The Determination of Aerodynamic Degeneration of Aircraft Design Characteristics Necessitated by the Amalgamation of Stealth Aircraft Design Constraints

Lee, Andrew

Paulmeier, Decker

The purpose of this study is to investigate the effects of stealth aircraft design constraints on the aerodynamic performance and mission capabilities of an aircraft. It is hypothesized if ordinary fighter aircraft are compared to stealth fighter aircraft than the ordinary aircraft would have superior aerodynamic performance.To investigate, a subsonic open return wind tunnel was created to compare stealth and ordinary aircraft. 1:100th scale models of the most prominent air-superiority stealth fighter jets as well as the most prominent air-superiority fighter jet were tested. To measure drag force, the model was held in place by a single strut support on a friction less sled attached to a spring scale.The experiment consisted of 50 trials for each aircraft.The final results showed that the F-22 had the lowest amount of drag force produced, and in order it was followed by the F-15, PAK-FA, and J-20. After analyzing the initial experiment it was found that three variables needed to be addressed. The variables were no proof of laminar flow in the wind tunnel, variable measurement of aircraft drag force, and a large standard deviation of data. A new properly proportioned subsonic open return wind tunnel was created for new testing. To show proof of laminar flow, a flow visualization system was created to visualize the airflow. In order to have more precise drag force measurement a sting mount that contained a load cell was used. 100 trials were conducted and the results were similar to the initial experiment and the standards of deviation were nearly identical. The final results of both experiments disproved the initial hypothesis and showed that an aircraft can be designed under stealth aircraft design constraints and still maintain aerodynamic performance.