
The Development of a Tactical Fighter

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The objective of this project is the development of a tactical fighter from a need for a better air weapon. This includes ideas, plans, testing, and final evaluation of the proposed craft. The first idea presented to the engineer is the need of a more advanced fighter, with certain requirements that have to be met. The hypothetical craft, JK-7 (Figure I), is a twin engine, single seat, tactical fighter with intended speeds of Mach 2-3. It is a purely offensive weapon with the ability to handle all of the proposed requirements. The ideas of this project will relate to theory, practicality, usefulness, research, and evaluation of the JK-7, through the knowledge and experimentation in the field of aeronautical engineering science.

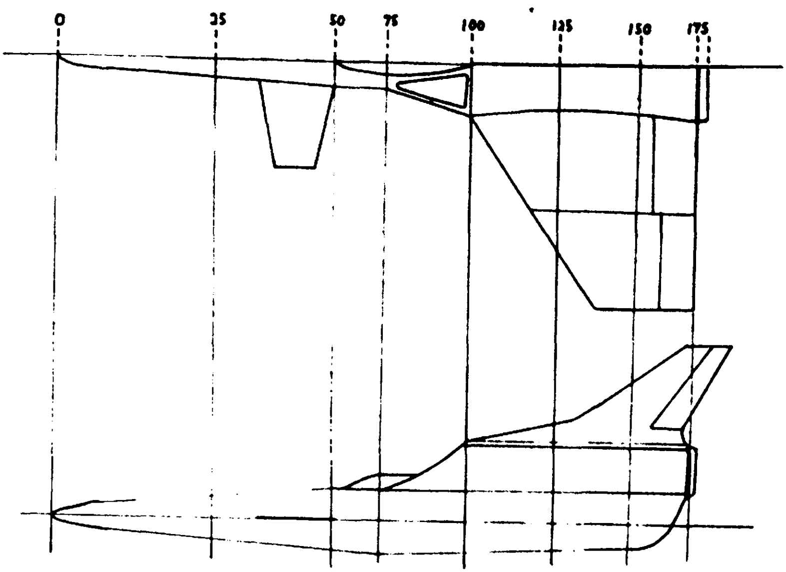

Figure I. General plans of the JK-7 proposed tactical fighter

METHODS

Testing was done in the wind-tunnel test section, Figure II. This section was designed and built as a part of the project. The tunnel is 102 × 11 × 11 inches and is equipped with a 4,000 rpm, variable-speed, electric motor. The speeds were controlled by a motor rheostat. The lift and drag models were mounted in a harness attached to a trapeze linked to a balance system outside the tunnel. The harness and trapeze were designed and constructed to produce minimal drag in the tunnel. The models were mounted inverted so that lift and drag forces would be down and rearward force vectors. The drag meter was a bell-crank lever attached to a scale that recorded the rearward movement of the model, drag, and measured the force in grams. The lever was attached to the model at the rear and base of the engines.

When a model was mounted in the tunnel the first thing checked was the angle of attack. It was corrected for that test series and the weight of the model was figured into the balance system. Then the tunnel was warmed up by letting the fan run for a short time and the lift and drag balances checked. At this point the tunnel velocity was started at 25X. Twenty-five X is about 35-40 mph indicated airspeed measured with an aircraft airspeed instrument. The amount of lift and drag was measured and recorded from the balances. Usually the test was run twice for each model at any speed. After measurements were recorded, the velocity was gradually increased to the next higher speed and again the lift scale was rebalanced and the drag read from the scale. The tests were run up to 50X. The data obtained from the two different scales were called C_L and C_D. C_L is the conventional coefficient for lift, F_L/qS, and C_D is the conventional coefficient for drag, F_D/qS. The C_L and C_D were figured in my own set convention. This was the most convenient for this project. My convention can be related to the standard C_L and C_D.

Results

Clean profile tests showed that the model has very good lift vs. velocity and drag vs. velocity curves. These tests taken at angles of attack of 10, 20, 30, and 40° showed that a good rate of climb develops at 30°—40X and that the stalling point was reached at 40°—30X without flaps.

The high-speed-tests profile, with the 30° downslope of the last 10 ft (scaled down) of the wing area, were reduced in relation to the reduction in the lifting surfaces. The stalling speed was increased at lower speeds and the stability of the profile was increased considerably at the higher speeds.

Vibration tests showed a tendency at higher speeds for the rear of the plane to start an oscillation from the sides. Additional fins are needed on the underside of the plane to add lateral stability.

In graphs, C_L and C_D were plotted against the velocity. The C_D curves were lower in all cases and began to approach the C_L lines at higher velocities. The stalling point was found on Figure III at the point where the C_D line overtook and crossed the C_L curve at 40°—30X. The best rate of climb developed on the 30° angle where the C_L rose sharply and the C_D rose only a slight degree faster than normal.

Discussion

By taking the data obtained by the lift and drag balances, the basic relation of velocity, lift, and drag look very good on a graph. The high angle of attack before stall indicates a low landing speed with very good low-speed maneuverability, but perhaps low pilot vision. The dropped wing tests seem to indicate that the profile retains stability at higher speeds.

Conclusions

Although these are preliminary tests and, to get better results, drop tests and inflight tests would have to be performed, the general plans are sound. Discrepancies have arisen in the designed aircraft JK-7, but by more testing, evaluation, and minor design changes, such as the underside stabilization fins, the design can be made a useful and practical air weapon. If past and present designs and configurations and the idea of design integration are used with theory and experimental evidence, the basic idea of the JK-7 is possible. I base this conclusion the data received through testing and the many theories and new ideas in the field of aeronautical engineering. This was the goal of this project: To investigate the possibilities of the JK-7, using the knowledge of aeronautical science.

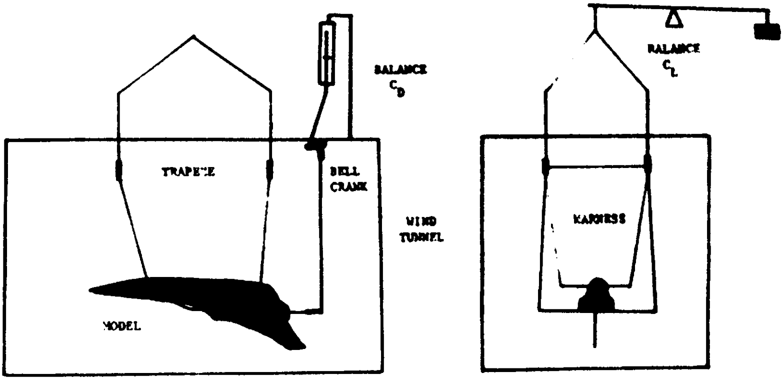

Figure II. Wind tunnel test setup lift and drag balances

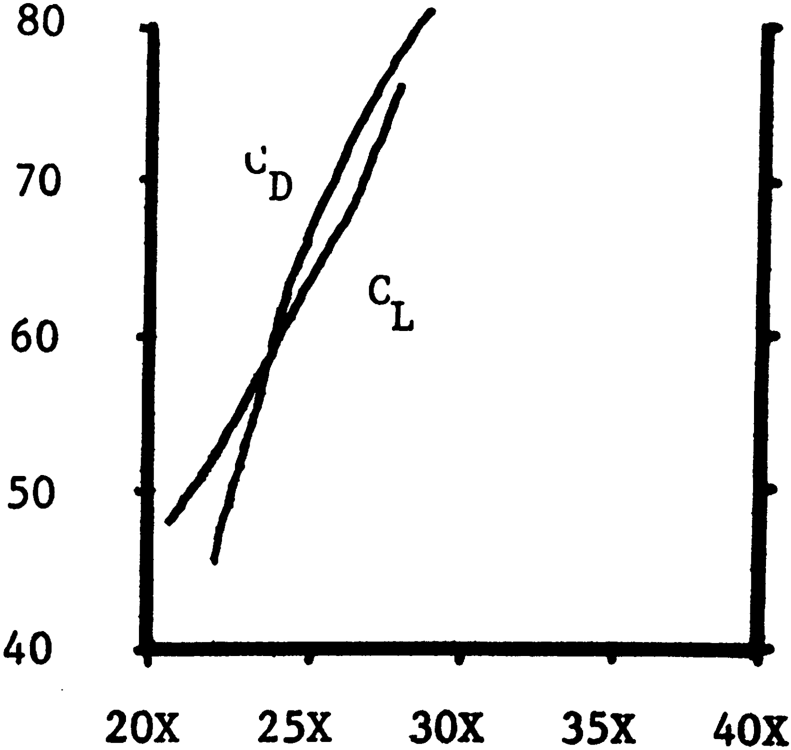

Figure III. The lift, C_L and drag, C_D, graph of the JK7 at angle of 40° showing the stalling point.