



## Drag of fighter-type canopies at subcritical Mach numbers

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DRAG OF FIGHTER-TYPE CANOPIES AT SUBCRITICAL MACH NUMBERS

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## DRAG OF FIGHTER-TYPE CANOPIES AT SUBCRITICAL MACH NUMBERS

### 1. NOTATION AND UNITS

|            |                                                                                         | <i>SI</i>       | <i>British</i>     |
|------------|-----------------------------------------------------------------------------------------|-----------------|--------------------|
| $A$        | cross-sectional area normal to free-stream direction<br>(see Figure 1)                  | $\text{m}^2$    | $\text{ft}^2$      |
| $A_c$      | maximum cross-sectional area of canopy normal to free-stream direction                  | $\text{m}^2$    | $\text{ft}^2$      |
| $C_{Dc}$   | drag coefficient of canopy = $D_c / \frac{1}{2}\rho V^2 A_c$                            |                 |                    |
| $D_c$      | drag of canopy                                                                          | N               | lbf                |
| $d$        | diameter of equivalent slender body = $2\sqrt{(A_c/\pi)}$                               | m               | ft                 |
| $K$        | canopy fineness ratio = $l/d$                                                           |                 |                    |
| $l$        | length of canopy                                                                        | m               | ft                 |
| $V$        | free-stream velocity                                                                    | m/s             | ft/s               |
| $x$        | distance from nose of aircraft in free-stream direction                                 | m               | ft                 |
| $\theta$   | angle between windscreen plane and free-stream direction<br>(defined in Equation (3.2)) | degrees         | degrees            |
| $\theta_p$ | windscreen angle in plan view                                                           | degrees         | degrees            |
| $\theta_s$ | windscreen angle in side view                                                           | degrees         | degrees            |
| $\rho$     | free-stream density                                                                     | $\text{kg/m}^3$ | $\text{slug/ft}^3$ |

### 2. INTRODUCTION

At subcritical speeds the canopy drag can be a significant proportion of the overall aircraft drag. However there are no recent data to support those used to derive this Data Item and hence, although a fairly good correlation appears to exist between the sparse data available, care should be exercised in using numerical values obtained from Figure 2. Therefore, this Data Item should be viewed principally as a qualitative rather than a quantitative guide to the drag characteristics of fighter-type canopies.

Figure 1 shows the canopy configuration considered. The general layout is shown in Figure 1a and the corresponding distribution of cross-sectional area is given in Figure 1b. The canopy area,  $A_c$ , is the maximum difference between the cross-sectional area of the fuselage alone and that of the fuselage-canopy combination. Figures 1c and 1d detail the canopy geometry for flat and vee-shaped windscreens respectively.

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