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Approximate wave drag of rectangular planform fairings at zero incidence in supersonic flow

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THE PREPARATION OF THIS DATA ITEM

The work on this particular Data Item which was monitored and guided by the Aerodynamics Committee. This Committee first met in 1942 and now has the following membership:

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Mr J. Weir	— University of Salford.

The technical work in the assessment of the available information and the construction and subsequent development of the Data Item was carried out by

Mr P.D. Chappell	— Head of Aircraft Motion Group.
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APPROXIMATE WAVE DRAG OF RECTANGULAR PLANFORM FAIRINGS
AT ZERO INCIDENCE IN SUPERSONIC FLOW

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APPROXIMATE WAVE DRAG OF RECTANGULAR PLANFORM FAIRINGS AT ZERO INCIDENCE IN SUPERSONIC FLOW

1. NOTATION AND UNITS

		SI	British
b	span of fairing	m	ft
C_{DW}	wave drag coefficient at zero incidence based on frontal area, $D_W / \frac{1}{2} \rho V^2 b t$		
c	chord of ramp (Figure 1) or of complete fairing (Table 5.1)	m	ft
D_W	wave drag at zero incidence	N	lbf
M	upstream Mach number		
m_1, m_2	chordwise fractions defining two- and three-slope profiles (see Table 5.1)		
t	height of fairing	m	ft
V	upstream velocity	m/s	ft/s
β	compressibility parameter, $(M^2 - 1)^{1/2}$		
ρ	density of air	kg/m ³	slug/ft ³
<i>Suffix</i>			
∞	denotes sectional or two-dimensional value		

2. NOTES

Figures 1 and 2 present data that enable a good approximation to be obtained for the wave drag at zero incidence of rectangular planform fairings with a range of constant streamwise profiles in supersonic flow. The data were derived using linearised supersonic flow theory, and as such are limited in application to fairings with small values of local slope (less than about 10 degrees).

The data in Figure 1 are for a simple ramp fairing⁵ and make no allowance for base drag. The data for the upper curve of Figure 2 were derived from the wave drag of rectangular wings with symmetrical diamond and hexagonal profiles at zero lift using the method of Derivation 2 in association with the data of Figure 1. These data were found to correlate to within ± 15 per cent at $\beta b/c = 0.1$ when normalised with respect to the relevant two-dimensional value of the wave drag coefficient provided that

$$|1 - m_1 - m_2| + |m_2 - m_1| \leq 0.5. \quad (2.1)$$