The major conclusion is that Thomas' method, with minor variations for $V < 1$, gives a limit, on the upstream side, to the separation point, and that, under conditions for relative remoteness from near-slot effects, is reasonably accurate. Much more cannot be said, due to the limitations of this data. Slot heights other than the one used may have an effect. There was a slight difference in temperature between the mainstream and jet; a density effect may appear. Finally, the data imply that separation control when $1 < V < 2$ is good. The apparatus was not long enough to determine the separation point in this range. More data would be very valuable.

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Simplification of the Wing-Body Interference Problem

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Nomenclature

$C_{L\alpha}$ = lift-curve slope coefficient
K = interference factor
r = radius of body
S = area
s = wing maximum semispan in combination with body

Subscripts

B = body
e = exposed wing
N = nose
REF = reference upon which coefficient is based
W = wing

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Discussion

A FREQUENTLY recurring problem in aerodynamic design is the determination of the lift-curve slope of a wing-body combination. A well-known technique for solving this problem is used in Ref. 1 and is taken from the original work reported in Ref. 2. The technique is derived from slender-body theory and may be expressed as

$$(C_{L_\alpha})_{WB} = (C_{L_\alpha})_N S_{N\mathrm{REF}}/S_{\mathrm{REF}} + (C_{L_\alpha})_e (S_e/S_{\mathrm{REF}})[K_{W(B)} + K_{B(W)}] \quad (1)$$

where the first term represents the body nose lift-curve slope, and the second term represents the wing lift-curve slope in the presence of the body and of the body caused by the wing. The interference factors were expressed in Ref. 2 [Eqs. (14) and (21), respectively], as follows:

$$K_{W(B)} = \frac{2}{\pi}\left\{\left(1 + \frac{r^4}{s^4}\right)\left[\frac{1}{2}\tan^{-1}\frac{1}{2}\left(\frac{s}{r} - \frac{r}{s}\right) + \frac{\pi}{4}\right] - \frac{r^2}{s^2}\left[\frac{s}{r} - \frac{r}{s} + 2\tan^{-1}\frac{r}{s}\right]\right\} \Big/ \left(1 - \frac{r}{s}\right)^2 \quad (2)$$

$$K_{B(W)} = \left(1 - \frac{r^2}{s^2}\right)^2 - \frac{2}{\pi}\left\{\left(1 + \frac{r^4}{s^4}\right)\left[\frac{1}{2}\tan^{-1}\frac{1}{2}\left(\frac{s}{r} - \frac{r}{s}\right) + \frac{\pi}{4}\right] - \frac{r^2}{s^2}\left[\left(\frac{s}{r} - \frac{r}{s}\right) + 2\tan^{-1}\frac{r}{s}\right]\right\} \Big/ \left(1 - \frac{r}{s}\right)^2 \quad (3)$$

where r is the body radius, and s is the wing semispan. Equations (2) and (3) may be combined to yield

$$K_{B(W)} + K_{W(B)} = [(r/s) + 1]^2 \quad (4)$$

The combined interference factors thus are expressed in a simple, easily remembered form that makes it unnecessary for the designer to refer to the graphs of each factor (presented in Ref. 2, p. 48).

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