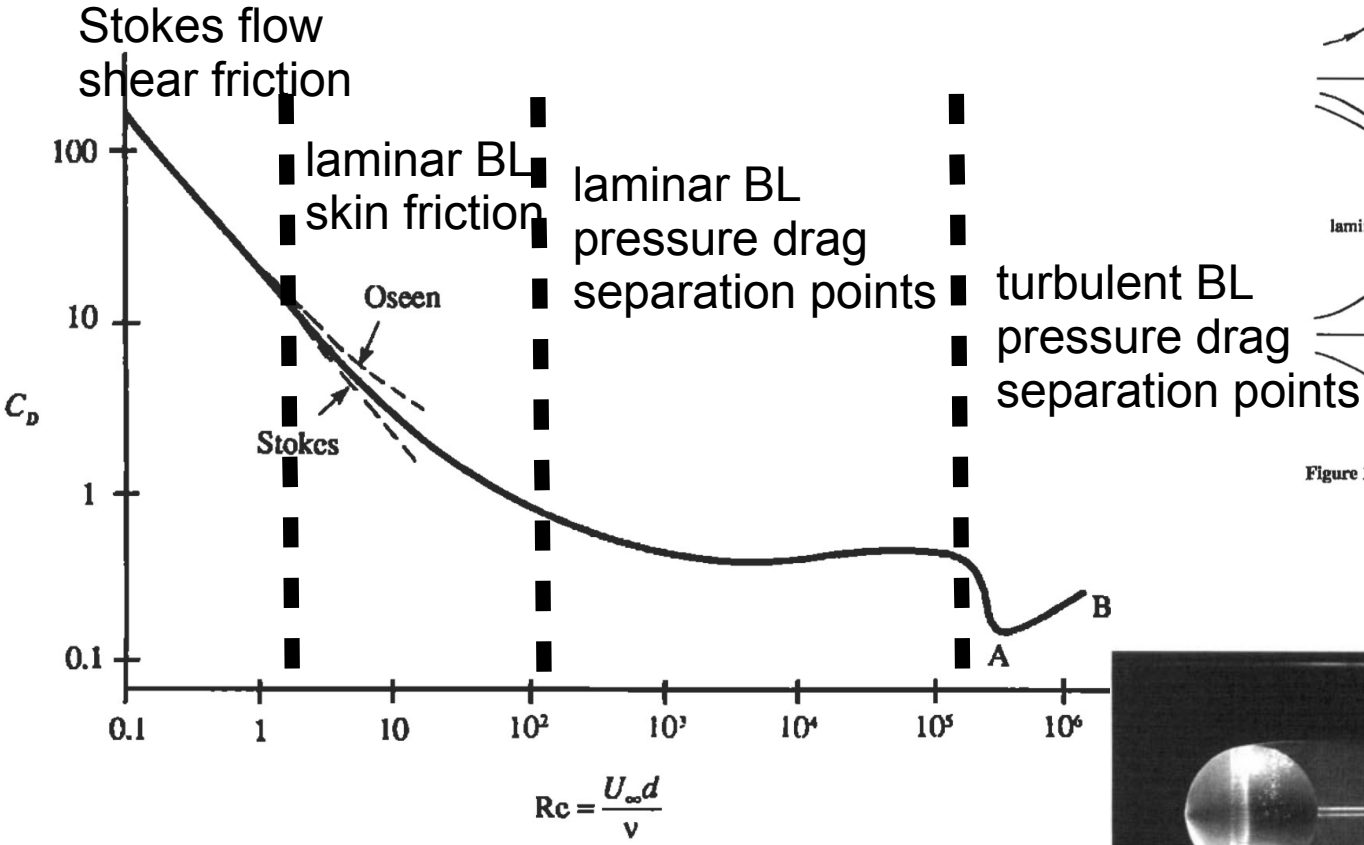
Sphere

Drag coefficient $Cd = FD / (1/2\ \rho\ \pi R^2\ U^2)$



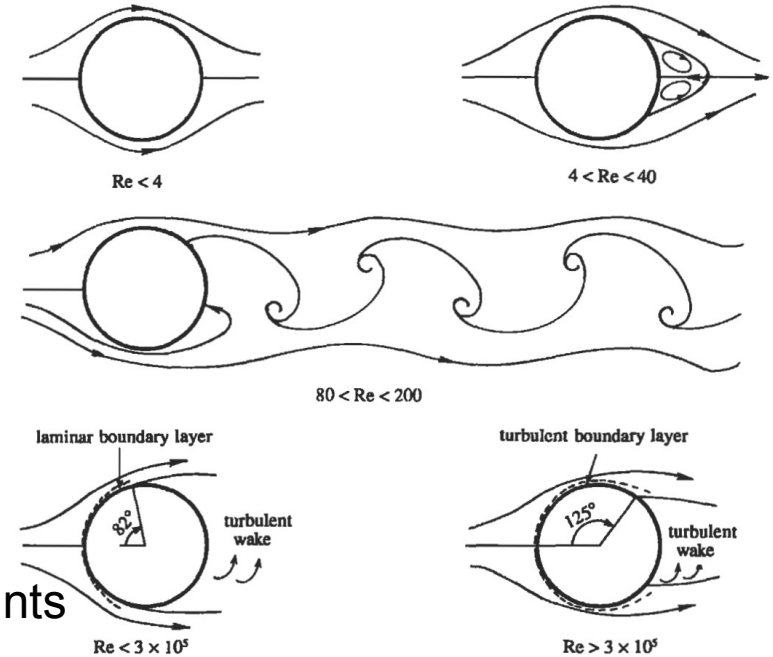
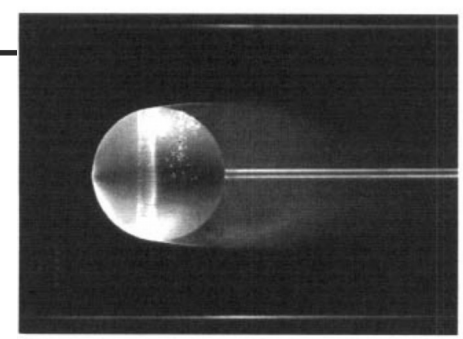
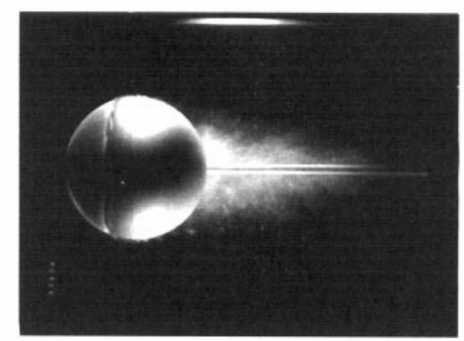


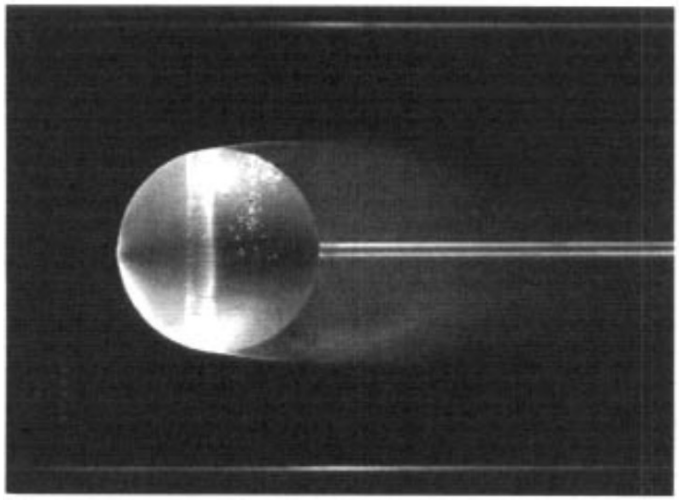
Figure 10.15 Some regimes of flow over a circular cylinder.

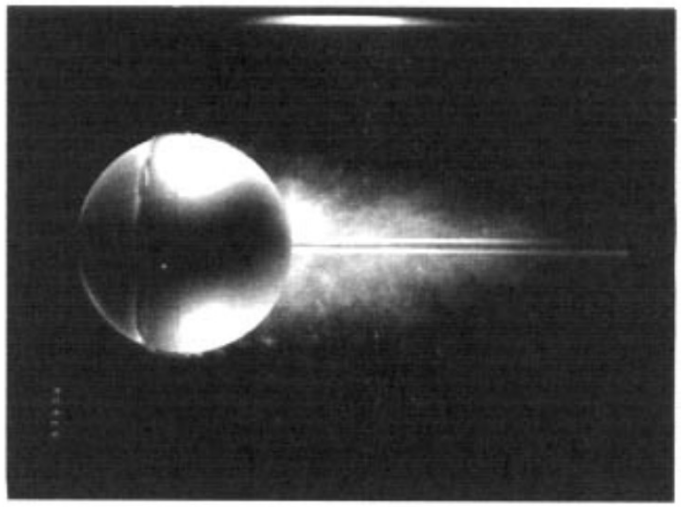




Sphere

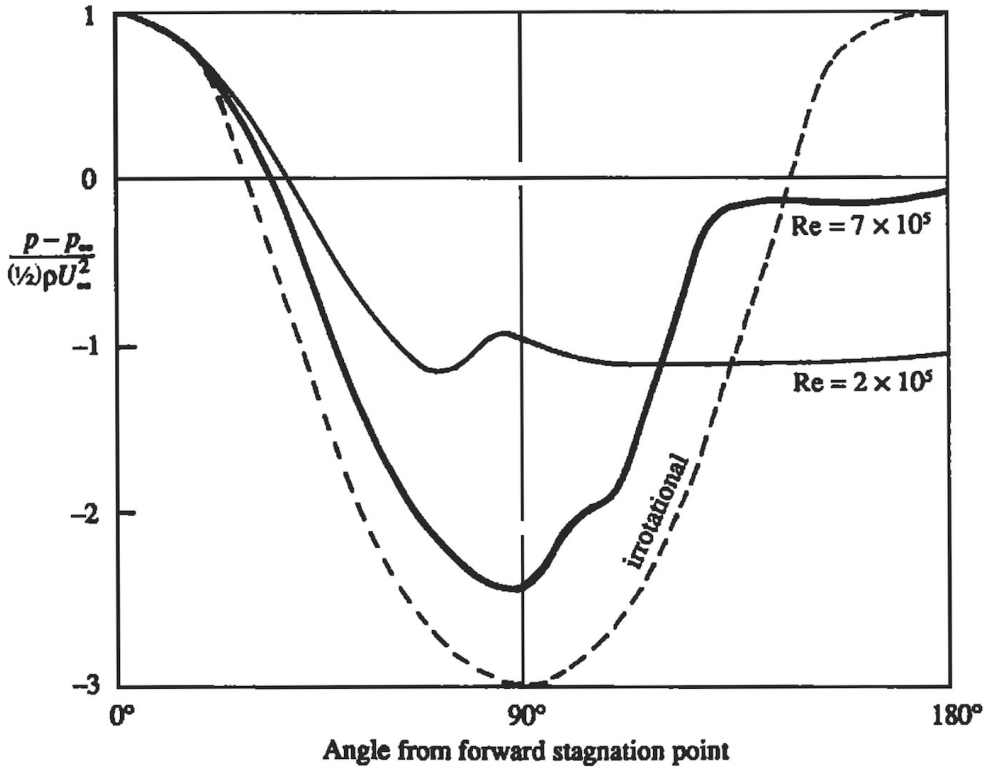
Re > > 10 : Drag = pressure force





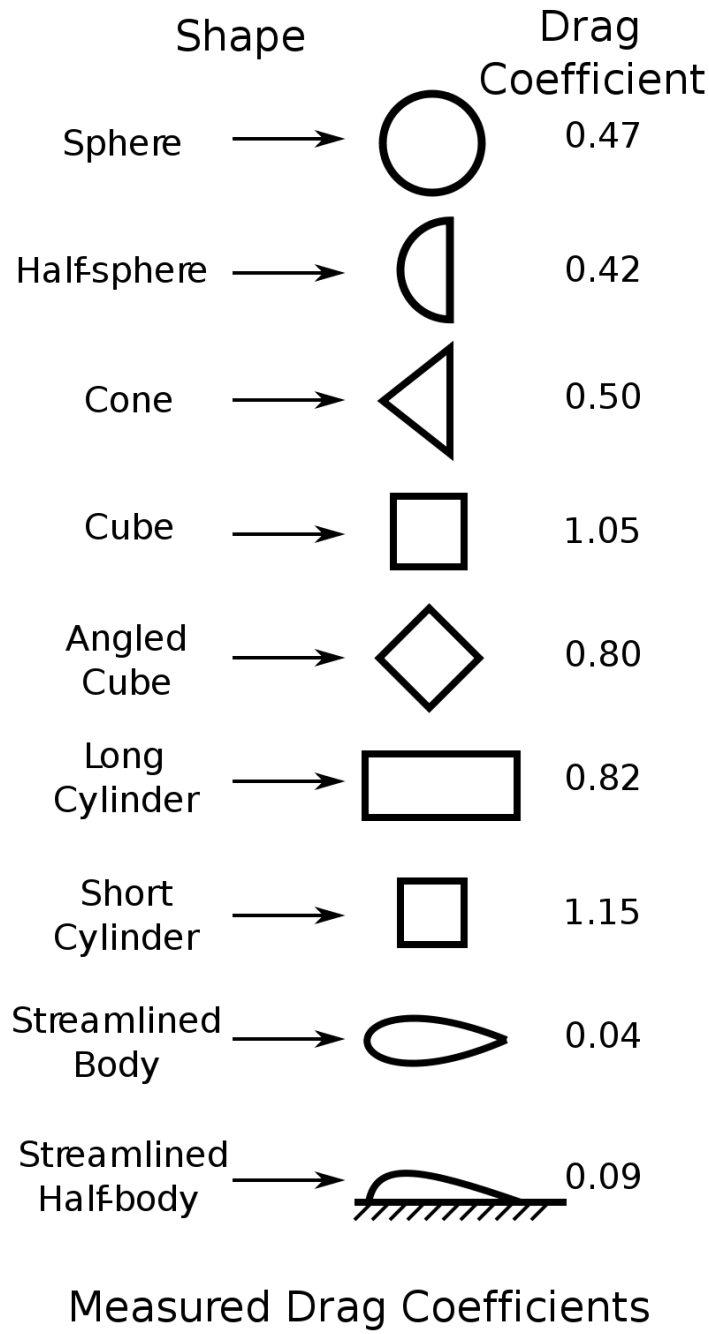
Re=2*10^5

Re=7*10^5



Geometry

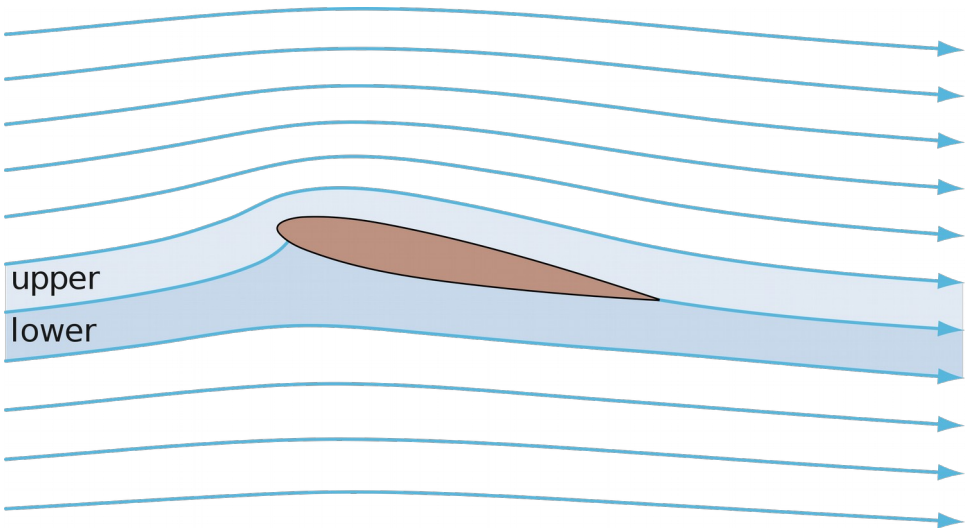
$Re \approx 10^4$



source wikipedia

airfoil

effect of the attack angle



potential flow theory

real measurements

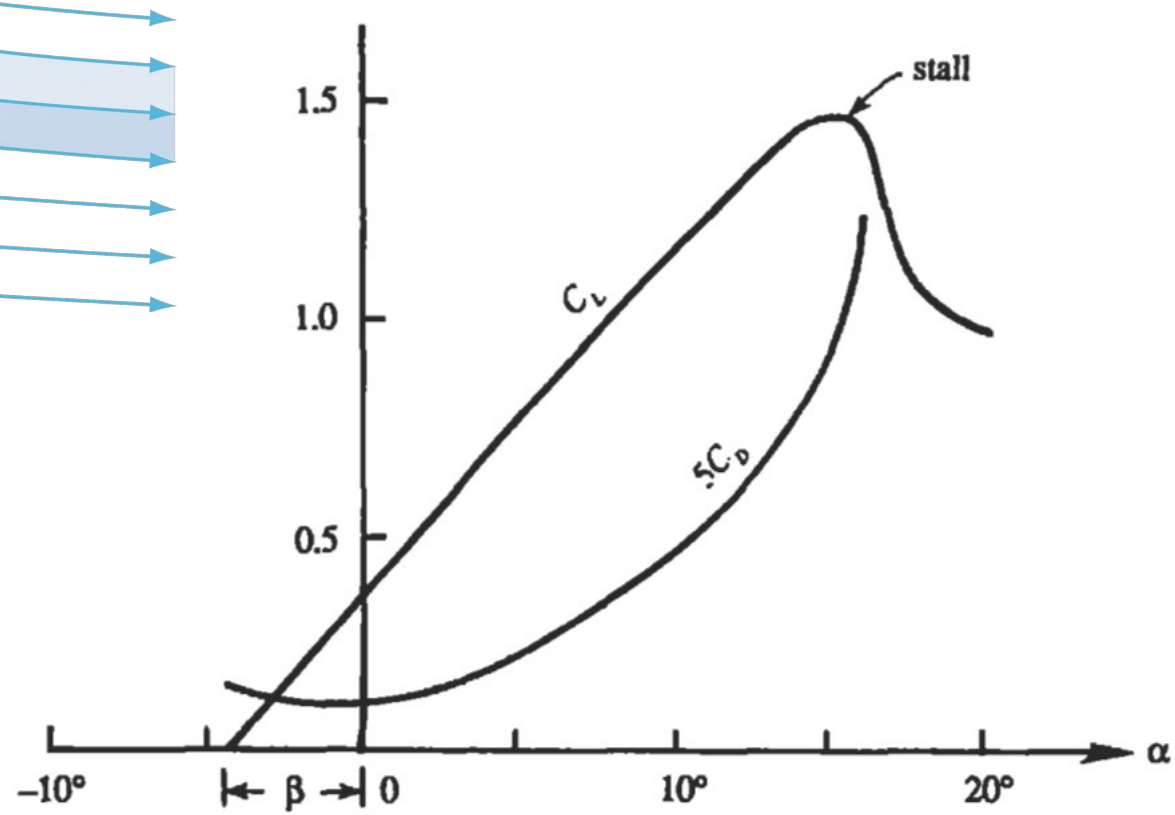
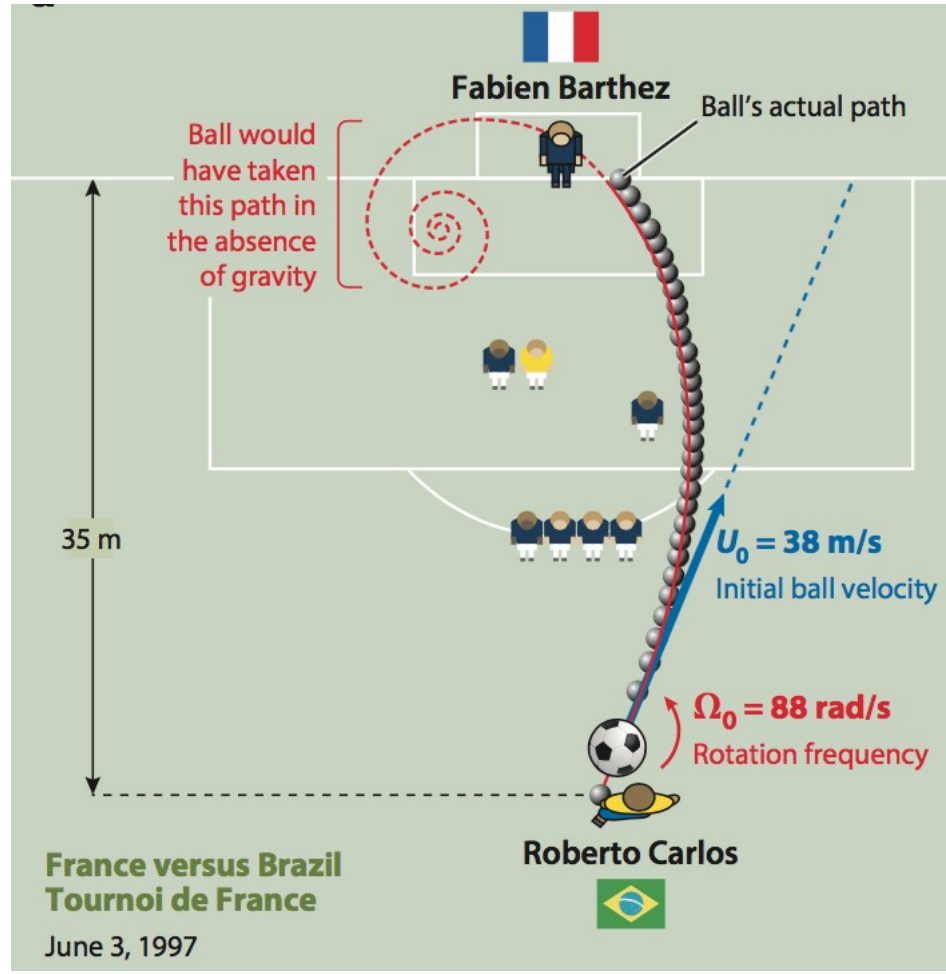


Figure 15.26 Lift and drag coefficients vs angle of attack.

Exercise

Roberto Carlos' wonder goal



Ω_o=14 tours/s = 88 rad/s
U_o=40 m/s
D=21 cm
M=450g
$\nu_{air}=1.5*10^{-5}$ m²/s

2D problem (gravity neglected)
Ω_o constant
circulation $\Gamma \approx \Omega_o R^2$
drag coefficient $C_D \approx 0.24$

WHAT IS THE BALL TRAJECTORY ???