

To: Dr. Willy

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Re: *Prototype summary*

Introduction

In this document the team is going to outline what we prototype how it turned out and what knowledge we gained. This will assist us in the future as we do more assembly.

Knowledge gained

The prototype that we presented in class is of a wing design that will include spars and ribs. This prototype was useful to the team for a few reasons. One very important thing is that our team has never used a laser cutter before and due to this we have zero experience on a machine like this. Because we are all novices there were errors that were made of course, but the errors are all lessons for the next time we need to use the laser cutter. One major error is we wanted more of a slip fit between the ribs and the spars. This turned out to not be as tight as we had wanted. The parts were cut to the same nominal size, due to this we thought the parts would fit tightly together. We neglected to take into account the kerf of the laser when making these parts. The ribs have a $3/8$ inch width seen in figure 1 and this is accurate from the design however the spars have a width of $11/32$ which means there is $1/32$ of an inch of play.

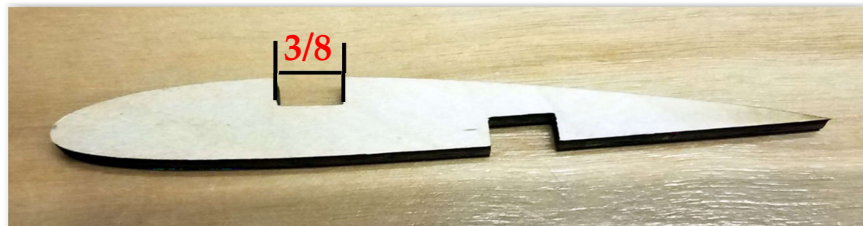


Figure 1: Rib with dimensions

While this sounds small this is actually quite big for the design as the parts can be off by an angle of 10 or more degrees. In the image below it illustrates the possible angle of deflection. While we tried to straighten everything back up as we did the glue up there was much more deflection during the dry fitting prior to fixing the ribs to the spars.

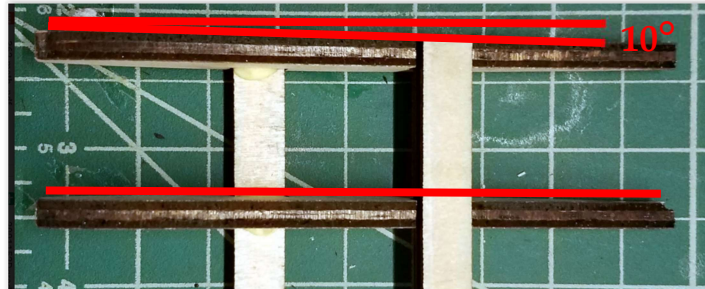


Figure 2: Ribs and spar diagram

Another thing that was interesting was the ribs were not cut out fully. That the leading edge the laser did not cut this can be seen in figure 3. Not sure the reason of this at this time but something to look into for the future. The aileron parts however cut out cleanly with no issues.



Figure 3: Leading edge not cut

It was also amazing how fast the parts cut out, we did not optimize the laser but it cut out in a little under 8 minutes. In the image below, the time is a little over 3 minutes. We had to do 2 passes to be able to get the parts fully cut out. This is why there is a discrepancy in the time.

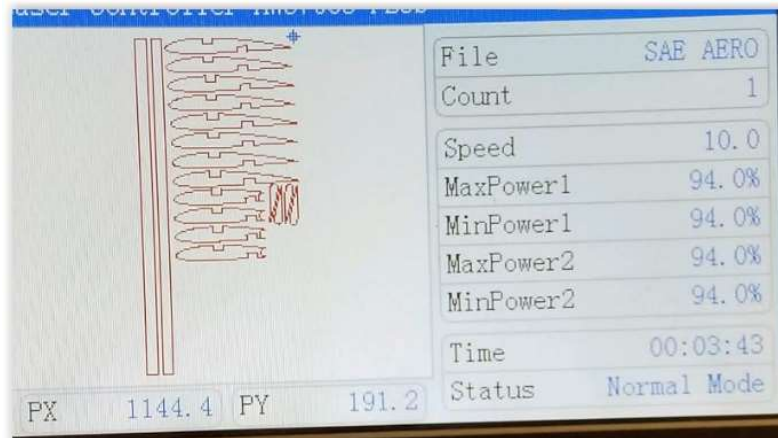


Figure 4: Laser cutter display

Here is an image of the assembly to give a better idea of what the design looks like right now.

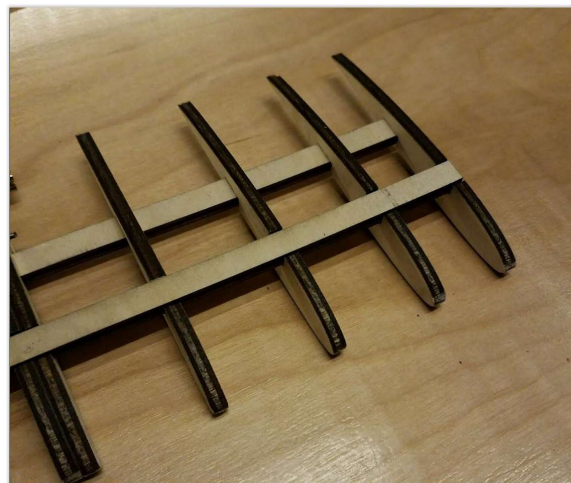


Figure 5: Design of the wing

Another thing that we learned is who the right people are to get in contact with to get access the laser cutter. This alone was almost harder than cutting the parts out or using Solidworks. The good news is we have the right channels to be able to get stuff done in the next semester.

Conclusion

All in all, this was a good project and were glad we finally got access to the laser cutter. We look forward to next semester being able to use it more and be able to make a plane that can fly.

Appendix – Extra photos

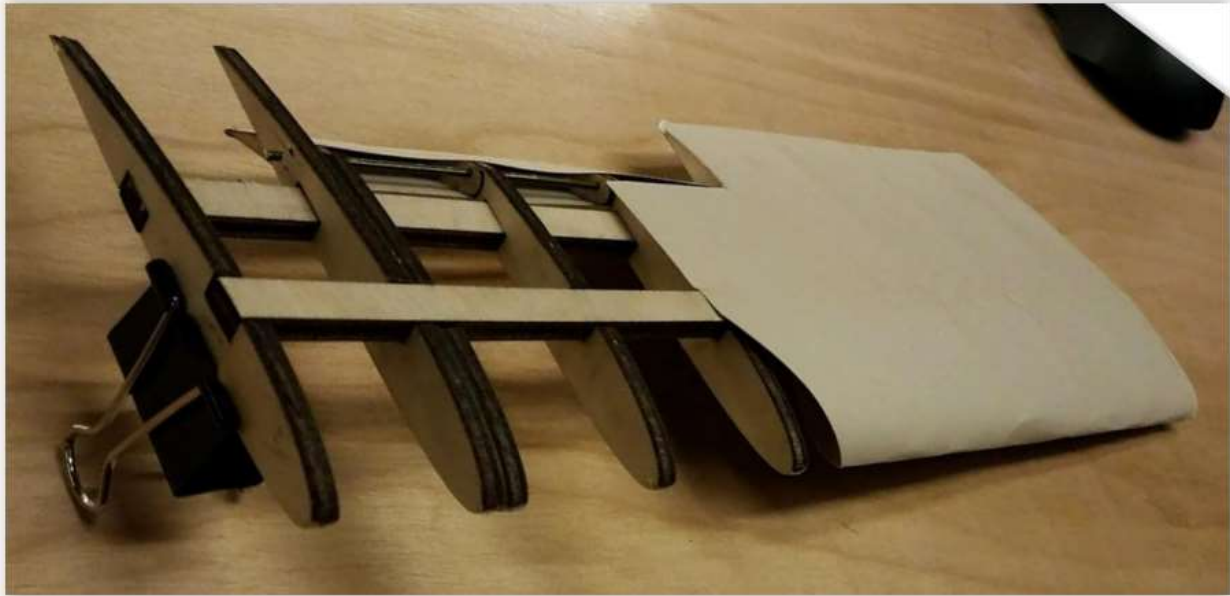


Figure A1: Skin and wing assembly



Figure A2: Airfoil 2412 with skin



Figure A3: Flaps down on wing