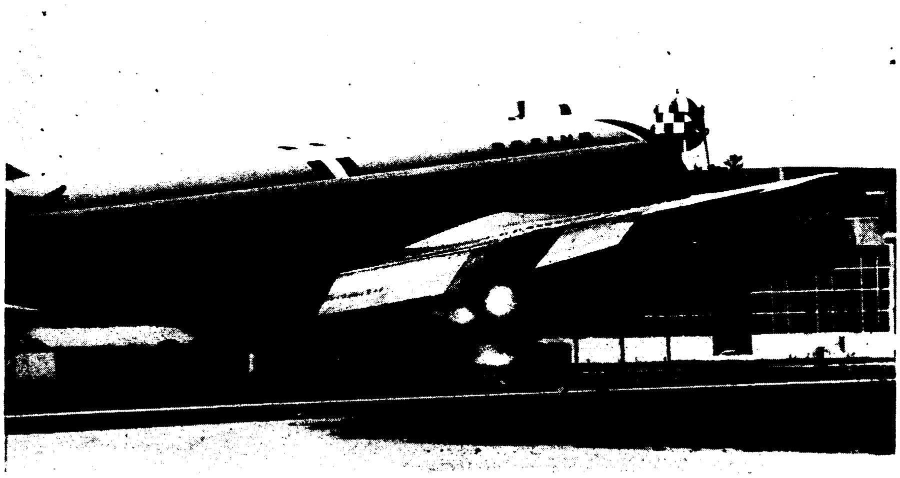

NASA

JET SLOW-DOWN—A Boeing 707 jet transport prototype is shown in a landing test at Wallops Island air strip. The National Aeronautics and Space Administration and Boeing are conducting tests to find ways to lower landing and take-off distances for large jet transports.

AERONAUTICS

Design Demands Heavy

The construction of an efficient supersonic airplane requires a design that allows extremely high speed in flight and low speed at takeoff and landing.

See Front Cover

➤ AIRLINER FLIGHTS between Los Angeles and New York in one and a half hours—that is an aim of engineers at the Langley Research Center, Hampton, Va.

Speeding up airplanes has been since World War I a pet project at Langley, which is now part of the National Aeronautics and Space Administration.

Langley's aeronautical engineers now are concentrating on developing a safe and practical supersonic commercial air transport (SCAT), an airliner that can fly much faster than sound. Sound travels at 760 miles per hour at sea level and 660 miles per hour at an altitude above 40,000 feet.

In Washington, Congressional groups are debating over how much money private industry should contribute to the design and development of a SCAT, which could have many military applications.

Among design goals are a speed of Mach 3.0, or three times the speed of sound; a range of 4,000 miles; ability to operate from existing jet airports; operating costs equivalent to current subsonic jet airliners, and a useful lifetime of 15 years, or 30,000 to 50,000 operating hours.

For efficient supersonic flight, an airplane should be long and slender with thin, short wings that are sharply swept back. But taking off, approaching and landing at low speeds calls ideally for long wings jutting straight out from the plane's body.

Seen on this week's front cover is a one-third scale model of a generalized design for a supersonic transport airplane in the 40-by-80-foot wind tunnel at Ames Research Center, Moffett Field, Calif. The model has a triangular, or delta, wing, fitted with large flaps on both the landing and trailing edges to improve lifting ability at low speeds.

Since 1945 Langley has been working on a variable-sweep wing, one that can be adjusted in flight to suit various needs. In 1959 engineers here found that instead of shoving the whole wing fore and aft on the fuselage, a structurally simple wing pivot could be used. The F-111 fighter-bomber, now under procurement, carries such a pivoted wing.

For high-speed operation at low altitudes where aerodynamic forces are high and little wing area is needed, the wings actually fold back over the fuselage, and the plane looks like a rocket.

The skin of such a transport must withstand temperatures as high as 650 degrees Fahrenheit at a speed of 2,000 miles per hour. The heat is generated by compression and friction of air molecules in contact with the plane.

Aluminum alloys, used in most of today's commercial airliners, lose their strength at this temperature. Studies favor a titanium alloy that has a melting point of about 3,000 degrees Fahrenheit.

At supersonic speeds, a plane is subject to shock wave drag. The shock wave is produced when an aircraft flies so fast it sharply compresses the air about it. The wave flows back on each side of the plane, like waves cut by the bow of a racing boat. This retards the plane's forward motion.

Recent research has demonstrated that shock wave drag can be reduced by a precise placing of engine housings, called nacelles, on the airframe.

NASA has studied a number of supersonic commercial air transport designs and finds three of them worthy of further consideration. One, SCAT-16, features a variable-sweep wing. Another, SCAT-17, has a long fuselage with a fixed delta wing.

The third, SCAT-15F, was designed within the past six months by an electronic computer. The model's long, slender fuselage is hard to distinguish from its wings which are twisted and slightly arched. The engine nacelles are attached under the wings.

Despite the wide variety in designs, Langley engineers predict that businessmen and vacationers will be riding aboard some type of supersonic airliner in the 1970's.

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AERONAUTICS

Giant Airfields for Jets May Soon Be Outmoded

➤ SPECIAL GIANT AIRFIELDS for jets may soon be outmoded. The reason is that the Boeing 707, which only six years ago was setting speed records for airlines, is being flown at a mere 90 miles an hour.

The new process, developed at the National Aeronautics and Space Administration's Langley Research Center, Hampton, Va., slows down giant jet planes so much they could land in airports now closed even to many propeller-driven airliners.

Langley is testing the process, called boundary layer control (BLC), on the Boeing 707, which usually lands at more than 135 miles an hour. So far, Langley test pilots have slowed the huge plane to as low as 65 miles an hour.

Most large propeller-driven planes land at about 100 miles an hour. The faster the landing speed, the longer the landing strip must be.

BLC increases the lifting ability of a wing, allowing the craft to land at lower speeds. It also lowers weather minimums and gives greater all-round safety.

BLC systems are designed to give the largest possible amount of aerodynamic lift on an airplane's wing and flat surfaces, even though the flaps are sharply deflected for landing.

High lift is obtainable only if air sticks closely to the curved shape of the wing and flaps. If it does not, areas of stall occur and lift is lost.

A pilot's choice of flap angle usually is limited to about 50 degrees because at higher angles the air flow will not follow the contour of the wing-flap combination.

The BLC system permits flap deflection of as much as 70 degrees.

The air supply for the BLC on the 707 is obtained from "bleed ports" in the high-pressure sections of the planes' four large turbo-fan engines. The compressed air is routed through a collector from which it is piped inside the wing to ejection slots at the leading edges of the flaps.

The Boeing airplane is typical of large, swept-wing jet transports in current airline use.

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