A METHODOLOGY OF INVESTIGATION INTO THE AERODYNAMIC EFFECTS ASSOCIATED WITH THRUST REVERSAL.

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KEYWORDS:

Main subjects: experimental aerodynamics, flow visualization, computational fluid dynamics (CFD)
Fluid: low speed flows
Visualization method(s): infra-red imaging
Other keywords: thrust reverse, wind tunnel, balance measurements

ABSTRACT: Considered in the present paper are possible aerodynamic and gas dynamic problems associated with thrust reverser's operation during landing. Trust reversal is one of effective methods for aircraft deceleration during landing run. However, in deploying the thrust reverser some problems can arise through the effects of revered flow. Ingestion of reversed jets into the engine distorts the velocity and temperature fields at the engine inlet, which can cause compressor surge and engine shutdown. Interactions of the reverse jets with the fuselage, wing and runway surface can affect the aircraft's aerodynamic characteristics at landing and during its run along the runway.

To effectively resolve these problems, proper methodologies were developed in TsAGI and a specialized setup was constructed for the TsAGI's T-104 wind tunnel to study the possible aerodynamic effects caused by an operating thrust reverser. The setup provides measuring pressure distribution, force and moment tests by strain gage balances as well as flow visualization though infra-red imaging. Advanced computational methods were developed and a non linear mathematic model of one of passenger aircraft configuration studied was used to demonstrate the results of experimental and numerical investigations into the effects of thrust reversal under various test conditions. It was found, that there is a spasmodic increase in negative lift within a narrow velocity range during runway run; this negative lift presses the model to the bottom of the simulated the runway. According to physical investigation and numerical computations performed, the increase in the negative lift is associated with turning the reversed flow under the wing along the test flow direction. In this case a classical effect of spanwise jet blowing is realized with an abrupt enlargement of the fluid contour.

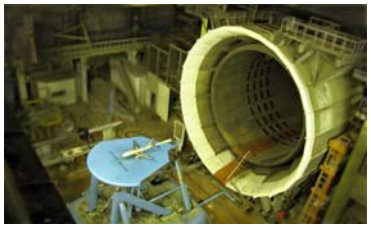

Fig. 1 Model in T-104 wind tunnel

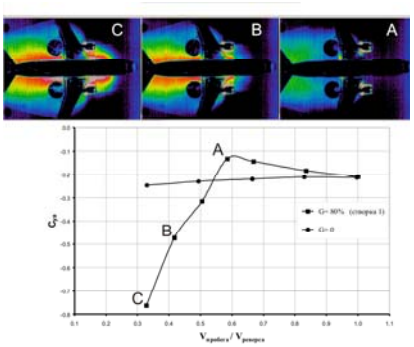

Fig. 2 Comparison of lift coefficient and thermal images

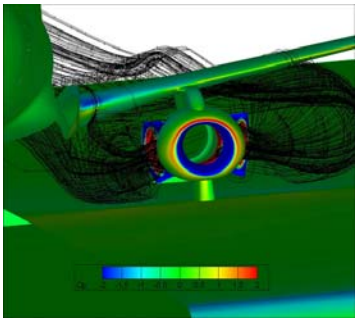

Fig. 3 Pressure coefficient distribution (CFD)