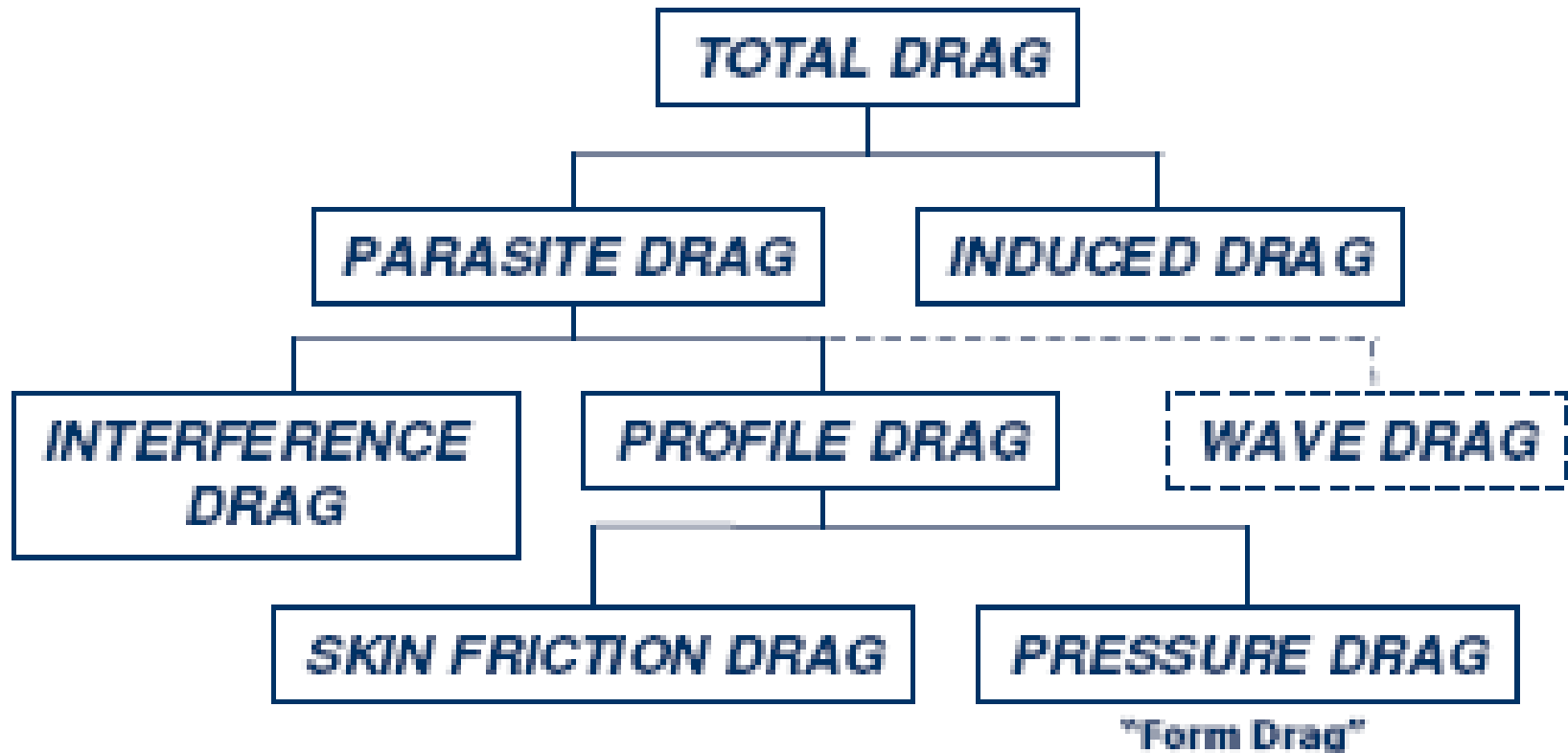
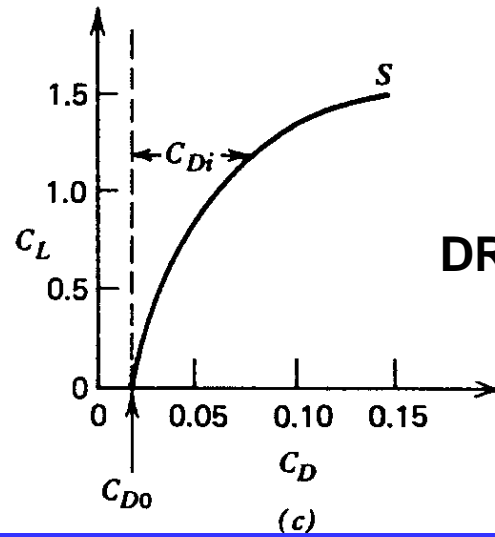
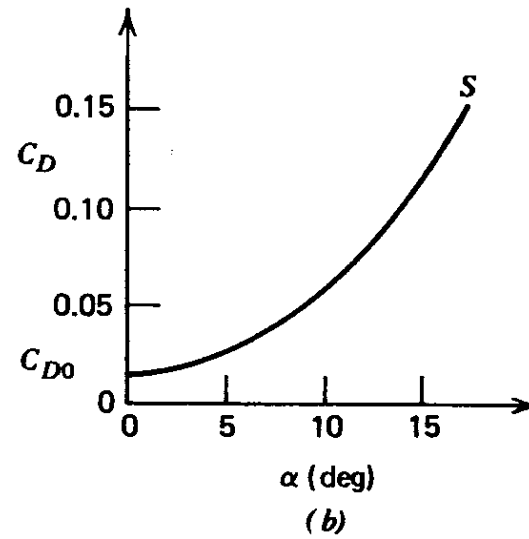
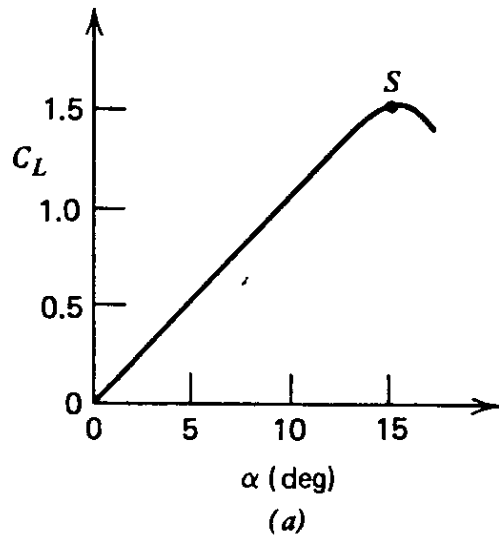


DRAG

- DRAG IS THE RESOLVED COMPONENT OF THE COMPLETE AERODYNAMIC FORCE WHICH IS *PARALLEL* TO THE *FLIGHT DIRECTION* (OR RELATIVE ONCOMING AIRFLOW).
- IT MUST ALWAYS ACT TO *OPPOSE* THE DIRECTION OF MOTION.
- IT IS THE *UNDESIRABLE* COMPONENT OF THE AERODYNAMIC FORCE WHILE LIFT IS THE DESIRABLE COMPONENT

TYPES OF DRAG





DRAG POLAR

Why should we study Atmospheric Properties

- Engineers design flight vehicles, turbine engines and rockets that will operate at various altitudes.
- They can not design these unless the atmospheric characteristics are not known.
- For example,

$$C_L = \frac{L}{\frac{1}{2} \rho V_\infty^2 S}$$

What is a standard atmosphere?

- Weather conditions vary around the globe, from day to day.
- Taking all these variations into design is impractical.
- A standard atmosphere is therefore defined, that relates flight tests, wind tunnel tests and general airplane design to a common reference.
- This common reference is called a “standard” atmosphere.

Powered Controls

May take one of two basic forms:

- Servo-assisted
 - Hydraulic pressure transmitted to *servo actuator* which assists mechanical linkage to move surface.
 - Linkage still available if power is lost but system then very heavy to operate.
- Fully power-operated
 - Control signals transmitted hydraulically, electrically (fly-by-wire) or optically (fly-by-light).