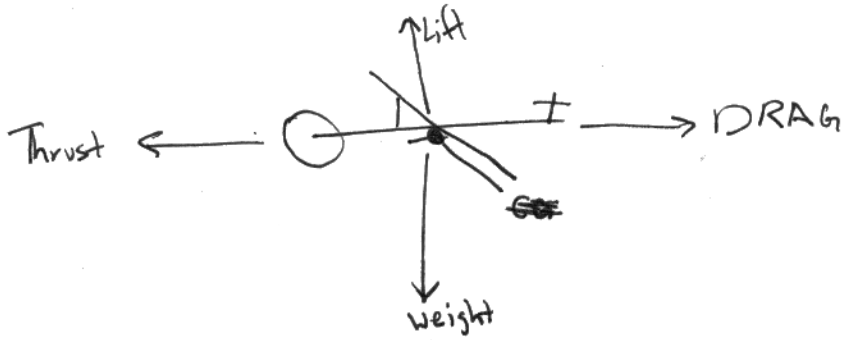
Four Forces

Vectors → ~~mg~~ magnitude + direction



~~Ef~~ Newtons three Laws

1. F=ma
2. Inertia
3. Actions Reaction

Daniel Bernoulli's Principle 1738 - "Hydrodynamica"

→ ↑V ↓P
→ ↓V ↑P ↓V↑P ↑V↓P ↓V↑P

Ex: → Wind Rushing through buildings
→ Rapids in a river

PV=nRT

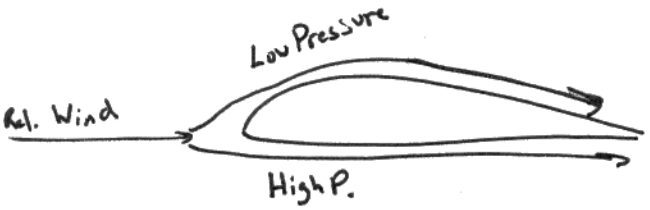
→ Stalls

→ ~~Not concerned to worry~~

→ factors that affects stall speed

Airfoils

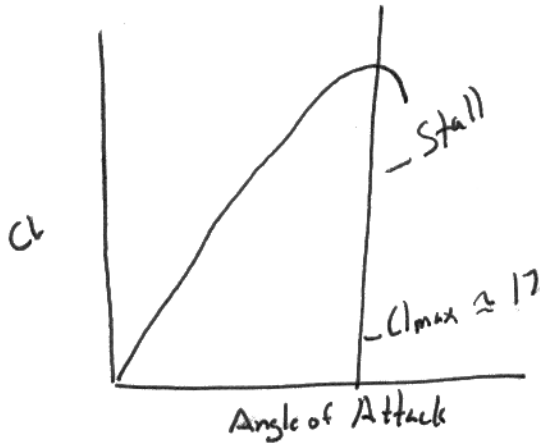
→ Any Sfc that provides aerodynamic force when it interacts w/ moving stream of air.



Creation of Lift
→ Low pressure on top
→ Rel wind hitting bottom of wind

Angle of incidence = angle between any chordline + longitudinal axis

Angle of Attack = angle between chord line + Relative wind
→ primarily controlled by pitch + power
→ determines amount of Lift produced



$$L = C_L V^2 \frac{P}{2} S$$

C_L = coefficient of Lift
V^2 = Velocity (feet/sec)
P = Air density slugs/cuft^3
S = wing sfc area (ft^2)

Stall

When AOA = Critical AOA

boundary layer unable to stay on wing
↓
= small layer of calm air

Wing twist → "washout" — Less angle of incidence at wing root
Better controllability in a stall.

Controlling Lift

1. Airspeed → Lift $\propto$ (airspeed)^2
2. Δing AOA = controls C_L
3. flaps (high Lift devices)
   P. 3-13
   → plain flap → ↑drag
   split flaps → ↑drag
   slotted → ↑camber, ↑lift, ↑wing area
   fowler → ↑wing area, ↑lift, ↑camber

Cessna flaps
10° → lift
20° → = lift = drag
30° = drag

4. Leading Edge Devices

fixed Slot → delay airflow separation

Slat → movable

Leading Edge flaps.

↑wing camber + Area

Weight

$F = m(9.8\ N/s^2)$ (kg)

Force ~~or~~ due to gravitational attraction ~~but~~ to earth.

Thrust

Controlled by manifold pressure/ power setting

→ Force ~~or~~ due to engine power.

Left turning tendancies

1. P-factor → descending blade produces more lift than ascending blade.
2. Spiraling Slipstream → backward flow of air hits Left side of vertical Stabalizer
3. Gyroscopic Precession → esp. tailwheel
4. Torque → action = reaction

Drag

2 types:

Parasite → Surface of aircraft disrupting the air.

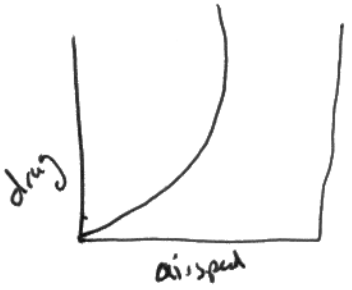
form → results from the shape of the airplane

Interference → two drag producing elements turbulence collides + "Interferes"

ex:  50%-200% increase

Skin friction → roughness of an airplanes Sfc.

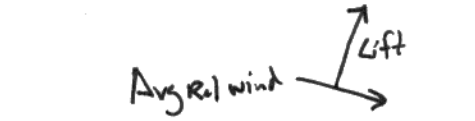
ex. screws
dirt



Induced Drag

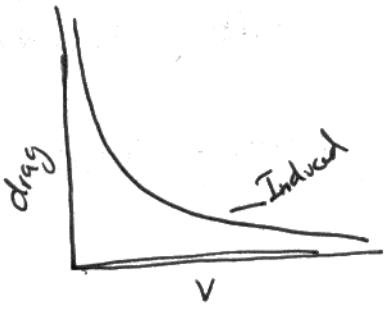
→ as a byproduct of Lift

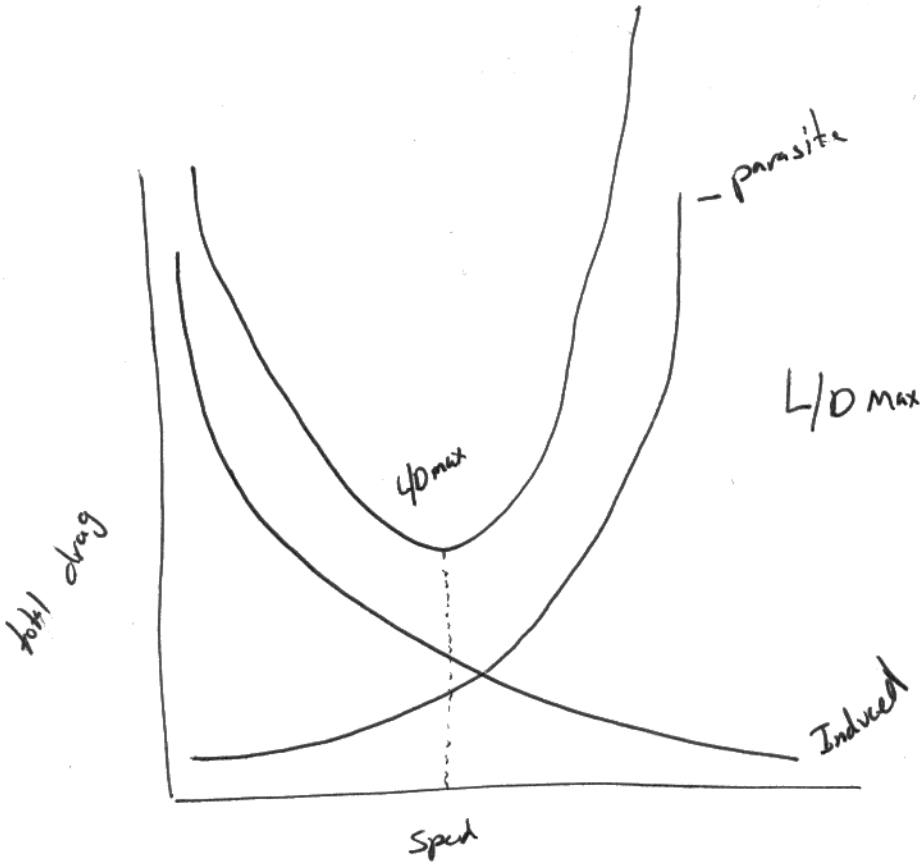
→ downwash angles relative wind down



Lift ↑ = Induced drag ↑

Induced drag $\propto \frac{1}{(\text{speed})^2}$





L/D max = glide speed

✱ Ground effect → less induced drag close to ground causes airplane to float...

Maneuvering Flight

Straight & Level

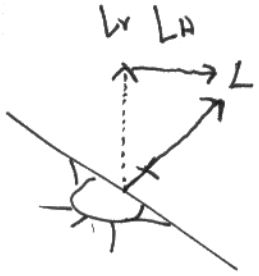
→ 4 forces = equilibrium

Lift = Weight Thrust = Drag

Climbing / Descending

→ ~~life~~ lift > drag

Turning Flight



↑ lift to keep Altitude

↑ AOA

Stability

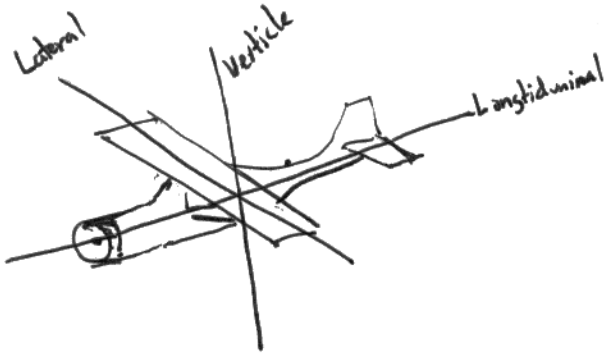
→ does the airplane tend to return to equilibrium?

Static:

If positive → Dynamic

3 axis

Longitudinal ①
Vertical ②
Lateral 3



Longitudinal Stability

→ stability around lateral axis (pitch)

→ unstable very dangerous

→ Effect of CG position

CG forward → nose heavy, ↑ stall speed, less elevator effectiveness

CG aft → tail heavy, ↓ stall speed, less stable, harder stall recovery.

Lateral Stability

→ Stability Around ~~&~~ Longitudinal Axis (Roll)

→ Usually Neutral

Verticle Stability

→ Stability Around ~~Yaw~~ Axis Vertical Axis

→ [redacted]

~~Load Factor~~