Another milestone in the field of aerodynamics was achieved recently with the successful flight testing of a supercritical wing at the Columbus Division of the North American Rockwell Corporation. The specially-designed airfoil was installed on a T-2C Buckeye twin-jet Navy trainer produced by the Columbus Division.

A research and development contract to design, build, and flight test a supercritical airfoil was awarded to the Columbus Division in the Spring of 1970 under the joint sponsorship of the National Aeronautics and Space Administration and the Naval Air Systems Command. The airfoil, which is relatively flatter on the top section than a conventional airfoil, is of the "supercritical wing" concept developed at the NASA Langley Research Center, Hampton, Virginia, under the direction of Dr. Richard T. Whitcomb.

North American Rockwell's work on airfoils designed to avoid transonic drag rise has been led at the Columbus Division by William E. Palmer. Palmer designed the aerodynamic contour of the T-2C supercritical wing, which is thicker than the standard production wing and features the flattened rather than the curved upper surface. The test wing was built-up from the T-2C's normal 12 percent thickness to 17 percent.

The new supercritical wing concept is designed to permit aircraft to operate efficiently at transonic speeds. The performance gains from this concept can be applied to increasing cruising speed or, through the use of the thicker wing, to provide space for high lift devices or to increase internal fuel and structural efficiency. Wing upper surfaces normally are curved to accelerate airflow to create a negative pressure-lift above the wings. At transonic speeds, however, the local airflow reaches supersonic speeds with resulting shock waves increasing drag and thus impairing efficiency. The supercritical wing, with a flattened upper surface, is so shaped that the transonic shock waves are weaker and positioned such that they do not cause excessive drag. Loss of lift because of the flat surface is compensated by a concave curve near the wing's trailing edge.

The Buckeye's wing arrangement permitted engineers to alter the existing wing contour without any change to the fuselage or aircraft systems, including the retracting landing gear. A standard production T-2C wing was modified by the addition of balsa wood and fiber glass to obtain the desired thickness and configuration. By applying the supercritical principle to the Columbus-built T-2C aircraft, a direct comparison can be made between a production line aircraft and the same type aircraft with a supercritical airfoil.
Supercritical wing specialists examining the new wing design on the T-2C aircraft prior to its first test flight are W.E. Palmer, left, of North American Rockwell's Columbus Division, and Dr. R.T. Whitcomb of the National Aeronautics and Space Administration.