A Mathematical Analysis of the Wright Brother's Wind Tunnel Tests

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The purpose of the investigation was to perform a mathematical analysis of the Wright Brother’s intellectual process of identifying and analyzing the problems of flight that led to the success of the first manned flight. Through mathematical and physical analysis of the wind tunnel tests, the ingenuity of the intellectual advancement that led to the success of manned flight was identified. Replicas of the original Wright Brother’s wind tunnel and lift and drag balances were constructed in conjunction with a series of brass airfoils fabricated to the exact dimensions of the Wright Brothers'. The lift and drag balances became the key to manned flight and were produced to determine the coefficients of lift and drag and the lift to drag ratio of an airfoil at a given angle of attack. Coefficients of lift and drag represent coefficients of performance of an airfoil of a specific shape and are respectively the factors of the equations for the force of lift and drag produced on a wing. Through a mathematical equation derived from data produced from the lift and drag balances, an optimal wing with the highest lift to drag ratio can be identified. Through torque analysis of the balances, a mathematical relationship was determined to derive the coefficients of lift and drag and the lift to drag ratio of an airfoil. The data produced from the reproductions of the Wright Brother’s wind tunnel experiments was then compared to the data produced by the Wright Brothers original wind tunnel experiments and a near-exact correlation was found. The results were analyzed to determine the effects of the three factors (aspect ratio, camber, wing shape) of wing construction. The analysis led to the selection of an airfoil that was most efficient and produced the highest force of lift.

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