A Study on Improvement of Aerodynamic Characteristic of next generation SST by Active Flow Control

Shigeru ASO
Department of Aeronautics and Astronautics, Kyushu University,
Fukuoka 812-8581, JAPAN
Keiichi KARASHIMA
Nishinippon Institute of Technology, Fukuoka, JAPAN

Recently fundamental studies on high speed transportation system (HST or next generation SST) has been studied around the world for better technology breakthrough.. One of the most important problems for designs of such vehicles is the aerodynamic characteristic improvement, especially for high L/D at any flight speed.. There are many ways to improve the aerodynamic characteristic of the main wing of SST. One of the suggested proposal of better aerodynamic characteristic improvement is active flow control. In this paper the present authors would like to explain our experimental efforts and try to offer the possibility for simulating our cases for better understanding of flow physics in the active control of the present flow conditions.

A experimental study on the improvement of aerodynamic characteristics of an arrow wing by lateral blowing in low speed flow has been conducted[1]. A modified arrow wing, which is one of the baseline configurations of the proto-type of next-generation SST, is selected for the experiments as shown Fig. 1. The testing model is the combination of a body of a circular cylinder and conical apex and a modified arrow wing with aspect ratio of 1.91. The lateral blowing is realized by injecting a pair of sonic jets in parallel to the trailing edge of the wing. The schematic diagram of the testing set-up is shown in the Fig. 2. The experiments have been performed in ISAS's transonic wind tunnel under the testing conditions of $M_{\infty} = 0.3 \sim 2.3$, $\mathrm{Re} = 1.1\times10^{7} \sim 1.6\times10^{7}$, $\alpha = -15\,\mathrm{deg} \sim 15\,\mathrm{deg}$ and $C_{\mu}(\textit{jet momentum coeeficient}) = 0.0084 - 0.0211$. The global features of active control by using lateral blowing are shown in Fig. 3. The results show that the C_L and L/D is increased by lateral blowing while C_D slightly increases at subsonic flows and C_D slightly increases at supersonic flows. The results suggest that the lateral blowing can be useful for the improvement of aerodynamic characteristics of the arrow wing at transonic flows as well as subsonic flows.

References

1) M. Kamishita, S.Aso, K. Karashima and K. Sato: Active Control of Aerodynamic Characterestics of Next-Generation SST Wing by Lateral Blowing, AIAA Paper 2000-0516.

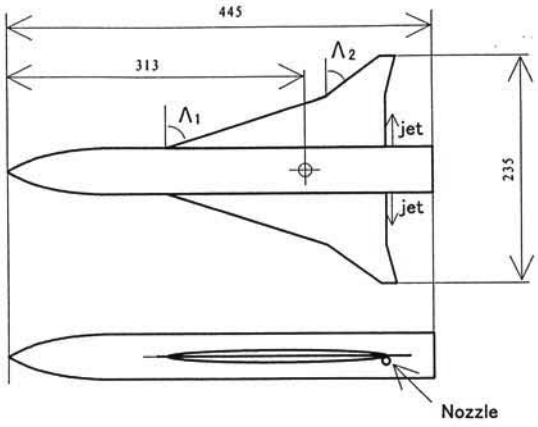

Fig.1 Model geometry

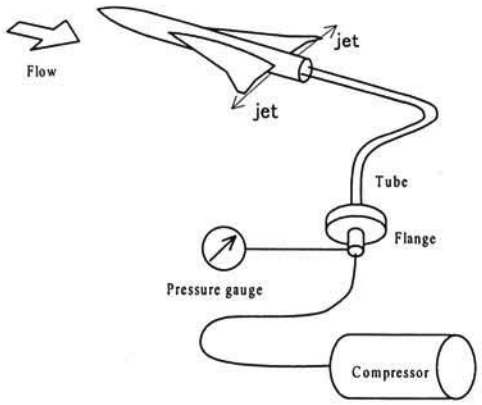

Fig.2 Schematic diagram

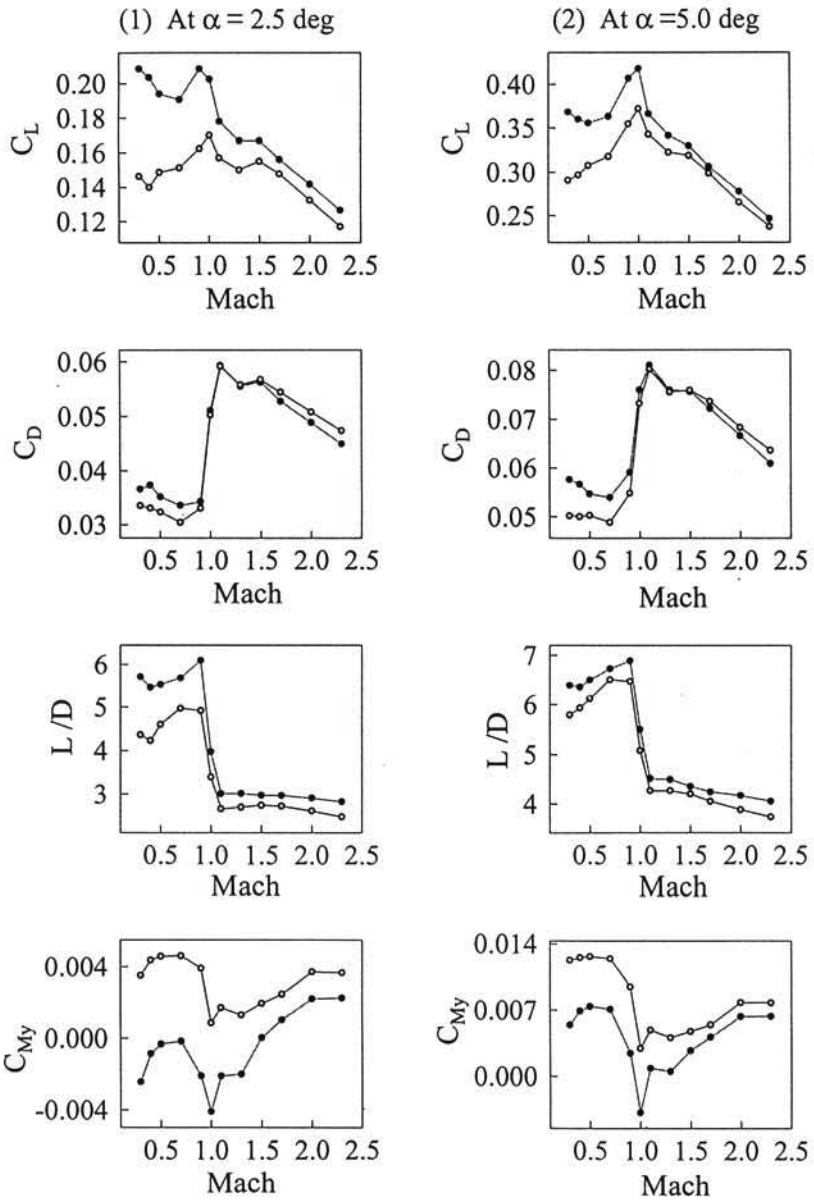

Fig.3 C_L, C_D, C_{My} and L/D vs Mach number

Lateral blowing

No blowing