A Universal Propeller Blade Molding Jig G. Mansfield 3/31/2017

Figures 1 and 2 show application of a jig I designed & built about 10 years ago for molding prop blades of any P/D value and blade planform for diameters from 6.5 to 16 inches. Figures 3, 4 & 5 show front /rear views and a detail of the protractor angle setting for the bare jig. The protractors and support plates were made of 1/8" masonite, using a 5" diameter hole saw on a drill press. The sawed male and female circles were then cut in half along their diameters using a sharp Exacto (and a lot of elbow grease) to get a very narrow cut. CA was applied to the diameter cut faces to harden their surfaces. The female support plates were shimmed with cardboard, glued onto their inside circular surface, then waxed for a smooth, sliding fit to the outside diameters of the male protractor plates-see figure 4. The paper glue-on protractors were gotten by scaling and printing "free downloadable protractors" from the internet.

I made the central support "rod" assembly of 3/8-24 threaded lamp tubing with low profile nuts and large fender washers to clamp the rotationally adjustable protractors to their fixed support plates (see fig 3 & 4). Sandpaper washers (60 grit) under the washers on the back side of the protractors prevent slipping under molding loads. I use 10 protractor stations for prop diameters of 9 inches and above. Props as small as 6.5" can be molded using a seven-station setup. Any pitch profile can be accommodated (helical, washed out tip, etc) by adjusting the protractors to match your plot of desired pitch angle versus prop radius. Figures 9 &10 show helical pitch angles and protractor angles for any prop radius and desired P/D value.

When molding the props, I first lay down a 1/64" ply base plate of the desired blade shape, topped with a clay "camber layer". I made a set of constant radius sheet aluminum scrapers to “screed” off the clay camber layer to any desired camber radius. Over the finished clay, saran wrap is added as a release agent. Then the wet laminated prop blank is tightly rubber banded over the base plate/camber layer and onto the protractors, then allowed to dry. After finish sanding, the blade is completed by mounting a basswood-dowel spar with epoxy. In Figures 6 & 7 see the finished blades in adjustable pitch hubs: aluminum tube for small tissue-covered balsa props, and a stronger carbon tube version for large fiber-glassed props. These molded prop assemblies weigh about 35-40% less than standard plastic props.

Recently two of my engineering students designed and built a machined aluminum jig featuring screw adjustment of protractor angles. I use a digital angle gage for fine tuning the settings. See this jig in Figure 8. ***Note: My original Masonite jig is available for personal demonstration by me and for on-loan use anytime to interested local FAC flyers.*** **gmansfield75@gmail.com** Phone 858-453-3857

Figure 1 - Larrabee 12”diameter prop blade on jig

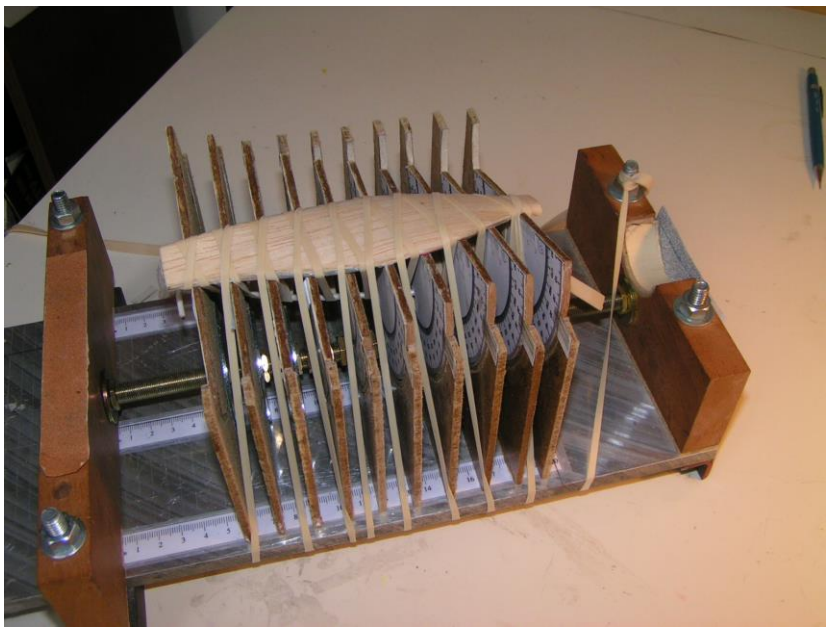

Figure 2 - Peck Profile 12” diameter prop blade on jig

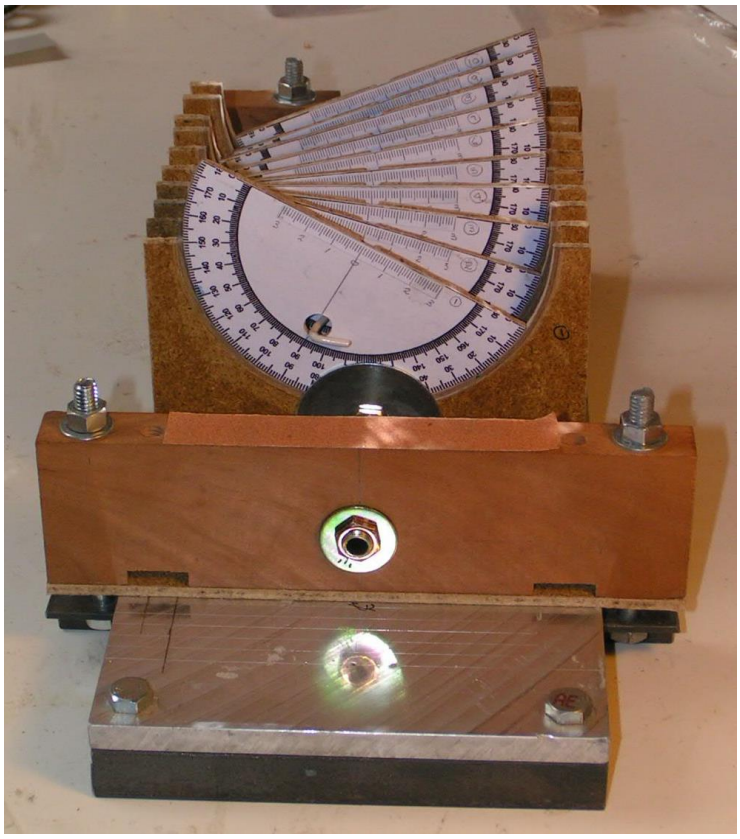

***Figure 3** – Jig Front View*

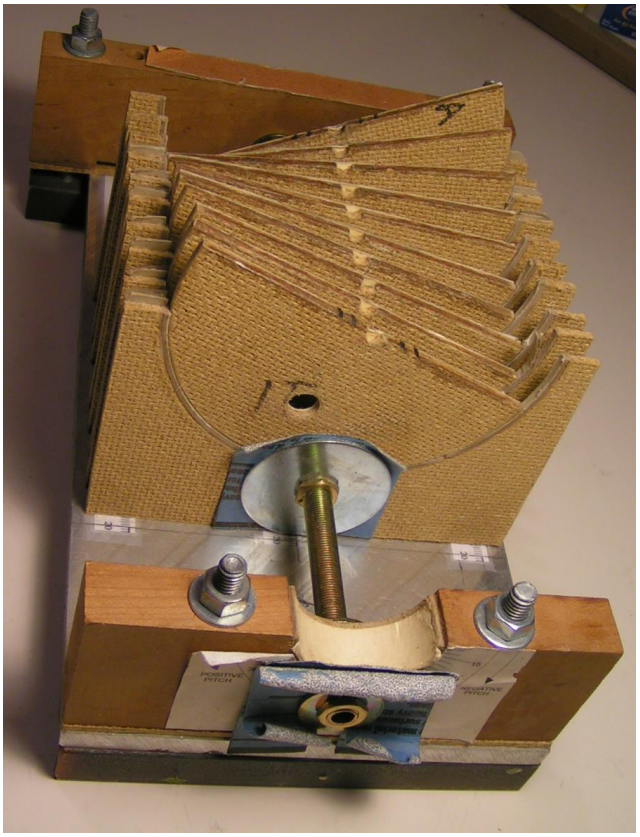

***Figure 4** – Jig Rear View*

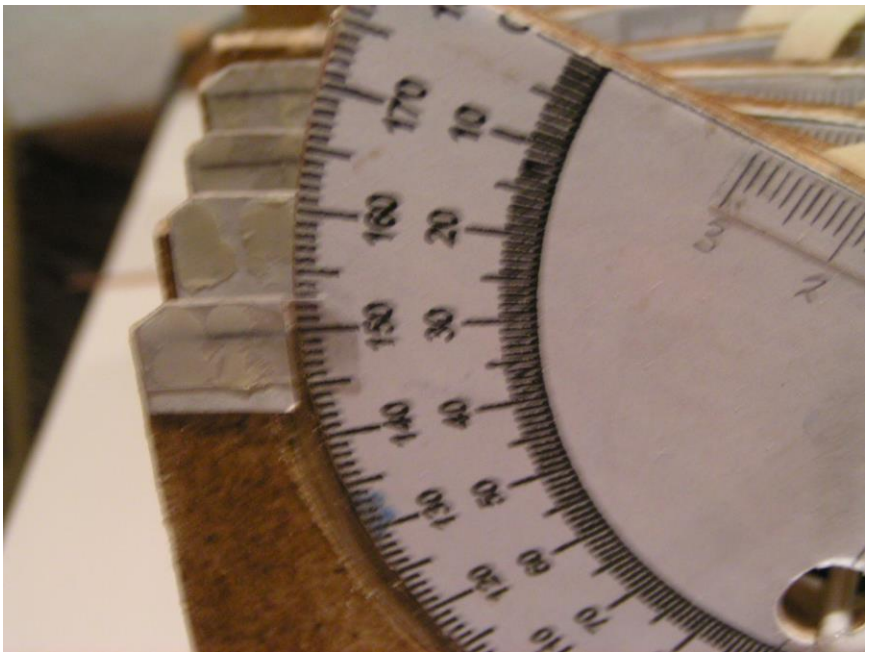

***Figure 5** – Detail of Protractor Readout*

***Figure 6** – 10" Molded Balsa Prop Assembly*

Weight Breakdown - Blades: 3.0 gm,
Hub: 1.0 gm, Gizmo Geezer: 2.42 gm
Total weight = 6.42 gm

***Figure 7** – 12" Fiber-glassed Balsa Prop Assembly*

Weight Breakdown - Blades: 5.85 gm,
Hub: 1.4 gm, Ruggedized G. Geezer: 2.83 gm
Total weight = 10.08 gm
Total weight with crocket hook = 10.87 gm

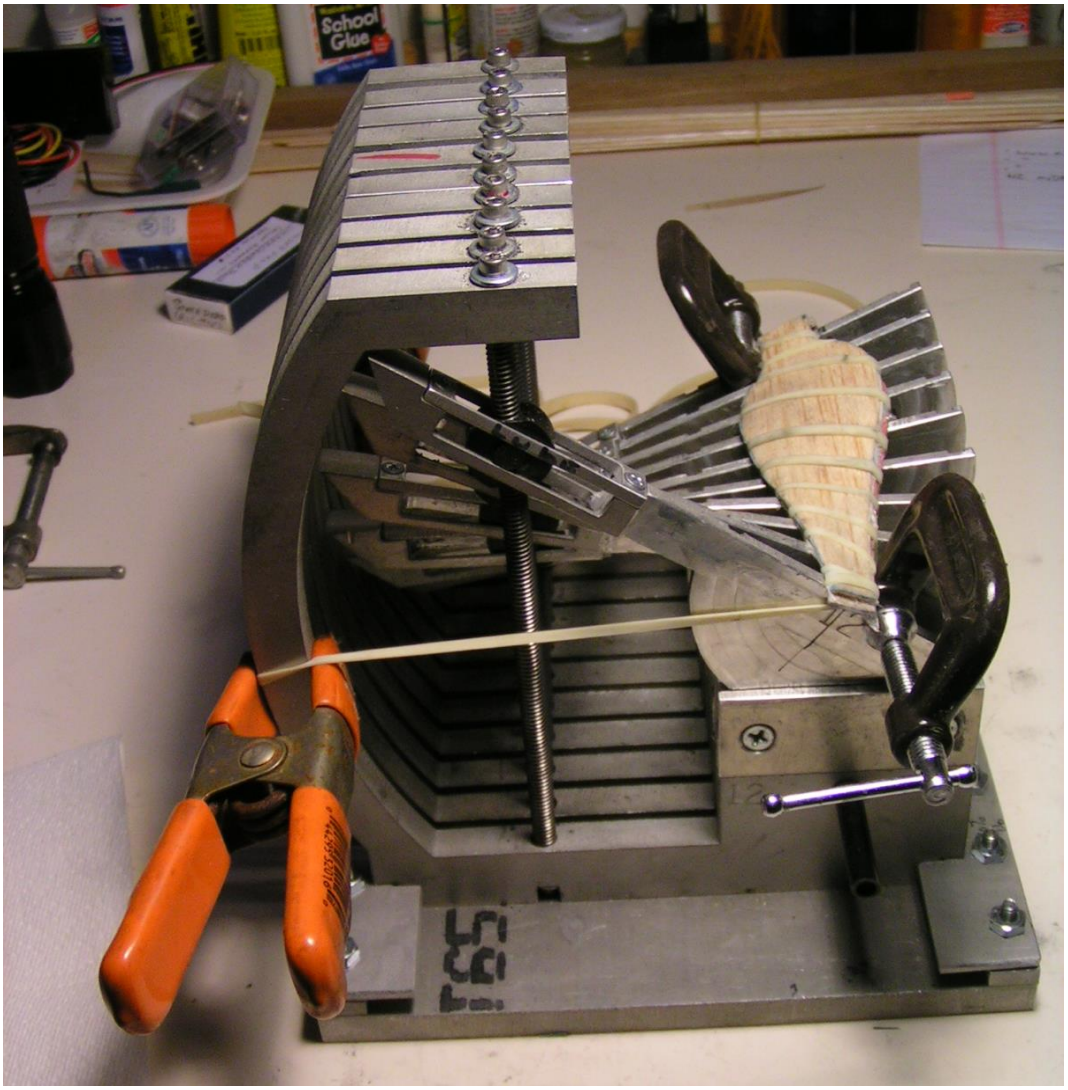

***Figure 8** – Machined Prop Molding Jig in Use*

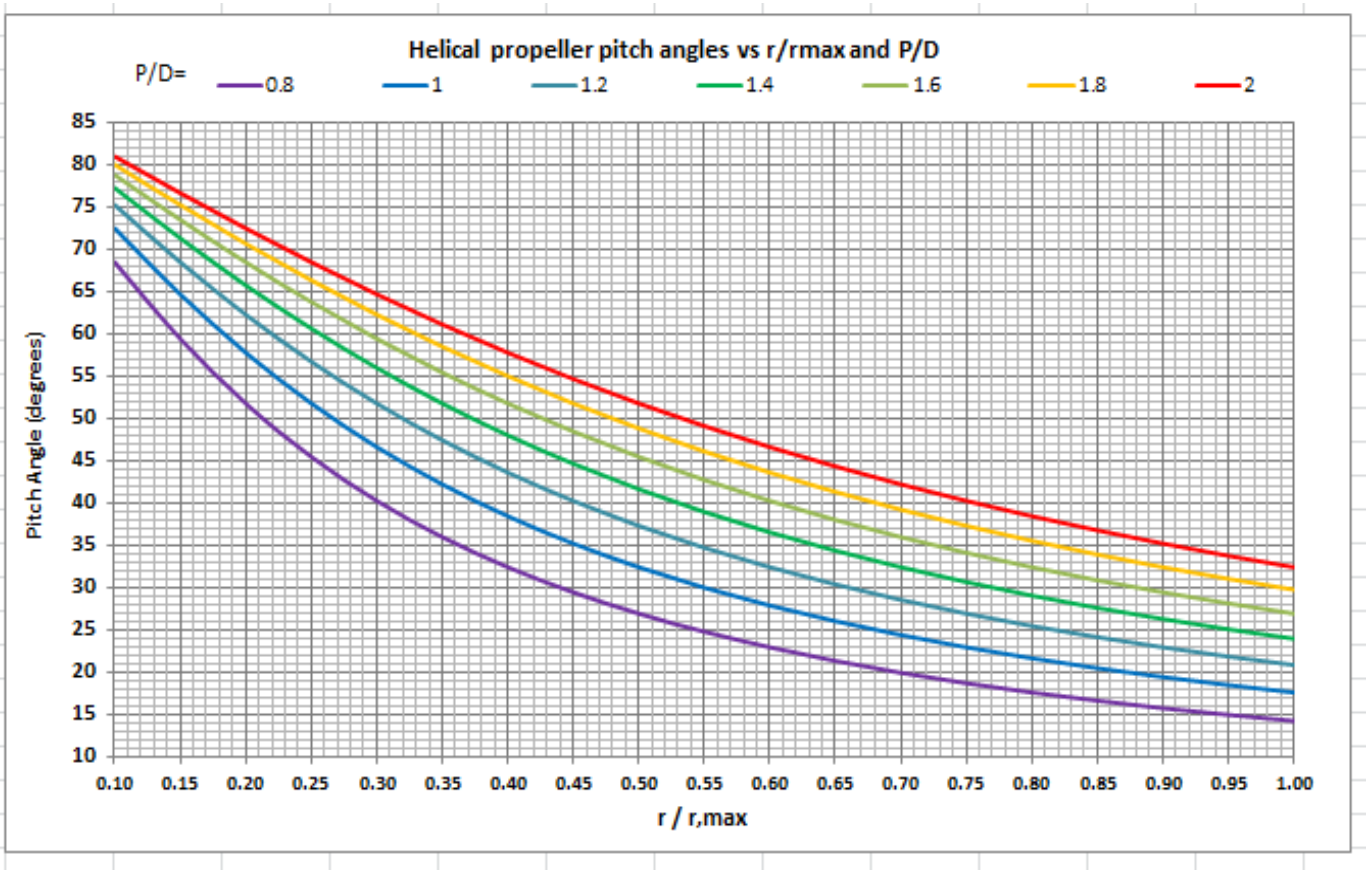

***Figure 9* – Plot of Helical Propeller Pitch Angle vs Radius and P/D**

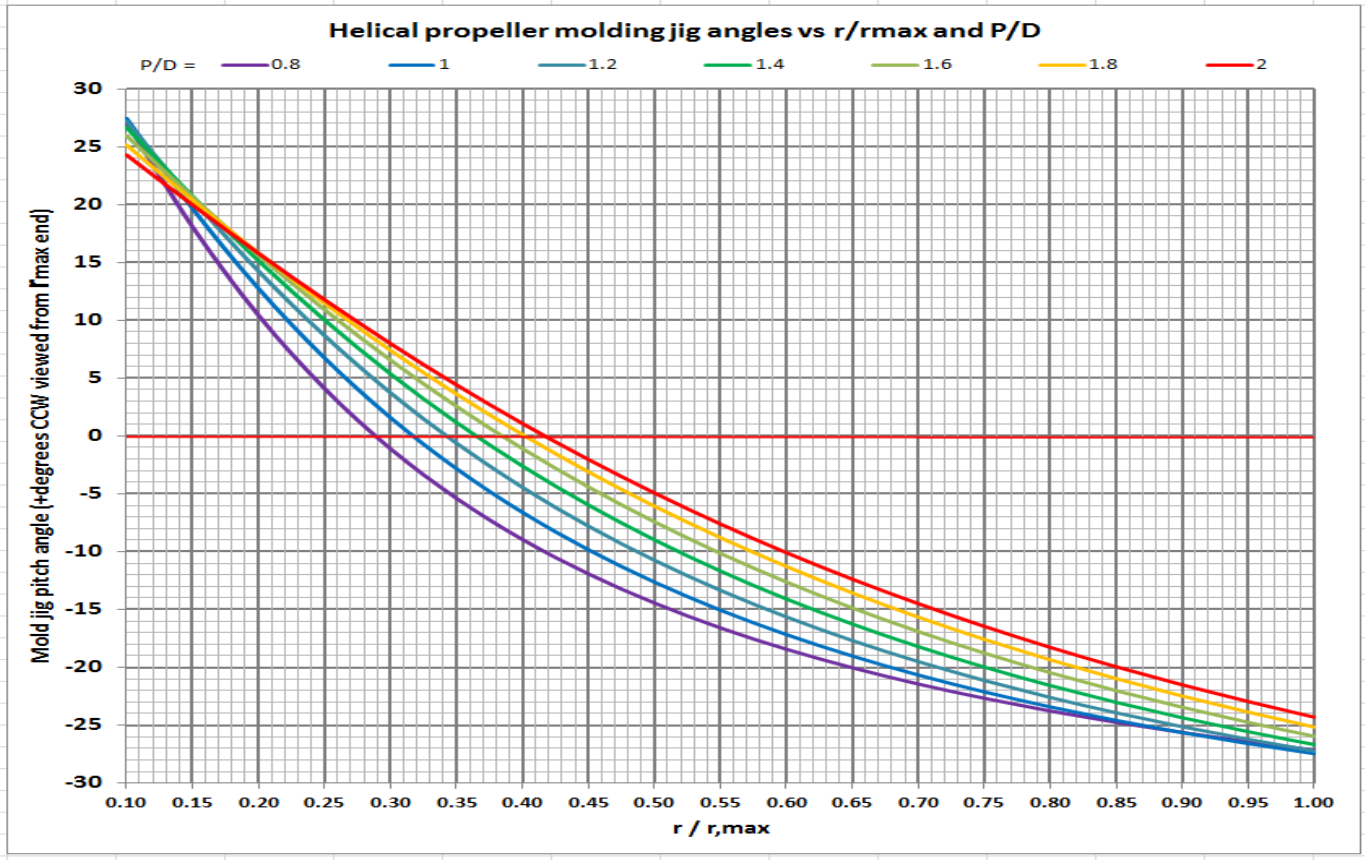

***Figure 10* – Plot of Helical Propeller Molding Jig Angle vs Radius and P/D**