CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
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Project Number
J0117

Project Title
Wow! The Wonders of Winglets!

Abstract

Objectives/Goals
Does adding winglets to a Boeing 757 reduce it's wake vortex? I think that adding winglets will reduce the wake vortex of the 757.

Methods/Materials
Materials: Dry ice, cooler, paper, 6in diameter, 3ft long plastic tube, styrofoam, assortment of wood files, styrofoam putty, fan, ruler, writing utensils, digital camera, tuna can, hot water, turkey baster, black paper, screen, duct tape, light, container for cold water, clock, tongs, and gloves. Building a Wind Tunnel: Obtain a six-inch diameter plastic tube three feet long; make a base for the tube by hollowing out Styrofoam; place screen inside of tube; get measuring tape or paper with cm marked on it and tape it to the outside; tape large piece of black paper to the outside of one side of the wind tunnel; place your fan 41 cm away from the tunnel. Get a piece of Styrofoam; draw your wing design on it; use design in Image A. Cut out the design not on your lines but make your design a little larger than you want it to be. Use wood files to file the Styrofoam to the shape in Image B. After shaping the wing, cover the wing with putty to make Styrofoam not porous. Testing: Place the wing inside of the wind tunnel using double sided tape. Place dry ice in tuna can full of hot water so that it starts to vaporize. Continually remove the cold water from the tin with a turkey baster and replace it with hot water. Turn on wind tunnel and observe. Count the number of visible vortices (swirls) during 30-second intervals. Repeat six times without and with the winglet.

Results
With Winglet: Once turbulence starts the winglet breaks apart the disturbance creating a less turbulent air stream. No noticeable vortex. Airflow was more laminar after the wing. Noticeable breaking of turbulence. Winglet cut disturbances, waves became flat and air was much less turbulent after wing remained smooth for 23 cm or until end of tunnel. observations Without Winglet: Vortex is noticeable in short bursts, some are larger than others are. Without Winglet: Turbulence was slightly increased after wing for 5 cm. Without Winglet: End was less laminar than with winglet. Edge of wing swirled and was turbulent. Near the tip there is more vortex.

Conclusions/Discussion
Winglets reduce the drag and wake vortex of a Boeing 757 wing. Without the winglet there were as many as 14 vortices per minute any of these could be fatal.

Summary Statement
Does adding winglets to a Boeing 757 reduce it's wake vortex?

Help Received
Eric Fujishin helped with dry ice, Janice Rourke helped with photos, karen perry helped with cutting pictures.