CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38758

Project Title

The Effect of a Wing's Winglet Length on Its Lift

Abstract

Objectives/Goals

My objective is to learn how the length of a winglet changes a wing's amount of lift. For this experiment, the hypothesis is that the wing with a winglet of 5 cm creates the most lift.

Methods/Materials

Materials

Box, Jump house pump, Hotwire cutter, EPP Foam, Balsa, Scale, Wooden Dowel

Materials

hot wire cutter was created, using red oak wood, galvanized steel wire of 24 gauge, a lithium polymer battery for power, springs, and finally alligator clips to wire everything together.

A wing was created, using insulation foam, and a template of an airfoil, which allowed the hot wire cutter to slice through the foam following the template giving a smooth, and accurate airfoil.

A wind tunnel was created, using a long box with 2 openings, and paper tubes, in order to smooth out the air for more accurate results, and a wooden dowel, which attached the wing to the scale.

Testing was done, by zeroing out the scale, aligning the bounce house pump at the entrance turning it on and recording the measurement given by the scale in grams.

Results

As can be seen by this data (Figure A and Figure B) it shows that changing the length of the winglet does dramatically affect the lift. In figure 1 the graph shows that the standalone wing without a winglet produces about 172.6 +/-3% grams of lift. However the wing that used a winglet of 5cm resulted in producing 184.3 +/-2.5% grams of lift. This shows about a 12 gram increase of lift from the standalone wing. But the winglets that were 7.5 cm to 10cm, showed a very large drop in lift, with the 7.5 cm winglet only producing about 115.6 +/-6% grams of lift and the 10 cm winglet producing a sligh more at 121.7 +/-6% grams of lift. However as, the winglet length exceeded 7.5 cm there was a very large deviation compared to the winglets under 5cm. The trend in this graph shows that a winglet about 5cm has the most lift, but as the winglet length starts increasing it loses a lot of lift.

Conclusions/Discussion

The data ultimately proves that a winglet that is 5 inches or half the size of the wingspan does produce the most lift. This shows that it is the most energy efficient, with lightweight. However, this can't be implemented on full-sized airliners since a winglet that is half the size of the wingspan would be unpractical and would not work. I accomplished the fact of finding the best point of lift, and energy efficiency in a small scale model wing.

Summary Statement

How does the length of a wiglet compared to the wing size affect the overall lift of the wing.

Help Received

Trausti, Dworzak