RESEARCH ON EFFECTS OF INTERFERENCE ON PERFORMANCE

Research carried out in the past has indicated that it is possible to obtain significant increases in the lift-to-drag ratio for transport configurations at Mach numbers between 2 and 3 through the use of favorable interference between the flow fields of the fuselage and wing and those of the nacelles and wing. Some favorable interference may be obtained by shaping the fuselage such that the pressure field above the wing is made more negative, while that below the wing is made more positive. Such an approach has been used in the design of the B-70. (Photo. of B-70) For configurations having the wing leading edge swept behind the Mach angle and with a large amount of wing trailing-edge sweep, significant improvements in the lift-to-drag may be obtained by shaping the fuselage to provide a deceleration of the flow along the aft portion of the upper surface. Similar favorable effects may be obtained by placing the engine nacelles along the aft portion of such a highly swept wing. (Photo. of swept-wing configuration) The improvements in lift-to-drag provided by such fuselage shaping and nacelle location result primarily from a significant reduction of the drag-due-to-lift. For the configuration shown, the drag-due-to-lift factor is less than one-half that for a configuration with a simple flat wing. In a completely different approach, theoretical analyses have indicated that it may be possible to obtain improvements in the lift-to-drag by the use of a half-circular ring-shaped wing placed above the fuselage. (Sketch of ring wing)

The fuselage shapings and nacelle locations investigated thus far have been arrived at primarily through an intuitive analysis of the probable
nonlinear flow. Probably, relatively little additional improvement can be obtained by a continuation of such an approach. Further gains will require a more complete knowledge of the real flow about the more interesting configurations at supersonic speeds. To obtain such knowledge, comprehensive pressure distribution and flow field investigations should be initiated. The ring-wing appears to be relatively impractical; however, experiments must be made on such a configuration to provide the background required to evaluate such an approach.