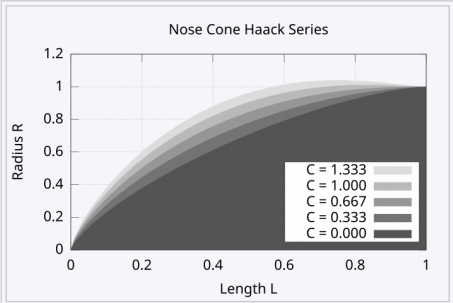
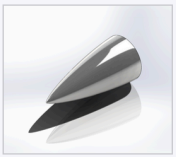
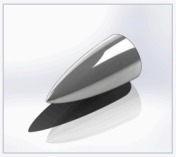
Haack series [edit]



Graphs illustrating Haack series nose cone shapes


LD-Haack (Von Kármán) ($C = 0$)


LV-Haack ($C = 1/3$)

Unlike all of the nose cone shapes above, Wolfgang Haack's series shapes are not constructed from geometric figures. The shapes are instead mathematically derived for the purpose of minimizing drag; a related shape with similar derivation being the Sears–Haack body. While the series is a continuous set of shapes determined by the value of C in the equations below, two values of C have particular significance: when $C = 0$, the notation LD signifies minimum drag for the given length and diameter, and when $C = 1/3$, LV indicates minimum drag for a given length and volume. The Haack series nose cones are not perfectly tangent to the body at their base except for the case where $C = 2/3$. However, the discontinuity is usually so slight as to be imperceptible. For $C > 2/3$, Haack nose cones bulge to a maximum diameter greater than the base diameter. Haack nose tips do not come to a sharp point, but are slightly rounded.

$$\theta(x) = \arccos\left(1 - \frac{2x}{L}\right)$$

$$y(\theta, C) = \frac{R}{\sqrt{\pi}}\sqrt{\theta - \frac{\sin(2\theta)}{2} + C\sin^3(\theta)}$$

Special values of C (as described above) include:

Haack series type	C value
LD-Haack (Von Kármán)	0
LV-Haack	$1/3$
Tangent	$2/3$