VICTORIA FLYING CLUB

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- Bookings, Questions

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Part II – Climbing and Descending

- Review *Basic* Climbing and Descending
- **Departure and Approach Climbs and Descents**
- **V-Speeds** (POH)
- **Flaps**
- **Balked Landings** – Power, Attitude, Trim
- Summary and Questions
- Pre-Flight Briefing

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Review *Basic* Climbing and Descending

- Mentally perform a *basic* **climb** and **level off** and state all required actions. (**APT**)
- Mentally perform a *basic* **power-off descent** and **level off** and state all required actions. (**PAT**)
- How do we maintain our **airspeed** during a climb with set power?
- How do we estimate our **glide path** during a descent?

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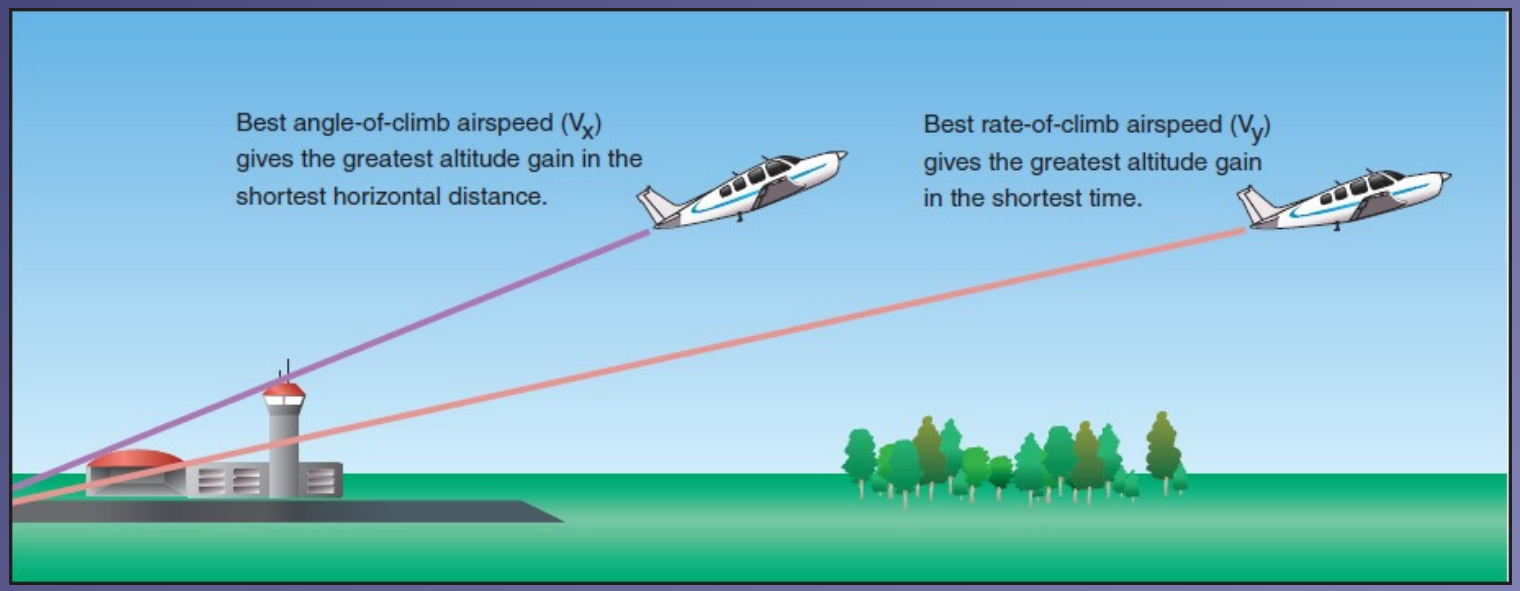
Departure and Cruise Climbs



- Best **angle** / gradient (*Vx*) – ensures best obstacle **clearance**
- Best **rate** (*Vy*)– minimizes climbing **time**
- **Normal** – improves forward **visibility** and engine **cooling**
- **En-Route** – addresses **ground speed**, **economics**, **convenience** and **comfort** (*Vcc = Vy + (Vy - Vx)*)

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Climb Attitudes

- Prolonged climbs may require attitude changes for **lookout**
- En-Route climbs improve visibility, engine cooling and economics
- Mixture can be leaned during climbs passing an altitude of ***3000 ft***
- Control airspeed with **pitch attitude** at **full power**
- *More* **nose-up** attitude requires *more* **rudder** input and vice versa

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Reference Climb Airspeeds

AIRSPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2550 pounds and may be used for any lesser weight.

Takeoff:	
Normal Climb Out	75-85 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	56 KIAS
Enroute Climb, Flaps Up:	
Normal, Sea Level	75-85 KIAS
Normal, 10,000 Feet	70-80 KIAS
Best Rate-of-Climb, Sea Level	74 KIAS
Best Rate-of-Climb, 10,000 Feet	72 KIAS
Best Angle-of-Climb, Sea Level	62 KIAS
Best Angle-of-Climb, 10,000 Feet	67 KIAS

- Reference **climb airspeeds** can be found in the **POH** under *Section 4* **Normal Procedures**

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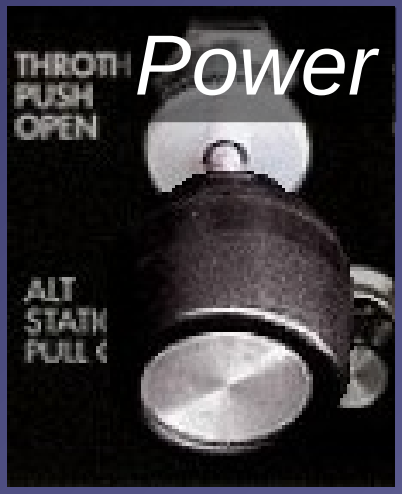
Establishing a Power-on Descent



- In cruise attitude **lookout** ahead and below
- Reduce **power** for estimated **descent airspeed**
- Keep **straight** and control **yaw** with **rudder**
- Decelerate to **descent airspeed** maintaining cruise attitude
- Establish required **pitch attitude** and **trim**

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Maintaining a Power-On Descent

- Adjust **power** and **attitude** to attain desired **descent airspeed** and **rate of descent**
- Re-**trim** after power and attitude adjustments
- Continue **lookout** and monitor external **references**, **heading**, **descent airspeed** and **rate of descent**

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Reference Descent Airspeeds

Landing Approach:	
Normal Approach, Flaps Up	65-75 KIAS
Normal Approach, Flaps 30°	60-70 KIAS
Short Field Approach, Flaps 30°	61 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	60 KIAS

- Reference **descent airspeeds** can be found in the **POH** under *Section 4* **Normal Procedures**

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Best Glide Airspeed

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2550 Lbs	105 KIAS
2200 Lbs	98 KIAS
1900 Lbs	90 KIAS
Maximum Glide	68 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS

- Best **glide airspeed** for power-off descents can be found in the **POH** under *Section 3* **Emergency Procedures**

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Operating Flaps

- Operate flaps *conservatively* while **airspeed** in **white arc**
- Flaps permit *lower* **airspeeds** and *steeper* **descent angles**
- Flaps support **obstacle clearance** approaches
- Retract **flaps** in **stages** within **white arc** (above ***48 KIAS***)

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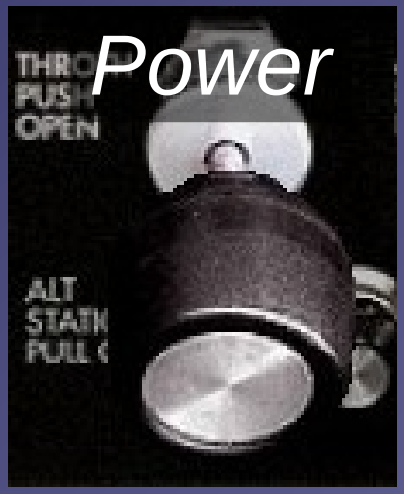
Balked Landings



- Apply **full power** and keep **straight** controlling **yaw**
- Establish and maintain *slight* **nose-up attitude**
- Control airspeed with attitude and retract **flaps** in **stages**
- **Trim** and continue to monitor **climb airspeed**
- Consider **ground effect** during go around

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Summary / Quiz

- Why do we use different airspeeds for climbs and descents?
- Where can we find the *Vx* and *Vy* airspeeds?
- Where can we find the best glide airspeed?
- Mentally perform a **power-on descent** and **level-off** describing all required actions. (**PAT**)
- Mentally perform a **balked approach** describing all required actions – remember the flaps. (**PAT**)

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Pre-Flight Briefing

- Exercise
- Training Area
- Departure and Arrival Procedures
- Weather Briefing / NOTAMs
- Aircraft and Documents
- Time and Fuel Requirements
- Safety Considerations and Responsibilities

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Additional Materials

- Additional materials for Climbing and Descending
- Flight Instructor Guide – Exercises 7 and 8
- Flight Instructor Guide – Lesson Plans 2, 3 and 4

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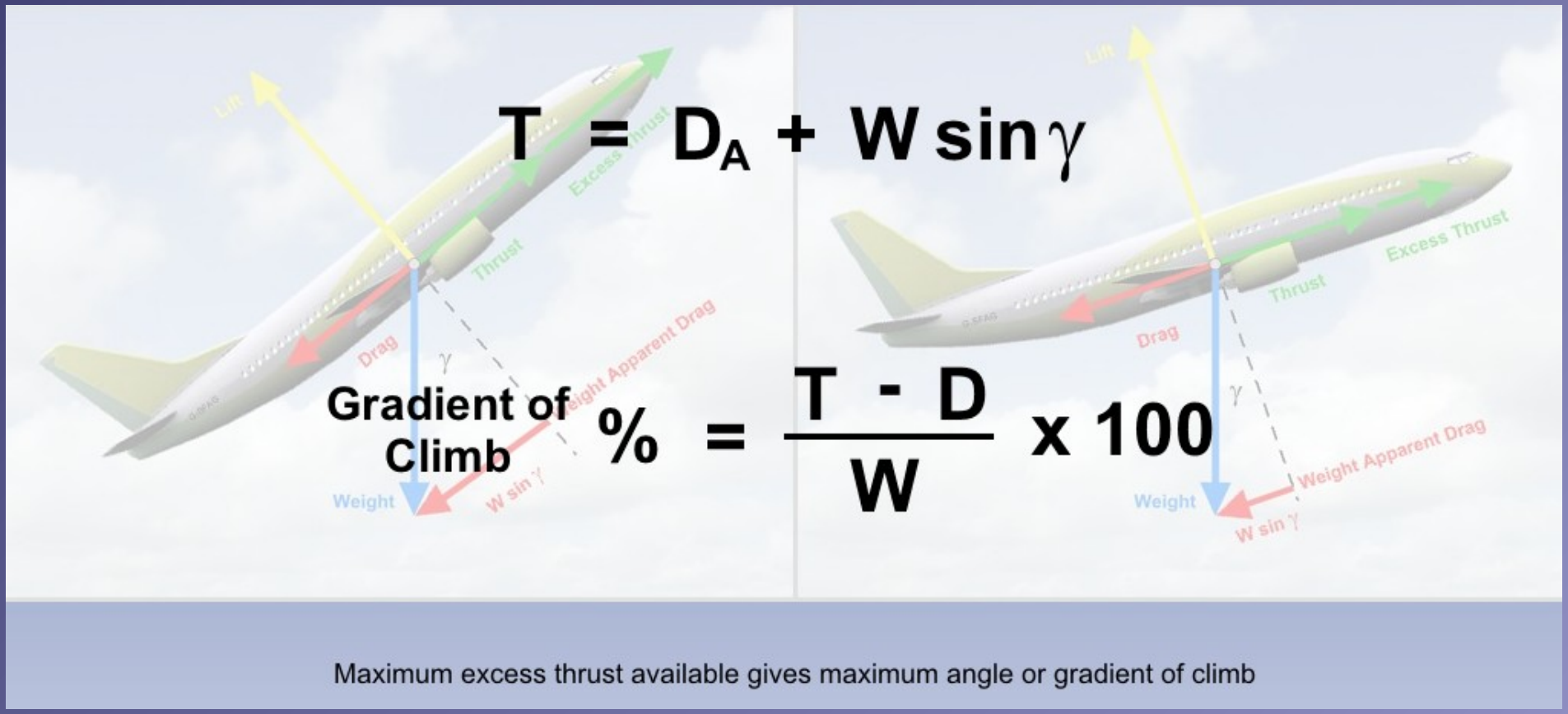
Angle or Gradient of Climb

$$T = D_A + W \sin\gamma$$



Maximum excess thrust available gives maximum angle or gradient of climb

- Weight increases weight apparent drag and excess thrust required
- Weight increases lift required and lift induced drag

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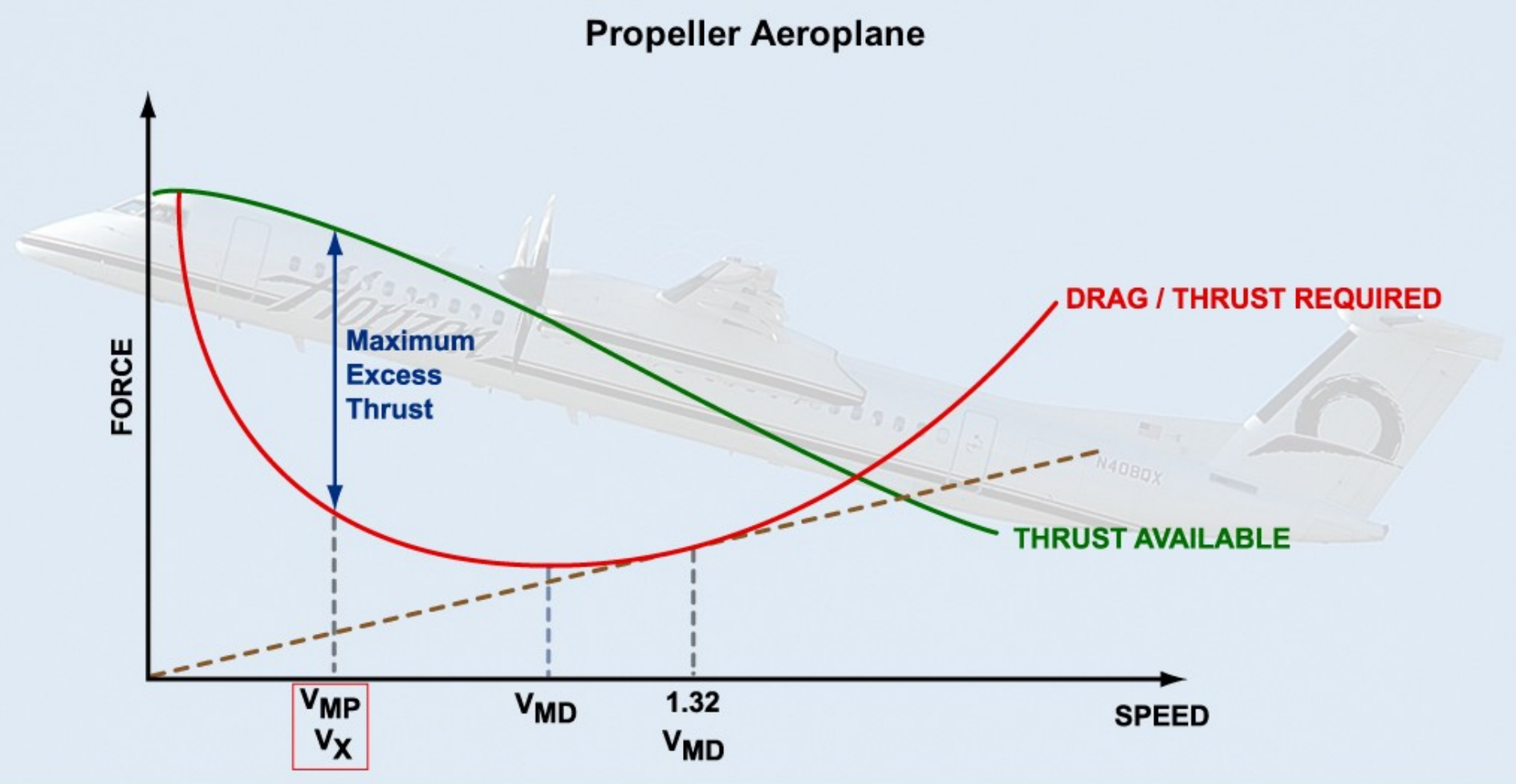
Maximum Excess Thrust



Angle/Gradient of Climb - Propeller Excess Thrust Graph and Vx

Maximum excess thrust occurs at VMP. Vx for a propeller aeroplane occurs at VMP.

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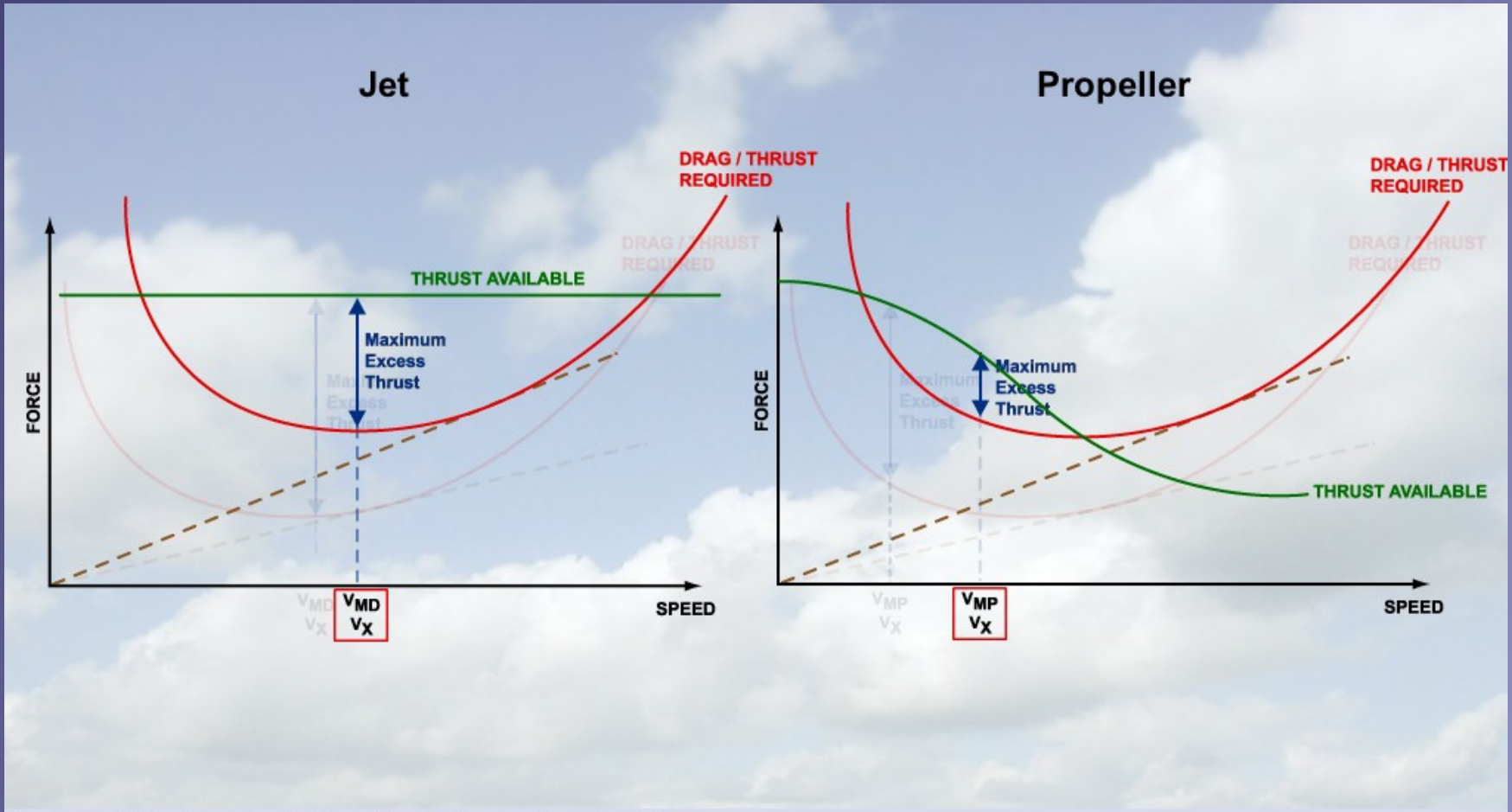
Weight and Excess Thrust



Factors Affecting Angle/Gradient - Increasing Weight

Effects 2 and 3. Increasing weight requires more lift. This increases induced drag and therefore total drag. The result is a decrease in excess thrust and a decrease in the climb angle. Vx increases.

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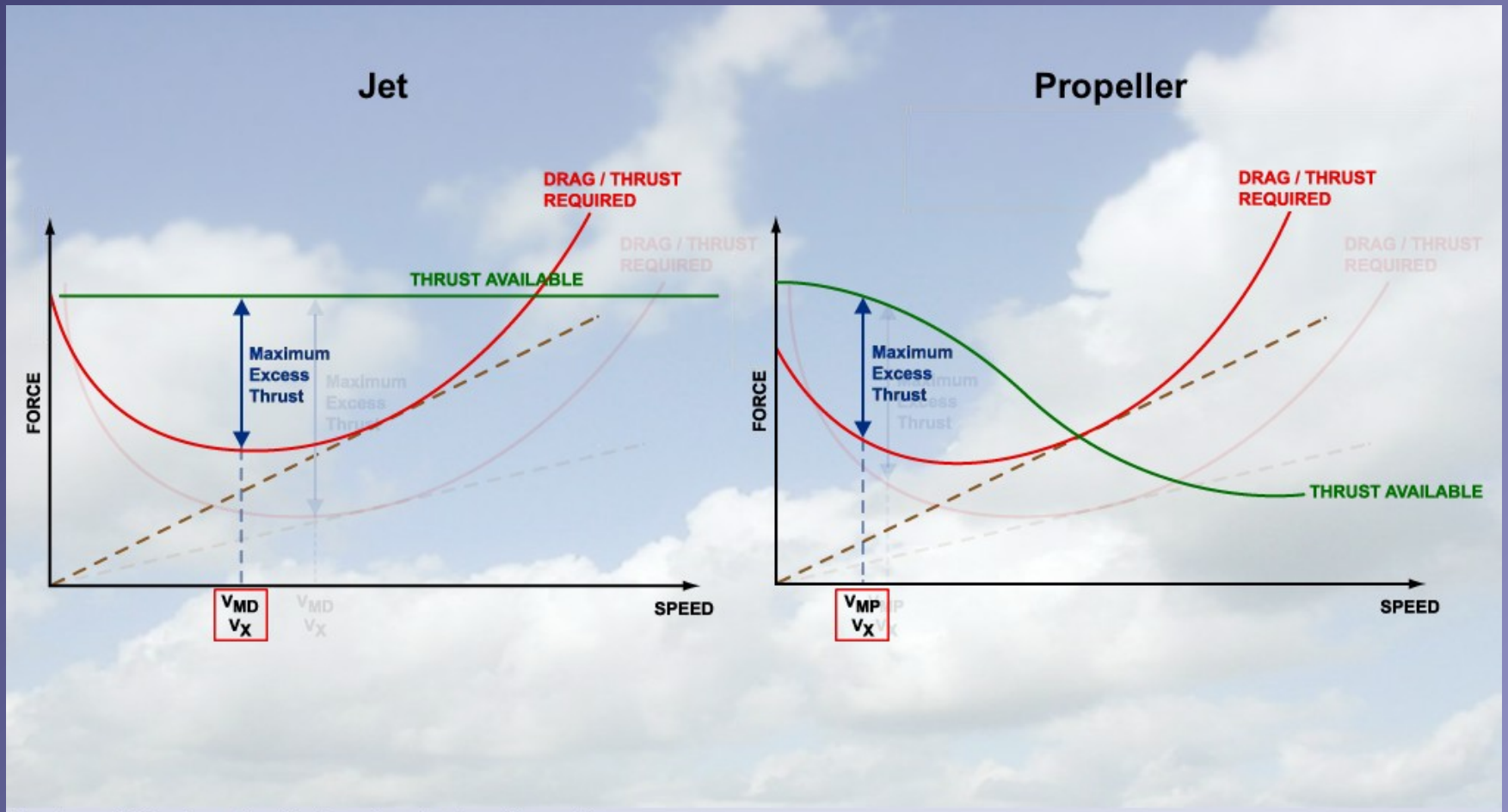
Configuration and Excess Thrust



Factors Affecting Angle/Gradient - Configuration

Flaps and undercarriage deployed increase parasite drag and therefore total drag. The result is a decrease in excess thrust and a decrease in the climb angle. Vx decreases.

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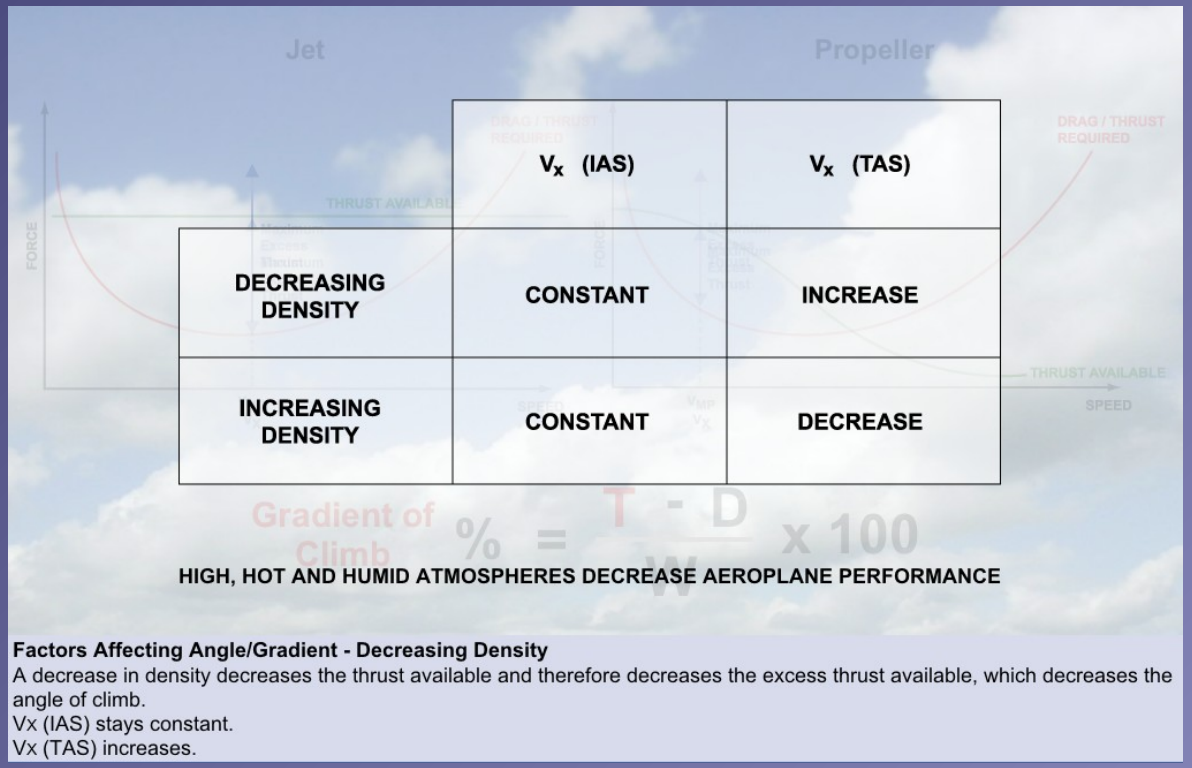
Air Density and Excess Thrust



	V_x (IAS)	V_x (TAS)
DECREASING DENSITY	CONSTANT	INCREASE
INCREASING DENSITY	CONSTANT	DECREASE

HIGH, HOT AND HUMID ATMOSPHERES DECREASE AEROPLANE PERFORMANCE

Factors Affecting Angle/Gradient - Decreasing Density
A decrease in density decreases the thrust available and therefore decreases the excess thrust available, which decreases the angle of climb.
Vx (IAS) stays constant.
Vx (TAS) increases.

- Vx remains essentially **constant** (IAS) for thrust-rated engines (jet)
- Vx may **increase** (IAS) for power-rated engines (piston propeller)

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Rate of Climb

$$\text{Rate of Climb} = \frac{\text{Excess Power}}{W} = \frac{\text{Power Available} - \text{Power Required}}{W}$$

Maximum Excess Power Available gives Maximum Rate of Climb

- Rate of climb depends on both angle of climb and airspeed
- Forces multiplied with speeds give powers
- F * v = F * s / t = W / t = P

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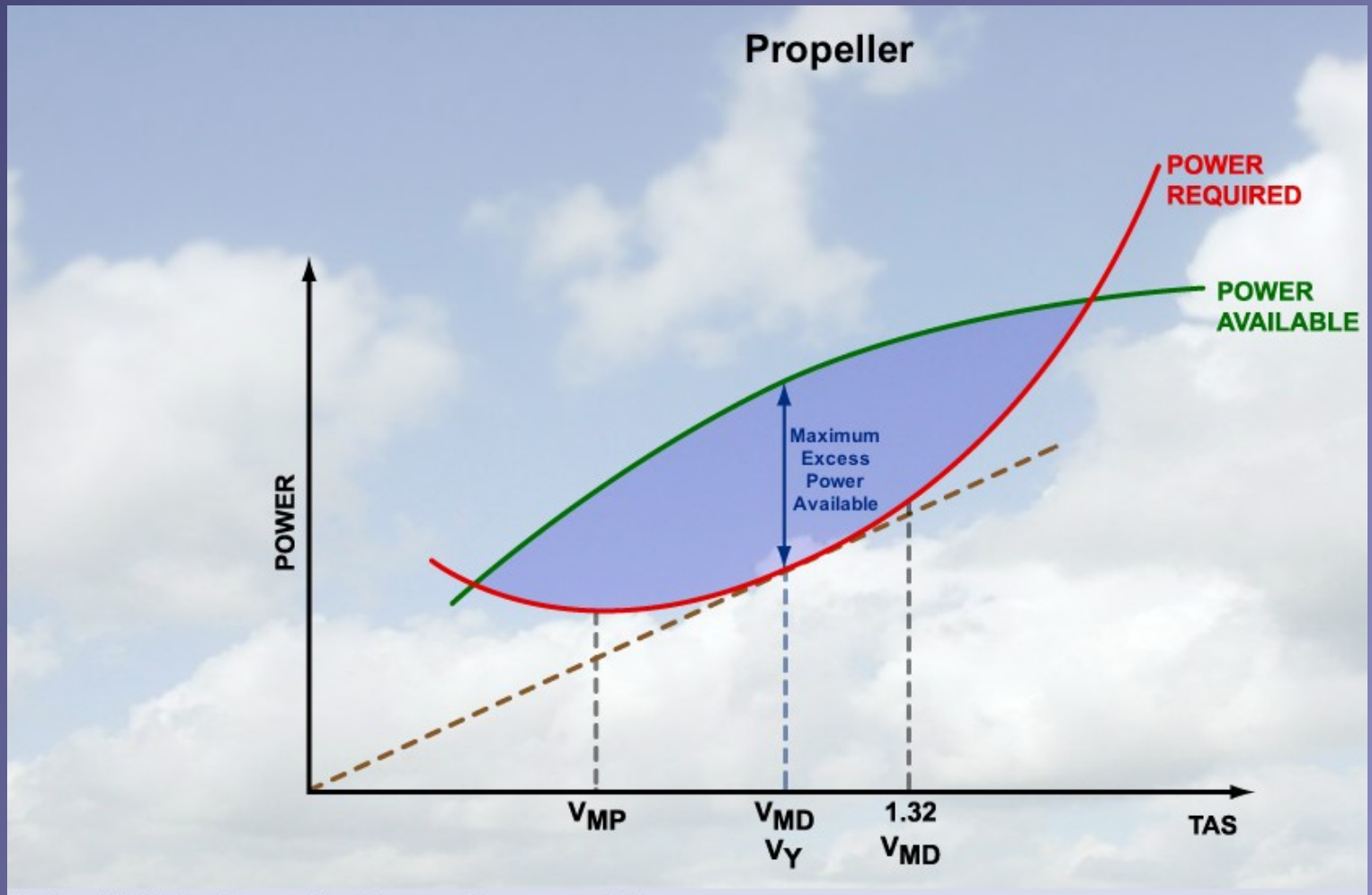
Maximum Excess Power



Rate of Climb - Propeller Excess Power and V_Y.
Maximum excess power available will give maximum rate of climb.
Vy for a propeller aeroplane occurs at V_{MD}.

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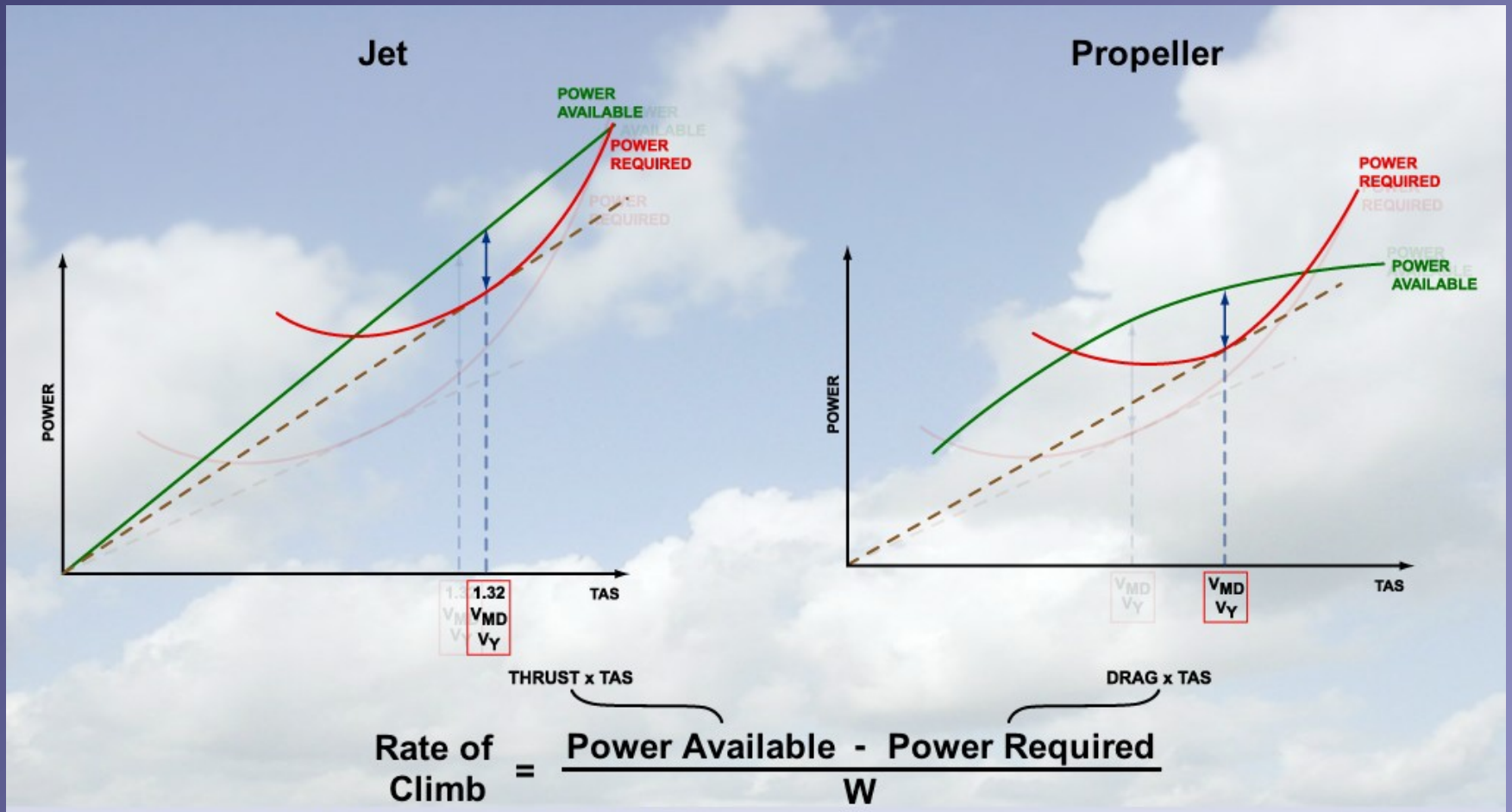
Weight and Excess Power



Factors Affecting Rate of Climb - Increasing Weight

Increasing weight increases the amount of weight apparent drag. This reduces the climb angle and therefore the rate of climb.
Increasing weight requires more lift, which increases drag and therefore power required. This decreases the excess power and therefore decreases the rate of climb.
V_Y increases.

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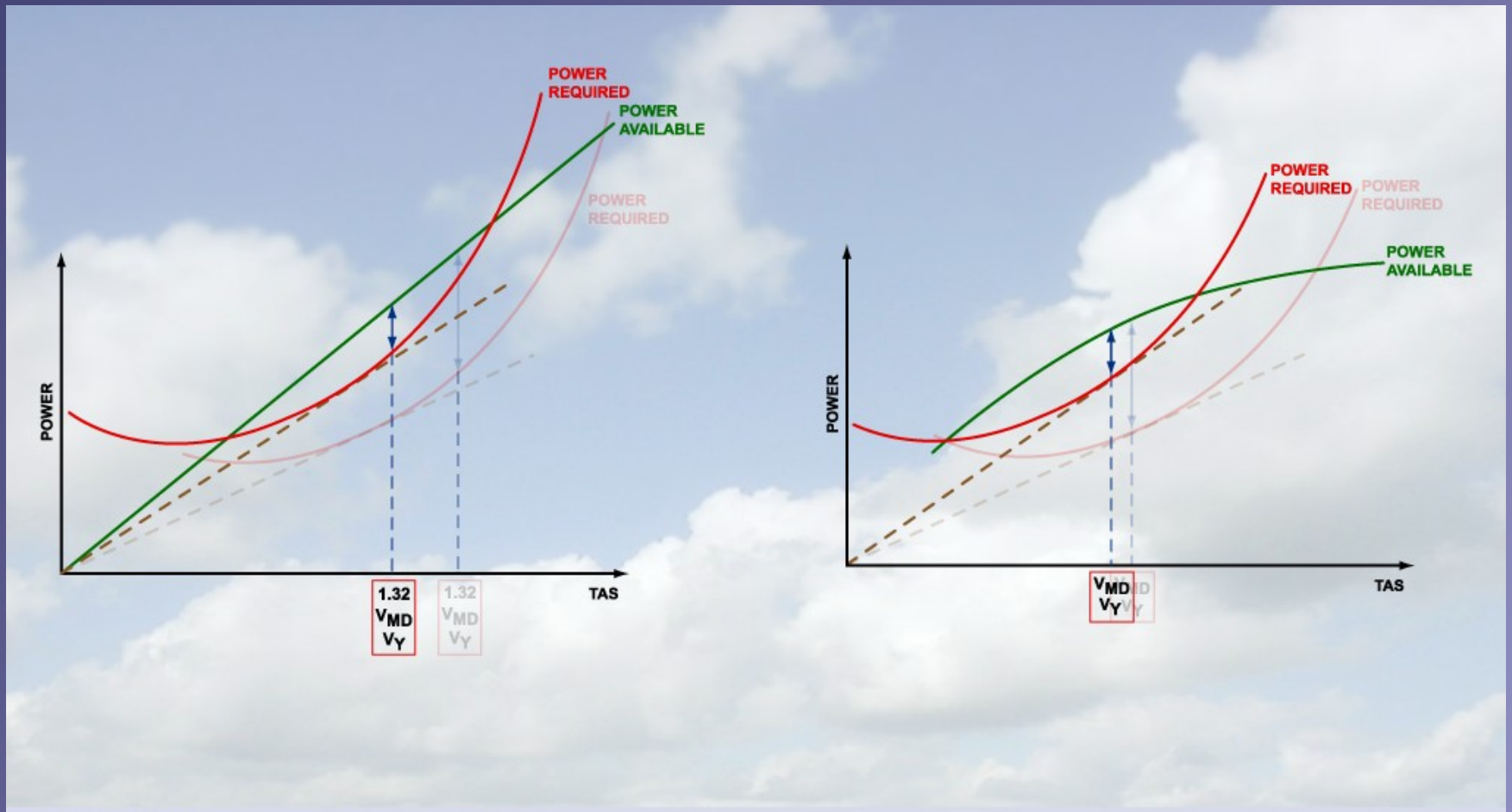
Configuration and Excess Power



Factors Affecting Rate of Climb - Configuration

Flaps and undercarriage deployed will increase parasite drag and therefore total drag. The result is a decrease in excess power and a decrease in the rate of climb.

V_Y decreases.

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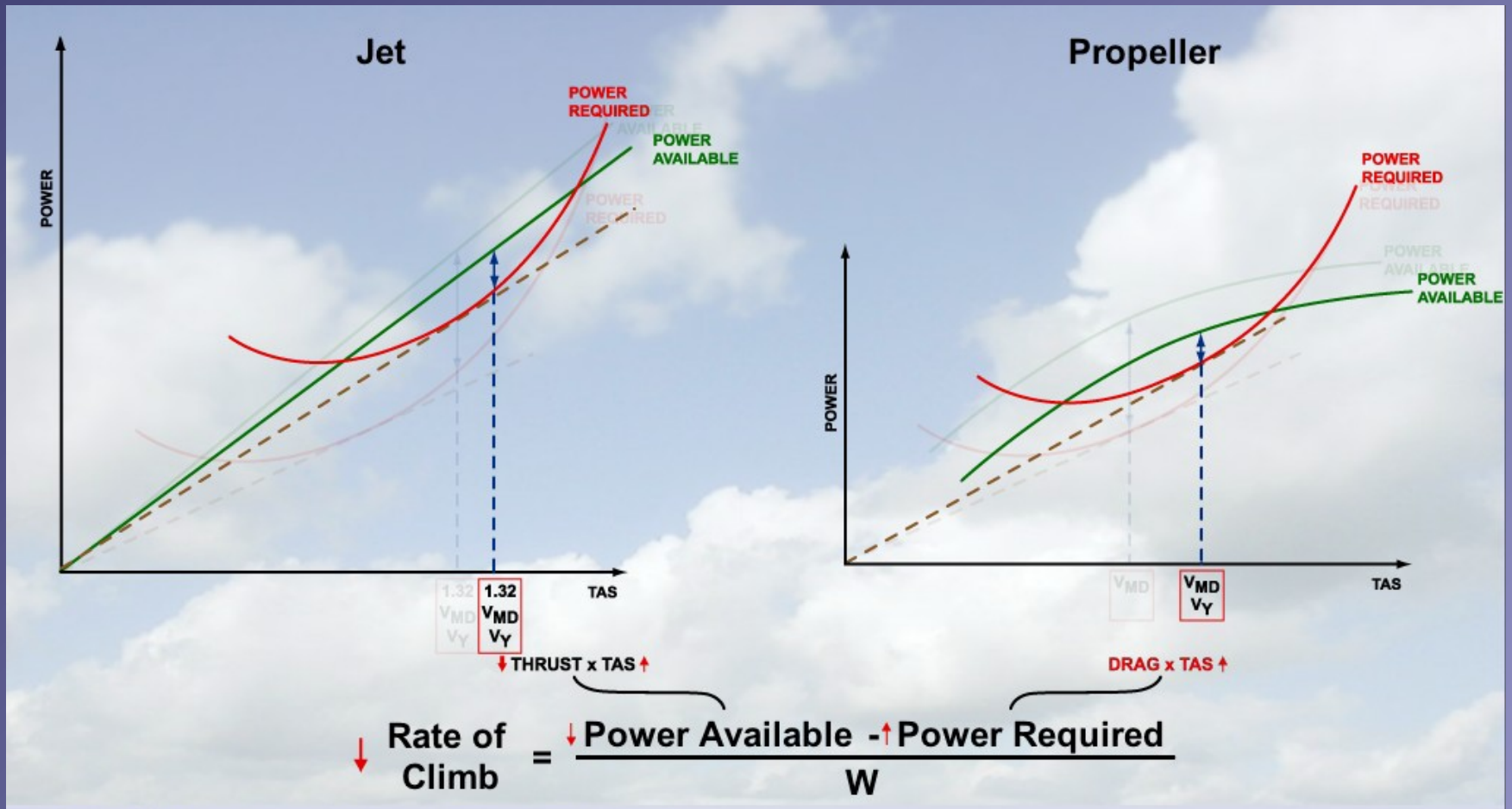
Air Density and Excess Power



Factors Affecting Rate of Climb - Decreasing Density

Decreases power available.

Increases power required.

Decreases excess power available and therefore the rate of climb.

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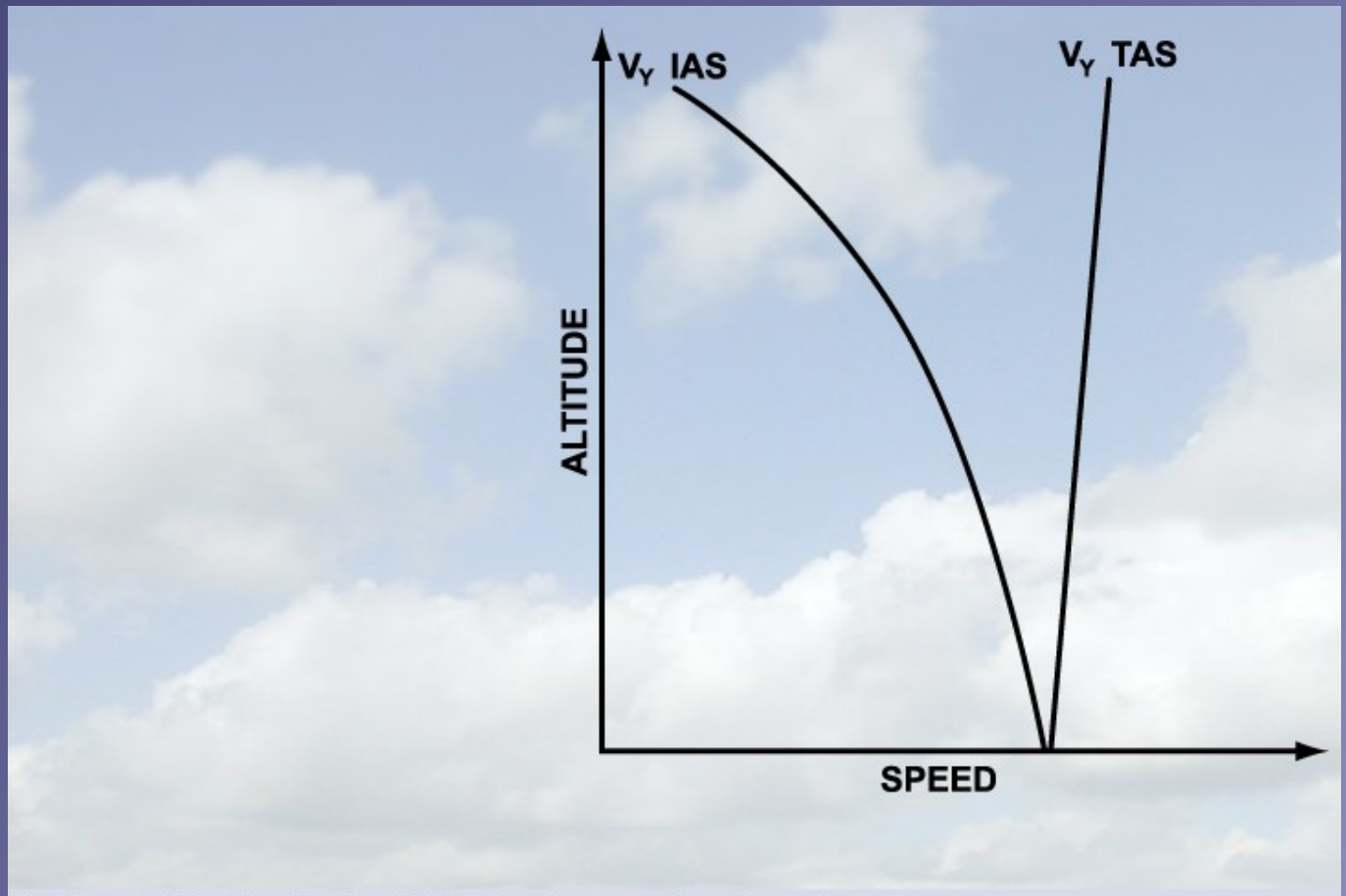
Vy – True versus Indicated Airspeed



Factors Affecting Rate of Climb - Decreasing Density
Decreases power available.
VY (TAS) increases.
VY (IAS) decreases.

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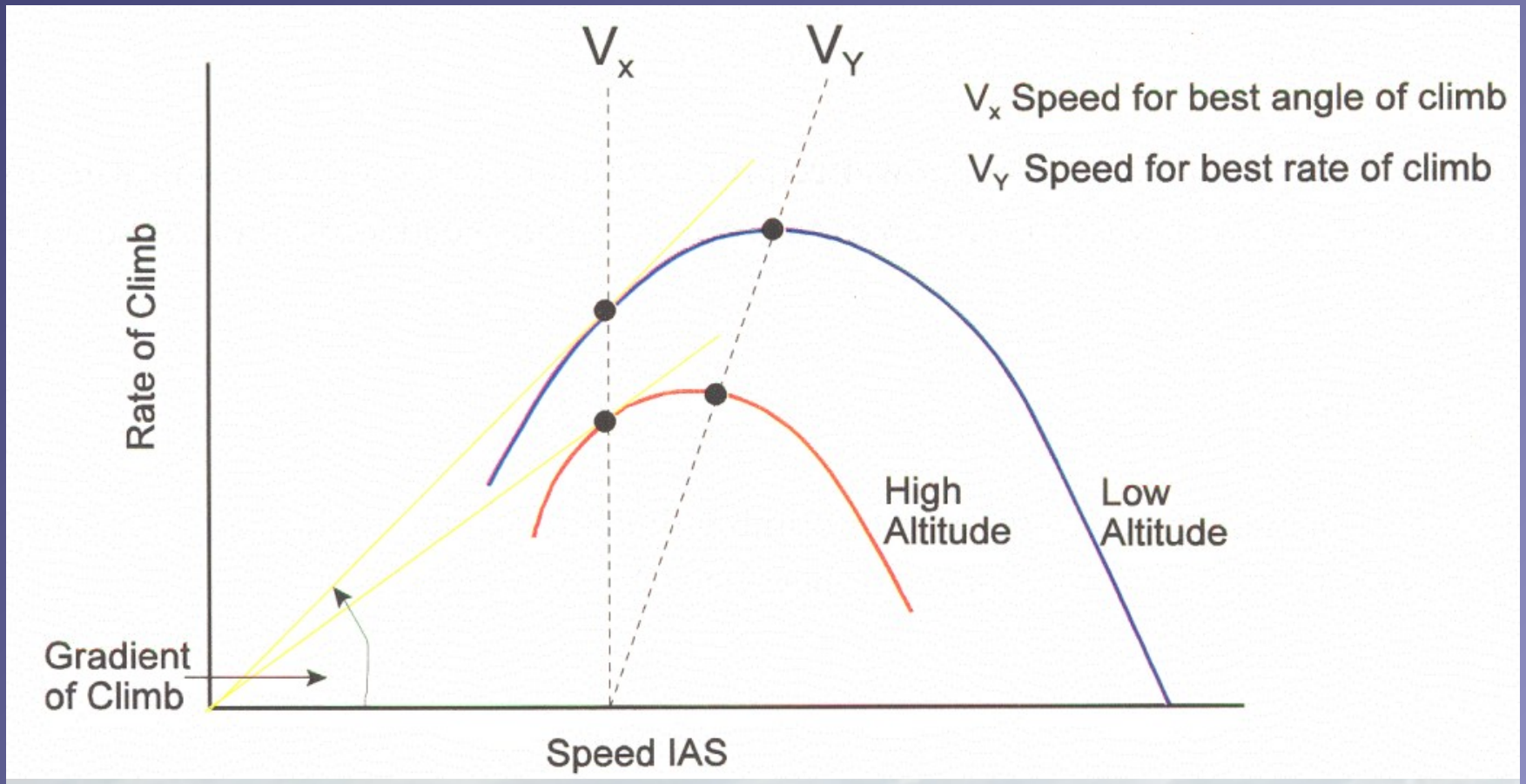
Absolute and Service Ceiling



Factors Effecting Rate of Climb - Ceiling Altitude

Absolute Ceiling - The altitude where the rate of climb is zero and where $V_Y = V_X$

Service Ceiling - The altitude where the best rate of climb airspeed will produce a specific rate of climb.