Calculations were made to determine the freon-air differences in the trailing edge value of the B.L. momentum thickness, $\delta$, on a two-dimensional body of length, $b$, in compressible flow. The basis of comparison rested on the assumptions that the freestream Reynolds number, the incompressible value of the B.L. shape parameter, $H$, and the viscosity relations were identical for both mediums, and also the freestream Mach numbers and the velocity distribution were related by the area-ratio method. The method of Teter in "Approx. Formulas for the Computation of Turbulent B.L. Momentum Thickness in Compressible Flows" was used to make these calculations. $H$ was assumed to be constant along the surface and equal to a value of 1.4.

A plot of $\frac{\delta}{b}$ versus freestream Mach number, $M_0$, for both freon and air is given in figure 1.

The velocity gradient in air was used for two values, 0.2 and 0.2, and the resulting linear velocity profiles were corrected by the area-ratio method to the equivalent velocity profiles in freon. The velocity distribution in freon was found to be practically linear but the
gradient changed for each condition as noted in figure 1.

After the momentum thickness at the trailing edge had been obtained the profile drag coefficient was calculated by the relation developed by Squire and Young which corrects for a velocity ratio other than unity at the trailing edge.

\[ C_d = 2 \left( \frac{\Theta}{\pi} \right) \left[ \frac{U}{(U_0_t)} \right] \frac{H_{ct} + 5}{2} \]

where the subscript "t" means trailing edge and c means compressible.

The calculated ratios of drag coefficients in air to the corresponding lift drag coefficient in foam for two velocity gradient conditions and two Mach number is shown in figure 2. Also figure 2 includes the momentum thickness ratios at the four conditions of Mach number and velocity gradient.

\[ H_{ct} = \frac{0.78}{\eta - 1} \]

where \( \eta = \frac{f(M)}{\left( \frac{U}{U_0_t} \right)^2} \)

\[ H_{ct} \] was determined from the relation.
losses in air for all three forms of loss, namely, shock, separation, and skin friction, and the total wake corrections are of the same order and sense.

The wake correction method depended on being able to express the wake pressure ratio at any point in the wake in terms of the freestream pressure ratio, $\frac{P_0}{H_0}$, and the wake loss coefficient $\frac{\Delta H}{H_0}$, because for any given test these two quantities are known. Having the wake pressure ratio distribution will permit the determination of the wake Mach number distribution.

The correction to the $\frac{\Delta H}{H_0}$ distribution in the wake was derived as follows:

$$\frac{P_w}{H_w} = \frac{P_w/H_0}{H_w/H_0}$$

where $H_0$ = freestream total head

$$= \frac{P_w/H_0}{H_0/H_0 + 1} = \frac{P_w/H_0}{1 - \frac{\Delta H}{H_0}}$$

$$= \frac{P_w/H_0}{1 - \frac{\Delta H}{q_c c_f \frac{H_0}{H_0}}} = \frac{P_w/H_0}{1 - \frac{\Delta H}{q_c c_f \frac{H_0}{H_0}} - \frac{P_0}{H_0}}$$

(A) $\frac{P_w}{H_w} = \frac{P_0/H_0}{1 - \frac{\Delta H}{q_c c_f \left(1 - \frac{P_0}{H_0}\right)}}$, where $c_f = \frac{q_c}{q_i} = f\left(\frac{P_0}{H_0}\right)$

and $P_0 = P_w$
At any point in the wake the pressure ratio and the local Mach number may be plotted for freon. By the area ratio method, the wake Mach number distribution may be calculated for air and by using equation A the DH distribution in air may be determined. Thus for every freestream pressure ratio (or Mach) there is a value of the loss coefficient in air which corresponds to some value of the coefficient in freon.

An accurate calculation was made for a range of values of \( \frac{\Delta H}{q} \) \text{FREON} and in figure 1 the difference, \( \left( \frac{\Delta H}{q} \right) \text{AIR} - \left( \frac{\Delta H}{q} \right) \text{FREON} \), is plotted against \( \frac{\Delta H}{q} \text{FREON} \) for a freon freestream Mach number of 0.8603.

A sample calculation was made for the wake profile of the 65-210 airfoil at an angle of attack of 75° and at a freestream Mach number \( M_{\text{FREON}} \) of 0.853 corresponding to \( M_{\text{FREON}} = 0.8603 \). The wake profile and the freon-air difference are shown in figure 2. The ratio of the integrated values of \( \frac{(\Delta H/q)_A}{(\Delta H/q)_F} \) to \( (\Delta H/q)_A \) for this case was 0.0125.
\[ C_{D_0} = \frac{2}{\left( \frac{L}{C} \right) t} \left[ \frac{V}{U_0} \right]^H \]

where \( H = H_{01} \)

\( c \) denotes compressible

\( \frac{\partial}{\partial t} \), trailing edge

\[ \frac{U}{U_0} = 1 - b \quad ; \quad b = 0.2 \]

\[ \left( \frac{\theta}{L} \right)_A - 1 = \frac{\Delta \left( \frac{\theta}{L} \right)_F}{\left( \theta / L \right)_F} \]

**Fig. 2**
\[
\frac{U}{U_0} = 1 + b \left( \frac{x}{L} \right)
\]

Fig. 1.