Technical Comments

Comment on "Measured Transition from Laminar to Turbulent Flow and Subsequent Growth of Turbulent Wakes"

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IT is rather interesting to find that Santayana's famous dictum, namely, "Those that fail to read history are bound to repeat its mistakes," is equally applicable to transition measurements. The authors state that Fig. 6[1] represents the new and hitherto unexplained phenomenon of a strong velocity dependence of the transition distance. This phenomenon is neither new nor unexplained. It has been predicted theoretically by Lees[2] and others, and observed experimentally by Demetriades and Gold[3] and others. The authors, incidentally, quote the latter as a reference.

The fact is the authors overlooked that $P(C_DA)^{1/2}$ is at best a scaling parameter for different shapes but the same velocity; at worst it is no similarity parameter at all. The theoretical predictions are actually that $\rho UX_T/\mu$ = const, and there is some experimental evidence supporting this prediction. The use of the square root of the drag area as a characteristic dimension, a favorite scale length, has hardly any justification here.

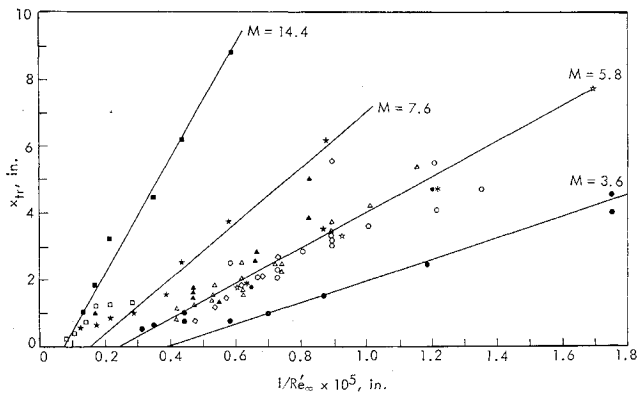

Fig. 1. Transition distance vs inverse of freestream Reynolds number per unit length $R'e_\infty = U_\infty/\nu_\infty$ (from Ref. 3).

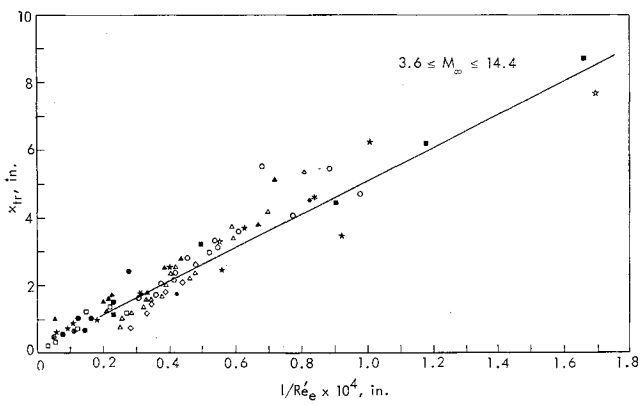

Fig. 2. Transition distance vs inverse of local Reynolds number per unit length $R'e_e = U_e/\nu_e$ (from Ref. 3).

I would suggest that the authors plot their data: X_T vs $(\rho U/\mu)^{-1}$† or $\rho UX_T/\mu$ vs M_∞ (see Figs. 1 and 2, which are taken from Ref. 3). It should be noted that the Mach number range covered in Fig. 2 is from 3.6 to 14.4, and there appears to be no indication of any radical departure from the low speed flow behavior at the higher Mach numbers. I would suspect, therefore, that plotting the data of Ref. 1 by the method suggested would reduce the spread in the data due to the velocity quite considerably. Should this not happen, then the authors' claim that they discovered something new will be much more justified.

References

[1] Clay, W. G., Labitt, M., and Slattery, R. E., "Measured transition from laminar to turbulent flow and subsequent growth of turbulent wakes," AIAA J. **3**, 837–841 (1965).

[2] Lees, L., "Hypersonic wakes and trails," ARS Paper 2662-62 (November 1962).

[3] Demetriades, A. and Gold, H., "Correlation of blunt-bluff body wake transition data," Firestone Flight Sciences Lab., Graduate Aeronautical Labs., California Institute of Technology, Pasadena, Calif., Hypersonic Research Project, Internal Memo. 12 (September 20, 1962).

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† For U = const, ρ/μ reduces more or less to P

Reply by Authors to J. Menkes

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THE authors have chosen to plot their results in a fashion that best represents their data in as close to raw form as possible. This allows the reader to conveniently handle it as he wishes [the use of $(C_DA)^{1/2}$ merely accommodates both the blunt and conical results].

Had the commentor availed himself of this convenience he could have plotted the newer data in the fashions that he suggests and found, as we had, that it failed to fit Demetriades and Gold's curves of X_T vs $1/Re_e'$ by an order of magnitude at best (lower branch of our curves) and two orders at worst (upper branch). Similar results were obtained for the X_T vs $1/Re_\infty'$ curves. Since the other data plotted by the authors fit these reductions very well, this result is almost obvious by inspection.

Within the limitations of the experiment, as it has been described, these data represent a new and interesting velocity effect.

Perhaps the commentor's quotation from Santayana (it usually reads "Those who can not remember the past are condemned to repeat it") should be replaced by the same author's "History is always wrong and so always needs to be rewritten."

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