Introduction to Drag

Typical drag coefficients, C_D, for the planar flow around "two-dimensional" objects or bodies are listed in Figure 1 and for a selection of "three-dimensional" objects in Figure 2. Almost all of this data pertains to high Reynolds numbers. Notice that most of the C_D values are of order one as was anticipated in section (Dab). Only for "streamlined" objects does the C_D become much smaller than one. Note also that drag coefficients for smooth bodies in turbulent flow are significantly less than those in laminar flow; this is the result of delayed separation as described in section (Dbc). However the coefficients for objects with sharp edges that cause separation in either laminar or turbulent flow exhibit no significant difference in the corresponding C_D values.

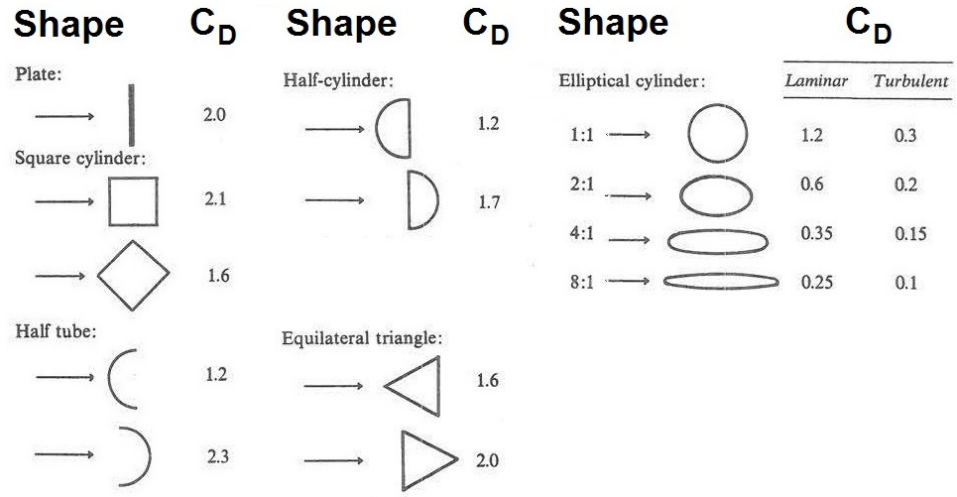

Figure 1: The drag coefficients (based on frontal projected area) for a number of two-dimensional objects.

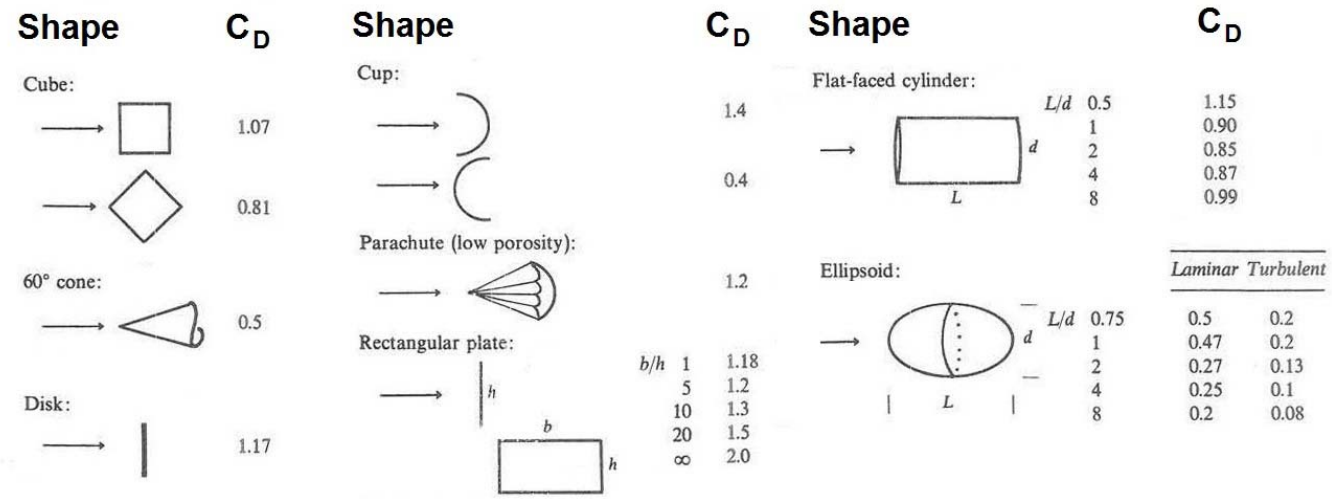

Figure 2: The drag coefficients (based on frontal projected area) for a number of three-dimensional objects.

The drag on objects of more complicated geometry, such as an automobile or aircraft, is most often determined by wind tunnel testing which usually involves determining the pressure coefficients at perhaps

hundreds of locations on the surface of the object. In the sections that follow we include some examples of the drag on such objects.