Technical Comments

Comparison of NASA Helium Tunnel Transition Data with Noise-Transition Correlation

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RECENT boundary-layer transition Reynolds number $(Re_t)_\delta$ data obtained on a sharp slender cone in the NASA Langley 22-in.-diam helium tunnel at $M_\infty = 21$ have been reported by Fischer and Wagner.[1] The purpose of this Comment is to compare these new data with the aerodynamic noise-transition correlation reported in Ref. 2. The noise-transition correlation was initially developed for sharp flat plates by Pate and Schueler[3] and later extended to sharp slender cones by Pate.[2]

In Ref. 1 (e.g., Fig. 8) Fischer and Wagner compared the helium tunnel data to an earlier correlation published by Pate[4] and found that the correlation prediction was about 60% higher than the helium tunnel data.

The difference between the correlating parameters used in Refs. 2 and 4 is the tunnel size normalizing parameter. In Ref. 4, the parameter $[0.56+0.44\,(C1/C)]$ (which was developed for sharp flat plates[3]) was used; whereas, in Ref. 2, it was found that the parameter $[0.8+0.2\,(C1/C)]$ provided a better correlation of the sharp cone data.

Presented in Fig. 1 are the Langley data compared with the noise-transition correlation and empirical equation from Ref. 2, and good agreement is seen to exist. It is to be noted the Langley data lie about an order of magnitude outside the range of data used in Ref. 2. The total skin friction coefficient (C_F) and the parameter $(Re_t)_\delta(\delta^*/C)^{1/2}$ used in Fig. 1 for the Langley data are the values reported in Ref. 1. The results presented in Fig. 1 show that the revised noise-transition correlation and empirical equation of Pate[2] provides a satisfactory prediction of the transition Reynolds numbers obtained in the Langley helium tunnel.

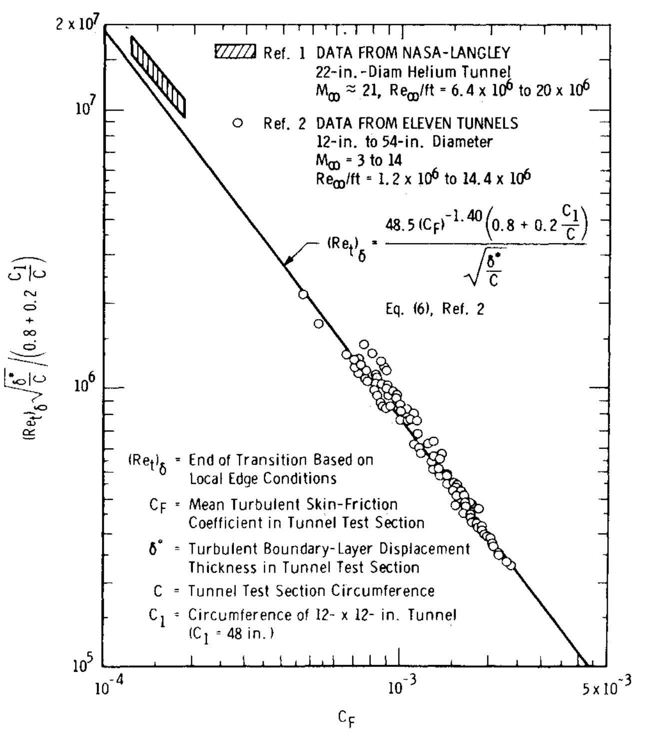

Fig. 1 Comparison of NASA helium tunnel sharp cone transition data with noise-transition correlation.[2]

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Index categories: Boundary-Layer Stability and Transition; Supersonic and Hypersonic Flow.

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[1] Fischer, M. C. and Wagner, R. D., "Transition and Hot-Wire Measurements in Hypersonic Helium Flow," *AIAA Journal*, Vol. 10, No. 10, Oct. 1972, pp. 1326–1332.

[2] Pate, S. R., "Measurements and Correlations of Transition Reynolds Numbers on Sharp Slender Cones at High Speeds," *AIAA Journal*, Vol. 9, No. 6, June 1971, pp. 1082–1090.

[3] Pate, S. R. and Schueler, C. J., "Radiated Aerodynamic Noise Effects on Boundary-Layer Transition in Supersonic and Hypersonic Wind Tunnels," *AIAA Journal*, Vol. 7, No. 3, March 1969, pp. 450–457.

[4] Pate, S. R., "Measurements and Correlations of Transition Reynolds Numbers on Sharp Slender Cones at High Speeds," AEDC-TR-69-172, Dec. 1969, Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

Comment on "Spherically-Symmetric Supersonic Source Flow: A New Use for the Prandtl-Meyer Function"

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IN a recent Note, Reddall[1] derived for the subject flow, relations between Mach number M, area ratio, and radius to the source R. He also derived parametric equations for the characteristic curves in this flow, in terms of M, R, and the flow angle θ, and states that these equations are "not well documented, if at all." These latter equations were apparently derived for the first time in Ref. 2 and have since been used extensively in the design of wind-tunnel nozzles.[3–5]

Reddall[1] also points out the "remarkable result" that the integral of θ between two points along a characteristic is one-half the change in the Prandtl-Meyer function between these

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