SUPERCritical Wing

Actual flight tests with NASA's Supercritical Wing have demonstrated in flight that the new airfoil shape does permit jet aircraft to operate more efficiently.

The new wing should permit jet aircraft of the future to operate at substantially lower costs by either increasing payload, or allowing the aircraft to cruise for increased distances with no increase in fuel consumption.

The new airfoil shape was originally tested on board an extensively modified F-8 jet fighter at NASA's Flight Research Center. It will also be evaluated on a variable swing-wing F-111 for possible military application.

At cruise speeds of modern jet transports, approximately Mach 0.8 or about 530 mph at a cruising altitude of 35,000 feet, the air flowing over the curved upper surface of the wing reaches supersonic speeds. This results in local shock waves on the wing that cause a sharp rise in aerodynamic drag and a significant decrease in efficiency.

When the speed of an aircraft approaches the speed of sound, regions of high supersonic airflow develop about the wing of the aircraft. This supersonic flow can cause severe local disturbances, known technically as shock waves and

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surface boundary layer flow separation. These disturbances can cause a substantial loss in flight efficiency, severe aircraft buffeting and adverse changes in the stability of the aircraft.

The supercritical wing shape has been developed to substantially delay the onset of these adverse effects. It is designed to reduce the intensity of the airflow disturbances at the higher speeds by flattening the upper portion of the wing, and curving the rear portion of the lower surface. This new shape permits an increase in the basic speed of the aircraft before the drag rise and buffet begin to take place and, thus, results in a more efficient wing.

The supercritical wing was developed at NASA's Langley Research Center, Hampton, Virginia in a wind tunnel program under the direction of Dr. Richard T. Whitcomb. These tests indicated that the new airfoil shape could allow highly efficient flight near the speed of sound, approximately 660 mph at cruising altitudes.