



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) James W. Whiting	Project Number J0123 34989
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Project Title
Falling Out of the Sky in a Plane: The Stalling Characteristics of Aircraft

Abstract

Objectives/Goals
The purpose of this scientific experiment was to answer the following question:
"How do Engine Power, Angle of Attack (AOA) and Wing Shape affect the stalling characteristics of an aircraft?#
Research indicates that if the Engine Power is too low, the AOA is too high and the Wing Shape is not suitable for flight then the wing will stop producing Lift to support the weight of the aircraft and it will STALL.

Methods/Materials
The experiment was conducted in a single engine, propeller-driven aircraft. The aircraft was flown level at 6,000 feet at different Engine Power and wing flap settings and put into a controlled Stall. The speed of the aircraft was reduced and the AOA increased to increase Lift and maintain a constant altitude. The increasing AOA was measured at 10 mph intervals until the aircraft stalled using an AOA protractor built for the experiment. A total of 46 test runs were completed with Engine Power settings of 80%, 60%, 40% (Power ON) and 0% (Power OFF) and wing flaps set Up and Inter.

Results
Overall, the test results indicated that AOA increased in a straight-line as air speed of the aircraft reduced through to the point of Stall to maintain Lift and, therefore, altitude. The effect of Inter flap reduced the starting speed of each test run by approximately 4m/s due to increased Drag. Stall speed also reduced by 1-2m/s with Inter flap due to increased Lift. However, the Stall speed of the aircraft was consistently in the narrow range of 26-28m/s due to the design parameters of the wing. It was also possible to increase the AOA by 1-2 degrees with Inter flap at the point of Stall also due to the increased Lift.

Conclusions/Discussion
The results generally supported the hypothesis # higher AOA was possible at higher Engine Power settings, wing shape was found to affect Lift and higher AOA increased Lift at lower speeds. An error was discovered during the Power Off Stall as the pendulum of the AOA protractor was affected by the rapid deceleration of the aircraft which could be improved by the use of a counterweight. Further improvements in future experiments would be to use lower flap settings to vary wing shape and to try to directly examine airflow over the wing possibly by using an array of pitot tubes.

Summary Statement
To understand how Engine Power, Angle of Attack and Wing shape affect the stalling characteristics of an aircraft.

Help Received
Experiment conducted in Father's aircraft who acted as a safety pilot.