Sphere Drag at Transonic Speeds and High Reynolds Numbers

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MEASUREMENTS of sphere drag have been made in the AEDC aeroballistics range "G" over the Mach number range $0.9 \leq M_\infty \leq 1.4$ at a Reynolds number of approximately 10^6. These values of sphere drag were found to be larger than the values derived from the experimental summary curves presented in Ref. 1. The change in sphere drag with Mach number near Mach 1, as well as with Reynolds number in excess of 10^5, is significant and care is required in establishing summary curves. On the basis of these more recent measurements and those contained in Refs. 2 and 3, the summary curves presented in Ref. 1 have been reevaluated. A plot of the revised values of sphere drag for $5\times10^2 \leq Re_\infty \leq 10^6$ and $0.1 \leq M_\infty \leq 1.75$ is presented in Fig. 1. The difference between the previous[1] and present values of sphere drag coefficient at $M_\infty = 0.955$ (Fig. 1) is representative of the changes that have been made, in the Mach number range of 0.8 to 1.5. Sphere drag coefficient is shown to increase with increasing Reynolds number for $10^5 \leq Re_\infty \leq 10^6$ for Mach numbers ranging from 0.9 to 1.75 (Fig. 1).

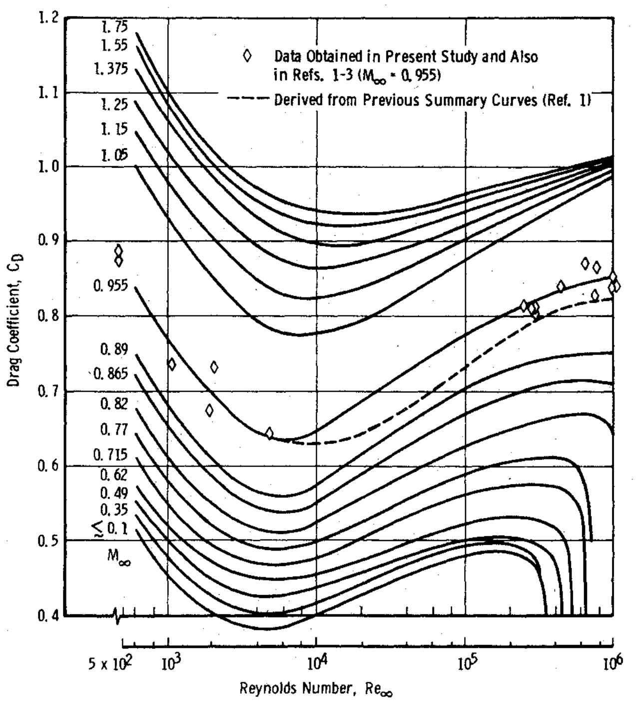

Fig. 1 Sphere drag coefficient variation with Mach and Reynolds number.

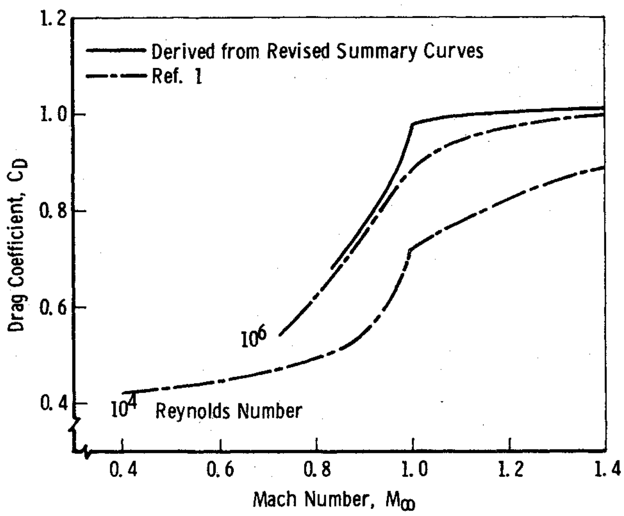

Fig. 2 Revised analysis of sphere drag in the transonic regime.

The variation of the revised values of C_D with M_∞ for $Re_\infty = 10^6$ are compared with the earlier values of Ref. 1 in Fig. 2. These revised values show a stronger dependence of C_D with M_∞ for $0.955 \leq M_\infty < 1.0$ than the $Re_\infty = 10^6$ values presented in Ref. 1.

References

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Index categories: Subsonic and Transonic Flow; Supersonic and Hypersonic Flow.

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Distribution Functions for Statistical Analysis of Monodisperse Composite Solid Propellant Combustion

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IN Ref. 1 a statistical basis for describing additive free composite propellant combustion was derived from continuity considerations. In this approach all states of all oxidizer particles populating the burning surface are incorporated into a rate defining expression through suitable distribution functions. These functions define the fraction of oxidizer particle/fuel surface pairs possessing planar surface areas ϵ_{ox} and ϵ_f such that (Nomenclature is the same as that of Ref. 1).

$$d^2N = NF_{ox}F_f d\epsilon_{ox} d\epsilon_f \tag{1}$$

In Ref. 1 the distribution functions F_{ox} and F_f were not related to propellant formulation and oxidizer variables. The

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