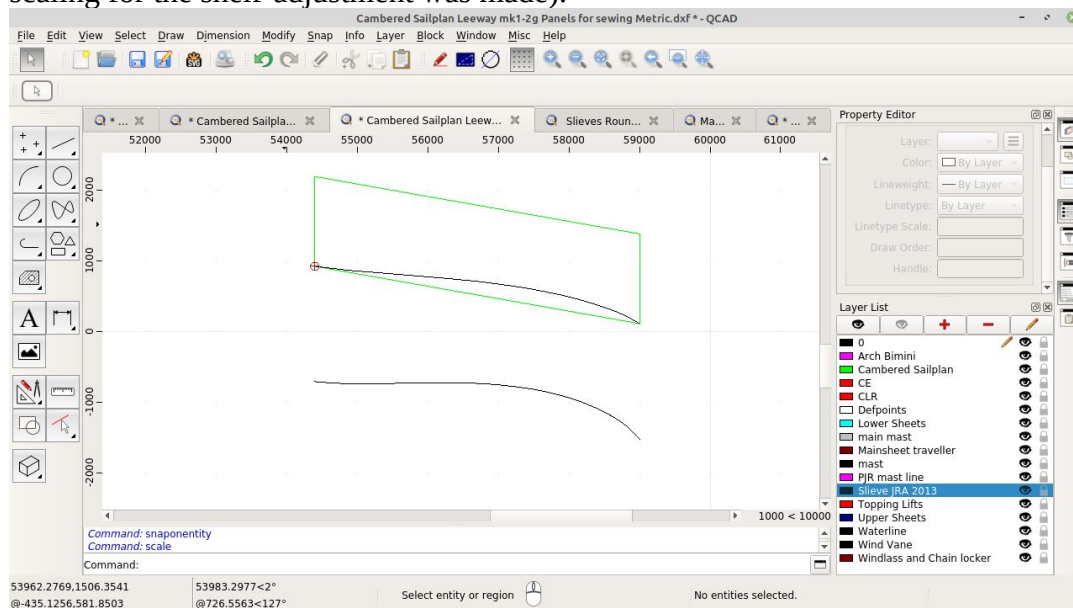


Now make the airfoil bottom the same length as the panel edge. Use Scale, use the front edge of the panel as your anchor point, and use the pointer (rather than specifying an value) to drag your airfoil to the opposite corner of the panel.

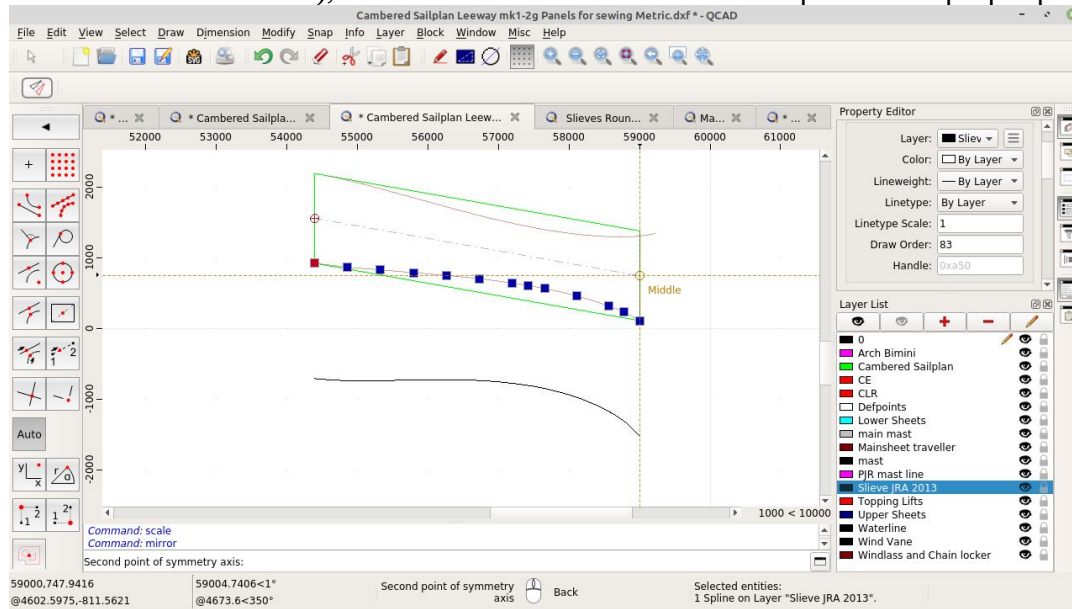


Now move your airfoil off the panel. You have just made a 30° shelf foot. Treat yourself to a snack and drink.

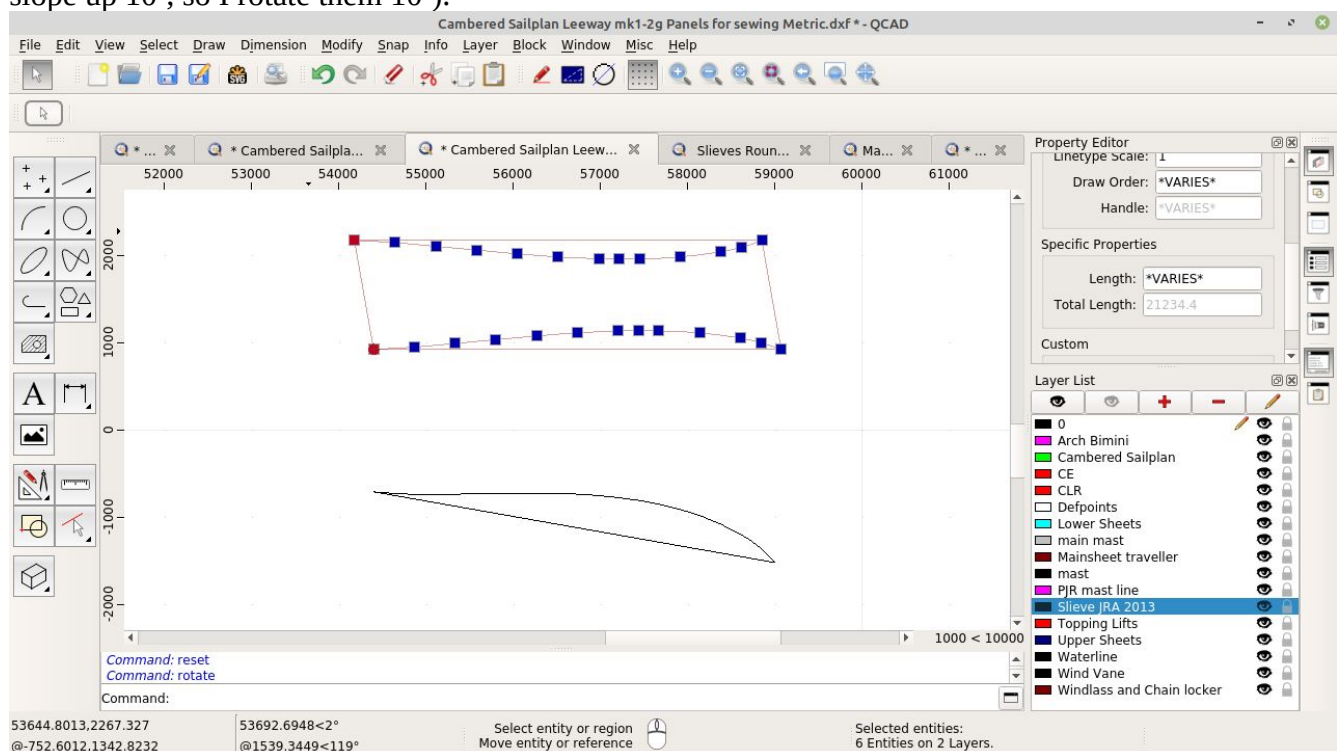
Next, because our shelf-foot is the shape of an airfoil our panel can't just be a parallelogram, it needs an airfoil shaped cut-out taken from its top and bottom sides where the shelf-foot will attach to. This can also be figured out with trigonometry ($a = \tan A(b)$, where b is the camber height of an airfoil for a given distance along the chord), but happily it also reduces to a simple ratio. Just take your base airfoil again, but this time scale it vertically by 0.5774. Now, we repeat all the above steps we did to make the shelf foot, but this time we'll end up with the shape we are going to remove from our parallelogram panel. Remember, these instructions have the airfoil horizontal (laid flat on the x-axis as shown in the above steps) for scaling. In the figure below the airfoil has been rotated and put onto the panel after the scaling for the shelf-adjustment was made).



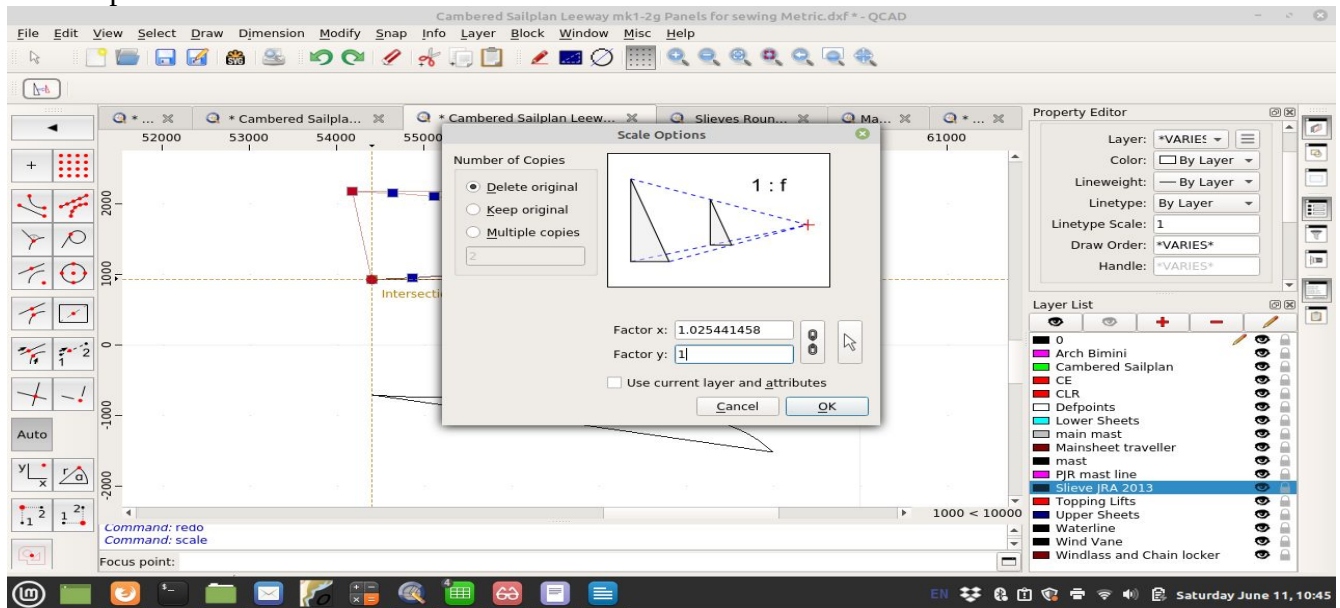
This time we also use the Mirror command to copy the airfoil to the top of the panel (mirror axis is middle of luff and leach), and then the Move command to snap it into its proper place in the corner.



We almost are finished, but our panel is a bit short from luff to leach now. The cloth of the panel has to cover the same distance as the curved surface of our shelf foot, since that is not a straight line, that distance is longer than the length of our panel. If you select the curved line of the shelf-foot and select the command Info > Total Length of Selection from the top menu. It gives you the total length of the top side of the airfoil (note, under View, you need Command Line turned on to easily see the result of Total Length of Selection). We need to stretch our panel so that it is this length along its upper and lower edge. To do this rotate the panel so the top and bottom are parallel with the x-axis (my panels slope up 10°, so I rotate them 10°).



The length of the top of my airfoil was 4793 and my panel length along the batten was 4674 so $4792.5/4673.6 = 1.025$. So, we now scale the panel in the x-axis only by 1.025. To finish rotate the panel back to its original angle (-10°), and you have now completed a panel and shelf foot for your 8% camber panel.



Now, you can delete the extra lines on the drawing and you have one completed panel and shelf foot. If most of your panels are the same you can just copy and/or mirror the parts as necessary. Drawing others of different camber does not take long after the first go.

